## 1.3.1 Institution integrates crosscutting issues relevant to Professional ethics, Gender, Human Values, Environment and Sustainability into the Curriculum.

| S.No | PROGRAMME CODE | COURSE CODE | COURSE NAME |
|---|---|---|---|
| 1 | 104,105,106,205,114,118 | 20HSMC501 | UNIVERSAL HUMAN VALUES 2:UNDERSTANDING HARMONY |

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SAI LEO NAGAR, CHENNAI-600 044.

# OPEN ELECTIVES
# AICTE - UHV

| 20HSMC501<br>SDG NO. 4&9 | UNIVERSAL HUMAN VALUES 2:<br>UNDERSTANDING HARMONY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**OBJECTIVES:**

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

**SYLLABUS:**

**The course has 28 lectures and 14 practice sessions in 5 modules:**

**UNIT I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

## UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensureSanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

## UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY - HARMONY IN HUMAN-HUMAN RELATIONSHIP

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

**UNIT IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

**UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

**TEXT BOOK:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

**REFERENCES:**


1. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology)Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)


**COURSE OUTCOMES**

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundational input. It would be desirable to follow it up by

a) Faculty-student or mentor-mentee programs throughout their time with the institution

b) Higher level courses on human values in every aspect of living. E.g. as a professional

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## 1.3.2 Number of value-added courses for imparting transferable and life skills offered during the year

Red Hat

Red Hat, Inc. hereby certifies that

# SREERANJANI S

has successfully completed all the program requirements and is certified as a

# Red Hat® Certified Engineer (RHCE®)

RANDOLPH R. RUSSELL
DIRECTOR OF RED HAT CERTIFICATION


November 18, 2022 CERTIFICATION ID: 220-145-551

Red Hat

Red Hat, Inc. hereby certifies that

# RAGAVAPRASAD S

has successfully completed all the program requirements and is certified as a

## RED HAT CERTIFIED SYSTEM ADMINISTRATOR

Red Hat Enterprise Linux 8

RANDOLPH R. RUSSELL

DIRECTOR, GLOBAL CERTIFICATION PROGRAMS

RED HAT CERTIFIED

SYSTEM ADMINISTRATOR

Red Hat

AUGUST 26, 2022 - CERTIFICATION ID: 220-086-318

# Nithiya Shree C J

**Test ID:** 389050032046672 | 6374361513 | sit20ad018@sairamtap.edu.in

**Test Date:** December 16, 2021

| Computer Science (Level 1) | Logical Ability | English Comprehension | Quantitative Ability (Advanced) |
|---|---|---|---|
| 27 /100 | 36 /100 | 48 /100 | 27 /100 |

| SVAR - Spoken English | WriteX - Essay Writing | Automata | Automata Fix |
|---|---|---|---|
| 59 /100 | 77 /100 | 0 /100 | 0 /100 |

**Personality**

Completed

## Computer Science (Level 1) — 27 / 100

| DS Basics | Linked Lists, Stacks and Queues | Trees and Graphs |
|---|---|---|
| 25 / 100 | 50 / 100 | 0 / 100 |

## Logical Ability — 36 / 100

| Inductive Reasoning | Deductive Reasoning | Abductive Reasoning |
|---|---|---|
| 25 / 100 | 44 / 100 | 39 / 100 |

## English Comprehension — 48 / 100

| Grammar | Vocabulary | Comprehension |
|---|---|---|
| 46 / 100 | 47 / 100 | 51 / 100 |

## Quantitative Ability (Advanced)

27 / 100

| Basic Mathematics | Advanced Mathematics | Applied Mathematics |
|---|---|---|
| 19 / 100 | 33 / 100 | 30 / 100 |

## SVAR - Spoken English

59 / 100 | CEFR: B1

### Competencies

| Pronunciation | Fluency | Active Listening |
|---|---|---|
| 59 / 100 | 68 / 100 | 68 / 100 |

| Spoken English Understanding | Vocabulary | Grammar |
|---|---|---|
| 60 / 100 | 20 / 100 | 60 / 100 |

### Job Suitability

| | |
|---|---|
| Direct Customer Interaction | International Voice Profile |
| Domestic Voice Profile | Backend Processing Profile |

## WriteX - Essay Writing

77 / 100 | CEFR: C1

| Content Score | Grammar Score |
|---|---|
| 81 / 100 | 69 / 100 |

## Automata

0 / 100

| Programming Ability | Programming Practices | Functional Correctness |
|---|---|---|
| 0 / 100 | 0 / 100 | 0 / 100 |

*This can potentially be a non-serious attempt.

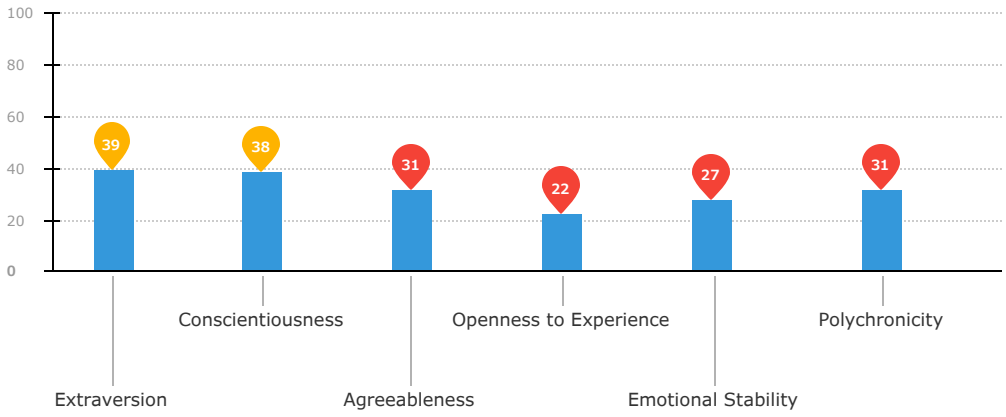
## Automata Fix

0 / 100

| Logical Error | Code Reuse | Syntactical Error |
|---|---|---|
| 0 / 100 | 0 / 100 | 0 / 100 |

## Personality

Completed




**Competencies**

People Interaction

Self-Drive

Trainability

Repetitive Job Suitability

**Work Attributes**

# 1 | Introduction

**About the Report**

This report provides a detailed analysis of the candidate's performance on different assessments. The tests for this job role were decided based on job analysis, O*Net taxonomy mapping and/or criterion validity studies. The candidate's responses to these tests help construct a profile that reflects her/his likely performance level and achievement potential in the job role

This report has the following sections:

The **Summary** section provides an overall snapshot of the candidate's performance. It includes a graphical representation of the test scores and the subsection scores.

The **Insights** section provides detailed feedback on the candidate's performance in each of the tests. The descriptive feedback includes the competency definitions, the topics covered in the test, and a note on the level of the candidate's performance.

The **Response** section captures the response provided by the candidate. This section includes only those tests that require a subjective input from the candidate and are scored based on artificial intelligence and machine learning.

The **Interview Questions** section provides a few probing questions on those competencies where the candidate's performance has been low. The interviewer can use these as a reference in case s/he wishes to assess the candidate on any of these competencies during the interview process.

The **Proctoring** section captures the output of the different proctoring features used during the test.

**Score Interpretation**

All the test scores are on a scale of 0-100. All the tests except personality and behavioural evaluation provide absolute scores. The personality and behavioural tests provide a norm-referenced score and hence, are percentile scores. Throughout the report, the colour codes used are as follows:

- Scores between 67 and 100
- Scores between 33 and 67
- Scores between 0 and 33

## 2 | Insights

### English Comprehension

48 / 100

This test measures the candidate's vocabulary, grammar and reading comprehension skills.

The candidate is able to construct short sentences and understand simple text. The ability to read and comprehend is important for most jobs. However, it is of utmost importance for jobs that involve research, content development, editing, teaching, etc.

### Logical Ability

36 / 100

#### Inductive Reasoning

25 / 100

This competency measures the candidate's ability to synthesize information and derive conclusions.

The candidate needs to put in a great deal of effort to improve her predictive reasoning skills. Inductive reasoning will help her derive general rules from specific situations and carry out various tasks without needing instructions from others.

#### Deductive Reasoning

44 / 100

This competency measures the candidate's ability to synthesize information and derive conclusions.

The candidate is able to understand simple instructions but her conclusions are only partially correct.

#### Abductive Reasoning

39 / 100

This competency measures the candidate's ability to reach a possible conclusion by forming and testing the hypothesis using the known information.

The candidate is able to use the available information and formulate simple hypothesis for further testing. But she may not able to reach expected conclusions with more complex information.

### Quantitative Ability (Advanced)

27 / 100

This test measures the candidate's ability to solve problems on basic arithmetic operations, probability, permutations and combinations, and other advanced concepts.

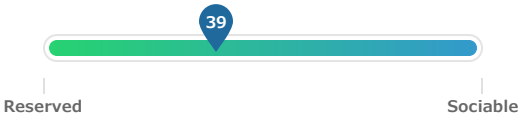
The candidate is able to perform simple arithmetic operations. Apart from their relevance in monetary transactions, these operations are used in other situations, such as dividing up tasks with one's colleagues, managing one's time at work, and planning the resources required to complete a task.

## Personality

Completed

### Competencies

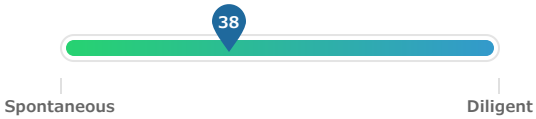
#### Extraversion




Extraversion refers to a person's inclination to prefer social interaction over spending time alone. Individuals with high levels of extraversion are perceived to be outgoing, warm and socially confident.

- The candidate is comfortable socializing to a certain extent. She may prefer small gatherings in familiar environments.
- She may feel at ease interacting with her close friends but may be reserved among strangers.
- She is likely to indulge in activities involving thrill and excitement that are not too risky.
- She contemplates the consequences before expressing any opinion or taking an action.
- She is likely to take charge when the situation calls for it and is comfortable following instructions as well.
- The candidate's personality may be suitable for jobs demanding flexibility in terms of working well with a team as well as individually.

#### Conscientiousness




Conscientiousness is the tendency to be organized, hard working and responsible in one's approach to her/his work. Individuals with high levels of this personality trait are more likely to be ambitious and tend to be goal-oriented and focused.

- The candidate is flexible and able to adapt her work pace to the job at hand.
- She is usually spontaneous but is likely to stick to a plan whenever necessary.
- She tends to be cautious when she deems it necessary.
- She may prefer to act according to the rules.
- She is likely to be confident in her ability to achieve goals but may need support to overcome occasional setbacks.
- The candidate is likely to be an efficient worker and tries to perform better than her peers. She may be well suited for jobs allowing flexibility regarding operating procedures.

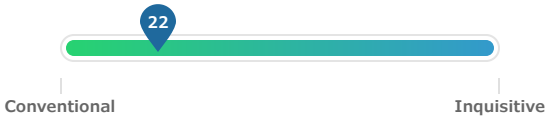
#### Agreeableness


Agreeableness refers to an individual's tendency to be cooperative with others and it defines her/his approach to interpersonal relationships. People with high levels of this personality trait tend to be more considerate of people around them and are more likely to work effectively in a team.

- The candidate may come across as outspoken. She may often play the role of the devil's advocate in discussions and question others' opinions and views.

- She is not gullible and is likely to carefully examine the situation before trusting in something/someone.
- She may not be strongly affected by human suffering and may be perceived as indifferent.
- She is likely to be confident of her achievements and does not shy away from talking about them.
- She may sometimes place self-interest above the needs of those around her. She may not be willing to compromise her own views in order to accommodate the views of others.
- The candidate may be suitable for jobs that require tough objective decisions and hard negotiation.

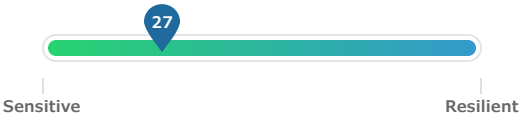
## Openness to Experience




Openness to experience refers to a person's inclination to explore beyond conventional boundaries in different aspects of life. Individuals with high levels of this personality trait tend to be more curious, creative and innovative in nature.

- The candidate may not be very open to new experiences lying outside her comfort zone and tends to prefer routine over variety.
- She may be pragmatic and is likely to be conventional in her outlook and actions and may not pursue an experimental approach to problem-solving.
- She may not have an appreciation for art.
- She may not like to express her emotions and feelings to others.
- She tends to demonstrate concrete thinking with a focus on practical solutions, as opposed to abstract ideas.
- The candidate's personality is more suited to job roles that require logical and rational thinking.

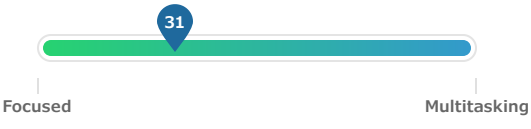
## Emotional Stability




Emotional stability refers to the ability to withstand stress, handle adversity, and remain calm and composed when working through challenging situations. People with high levels of this personality trait tend to be more in control of their emotions and are likely to perform consistently despite difficult or unfavourable conditions.

- The candidate is likely to be sensitive, emotional and may tend to worry about situations.
- She may react to everyday events with greater intensity and may become emotional.
- She may hesitate to face certain stressful situations and might feel anxious about her ability to handle them.
- She may find it hard to elicit self restraint and may tend to make impulsive decisions.
- The candidate's personality is more suited for less stressful jobs.

## Polychronicity



Polychronicity refers to a person's inclination to multitask. It is the extent to which the person prefers to engage in more than one task at a time and believes that such an approach is highly productive. While this trait describes the personality disposition of a person to multitask, it does not gauge their ability to do so successfully.

- The candidate prefers to work on one task at a time, complete it and then move on to the next.
- She prefers orderliness and likes to concentrate on the task at hand without any distractions.
- She can find it difficult to be placed in a work environment where there is a need to multitask or where expected to engage in multiple projects simultaneously.

## Automata Fix

0 / 100

This test measures the candidate's debugging skills. It checks her/his ability to fix logical and syntactical errors and to reuse an existing code.

The candidate needs to put in substantial effort into learning to read source codes and error messages and in understanding what a set of coding instructions is trying to achieve. Being able to understand and diagnose source code issues is an important part of the daily routine of a software engineer.

## Computer Science (Level 1)

27 / 100

This test will assess your knowledge and understanding on the concepts of data structure basics, linked lists, stacks and queues, and trees and graphs.

This test assesses candidate's knowledge and understanding on the concepts of data structure basics, linked lists, stacks and queues, and trees and graphs.

- The candidate has very basic knowledge of the technical terms and understands elementary concepts.
- She needs to put in effort to improve her conceptual and practical knowledge in computer science. This will also build a strong foundation for her to learn more advanced topics of the subject.

## SVAR - Spoken English

59 / 100 | CEFR: B1

- The candidate demonstrates an understanding of the main ideas, context, and details of speech regarding familiar situations typically encountered in work, school, and home life.
- She can deal effectively with most situations that typically arise while travelling in areas where English is commonly spoken.
- She can deliver simple speech with connected sentences and paragraphs on topics that are familiar or are of personal interest.
- She can describe experiences, events, hopes, and future plans, and can give reasons and brief explanations for opinions and personal preferences.

## Competencies

### Pronunciation

59 / 100

The ability to articulate words in a manner that is generally understood by native and non-native speakers. Speech is delivered with a neutral accent.

- The candidate's pronunciation is satisfactory but is influenced by her primary language.
- She often places improper stress on syllables.
- Her mistakes in pronunciation may impede the comprehensibility of her speech by native and other non-native speakers.

### Fluency

68 / 100

The ability to express oneself effortlessly and articulately. Speech is delivered with correct rhythm and intonation.

- The candidate maintains a fairly smooth flow of speech.
- Her speech exhibits some disruptions such as hesitations, interjections, revisions, or self-correction.
- The rhythm and intonation of her speech can affect listenability and can obscure the comprehensiveness of the candidate's ideas.

### Active Listening

68 / 100

The ability to comprehend and remember spoken information; to compensate for unfamiliar or missed words; and to anticipate upcoming details, based on the context of the speech.

- The candidate possesses a very good ability to comprehend and reproduce new information that she receives.
- She can compensate for missed or unfamiliar words and grasp the meaning of the speech.
- The candidate may commit minor errors while reproducing the information, but the meaning of the information will not be lost or altered.
- The candidate's errors may be due to distraction or unfamiliarity with new words.

### Spoken English Understanding

60 / 100

The ability to discern main ideas and details in spoken information. The ability to comprehend the speaker's intent and to respond accordingly.

- The candidate exhibits satisfactory understanding of spoken English.
- She grasps the main idea and context of conversation and spoken information, but misses important details.
- At times, she may misinterpret large portions of the speech, and therefore may fail to respond to questions and instructions in an appropriate manner.

## Vocabulary

20 / 100

The ability to recognize words and phrases, as well as the proper context for words with similar meanings.

- The candidate possesses a limited knowledge of English words and phrases.
- She encounters difficulty when comprehending even routine situations.
- She commits frequent errors that impede effective communication.

## Grammar

60 / 100

The ability to construct proper sentences and paragraphs using correct syntax.

- The candidate exhibits very good knowledge of sentence structure and syntax.
- She consistently demonstrates knowledge and control over grammatical technique.
- She may commit occasional errors, but these errors will not alter the sentence meaning or lead to miscommunication.

## 3 | Response

### WriteX - Essay Writing

77 / 100 | CEFR: C1

**Question**

**Nowadays, many youngsters constantly look for job opportunities abroad and in the long term want to settle there.**
In your view, what are the reasons for the same? Do you wish to settle abroad or stay back in India? Substantiate your response with reasons.

**Scores**

| Content Score | Grammar Score |
|---|---|
| 81 / 100 | 69 / 100 |

**Response**

actually coming to point ,people prefer to work and settle in abroad for some issues su ch as for money,job,family,or a change travelling from one country to other.It is good whne youngsters prefer to go abroad for job and money because they need to survive and adopt themselves.Many go to abroad because of good education system,communic ation and more job opportunities .But in my point of view its better to be in our countr y study and search for a job.Because for every people their nation is the pride and mos t importantly its safe to be in our own country looking back to anyother country for you ngers.Though we may change for job seek or money etc..but our safety and security is important only our country cares about our people security and well-being ,none other countries cannot.Most of the country may not have proper security people may face se veral issues and many people die due to lack of security or boom blast terrosit .Own co untry provide people protected and secure due to strong army and navy support.Theref ore its safe to be in in our own country and youngsters to study or look for job as in ou r own country lot of facilities and jobs are available.

**Error Summary**

| | |
|---|---|
| Spelling | 4 |
| White Space | 15 |
| Style | 0 |
| Grammar | 0 |
| Typographical | 3 |

**Essay Statistics**

| 209 | 10 | 21 | 113 | 94 |
|---|---|---|---|---|
| Total words | Total sentences | Average sentence length | Total unique words | Total stop words |

**Error Details**

Spelling

| | |
|---|---|
| ...ng from one country to other.It is good whne youngsters prefer to go abroad for job ... | Possible spelling mistake found |

| | |
|---|---|
| ...o be in our own country looking back to anyother countr y for youngers.Though we may chan... | Possible spelling mistake found |
| ...ry looking back to anyother country for youngers.Though we may change for job seek or mo... | Possible spelling mistake found |
| ...e due to lack of security or boom blast terrosit .Own cou ntry provide people protected a... | Possible spelling mistake found |

## White Space

| | |
|---|---|
| actually coming to point ,people prefer to work and settle i n abro... | Put a space after the comma, but not before the comma |
| ...abroad for some issues such as for money,job,family,or a change travelling from one ... | Put a space after the comma |
| ...some issues such as for money,job,family,or a change tr avelling from one country to... | Put a space after the comma |
| ...ge travelling from one country to other.It is good whne y oungsters prefer to go ab... | Add a space between sentences |
| ...ey need to survive and adopt themselves.Many go to abr oad because of good education... | Add a space between sentences |
| ... themselves.Many go to abroad because of good educati on system,communication and ... | Possible typo: you repeated a whitespace |
| ...abroad because of good education system,communicatio n and more job opportunities .But in my p... | Put a space after the comma |
| ...communication and more job opportunities .But in my po int of view its better to be... | Don't put a space before the full stop |
| ...mmunication and more job opportunities .But in my poin t of view its better to be in... | Add a space between sentences |
| ... our country study and search for a job.Because for ever y people their nation is the pr... | Add a space between sentences |
| ...g back to anyother country for youngers.Though we may change for job seek or money etc... | Add a space between sentences |
| ...about our people security and well-being ,none other cou ntries cannot.Most of the ... | Put a space after the comma, but not before the comma |
| ...well-being ,none other countries cannot.Most of the coun try may not have proper secu... | Add a space between sentences |
| ... lack of security or boom blast terrosit .Own country pro vide people protected and... | Don't put a space before the full stop |
| ...ack of security or boom blast terrosit .Own country provi de people protected and se... | Add a space between sentences |

## Typographical

| | |
|---|---|
| actually coming to point ,people prefer to work ... | This sentence does not start with an uppercase letter |

| | |
|---|---|
| ... we may change for job seek or money etc..but our safet y and security is important... | Two consecutive dots |
| ...ure due to strong army and navy support.Therefore its s afe to be in in our own country an... | Did you forget a comma after a conjunctive/linking adverb? |

## Automata Fix

0 / 100 Code Replay

### Question 1 (Language: Java)

The function/method ***mergeLists*** accepts two arguments - *list1* and *list2,* representing two singly linked lists whose elements are sorted in ascending order of their values. This function is supposed to return a linked list formed by merging *list1* and *list2* such that the linked list remains sorted.

