
*Mini Project Report On*

# RSET NAVIGATOR

*Submitted in partial fulfillment of the requirements for the award of the degree of*

## Bachelor of Technology

*in*

***Computer Science & Engineering***

**By**

**Aarya Purushothaman (u2103003)**

**Bhavya Sanker EV (u2103063)**

**Amal Jose K (u2103030)**

**CK Zaid(u2103067)**

**Under the guidance of**

**Mr.HARIKRISHNAN M**

**Department of Computer Science & Engineering**
**Rajagiri School of Engineering & Technology (Autonomous)**
**(Affiliated to APJ Abdul Kalam Technological University)**
**Rajagiri Valley, Kakkanad, Kochi, 682039**
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# CERTIFICATE

*This is to certify that the mini project report entitled* ***"RSET Navigator"*** *is a bonafide record of the work done by* ***Aarya Purushothaman (u2103003), Bhavya Sanker EV (u2103063), Amal Jose K (u2103030), CK ZAID (U2103067)****, submitted to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in Computer Science and Engineering during the academic year 2023-2024.*

Mr.Harikrishnan M
Assistant Professor
Dept. of CSE
RSET

Mr.Harikrishnan M
Assistant Professor
Dept. of CSE
RSET

Dr.Preetha KG
Professor
Dept. of CSE
RSET

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**Aarya Purushothaman (u2103003)**

**Bhavya Sanker EV (u2103063)**

**Amal Jose K (u2103030)**

**CK Zaid(u2103067)**

# Abstract

Indoor navigation system offer a compelling solution to streamline navigation within college campuses,providing users with real time guidance and personalized route recommendations tailored to their specific destinations.Students, especially freshmen and transfer students ,often find themselves overwhelmed by the sheer size and complexity of college campuses,leading to frustration and unnecessary delays in finding classrooms, lecture halls, libraries and other essential facilities.The benefit of our project is that it is efficient,up to date and is accessible for everyone.

# Contents

# Chapter 1

# Introduction

## 1.1 Background

Large campuses can be labyrinthine, with buildings sprawling across vast areas and intricate floor plans. This complexity can be particularly daunting for new students, faculty, and visitors unfamiliar with the layout. Traditional methods of navigating campuses, such as physical maps or asking for directions, can be time-consuming and frustrating. Here's where indoor campus navigation systems come into play.

The Limitations of Existing Solutions:
1. GPS inoperability: Global Positioning Systems (GPS) are rendered useless indoors due to signal blockage by buildings.
2. Inaccuracy of static maps: Physical maps can quickly become outdated with changes to the campus infrastructure.

The Need for Indoor Campus Navigator:
1. Improved User Experience: A well-designed indoor navigation system can significantly enhance the experience of navigating a campus. It can save time, reduce stress, and improve overall campus familiarity.
2. Increased Efficiency: By streamlining navigation, faculty, staff, and students can optimize their time by reaching destinations faster.

This project proposes a hybrid approach to indoor campus navigation, utilizing both Wi-Fi fingerprinting and QR code scanning.
Wi-Fi fingerprinting: Leverages the existing Wi-Fi infrastructure to pinpoint a user's location within a building.

QR code scanning: Provides additional information and functionalities importantly giving information on the floor numbers.

## 1.2 Problem Definition

The aim of the campus navigator is to provide an efficient and user-friendly solution for navigating complex indoor environments, catering to diverse user needs, ensuring real-time updates, accessibility, ultimately enhancing campus experience and promoting inclusivity.

Developing an indoor navigation system for a college campus requires addressing challenges such as complex indoor environments and diverse user needs, while ensuring real-time updates, accessibility, to provide an intuitive and cost-effective solution for efficient navigation.

## 1.3 Scope and Motivation

The Rset navigator will focus on providing a user-friendly and informative navigation experience within the campus buildings.The indoor campus navigator leverages Wi-Fi fingerprinting to guide users within buildings, offering turn-by-turn directions and information on points of interest. While it won't track users or navigate outdoor areas, it provides a user-friendly and informative navigation experience. Regular data updates are crucial to maintain accuracy, and future iterations could incorporate features like real-time event integration.

RSET Navigator can help students, faculty, and visitors find their way around quickly, reducing stress and saving time. This project lets you develop valuable technical skills in app development, indoor positioning systems, and routing algorithms.By providing real-time updates and efficient routes, the system aims to save time and effort for students, faculty, and visitors, improving overall campus experience.

## 1.4 Objectives

- Here are the objectives of our project " Rset Navigator":

  1. Enhanced Navigation: Provide real-time, turn-by-turn navigation within buildings, guiding users from their current location to their desired destination with our college.

2. Improved Efficiency: Reduce time spent searching for locations, allowing faculty, staff, and students to optimize their schedules.
3. Increased User Accessibility: Offer easy-to-use navigation for all users, including students and faculties from other colleges as well.
4. Dynamic Content Delivery: Utilize QR codes strategically placed throughout the campus to provide additional information importantly the floor numbers.
5. Cost-Effective Implementation: Already existing Wi-Fi infrastructure and readily available QR code technology to create a cost-efficient navigation system.
6. Improved Campus Experience: By reducing navigation-related stress and confusion, the system can contribute to a more positive and welcoming environment for everyone on campus.

### 1.5 Challenges

Developing an indoor navigation system for college presents several challenges.One of the major challenges is that the campus might have complex indoor layouts with multiple buildings,floors making it very difficult and challenging to accurately map and navigate.Ensuring the system is accessible to individuals with disabilities poses another hurdle, requiring careful consideration of alternative routes, elevators, and other accessibility features.Beyond technical challenges, encouraging widespread adoption requires a strategy to convince students and faculty to use the app.

### 1.6 Assumptions

The Assumptions of indoor campus navigator are as listed below:
1.Wi-Fi Availability: The system assumes consistent and reliable Wi-Fi coverage throughout the campus building.

2.User Willingness: The system assumes users are willing to download and utilize the dedicated navigation app.

## 1.7 Societal / Industrial Relevance

The indoor navigator holds significant societal and industrial relevance:
1. Enhanced Accessibility: By providing accessible navigation solutions, the project promotes inclusivity for individuals with disabilities, facilitating their participation in educational activities and campus life.

2. Improved Efficiency and Productivity: The navigation system streamlines navigation processes, saving time and effort for students, faculty, and staff, ultimately enhancing productivity and efficiency within the academic environment.

3. Technological Innovation: Implementing advanced navigation technologies showcases the integration of cutting-edge solutions into educational institutions, fostering innovation and demonstrating the practical applications of technology in addressing real-world challenges.

4. Data Analytics and Decision-making: The system's data analytics capabilities can provide valuable insights into user behaviors, traffic patterns, and campus utilization, informing strategic decision-making processes for facility management and resource allocation.

5. Competitive Advantage for Colleges: Colleges that offer sophisticated navigation systems gain a competitive edge in attracting prospective students and faculty, demonstrating a commitment to modernization and providing a superior campus experience.

## 1.8 Organization of the Report

The report explores the development of an indoor campus navigation system utilizing a combination of Wi-Fi and QR code scanning technology.The report begins

by highlighting the challenges of navigating large, complex campuses and the limitations of existing solutions like GPS and static maps. It emphasizes the need for a user-friendly and efficient indoor navigation system.The report outlines several objectives, including enhanced navigation, improved efficiency, increased user accessibility, and contextual information delivery via QR codes.The report acknowledges key assumptions underlying the project's success, such as reliable Wi-Fi coverage,user willingness to adopt the navigation app etc.The report concludes by summarizing the potential benefits of the indoor campus navigator for students, faculty, staff, and visitors. It also acknowledges potential challenges and areas for future development.

