CHENNAI INSTITUTE OF TECHNOLOGY

Sarathy Nagar, Kundrathur, Chennai-600069

An Autonomous Institute Approved by AICTE and Affiliated to Anna University,

Chennai

ELECTRONICS AND COMMUNICATION ENGINEERING

ROVER FOR ASSISSTING RESCUE SERVICES

A Report on Core Course Project

Electronics and Communication Engineering

By

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Vision of the Institute:

To be an eminent centre for Academia, Industry and Research by imparting knowledge, relevant practices and inculcating human values to address global challenges through novelty and sustainability.

Mission of the Institute:

IM1.To creates next generation leaders by effective teaching learning methodologiesand instill scientific spark in them to meet the global challenges.

IM2.To transform lives through deployment of emerging technology, novelty and sustainability.

IM3.To inculcate human values and ethical principles to cater the societal needs.

IM4.To contributes towards the research ecosystem by providing a suitable, effectiveplatform for interaction between industry, academia and R & D establishments.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Vision of the Department:

To Excel in the emerging areas of Electronics and Communication Engineering by imparting knowledge, relevant practices and inculcating human values to transform the students as potential resources to cater the industrial and societal development through sustainable technology growth.

Mission of the Department:

DM1: To provide strong fundamentals and technical skills through effective teaching learning Methodologies. .

DM2: To transform lives of the students by fostering ethical values, creativity and innovation to become Entrepreneurs and establish Start-ups.

DM3: To habituate the students to focus on sustainable solutions to improve the quality of life and welfare of the society.

DM4: To provide an ambience for research through collaborations with industry and academia.

DM5: To inculcate learning of emerging technologies for pursuing higher studies leading to lifelong learning.

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CERTIFICATE

This is to certify that the "**Core Course Project**" Submitted by **VISHNUVEL R**, **NAVANEETHA KUMAR LS** is a work done by him and submitted during **2023-2024** academic year, in partial fulfilment of the requirements for the award of the degree of **BACHELOR OF ENGINEERING** in **DEPARTMENT OF ELECTRONICS AND COMMUNICATION**, at Design, Fabrication of Electronics field.

Core Course Project Coordinator   **Internal Examiner**

Head of the Department   **External Examiner**

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VISHNUVEL R
NAVANEETHA KUMAR LS

PREFACE

We student of Electronics and Communication Engineering require to do an Project to enhance my knowledge. The purpose of core course Project is to acquaint the students with practical application of theoretical concept taught to me during my course period.

It was a great opportunity to have close comparison of theoretical concept in practical field. This report may depict deficiencies on my part but still it is an account of my effort.

The output of my analysis is summarised in a shape of Industrial Project the content of report shows the details of sequence of these. This is my Core Course Project report which I have prepared for the sake of my Second year Project. Being an engineer, I should help the society for inventing something new by utilising my knowledge which can help them to solve their problem.

ABSTRACT

This project comprises two integral components: an aerial surveillance drone and a versatile rover designed to fulfil dual roles. The primary function of the rover is to approach individuals in distress, reassuring them of imminent aid while simultaneously acquiring vital health data, such as heart rate, through the implementation of photoplethysmography (PPG) techniques.