The function/method compiles successfully but fails to return the desired result for some test cases. Your task is to fix the code so that it passes all the test cases.

**Helper Description**
The following structure is used to represent a node of the linked list and is already implemented in the default code (Do not write this definition again in your code):

```
struct LNode;
typedef struct LNode lnode;
struct LNode
{
   int value;
   lnode* next;
};
```

**Original Code** **Test cases passed: 0%**

```
9
10      else if (list2==null)
11          return(list1);
12
13      if (list1.value <= list2.value)
14      {
...
23      }
24
```

**Response** **Test cases passed: 0 %**

```
9
10      else if (list2==null)
11          return(list1);
12
13
14      if (list1.value <= list2.value)
15      {
...
24      }
25
```

| | | | |
|---|---|---|---|
| 25 | return result; | 26 | return result; |
| | | 27 | System.out.println("list1","list2") |
| 26 | } | 28 | } |
| 27 | } | 29 | } |

No change | Code insertions | Code deletions | Code edits | Skipped comment part

## Compilation Statistics

| 1 | 1 |
|---|---|
| Total attempts | Successful |

| | |
|---|---|
| Response time: | 00:03:24 |
| Average test case pass percentage per compile: | 0% |

## Question 2 (Language: Java)

A binary search tree (BST) is defined as a binary tree in which each node satisfies the property such that its value is larger than the value of every node in its left subtree, and less than or equal to the value of every node in its right subtree. The distance between two values in a binary search tree is the minimum number of edges traversed to reach from one value to the other.

The function/method ***isSubBST*** accepts two input arguments - *bRoot1* and *bRoot2*, representing the root of the first tree and the root of the second tree. It returns 1 if the tree with root *bRoot2* is a subtree of a tree with root *bRoot1,* else it returns 0.

The function/method compiles successfully but fails to return the desired result for some test cases. Your task is to fix the code so that it passes all the test cases.

**Note:**
The function/method ***isSubBST*** uses another function/method - ***areIdentical,*** which accepts two root nodes, *bst1* and *bst2,* to check if these two binary search trees are identical or not.

**Helper Description**
The following structure is used to represent a node of the tree and is already implemented in the default code (Do not write this definition again in your code):

```
struct TNode;
typedef struct TNode tnode;
struct TNode{
   tnode* left;
   tnode* right;
   int value;
};
```

| Original Code | Test cases passed: 65.63% | Response | Test cases passed: 0 % |
|---|---|---|---|
| 30 return 1; | | 30 return 1; | |
| 31 else | | 31 else | |
| 32 return 0; | | 32 return 0; | |
| | | 33 System.out.println("bRoot1,"bRoot") | |
| 33 | | 34 | |
| 34 } | | 35 } | |
| 35 } | | 36 } | |

No change | Code insertions | Code deletions | Code edits | Skipped comment part

**Compilation Statistics**

| Total attempts | Successful |
|---|---|
| 0 | 0 |

| | |
|---|---|
| Response time: | 00:01:03 |
| Average test case pass percentage per compile: | 0% |

**Question 3 (Language: Java)**

The function ***getArraySum(int *arr, int len)*** is supposed to calculate and return the sum of elements of the input array *arr* of length *len* (*len* ≥ *0*).
The function compiles successfully but fails to return the desired result because of logical errors.

Your task is to debug the program so that it passes all the test cases.

*Assumption:*
You may assume that sum of the elements of the array *arr* will not exceed the range of its data type.

| Original Code | Test cases passed: 66.67% | Response | Test cases passed: 0 % |
|---|---|---|---|
| 6 sum = arr[i]; | | 6 sum = arr[i]; | |
| 7 } | | 7 } | |
| 8 return sum; | | 8 return sum; | |
| | | 9 System.out.println("ArraySum"); | |
| 9 } | | 10 } | |

```
10 }
```

```
11 }
```

No change | Code insertions | Code deletions | Code edits | Skipped comment part

**Compilation Statistics**

| 0 | 0 |
|---|---|
| Total attempts | Successful |

| | |
|---|---|
| Response time: | **00:01:03** |
| Average test case pass percentage per compile: | **0%** |

**Question 4 (Language: Java)**

The function ***printTable(int num)*** is supposed to print the first ten multiples of the multiplication table of the input number *num*.

The function compiles fine but fails to return the desired result for some test cases.

Your task is to fix the program so that it passes all the test cases.

The candidate did not make any changes in the code.

**Compilation Statistics**

| 0 | 0 |
|---|---|
| Total attempts | Successful |

| | |
|---|---|
| Response time: | **00:00:19** |
| Average test case pass percentage per compile: | **12.5%** |

**Question 5 (Language: Java)**

The function ***calculateGeneralLCM(int *arr, int len)*** accepts an integer array *arr* of length *len*.

It is supposed to calculate and return the LCM of elements in the input array.

Another function ***calculateLCM(int a,int b)*** returns the LCM of two input numbers *a* and *b*.

Your task is to use the ***calculateLCM(int a,int b)*** function to complete the code in ***calculateGeneralLCM(int *arr, int len)*** so that it passes all test cases.

| Original Code | Test cases passed: 0% | Response | Test cases passed: 0 % |
|---|---|---|---|
| 17 LCM++; | | 17 LCM++; | |
| 18 } | | 18 } | |
| 19 return LCM; | | 19 return LCM; | |
| | | 20 System.out.println("int a","int b"); | |
| 20 } | | 21 } | |
| 21 | | 22 | |
| 22 | | 23 | |

No change | Code insertions | Code deletions | Code edits | Skipped comment part

**Compilation Statistics**

| 0 Total attempts | 0 Successful | Response time: | 00:00:42 |
|---|---|---|---|
| | | Average test case pass percentage per compile: | 0% |

**Question 6 (Language: Java)**

You are given a predefined structure ***PalindromeCollection*** and also a collection of functions that can be used to perform some basic operations on the structure.

You must implement the function ***printPalindrome(int num, int n)*** to accepts initial number *num* and number of digits *n* as inputs and print all the palindrome numbers of *n* digits starting from the initial number *num*

Use the ***PalindromeCollection*** class and the associated functions for this task.

(Please refer to the *Helper Code* tab for details regarding the class ***PalindromeCollection*** and the predefined functions around it)

| Original Code | Test cases passed: 0% | Response | Test cases passed: 0 % |
|---|---|---|---|
| 4 { | | 4 { | |
| 5 public void printPalindrome(int num, int n) | | 5 public void printPalindrome(int num, int n) | |
| 6 { | | 6 { | |
| 7 // write your code here | | 7 | |

| | | | |
|---|---|---|---|
| 8 | } | 8 | } |
| 9 | | 9 | |
| 10 | } | 10 | } |

No change | Code insertions | Code deletions | Code edits | Skipped comment part

**Compilation Statistics**

| 0 | 0 |
|---|---|
| Total attempts | Successful |

| | |
|---|---|
| Response time: | 00:01:34 |
| Average test case pass percentage per compile: | 0% |

**Question 7 (Language: Java)**

The function ***checkGreatestFactor(int num)*** accepts an integer *num* as an input and is supposed to return the highest factor that is less than *num*.

It uses another function ***calculateFactor(int inputNumber)*** for calculating the factors of a number.

The function *checkGreatestFactor* looks fine but gives a compilation error.

Your task is to fix the program so that it passes all the test cases.

| Original Code — Test cases passed: 0% | | Response — Test cases passed: 0 % | |
|---|---|---|---|
| 18 | maxFactor=i; | 18 | maxFactor=i; |
| 19 | } | 19 | } |
| 20 | return maxFactor; | 20 | return maxFactor; |
| | | 21 | System.out.println("GreatestFactor"); |
| 21 | } | 22 | } |
| 22 | | 23 | |
| 23 | } | 24 | } |

No change | Code insertions | Code deletions | Code edits | Skipped comment part

## Compilation Statistics

| 0 | 0 |
|---|---|
| Total attempts | Successful |

| | |
|---|---|
| Response time: | **00:00:49** |
| Average test case pass percentage per compile: | **0%** |

## Automata

**0** / 100 Code Replay

### Question 1 (Language: Python)

A company Dictory is launching a new dictionary application for mobile users. Initially, the dictionary will not have any words. Instead it will be an auto-learning application that will learn according to a user's given text. When a user types text, the application auto-detects the words that appear more than once. The application then stores these words in the dictionary and uses them as suggestions in future typing sessions.

Write an algorithm to identify which words will be saved in the dictionary.

### Scores

**Programming Ability**

**0** / 100

NA

**Programming Practices**

**0** / 100

Programming practices score cannot be generated. This is because source code has syntax/runtime errors and is unparseable or the source code does not meet the minimum code-length specifications.

**Functional Correctness**

**0** / 100

## Final Code Submitted

Compilation Status: Pass

```
1
2 """
3
4 """
5 def dictWords(textInput):
6     # Write your code here
7
8     return
9
10 def main():
11     # input for textInput
12     textInput = str(raw_input())
13
14     result = dictWords(textInput)
15     print(" ".join([str(res) for res in result]))
16
17 if __name__ == "__main__":
18     main()
```

## Code Analysis

### Errors/Warnings

There are no errors in the candidate's code.

### Structural Vulnerabilites and Errors

There are no errors in the candidate's code.

## Test Case Execution

Passed TC: **0%**

Total score

0/14

| 0% | 0% | 0% |
|---|---|---|
| Basic(**0**/8) | Advance(**0**/5) | Edge(**0**/1) |

## Test Cases: Deep Dive

## Compilation Statistics

| 1 | 1 | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|
| Total attempts | Successful | Compilation errors | Sample failed | Timed out | Runtime errors |

| | |
|---|---|
| Response time: | **00:01:55** |
| Average time taken between two compile attempts: | **00:01:55** |
| Average test case pass percentage per compile: | **0%** |

## Test Case Execution

There are three types of test-cases for every coding problem:

**Basic:** The basic test-cases demonstrate the primary logic of the problem. They include the most common and obvious cases that an average candidate would consider while coding. They do not include those cases that need extra checks to be placed in the logic.

**Advanced:** The advanced test-cases contain pathological input conditions that would attempt to break the codes which have incorrect/semi-correct implementations of the correct logic or incorrect/semi-correct formulation of the logic.

**Edge:** The edge test-cases specifically confirm whether the code runs successfully even under extreme conditions of the domain of inputs and that all possible cases are covered by the code

## Question 2 (Language: Python)

You are given a list of integers and an integer *K*. Write an algorithm to find the number of elements in the list that are strictly less than *K*.

## Scores

### Programming Ability

**0** / 100

NA

### Programming Practices

**0** / 100

Programming practices score cannot be generated. This is because source code has syntax/runtime errors and is unparseable or the source code does not meet the minimum code-length specifications.

### Functional Correctness

**0** / 100

## Final Code Submitted

**Compilation Status: Pass**

```
1
2 """
  element, representing the array with size of element_size.
```

## Code Analysis

### Errors/Warnings

```
3
4 num, representing the integer to be compared(K).
5 """
6 def noOfElement(element, num):
7     # Write your code here
8
9     return
10
11 def main():
12     # input for element
13     element = []
14     element_size  = int(raw_input())
15     element = list(map(int,raw_input().split()))
16     # input for num
17     num = int(raw_input())
18
19     result = noOfElement(element, num)
20     print result,
21
22 if __name__ == "__main__":
23     main()
```

There are no errors in the candidate's code.

**Structural Vulnerabilites and Errors**

There are no errors in the candidate's code.

## Test Case Execution

Passed TC: **0%**

Total score

0/16

| 0% | 0% | 0% |
|---|---|---|
| Basic(**0**/6) | Advance(**0**/8) | Edge(**0**/2) |

## Test Cases: Deep Dive

## Compilation Statistics

| 2 | 2 | 0 | 0 | 0 | 2 |
|---|---|---|---|---|---|
| Total attempts | Successful | Compilation errors | Sample failed | Timed out | Runtime errors |

| | |
|---|---|
| Response time: | **00:04:47** |
| Average time taken between two compile attempts: | **00:02:24** |
| Average test case pass percentage per compile: | **0%** |

## Test Case Execution

There are three types of test-cases for every coding problem:

**Basic:** The basic test-cases demonstrate the primary logic of the problem. They include the most common and obvious cases that an average candidate would consider while coding. They do not include those cases that need extra checks to be placed in the logic.

**Advanced:** The advanced test-cases contain pathological input conditions that would attempt to break the codes which have incorrect/semi-correct implementations of the correct logic or incorrect/semi-correct formulation of the logic.

**Edge:** The edge test-cases specifically confirm whether the code runs successfully even under extreme conditions of the domain of inputs and that all possible cases are covered by the code

## SVAR - Spoken English

59 / 100 | CEFR: **B1**

This section of the report will be generated once the responses of this test have been processed.

## 4 | Interview Questions

### Personality

#### Competencies

**Extraversion**

What steps do you take to understand your colleagues' personalities? Give an example where you found it hard to adjust to one particular colleague.

**Conscientiousness**

In your previous organization, did you think that any part of your regular work was unnecessary? If you had had control of the processes, which aspects would you have changed?

**Agreeableness**

Describe a project or idea you persuaded management in your organization to pursue that brought you the greatest satisfaction.

Describe a time when you failed to convince someone of something that you knew was correct.

**Openness to Experience**

Describe an instance when you solved a problem by using an unorthodox approach or technique. Was the technique effective? Were you satisfied with the outcome? Why did you decide to try such an unusual approach?

Have you ever refrained from making a decision or voicing your opinion because you thought that you did not have sufficient information? Please explain.

**Emotional Stability**

Describe a time when you disagreed with a peer because you believed you were right and there was a positive outcome. Why did you disagree and how was it resolved?

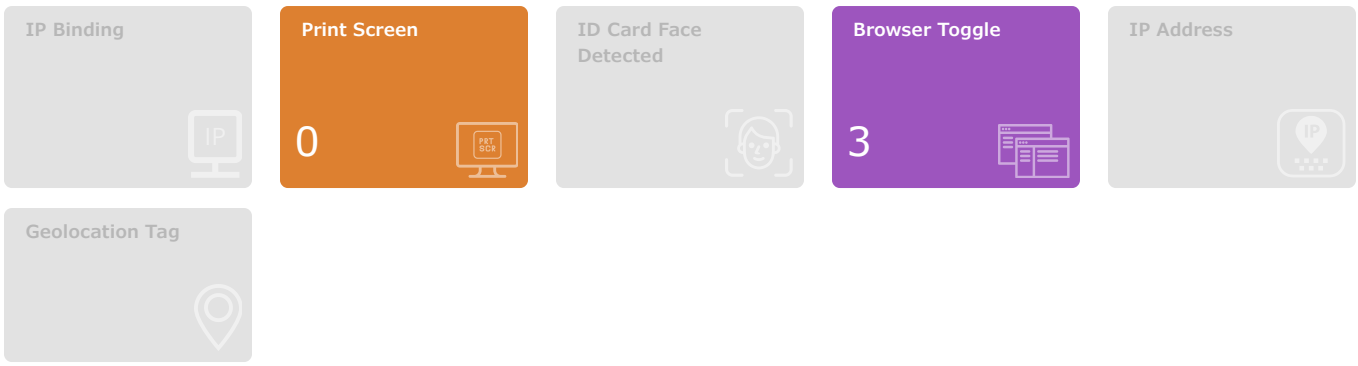
Describe an instance when you were forced to compromise for the benefit of your team.

**Polychronicity**

Do you think that the ability to multitask increases productivity?

You are a college student and you must complete an assignment for your professor. You are very familiar with the topic and the assignment is simple. What would be your work method in this instance? Would you watch TV and listen to music while completing it? Or would you concentrate on the assignment in silence, and then watch TV?

## 5 | Proctoring




### AI Proctoring Information

**Print Screen:** The number of times the candidate attempted to take a screenshot of the assessment screen using the “print screen” function on their device. Note: This impacts proctoring index.

**ID Card Face Detected:** Looks at the candidate images captured during the assessment and flags anywhere different people appear to be present. Snapshots are included in the report.

**Browser Toggle:** Either the proportion of time the candidate spent focused on a tab/window other than that of assessment screen (%), or the number of times the candidate toggled to another tab/window (count). Note: This impacts proctoring index.

**IP Address:** Confirms that the candidate took the assessment from the specified IP address(s).

**Geolocation Tag:** Detects whether the candidate attempted the assessment from a location beyond the distance set by the administrator.

Corporate Social Responsibility

Cisco Networking Academy

Certificate of Course Completion

# Cybersecurity Essentials

For completing the Cisco Networking Academy® Cybersecurity Essentials course, and demonstrating the following abilities:

- Describe the tactics, techniques and procedures used by cyber criminals.
- Describe the principles of confidentiality, integrity, and availability as they relate to data states and cybersecurity countermeasures.
- Describe technologies, products and procedures used to protect confidentiality, ensure integrity and provide high availability.
- Explain how cybersecurity professionals use technologies, processes and procedures to defend all components of the network.
- Explain the purpose of laws related to cybersecurity.

**Mithunesh Rajan A**

Student

**ICT Academy**

Academy Name

**India**

Location

**14 Sep 2021**

Date

Laura Quintana
VP & General Manager, Cisco Networking Academy

Corporate Social Responsibility

Cisco Networking Academy

Certificate of Course Completion

# Introduction to Cybersecurity

For completing the Cisco Networking Academy® Introduction to Cybersecurity course, and demonstrating the ability to explain the following:

- Global implications of cyber threats
- Ways in which networks are vulnerable to attack
- Impact of cyber-attacks on industries
- Cisco’s approach to threat detection and defense
- Why cybersecurity is a growing profession
- Opportunities available for pursuing network security certifications

Laura Quintana
VP & General Manager, Cisco Networking Academy

**Mithunesh Rajan A**

Student

**12 May 2021**

Date

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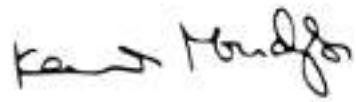
December 3rd 2022



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**IIT Bombay**

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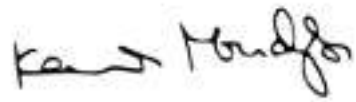

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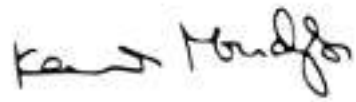

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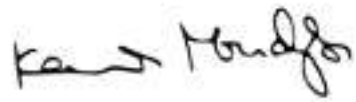

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**Prof. Kannan M Moudgalya**
**IIT Bombay**

Spoken Tutorial is a project at IIT Bombay, started with funding from the National Mission on Education through ICT, Ministry of Education (previously MHRD), Govt. of India

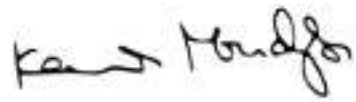
Spoken Tutorial
Project at
IIT Bombay

# Certificate for Completion of Scilab Training

This is to certify that **THAMIZHARASAN K** has successfully completed **Scilab** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

**Nantha kumar P** from **Sri Sai Ram Institute of Technology** invigilated this examination. This training is offered by the Spoken Tutorial Project, IIT Bombay.

