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Alzheimer's Patient Monitoring System

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Abstract: In our project, we seek a smart and reliable Alzheimer Patient Monitoring System on the basis of IoT-based technology. The system can monitor the health and safety of Alzheimer's patients in real-time and alert caregivers in case of an emergency. We are using a vibration sensor to detect sudden falls or movements, which are common and dangerous for such patients are a safety. A moisture sensor has been added to check for hygiene-related issues such as incontinence, which will help in ensuring cleanliness and the comfort. The humidity sensor confirms the environmental conditions around the patient to maintain the patient in a healthy and safe environment. To track the movement of the patient and prevent them from being lost, we have included a GPS module that constantly monitors their location. All the data collected by the sensors is displayed on an LCD screen for local observ ation. The entire system is also connected to Adafruit IO, an internet-based IoT platform for remote real-time observation. Adafruit IO Caregivers receive real-time alerts and notifications on their device, enabling them to respond instantly in the event of any form of emergency. The project has been planned to improve patient care, improve independence, and reduce the workload on caregivers by making optimal use of smart technology

Keywords: *Alzheimer's Monitoring, IoT, Vibration Sensor, Moisture Sensor, GPS Tracking, Humidity Sensor, Adafruit IO, Patient Safety, Remote Health Monitoring.*

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I. INTRODUCTION

Alzheimer's disease is a chronic neurological condition that impacts millions of people worldwide, primarily the elderly. It impacts memory, thinking ability, and behavior, leading to confusion, disorientation, and a failure to perform daily activities. One of the biggest issues of caring for Alzheimer's patients is having to continuously monitor, as patients are highly prone to falling, walking off, or forgetting basic hygiene practices. Such conditions render caregiving physically demanding and emotionally draining. Technology has been very promising in recent years to address such challenges with smart monitoring systems based on embedded electronics and the Internet of Things (IoT).

This project envisions design and development of a low-cost and efficient Alzheimer Patient Monitoring System with multi- sensor and IoT capabilities. The system is equipped with a vibration sensor for detecting falls, the most prevalent cause of injury in Alzheimer patients. A moisture sensor is used for observing personal hygiene level, highly effective in the case of incontinence. The humidity sensor helps in maintaining safe and comfortable living conditions by observing indoor air conditions. The availability of a GPS module facilitates realtime tracking of the facility, which is crucial in avoiding wandering-related accidents. An LCD display is utilized for local monitoring with real-time feedback on sensor values.

For remote monitoring, all the sensor values are transmitted to Adafruit IO, a cloud-based system for real-time monitoring of data via a computer or a smartphone. Alarm can be triggered if any sensor detects out-of-range value, facilitating early action. The main goal of this system is a patient safety improvement, reduction in caregiver burden, and encouragement of independent living in a patient with alzheimer's disease.

II. METHODOLOGY

The Alzheimer Patient Monitoring System is a technologydriven solution aimed at improving the care and safety of individuals suffering from Alzheimer's disease. Alzheimer's is a progressive neurological disorder that leads to memory loss, confusion, disorientation, and in many cases, providers to act swiftly and efficaciously against possible emergencies.

The main piece of the system is a microcontroller, our example here being the ESP32, that is the central unit that gathers, processes, and releases information from all of the

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connected sensors. Every sensor contains embedded C/C++ code with the threshold values wanted. The vibration sensor, for instance, is wandering behavior. Due to the unpredictable nature of the condition, continuous and real-time monitoring is essential. Traditional caregiving often falls short in offering round-the- clock supervision, which can lead to accidents or emergencies. To address this challenge, our system integrates multiple sensors and IoT technology to monitor the patient's physical status and environment remotely and effectively.

The core of the system is a microcontroller (such as an Arduino or ESP32), which reads from a set of sensors. The vibration sensor is used to detect sudden motion or collisions that could indicate a fall—an event that is a common and potentially harmful danger to Alzheimer's patients. If a fall had happened, the system might quickly trigger an alarm, allowing caregivers to respond quickly and perhaps avert severe injury.

A wet condition sensor operates to identify wet situations that may arise due to incontinence. This monitoring is essential in the maintenance of hygiene and prevention of the development of skin infections. Moreover, it minimizes the caregivers' workload by providing automatic notice in case of the requirement for assistance.

Environmental conditions contribute a lot to the comfort and welfare of the patients. A humidity sensor is employed to measure the amount of moisture present in the air. Low humidity or very high humidity can cause discomfort or initiate health issues, especially among older patients who have breathing sensitivities. The system will issue an alert to the caregivers when the environmental conditions are not appropriate. A GPS module facilitates continuous tracking of the patient's geographic location. This feature is particularly important when patients have a tendency of losing their way from designated safe zones. If the patient strays outside a specified boundary, the system can notify caregivers in real time, thereby preventing the patient from losing their way.

The system has an LCD display that allows the data from the sensor to be displayed instantly. This allows people around the patient to just see their current condition without the necessity to glance at a distant device.

The system relies on Adafruit IO, a cloud-based IoT platform, to hold and display real-time sensor data. The microcontroller is connected to the internet through Wi-Fi and sends the data to Adafruit IO, where they are visualized using custom dashboards. The caregivers are able to view the patient remotely on a computer or smartphone and receive alerts in the event of unusual sensor readings.

In short, this system integrates embedded tech with IoT to introduce a safe, automated, and scalable system for the care of Alzheimer patients. It facilitates patient safety, encourages proactive care, and enables family members and healthcare set to detect normal usage and a potential fall, and thus immediately sends a notification when the threshold is reached.