The drone, equipped with an x-ray camera, plays a pivotal role in the reconnaissance phase. It captures images using the x-ray camera, allowing a human detection algorithm to identify individuals who might be obscured by obstacles. This ensures that no victim is inadvertently overlooked during search and rescue operations.
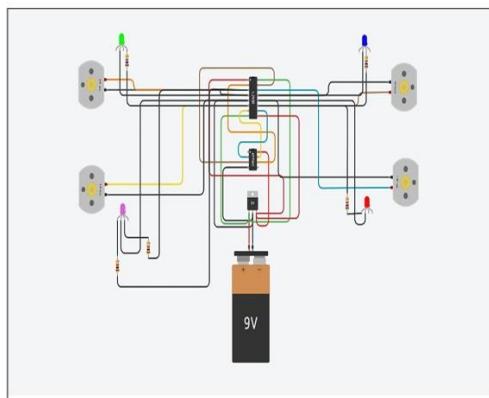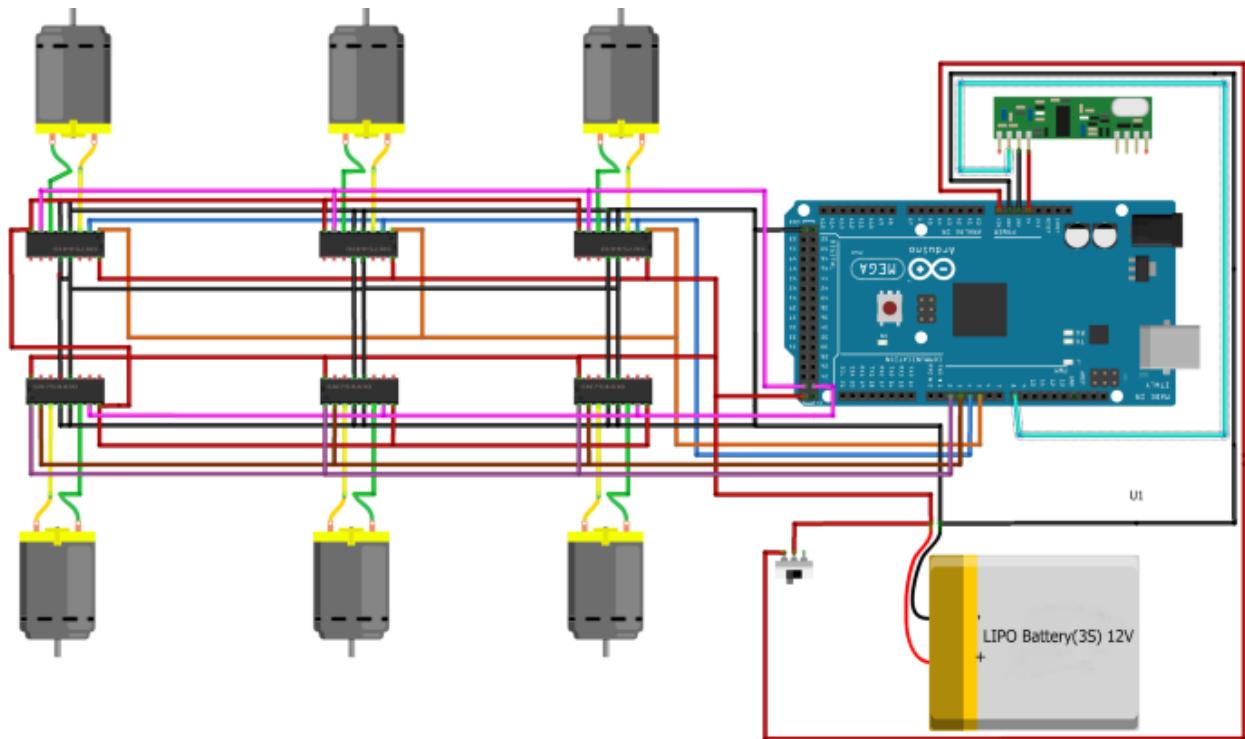
A magnetic switch facilitates the seamless attachment and detachment of the rover to the drone. This mechanism enables the drone and rover to operate jointly as needed, enhancing the efficiency and adaptability of the search and rescue mission.