December 3rd 2022



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Spoken Tutorial
Project at
IIT Bombay

# Certificate for Completion of Scilab Training

This is to certify that **HARIHARAN A** has successfully completed **Scilab** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

**Nantha kumar P** from **Sri Sai Ram Institute of Technology** invigilated this examination. This training is offered by the Spoken Tutorial Project, IIT Bombay.

December 3rd 2022

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**IIT Bombay**

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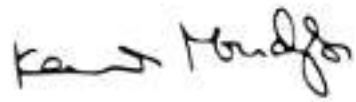
Spoken Tutorial
Project at
IIT Bombay

# Certificate for Completion of Scilab Training

This is to certify that **NACHIAPPAN N** has successfully completed **Scilab** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

**Nantha kumar P** from **Sri Sai Ram Institute of Technology** invigilated this examination. This training is offered by the Spoken Tutorial Project, IIT Bombay.

December 3rd 2022



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Spoken Tutorial
Project at
IIT Bombay

# Certificate for Completion of Scilab Training

This is to certify that **NACHIARAPPAN M** has successfully completed **Scilab** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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December 3rd 2022

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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **AJAY R** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **AKASH S** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **ALVITONE A** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **ANIRUDH P** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **BHUVANESWARI M** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **BRABU RAJ B** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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Spoken Tutorial Project at IIT Bombay

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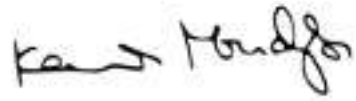
May 8th 2023



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# Certificate of Participation

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May 8th 2023

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **DHAMODHARA PRASADH B** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **DURGANANDHINI K** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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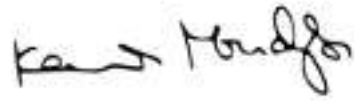
May 8th 2023



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May 8th 2023

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May 8th 2023

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **GUNAL D** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **HANUSOOYAA B K** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **HARISH D** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **IMMANUEL GEORGE REGLAND B** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **JAGADISHWARAN K A** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **JAYANANTHAN R** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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# Certificate of Participation

This is to certify that **KARMUGIL K** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

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May 8th 2023

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# Certificate of Participation

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May 8th 2023

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May 8th 2023

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# Certificate of Participation

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May 8th 2023

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# Certificate of Participation

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May 8th 2023

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May 8th 2023

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# Certificate of Participation

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May 8th 2023

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# Certificate of Participation

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# Certificate of Participation

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May 8th 2023

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **NIKITHA V** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

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May 8th 2023

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Spoken Tutorial
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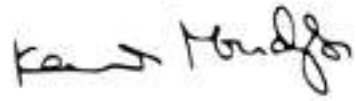
May 8th 2023



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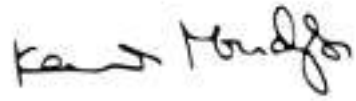

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May 8th 2023

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May 8th 2023

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May 8th 2023

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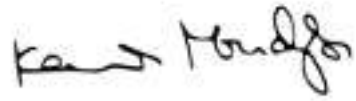

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May 8th 2023

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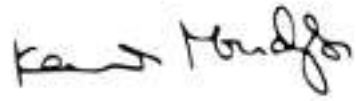

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This is to certify that **s.varshini priyadharshini** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **AKASH J** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

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This is to certify that **AMARSUKIRTHA N** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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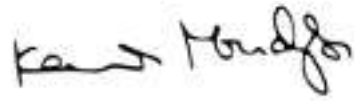
May 8th 2023



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May 8th 2023

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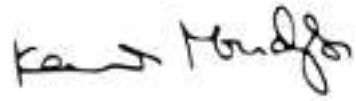
May 8th 2023



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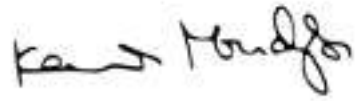

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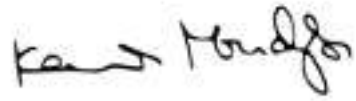

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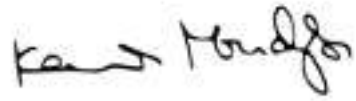

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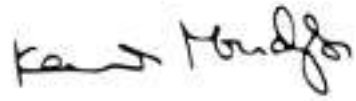

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **NITHYA S** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

**Prof. Kannan M Moudgalya**
**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **POOJA A** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

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**IIT Bombay**

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Spoken Tutorial
Project at
IIT Bombay

# Certificate of Participation

This is to certify that **PRAVEEN P** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **PREETHI GOWSALYA D** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **PUVIARASU A** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

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**IIT Bombay**

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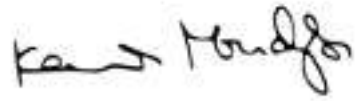
Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **RAJALAKSHMI N** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023



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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **SAIVISHAL P** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **SANGAVI M** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

A comprehensive set of topics pertaining to **Blender** were covered in the training.

May 8th 2023

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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **SANJAY R** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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**IIT Bombay**

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Spoken Tutorial Project at IIT Bombay

# Certificate of Participation

This is to certify that **SANTHOSHINI I** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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**IIT Bombay**

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# Certificate of Participation

This is to certify that **SARAVANAN K** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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**IIT Bombay**

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# Certificate of Participation

This is to certify that **SHAMEER AHAMAD KHAN S** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **SHANMUGAPRIYAN E** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **SHOBHANA K** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **N.SOBANA N** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **SRIVARSHINI S** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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Project at
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# Certificate of Participation

This is to certify that **SUNIL KUMAR R** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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This is to certify that **SYED AADIL S J** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **VAISHNAVI G** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

This is to certify that **VARSHA A** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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May 8th 2023

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# Certificate of Participation

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# Certificate of Participation

This is to certify that **SOSHYA JOSHI** participated in the **Blender** training organized at **Sri Sai Ram Institute of Technology** in **January 2023** semester, with course material provided by the Spoken Tutorial Project, IIT Bombay.

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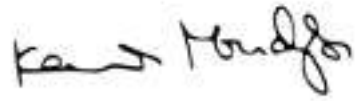
May 8th 2023



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ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27567

Date: 21 April 2023

This is to certify that

**ASSA A**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766100

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **B** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766100

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27568

Date: 21 April 2023

This is to certify that

**K R DHARSHINI**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766101

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **A** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766101

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27569

Date: 21 April 2023

This is to certify that

**MEENALOSHINI E**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766102

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **B** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766102

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27570

Date: 21 April 2023

This is to certify that

**KEERTHI U**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766103

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **A** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766103

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27576

Date: 21 April 2023

This is to certify that

**MITHUNESH RAJAN A**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766109

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **A** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766109

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27577

Date: 21 April 2023

This is to certify that

**R V VISSHNU PRIYA**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766110

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **C** Grade.

In association with

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Chief Executive Officer
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S1766110

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27578

Date: 21 April 2023

This is to certify that

**NAVEEN A**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766111

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **A** Grade.

In association with

aws

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Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766111

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27579

Date: 21 April 2023

This is to certify that

**THIYAGARAJAN S**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766112

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **B** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766112

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27580

Date: 21 April 2023

This is to certify that

**DHARINI T**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766113

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **A** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766113

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27581

Date: 21 April 2023

This is to certify that

**DEVIKA A**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766114

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **A** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766114

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SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27582

Date: 21 April 2023

This is to certify that

**VARSHINI C**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766115

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **B** Grade.

In association with

aws

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Chief Executive Officer
ICT Academy

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S1766115

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27583

Date: 21 April 2023

This is to certify that

**NANDHINI G**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766116

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

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In association with

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Hari Balachandran
Chief Executive Officer
ICT Academy

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S1766116

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27584

Date: 21 April 2023

This is to certify that

**DANYA SHRI CHANDRASEKARAN**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766117

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

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In association with

aws

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Chief Executive Officer
ICT Academy

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S1766117

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27585

Date: 21 April 2023

This is to certify that

**PRINCY YUVANITA G V**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766118

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **B** Grade.

In association with

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Chief Executive Officer
ICT Academy

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S1766118

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27586

Date: 21 April 2023

This is to certify that

**ANANYA A**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766119

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Chief Executive Officer
ICT Academy

A >=80 | B >=60 & <80 | C >=40 & <60 | D <40

S1766119

ICTACADEMY®

SKILL TESTER®
Competency Measure

# Certificate of Proficiency

C. No: S23-27587

Date: 21 April 2023

This is to certify that

**AKSHATHA S**

of Sri Sairam Institute of Technology, Chennai bearing ID S1766120

has successfully completed all the requirements for

**Cloud Solutions Architect - Associate (AWS)**

through assessment administered by ICT Academy and

has been awarded **A** Grade.

In association with

aws

Hari Balachandran
Chief Executive Officer
ICT Academy

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S1766121

Spoken Tutorial
Project at
IIT Bombay

# Certificate for Completion of Python 3.4.3 Training

This is to certify that **ABINESH S G ABINESH S G** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

**Nantha kumar P** from **Sri Sai Ram Institute of Technology** invigilated this examination. This training is offered by the Spoken Tutorial Project, IIT Bombay.

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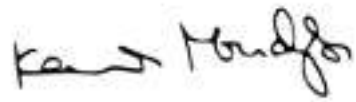

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# Certificate for Completion of Python 3.4.3 Training

This is to certify that **AJITH D** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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# Certificate for Completion of Python 3.4.3 Training

This is to certify that **ALLAN ARMSTRONG S ALLAN ARMSTRONG S** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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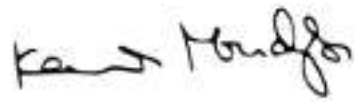

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# Certificate for Completion of Python 3.4.3 Training

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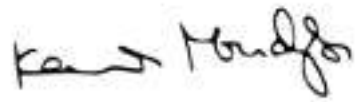

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# Certificate for Completion of Python 3.4.3 Training

This is to certify that **GOVARTHANAN P GOVARTHANAN P** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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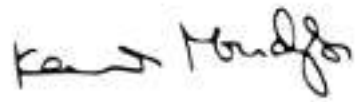

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# Certificate for Completion of Python 3.4.3 Training

This is to certify that **HARI SKANDAN S** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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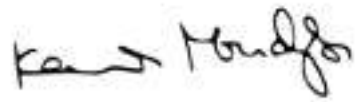

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# Certificate for Completion of Python 3.4.3 Training

This is to certify that **JANDHYALA BADRINATH** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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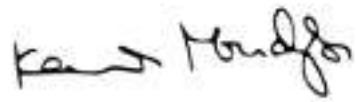

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This is to certify that **JASWANTH KUMAR R JASWANTH KUMAR R** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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# Certificate for Completion of Python 3.4.3 Training

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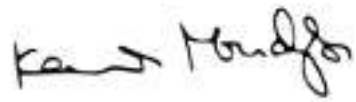

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# Certificate for Completion of Python 3.4.3 Training

This is to certify that **KRISHNA KUMAR T KRISHNA KUMAR T** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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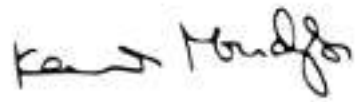

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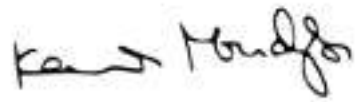

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This is to certify that **NIVASHKUMAR R NIVASHKUMAR R** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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This is to certify that **SABARI SRI B SABARI SRI B** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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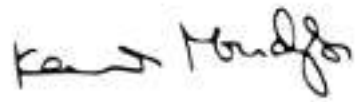

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This is to certify that **SABARINATH S SABARINATH S** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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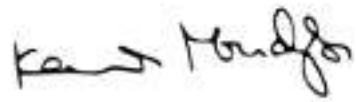

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This is to certify that **VISHAL D VISHAL D** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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This is to certify that **HARISH REDDY MALLU REDDYMALLU** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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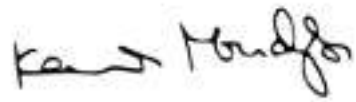

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This is to certify that **RAHUL V** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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This is to certify that **SRIRAM S** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

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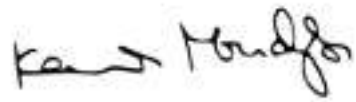

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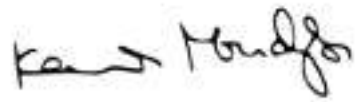
December 10th 2022



**Prof. Kannan M Moudgalya**
**IIT Bombay**

Spoken Tutorial is a project at IIT Bombay, started with funding from the National Mission on Education through ICT, Ministry of Education (previously MHRD), Govt. of India

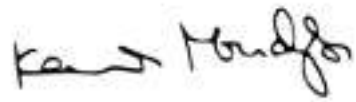
Spoken Tutorial
Project at
IIT Bombay

# Certificate for Completion of Python 3.4.3 Training

This is to certify that **SRIDHAR V** has successfully completed **Python 3.4.3** test organized at **Sri Sai Ram Institute of Technology** by **D SATHISH KUMAR** with course material provided by the Spoken Tutorial Project, IIT Bombay. Passing an online exam, conducted remotely from IIT Bombay, is a pre-requisite for completing this training.

**Nantha kumar P** from **Sri Sai Ram Institute of Technology** invigilated this examination. This training is offered by the Spoken Tutorial Project, IIT Bombay.

December 10th 2022



**Prof. Kannan M Moudgalya**
**IIT Bombay**

Spoken Tutorial is a project at IIT Bombay, started with funding from the National Mission on Education through ICT, Ministry of Education (previously MHRD), Govt. of India

## 1.3.3 Number of students enrolled in the courses under 1.3.2

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## DEPARTMENT OF ECE

## RED HAT LINUX STUDENTS -EVEN 2022-23

**DATES[2.3.2023 AN,3.3.2023,7.3.2023,9.3.2023,11.3.2023]**

Training Attended:

| S.NO | STUDENT NAME | CLASS |
|---|---|---|
| 1 | B.Hemalatha | II ECE A |
| 2 | A.Sadhana | II ECE A |
| 3 | R.Manjunath | II ECE A |
| 4 | R.Niranjan | II ECE B |
| 5 | L.Bhuvanesh | II ECE B |
| 6 | M.hari Krishnan | II ECE B |
| 7 | B.Vishwa | II ECE B |
| 8 | D.Praveen Kumar | II ECE B |
| 9 | G.Ragavendra | II ECE B |
| 10 | S.Divyashree | II ECE B |
| 11 | Jithendra Singh | II ECE B |

**STUDENTS LIST WRITTEN RHCSA EXAM**

| S.NO | STUDENT NAME | CLASS |
|---|---|---|
| 1 | B.Hemalatha | II ECE A |
| 2 | A.Sadhana | II ECE A |
| 3 | B.Vishwa | II ECE B |
| 4 | S.Divyashree | II ECE B |
| 5 | M.hari Krishnan | II ECE B |

HOD

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# SKILL ENHANCEMENT TRAINING

**Trainer Name : Ethnus**

**Date : 19.09.2022 to 24.09.2022, 2nd Year Student(2025 Passing out)**

| S.No | Department | Section | Number of Students | Room No | Block/Floor |
|---|---|---|---|---|---|
| 1 | CSE | C | 62 | IW1110 | WEST WING / GROUND FLOOR |
| 2 | CCE | A | 61 | IW1111 | WEST WING / GROUND FLOOR |
| 3 | ECE | B | 63 | IW1109 | WEST WING / GROUND FLOOR |
| 4 | IT | B | 62 | IW1108 | WEST WING / GROUND FLOOR |
| 5 | EEE | A | 62 | IW1105 | WEST WING / GROUND FLOOR |
| 6 | AI&DS | A | 61 | IW1101 | WEST WING / GROUND FLOOR |
| | | Total | 371 | | |

DEAN- TAPCELL

16.09.2022
for PRINCIPAL

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## SKILL ENHANCEMENT TRAINING

**Trainer Name : FACE**

**Date : 19.09.2022 to 24.09.2022, 2nd Year Student(2025 Passing out)**

| S.No | Department | Section | Number of Students | Room No | Block/Floor |
|---|---|---|---|---|---|
| 1 | CSE | A | 61 | IW1102 | WEST WING / GROUND FLOOR |
| 2 | CSE | B | 60 | IW1107 | WEST WING / GROUND FLOOR |
| 3 | IT | A | 63 | IW1104 | WEST WING / GROUND FLOOR |
| 4 | ECE | A | 61 | IW1103 | WEST WING / GROUND FLOOR |
| 5 | MECH | A | 50 | IW1106 | WEST WING / GROUND FLOOR |
| | | Total | 295 | | |

DEAN- TAPCELL

for PRINCIPAL

16.09.2022

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## LIST OF TOP 100 STUDENTS FOR AWS

| Sl. No. | Program | Students ID | Student Reg No. | Name of the student | PGPA | Amount by REAP | Remaining Amount to be Paid by student |
|---|---|---|---|---|---|---|---|
| 1 | EC | SIT20EC022 | 412420106043 | NITHYA SREE V | 8.925 | 5000 | 0 |
| 2 | CS | SIT20CS095 | 412420104102 | RAJ RONALD SHAW | 8.905 | 5000 | 0 |
| 3 | EC | SIT20EC001 | 412420106062 | SETHUKKARASI V | 8.86 | 5000 | 0 |
| 4 | IT | SIT20IT021 | 412420205047 | KIRUBAVATHI D | 8.805 | 5000 | 0 |
| 5 | AD | SIT20AD022 | 412420243007 | ASSA A | 8.802 | 5000 | 0 |
| 6 | AD | SIT20AD004 | 412420243010 | DEVIKA A | 8.749 | 5000 | 0 |
| 7 | IT | SIT20IT105 | 412420205117 | VINISH S | 8.748 | 5000 | 0 |
| 8 | AD | SIT20AD001 | 412420243016 | KEERTHI U | 8.735 | 5000 | 0 |
| 9 | CS | SIT20CS064 | 412420104117 | SARAN R | 8.735 | 5000 | 0 |
| 10 | EC | SIT20EC060 | 412420106076 | VARSHINI C | 8.732 | 5000 | 0 |
| 11 | AD | SIT20AD006 | 412420243044 | THIYAGARAJAN S | 8.724 | 5000 | 0 |
| 12 | EC | SIT20EC063 | 412420106032 | JEEVITHA K | 8.723 | 5000 | 0 |
| 13 | CS | SIT20CS004 | 412420104139 | VARSHA V | 8.712 | 5000 | 0 |
| 14 | EC | SIT20EC009 | 412420106016 | BEBISHA D | 8.703 | 5000 | 0 |
| 15 | EC | SIT20EC034 | 412420106083 | VISSHNU PRIYA R.V | 8.692 | 5000 | 0 |
| 16 | CS | SIT20CS098 | 412420104084 | NITHIS KUMAR T | 8.68 | 5000 | 0 |
| 17 | CS | SIT20CS024 | 412420104027 | DEVI SREE G | 8.676 | 5000 | 0 |
| 18 | CS | SIT20CS110 | 412420104034 | DHARINI R | 8.668 | 5000 | 0 |
| 19 | AD | SIT20AD046 | 412420243001 | AARADHYANIDHI AIYER | 8.652 | 5000 | 0 |
| 20 | CS | SIT20CS033 | 412420104046 | INBASEKAR S | 8.649 | 5000 | 0 |
| 21 | CS | SIT20CS079 | 412420104002 | AANANDHINI S | 8.64 | 5000 | 0 |
| 22 | EC | SIT20EC038 | 412420106061 | SEKAR P | 8.639 | 5000 | 0 |
| 23 | IT | SIT20IT012 | 412420205038 | JAGADISHWARAN K.A | 8.625 | 3750 | 1250 |
| 24 | CO | SIT20CO049 | 412420118022 | KARTHIKAYANI D | 8.623 | 3750 | 1250 |
| 25 | IT | SIT20IT033 | 412420205094 | SENTHAMILSELVI P | 8.616 | 3750 | 1250 |
| 26 | IT | SIT20IT014 | 412420205011 | ANUPRIYA S | 8.612 | 3750 | 1250 |
| 27 | EC | SIT20EC002 | 412420106014 | ASHWIN R | 8.611 | 3750 | 1250 |
| 28 | IT | SIT20IT043 | 412420205056 | MARY MAGDALENE C | 8.605 | 3750 | 1250 |
| 29 | AD | SIT20AD032 | 412420243008 | ASWINI P | 8.602 | 3750 | 1250 |
| 30 | IT | SIT20IT090 | 412420205031 | GUNAL D | 8.564 | 3750 | 1250 |
| 31 | CS | SIT20CS054 | 412420104069 | MADHUMITHA D | 8.562 | 3750 | 1250 |
| 32 | CS | SIT20CS086 | 412420104140 | VASANTH PRIYADHARSAN | 8.559 | 3750 | 1250 |
| 33 | CS | SIT20CS031 | 412420104061 | KAVIARASAN M S | 8.554 | 3750 | 1250 |
| 34 | IT | SIT20IT031 | 412420205040 | JAYASHREE K | 8.554 | 3750 | 1250 |
| 35 | EC | SIT20EC017 | 412420106010 | ANI SUGESH D S | 8.553 | 3750 | 1250 |
| 36 | CS | SIT20CS036 | 412420104008 | AKALYA P | 8.551 | 3750 | 1250 |
| 37 | AD | SIT20AD049 | 412420243039 | SRIDHAR V | 8.548 | 3750 | 1250 |
| 38 | CS | SIT20CS125 | 412420104036 | DIVYA SREE K | 8.546 | 3750 | 1250 |
| 39 | CS | SIT20CS042 | 412420104141 | VASANTHAKUMARAN U | 8.543 | 3750 | 1250 |
| 40 | CS | SIT20CS081 | 412420104105 | ROHIT DAS | 8.539 | 3750 | 1250 |