# Chapter 2

# Software Requirements Specification

## 2.1 Introduction

### 2.1.1 Purpose

The Purpose of the document is to provide a description of the web application "RSET NAVIGATOR". The primary purposes of the indoor navigation application involves pathfinding, time efficiency, indoor positioning. In summary, the purpose of an indoor navigation system is to simplify and optimize the navigation experience within indoor spaces.

### 2.1.2 Product Scope

The RSET Navigator is an application which helps the individual to reach the desired destination after once they input their location by scanning the QR code. This application is not time consuming and helps the students especially freshmen to avoid unnecessary delays in finding classrooms, lecture halls, libraries and other facilities. The system also employs algorithms like QR code scanning to improve accuracy.

## 2.2 Overall Description

### 2.2.1 Product Perspective

RSET Navigator is mainly tailored for the college environment to enhance campus navigations through a user-friendly mobile application. This is a self-contained product that addresses the challenges associated with finding large and complex indoor spaces.

#### 2.2.2 Product Functions

Mapping and Localisation (Priority:High) Mapping and Localisation involves creation of digital maps of indoor spaces, providing users with accurate navigation instructions within indoor environments. It also determines the user's current location within the indoor space.

Search Functionality(Priority:High) Search functionality allows the users to search for specific destinations or facilities and calculate optimal routes from the user's current location to their desired destination.

Multi-floor Navigation(Priority:High) Multi-floor navigation supports navigation across multiple floors in a building which enables users to select their desired destination floor from a list of available floors in the building. Detailed maps of each floor are available to the users displaying the navigation routes and current location.

#### 2.2.3 Operating Environment

RSET Navigator will operate in various environments, primarily on mobile devices such as smartphones and tablets. It is compatible with android versions X and above. It also needs location based services(GPS) for determining the user's location accurately.

#### 2.2.4 Assumptions and Dependencies

Some of the assumptions include : i) The input that the user provides should be a destination inside the campus. ii) The user should grant permission to access the GPS location.

## 2.3 External Interface Requirements

#### 2.3.1 Hardware Interfaces

The college campus indoor navigation system is made to be light and efficient, needing only basic hardware so that everyone can easily use it. The app is designed to work really well on mobile phones and tablets, making sure it can be used on the devices most people at the college use, like students, teachers, and staff. Recommended specifications include devices with moderate processing power, along with at least 4 GB of RAM for smooth operation. The main idea is to make sure everyone

on campus can easily use the navigation system.

2.3.2 Software Interfaces

The software interface developed using Java, XML, and Android Studio involves writing the application logic in Java, defining the layout and appearance of the user interface using XML, and utilizing Android Studio as the development environment to bring everything together.

2.3.3 Communications Interfaces

Through the communication interface, users can input their destinations, while the system accesses real-time location data. The backend server processes this information, calculating optimal routes and providing navigation instructions to users via the user interface. Additionally, feedback mechanisms allow users to report navigation errors and suggest improvements.

## 2.4 System Features

2.4.1. Mapping

1. Description and Priority

Designing an indoor navigation system for a college campus mainly involves creating detailed maps of various places to assist users in navigating in order to reach their desired destination. This system functionality is of the highest priority as it obtains the main data of the application.

2. Stimulus/Response Sequences

Users can input the desired destination they want to reach. Once provided, the app will take the individual to the destination in the shortest path possible.

3. Functional Requirements

The application must be installed beforehand on every mobile phone. REQ-1:Bluetooth REQ-2:GPS

2.4.2 Localization

1. Description and Priority Localization is a crucial aspect of an indoor navigation project, ensuring accurate positioning of users within a confined space. This system

functionality is also of the highest importance so as to locate the position of the individuals.

2. Stimulus/Response Sequences
The individual scans the QR code and the current location of the individual can be obtained from that and the app responds accordingly.

3. Functional Requirements The individual needs a proper internet connection while scanning the QR code.

## 2.5 Other Nonfunctional Requirements

### 2.5.1 Performance Requirements

Accuracy: The navigator should accurately determine the user's location within the indoor environment. This could be specified in terms of distance from the actual location or in terms of room or zone accuracy. Robustness: The system should be robust against environmental factors such as signal interference, changes in lighting conditions, or obstacles in the indoor space. Battery Efficiency: For mobile devices, the navigator should be optimized for bat- tery efficiency to minimize drain while in use.

Scalability: The system should be scalable to support a large number of users simultaneously without sacrificing performance.

### 2.5.2 Safety Requirements

Testing and Certification: Conducting thorough testing and certification of the indoor navigation system to verify its compliance with safety standards and regulations.

Maintenance and Upkeep: Regular maintenance and upkeep of the system to ensure its reliability and functionality, including periodic checks of software and updates.

### 2.5.3 Security Requirements

Secure Communication: Ensure that communication between client devices (e.g.,

smartphones, tablets) and the indoor navigation system server is encrypted using protocols such as HTTPS (SSL/TLS) to prevent eavesdropping and tampering. Encryption: Encrypt sensitive data such as user location information, personal data, and communication between client devices and the navigation server to prevent unauthorized interception or tampering.

### 2.5.4 Software Quality Attributes

Availability: The system should maintain high availability to ensure users can access navigation services whenever needed.

Correctness: The system should provide accurate and correct navigation instructions to users.

Portability: The system should be portable across different devices and platforms, including smartphones, tablets etc. Adaptability: The system should be capable of adapting to changes in the indoor environment, such as modifications to building layouts or additions of new points of interest, with minimal disruption to service.

# Chapter 3

# System Architecture and Design

## 3.1 System Overview

This project aims to develop an indoor navigation system that assists users in finding their way around indoor environments. Unlike GPS which struggles indoors, this system will leverage various technologies to provide accurate positioning and guidance.

*Map Creation:*

A high-fidelity digital map of the indoor space is created. This map can be generated through manual surveying or by utilizing specialized mapping tools. Points of Interest (POI) are identified and marked on the map.