Introduction

We present invention described here is one of a kind, hierarchically arranged device proposed for the DRM (Disaster Rescue Management) operation. Disaster Rescue operation are very complex and difficult. The loss of human life during this operation has been an area of concern for various organizations. In places with heavy rainfall and bad weather, DRM operation becomes an uphill task [1]-[3]. The proposed invention is a hybrid UAV with an in-built Rover capable of image capturing with live feeds to the remote central station and thermal image capturing capability. The system is built such that, in case of heavy debris and landslide where Rover operation can't be initiated at starting due to blockage of path for rover to move, the UAV is initiated and the Rover takes over when is clear path is visible. The device is equipped with GPS (Global Positioning System) with sends the location to the central system or remote command Centre whenever the image capturing system detects a heat signature through thermal imaging. In case of GPS failure, the system is developed with secondary back up which drops a sensors marker which the remote unit can track. The system proposed here is developed with an aim of reducing the loss of human life and increase effective DRM operation which reduces the time taken for search and rescue operation.

TINKER CAD STIMULATION

Drone Simulation

Magnetic Switch

Software Implementation for IoT

Android Service: Android has changed into a highly popular software operating system operating in voluminous of smartphones. Android scores in terms of user-friendly features and services. Many companies are using android software system for his or her smartphone device to produce high end features to their users. The Proposed system aims in designing a well-built system that monitors real time emission levels and temperature of all the Industries and required areas, store all the collected data in and analyze them in cloud using Internet of Things. This method uses various sensors like temperature and humidity sensor,MQ-135 sensor, to measure various parameters like temperature, humidity, gas, noise respectively.

WIFI module is utilized to store the data within the cloud which is flexible and simple to attach and it's connected through the hotspot. The information are often viewed in any browser including smart phones by logging in using the credentials.

For Air Quality Index to be calculated there's a requirement to record the concentration of minimum three pollutants out of which one amongst should be PM10 or PM2.5.Thus, for the proposed system include Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Particulate Matter (Size less than 10µm) or PM10 such that we are ready to calculate the AQI correctly and that we include temperature sensor to live the environmental parameters too. The project uses the concept of IoT for monitoring and controlling the system employing a IoT cloud server.

The Node MCU is configured to transfer the measured data of all sensors on a distant server. The net application provides global access to the measured data using any device that has internet connection capability. Data collected from the sensors are analyzed and passed the data within the sort of a string to update the net page within the remote server.

The system also uses an android app called Industrial Pollution Monitoring System which shows the sensors data graphically. The proposed system employs Arduino together with Sulphur Dioxide (SO2), NO2 and PM-10 Sensor along with the temperature and humidity sensor to attain the task of air quality monitoring.

List of Components

- **Arduino Board**
- **Transmitter and receiver**
- **Frame[rover]**
- **Brushless motors**
- **Lithium ion battery**
- **STM 32 camera**
- **Wheels**

MQ Sensor:
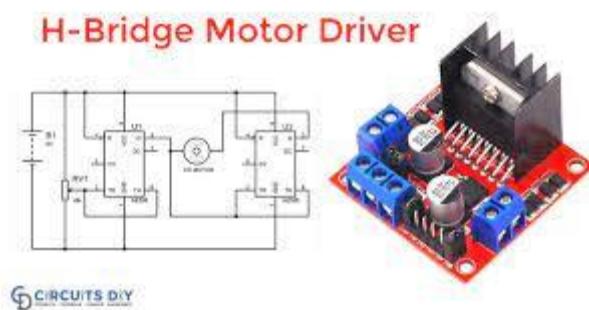
- Gas detection.

- Provide real-time measurements of gas concentrations.

- They are connected to Arduino for data processing.

- They are programmed to trigger notifications when gas concentration exceed predefined thresholds.

- The input supply cut.

- Small and affordable.

In current technology scenario, monitoring of gases produced is extremely important. From home appliances like air conditioners to electric chimneys and safety systems at industries monitoring of gases is extremely crucial. Thus gas sensors play a major role in industrial pollution monitoring. Figure is a basic gas sensor used in most of the gas detecting equipments.

MOTOR DRIVER L293D:

The L293D is a 16-pin Motor Driver IC which can control a set of two DC motors simultaneously in any direction. The L293D is designed to provide bidirectional drive currents of up to 600 mA (per channel) at voltages from 4.5 V to 36 V (at pin 8!). You can use it to control small dc motors.

