SECURE IOT ASSISTANT BASED SYSTEM FOR ALZHEIMER'S DIAGNOSIS

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ABSTRACT

This paper presents the development of a patient tracking and monitoring system using GPS, the ESP32 microcontroller, and GSM technology to ensure the safety of patients, particularly those with medical conditions or cognitive impairments. The system tracks the patient's real-time location and notifies caregivers if the patient moves outside a designated area using geofencing. Additionally, the system sends periodic reminders to the patient for task completion, such as medication intake or physical exercises. The paper details the system components, functionality, and power management strategies, with the goal of providing a reliable and efficient solution for patient monitoring.

Keywords: Patient tracking, Monitoring system, GPS, ESP32 microcontroller, GSM technology, Healthcare monitoring, IoT-based healthcare, Wearable technology.

I INTRODUCTION

Alzheimer's disease (AD) is one of the most common causes of dementia, affecting millions of people globally. As the disease progresses, patients may experience disorientation, memory loss, and wandering behavior, putting them at significant risk. The caregiving process can be overwhelming, as family members and healthcare providers are often unable to monitor patients continuously. To address these challenges, this paper proposes a Secure IoT Assistant-Based System for Alzheimer's Diagnosis and Monitoring, which utilizes GPS tracking, GSM communication, and microcontroller- based devices for real-time location tracking and caregiver notifications. This IoT-based solution aims to ensure patient safety, improve caregiving efficiency, and provide timely intervention. The growing concern for patient safety, especially among elderly individuals or those with chronic conditions, has led to the development of several tracking and monitoring systems. These systems typically leverage GPS and GSM technology to ensure that patients remain within a safe area and receive reminders for critical tasks, such as medication and health checks. This paper introduces an integrated solution that utilizes the ESP32 WROOM 32 microcontroller, the Neo M8N GPS module, and GSM communication modules (SIM 800L/SIM 900A) to track the patient's location, send real-time alerts to caregivers, and provide task reminders to the patient at regular intervals.

II LITERATURE SURVEY

[1] "GPS Tracking for Alzheimer's Patients" by J. M. García et al. (2013).

This project presents a GPS tracking system for Alzheimer's patients. It uses a wearable device to track patient location in real-time. The system provides alerts for wandering or emergency situations. Caregivers can receive notifications and track patient location remotely. The system aims to improve patient safety and reduce caregiver stress. It has the potential to enhance the quality of life for Alzheimer's patients.

[2]" Wearable sensors for health monitoring" by De Rossi et al. (2014).

This paper explores wearable sensors for health monitoring. It discusses tracking physiological signals like heart rate and temperature. Wearable sensors can monitor chronic diseases and track physical activity. They can also detect falls and provide real-time health feedback. The paper

highlights challenges like accuracy and power consumption. It showcases wearable sensors' potential to revolutionize healthcare.

[3]" Alzheimer's disease management using wearable devices" by Iyengar, S. S., et al. (2015).
This paper explores wearable devices for managing Alzheimer's disease. It discusses using wearables to track patient location and vital signs. Wearable devices can
monitor patient activity and detect falls. They can also provide reminders and alerts for medication and appointments. The paper highlights the potential of wearables to improve patient care. It showcases wearable devices as a promising tool for
Alzheimer's management.

[4]" IoT-Based Healthcare Monitoring System for Elderly" by S. S. Iyengar et al. (2018).
The system used IoT devices to collect and transmit data to a cloud-based platform. Authors developed algorithms to analyze data and detect anomalies. They designed a wearable sensor network to track vital signs and activity levels. The system
provided real-time alerts and notifications to caregivers and healthcare professionals. The proposed system uses wearable sensors and IoT devices to track vital signs,
activity levels, and environmental factors.

[5]" Wearable IoT Devices for Real-Time Alzheimer’s Patient Monitoring and Early Detection" Zhang, Y., Chen, M., & Yang, L. (2019).
These devices track physiological and behavioral data, such as movement patterns, heart rate, and cognitive responses. The collected data is analyzed using machine learning algorithms to detect early signs of cognitive decline. Continuous monitoring helps caregivers and medical professionals intervene promptly, improving patient care. The system enhances safety by detecting anomalies like falls or wandering.
This innovative approach aims to support early diagnosis, personalized treatment, and better quality of life for Alzheimer’s patients.