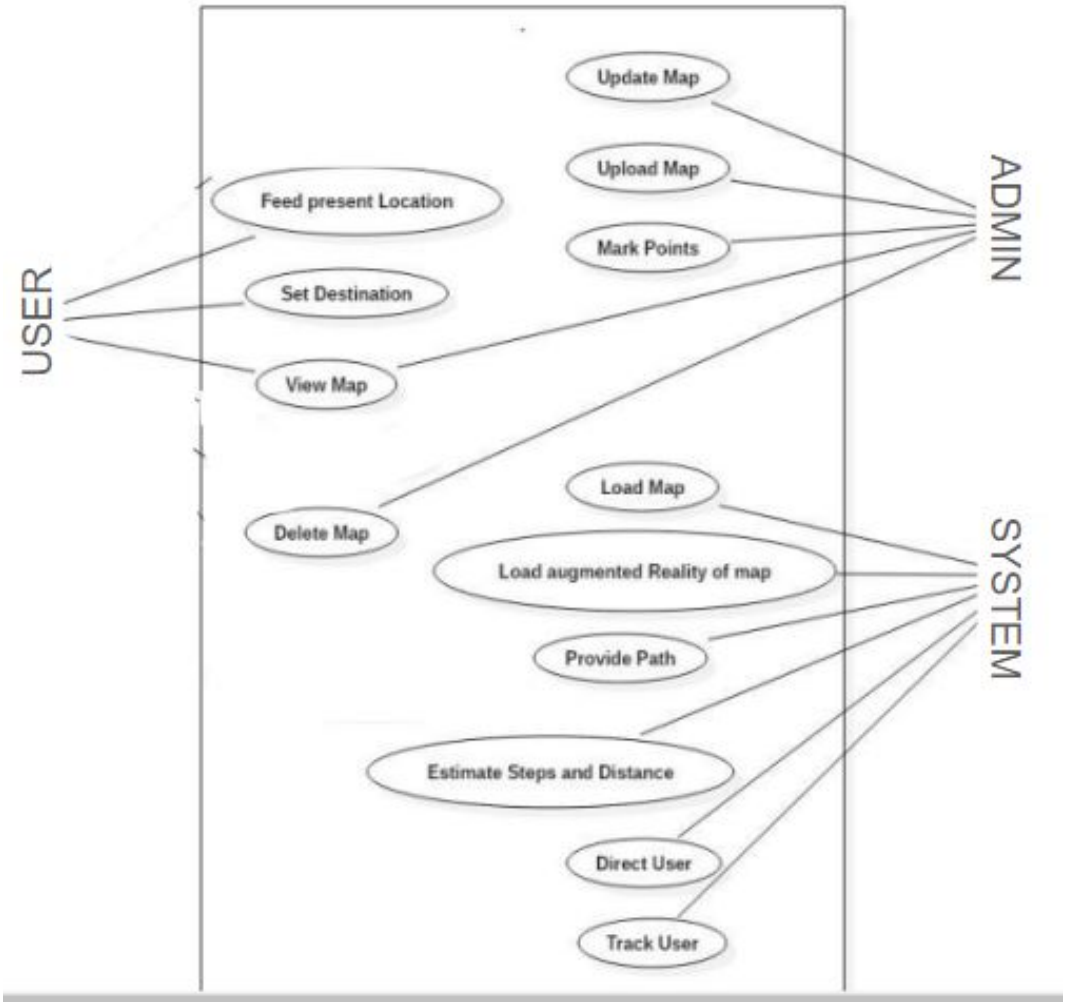
*Positioning Technology Integration:*

Beacons or other positioning devices are strategically placed throughout the indoor space. These devices can transmit signals that are picked up by user devices (smartphones typically). Wi-Fi are commonly used technologies for indoor positioning. Smartphones can detect signals from these strategically placed devices and estimate the user's location based on received signal strength or signal arrival time.

*Navigation Algorithm:*

The system employs a routing algorithm that calculates the optimal path for the user to reach their destination. This algorithm considers factors like: Shortest distance Accessibility (stairs, elevators) One-way corridors The chosen route is then highlighted on the map within the user application.

## 3.2 Architectural Design




USE CASE DIAGRAM

## 3.3 Proposed Methodology/Algorithms

### 3.3.1 Algorithm for QRcode scanner

function QRCodeScanner():

while true:

frame = captureFrameFromCamera()

qr_codes = detectQRCode(frame)

```
if qr_codes is not empty:
for qr_code in qr_codes:
location_info = decodeQRCode(qr_code)
if location_info is valid:
floor_number = location_info.floor_number
current_location = location_info.current_location
displayNavigationPage(floor_number, current_location)
break
else:
displayErrorMessage("Invalid QR code")
function displayNavigationPage(floor_number, current_location):
destinations = getDestinationsForFloor(floor_number)
while true:
selected_destination = getUserInput(destinations)
if selected_destination is valid:
shortest_route = calculateShortestRoute(current_location, selected_destination)
displayRoute(shortest_route)
break
else:
displayErrorMessage("Invalid destination")
```

### 3.3.2 Dijkstra's algorithm

```
function dijkstra(start, end, graph):
visited = set()
dist = node: infinity for node in graph
dist[start] = 0
pq = PriorityQueue()
pq.enqueue(start, 0)

while not pq.isEmpty():
```

u = pq.dequeue()

if u == end:

break

if u in visited:

continue

visited.add(u)

for v, weight in graph[u]:

alt = dist[u] + weight

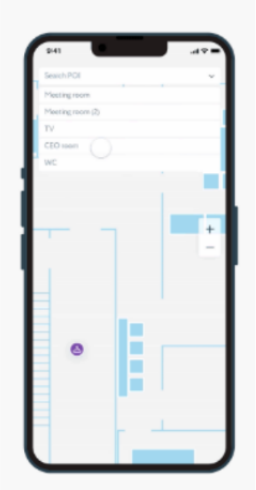
if alt ¡ dist[v]: dist[v] = alt

pq.enqueue(v, alt)

return dist[end]

### 3.4 User Interface Design


SCAN THE QR CODE



SELECT DESTINATION

ROUTE MAP

USE CASE DIAGRAM

## 3.5 Description of Implementation Strategies

For mobile app development specifically on Android, utilize Kotlin as the primary programming language and Android Studio as the integrated development environment (IDE) along with the Android SDK. Design an intuitive and user-friendly interface for the navigation application. For example, creating map views and navigation instructions. Conduct a thorough site survey to understand the layout and identify optimal locations for Wi-Fi access points. Install Wi-Fi access points throughout the facility, ensuring they cover the required areas without signal overlap or dead zones. Integrate the Wi-Fi infrastructure with navigation software that can interpret signal strength and triangulate positions. Implement functionality to import and integrate indoor map data into your application. Integrate the chosen indoor positioning system (IPS) technology into your application. Use Dijkstra's algorithms to calculate optimal routes between locations within the campus. Test the system extensively to ensure accuracy and reliability. Once tested, deploy the system and provide training for users and administrators.. Regularly maintain the system and update the software to improve performance and add new features.

## 3.6 Module Division

*QR Code Scanner Module:* Responsible for capturing frames from the camera and detecting QR codes. Contains functions for decoding QR codes and extracting location information. Interfaces with the Navigation Module to pass the location information after successful QR code scanning.

*User Interface Module:* Handles the overall user interface of the application. Includes components for displaying QR code scanning interface, navigation page, destination selection interface, etc. Interfaces with all other modules to provide seamless user interactions.

*Destination Selection Module:* Allows users to select their destination after scanning the QR code. Provides a user-friendly interface for browsing available destinations.

Interfaces with the Navigation Module to initiate route calculation after destination selection.

*Map Display Module:* Displays the indoor map of the campus. Provides functions for rendering landmarks, paths, and other relevant information on the map. Interfaces with the Navigation Module to display the navigation route.

*Navigation Module:* Handles the navigation logic of the application. Provides functions for calculating the shortest route between two locations. Interfaces with the Map Display Module to visualize the navigation route.

*Data Management Module:* Manages the storage and retrieval of campus map data, including floor plans, landmark locations, and navigation graph. Provides functions for updating map data and syncing with a server if necessary. Interfaces with the QR Code Scanner Module and Navigation Module to provide location information and route calculations.

*Integration and Testing Module:* Integrates all modules together to ensure they work seamlessly. Performs testing, including unit tests, integration tests, and user acceptance tests, to verify the functionality and usability of the application. Interfaces with the Development Environment for deployment and distribution of the application.

