

SUMMER INTERNSHIP REPORT
on
“AUTONOMOUS GROUND ELECTRIC VEHICLE”

(Duration: 4 Weeks) | Mode: On-site (Hyderabad)

Submitted by

K.Nithin Kumar Goud

Roll Number: 160722735076

Batch: 2025 – 2026

Under the Mentorship of

Dr K Jaya Sankar

Professor, Dept. of ECE



Department of Electronics And Communication Engineering

Methodist College of Engineering and Technology,

King Koti, Abids, Hyderabad-500001.

2025-2026

**Methodist College of Engineering and Technology, King
Koti, Abids, Hyderabad-500001,**

Department of Electronics And Communication Engineering



DECLARATION BY THE CANDIDATE

I'm **K.Nithin Kumar Goud**, Roll No**160722735076**., student of Methodist College of Engineering and Technology, pursuing Bachelor of Engineering in Electronics and communication engineering, hereby declare that the Summer Internship Report entitled “**AUTONOMOUS GROUND ELECTRIC VEHICLE**”, carried out in 2025-26 under the mentorship of **Dr K Jaya Sankar , Professor, Department of ECE** is the result of my own work. This report is submitted in partial fulfilment of the requirements for the award of the Bachelor of Engineering degree in Electronics and Communication Engineering. I further declare that the work presented in this report has not been copied or reproduced from any other source and is a genuine record of my effort.

Name: K.Nithin Kumar Goud

Roll No.: 160722735076

**Methodist College of Engineering and Technology, King Koti,
Abids, Hyderabad-500001.**

**Department of ELECTRONICS AND COMMUNICATION
ENGINEERING**



CERTIFICATE

This is to certify that the Summer Internship Report entitled “AUTONOMOUS GROUND ELECTRIC VEHICLE” has been carried out by **K.Nithin Kumar Goud**, Roll No**160722735076**, a student of Bachelor of Engineering in Electronics and communication engineering, in the **Department of Electronics And Communication Engineering** at **Methodist College of Engineering and Technology**, Hyderabad. The work embodied in this report is a bonafide record of the student’s effort, carried out in 2025-26 under my supervision and mentorship, during the internship period from 5th may 2025 to 31st may 2025 at PRAGYATMIKA. This report has not been submitted to any other university or institution for the award of any degree or diploma.

Academic Mentor

Dr K Jaya Sankar

Professor, Department of ECE

Head of the Department

DR. VSSN SRINIVASA BABA

PROFESSOR AND HEAD DEPT OF ECE

Place: Hyderabad

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my internship guide, Amit K Choudhary, Head Training Research, PRAGYATMIKA, The Power of Intelligence, for giving me the opportunity to work on this project. This internship would not have been possible without his valuable guidance, innovative ideas, constant encouragement, and continuous support throughout the internship period.

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My sincere thanks to Dr.VSSN Srinivasa Baba, Professor and Head, Department of Electronics and communication engineering, for her valuable advice, motivation, and continuous encouragement, which played a major role in the successful completion of this internship work.

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Finally, I would like to express my deepest appreciation to my parents for their unconditional love, moral support, and encouragement throughout my academic journey. Their faith in me and constant motivation have been the driving force behind my efforts.



VISION

To strive to become center of excellence in Education, Research with moral, ethical values and serve society.

MISSION

M1: To provide Electronics & Communication Engineering knowledge for successful career either in industry or research

M2: To develop Industry-Interaction for innovation, product-oriented research and development.

M3: To facilitate value added education combined with hands-on trainings.

Program Educational Objectives:

After 3-5 years of graduating, the graduates will be able to:

PEO-1: Apply the knowledge of Basic sciences and Engineering in designing and implementing the solutions in emerging areas of Electronics and Communication Engineering.

PEO-2: Pursue the research or higher education and practise profession. **PEO-3:** Adapt to the technological advancements for providing the sustainable engineering solutions to meet organisation/society needs.