| 41 | EC | SIT20EC078 | 412420106058 | SAVEENA K U | 8.539 | 3750 | 1250 |
|---|---|---|---|---|---|---|---|
| 42 | AD | SIT20AD003 | 412420243021 | MITHUNESH RAJAN A | 8.535 | 3750 | 1250 |
| 43 | CS | SIT20CS134 | 412420104022 | BLESSY CAROLIN S | 8.535 | 3750 | 1250 |
| 44 | CO | SIT20CO019 | 412420118013 | GAYATHRI L | 8.525 | 3750 | 1250 |
| 45 | CO | SIT20CO008 | 412420118018 | JAYAPRIYA M | 8.515 | 3750 | 1250 |
| 46 | CS | SIT20CS023 | 412420104068 | LAAVANYA P | 8.512 | 3750 | 1250 |
| 47 | EC | SIT20EC006 | 412420106042 | NAVEEN A | 8.497 | 3750 | 1250 |
| 48 | IT | SIT20IT006 | 412420205017 | BENITA SHARON K R | 8.49 | 2500 | 2500 |
| 49 | EC | SIT20EC069 | 412420106041 | NANDHINI G | 8.488 | 2500 | 2500 |
| 50 | IT | SIT20IT087 | 412420205072 | PADMAPRIYA S | 8.487 | 2500 | 2500 |
| 51 | IT | SIT20IT058 | 412420205075 | PORKODI E | 8.468 | 2500 | 2500 |
| 52 | EC | SIT20EC037 | 412420106073 | THARANIY G | 8.463 | 2500 | 2500 |
| 53 | AD | SIT20AD045 | 412420243011 | DHARSHINI K R | 8.46 | 2500 | 2500 |
| 54 | AD | SIT20AD019 | 412420243023 | NEBO ELEYAZER ABINADAI | 8.46 | 2500 | 2500 |
| 55 | AD | SIT20AD023 | 412420243030 | REENA S | 8.459 | 2500 | 2500 |
| 56 | CS | SIT20CS043 | 412420104096 | PRIYANKA R | 8.455 | 2500 | 2500 |
| 57 | CS | SIT20CS074 | 412420104018 | AYESHA TANSEERA A | 8.448 | 2500 | 2500 |
| 58 | IT | SIT20IT080 | 412420205068 | NIKITHA V | 8.447 | 2500 | 2500 |
| 59 | CS | SIT20CS126 | 412420104121 | SHANJAYSHRI M | 8.446 | 2500 | 2500 |
| 60 | IT | SIT20IT042 | 412420205028 | GAYATHRI B | 8.444 | 2500 | 2500 |
| 61 | CS | SIT20CS006 | 412420104066 | KOUSHIK E R | 8.44 | 2500 | 2500 |
| 62 | EC | SIT20EC019 | 412420106008 | ANANYA A | 8.438 | 2500 | 2500 |
| 63 | EC | SIT20EC093 | 412420106077 | VENUSRI S | 8.435 | 2500 | 2500 |
| 64 | CS | SIT20CS003 | 412420104006 | ADHAVAN M | 8.432 | 2500 | 2500 |
| 65 | EC | SIT20EC042 | 412420106003 | ABINAYA K | 8.422 | 2500 | 2500 |
| 66 | IT | SIT20IT010 | 412420205046 | KIRTHIKA S | 8.418 | 2500 | 2500 |
| 67 | AD | SIT20AD043 | 412420243009 | DANYA SHRI CHANDRASEK | 8.41 | 2500 | 2500 |
| 68 | IT | SIT20IT099 | 412420205027 | DURGANANDHINI K | 8.41 | 1250 | 3750 |
| 69 | CS | SIT20CS013 | 412420104113 | SANJANAA J | 8.405 | 1250 | 3750 |
| 70 | EC | SIT20EC013 | 412420106019 | DHAMINI T | 8.404 | 1250 | 3750 |
| 71 | IT | SIT20IT119 | 412420205098 | SHIYAM K | 8.404 | 1250 | 3750 |
| 72 | CS | SIT20CS052 | 412420104028 | DHAASARATHY M | 8.402 | 1250 | 3750 |
| 73 | IT | SIT20IT038 | 412420205049 | KUZHALI R | 8.402 | 1250 | 3750 |
| 74 | CO | SIT20CO027 | 412420118020 | JIFFY RENISSA A | 8.395 | 1250 | 3750 |
| 75 | EC | SIT20EC048 | 412420106068 | SRI HARISH S | 8.393 | 1250 | 3750 |
| 76 | EC | SIT20EC089 | 412420106050 | PRINCY YUVANITA G V | 8.391 | 1250 | 3750 |
| 77 | CO | SIT20CO006 | 412420118004 | ARAVINDH T S | 8.389 | 1250 | 3750 |
| 78 | EC | SIT20EC083 | 412420106052 | RAHUL G | 8.385 | 1250 | 3750 |
| 79 | IT | SIT20IT030 | 412420205032 | HANUSOOYAA B K | 8.384 | 1250 | 3750 |
| 80 | EC | SIT20EC067 | 412420106036 | KEERTHIVASAN A | 8.374 | 1250 | 3750 |
| 81 | CS | SIT20CS055 | 412420104063 | KEERTHANA R | 8.372 | 1250 | 3750 |
| 82 | CS | SIT20CS046 | 412420104025 | DEEPIKA LAKSHMI M B | 8.368 | 1250 | 3750 |
| 83 | AD | SIT20AD030 | 412420243036 | SANTHOSH V | 8.362 | 1250 | 3750 |
| 84 | AD | SIT20AD028 | 412420243042 | SUPRIYA V | 8.356 | 1250 | 3750 |
| 85 | CO | SIT20CO022 | 412420118005 | BHAGAVATHRAM G | 8.356 | 1250 | 3750 |
| 86 | IT | SIT20IT050 | 412420205053 | MADHUL MANOJ | 8.355 | 1250 | 3750 |
| 87 | CS | SIT20CS068 | 412420104111 | SANDEEP R | 8.348 | 1250 | 3750 |
| 88 | IT | SIT20IT034 | 412420205023 | DEEPIKA S | 8.348 | 1250 | 3750 |
| 89 | CS | SIT20CS102 | 412420104054 | JEYA SUDIKSHAA M M | 8.344 | 1250 | 3750 |

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**Trainer Name : FACE**

## Date : 29.07.2022 to 04.08.2022, 3rd Year Student(2024 Passing out) – 6 Days

| S.No | Department | Section | Number of Students | Room No | Block/Floor |
|---|---|---|---|---|---|
| 1 | CSE | A | 51 | IW4101 | WEST WING 3RD FLOOR |
| 2 | CSE | B | 52 | IW4102 | |
| 3 | IT | A | 59 | IW4103 | |
| 4 | ECE | A | 43 | IW4104 | |
| 5 | MECH | A | 39 | IW4105 | |
| | | Total | 244 | | |

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## Trainer Name: Six Phrase

## Date : 29.07.2022 to 04.08.2022, 3rd Year Student(2024 Passing out) – 6 Days

| S.No | Department | Section | Number of Students | Room No | Block/Floor |
|---|---|---|---|---|---|
| 1 | CSE | C | 51 | IW4106 | WEST WING 3RD FLOOR |
| 2 | CCE | A | 46 | IW4107 | |
| 3 | ECE | B | 41 | IW4108 | |
| 4 | IT | B | 61 | IW4109 | |
| 5 | EEE | A | 52 | IW4110 | |
| 6 | AI&DS | A | 47 | IW4112 | |
| | | Total | 298 | | |

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**Trainer Name : X**

## Date : 13th,14th,15th,16th and 17th of JUNE 2022

| S.No | Department | Section | Number of Students | venue |
|---|---|---|---|---|
| 1 | CSE | A | 51 | CSE innovation lab second floor (East Wing) |
| 2 | CSE | B | 53 | CSE lab partion II second floor (East Wing) |
| 3 | IT | A | 59 | IT Innovation lab second floor (East Wing) |
| 4 | ECE | A | 43 | Mech CAD lab Second floor (West Wing) |
| 5 | MECH | A | 38 | EEE simulation Lab First floor (West Wing) |
| | | Total | 244 | |

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## Trainer Name : Y

## Date : 13th,14th,15th,16th and 17th of JUNE 2022

| S.No | Department | Section | Number of Students | venue |
|---|---|---|---|---|
| 1 | CSE | C | 51 | CSE lab partion I second floor (East Wing) |
| 2 | AI&DS | A | 47 | AIDS Lab Second floor (South Wing) |
| 3 | ECE | B | 41 | ECE Lab Second floor (East Wing) |
| 4 | IT | B | 61 | IT lab partion I second floor (East Wing) |
| 5 | CCE | A | 47 | IT lab partion II second floor (East Wing) |
| 6 | EEE | A | 52 | CSE Lab First floor (West Wing) |
| | | Total | 299 | |

## 1.3.4 Number of students undertaking field work/projects/ internships / student projects

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| S.No. | Project ID | Register Number | Name of the Batch Member | Project Title | Name of the Project Guide |
|---|---|---|---|---|---|
| 1 | IT2023ECPJ01 | 412419106061 | Rinthya M | Shopping trolley for blind people | Dr.G.Saravanan |
| | | 412419106006 | Anusruthi P | | |
| | | 412419106076 | Shakthi V | | |
| 2 | IT2023ECPJ02 | 412419106049 | Pooja.P | SOIL COMMUNICATION THROUGH WIRELESS UNDERGROUND SENSOR | Mrs.P.S.Arthy |
| | | 412419106090 | Uma.N | | |
| | | 412419106013 | Dhanuja.N | | |
| 3 | IT2023ECPJ03 | 412419106008 | Arunachalam.V.R | FRACTAL ANTENNA DESIGN | Mrs.V.Subhashini |
| | | 412419106007 | Aravindan.S | | |
| | | 412419106074 | Sasidharan.M | | |
| 4 | IT2023ECPJ04 | 412419106079 | Sivaraman.G | Border Alert system and Cyclone Emergency contact for Fisherman Emergency indication and Surveillance System | Mrs.D.Pusgararani |
| | | 412419106036 | Iyer charan murthy | | |
| | | 412419106053 | Praveenkanth | | |
| 5 | IT2023ECPJ05 | 412419106091 | Vaishnavi.v | iBeacon Tracking Application | Mrs.Chitra |
| | | 412419106063 | Ritika.P | | |
| | | 412419106028 | Haripriya RMC | | |
| 6 | IT2023ECPJ06 | 412419106027 | Harini.M.S | Gesture vocalizer for deaf and dumb | Dr.P.Saravanan |
| | | 412419106036 | Kannagi.P | | |
| | | 412419106005 | Anuratha Rahavi.LR | | |
| 7 | IT2023ECPJ07 | 412419106024 | Hariharan.D | Securing of Internet of Things (IoT) Against Security Threats | Mrs.Lakshmidevi |
| | | 412419106052 | Prasanna.S | | |
| | | 412419106022 | Ganeshkumar M | | |
| 8 | IT2023ECPJ08 | 412419106003 | Aishwarya.S | Assessment writing robot for disable people | Mrs.K.Sivasankari |
| | | 412419106064 | K.Roopika | | |
| | | 412419106057 | I.Priyanka | | |
| 9 | IT2023ECPJ09 | 412419106080 | Shyamalavanan M | ROAD MONITORING SMART POLE | Mrs.Parameswari |
| | | 412419106031 | Jaganraj A | | |
| | | 412419106014 | Deepak.N | | |
| 10 | IT2023ECPJ10 | 412419106051 | Prakashkumar S | Air conditioner using Peltier | Mrs.K.Sangeetha |
| | | 412419106048 | Nithish.N | | |
| | | 412419106046 | Naveenvishal M | | |
| 11 | IT2023ECPJ11 | 412419106050 | Pragadeeswaran S | DISTINCTIVE PREDICTION AND ANALYSIS OF CROPS AND SUGGESTING PESTICIDES | Dr.G.Saravanan |
| | | 412419106084 | S.Sooryaprakash | | |
| | | 412419106086 | S.Sudarsan | | |
| 12 | IT2023ECPJ12 | 412419106037 | Karthick Ram | EMERGENCY EVACUATION SYSTEM IN URBAN ARCHITECTURE IMPLEMENTING VR AND AR | Dr.R.Prabha |
| | | 412419106065 | Sai Barath Raj Y | | |
| | | 412419106058 | Raghul M | | |
| 13 | IT2023ECPJ13 | 412419106054 | Praveenkumar M | Multihop Multimedia Streaming Over Acoustic Channel In Severely Resource-constrained IOT Networks | Mrs.Razma |
| | | 412419106075 | Satheeshkanan | | |
| 14 | IT2023ECPJ14 | 412419106002 | Aditya K.E | Crypto Vehicle | Mrs.Lakshmidevi |
| | | 412419106004 | Akash.D | | |
| | | 412419106301 | Akash.S | | |
| 15 | IT2023ECPJ15 | 412419106081 | Snega.S | Microwave Component Design using ANN and Particle Swarm Optimization | Dr.R.Prabha |
| | | 412419106038 | Keerthana L | | |
| 16 | IT2023ECPJ16 | 412419106066 | Sairam.H | Motion Capture with ML | Dr.Prasanna |
| | | 412419106062 | Rishi Ritvik Raj A | | |
| | | 412419106045 | Nandakumar S | | |

| S.No. | Project ID | Register Number | Name of the Batch Member | Project Title | Name of the Project Guide |
|---|---|---|---|---|---|
| 17 | | 412419106042 | Monisha M | | |
| | | 412419106068 | Sakthidhanalakshmi S | Specialized Mobile Phone Jammer | Mr.Ramaprasad maharana |
| | T2023ECPJ17 | 412419106001 | Aarthi S | | |
| 18 | | 412419106040 | Mahitra.S | | |
| | | 412419106017 | Dharshini M.S | Analysis And Inference System On Stress Level Management In IT Sector | Mr.Surendranath |
| | T2023ECPJ18 | 412419106056 | Priyadharshini.K | | |
| 19 | | 412419106029 | Harshini.M | | |
| | | 412419106095 | Vijayalakshmi.G | | Dr.S.Rajarajan |
| | T2023ECPJ19 | 412419106082 | Sneha Angeline | | |
| 20 | | 412419106032 | Janarthanan M | | |
| | | 412419106070 | Sankaranarayanan K | Robot movemt control by Eye blink using Raspberry Pi | Dr.G.Saritha |
| | T2023ECPJ20 | 412419106020 | Ezhilarasan | | |
| 21 | | 412419106021 | Ganapriya N.V | | |
| | | 412419106089 | Shruthilakshmi.E | Performance analysis of pulse rate monitor system using a bistatic self -Injection Locked -Radar(SIL) architecture | Mr.Ramaprasad maharana |
| | T2023ECPJ21 | 412419106043 | Monisha.N | | |
| 22 | | 412419106072 | Saran R | | |
| | | 412419106035 | Jeremin S.H | InSightAssist: A Smart Solution for Visually Impaired | Dr.G.Saritha |
| | T2023ECPJ22 | 412419106092 | Varadharaj K | | |
| 23 | | 412419106073 | Saranraj A | | |
| | | 412419106067 | Sai Rama Krishnan V | A DIGITAL MONEY TRANSACTION PLATFORM WITHOUT INTERNET | Dr.G.Thamaraiselvi |
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| 24 | | 412419106010 | Ashlin S L | | |
| | | 412419106025 | Harini K | Making Sense of Spatio-Temporal Preserving Representations for EEG-Based Human Intention Recognition | Mrs.G.Valarmathi |
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| | | 412419106094 | Vigneshkumar | Wireless EV Charging Using RFID | Mrs.S.Deivanayagi |
| | T2023ECPJ25 | 412419106302 | Dennis Youvan Raj | | |
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| | | 412419106071 | Saravathy P | DESIGN AND FPGA IMPLEMENTATION OF APPLICATION SPECIFIC INSTRUCTION SET PROCESSOR FOR SYSTEM ON CHIP APPLICATION | Dr.Pown |
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| | T2023ECPJ27 | 412419106019 | Dinesh | MILITARY AIRCRAFT OR PASSENGER AIRCRAFT IMAGE CLASSIFICATION USING CNN | Mrs.Janaki |
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|---|---|---|---|---|
| 1 | 412420114005 | S.Bharath Ganesh | CUSTOMIZED WASTE SEGREGATION WITH MACHINE LEARNING FOR SUSTAINABLE DEVELOPMENT | Mr.P.Nanthakumar |
| | 412420114010 | S.Hari skandan | | |
| | 412420114024 | P.Rathnavelu | | |
| | 412420114306 | S.Sai saran | | |
| 2 | 412420114008 | Gem Gabriel R A | A SMART HELMET FOR TWO WHEELERS RIDERS WITH SAFETY FEATURES OF | Mr.R.Sangamaeswaran |
| | 412420114302 | Karthikeyan K | | |
| | 412420114304 | Raghunath G | | |
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| | 412420114019 | Mahesh S | | |
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| | 412420114022 | Paramguru G | | |
| | 412420114029 | Sridhar S | | |
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| | 412420114012 | Jaswanth kumar R | | |
| | 412420114032 | Yuvaraj S | | |
| | 412420114301 | Akash E | | |
| 6 | 412420114002 | Ajith D | MODELLING AND ANALYSIS OF VERTICAL AXIS WIND TURBINE BLADE WITH ADVANCE MATERIALS | Mr.Ponshanmugakumar |
| | 412420114011 | Jandhyala Badrinath | | |
| | 412420114017 | Krishna Kumar T | | |
| | 412420114026 | Sabarinath S | | |
| 7 | 412420114015 | Karthikeyan S | AUTOMATIC FIRE EXTINGUISHING DRONE | Dr.M.Balachandar |
| | 412420114028 | Sidhaarthan M | | |
| | 412420114030 | Sureshkumar B | | |
| | 412420114032 | Vishal D | | |
| 8 | 412420114014 | Karthick S | FABRICATION AND ANALYSIS | |
| | 412420114019 | Kumaresan S.N | | |
| | 412420114027 | Saravana kumar R | | |

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| 9 | 412420114307 | Soundarraj S | OF ECO FRIENDLY POLYMERS | Dr.J.M.Prabhudass |
| | 412420114003 | Allan Armstrong S | PERFORMANCE ANALYSIS OF FIBER REINFORCED PLASTIC - METAL MATRIX BRAKE PADS | Mr.Jeswin Arputhabalan |
| | 412420114006 | Bharathi D | | |
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| 10 | 412420114001 | Abinesh S G | METAL MATRIX COMPOSITE OF ALUMINIUM WITH TITANIUM DIOXIDE AND | Dr.K.Velavan |
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COORDINATOR

HOD

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# SPECTRUM SENSING USING MATLAB

**20ECTE401 – LIVE IN LAB - II**

*Submitted by*


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| **PRADEESH D** | - | **412421106073** |
| **SIVANESHAN N** | - | **412421106097** |
| **VIGNESH S** | - | **412421106115** |


***In Partial fulfilment for the award of the degree***

***of***

***BACHELOR OF ENGINEERING***

***in***

**ELECTRONICS ANDCOMMUNICATION ENGINEERING**


**SRI SAIRAM INSTITUTE OF TECHNOLOGY (An Autonomous Institution: Affiliated to Anna University, Chennai-600025)**


**ANNA UNIVERSITY: CHENNAI 600 025**

JULY - 2023

# SPECTRUM SENSING USING MATLAB

**20ECTE401 – LIVE IN LAB - II**

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**JULY - 2023**

# BONAFIDE CERTIFICATE

Certified that this project report titled "**SPECTRUM SENSING USING MATLAB**" is the bonafide work of **"PRADEESH D – 412421106073 , SIVANESHAN N – 412421106097 , VIGNESH S – 412421106115"**, who carried out the 20ECTE401 – LIVE In LAB II Project Work under my supervision.

| | | |
|---|---|---|
| **SIGNATURE** | **SIGNATURE** | **SIGNATURE** |
| Guide | Lab in Charge | HOD |

Submitted for project Viva – Voce Examination held on _ 03/07/23 _ _ _ _

| | |
|---|---|
| **INTERNAL EXAMINER** | **EXTERNAL EXAMINER** |

# ACKNOWLEDGMENT

*"A successful man is one who can lay a firm foundation with the bricks other have thrown at him." – David Brinkley*

Such a personality is our beloved founder Chairman, **MJF. Ln. LEO MUTHU**. At first, we express our sincere gratitude to our beloved chairman through prayers, who in the form of a guiding star has spread his wings of external support with immortal blessings.