[6]" Secure Cloud-IoT System for Alzheimer’s Disease Prediction and Monitoring Using Machine Learning" by Patel, S., Joshi, D., & Mehta, V. (2020).
The system uses machine learning algorithms to analyze patient data and predict disease progression. It integrates wearable IoT devices, cloud computing, and machine learning for real-time monitoring. The system ensures secure data transmission and storage using encryption and access controls. It enables early detection and intervention, improving patient care and quality of life.

[7]" AI-Driven IoT Solutions for Alzheimer’s Care: A Review of Wearable Devices and Remote Monitoring Techniques" by Goyal, P., Singh, R., & Kaur, A. (2021).
The review focuses on wearable devices and remote monitoring techniques. It explores the use of wearable sensors, GPS, and other technologies for patient tracking and monitoring. AI-powered algorithms are discussed for analyzing patient data and detecting anomalies. The review highlights the potential of AI-driven IoT solutions for improving Alzheimer's care and patient outcomes. It identifies
challenges and future directions for research in this area.

[8]" Edge Computing for Alzheimer’s Disease Detection and Management in IoT- Based Systems" by Alam, M., Hussain, S., & Raza, S. (2022).
The framework uses wearable IoT devices to collect patient data. Edge computing Is employed for real-time data analysis and processing. Machine Learning algorithms are used for disease detection and prediction. The framework enables
timely interventions and improves patient outcomes. It reduces latency and improves data security by processing data at the edge.

[9]" Blockchain-Enabled Secure IoT Framework for Protecting Alzheimer's Patient Data" by Kumar, R., & Gupta, P. (2023).
The framework uses blockchain technology to ensure secure data storage and transmission. IoT devices collect patient data, which is then encrypted and stored on a blockchain network. Smart contracts are used to regulate data access and ensure patient consent. The framework protects patient data from unauthorized access and tampering.
[10]" Smart Home Automation and IoT in Alzheimer's Patient Assistance: A Future Perspective " Lee, C., & Park, J. (2024).
The paper discusses how IoT sensors and devices can be integrated into smart homes. It highlights the benefits of IoT-based systems for patient monitoring, safety, and care. The authors propose a future perspective on the development of personalized IoT-based assistance systems. These systems aim to improve patient quality of life and reduce caregiver burden. The paper emphasizes the need for further research and development in this area.

III EXISTING SYSTEM

The existing system for this project is a wearable assistance band designed for patients with Alzheimer's disease, utilizing a combination of GPS, Wi-Fi, and GSM technologies to track and monitor their location and activities. The system consists of a wearable band equipped with a GPS module (Neo M8N) that provides location data, a GSM module (SIM 800L) that sends notifications to the caretaker via SMS, and a microcontroller (ESP32 WROOM 32 WiFi BLE) that processes data and sends notifications. When the patient is out of a bounded area, the system sends an SMS notification to the caretaker, ensuring timely intervention and assistance. Additionally, the system sends reminders to the patient to perform certain tasks at regular intervals, promoting independence and self-care. The wearable band also features an emergency button that can be pressed by the patient to send an SOS notification to the caretaker in case of an emergency. Overall, the existing system provides a comprehensive solution for tracking and monitoring patients with Alzheimer's disease, enhancing their safety, independence, and quality of life. However, the system can be further improved and expanded to include additional features and functionalities, such as integration with wearable devices, mobile apps, and cloud-based services, to provide more advanced and personalized care for patients with Alzheimer's disease.

IV DISADVANTAGES

1. **Security Risks:** The system stores sensitive information, such as Wi-Fi passwords and GSM numbers, in plain text, making it vulnerable to hacking and unauthorized access.
2. **Limited Battery Life:** The device's battery life may be limited due to the power- consuming GPS, GSM, and Wi-Fi modules, requiring frequent recharging or battery replacement.
3. **Dependence on Internet Connectivity:** The system's functionality relies heavily on internet connectivity, which may be unreliable or unavailable in certain areas, rendering the device ineffective.
4. **Complexity and Cost:** The system's hardware and software components may be complex and expensive to develop, maintain, and repair, making it inaccessible to some users.
5. **Dependence on GSM Network:** The system relies on the GSM network to send notifications, which can be unreliable in areas with poor network coverage.
6. **Difficulty in Tracking Indoor Movement:** The system may struggle to accurately track the patient's movement indoors, where GPS signals are weak.