PEO-4: Work as an individual or in a team with professional ethics and values.

Program Specific Outcomes:

At the end of 4 years, ECE graduates at MCET will be able to:

PSO1: Professional Competence: Apply the knowledge of Electronics & Communication Engineering principles in VLSI, Signal processing, Communication, Embedded system & Control Engineering.

PSO2: Technical Skills: Design and implement products using the cutting- edge software and hardware tools.

PSO3: Social consciousness: Demonstrate the leadership qualities and strive for the betterment of organization, environment and society.

PROGRAM OUTCOMES

PO1: Engineering knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals, and an engineering specialization to develop the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society, and environment as required.

PO4: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis and interpretation of data to provide valid conclusions.

PO5: Engineering tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international laws.

PO8: Individual and collaborative teamwork: Function effectively as an individual, and as a member or leader in diverse teams/multi-disciplinary teams.

PO 9: Communication: Communicate effectively and inclusively within engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, considering cultural, language, and learning differences.

PO10: Project management and finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-long learning: Recognize the need for and have the preparation and ability for i). independent and life-long learning ii). Adaptability to new and emerging technologies and iii). Critical thinking in the broadest context of technological change.

ABSTRACT

The internship on **Autonomous Ground Electric Vehicles (AGEV)** was undertaken to gain practical exposure in embedded systems, robotics, and IoT-based smart mobility solutions. The objective was to understand the design and implementation of autonomous navigation systems while integrating multiple sensors and communication protocols into a functional prototype.

The program was conducted at *Pragyatmika – Centre of Excellence* in offline mode over a period of four weeks, from **5th May to 31st May 2025**. During this time, the primary focus was on building and testing a four-wheel drive robotic vehicle equipped with ESP32 microcontroller, ultrasonic and LiDAR sensors, GPS, and cloud connectivity.

Key activities included assembling the robotic chassis, interfacing sensors for obstacle detection, implementing Bluetooth and Wi-Fi communication, configuring MQTT dashboards for cloud control, and integrating GPS for real-time navigation. The final phase involved sensor fusion, navigation logic, and system optimization, leading to a fully autonomous and cloud-integrated vehicle.

Through this internship, significant learning outcomes were achieved, including proficiency in ESP32 programming, sensor interfacing, wireless communication protocols, and IoT cloud integration. Additionally, skills in debugging, system testing, and project documentation were strengthened.

Overall, the internship resulted in the successful development of a **functional AGEV prototype** capable of autonomous navigation and remote monitoring. The experience enhanced technical expertise, problem-solving ability, and practical understanding of smart vehicle technologies, contributing to future applications in intelligent transportation and civic innovation.

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INTERNSHIP REPORT

Autonomous Ground Electric Vehicle (AGEV)

Pragyatmika – Centre of Excellence

(5th May 2025 – 31st May 2025)

1. INTRODUCTION

Internships play a transformative role in shaping the professional capabilities of engineering students. They act as a bridge between theoretical academic concepts and real-world industrial applications. In the modern landscape of Electronics and Communication Engineering, technologies such as IoT, robotics, embedded systems, and automation are crucial for innovation.

This internship aimed to provide dedicated hands-on experience in the field of Autonomous Ground Electric Vehicles (AGEVs)—a rapidly emerging domain in smart transportation and robotics. My primary objective was to gain practical exposure in embedded system design, autonomous navigation, and wireless communication using powerful microcontroller platforms such as ESP32. Over the course of 4 weeks, I gained deep insights into microcontroller architecture, sensor calibration, motor control, cloud connectivity, and navigation logic.

2. ORGANIZATION PROFILE

Organization: Pragyatmika – Centre of Excellence

Location: Hyderabad

Website: www.pragyatmika.co.in Pragyatmika is a leading Centre of Excellence focusing on Robotics, Industrial IoT, Electric Vehicles, Embedded Systems, Automation, and Artificial Intelligence. The organization provides industry-aligned training, research programs, and hands-on project-based learning to engineering students.