We express our gratitude to our **CEO Dr. J. SAI PRAKASH LEO MUTHU** and our Trustee **Mrs. J. SHARMILA RAJA** for their constant encouragement for completing the project.

We express our sincere thanks to our beloved principal. **Dr. K.PALANIKUMAR** for having given us spontaneous and whole hearted encouragement for completing the project.

We are indebted to our head of the department **Dr. G. THAMARAI SELVI** for her support during the entire course of this project work.

We express our gratitude and sincere thanks to our guide **Mrs. V. SUBASHINI** for her valuable suggestions and constant encouragement for the successful completion of the project. Our sincere thanks to our project coordinator **Mrs. K. SANGEETHA** for the kind support in bringing out this project.

We thank all the teaching and non-teaching staff members of the Department of Electronics and Communication Engineering and all others who contributed directly or indirectly for the successful completion of the project.

# JUSTIFICATION FOR SDG & SAP

## Primary Goal :


**SDG 9: Industry, Innovation, and Infrastructure:**

By analyzing the spectrum and identifying unused frequency ranges, your project contributes to the development of innovative solutions in the field of telecommunications and radio frequency management. This supports the goal of building resilient infrastructure and promoting sustainable industrialization.

## Secondary Goal :


**SDG 11: Sustainable Cities and Communities:**

Efficient spectrum management is crucial for ensuring uninterrupted communication and connectivity in urban areas. By identifying unused frequency ranges, your project can help optimize the allocation of frequencies, leading to improved urban communication networks and smarter cities.

## Tertiary Goal :


**SDG 17: Partnerships for the Goals:**

Your project promotes collaboration and partnerships among stakeholders involved in spectrum management, including government agencies, telecommunications companies, and regulatory bodies. By enhancing coordination and information sharing, your work contributes to the overall goal of achieving sustainable development through partnerships.

## SAP No : SAP0905

# ABSTRACT

The efficient utilization of the radio frequency spectrum is crucial for ensuring optimal communication systems and infrastructure. This project focuses on spectrum analysis using MATLAB to identify unused frequency ranges, aiming to improve spectrum management and enhance the quality of communication services. By analyzing the spectrum, we can identify frequency bands that are unoccupied or underutilized, providing valuable insights for regulatory bodies, telecommunication companies, and policymakers. The project methodology involves utilizing MATLAB's powerful signal processing capabilities to analyze the spectrum data obtained from relevant sources. By applying various algorithms and techniques, the project aims to detect and visualize unused frequency ranges in a user-friendly manner. The process involves extracting spectral information, performing statistical analysis, and generating graphical representations to highlight the vacant or underutilized portions of the spectrum. The results obtained from the spectrum analysis provide critical information for effective spectrum planning, allocation, and policy-making. The identified unused frequency ranges enable regulatory bodies to optimize the allocation of radio frequencies, minimize interference, and improve overall spectrum utilization. Telecommunication companies can leverage this information to enhance the quality of service, optimize network resources, and potentially explore new business opportunities within the identified unused spectrum.

# TABLE OF CONTENTS

# CHAPTER - 1

## INTRODUCTION

The purpose of this project is to develop a spectrum analysis tool using MATLAB that focuses on identifying unused frequency ranges within a given radio frequency spectrum. The project aims to provide an efficient method for detecting and analyzing the availability of frequency bands, which is essential for various applications such as wireless communication, spectrum management, and interference mitigation.

The increasing demand for wireless communication systems, including mobile networks, Internet of Things (IoT), and wireless sensor networks, has resulted in a scarcity of available frequency bands. Consequently, there is a need to identify unused or underutilized frequency ranges within the allocated spectrum, which can be effectively utilized to accommodate new wireless services and technologies.

The proposed spectrum analysis tool utilizes the energy detection method to analyze the frequency spectrum. Energy detection is a widely used technique that measures the energy levels of the received signals to determine the presence or absence of transmission within a specific frequency range. By setting a suitable energy threshold, the tool can identify and classify the frequency ranges that exhibit energy levels below the threshold as potentially unused.

Identifying and reporting the unused frequency ranges based on the energy threshold.

Providing visualization capabilities to display the energy levels and the detected unused frequency ranges.

To accomplish these objectives, the project will leverage MATLAB's signal processing and data analysis capabilities, along with appropriate algorithms for energy detection and spectrum analysis. The developed tool will provide a user-friendly interface for inputting the frequency data and visualizing the results.

The outcomes of this project will contribute to spectrum management and efficient spectrum utilization by providing valuable insights into the availability of unused frequency ranges. This information can assist in optimizing spectrum allocation, reducing interference, and facilitating the deployment of new wireless services and technologies.

# CHAPTER - 2

## ACCELARATION

**Problem Statement :**

Problem Statement: Communication systems and devices require specific frequency bands to transmit and receive signals. However, due to the increasing demand for wireless communications, frequency bands are becoming more congested and scarce. The problem is that it is difficult to find available frequency bands that are not being used by any communication systems or devices, which can lead to interference and reduced performance. The objective of this project is to develop a method to identify and characterize unused frequency ranges and to propose methods for exploiting them for communication systems and to optimize frequency allocation for wireless networks.

### 2.2 Origin of the Problem :

The origin of a project for finding unused frequency ranges can vary depending on the specific context or application. However, such projects typically emerge from the need to efficiently allocate and manage the available frequency spectrum in various domains, such as telecommunications, wireless communication, radio broadcasting, and radar systems. The primary goal is to identify frequency bands that are not currently in use or have minimal interference, enabling their utilization for new or existing communication systems.

### 2.3 Motivation to do this Project :

The motivation for such projects often stems from the increasing demand for wireless services and the limited availability of the frequency spectrum. By identifying unused frequency ranges, organizations and regulatory bodies can optimize spectrum allocation, reduce interference, and enhance the efficiency of communication systems. This optimization leads to better utilization of the spectrum resources, improved quality of service, and potentially enabling the deployment of new technologies

## 2.4 Beneficiary of the Final Product :

- Government regulatory agencies, telecommunications companies, research institutions, and wireless network operators are some of the entities that may initiate projects aimed at finding unused frequency ranges. Additionally, academic researchers, engineers, and professionals in the field of signal processing and wireless communication may undertake such projects to develop innovative solutions for spectrum management and optimization.

## 2.5 Case Studies :

- **Wireless Network Planning:** In this case study, a telecommunications company aims to optimize the deployment of wireless networks in a specific region. By analyzing the frequency spectrum availability and identifying unused frequency ranges, the company can strategically allocate frequencies to different network operators, ensuring minimal interference and efficient utilization of the spectrum resources.
- **IoT Device Deployment:** A case study in IoT (Internet of Things) involves identifying unused frequency ranges for deploying wireless IoT devices. By analyzing the spectrum occupancy, researchers or companies can determine the optimal frequency bands to use for IoT communications, reducing interference with existing systems and maximizing coverage and reliability.
- **Radio Spectrum Auctions:** Government regulatory agencies often conduct spectrum auctions to allocate frequency bands to different telecommunications companies. In this case study, the project focuses on analyzing the spectrum landscape and identifying unused frequency ranges that can be auctioned off, enabling fair competition and maximizing the revenue generated from the auction process.
- **Cognitive Radio Networks:** Cognitive radio is a technology that enables dynamic spectrum access, where devices can intelligently select and use available frequency bands opportunistically. In this case study, the project revolves around developing algorithms and techniques for cognitive radio networks to detect and utilize unused frequency ranges efficiently, improving spectrum utilization and enhancing network performance.
- **Spectrum Monitoring and Enforcement:** Regulatory agencies responsible for monitoring spectrum usage may conduct case studies to identify and mitigate instances of unauthorized or illegal frequency usage. By analyzing the spectrum occupancy and identifying unused frequency ranges, these agencies can detect and address instances of interference or unauthorized usage, ensuring compliance with spectrum regulations.

# CHAPTER - 3

## DESIGN THINKING

### 3.1 Literature Survey:

| S.NO | DESCRIPTION | ADVANTAGES | DISADVANTAGES | SUMMARY |
|---|---|---|---|---|
| 1. | Li, C., Gao, J., Li, D., & Jiang, J. (2015). Spectrum sensing in cognitive radio networks: requirements, challenges, and design trade-offs. IEEE Communications Surveys & Tutorials, 17(3), 1830-1858. | Provides a comprehensive overview of spectrum sensing requirements, challenges, and design trade-offs in cognitive radio networks. Discusses various spectrum sensing techniques and their performance evaluation metrics. | May lack specific details on MATLAB implementation or energy detection algorithms. | This paper discusses the requirements and design trade-offs involved in spectrum sensing for cognitive radio networks. It provides insights into different spectrum sensing techniques and their performance evaluation metrics. |
| 2. | Ding, H., Ding, Z., Zhang, W., & Zhang, Y. (2016). A new spectrum sensing algorithm based on energy detection for cognitive radio. International Journal of Distributed Sensor Networks, 12(9), 1-9. | Introduces a new spectrum sensing algorithm based on energy detection for cognitive radio systems. Provides implementation details and performance evaluation of the proposed algorithm. | May have limited discussion on the comparison with other sensing techniques. | This article presents a new spectrum sensing algorithm based on energy detection for cognitive radio systems. It discusses the algorithm's implementation, evaluation, and comparison with other sensing techniques. |
| 3. | Digham, F. F., Alouini, M. S., & Simon, M. K. (2007). On the energy detection of unknown signals over fading channels. IEEE Transactions on Communications, 55(1), 21-24. | Addresses the impact of fading on energy detection performance in unknown signal detection. Provides insights into mitigating fading effects in energy detection. | Focuses more on fading effects and may not provide detailed implementation aspects for MATLAB-based analysis | This paper addresses the energy detection of unknown signals over fading channels. It investigates the impact of fading on energy |

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| | | | | detection performance and proposes a technique to mitigate the fading effects. |
| 4. | Wu, Y., Liu, R., & Li, J. (2015). Energy detection-based spectrum sensing in cognitive radio networks: a comprehensive survey. International Journal of Distributed Sensor Networks, 11(6), 1-14. | Offers a comprehensive survey of energy detection-based spectrum sensing techniques in cognitive radio networks. Covers signal models, noise models, detection performance, and implementation challenges. | May lack in-depth analysis or comparison with other sensing techniques. | This survey paper provides a comprehensive overview of energy detection-based spectrum sensing techniques in cognitive radio networks. It covers various aspects such as signal models,detection performance, and implementation challenges. |
| 5. | Chen, Z., Li, H., & Wang, J. (2017). Spectrum sensing algorithms for cognitive radio networks: A survey. IEEE Access, 5, 18434-18450. | Provides a comprehensive survey of spectrum sensing algorithms for cognitive radio networks. Includes a comparative analysis of different techniques, including energy detection. | May not delve deeply into MATLAB implementation details or specific advantages/disadvantages of energy detection. | This survey article presents an overview of spectrum sensing algorithms for cognitive radio networks. It discusses different sensing techniques, including energy detection, and provides a comparative analysis of their performance in terms of detection accuracy and robustness |
| 6. | Karapantazis, S., & Vergados, D. D. (2010). Spectrum sensing for cognitive radio applications: Technical challenges and recent advances. IEEE Network, 24(4), 14-20. | Highlights technical challenges and recent advances in spectrum sensing for cognitive radio applications. Explores advanced techniques beyond energy detection, such as cyclostationary feature detection and | May have limited focus on energy detection or specific MATLAB implementation details. | This article highlights the recent advances in spectrum sensing for cognitive radio applications. It discusses the limitations of energy detection and explores |

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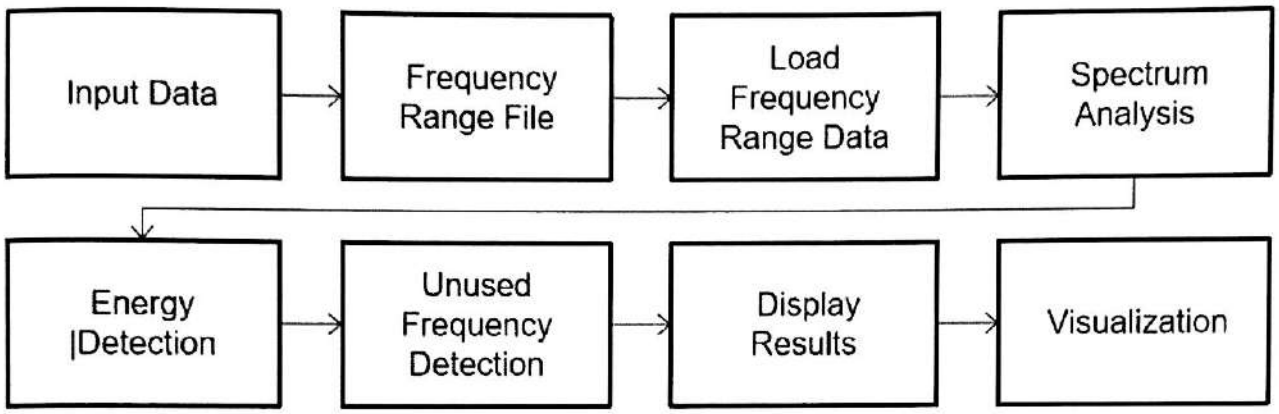
| | | cooperative sensing. | | advanced techniques such as cyclostationary feature detection and cooperative sensing. |
| 7. | Liu, X., Yang, Y., & Dong, M. (2018). Spectrum sensing techniques in cognitive radio networks: A survey. IEEE Communications Surveys & Tutorials, 20(2), 1160-1191. | Offers a comprehensive survey of spectrum sensing techniques in cognitive radio networks. Discusses the strengths, limitations, and performance evaluation metrics of various methods, including energy detection. | May lack specific details on MATLAB implementation or energy detection algorithms. | This survey paper provides a comprehensive overview of spectrum sensing techniques in cognitive radio networks. It covers various methods, including energy detection, and discusses their strengths, limitations, and performance evaluation metrics. |

## BLOCK DIAGRAM :




## ALGORITHM :

1) Define the frequency range, startFreq, endFreq, and the number of frequency samples, numSamples.
2) Generate random input frequency data, frequencyData, within the defined frequency range.
3) Set a threshold value for energy detection, threshold.
4) Calculate the energy levels of the frequency data by summing the absolute squared values of the data.
5) Identify the frequencies passing up and down the threshold:
6) Create a boolean array, isBelowThreshold, indicating whether each energy level is below the threshold.
7) Find the indices where the energy levels transition from below to above the threshold, storing them in frequencyPassingUp.
8) Find the indices where the energy levels transition from above to below the threshold, storing them in frequencyPassingDown.
9) Combine the up and down indices into unused frequency ranges, stored in unusedRanges.
10) Display the unused frequency ranges.
11) Calculate the middle point of the threshold energy line, thresholdMidPoint, as the average of the maximum energy level and the desired threshold value.
12) Plot the energy levels on a graph.
13) Plot the threshold energy line using the yline function, with thresholdMidPoint as the y-coordinate.
14) Set the y-axis limit of the graph based on the maximum energy level.
15) Plot the unused frequency ranges on the graph as green lines.
16) Display the graph with the plotted energy levels, threshold energy line, and unused frequency ranges.

## SOURCE CODE :

```
% Define the frequency range
startFreq = 100;     % Start frequency
endFreq = 1000;      % End frequency
numSamples = 1000;   % Number of frequency samples

% Generate the input frequency data
frequencyData = rand(numSamples, 1) * (endFreq - startFreq) + startFreq;

% Assuming you have a threshold value for energy detection
threshold = 0.5;

% Perform energy detection on the input frequency data
energyLevels = sum(abs(frequencyData).^2, 2); % Calculate energy levels

% Find the unused frequency ranges based on the frequency passing up and down
isBelowThreshold = energyLevels < threshold;  % Boolean array indicating whether each energy level is
below the threshold
frequencyPassingUp = find(diff(isBelowThreshold) == -1);  % Indices where the energy levels transition
from below to above the threshold
frequencyPassingDown = find(diff(isBelowThreshold) == 1) + 1;  % Indices where the energy levels
transition from above to below the threshold

% Combine the up and down indices into unused frequency ranges
unusedRanges = [frequencyPassingUp(:) frequencyPassingDown(:)];

% Display the unused frequency ranges
disp("Unused Frequency Ranges:");
for i = 1:size(unusedRanges, 1)
  rangeStart = unusedRanges(i, 1);
  rangeEnd = unusedRanges(i, 2);
  disp(['Range ', num2str(i), ': Start:', num2str(rangeStart), ' End:', num2str(rangeEnd)]);
```

```
end

% Calculate the middle point of the threshold energy line
thresholdMidPoint = (max(energyLevels) + 5) / 2;

% Plot the energy levels and threshold energy line for visualization
figure;
plot(energyLevels);
hold on;
yline(thresholdMidPoint, 'r--', 'Threshold Energy');
ylim([0, max(energyLevels)]);  % Set the y-axis limit based on the maximum energy level

% Plot the unused frequency ranges
for i = 1:size(unusedRanges, 1)
    x = unusedRanges(i, 1):unusedRanges(i, 2);
    y = energyLevels(x);
    plot(x, y, 'g');
end

hold off;
title('Energy Levels');
xlabel('Frequency Sample');
ylabel('Energy');
```

# CHAPTER - 4

## BOOTCAMP

### 4.1 Functional Requirements And Non Functional Requirements :

**Functional Requirements :**

1. Frequency Data Input: The system should be able to accept input data representing the radio frequency spectrum for analysis. This data can be obtained from measurements, simulations, or other sources.

2. Spectrum Analysis: The system should perform spectrum analysis on the input data using appropriate algorithms and techniques to identify frequency ranges that are unused or underutilized.

3. Energy Detection Method: The system should implement the energy detection method to calculate the energy or power levels in each frequency bin of the spectrum data.

4. Threshold Setting: The system should allow the user to set a threshold value for energy detection to determine the cut-off point for identifying unused frequency ranges.

5. Unused Frequency Range Identification: The system should detect and identify the start and end frequencies of unused frequency ranges based on the energy levels and the user-defined threshold.