We use motor drivers to give high power to the motor by using a small voltage signal from a microcontroller or a control system. If the microprocessor transmits a HIGH input to the motor driver, The driver will rotate the motor in one direction keeping the one pin as HIGH and one pin as LOW.
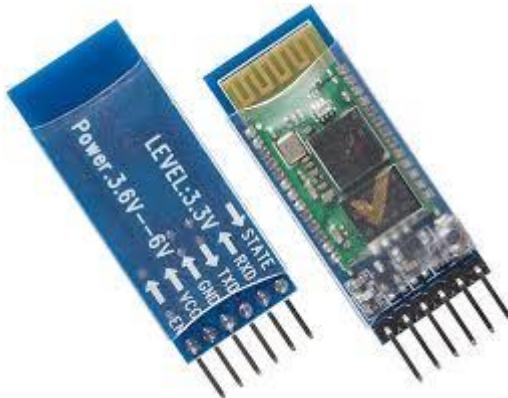
STM 32 CAM MODULE:

The basic working principle of STM32 microcontrollers involves the execution of instructions stored in their flash memory. These instructions are fetched and decoded by the microcontroller, and the corresponding operations are performed.

The camera module is a product used to take photos and videos from mobile devices, such as smartphones, automobile, and smart home appliances.

Bluetooth Module HC05:

Compact Wireless Solution: Bluetooth modules provide a compact and efficient wireless communication solution for electronic devices.

Integrated Components: These modules typically include a Bluetooth chipset, antenna, and optional microcontroller, all working together to enable seamless data exchange.

Secure Connections: They allow devices to establish secure connections, ensuring data privacy and integrity during transmission.

Versatile Applications: Bluetooth modules find use in various applications such as wireless audio streaming for headphones and speakers.

IoT Communication: They facilitate communication among IoT devices, enabling smart homes and industrial automation.
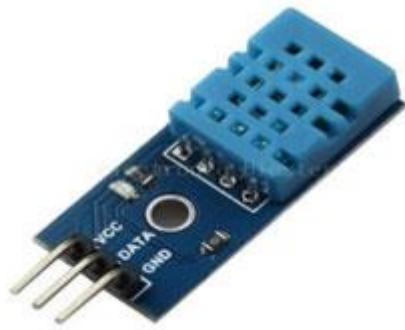
Remote Control: Bluetooth modules enable remote control functionalities, making them ideal for drones, robots, and other remote-operated devices.

Reliable Networks: Offering a reliable way to create short-range wireless networks, these modules enhance connectivity and convenience.

Easy Pairing: Users can easily pair their devices with Bluetooth modules, simplifying the setup process.

Efficient Data Transmission: With efficient data transmission protocols, Bluetooth modules ensure smooth and reliable data transfer.

Temperature and Humidity Sensor:

DHT11, a Humidity and Temperature Sensor generate calibrated digital output. DHT11 are often interfacing with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 may be a low-cost humidity and temperature sensor which provides high reliability and long-term stability. In Figure we infer that the sensor consist of 4 pins namely Vcc, Data pin, Nc, and GND respectively.

- ❖ DHT sensors are used to monitor the temperature and humidity in the industrial environment for workers safety precaution.

- ❖ The accurate measurements are simultaneously entered in the google sheet

APPLICATIONS

1. Search and Rescue Operations:

The drone can be deployed to search for individuals in remote or disaster-stricken areas. It uses its aerial surveillance capabilities, including the x-ray camera, to locate and identify people who might be trapped or in need of assistance. The rover, equipped with a PPG sensor, can approach victims to assess their health status, including heart rate, and reassure them until help arrives. This application enhances the efficiency and effectiveness of search and rescue missions, especially in challenging terrains.

2. Emergency Response Teams:

Emergency response teams can use this system to quickly assess the situation in disaster zones. The drone provides real-time images of the affected area, helping teams plan their response strategies. Meanwhile, the rover can be dispatched to approach injured individuals, gather health data, and provide immediate reassurance.