3. INTERNSHIP DETAILS

Duration: 5th May 2025 – 31st May 2025 (4 Weeks)

Mode: Offline

Department: Autonomous Vehicles / Industrial IoT

Training Platform: Pragyatmika ESP32-based 4WD Robotic Kit

Domain: IoT, Robotics, Autonomous Vehicles

Project Title: Autonomous Ground Electric Vehicle (AGEV)

During this internship, I was assigned to the Autonomous Vehicles Division where I worked on robotic systems, microcontrollers, sensors, and IoT connectivity. The training provided a structured pathway starting with fundamentals of robotics and gradually advancing to autonomous navigation logic and cloud integration.

4. DESCRIPTION OF WORK DONE

1. Project Title

Human Fall Detection, Alert, and Rescue System – ESP32 & MPU6050 Based Safety Monitoring System

2. Project Objectives

- To understand the architecture of an IoT-based human safety monitoring system.
- To design and develop a fall-detection module using MPU6050 accelerometer + gyroscope.
- To classify human activity (standing, walking, falling) using acceleration-based thresholds.
- To send automatic alerts through Wi-Fi, MQTT, SMS/Call API (optional) after a fall event.
- To implement GPS-based location tracking for emergency rescue.
- To integrate all modules into one complete fall detection + alert + rescue system.

3. Tools and Technologies Used

Microcontroller: ESP32 Development Board (Wi-Fi + Bluetooth, 240 MHz Dual Core)

Sensors:

- MPU6050 (Accelerometer + Gyroscope)
- Optional: Heart-rate sensor (MAX30102)
- Optional: Shock/Impact sensor
- Communication Protocols:
- I²C, UART, GPIO, Wi-Fi, MQTT

Software Tools:

- Arduino IDE
- Serial Monitor
- Adafruit IO / Blynk / Firebase (for Cloud Alerts)

Cloud Platform:

- Adafruit IO MQTT Dashboard (Fall status, emergency alert, GPS map)

4.4 System Design and Development Block

Diagram Components

- ESP32 Microcontroller – Core processing & algorithm execution
- MPU6050 Sensor Module – Measures acceleration & angular velocity
- GPS Module (NEO-6M) – Provides latitude/longitude during emergencies
- Alert System – Wi-Fi/MQTT, Buzzer, LED
- Cloud Dashboard – Real-time alerting and monitoring
- Battery Module – Rechargeable 3.7V/5V Li-Ion

Working Flow

1. Sensors continuously capture acceleration & gyro values.
2. ESP32 processes the data in real time.
3. Fall detection algorithm checks for sudden drop + impact + inactivity.
4. If fall is confirmed → alert triggers automatically.
5. MQTT/Wi-Fi sends message to cloud dashboard / mobile.
6. GPS coordinates are uploaded for rescue teams or family members.
7. Manual cancellation option available to avoid false alerts.

4.5 Implementation Modules

Module 1 – Sensor Calibration & MPU6050 Setup

- Calibrated MPU6050 offsets for accurate readings.
- Interfaced with ESP32 via I²C.
- Captured raw values (Accel X/Y/Z & Gyro X/Y/Z).

Module 2 – Fall Detection Algorithm

- Implemented threshold-based detection:
- Peak acceleration > impact threshold
- Sudden orientation change
- Inactivity after fall
- Tested with multiple fall scenarios (forward, backward, sideways).

Module 3 – Emergency Alert System

- ESP32 connected to Wi-Fi.
- Configured MQTT dashboard for alerts.
- When fall occurs:
- “FALL DETECTED” alert message is pushed to cloud.
- Buzzer/LED starts blinking.
- Optional SMS/Call integration using API.

Module 4 – GPS Tracking

- Interfaced NEO-6M with ESP32 via UART.
- Extracted NMEA sentences → latitude, longitude, speed.
- Sent GPS data to cloud dashboard for rescue assistance.