## 3.7 Work Schedule - Gantt Chart

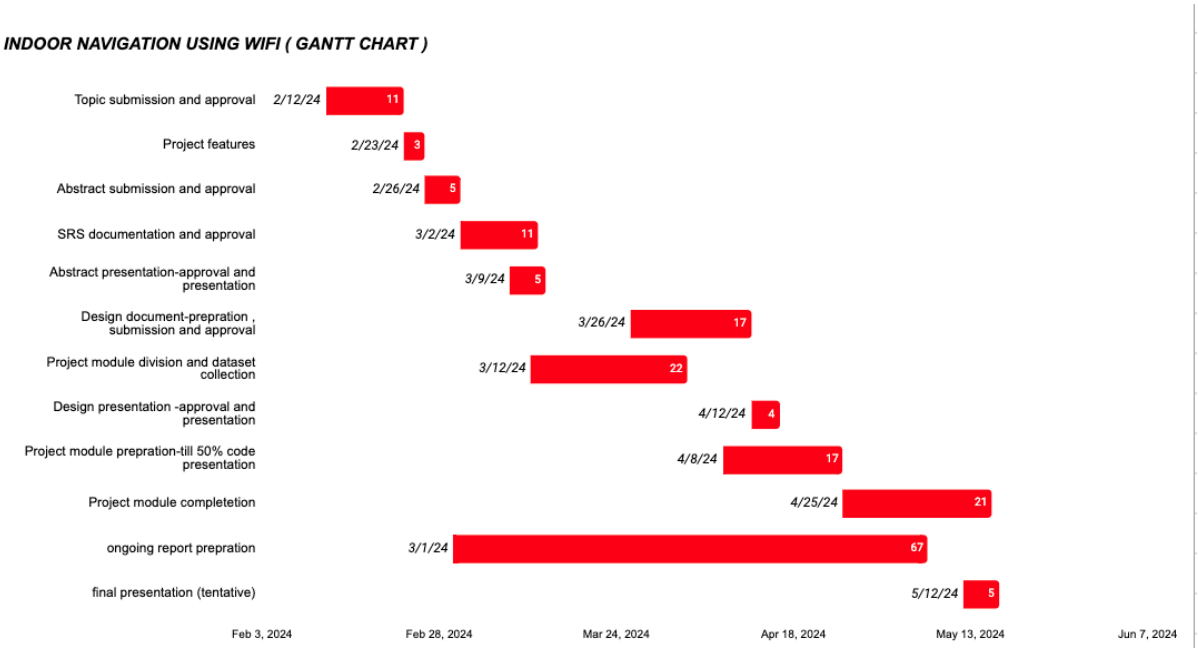



Figure 3.1: Caption

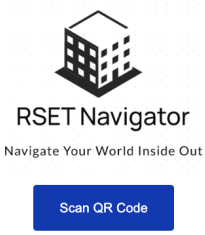
# Chapter 4

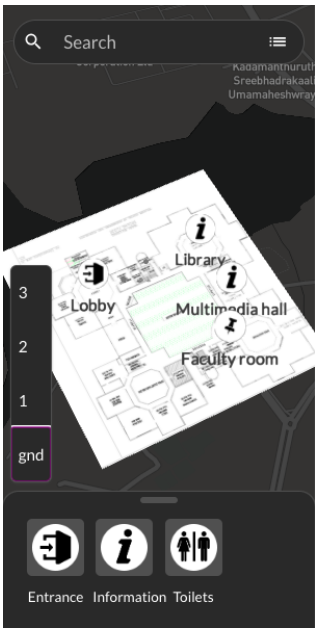
# Results and Discussions

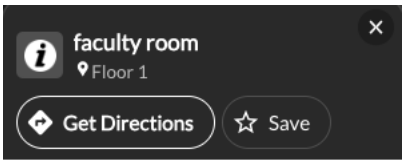
## 4.1 Overview

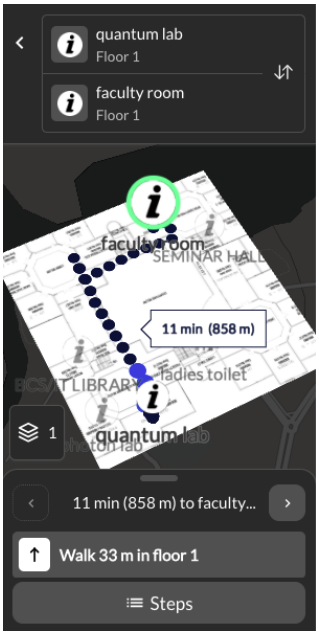
The indoor college navigation system successfully enhanced the user experience by making campus navigation more efficient and reliable. Users found it significantly easier to reach their destinations, with a high level of satisfaction reported overall. The system's effectiveness was further supported by its robust integration of updates and interactive maps, which streamlined the navigation process and demonstrated strong potential for broader application in similar environments.

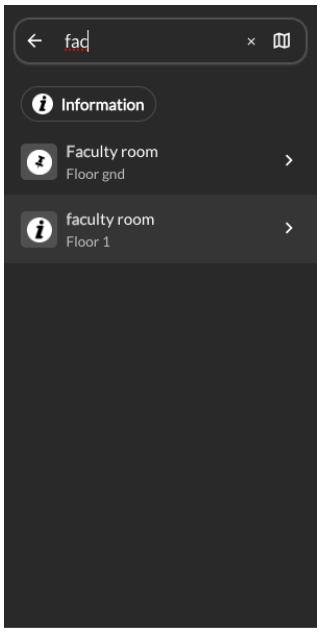
## 4.2 Testing


RSET Navigator
Navigate Your World Inside Out
Scan QR Code


Search
Library
Lobby
Multimedia hall
Faculty room
3
2
1
gnd
Entrance
Information
Toilets


faculty room
Floor 1
Get Directions
Save


quantum lab
Floor 1
faculty room
Floor 1
11 min (858 m)
ladies toilet
1
11 min (858 m) to faculty...
Walk 33 m in floor 1
Steps