3. Medical Assistance in Remote Areas:

In remote areas with limited access to healthcare facilities, the rover can act as an initial medical responder. It can approach individuals, obtain their health status using the PPG sensor, and transmit the data to medical professionals for remote diagnosis. This application extends healthcare services to areas where traditional infrastructure is lacking or inaccessible.

4. Wildlife Conservation:

   The drone's x-ray camera can be used to detect and monitor wildlife populations. The rover, when deployed in wildlife reserves or conservation areas, can approach animals to gather vital health data without causing disturbance. Researchers can use this information to monitor the health and well-being of endangered species and implement conservation measures.

5. Security and Surveillance:

   Both the drone and rover can be employed for security purposes in public events or sensitive areas. The drone provides aerial surveillance to monitor crowds or detect suspicious activities from above. The rover, equipped with its human detection algorithm, can navigate through obstructions to verify the presence of individuals in restricted areas.

6. Environmental Monitoring:

The system can monitor environmental factors in remote or hazardous locations. The drone captures images for assessing environmental conditions, such as pollution levels or natural disasters. The rover can collect samples or data points on the ground, providing valuable insights for environmental research and monitoring.

7. Educational and Research Purposes:

Universities or research institutions can utilize the system for educational purposes in robotics, remote sensing, and health monitoring technologies. Students and researchers can explore applications of drone technology, PPG sensors, and x-ray imaging in various fields through hands-on projects.

Advantages

1. Enhanced Search and Rescue Operations:

The system allows for quick deployment and efficient search capabilities in remote or disaster-stricken areas. Aerial surveillance from the drone provides real-time images, aiding in the identification of individuals in need of assistance. The rover's ability to approach victims, assess their health status with the PPG sensor, and reassure them enhances the effectiveness of rescue missions.

2. Improved Health Assessment in Emergency Situations:

With the rover's PPG sensor, emergency responders can quickly gather crucial health data from individuals in distress. The ability to measure heart rate and health status remotely helps in triaging patients and providing timely medical assistance.

3. Flexible and Adaptable System:

The drone and rover can operate together as a unified system or separately as needed. The magnetic switch mechanism allows for easy attachment and detachment, providing flexibility in deployment strategies.

4. Efficient Human Detection and Surveillance:

The drone's x-ray camera and human detection algorithm ensure that no victim is overlooked, even if they are obscured by obstacles. This feature

enhances the system's surveillance capabilities for security applications or in crowded areas.

5. Increased Accessibility to Remote Areas:

The system can reach remote or inaccessible areas where traditional rescue operations might face challenges. It extends the reach of emergency response and healthcare services to regions with limited infrastructure.

6. Data Collection for Research and Analysis:

Both the drone and rover can collect valuable data, such as environmental conditions, health metrics, or wildlife populations. Researchers can use this data for environmental monitoring, wildlife conservation, or healthcare studies.

7. Convenience and Safety for Victims:

Victims in distress can receive reassurance and initial medical assessment from the rover without direct human contact. This reduces risks for both victims and responders, especially in hazardous or uncertain situations.

8. Educational and Training Opportunities:

The system provides a hands-on learning platform for students, researchers, and emergency response personnel. It allows for training simulations, experimentation with robotics and sensor technologies, and exploration of various applications.

9. Cost-Effective and Scalable Solution:

The modular design of the system allows for scalability and customization based on specific needs. It offers a cost-effective approach to integrating drone and rover technologies for diverse applications.

10. Integration with Existing Technologies:

The system can be integrated with existing emergency response infrastructure, healthcare systems, or security protocols. This integration enhances the overall effectiveness and interoperability of the system with established processes.

These advantages highlight the potential impact of the drone and rover system in improving emergency response, healthcare delivery, security surveillance, environmental monitoring, and educational initiatives. The system's versatility and capabilities make it a valuable tool for various scenarios where quick and effective data collection, assessment, and action are critical.