Module 5 – Cloud Dashboard Development

- Created buttons for:
- System ON/OFF
- Emergency Acknowledgement
- Location display
- Display widgets for: Fall Status, Live GPS, Sensor Data.

Module 6 – Wearable Integration

- Packed the ESP32 + MPU6050 + battery in a compact wearable case.
- Ensured mobility and continuous monitoring.

4.6 Mini-Projects Completed

Project 1 – Basic Motion Detection

- Used MPU6050 to detect simple motions.
- Output: Standing, walking, running classification.

Project 2 – Impact Detection Prototype

- Detected shock and sudden acceleration spikes.
- Output: Triggered buzzer for strong impacts.

Project 3 – Fall Detection with Cloud Alert

- Combined MPU6050 + ESP32 + MQTT for full system.
- Output: Push notification sent to dashboard with GPS location.

4.7 Final Integrated System

- ESP32 acts as the brain controlling all modules.
- MPU6050 continuously monitors human activity.
- GPS sends real-time location after a fall.
- Cloud platform enables remote monitoring & rescue.
- Buzzer & LED act as immediate local alarms.

5. SKILLS AND KNOWLEDGE GAINED

Technical Skills

- ESP32 programming (Arduino IDE)
- Sensor interfacing: MPU6050, GPS
- Wi-Fi, MQTT, and IoT cloud communication
- Implementation of fall detection algorithms
- Data extraction, calibration, filtering
- Hardware debugging & circuit optimization
- Wearable embedded system design

Soft Skills

- Problem-solving and analytical thinking
- Documentation and technical reporting
- Time management for module completion
- Collaboration and discussion

6. CHALLENGES FACED AND SOLUTIONS

Sensor Noise & False Positives

- Applied complementary filtering + moving average smoothing.

Wi-Fi Connectivity Drops

- Implemented automatic reconnection routine in loop().

MPU6050 Drift Issues

Used offset calibration & periodic re-centering.

GPS Slow Lock Time

- Activated warm-start caching for faster satellite fix.

False Alerts During Running/Jumping

- Added multi-condition checking (impact + orientation + inactivity).

7. OUTCOMES AND CONTRIBUTIONS

- Developed a fully functional human fall detection system.
- Implemented real-time alerts using MQTT + Wi-Fi.
- Added GPS-based rescue assistance.
- Achieved high detection accuracy through threshold tuning.
- Created wearable prototype for elderly/medical use.
- Gained hands-on experience in IoT-based safety systems.

8. FUTURE SCOPE

- Add camera module for vision-based fall verification.
- Integrate ML algorithms for more accurate fall classification.
- Include GSM/SIM support for SMS and call alerts.
- Implement continuous health monitoring using additional sensors.
- Develop a mobile app for real-time monitoring and rescue coordination.