fac
Information
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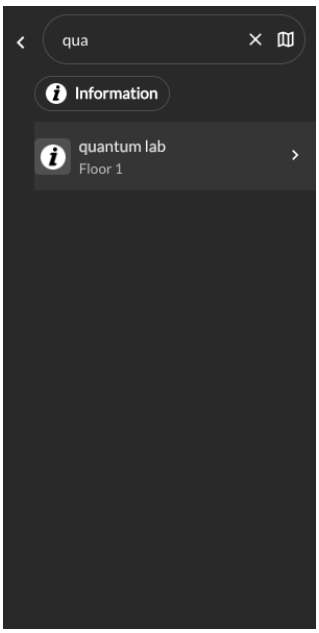
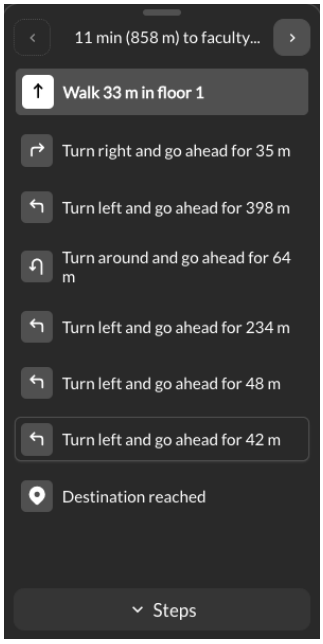
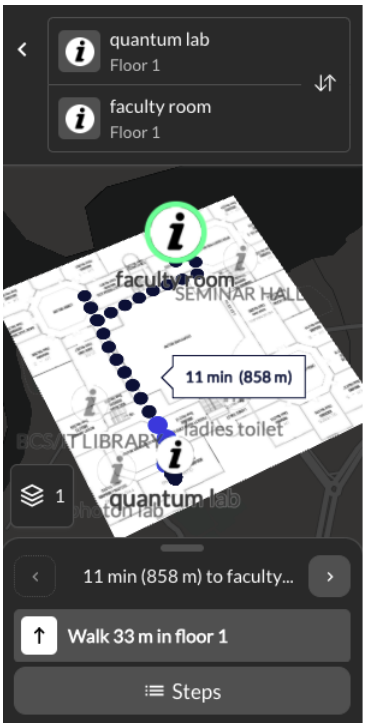
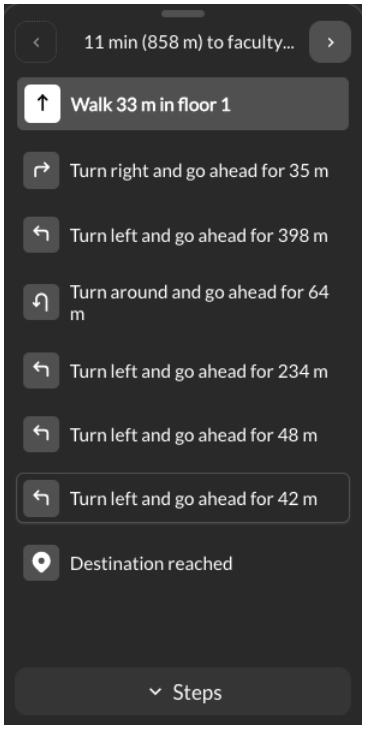
Floor gnd
faculty room
Floor 1


qua
Information
quantum lab
Floor 1


11 min (858 m) to faculty...
Walk 33 m in floor 1
Turn right and go ahead for 35 m
Turn left and go ahead for 398 m
Turn around and go ahead for 64 m
Turn left and go ahead for 234 m
Turn left and go ahead for 48 m
Turn left and go ahead for 42 m
Destination reached
Steps

## 4.3 Quantitative Results




## 4.4 Discussion

Indoor collage navigation involves moving through various interconnected spaces within a building, such as hallways, staircases, and rooms, to reach desired locations. Effective navigation often relies on clear signage, intuitive layout design, and sometimes digital aids like interactive maps or mobile applications. Good lighting, distinct landmarks, and consistent design elements also play crucial roles in helping individuals orient themselves and find their way efficiently. Understanding the building's layout and familiarizing oneself with key areas, such as classrooms, restrooms, and exits, can significantly enhance the navigation experience..

# Chapter 5

# Conclusion

## 5.1 Conclusion

In conclusion, a collage navigation system offers a multifaceted approach to indoor navigation, blending traditional methods with modern technology to create a seamless experience. By incorporating clear signage, intuitive layout design, and digital aids such as interactive maps or mobile applications, collage navigation systems provide users with the tools they need to navigate complex indoor environments effectively. These systems promote accessibility, efficiency, and user satisfaction by leveraging lighting, landmarks, and consistent design elements to aid orientation. As the demand for efficient indoor navigation grows across various settings like universities, office complexes, and shopping malls, collage navigation systems will continue to evolve, offering increasingly sophisticated features to meet the diverse needs of users.

## 5.2 Future Scope

The future scope of collage indoor navigation systems is poised for significant advancements. Integrating augmented reality, machine learning, and advanced indoor positioning technologies, these systems will offer personalized, multi-modal navigation experiences tailored to individual preferences and accessibility needs. By leveraging smart building infrastructure and prioritizing sustainability, future systems will enhance user experiences while optimizing energy efficiency. With ongoing innovation, indoor navigation systems will continue to evolve, ensuring seamless navigation within complex indoor environments.

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[10] Z. Zhang, S. He, Y. Shu and Z. Shi, "A Self-Evolving WiFi-based Indoor Navigation System Using Smartphones," in IEEE Transactions on Mobile Computing, vol. 19, no. 8, pp. 1760-1774, 1 Aug. 2020, doi: 10.1109/TMC.2019.2915221. keywords: Wireless fidelity;Indoor navigation;Synchronization;Smart phones;Real-time systems;Feature extraction;Indoor navigation;self-evolving;WiFi-based;leader-follower;long-term utility;smartphone,

# Appendix A: Presentation

# RSET NAVIGATOR

**GUIDE :**
Mr. Harikrishnan M

**TEAM MEMBERS:**
CK Zaid
Amal Jose K
Bhavya Sanker EV
Aarya Purushothaman



## CONTENTS

# INTRODUCTION

- Indoor navigation system offer a compelling solution to streamline navigation within college campuses,providing users with real time guidance and personalized route recommendations tailored to their specific destinations.

- Faculty members and staff similarly grapple with the challenge of navigating between departments, offices and meeting spaces, while visitors may feel disoriented and lost amidst the corridors of unfamiliar buildings.

- Students, especially freshmen and transfer students ,often find themselves overwhelmed by the sheer size and complexity of college campuses,leading to frustration and unnecessary delays in finding classrooms, lecture halls, libraries and other essential facilities.



# PROBLEM DEFINITION

To develop an indoor navigation system for RSET that helps users navigate through complex indoor environment efficiently.

# OBJECTIVES

- **Improved Wayfinding**: Especially for freshmen or visitors unfamiliar with the campus layout, an indoor navigation system can provide turn-by-turn directions to any point of interest within a building or across campus. This reduces stress and wasted time wandering around lost
- **Accessibility Features**: The system can be designed to consider accessibility needs. Features like elevator locations, accessible restroom designations, and clear path guidance can be integrated for users with disabilities.
- **Efficient Use of Time**: By providing the most efficient route, the system can help students get to class or appointments on time, maximizing their time management.



# SCOPE AND RELEVANCE

- In today's world, navigating large and complex indoor spaces like university campuses, hospitals, or corporate buildings can be a frustrating experience,Advancements in smartphone technology offer a promising solution.
- **Enhanced user experience** :Indoor navigation offers turn by turn directions, improved accessibility for individuals.
- **Improved Campus Management**: Campuses can leverage data on user movement patterns to optimize building layouts ,allocate resources more effectively, and make data driven decisions regarding space utilization .

# SYSTEM DESIGN

## SYSTEM OVERVIEW

**Map Creation:**

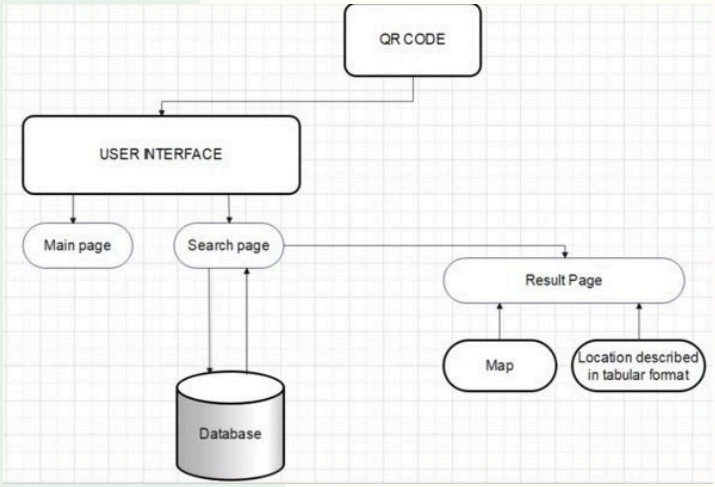
A high-fidelity digital map of the indoor space is created. This map can be generated through manual surveying or by utilizing specialized mapping tools. Points of Interest (POI) are identified and marked on the map.