Limitation

1. Limited Battery Life:

Both the drone and rover rely on battery power, which may have limited endurance. Continuous operation in remote areas or during prolonged search and rescue missions could be restricted by battery life.

2. Weather Dependency:

Adverse weather conditions such as strong winds, heavy rain, or low visibility can affect the performance and safety of the drone. Harsh weather might limit the system's ability to conduct aerial surveillance or navigate challenging terrains.

3. Line-of-Sight Constraints:

The effectiveness of the drone's x-ray camera and human detection algorithm may be hindered by obstacles. Dense foliage, buildings, or other obstructions can limit the system's ability to identify individuals in hidden or obstructed locations.

4. Limited Payload Capacity:

The drone's payload capacity may restrict the types of equipment or sensors that can be carried.This limitation could impact the range of health assessment tools or additional surveillance equipment that the system can incorporate.

5. Interference and Signal Loss:

Wireless communication between the drone and rover may experience interference in crowded or signal-dense environments. Signal loss or disruptions

could affect data transmission, command execution, or the ability to maintain a stable connection.

6. Complexity of Human Detection Algorithm:

The effectiveness of the human detection algorithm relies on the accuracy of the software and image processing techniques. Complex environments or variations in lighting conditions might challenge the algorithm's ability to accurately identify individuals.

7. Maintenance and Repair Challenges:

Both the drone and rover require regular maintenance to ensure proper functionality and safety. Repairing or replacing components in remote or inaccessible locations could pose logistical challenges.

8. Regulatory and Legal Considerations:

Operating drones and rovers in certain areas may be subject to local regulations, airspace restrictions, or privacy laws. Compliance with these regulations and obtaining necessary permits could be time-consuming or restrictive.

9. Limited Range and Communication Distance:

The range of communication between the drone and rover may be limited by the strength of the wireless modules. This limitation could affect the system's coverage area or the distance over which health data can be transmitted.

Objectives

The objectives of the drone and rover system are multifaceted, aiming to revolutionize various aspects of emergency response, healthcare, security, and environmental monitoring. Firstly, the system seeks to enhance search and rescue operations by providing quick deployment, aerial surveillance capabilities, and accurate human detection algorithms. It aims to improve the efficiency of locating and assisting individuals in remote or disaster-affected areas. Secondly, a key objective is to develop a rover with a photoplethysmography (PPG) sensor for real-time health assessment, particularly focusing on measuring heart rate and obtaining vital health data. This objective aims to provide critical health information to emergency responders and healthcare professionals, aiding in triage and treatment decisions.

Another pivotal goal is the implementation of human detection algorithms using the drone's x-ray cameras, ensuring the accurate identification of individuals even in obscured or challenging terrains. The system aims to enhance security and surveillance capabilities, especially in public events or crowded areas, by enabling the identification and monitoring of individuals of interest. Additionally, the system seeks to facilitate versatile deployment strategies through a magnetic switch mechanism, allowing for seamless attachment and detachment of the rover to the drone as needed.

Furthermore, the objectives include expanding the system's environmental monitoring capabilities to assess pollution levels, wildlife populations, and natural disasters. This aspect aims to contribute valuable data for environmental

research, conservation efforts, and disaster response planning. Creating an educational and research platform is also a significant objective, providing opportunities for students, researchers, and emergency response personnel to explore drone and rover technologies.

Optimizing system efficiency and adaptability is another critical goal, focusing on power management, data transmission, and modular design for maximum versatility. Ultimately, the system aims to contribute to improved safety, connectivity, and innovation in the fields of robotics, healthcare, and emergency management. By achieving these objectives, the drone and rover system aspires to be a transformative tool in enhancing emergency response capabilities, healthcare delivery, security surveillance, environmental conservation, and educational initiatives.