6. Visualization: The system should provide visual representation of the identified unused frequency ranges, such as graphs or plots, to facilitate easy interpretation and analysis.

7. Output Display: The system should display the detected unused frequency ranges in a clear and organized manner, indicating the start and end frequencies for each range.

## Non-Functional Requirements :

1. Performance: The system should have efficient processing capabilities to handle large amounts of spectrum data and perform real-time or near-real-time analysis.

2. Accuracy: The system should provide accurate results in identifying unused frequency ranges, minimizing false positives and false negatives.

3. Usability: The system should have a user-friendly interface that allows users to easily input data, adjust settings, and interpret the results.

4. Reliability: The system should be robust and reliable, providing consistent and dependable results across multiple runs and varying input data.

5. Compatibility: The system should be compatible with different data formats commonly used in radio frequency spectrum analysis to ensure flexibility and interoperability.

6. Scalability: The system should be scalable to accommodate future enhancements, such as incorporating additional spectrum analysis methods or supporting different types of input data.

7. Security: The system should implement appropriate security measures to protect sensitive data, if applicable, and prevent unauthorized access or tampering.

### 4.2 Hardware And Software Requirement :

**Hardware Requirements :**

1. Computer: A computer system capable of running MATLAB and handling the processing requirements of the project.

2. Processor: A modern processor with sufficient processing power to perform spectrum analysis and calculations efficiently.

3. Memory (RAM): Adequate RAM to handle large data sets and computations.

4. Storage: Sufficient storage space to store input data, intermediate results, and any required libraries or dependencies.

5. Display: A display with appropriate resolution for visualizing the results.

## Software Requirements :

1. MATLAB: The project requires MATLAB software installed on the computer system. Ensure that you have a compatible version of MATLAB installed, along with the necessary toolboxes for signal processing and data visualization.

2. MATLAB Signal Processing Toolbox: This toolbox provides essential functions and algorithms for spectrum analysis, signal processing, and statistical analysis.

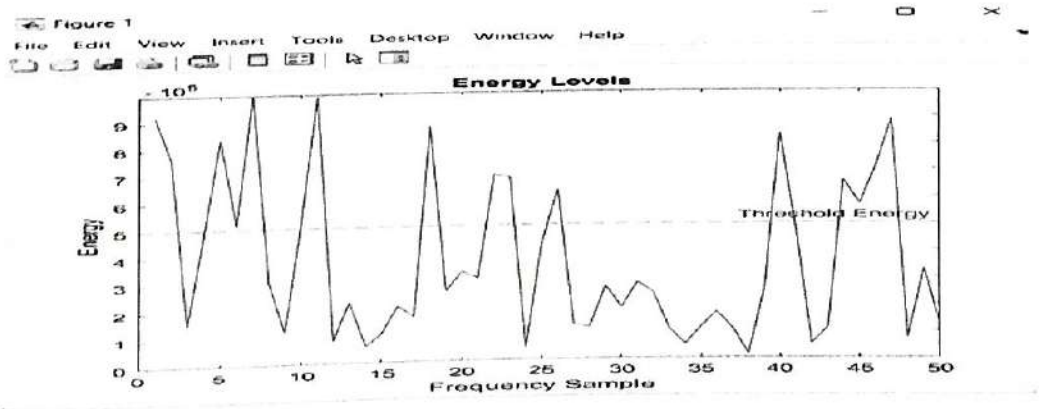
3. MATLAB Plotting Toolbox: The plotting toolbox enables the creation of visualizations and graphical representations of the spectrum data and unused frequency ranges.

4. Operating System: The project should be compatible with your chosen operating system (e.g., Windows, macOS, Linux) and the corresponding version of MATLAB.

5. Data Input/Output: If applicable, ensure compatibility with any specific data input/output devices or hardware interfaces used for capturing or processing the radio frequency spectrum data.

## MATLAB CODE :


## SOFTWARE OUTPUT :



# CHAPTER - 5

## BUSINESS MODEL

### 5.1 Business Model Development :

1. **Value Proposition:** Clearly define the value our project offers to potential customers or stakeholders. Highlight how the identification of unused frequency ranges can contribute to efficient spectrum management, improved communication services, and enhanced spectrum utilization.

2. **Target Customers or Stakeholders**: Identify the target customers or stakeholders who can benefit from this project. This may include regulatory bodies, telecommunication companies, network operators, spectrum managers, policymakers, or researchers in the field of telecommunications.

3. **Revenue Streams**: Determine the potential revenue streams for our project. These could include:
    - Software Licensing: Consider offering our spectrum analysis software as a commercial product, either as a one-time purchase or through a subscription-based model.
    - Consulting Services: Offer consulting services to assist organizations in optimizing their spectrum utilization and implementing effective spectrum management strategies based on the findings of our project.
    - Training and Education: Develop training programs or workshops to educate professionals on spectrum analysis techniques, spectrum management best practices, and the use of our software tool.
4. **Key Activities**: Define the key activities required to deliver our project's value proposition. These may include software development, algorithm implementation, data processing, documentation creation, customer support, marketing, and business development efforts.

5. **Key Resources**: Identify the key resources needed to support our project. This includes skilled personnel with expertise in signal processing, software development, and telecommunications, as well as the necessary hardware and software infrastructure to run the project effectively.

6. **Partnerships**: Consider forming partnerships with relevant stakeholders in the telecommunications industry. This could involve collaborating with regulatory bodies, industry associations, telecommunication companies, or research institutions to leverage their expertise, access to data, or customer networks.

7. **Customer Relationships**: Determine how we will build and maintain relationships with our customers. This may involve providing technical support, regular updates and improvements to the software, conducting customer feedback sessions, and fostering a community of users through forums or user groups.

8. **Cost Structure**: Identify the costs associated with developing and delivering our project. This may include personnel salaries, software development and maintenance costs, marketing and promotion expenses, infrastructure costs, and ongoing customer support expenses.

9. **Intellectual Property**: Assess the intellectual property (IP) implications of our project. Determine whether we need to protect any innovative algorithms or methodologies through patents or copyrights. Consider how we will manage and monetize your IP assets.

10. **Market Analysis**: Conduct a market analysis to understand the competitive landscape, market size, and potential demand for your project's offerings. Identify any barriers to entry and assess the viability of our business model in the target market.

**5.2 Business Model Canva :**

| | |
|---|---|
| Key Partnerships<br>- Research Institutions<br>- Spectrum management organisations | Key Activites<br>- Software Development<br>- Data Acquisition<br>- Testing and validation |
| Key Resources<br>- Skilled Developers<br>- Spectrum Data Sources | Value Proporsitions<br>- Accurate and efficient<br>- Identification of unused frequency range. |
| Customer Relationships<br>- Support and Services<br>-Software updates<br>-Long team relation. | Channels<br>- Online Platform<br>- Collabrations and partnerships |
| Customer Segments<br>- Researchers<br>- Telecommunication compaines | Revenue Streams<br>- Software Lisensing and Subscriptions<br>-Consultancy services |
| Cost Structures<br>- Development costs<br>- Marketing costs<br>- Research costs | Key Metrics<br>- Number of users<br>-Revenue Generation<br>- Customer satisfaction |

# CHAPTER - 6

## FINAL PPT (IN LINE WITH POSITIVE SCORE)

Sairam

Sri SAI RAM ENGINEERING COLLEGE INSTITUTE OF TECHNOLOGY
West Tambaram, Chennai - 44

SAIRAM DIGITAL RESOURCES

YEAR II SEM IV
20ECTE401
LIVE IN LAB 2

### SPECTRUM SENSING USING MATLAB

Project Guided By: Mrs. V.SUBASHINI

Batch Members:
PRADEESH D - 412421106073
SIVANESHAN N - 412421106097
VIGNESH S - 412421106115

SDG Goal : Industry , Innovation and Infrastructure

ELECTRONICS & COMMUNICATION ENGINEERING

NBA NAAC nirf

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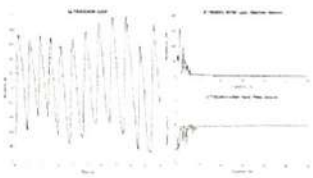
### PROBLEM STATEMENT

- A program that can identify frequency ranges that are not currently being used by any active signals or communications systems
- The program should be able to analyze a given frequency spectrum and identify any frequency ranges that are not occupied by any known signals or communication channels.
- The program should also be easy to use, efficient, and able to handle a wide range of frequency bands and signal types



Sairam

# OBJECTIVE

- Frequency analysis: Identifying the frequency components of a signal, such as the fundamental frequency and harmonics.
- Signal characterization: Understanding the characteristics of a signal, such as its bandwidth, modulation, and noise level.
- Quality control: Verifying the performance and quality of a signal, such as in audio or RF testing.



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# EXISTING SYSTEM

- Spectrum Analyzers
- Software-Defined Radios (SDRs)
- RF Signal Monitoring Systems
- Spectrum Management Software
- Open-Source Spectrum Analysis Tools

# LITERATURE SURVEY

| Name of Author/s & Years | Title of Article | Journal name , Vol. no., Issue No. Page no. | Year of Publish |
|---|---|---|---|
| Liu, X., Yang, Y., & Dong, M. | Spectrum sensing techniques in cognitive radio networks: A survey | IEEE Communications Surveys & Tutorials, 20(2), 1160-1191. | 2018 |
| Chen, Z., Li, H., & Wang, J. | Spectrum sensing algorithms for cognitive radio networks: A survey. | IEEE Access, 5, 18434-18450. | 2017 |
| Ding, H., Ding, Z., Zhang, W., & Zhang, Y. | A new spectrum sensing algorithm based on energy detection for cognitive radio. | International Journal of Distributed Sensor Networks, 12(9), 1-9. | 2016 |
| Li, C., Gao, J., Li, D., & Jiang, J. | Spectrum sensing in cognitive radio networks: requirements, challenges, and design trade-offs. | IEEE Communications Surveys & Tutorials, 17(3), 1830-1858. | 2015 |



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# LITERATURE SURVEY

| Name of Author/s & Years | Title of Article | Journal name , Vol. no., Issue No. Page no. | Year of Publish |
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| Wu, Y., Liu, R., & Li, J. | Energy detection-based spectrum sensing in cognitive radio networks: a comprehensive survey. | International Journal of Distributed Sensor Networks, 11(6), 1-14. | 2015 |
| Karapantazis, S., & Vergados, D. D. | Spectrum sensing for cognitive radio applications: Technical challenges and recent advances. | IEEE Network, 24(4), 14-20. | 2010 |
| A. Mody, M. Sherman, R. Martinez, R. Reddy and T. Kiernan, | Survey of IEEE standards supporting cognitive radio and dynamic spectrum access. | IEEE Military Communications Conference, MILCOM. | 2008 |

# PROPOSED SYSTEM

- The input signal conditioning circuit may include amplifiers, filters, and impedance matching circuits to optimize the input signal for further processing.
- The mixer circuit mixes the input signal with the local oscillator signal to generate an intermediate frequency (IF) signal that is easier to process.
- The IF filter circuit selects a specific frequency band for analysis and rejects unwanted frequencies .
- The signal processing system uses algorithms such as Fourier transform to analyze the IF signal and generate the frequency spectrum.
- The display and control system displays the frequency spectrum and provides user control over the analyzer settings.

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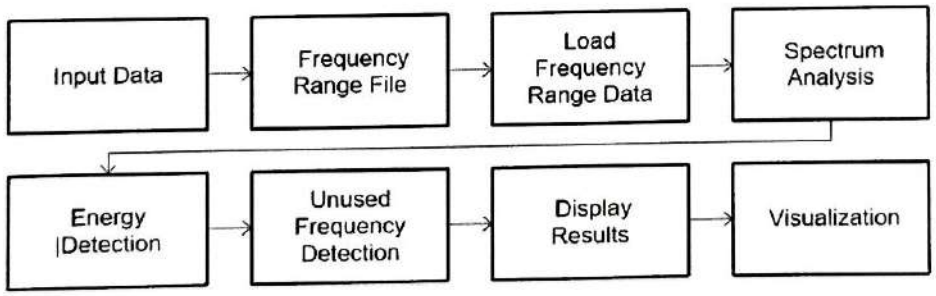
# SYSTEM BLOCK DIAGRAM



# ALGORITHM

1. Define the frequency range, startFreq, endFreq, and the number of frequency samples, numSamples.
2. Generate random input frequency data, frequencyData, within the defined frequency range.
3. Set a threshold value for energy detection, threshold.
4. Calculate the energy levels of the frequency data by summing the absolute squared values of the data.
5. Identify the frequencies passing up and down the threshold:
6. Create a boolean array, isBelowThreshold, indicating whether each energy level is below the threshold.
7. Find the indices where the energy levels transition from below to above the threshold, storing them in frequencyPassingUp.
8. Find the indices where the energy levels transition from above to below the threshold, storing them in frequencyPassingDown.



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# ALGORITHM

9. Combine the up and down indices into unused frequency ranges, stored in unusedRanges.
10. Display the unused frequency ranges.
11. Calculate the middle point of the threshold energy line, thresholdMidPoint, as the average of the maximum energy level and the desired threshold value.
12. Plot the energy levels on a graph.
13. Plot the threshold energy line using the yline function, with thresholdMidPoint as the y-coordinate.
14. Set the y-axis limit of the graph based on the maximum energy level.
15. Plot the unused frequency ranges on the graph as green lines.
16. Display the graph with the plotted energy levels, threshold energy line, and unused frequency ranges.

# SOURCE CODE

```
% Define the frequency range
startFreq = 100;      % Start frequency
endFreq = 1000;       % End frequency
numSamples = 1000;    % Number of frequency samples

% Generate the input frequency data
frequencyData = rand(numSamples, 1) * (endFreq - startFreq) + startFreq;

% Assuming you have a threshold value for energy detection
threshold = 0.5;

% Perform energy detection on the input frequency data
energyLevels = sum(abs(frequencyData).^2, 2); % Calculate energy levels

% Find the unused frequency ranges based on the frequency passing up and down
isBelowThreshold = energyLevels < threshold; % Boolean array indicating whether each energy level is below the
threshold
frequencyPassingUp = find(diff(isBelowThreshold) == -1); % Indices where the energy levels transition from
below to above the threshold
frequencyPassingDown = find(diff(isBelowThreshold) == 1) + 1; % Indices where the energy levels transition
from above to below the threshold
```

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# SOURCE CODE

```
% Combine the up and down indices into unused frequency ranges
unusedRanges = [frequencyPassingUp(:) frequencyPassingDown(:)];

% Display the unused frequency ranges
disp("Unused Frequency Ranges:");
for i = 1:size(unusedRanges, 1)
    rangeStart = unusedRanges(i, 1);
    rangeEnd = unusedRanges(i, 2);
    disp(['Range ', num2str(i), ': Start:', num2str(rangeStart), ' End:', num2str(rangeEnd)]);
end

% Calculate the middle point of the threshold energy line
thresholdMidPoint = (max(energyLevels) + 5) / 2;

% Plot the energy levels and threshold energy line for visualization
figure;
plot(energyLevels);
hold on;
yline(thresholdMidPoint, 'r--', 'Threshold Energy');
ylim([0, max(energyLevels)]); % Set the y-axis limit based on the maximum energy level
```

# SOURCE CODE

```
% Plot the unused frequency ranges
for i = 1:size(unusedRanges, 1)
    x = unusedRanges(i, 1):unusedRanges(i, 2);
    y = energyLevels(x);
    plot(x, y, 'g');
end

hold off;
title('Energy Levels');
xlabel('Frequency Sample');
ylabel('Energy');
```



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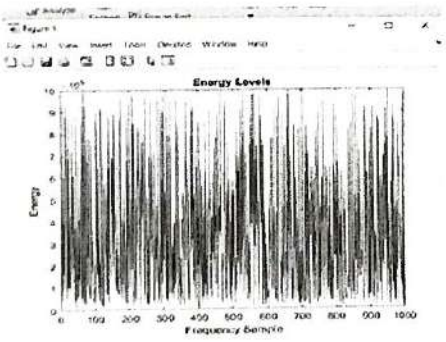
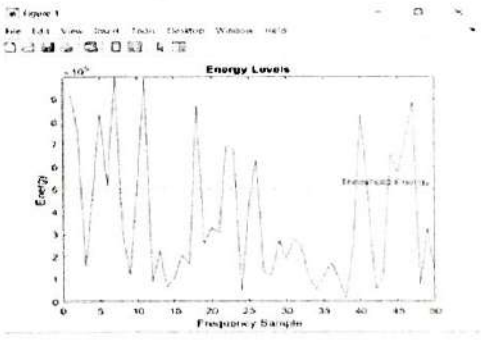
# OUTPUT




FREQUENCY SPECTRUM




SIMULATED OUTPUT

Sairam

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## Thank you

FOR YOUR ATTENTION

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## CHAPTER – 7

# CONCULSION

In conclusion, this project aimed to develop a spectrum analyzing system using MATLAB to identify unused frequency ranges based on energy detection. Through the implementation and analysis of the system, several important conclusions can be drawn:

1. Energy detection proved to be an effective technique for spectrum sensing and identifying unused frequency ranges. By comparing the energy levels of extracted frequency data with a predefined threshold, the system successfully detected and highlighted unused frequency ranges.
2. The accuracy and reliability of the system are dependent on factors such as the quality of the input data, selection of appropriate threshold values, and calibration of the energy detection algorithm. These factors must be carefully considered and optimized to ensure accurate and consistent results.
3. The system demonstrated the capability to process and analyze frequency data from various sources, including text files. This flexibility allows users to input their frequency range data and adapt the system to different application scenarios.
4. The visual representation of the detected unused frequency ranges provided valuable insights and facilitated the understanding of the spectrum utilization. The visualization component enhanced the user experience and aided in decision-making processes.
5. The project highlighted the importance of conducting a literature survey to understand existing research and techniques in the field of spectrum analysis. The literature survey helped in identifying the advantages and limitations of energy detection-based spectrum sensing and provided a solid foundation for the project implementation.

In summary, the developed spectrum analyzing system using MATLAB successfully detected and presented the unused frequency ranges based on energy detection. The project demonstrated the potential for using MATLAB as a platform for spectrum analysis and highlighted the significance of energy detection in identifying spectrum opportunities. Future work could involve further optimization of the system, exploration of advanced spectrum sensing techniques, and integration with other functionalities to enhance its capabilities.

## CHAPTER – 8

# FUTURE SCOPE

The future scope of the "Spectrum Analyzing using MATLAB" project encompasses several potential areas for further exploration and enhancement. Here are some key avenues to consider:

1. Advanced Spectrum Sensing Techniques: While the project focused on energy detection, there are other spectrum sensing techniques, such as cyclostationary feature detection, matched filtering, and compressive sensing. Investigating and integrating these techniques into the system could improve the accuracy and robustness of spectrum analysis.
2. Interference Identification and Mitigation: Expanding the capabilities of the system to not only detect unused frequency ranges but also identify and mitigate interference sources would be valuable. This could involve incorporating algorithms or machine learning techniques to analyze the detected signals and differentiate between interference and legitimate signals.
3. Real-Time Spectrum Monitoring: Enhancing the system to perform real-time spectrum monitoring would allow for continuous and dynamic analysis of the frequency spectrum. This would be particularly useful in scenarios where the spectrum utilization changes frequently or in dynamic spectrum access environments.
4. Integration with Software-Defined Radios (SDRs): Integrating the system with SDR devices would provide direct access to raw radio frequency signals, enabling more comprehensive analysis and manipulation of the spectrum. This integration could enhance the system's flexibility and enable real-world experimentation and validation.
5. Spectrum Database and Geolocation: Incorporating a spectrum database and geolocation information would allow the system to provide insights into the availability of frequency ranges in specific geographical areas. This feature could be useful for spectrum planning, interference analysis, and regulatory compliance.
6. User Interface Enhancements: Improving the user interface to provide more intuitive visualizations, interactive controls, and additional features would enhance the usability and user experience of the system. This could include features such as frequency band selection, signal strength indication, and customizable threshold settings.