**Positioning Technology :**

For navigation purposes, we marked all key locations (classrooms, offices, etc.) as points of interest on a digital map. Dijkstra's algorithm was used to calculate the shortest path between any two points, ensuring the most efficient navigation experience.



# ARCHITECTURAL DESIGN



# MODULE DIVISION

**QR Code Scanner Module**:
Responsible for capturing frames from the camera and detecting QR codes. Contains functions for decoding QR codes .

**User Interface Module:**
Handles the overall user interface of the application. Includes components for displaying QR code scanning interface, navigation page, destination selection interface, etc. Interfaces with all other modules to provide seamless user interactions.



**Destination Selection Module:**
Allows users to select their destination after scanning the QR code. Provides a user friendly interface for browsing available destinations. Interfaces with the Navigation Module to initiate route calculation after destination selection.

**Map Display Module:**
Displays the indoor map of the campus. Provides functions for rendering landmarks, paths, and other relevant information on the map. Interfaces with the Navigation Module to display the navigation route.

**Navigation Module:**

Handles the navigation logic of the application.Provides functions for calculating the shortest route between two locations. Interfaces with the Map Display Module to visualize the navigation route.

**Integration and Testing Module:**

Integrates all modules together to ensure they work seamlessly. Performs testing,including unit tests,integration tests, and user acceptance tests, to verify the functionality and usability of the application. Interfaces with the Development Environment for deployment and distribution of the application.



# QR CODE ALGORITHM

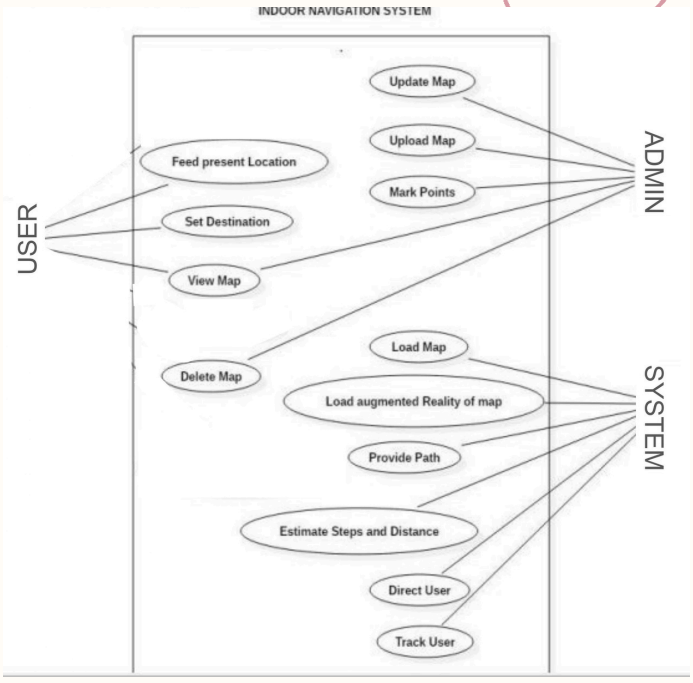
```
function QRCodeScanner():
while true:
frame = captureFrameFromCamera()
qr_codes = detectQRCode(frame)
if qr_codes is not empty:
for qr_code in qr_codes:
location_info = decodeQRCode(qr_code)
if location_info is valid:
floor_number = location_info.floor_number
current_location = location_info.current_location
displayNavigationPage(floor_number, current_location)
break
else:
displayErrorMessage("Invalid QR code")
function displayNavigationPage(floor_number, current_location):
destinations = getDestinationsForFloor(floor_number)
while true:
selected_destination = getUserInput(destinations)
if selected_destination is valid:
shortest_route = calculateShortestRoute(current_location, selected_destination)
displayRoute(shortest_route)
break
else:
displayErrorMessage("Invalid destination")
```

# DIJKSTRA'S ALGORITHM

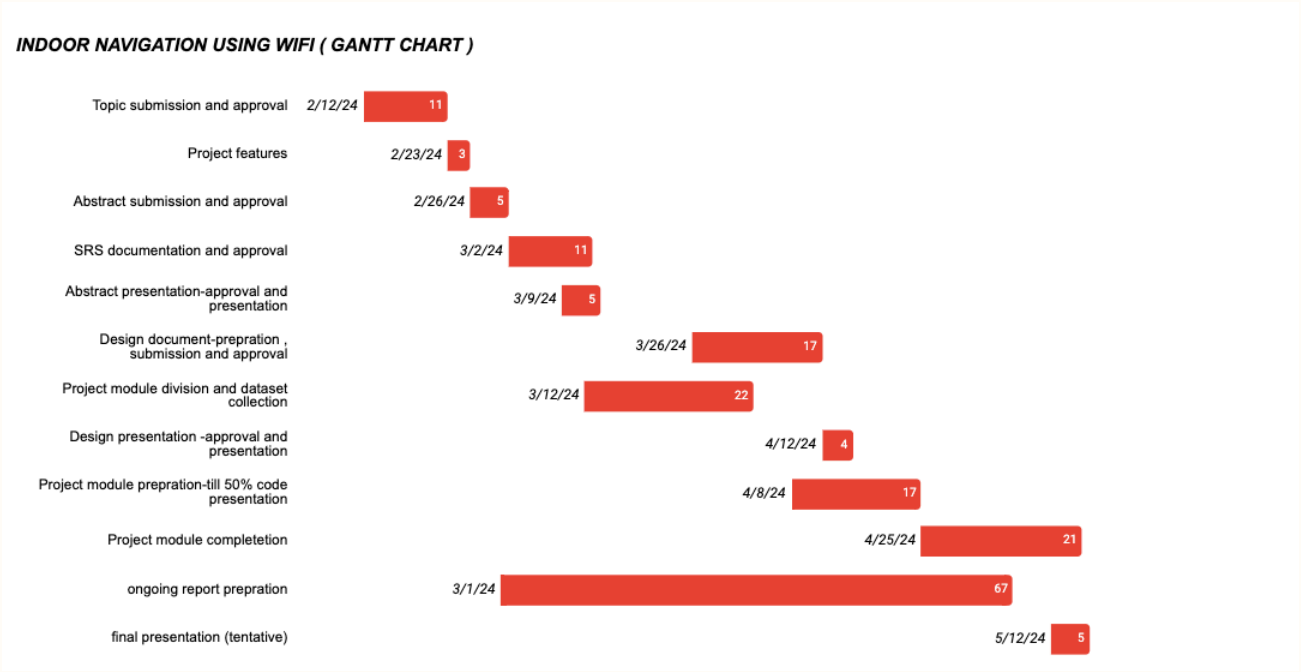
```
function dijkstra(start, end, graph):
    visited = set()
dist = {node: infinity for node in graph}
    dist[start] = 0
    pq = PriorityQueue()
    pq.enqueue(start, 0)
    while not pq.isEmpty():
        u = pq.dequeue()
        if u == end:
            break
        if u in visited:
            continue
        visited.add(u)
    for v, weight in graph[u]:
        alt = dist[u] + weight
        if alt < dist[v]:
            dist[v] = alt
            pq.enqueue(v, alt)
    return dist[end]
```