Conclusion

In conclusion, the drone and rover system presents a promising solution for enhancing search and rescue operations, health assessment capabilities, and security surveillance. With its ability to combine aerial surveillance, human detection algorithms, and real-time health monitoring, the system aims to improve efficiency and effectiveness in emergency response scenarios. The versatile deployment options, seamless attachment mechanism, and potential for environmental monitoring also make it a valuable asset in diverse applications. As technology advances, this system stands poised to contribute significantly to safety, connectivity, and innovation in the fields of robotics, healthcare, and emergency management.

References

❖ www.wikipedia.com

❖ www.electronicshub.org

❖ www.google.com/image

❖ www.electronicshub.org/projects/cellphonedetector

PO & PSOAttainment

PO.No	Graduate Attribute	Attained	Justification
PO 1	**Engineering knowledge**	Yes	Engineering knowledge justifies its value through practical problem-solving abilities, technical expertise, and its significant impact on society's progress, innovation, and well-being.
PO 2	**Problem analysis**	Yes	Problem analysis is essential as it lays the foundation for effective decision-making, identifying root causes, and devising optimal solutions, leading to successful outcomes.
PO 3	**Design/Development of solutions**	Yes	Design and development of solutions are justified by their ability to address complex challenges effectively, improve efficiency, and enhance the overall quality of life through innovative and practical implementations.
PO 4	**Conduct investigations of complex problems**	Yes	Conducting investigations of complex problems is essential to uncover underlying causes, inform effective solutions, and ensure informed decision-making in various fields, driving progress and mitigating risks.

PO.No	Graduate Attribute	Attained	Justification
PO 5	**Modern Tool usage**	Yes	Modern tool usage is justified by its efficiency and effectiveness in streamlining processes, enhancing productivity, and staying competitive in an ever-evolving technological landscape.
PO 6	**The Engineer and society**	Yes	Engineers benefit society by designing and implementing innovative solutions that improve infrastructure, technology, and quality of life while considering environmental sustainability for a more resilient and eco-friendly future.
PO 7	**Environment and Sustainability**	Yes	Engineers benefit society by designing and implementing innovative solutions that improve infrastructure, technology, and quality of life while considering environmental sustainability for a more resilient and eco-friendly future.
PO 8	**Ethics**	Yes	Ethics justifies moral principles that guide human behavior, fostering trust, integrity, and fairness while ensuring responsible

PO.No	Graduate Attribute	Attained	Justification
			decision-making and mutual respect in all aspects of life.
PO 9	**Individual and team work**	Yes	Individual work justifies personal accountability and expertise, while teamwork fosters collaboration and synergy, leading to diverse perspectives and more effective problem-solving.
PO 10	**Communication**	Yes	Communication justifies its importance by facilitating effective exchange of ideas, information, and emotions, fostering understanding, collaboration, and building strong interpersonal connections.
PO 11	**Project management and finance**	Yes	Project management ensures efficient execution of tasks, optimal resource allocation, and timely completion of projects, leading to successful outcomes. Finance plays a crucial role in allocating funds, managing budgets, and making informed decisions, ensuring financial stability and sustainable growth.
PO 12	**Life-long learning**	Yes	Life-long learning justifies itself by ensuring continuous personal and professional growth, keeping individuals adaptable and relevant in a rapidly changing world, while fostering a deeper understanding and appreciation of the

PO.No	Graduate Attribute	Attained	Justification
		29	complexities of life.

PSO.No	Graduate Attribute	Attained	Justification
PSO 1	To analyse, design and develop quality solutions in Communication Engineering by adapting the emerging technologies.	**Yes**	Adapting emerging technologies in Communication Engineering enables the creation of innovative, high-quality solutions that stay ahead of industry trends and meet evolving user needs. This approach fosters efficient, effective, and cutting-edge communication systems.
PSO 2	To innovate ideas and solutions for real time problems in industrial and domestic Automation using Embedded & IOT tools.	**Yes**	By leveraging Embedded & IoT tools, innovation in industrial and domestic Automation becomes attainable, facilitating real-time problem-solving and empowering efficient, connected, and automated systems for enhanced productivity and convenience.