Limited Integration with Other Health Monitoring Systems: The system may not integrate seamlessly with other health monitoring systems, limiting its ability to provide a comprehensive view of the patient's health.

V PROPOSED METHODOLOGY

This project involves a comprehensive and structured approach to develop and deploy an intelligent wearable assistance band for patients with Alzheimer's disease. The methodology begins with a thorough literature review of existing research on Alzheimer's disease, wearable technology, and GPS tracking systems to identify the current state of the art and potential areas for improvement. Following this, the system design phase involves designing the architecture of the proposed system, including the wearable band, GPS module, GSM module, and microcontroller. The hardware development phase involves developing the hardware components of the system, including the wearable band and the GPS and GSM modules. In parallel, the software development phase involves developing the software components of the system, including the firmware for the microcontroller and the web-based interface for caretakers. Once the hardware and software components are developed, the system integration phase involves integrating these components to ensure seamless communication and functionality. The system is then thoroughly tested and evaluated to ensure its accuracy, reliability, and usability. A pilot study is conducted to test the system in a real-world setting and gather feedback from patients and caretakers. Based on the results of the pilot study and feedback from patients and caretakers, the system is refined and iterated to improve its effectiveness and efficiency. Finally, the system is deployed in a larger-scale setting, such as a healthcare facility or a community-based program, and continuously evaluated and improved to ensure its ongoing effectiveness and efficiency in supporting patients with Alzheimer's disease.

VI BLOCK DIAGRAM

The system consists of an ESP32 microcontroller, GPS module, GSM module, and Wi-Fi module. It initializes these modules, connects to the internet via Wi-Fi, and retrieves location data from the GPS module. The system enables voice calls and SMS functionality using the GSM module and hosts a webpage for remote monitoring. When the emergency button is pressed, it sends an SMS alert and initiates a voice call to the caretaker's number. The system is a wearable device that tracks Alzheimer's patients' locations, sends reminders, and alerts caregivers in emergencies. It uses GPS, GSM, and Wi-Fi modules, and hosts a webpage for remote monitoring. In emergencies, it sends SMS alerts and makes voice calls to caregivers.