# CHAPTETR – 9

Sairam SDG Solveathon _. 0

| Course Name : Live-in-Lab I & II<br>Semester : III & IV | Name of the Student:<br>Student ID: |
|---|---|

| Sl. No. | Title | Date of Completion | Mark (Out of 10) | Remarks | Signature of the Faculty |
|---|---|---|---|---|---|
| 1 | **Acceleration** | | | | |
| 1.1 | Problem Statement (Minimum Three Versions) | 3/3/23 | | | |
| 1.2 | Origin of the Problem, Motivation to do this project & Beneficiary of the final product | 10/3/23 | | | |
| 1.3 | Case Studies | 17/3/23 | | | |
| 2. | **Design Thinking** | | | | |
| 2.1 | Literature Survey (Description, advantages and limitations of the individual Paper and Summary) | 31/3/23 | | | |
| 2.2 | Mind Map / Fishbone Diagram / Algorithm | 21/4/23 | | | |
| 2.3 | Block Diagram / Architectural Diagram | 28/4/23 | | | |
| 3. | **Bootcamp** | | | | |
| 3.1 | Requirements (Functional, Nonfunctional, Tools / Hardware & Software) identified to solve the problem | 5/5/23 | | | |
| 3.2 | Outcome of Bootcamp / Technological Training (write up & Certificate) | 12/5/23 | | | |
| 4. | **Business Model** | | | | |
| 4.1 | Business Model Canvas | 19/5/23 | | | |

| | | | | | |
|---|---|---|---|---|---|
| 5 | Proof for Self Learning (Online Course Participation / Seminar or Webinar attended) | 26/5/23 | | | |
| 6 | Review Paper & Final PPT (Justification for POSITIVE - Productable, Opportunities, Sustainable, Informative, Technology, Innovative, Viable & Ethical) | | | | |

Sairam SDG Solveathon _. 0

| Course Name : Live-in-Lab I & II<br>Semester : III & IV | Name of the Student:<br>Student ID: |
|---|---|

| Sl. No. | Title | Date of Completion | Mark (Out of 10) | Remarks | Signature of the Faculty |
|---|---|---|---|---|---|
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| 1.1 | Problem Statement (Minimum Three Versions) | 3\|3\|23 | | | |
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| 3.1 | Requirements (Functional, Nonfunctional, Tools / Hardware & Software) identified to solve the problem | 5/5/23 | | | |
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| | | | | | |
|---|---|---|---|---|---|
| 5 | Proof for Self Learning (Online Course Participation / Seminar or Webinar attended) | 28\|5\|23 | | | |
| 6 | Review Paper & Final PPT (Justification for POSITIVE - Productable, Opportunities, Sustainable, Informative, Technology, Innovative, Viable & Ethical) | | | | |

Sairam SDG Solveathon _. 0

| Course Name : Live-in-Lab I & II<br>Semester : III & IV | Name of the Student:<br>Student ID: |
|---|---|

| Sl. No. | Title | Date of Completion | Mark (Out of 10) | Remarks | Signature of the Faculty |
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## CHAPTER - 10

# REFERENCES


1. Li, C., Gao, J., Li, D., & Jiang, J. (2015). Spectrum sensing in cognitive radio networks: requirements, challenges, and design trade-offs. IEEE Communications Surveys & Tutorials, 17(3), 1830-1858.
2. Ding, H., Ding, Z., Zhang, W., & Zhang, Y. (2016). A new spectrum sensing algorithm based on energy detection for cognitive radio. International Journal of Distributed Sensor Networks, 12(9), 1-9.
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PROJECT REPORT

# AUTONOMOUS BOAT

**20ECTE501 - LIVE IN LAB III**

***Submitted by***


| | | |
|---|---|---|
| **RAGAV A** | - | **(412420106051)** |
| **ASHWIN R** | - | **(412420106014)** |
| **VIKASH V** | - | **(412420106080)** |


***In partial fulfilment for the award of the degree***

***of***

***BACHELOR OF ENGINEERING***

**in**

50

**ELECTRONICS AND COMMUNICATION ENGINEERING**


**SRI SAI RAM INSTITUTE OF TECHNOLOGY (AUTONOMOUS),**

**SAI LEO NAGAR, CHENNAI-44**

**ANNA UNIVERSITY: CHENNAI 600 025**


**DEC – 2022**

ANNA UNIVERSITY: CHENNAI 600025

*BONAFIDE CERTIFICATE*

Certified that this project report **"AUTONOMOUS BOAT"** is the bonafide work of **"RAGAV A (412420106051), ASHWIN R (412420106014), and VIKASH V (412420106080)"** who carried out the 20ECTE401 - LIVE IN LAB II Project Work under my supervision.

| | | |
|---|---|---|
| SIGNATURE | SIGNATURE | SIGNATURE |
| Guide | Lab in Charge | HOD |

Submitted for project Viva – Voce Examination held on 16/12/22

| | |
|---|---|
| **INTERNAL EXAMINER** | **EXTERNAL EXAMINER** |

# ACKNOWLEDGEMENT

*Almost every successful person begins with two beliefs: the future can be better than the present and I have the power to make it so - David Brooks.*

Such a personality is our beloved founder Chairman, **Thiru. MJF. Ln. LEO MUTHU**. At first, we express our sincere gratitude to our beloved chairman through prayers, who in the form of a guiding star has spread his wings of external support with immortal blessings.

We express our gratitude to our CEO **Mr. J. SAI PRAKASH LEO MUTHU** and our Trustee **Mrs J. SHARMILA RAJA** for their constant encouragement for completing the project.

We express our sincere thanks to our beloved principal, **Dr. K. PALANIKUMAR** for having given us spontaneous and whole hearted encouragement for completing the project.

We are indebted to our head of the department **Dr. G. THAMARAI SELVI** for her support during the entire course of this project work.

We express our gratitude and sincere thanks to our guide **Mrs. R. LAKSHMI DEVI** for her valuable suggestions and constant encouragement for the successful completion of the project.

We thank all the teaching and non-teaching staff members of the Department of Electronics and Communication Engineering and all others who contributed directly or indirectly for the successful completion of the project.

## ABSTRACT

The ocean acts as place for the weather and climate. It also serve as a channel to transport large amount of goods between the continents .In recent times, air and water temperature, pressure changes rapidly. To measure these information, oceanographers use Buoy and data is collected by oceanographers. The data obtained from the satellite cannot be treated as the primary source as they are not precise. Buoy stays in a stationary state in water and collects information within a specific range on the sea. Approximately a buoy can detect within a range of 3 nautical mile. Even though the ocean is spread across we may not able to fully utilize the ocean resource and not make a maritime a safer route. Due to this travelers have to sail through a long route to reach their destination .The value produced by the buoy and satellite is not real time. In order to increase more accuracy, a mini boat can be employed and would be able to collect all the required data and parameters from the ocean and send to the sailor's real time. This could be cost effective and provide a large area of coverage on the ocean.

## TABLE OF CONTENTS

## TABLE OF FIGURES

# CHAPTER 1

# INTRODUCTION

## 1.1 OVERVIEW OF THE MODEL

The ocean acts as place for livelihood for fishes and other aquatics. It acts as route for major transport across the globe .Due to global warming rising sea water level the air and water temperature, pressure and current are keeps rapidly changing. To measure these change oceanographers use various methodologies to collect information. The satellite obtained cannot be treated as the primary source as these are not precise. Buoy stays in a stationary state in water and collects information small radius location where it is stationed .Approximately a buoy can detect an area of about 3 Nautical Mile. Sailors travel in regular route instead of utilizing the large spread ocean. Due to this travellers have to sail through a long way to reach their destination.

To overcome the above mentioned problem we have come up with the solution. In order to increase more accuracy, and enable traffic less sea route a mini boat can be employed and would be able to collect all the required data and parameters from the ocean and send to the sailor's real time. This could be a cost effective and provide a large area of coverage on the ocean. To collect information such as air and water temperature, barometric pressure and wave height using motor boat. This could increase more accuracy and to make data more efficient for seafarer to navigate the marine vessel which carries expensive cargos. It can also be used to detect ocean salinity which will be helpful to understand the effect of global warming on water cycle.

## 1.2 OBJECTIVE

To collect information about air and water temperature, barometric pressure and wave height using motor boat. In order to increase more accuracy and to make data more efficient for seafarer to navigate the marine vessel which carries expensive cargos. It is also used to detect ocean salinity which will be helpful to understand the effect of global warming on water cycle. Collected data will be transmitted using very low frequency antenna.

## 1.3 SCOPE OF THE PROJECT

Transportation of cargos using ships are increasing a lot these days, and cruise tourism and transportation are also expanding globally. This small autonomous boat is used to identify temperature, pressure, and other data that can also be detected. This self-driving boat is made with dc servomotors and weighs less, allowing it to easily float and survive the waves of the sea. Additionally, it is able to convey the necessary information regarding the sea's temperature and pressure. It can be used for more than just boat transportation; it can also be used to determine salinity, pressure, temperature, and other parameters at sea level. This autonomous boat's future capabilities include these.

# CHAPTER 2

# REVIEW OF LITERATURE

## 2.1 LITERATURE SURVEY

| S. No | TITLE | AUTHOR | PUBLISHED IN | INFERENCE |
|---|---|---|---|---|
| 1. | Marine autonomous system | Abhilash Somayajula Vijay kumar Suresh rajendran | IITM RESEARCH | Research about the they used in this project. We also search about the components that they have used. |
| 2. | Autonomous Boat system | Lorenzo Steccanella Domenico Daniele | INTCATCH | We had a research on this paper about their work on transmitting data from the boat |
| 3. | Sucessful execution of remotely piloted autonomous marine vehicle | Sudhir pai Roger hine | IEEE | In this article we came to know how they designed the boat. |
| 4. | Toward an autonomous sailing boat | Clement perez Federic plument | IEEE Published: April 2015 | In this paper, we had learnt about the |

| | | | | |
|---|---|---|---|---|
| | | | | Technology and compents they have used. |
| 5. | Low RCS microstrip patch antenna using frequency selective surface | Ying liu<br>Yuwen Hao<br>Hui wang<br>Kun li | IEEE- APCAP<br>Year:2016 | In this article, know about the transmitter and receiver technology and also their technology they have used |
| 6. | Autonomous Surface Vehicle for Real-time Monitoring of Water Bodies in Bangladesh | Sayantan Roy<br>Razin Bin Issa<br>Mohammed Rahman | ICITAEE<br>Published<br>Year:2018 | In this article we known about this project, they have tried to develop a system to monitor water quality data of some water bodies in Dhaka city using a small autonomous hovering boat. Therefore, this autonomous GPS guided water monitoring system can have a positive impact on water quality monitoring |

| | | | | |
|---|---|---|---|---|
| | | | | as well as assessment of water quality parameters. |
| 7. | Fully Autonomous Focused Exploration for Robotic Environmental Monitoring | Gregory Hitz<br>Alkis gotovos | IEEE Published Year:2014 | In this article, we came to know about the Robotic sensors are promising instruments for monitoring spatial phenomena. Oftentimes, rather than aiming to achieve low prediction error everywhere, one is interested in determining whether the phenomenon exhibits certain critical behavior. In this paper, we consider the probiem of focusing autonomous sampling to |

| | | | | |
|---|---|---|---|---|
| | | | | determine whether and where the sensed spatial field exceeds a given threshold value. We introduce a receding horizon path planner. LSE-DP. |
| 8. | A Low-Cost Autonomous Surface Vehicle for Multi-Vehicle Operations | Reeve Lambert, Brian Page, Jalil Chavez1 and Nina Mahmoudian | IEEE Year 2021 | To provide a low-cost modular easily deployable platform for advancing marine autonomy and supporting multi-vehicle missions. an Autonomous Surface Vehicles (ASV) called BREAM (Boat for Robotic Engineering and Applied Machine-Learning) is de veloped by Purdue University. |

| | | | | |
|---|---|---|---|---|
| 9. | A PID Controlled Autonomous Surface Vessel | Giorgos A. Demetriou | IEEE Year-2016 | Aquatic unmanned robotic systems have gained popularity due to their abilities to perform a wide range of applications at low cost and no risk to human lives. |
| 10. | Project and Control Allocation of a 3 DoF Autonomous Surface Vessel With Aerial Azimuth Propulsion System | MATHAUS FERREIRA DA SILVA1, LEONARDO DE MELLO HONÓRIO | IEEE YEAR: 2020 | To gather hydrological measurements is a difficult task for Autonomous Surface Vessels. It is necessary for precise navigation considering underwater obstacles, shallow and fast water, and also mitigate misreading due to disturbs caused by their propulsion system. |

# CHAPTER 3

# SYSTEM ANALYSIS

## 3.1 EXISTING SYSTEM

In these modern days, cargo transportation and cruise tourism are becoming more popular and more ships travelling in the sea. Weather data have been given by the satellite like GPS etc. It has been used by the captain of the ship while travelling in the sea. It can be changed hour to hour and it is not stable. Sea level temperature and climate in sea it is not always same any time storm will cause in mid sea and any time sea wave will rise and it will be very dangerous to ship and travelling people in that ship.

## 3.2 DISADVANTAGES OF EXISTING SYSTEM

- Cruise and ship travelling are not always safe it may cause any problem to people who are travelling.
- Climate in sea level and mid sea it may differ from land and also can't predict and satellite data also varied so, it also damage the ship and danger to people.

## 3.3 PROPOSED SYESTEM

Cargo ships and ship trading are becoming increasingly popular these days, and cruise tourism and transportation are also expanding globally. To overcome above mentioned issues in sea like storm and waves. This small autonomous boat is used to identify temperature, pressure, and other data that can also be detected. This self-driving boat is made with dc servomotors and weighs less, allowing it to easily float and survive the waves of the sea. Additionally, it is able to convey the necessary information regarding the sea's temperature and pressure. It can be used for more than just boat transportation; it can also be used to determine salinity, pressure, temperature, and other parameters at sea level. This autonomous boat's future capabilities include these. Fig 3.1 depicts about the future prototype of project.

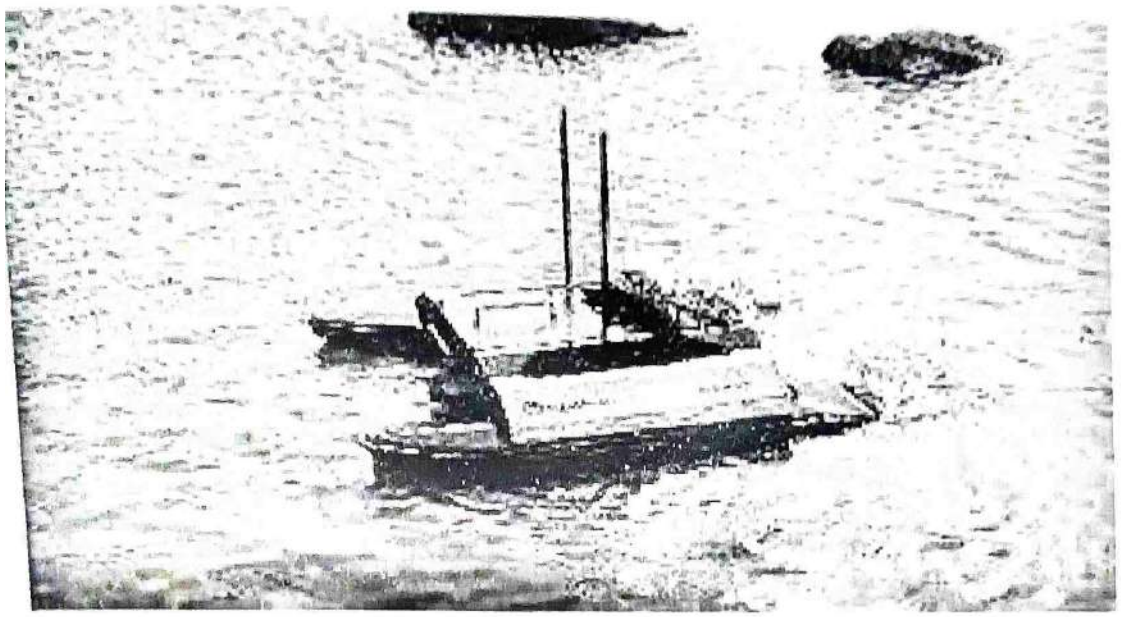

**Fig 3.1 Prototype**

## 3.4 ADVANTAGES OF THE PROPOSED SYSTEM

- The advantages in this proposed system is cost efficient.
- The autonomous boat is small in size compared to other ships and also it is more efficient.
- The autonomous boat has many features like detecting temperature, pressure, salinity, air speed and also live visuals of the sea.
- It has also implemented with camera.

# CHAPTER 4

# COMPONENTS AND INTEGRATION

## 4.1 INTRODUCTION

The components and integration are important/heart thing of any project that is mainly used to implement the project design and to build the project with help of many software and hardware. The boat have been implemented using both hardware and software.

## 4.2 COMPONENTS REQUIRED

The proposed model has been implemented with the following hardware and software components.

### Hardware Components

- Servo Motors
- Brushless DC Motor
- Transmitter and Receiver
- GPS
- Temperature Sensor
- Pressure Sensor
- Battery
- camera

### Software Components

- Blender Software
- Arduino IDE

### 4.2.1 Servo Motors

Servo motors (or servos) are self-contained electric devices that rotate or push parts of a machine with great precision. By rotating a shaft connected to the engine throttle, a servo regulates the speed of a fuel-powered car or aircraft. These motors run on electricity from a battery and spin at high RPM (rotations per minute) but put out very low torque. An arrangement of gears takes the high speed of the motor and slows it down while at the same time increasing the torque. The gear design inside the servo case converts the output to a much slower rotation speed but with more torque (big force, little distance). The amount of actual work is the same, just more useful. Gears in an inexpensive servo motor are generally made of plastic to keep it lighter and less costly.

**Fig 4.1 DC servo motor**

Figure 4.1 depicts the DC servo motor, a type of servomotor that uses DC electrical input to generate mechanical output like velocity, acceleration or position is known as DC servomotor. It is somewhat similar to a normal DC motor. However, there exist some differences between a normal dc motor and dc servomotor. Basically, DC servomotors of all types are required to be excited individually. This leads to provide linear characteristics between torque and speed.travel debuggers, perform static code analysis, and add code linters using the Language Server Protocol.

A type of servomotor that uses DC electrical input to generate mechanical output like velocity, acceleration or position is known as DC servomotor. It is somewhat similar to a normal DC motor. However, there exist some differences between a normal DC motor and DC servomotor. Basically, DC servomotors of all types are required to be excited individually. This leads to provide linear characteristics between torque and speed. We have already discussed in our previous article that servomotors are the devices that are used to change electrical input into positional mechanical output. A normal DC motor that utilizes the principle of servomechanism simply converted into a dc servomotor. More simply, we can say that a DC motor controlled with servomechanism is known as DC servomotor. It is known to us that the type of input applied to the servomotor leads to its classification as AC servomotor and DC servomotor.

### 4.2.2 Brushless DC Motor

A brushless DC motor (also known as a BLDC motor or BL motor) is an electronically commuted DC motor which does not have brushes. Fig 4.2 Depicts the image of the BLDC motor. The controller provides pulses of current to the motor windings which control the speed and torque of the synchronous motor. These types of motors are highly efficient in producing a large amount of torque over a vast speed range. In brushless motors, permanent magnets rotate around a fixed armature and overcome the problem of connecting current to the armature. Commutation with electronics has a large scope of capabilities and flexibility. They are known for smooth operation and holding torque when stationary.

Brushless DC motor has only two basic parts: rotor and the stator. The rotor is the rotating part and has rotor magnets whereas stator is the stationary part and contains stator windings. In BLDC permanent magnets are attached in the rotor and move the electromagnets to the stator. The high power transistors are used to activate electromagnets for the shaft turns. The controller performs power distribution by

using a solid-state circuit. A motor converts supplied electrical energy into mechanical energy. Various types of motors are in common use. Among these, brushless DC motors (BLDC) feature high efficiency and excellent controllability, and are widely used in many applications. The BLDC motor has power-saving advantages relative to other motor types. Brushed DC motors, featuring simple design and easy control, are widely used to open and close disk trays. In cars, they are often used for retracting, extending, and positioning electrically-powered side windows. The low cost of these motors makes them suitable for many uses. One drawback is that brushes and commutators tend to wear relatively quickly as a result of their continued contact, requiring frequent replacement and periodic maintenance.