# DESIGN MODELS



# WORK DIVISION






# SOFTWARE /HARDWARE REQUIREMENTS

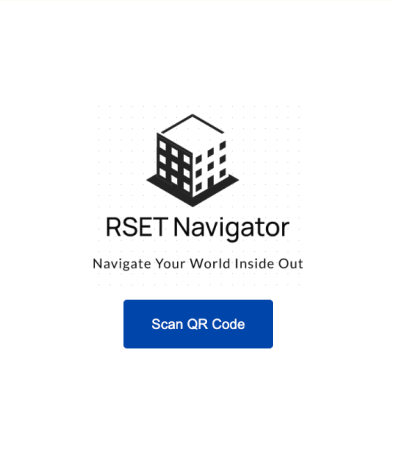
- **SOFTWARE REQUIREMENTS**

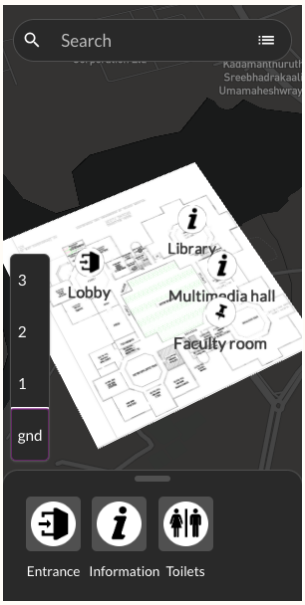
  React JS
  HTML CSS
  XML

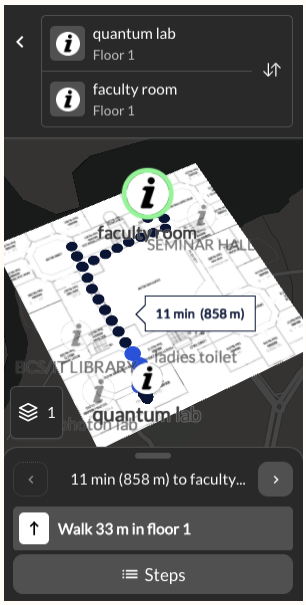
- **HARDWARE REQUIREMENTS**

  Mobile Phones
  Laptops

# RESULTS






# CONCLUSION

In conclusion, a college navigation system offers a multifaceted approach to indoor navigation, blending traditional methods with modern technology to create a seamless experience. By incorporating clear signage, intuitive layout design, and digital aids such as interactive maps or mobile applications, college navigation systems provide users with the tools they need to navigate complex indoor environments effectively. These systems promote accessibility, efficiency, and user satisfaction by leveraging lighting, landmarks, and consistent design elements to aid orientation.

# FUTURE ENHANCEMENTS

The future scope of college indoor navigation systems is poised for significant advancements. Integrating augmented reality, machine learning, and advanced indoor positioning technologies, these systems will offer personalized, multi-modal navigation experiences tailored to individual preferences and accessibility needs. By leveraging smart building infrastructure and prioritizing sustainability, future sys-tems will enhance user experiences while optimizing energy efficiency. With ongoing innovation, indoor navigation systems will continue to evolve, ensuring seamless navigation within complex indoor environments.



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# Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

**RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY**

**(AUTONOMOUS)**

**RAJAGIRI VALLEY, KAKKANAD, KOCHI, 682039**

**(Affiliated to APJ Abdul Kalam Technological University)**

# Vision, Mission, Programme Outcomes and Course Outcomes

### Institute Vision

To evolve into a premier technological institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

### Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

### Department Vision

To become a centre of excellence in Computer Science and Engineering, moulding

professionals catering to the research and professional needs of national and international organizations.

**Department Mission**

To inspire and nurture students, with up-to-date knowledge in Computer Science and Engineering, ethics, team spirit, leadership abilities, innovation and creativity to come out with solutions meeting societal needs.

**Programme Outcomes (PO)**

Engineering Graduates will be able to:

**1. Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**4. Conduct investigations of complex problems**: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**5. Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**6. The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**7. Environment and sustainability**: Understand the impact of the professional

engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**8. Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**9. Individual and Team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

**10. Communication**: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

**11. Project management and finance**: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

**12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

**Programme Specific Outcomes (PSO)**

A graduate of the Computer Science and Engineering Program will demonstrate:

**PSO1: Computer Science Specific Skills**

The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of computer science and thereby engage in national grand challenges.

**PSO2: Programming and Software Development Skills**

The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.

**PSO3: Professional Skills**

The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as

an eminent researcher and entrepreneur.

**Course Outcomes**

After the completion of the course the student will be able to:

**CO1:**

Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)

**CO2:**

Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)

**CO3:**

Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)

**CO4:**

Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)

**CO5:**

Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)

# Appendix C: CO-PO-PSO Mapping

## COURSE OUTCOMES:

After completion of the course the student will be able to

| SL. NO | DESCRIPTION | Blooms' Taxonomy Level |
|---|---|---|
| CO1 | Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply) | Level 3: Apply |
| CO2 | Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply) | Level 3: Apply |
| CO3 | Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply) | Level 3: Apply |
| CO4 | Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply) | Level 3: Apply |
| CO5 | Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply) | Level 3: Apply |

## CO-PO AND CO-PSO MAPPING

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | | | 2 |
| CO4 | 2 | 3 | 2 | 2 | 2 | | | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | | 2 | 3 | 2 | 2 | 2 |

3/2/1: high/medium/low

## JUSTIFICATIONS FOR CO-PO MAPPING

| MAPPING | LOW/ MEDIUM/ HIGH | JUSTIFICATION |
|---|---|---|
| 101003/CS622T.1-PO1 | **HIGH** | Identify technically and economically feasible problems by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| 101003/CS622T.1-PO2 | **HIGH** | Identify technically and economically feasible problems by analysing complex engineering problems reaching substantiated conclusions using first principles of mathematics. |
| 101003/CS622T.1-PO3 | **HIGH** | Design solutions for complex engineering problems by identifying technically and economically feasible problems. |
| 101003/CS622T.1-PO4 | **HIGH** | Identify technically and economically feasible problems by analysis and interpretation of data. |
| 101003/CS622T.1-PO6 | **MEDIUM** | Responsibilities relevant to the professional engineering practice by identifying the problem. |
| 101003/CS622T.1-PO7 | **MEDIUM** | Identify technically and economically feasible problems by understanding the impact of the professional engineering solutions. |
| 101003/CS622T.1-PO8 | **HIGH** | Apply ethical principles and commit to professional ethics to identify technically and economically feasible problems. |
| 101003/CS622T.1-PO9 | **MEDIUM** | Identify technically and economically feasible problems by working as a team. |
| 101003/CS622T.1-PO10 | **MEDIUM** | Communicate effectively with the engineering community by identifying technically and economically feasible problems. |
| 101003/CS622T.1-P011 | **MEDIUM** | Demonstrate knowledge and understanding of engineering and management principles by selecting the technically and economically feasible problems. |
| 101003/CS622T.1-PO12 | **HIGH** | Identify technically and economically feasible problems for long term learning. |
| 101003/CS622T.1-PSO1 | **MEDIUM** | Ability to identify, analyze and design solutions to identify technically and economically feasible problems. |
| 101003/CS622T.1-PSO2 | **MEDIUM** | By designing algorithms and applying standard practices in software project development and Identifying technically and economically feasible problems. |
| 101003/CS622T.1-PSO3 | **MEDIUM** | Fundamentals of computer science in competitive research can be applied to Identify technically and economically feasible problems. |
| 101003/CS622T.2-PO1 | **HIGH** | Identify and survey the relevant by applying the knowledge of mathematics, science, engineering fundamentals. |