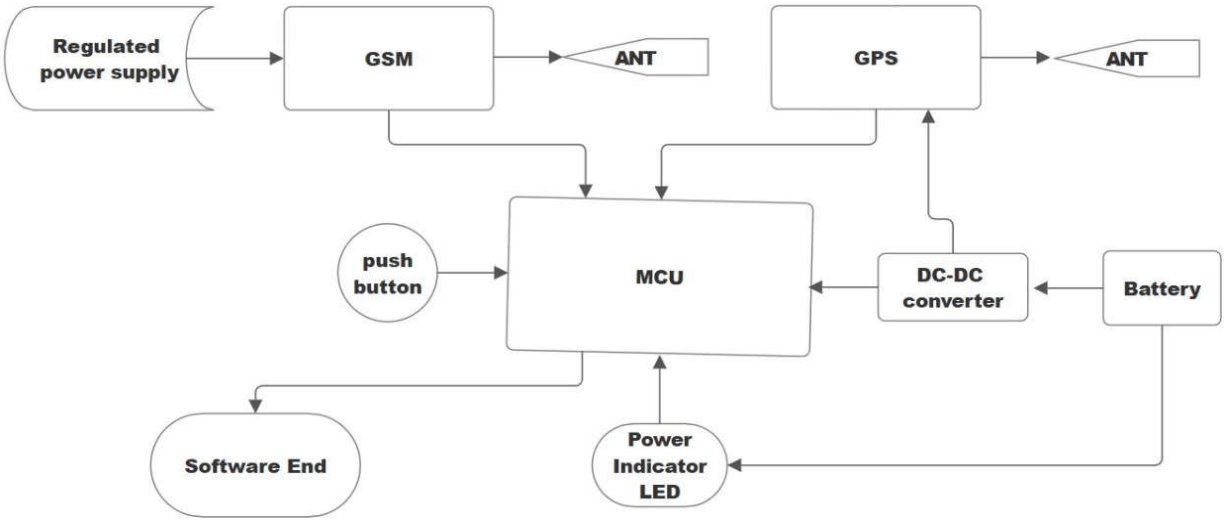

FIG NO:6.1 WORKING FLOW OF BLOCK DIAGRAM

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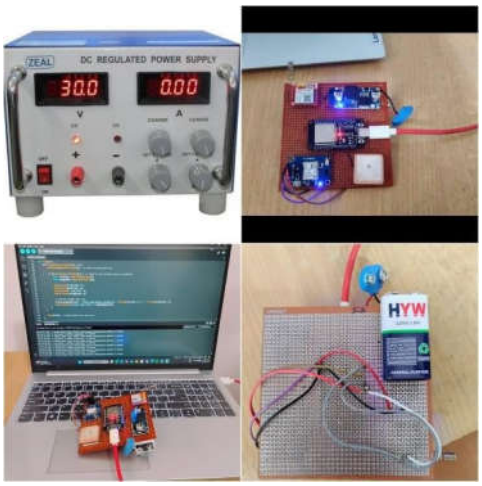

FIG 6.1 DC REGULATED POWER SUPPLY

ADVANTAGES

1. **Improved Patient Safety:** The system ensures the patient's safety by tracking their location and sending notifications to the caretaker in case of an emergency.
2. **Real-Time Notifications:** The system sends real-time notifications to caretakers in case of an emergency, ensuring prompt intervention and assistance.
3. **Reduced Stress and Anxiety:** The system reduces stress and anxiety for caretakers by providing them with real-time updates on the patient's location and activities.
4. **Enhanced Caretaker-Patient Relationship:** The system enables caretakers to provide more personalized and effective care to patients with Alzheimer's disease.
5. **Accurate Location Tracking:** The system uses GPS technology to provide accurate location tracking, ensuring that patients can be quickly located in case of an emergency.
6. **Increased Patient Engagement:** The system encourages patients to take an active role in managing their care, promoting patient engagement and empowerment.
7. **Reduced Healthcare Costs:** The system has the potential to reduce healthcare costs By reducing the need for hospitalizations and emergency services.

VII APPLICATION

1. **Healthcare Facilities:** The system can be used in healthcare facilities, such as and nursing homes, to track and monitor patients with Alzheimer's disease.
2. **Home Care:** The system can be used in home care settings to enable patients with Alzheimer's disease to live independently and safely.
3. **Assisted Living Facilities:** The system can be used in assisted living facilities to provide an additional layer of safety and support for patients with Alzheimer's disease.
4. **Community-Based Programs:** The system can be used in community-based programs, such as adult day care programs, to provide support and safety for patients with Alzheimer's disease.
5. **Research and Development:** The system can be used in research and development settings to study the behavior and needs of patients with Alzheimer's disease.
6. **Personal Use:** The system can be used by individuals with Alzheimer's disease and their families to provide an additional layer of safety and support in daily life.

7. Geriatric Care: The system can be used in geriatric care settings to provide specialized care and support for older adults with Alzheimer's disease and other age- related conditions.RESULT