9. CONCLUSION

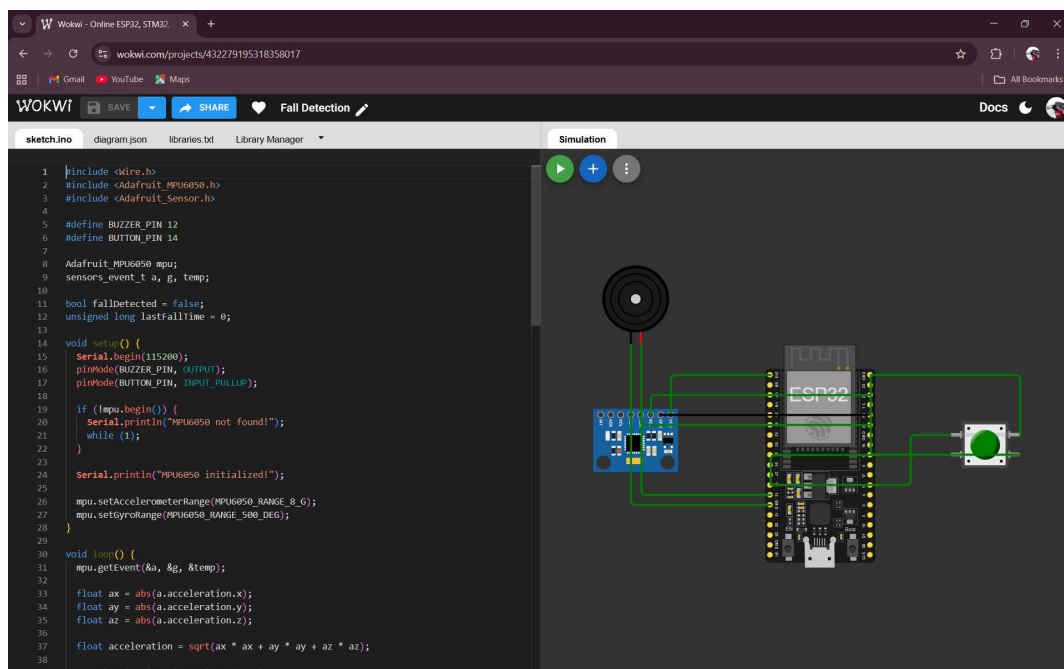
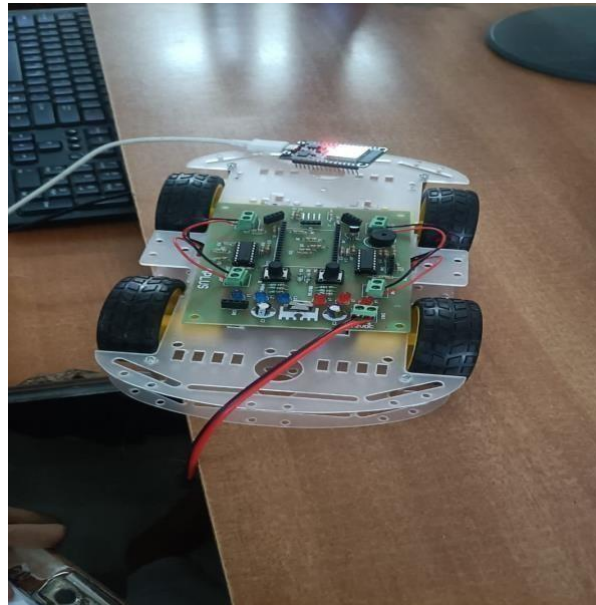
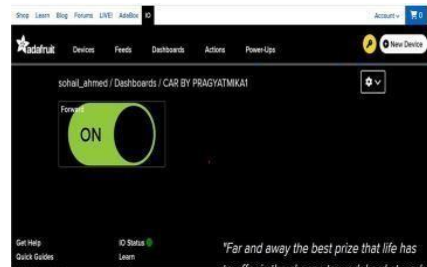
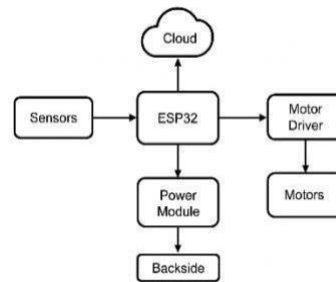
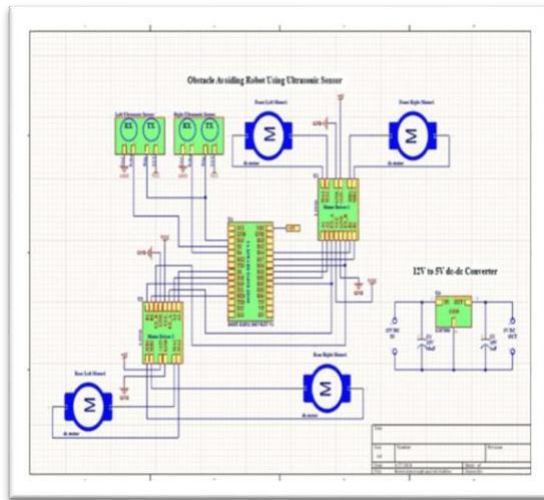
This project provided valuable practical experience in IoT-based human safety monitoring and embedded system design. Working with the ESP32, MPU6050, wireless communication, and cloud platforms strengthened my understanding of real-time data processing and emergency alert systems.