**Fig 4.2 BLDC Motor**

A stepper motor is driven by pulses; it rotates through a specific angle (step) with each pulse. Because the rotation is precisely controlled by the number of pulses received, these motors are widely used to implement positional adjustments. They are often used, for example, to control paper feed in fax machines and printers—since these devices feed paper in fixed steps, which are easily correlated with pulse count. Pausing can also be easily controlled, as motor rotation stops instantly when the pulse signal is interrupted. With synchronous motors, rotation is synchronous with the frequency of the supply current. These motors are often used to drive the rotating trays in microwave ovens; reduction gears in the motor unit can be used to obtain the appropriate rotational speeds to heat food. With induction motors, too, the rotation speed varies with frequency; but the movement is not synchronous. In the past, these motors were often used in electric fans and washing machines. There are

various types of motor in common use. In this session, we look at the advantages and applications of brushless DC motors.

DC brushless motor, as their name implies, brushless DC motors do not use brushes. With brushed motors, the brushes deliver current through the commutator into the coils on the rotor. So how does a brushless motor pass current to the rotor coils? It doesn't because the coils are not located on the rotor. Instead, the rotor is a permanent magnet; the coils do not rotate, but are instead fixed in place on the stator. Because the coils do not move, there is no need for brushes and a commutator.

### 4.2.3 Transceiver

Transmitter and receiver are electronic devices which are used to transmit and receive useful data. Production of radio waves with the help of the antenna provided generates radio frequency on application of current which excites the alternating current and thus produces radio waves and further radiation is done by it. A transmitter is a necessary component of all electronic devices such as cell phones, television stations, ships etc. They are also used for navigation purposes. Receiver is an electronic device that receives signals and radio waves that are transmitted by the transmitter. The function of transmitting, receiving and accepting of electronic signals works on a particular frequency and converts them to useful form.

A decoder is installed in a receiver whose function is to decode and then sends it to the amplifier. An amplifier is an electronic device that converts the signals sent by the receiver to a pair of speakers. The power and current of the signal is increased by an amplifier. The speakers are also known as amplifying devices. Note: Sometimes installation of transmitters may become improper and give false reading or signals of different frequency. A transmitter of a radio does not work without the help of an antenna. Transmitters used for broadcasting purposes may get damaged due to lightning. Also, most of the receivers such as an audio receiver gets

damaged as they do not have any fuses. Fig 4.3 depicts the picture of transmitter and receiver.

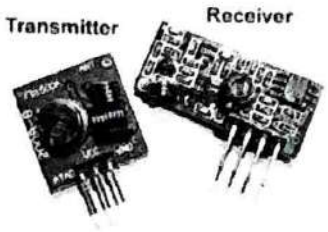


**Fig 4.3 Transceiver**

### 4.2.4 GPS (Global Positioning System)

The Global Positioning System (GPS) is a satellite constellation supporting highly accurate positioning, navigation and timing (PNT) measurements worldwide. As one of the first satellite positioning systems, GPS has become integral to work done worldwide, including precision agriculture, autonomous vehicles, marine or aerial surveying and defence applications. In this article, it is explained about GPS, how it works, difference between GPS and other satellite systems like Global Navigation Satellite Systems (GNSS), as well as the equipment and applications GPS supports. You can find further information on GPS and satellite technologies in our book, An Introduction to GNSS. GPS is one of many GNSS that provides positioning, navigation and timing (PNT) measurements. While operated by the U.S. Space Force, a branch of the U.S. Armed Forces, GPS is available for use by anyone worldwide. GPS was started in 1973, launching its first satellite in 1978. Satellites are developed and launched in series known as blocks. In total, 10 Block I GPS satellites were launched between 1978 and 1981. The Block II series satellites were launched beginning in 1989 and were capable of broadcasting on two L-Band radio frequencies. GPS' Block II had several developmental series, including Block IIA, IIR, IIR-M and IIF. Each set of satellites built upon the previous designs and

capabilities, culminating in Block III. This third generation of GPS satellites begins with Block IIIA series' new signals and higher broadcasting power.

The first IIIA satellite of 10 was launched in 2018 Satellites are continually broadcasting their orbital position and exact time at that position on radio frequencies. That signal is received by antennas, along with at least three other satellite signals, then processed in a GPS receiver to compute a user's location. PS broadcasts on L1 (1575.42 MHz), L2 (1227.60 MHz) and L5 (1176.45 MHz) civilian frequencies; GPS also broadcasts on L3 (1381.05 MHz) and L4 (1379.913 MHz) for governmental and regional satellite-based augmentation systems (SBAS). Several satellites also broadcast M-code, a military code carried on the L1 and L2 frequencies designed for exclusive use by the U.S. military.

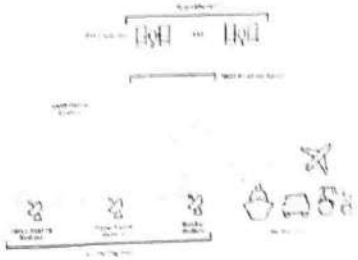

**Fig 4.4 Working of GPS**

Fig 4.4 depicts the working of GPS.A positioning system is only as good as its processor. A high-precision GPS receiver will be far more accurate than a mobile phone, for example. Potential sources of errors are identified and modelled at monitoring and control stations to optimize accuracy. Most errors come from clock errors, orbital drift, atmospheric and multipath delays and radio frequency interference. These sources constantly threaten positioning, navigation and timing accuracy by contributing to geometric dilution of precision. Some technologies help mitigate dilution of precision and these errors, including subscriptions to GNSS/GPS correction services, SBAS and the fusion of additional sensors like inertial navigation systems or radar. More precise GPS receivers also help mitigate errors

through different algorithms by computing a position through pseudo range or carrier wave calculations.

### 4.2.5 Temperature and Pressure Sensor

Pressure is defined as the applied force by a liquid or gas on a surface and it is usually measured in units of force per unit of surface area. Common units are Pascal (Pa), Bar (bar), N/mm2 or psi (pounds per square inch). A sensor is a device that measures a physical quantity and translates it to a signal. The quantity can be for instance temperature, length, force, or – of course – pressure. The signal is in most cases electrical but can also be optical.


**Fig.4.5 Barometric pressure sensor**

Therefore, a pressure sensor is an instrument consisting of a pressure sensitive element to determine the actual pressure applied to the sensor (using different working principles) and some components to convert this information into an output signal. Pressure sensitive element where metal strain gauges are glued on or thin film gauges are applied on by sputtering. This measuring element can either be a diaphragm or for metal foil gauges measuring bodies in can-type can also be used. The big advantages of this monolithic can-type design are an improved rigidity and the capability to measure highest pressures of up to 15,000 bar. The electrical connection is normally done via a Wheatstone bridge which allows for a good amplification of the signal and precise and constant measuring result

A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors). Non-contact temperature sensors are usually infrared (IR) sensors.

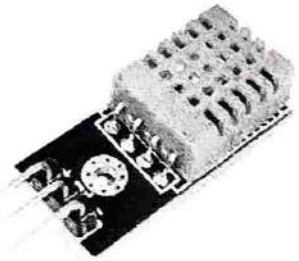

**Fig.4.6 Temperature sensor**

They remotely detect the IR energy emitted by an object and send a signal to a calibrated electronic circuit that determines the object's temperature. Among the contact temperature sensors are thermocouples and thermistors. A thermocouple is comprised of two conductors, each made of a different type of metal, that are joined at an end to form a junction. When the junction is exposed to heat, a voltage is generated that directly corresponds to the temperature input. This happens on account of the phenomena called the thermoelectric effect.

### 4.2.6 Blender Software

Blender is the free and open source 3D creation suite. It supports the entirety of the 3D pipeline—modelling, rigging, animation, simulation, rendering, compositing and motion tracking, even video editing and game creation. Advanced users employ Blender's API for Python scripting to customize the application and write specialized tools; often these are included in Blender's future releases. Blender is well suited to individuals and small studios who benefit from its unified pipeline and responsive development process. Examples from many Blender-based projects are available in the showcase.

Blender is cross-platform and runs equally well on Linux, Windows, and Macintosh computers. Its interface uses OpenGL to provide a consistent experience. To confirm specific compatibility, the list of supported platforms indicates those regularly tested by the development team. As a community-driven project under the GNU General Public License (GPL), the public is empowered to make small and large changes to the code base, which leads to new features, responsive bug fixes, and better usability. Blender has no price tag, but you can invest, participate, and help to advance a powerful collaborative tool: Blender is your own 3D software.

# CHAPTER 5
# SYSTEM WORKING AND INTERFACE

## 5.1 WORKING AND INTERFACE

Cargo ships and ship transport industry are becoming increasingly popular these days, and cruise tourism have been increasing rapidly across the globe. To overcome above mentioned issues in sea like storm and waves. This small autonomous boat is used to identify temperature, pressure, and other data that can also be detected. This self-driving boat is made with dc servomotors and weighs less, allowing it to easily float and survive the waves of the sea. Additionally, it is able to convey the necessary information regarding the sea's temperature and pressure. It can be used for more than just boat transportation; it can also be used to determine salinity, pressure, temperature, and other parameters at sea level. This autonomous boat's future capabilities include these. Fig 5.1 depicts the simulation of boat from rendered result.

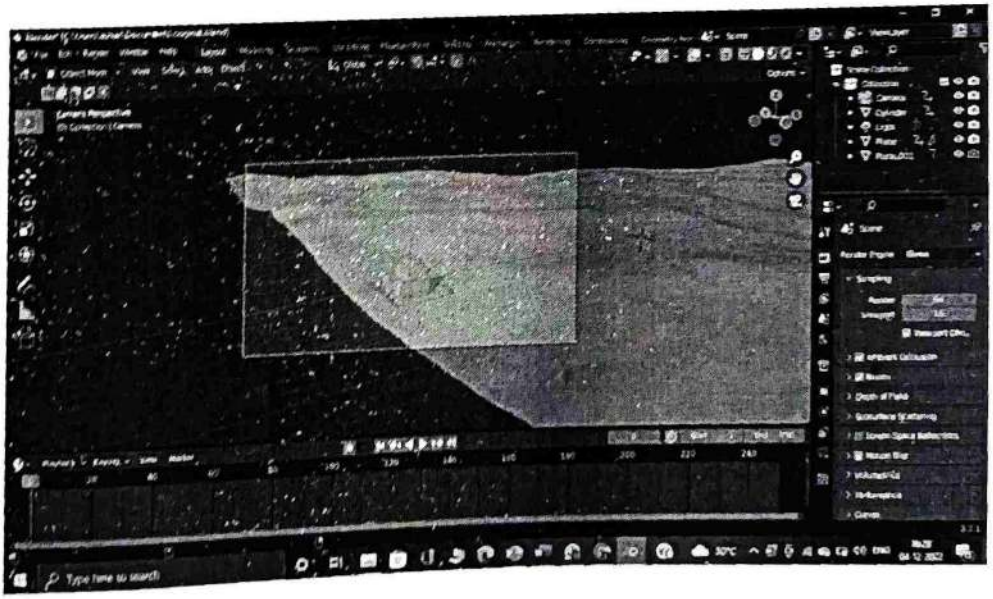

**Fig 5.1 Simulation of Boat**

The two fig. 5.2 and fig. 5.3 depicts about the code and the working of the code in visual studio code and it also depicts in the above two figures.

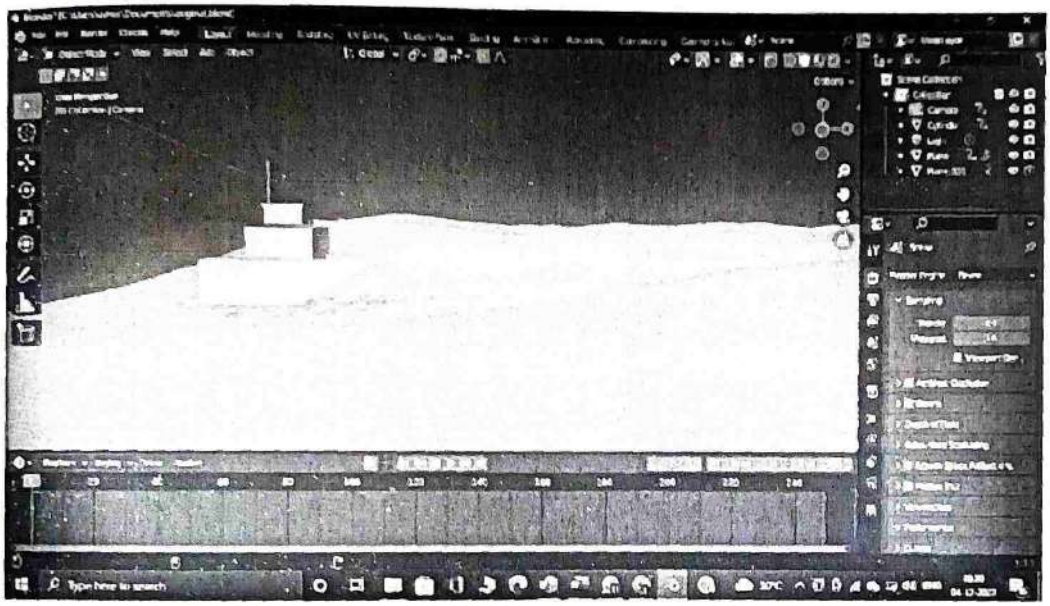

**Fig 5.2 Working of the Boat using Blender**

## 5.2 Advantages

- The advantages in this proposed system are cost efficient.
- The autonomous boat is small in size compared to other ships and also it is more efficient.
- The autonomous boat has many features like detecting temperature, pressure, salinity, air speed and also live visuals of the sea.
- It has also implemented with camera.

# CHAPTER 6
# EXPERIMENTAL RESULTS

## 6.1 EXPERIMENTAL SETUP

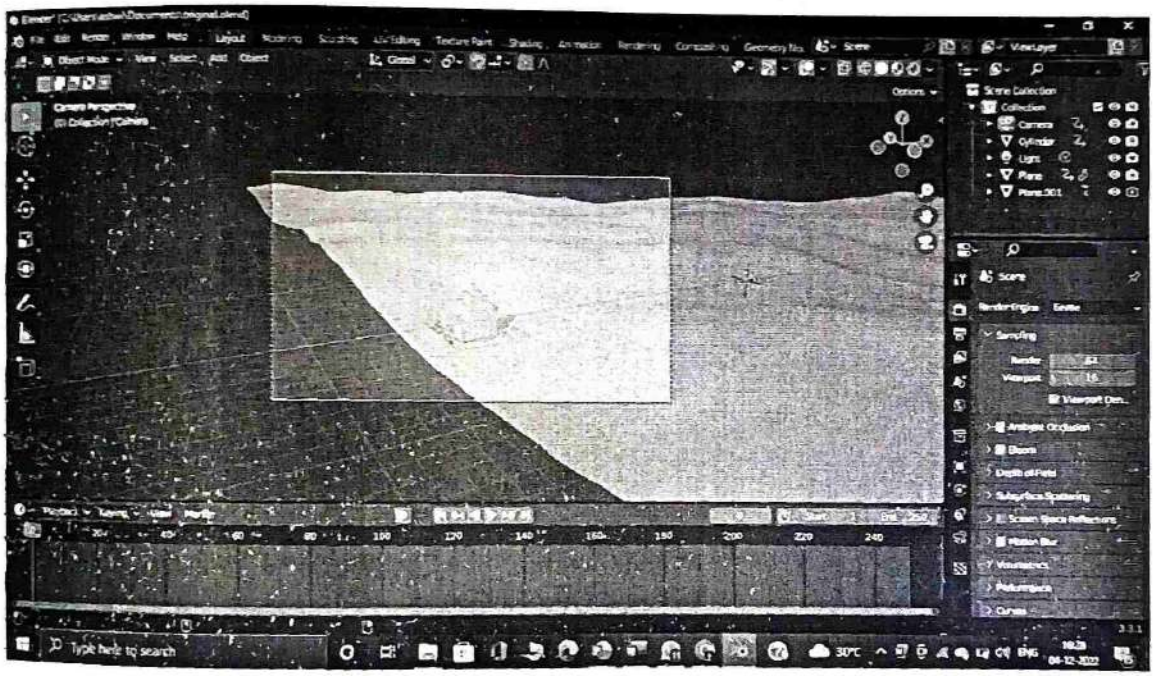

**Figure 6.1 Blender file setup**

Fig 6.1 Depicts about the experimental setup in the blend software using the STL file. It is used to visualize the autonomous boat which is going to be built in future.

## 6.2 EXPERIMENTAL RESULT

The result has been produced with the help of the blender and also produces the visualization of the boat using the blender software. It is used to visualize the project and design the boat with the help of blender software.

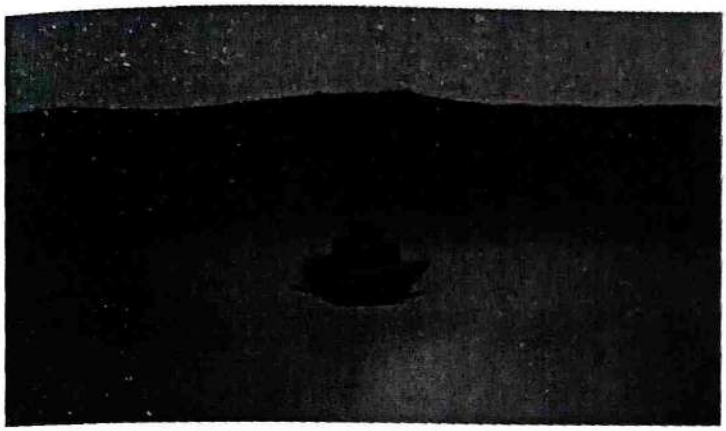

**Figure 6.2. Result of blender model**

Thus, the figure 6.2.1 & 6.2.2 depicts about the result of boat visual using the blender software and also it is simulated video which is attached below.

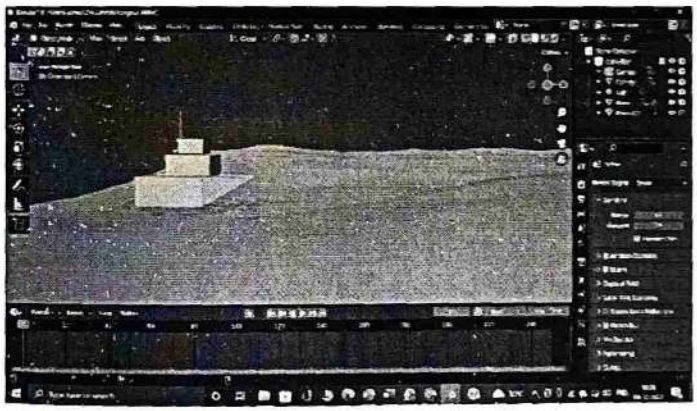

**Figure 6.3 Result of the blender software**

## 6.3 Applications

1. The advantages in this proposed system are cost efficient.
2. The autonomous boat is small in size compared to other ships and also it is more efficient.
3. The autonomous boat has many features like detecting temperature, pressure, salinity, air speed and also live visuals of the sea.
4. It has also implemented with camera.

# CHAPTER 7

# CONCLUSION AND FUTURE SCOPE

## 7.1 CONCLUSION

In current scenario, temperature of water, temperature of air, water pressure is measured using buoy and data is collected by oceanographers. These data are not precise. Buoy stays in a stationary state and collects data within a specific range. Approximately, a buoy can collect data within 3 nautical miles. Even though the ocean is spread across, we may not able to fully utilize the ocean resource and not make a maritime a safer route. Due to this travellers have to sail through a long route to reach their destination. In order to increase more accuracy, a mini boat can be employed and would be able to collect all the required real time data and parameters from the ocean and send to the sailors. This will improve transportation of goods much faster. This could be cost efficient and cover a lot of area to improve accuracy of the data.

## 7.1 FUTURE SCOPE

The future scope of this project, this report is just to discuss about the visual of the fully completed project and also components required for the autonomous boat. Next phase boat had completed. Also planned to provide the camera for live visuals of the live status. It is future planned for the boat and also many more features are planned to implement on the boat in the future.

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