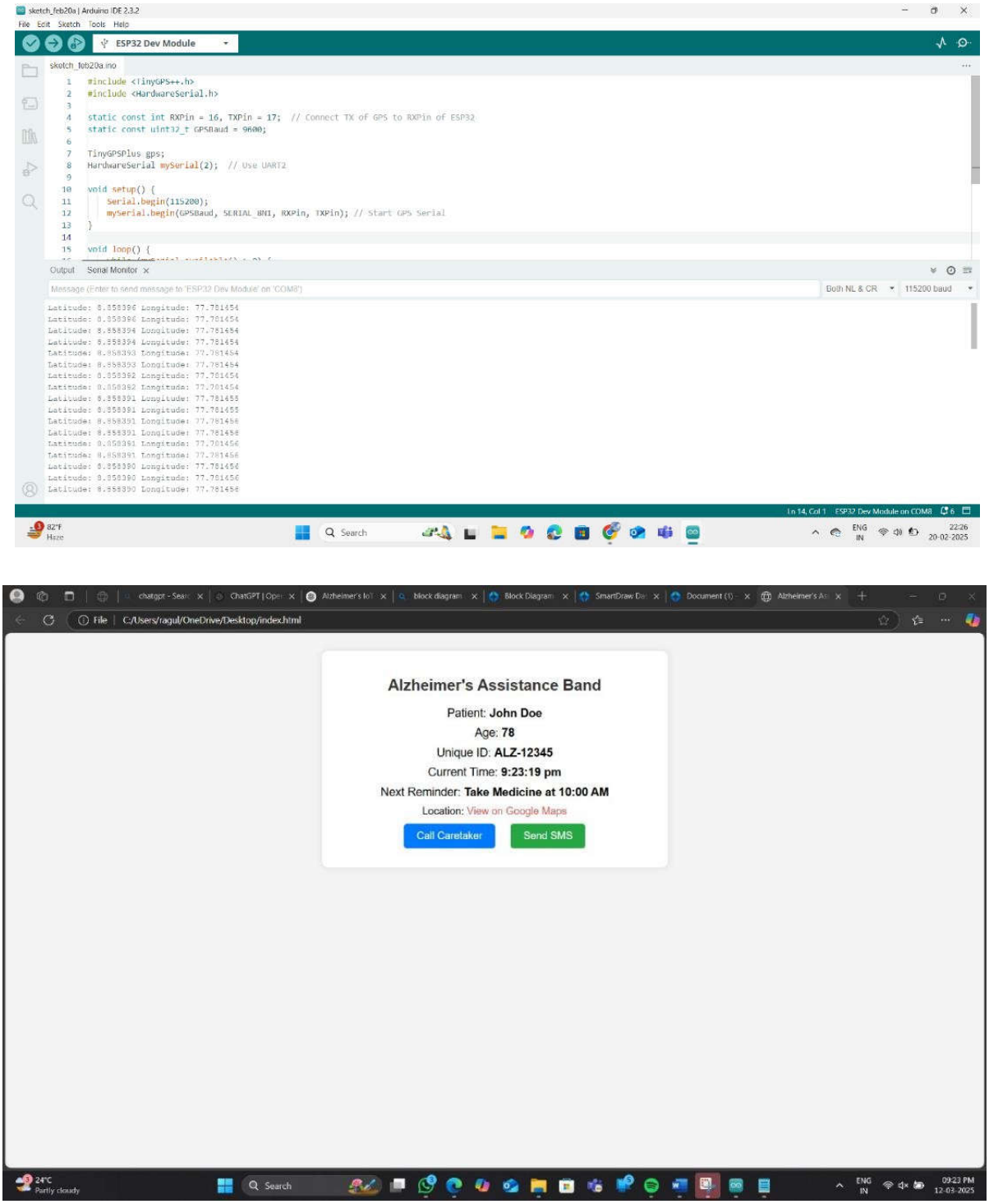

FIG NO.7.1 OUTPUT OF REMINDER NOTIFICATION OF PATIENT

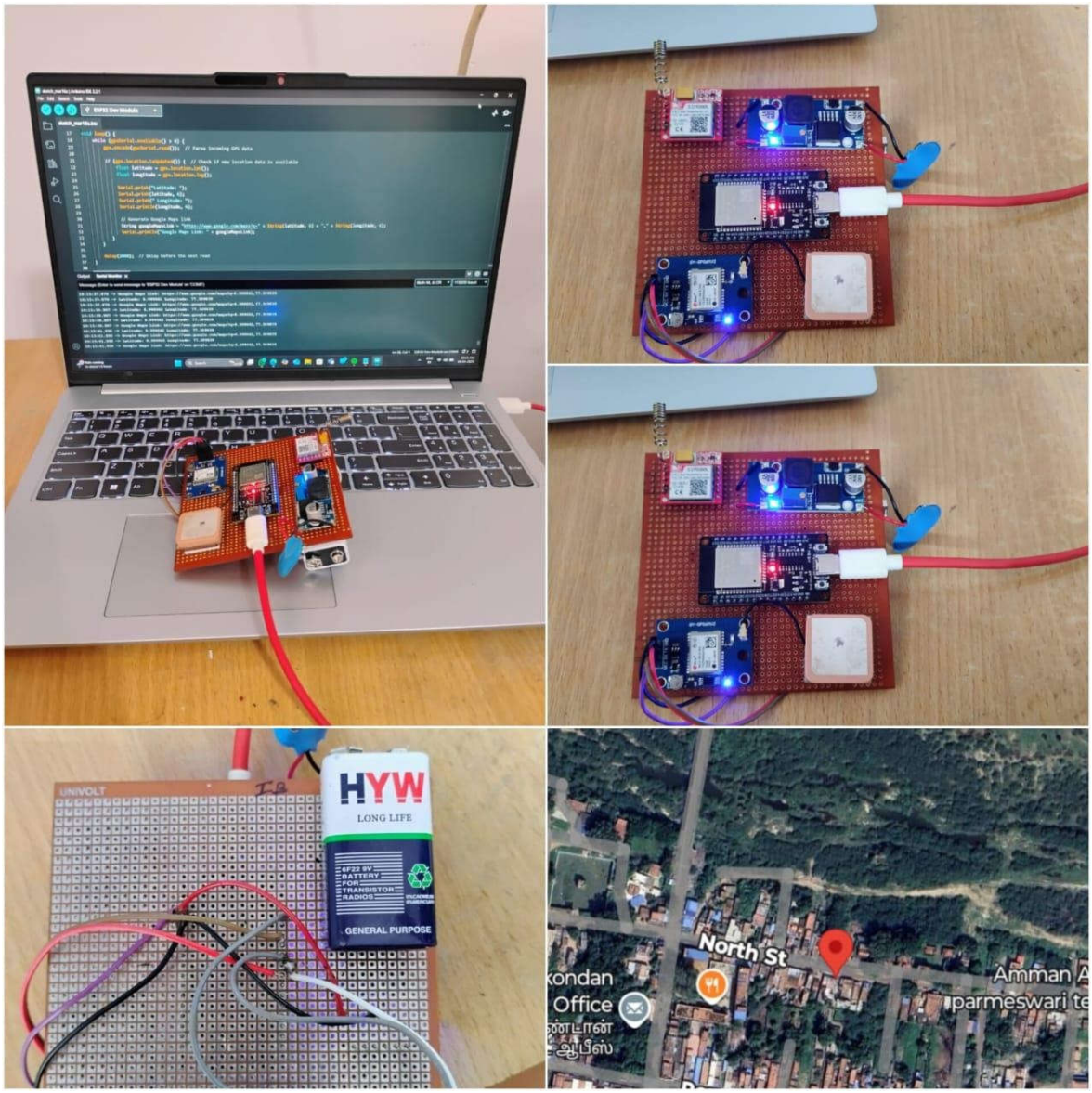

FIG NO.9.1 ACTUAL CIRCUIT REPRESENTATION WITH LOCATION

VIII CONCLUSION

The wearable device for Alzheimer's patients is a comprehensive solution that integrates GPS, GSM, and Wi-Fi technologies to provide real-time location tracking, emergency alerts, and remote monitoring. The system has the potential to improve patient safety, enhance caregiver response, and increase patient independence. With its user-friendly design and affordable cost, this device can be a valuable tool for caregivers and healthcare professionals. Overall, this project demonstrates the potential of technology to improve healthcare outcomes and enhance the quality of life for individuals with Alzheimer's disease.

IX FUTURE SCOPE

The future scope of this project includes integrating wearable sensors to track vital signs, implementing artificial intelligence and machine learning algorithms to analyze patient data, and integrating voice assistants for voice-based emergency calls. Additionally,

developing a multi-language interface, cloud-based data analytics platform, and expanding the device's application to other healthcare areas, such as monitoring patients with chronic diseases or disabilities, will further enhance the device's functionality and impact.

X REFERENCES

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