| | | |
|---|---|---|
| 101003/CS622T.2-PO2 | **HIGH** | Identify, formulate, review research literature, and analyze complex engineering problems get familiarized with software development processes. |
| 101003/CS622T.2-PO3 | **HIGH** | Design solutions for complex engineering problems and design based on the relevant literature. |
| 101003/CS622T.2-PO4 | **HIGH** | Use research-based knowledge including design of experiments based on relevant literature. |
| 101003/CS622T.2-PO5 | **HIGH** | Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes by using modern tools. |
| 101003/CS622T.2-PO6 | **MEDIUM** | Create, select, and apply appropriate techniques, resources, by identifying and surveying the relevant literature. |
| 101003/CS622T.2-PO8 | **HIGH** | Apply ethical principles and commit to professional ethics based on the relevant literature. |
| 101003/CS622T.2-PO9 | **MEDIUM** | Identify and survey the relevant literature as a team. |
| 101003/CS622T.2-PO10 | **HIGH** | Identify and survey the relevant literature for a good communication to the engineering fraternity. |
| 101003/CS622T.2-PO11 | **MEDIUM** | Identify and survey the relevant literature to demonstrate knowledge and understanding of engineering and management principles. |
| 101003/CS622T.2-PO12 | **HIGH** | Identify and survey the relevant literature for independent and lifelong learning. |
| 101003/CS622T.2-PSO1 | **MEDIUM** | Design solutions for complex engineering problems by Identifying and survey the relevant literature. |
| 101003/CS622T.2-PSO2 | **MEDIUM** | Identify and survey the relevant literature for acquiring programming efficiency by designing algorithms and applying standard practices. |
| 101003/CS622T.2-PSO3 | **MEDIUM** | Identify and survey the relevant literature to apply the fundamentals of computer science in competitive research. |
| 101003/CS622T.3-PO1 | **HIGH** | Perform requirement analysis, identify design methodologies by using modern tools & advanced programming techniques and by applying the knowledge of mathematics, science, engineering fundamentals. |
| 101003/CS622T.3-PO2 | **HIGH** | Identify, formulate, review research literature for requirement analysis, identify design methodologies and develop adaptable & reusable solutions. |

| | | |
|---|---|---|
| 101003/CS622T.3-PO3 | **HIGH** | Design solutions for complex engineering problems and perform requirement analysis, identify design methodologies. |
| 101003/CS622T.3-PO4 | **HIGH** | Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| 101003/CS622T.3-PO5 | **HIGH** | Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools. |
| 101003/CS622T.3-PO6 | **MEDIUM** | Perform requirement analysis, identify design methodologies and assess societal, health, safety, legal, and cultural issues. |
| 101003/CS622T.3-PO7 | **MEDIUM** | Understand the impact of the professional engineering solutions in societal and environmental contexts and Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions. |
| 101003/CS622T.3-PO8 | **HIGH** | Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions by applying ethical principles and commit to professional ethics. |
| 101003/CS622T.3-PO9 | **MEDIUM** | Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings. |
| 101003/CS622T.3-PO10 | **MEDIUM** | Communicate effectively with the engineering community and with society at large to perform requirement analysis, identify design methodologies. |
| 101003/CS622T.3-PO11 | **MEDIUM** | Demonstrate knowledge and understanding of engineering requirement analysis by identifying design methodologies. |
| 101003/CS622T.3-PO12 | **HIGH** | Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by analysis, identify design methodologies and develop adaptable & reusable solutions. |
| 101003/CS622T.3-PSO3 | **MEDIUM** | The ability to apply the fundamentals of computer science in competitive research and prior to that perform requirement analysis, identify design methodologies. |
| 101003/CS622T.4-PO1 | **MEDIUM** | Prepare technical report and deliver presentation by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| 101003/CS622T.4-PO2 | **HIGH** | Identify, formulate, review research literature, and analyze complex engineering problems by preparing technical report and deliver presentation. |

| | | |
|---|---|---|
| 101003/CS622T.4-PO3 | **MEDIUM** | Prepare Design solutions for complex engineering problems and create technical report and deliver presentation. |
| 101003/CS622T.4-PO4 | **MEDIUM** | Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions and prepare technical report and deliver presentation. |
| 101003/CS622T.4-PO5 | **MEDIUM** | Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and Prepare technical report and deliver presentation. |
| 101003/CS622T.4-PO8 | **HIGH** | Prepare technical report and deliver presentation by applying ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| 101003/CS622T.4-PO9 | **HIGH** | Prepare technical report and deliver presentation effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings. |
| 101003/CS622T.4-PO10 | **HIGH** | Communicate effectively with the engineering community and with society at large by prepare technical report and deliver presentation. |
| 101003/CS622T.4-PO11 | **MEDIUM** | Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work by prepare technical report and deliver presentation. |
| 101003/CS622T.4-PO12 | **HIGH** | Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by prepare technical report and deliver presentation. |
| 101003/CS622T.4-PSO1 | **MEDIUM** | Prepare a technical report and deliver presentation to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas. |
| 101003/CS622T.4-PSO2 | **MEDIUM** | To acquire programming efficiency by designing algorithms and applying standard practices in software project development and to prepare technical report and deliver presentation. |
| 101003/CS622T.4-PSO3 | **MEDIUM** | To apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs by preparing technical report and deliver presentation. |
| 101003/CS622T.5-PO1 | **HIGH** | Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| 101003/CS622T.5-PO2 | **HIGH** | Identify, formulate, review research literature, and analyze complex engineering problems by applying engineering and management principles to achieve the goal of the project. |

| | | |
|---|---|---|
| 101003/CS622T.5-PO3 | **HIGH** | Apply engineering and management principles to achieve the goal of the project and to design solutions for complex engineering problems and design system components or processes that meet the specified needs. |
| 101003/CS622T.5-PO4 | **MEDIUM** | Apply engineering and management principles to achieve the goal of the project and use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| 101003/CS622T.5-PO5 | **MEDIUM** | Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and to apply engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PO6 | **MEDIUM** | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities by applying engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PO7 | **MEDIUM** | Understand the impact of the professional engineering solutions in societal and environmental contexts, and apply engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PO8 | **HIGH** | Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice and to use the engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PO9 | **MEDIUM** | Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings and to apply engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PO11 | **MEDIUM** | Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments and to apply engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PO12 | **HIGH** | Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change and to apply engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PSO1 | **MEDIUM** | The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas. Apply engineering and management principles to achieve the goal of the project. |

| | | |
|---|---|---|
| 101003/CS622T.5-PSO2 | **MEDIUM** | The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry and to apply engineering and management principles to achieve the goal of the project. |
| 101003/CS622T.5-PSO3 | **MEDIUM** | The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur and apply engineering and management principles to achieve the goal of the project. |