The designed system successfully detects falls, sends alerts, and provides accurate location tracking, making it suitable for elderly care, medical monitoring, and workplace safety applications. Overall, the project helped build strong technical foundations in embedded systems, IoT, signal analysis, and practical problem-solving.

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11. ANNEXURES



July 26th, 2025

HR/EXP/25-07/009/702037

To Whom So Ever It May Concern

This is to certify that **K NITHIN KUMAR GOUD** has completed SUMMER INTERNSHIP with PRAGYATMIKA, The Power of Intelligence at PRAGYATMIKA CoE -IIoT, MCET Campus, Abids, Hyderabad from 5th May 2025 to 31st May 2025.

The Internship domain was AUTONOMOUS GROUND ELECTRIC VEHICLES – CONTROL SYSTEMS.

The intern has participated in the project Human fall detection, alert and rescue systems for humans.

We wish a success in all future endeavors.

With All the best wishes,



Amit K Choudhary

Head, Training & Research

PRAGYATMIKA, The Power of Intelligence

Email: amit@pragyatmika.co.in

Services Offered:

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Electronic Kits and Spares | PCB | Embedded Systems and AI | Computer Vision | Heuristic and Machine Learning |
Sensors | Cloud Development

12. Week Work Log

Week	Topics Covered	Practical Work	Outcome
Week 1 (5th May – 11th May 2025)	<ul style="list-style-type: none">- Introduction to Autonomous Ground Electric Vehicles- Overview of ESP32 architecture- GPIO, PWM, UART, ADC, I2C basics- Hands-on training with ESP32 board- 4WD robotic chassis introduction	<ul style="list-style-type: none">- Assembled 4WD robot chassis- Mounted motors, wheels, wiring- Tested basic motor movement using L293D- Initial ultrasonic sensor wiring	<ul style="list-style-type: none">- Robot assembled successfully- Basic movement achieved- Understood ESP32 pin configuration
Week 2 (12th May – 18th May 2025)	<ul style="list-style-type: none">- Ultrasonic HC-SR04 sensor working- VL53L0X Time-of-Flight LiDAR basics- ADC usage in ESP32- Serial debugging	<ul style="list-style-type: none">- Ultrasonic sensor interfacing- LiDAR sensor testing- ADC battery monitoring- Built Obstacle Avoidance Robot	<ul style="list-style-type: none">- Accurate obstacle detection implemented- Completed autonomous prototype stage
Week 3 (19th May – 25th May 2025)	<ul style="list-style-type: none">- Bluetooth basics- Wi-Fi and MQTT protocols- Cloud IoT using Adafruit IO- GPS (NEO-6M) introduction	<ul style="list-style-type: none">- Gesture controlled robot via Bluetooth- Wi-Fi connectivity setup- MQTT dashboard control- GPS data extraction (lat, long, speed)	<ul style="list-style-type: none">- Robot controlled via cloud- Bluetooth + Wi-Fi + GPS integrated
Week 4 (26th May – 31st May 2025)	<ul style="list-style-type: none">- Sensor fusion (Ultrasonic + LiDAR)- Autonomous navigation logic- Motor safety & PWM optimization- Final project integration	<ul style="list-style-type: none">- Combined all modules- GPS + Cloud + LiDAR + Ultrasonic system- Outdoor and indoor testing- Final demonstration preparation	<ul style="list-style-type: none">- Fully functional AGEV model developed- Completed autonomous + cloud integrated vehicle