The humidity sensor is also necessary to identify hygiene issues, especially for patients who may not be able to express their discomfort. The GPS module ensures there are regular updates of the patient's location coordinates, which are then processed and confirmed against a specified geofenced safe zone set within the system.

All data is displayed locally on-board the LCD for immediate identification. Where off-site monitoring is employed, the system sends real-time sensor data to Adafruit IO, a cloudbased Internet of Things platform. Caregivers are able to view sensor data, track location on a map, and receive real- time alerts by email or mobile notification whenever any anomalies are detected.

It is powered by a battery pack or a stable power supply, hence it is portable and ensures continuous operation. Systematic testing and validation processes were conducted to analyze the reliability and accuracy of data transmission, even in varying environmental conditions.

In total, the approach adopted guarantees that the Alzheimer Patient Monitoring System is effective, scalable, and able to offer instant data access along with emergency alerts to caregivers, thereby greatly improving the quality of life for patients and caregivers.

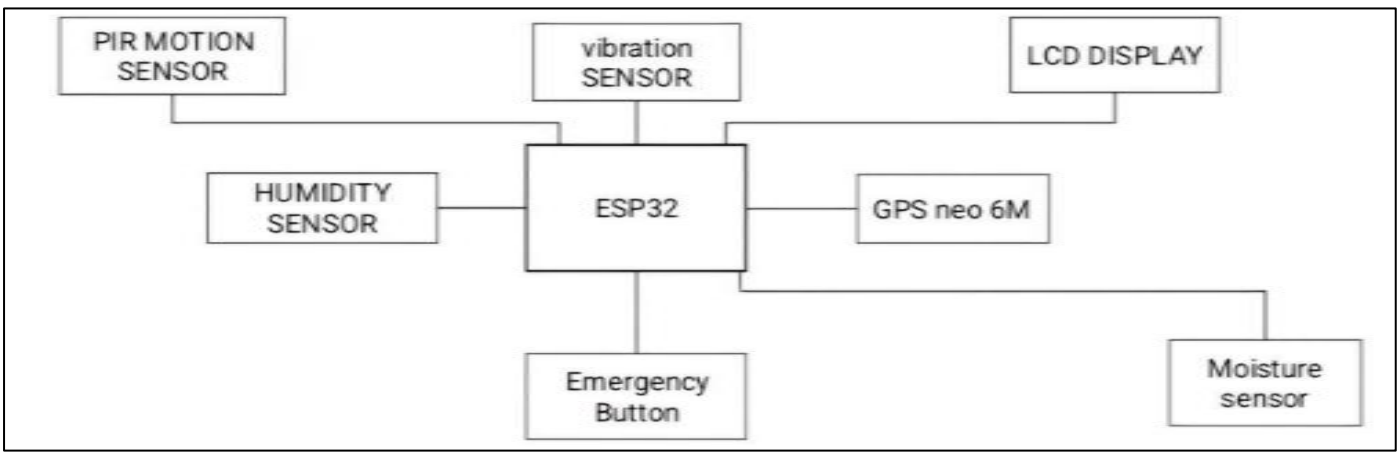

Fig 1 Flowchart

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III. IMPLEMENTATION

The project is an Arduino-based embedded system with several sensors and modules that are combined to gather and show data. The main parts are a GPS module, PIR motion sensor, an LCD display, and a breadboard for circuit prototyping. The system is powered and programmed using a USB cable attached to a PC.

When the system is switched on, the GPS module begins to receive signals from satellites and generates real-time location information (latitude and longitude). The PIR sensor keeps looking for any movement around it. When there is movement, it sends a signal to the microcontroller. The Arduino interprets the data received from the GPS and the PIR sensor and then prints out relevant information on the LCD module.

The breadboard is the wiring and connectivity hub for the components without soldering. The data transfer among components is handled through jumper wires to achieve uninterupted signal flow. The system can also be configured to record the data or send notification if there's motion detected, based on the software loaded to the Arduino.

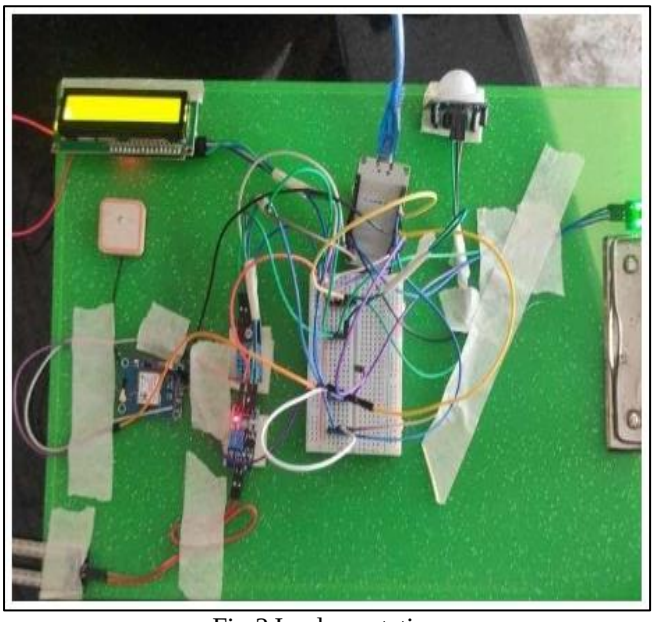

Fig 2 Implementation

IV. RESULTS AND DISCUSSION

Alzheimer Patient Monitoring System successfully showcases the integration of different sensors and IoT technology for real- time monitoring of Alzheimer patient safety, health, and environment. The system can detect severe incidents such as falls, moisture presence, and changes in environmental humidity. The system also provides accurate real-time GPSbased location tracking, ensuring security to the patient in the event of wandering.

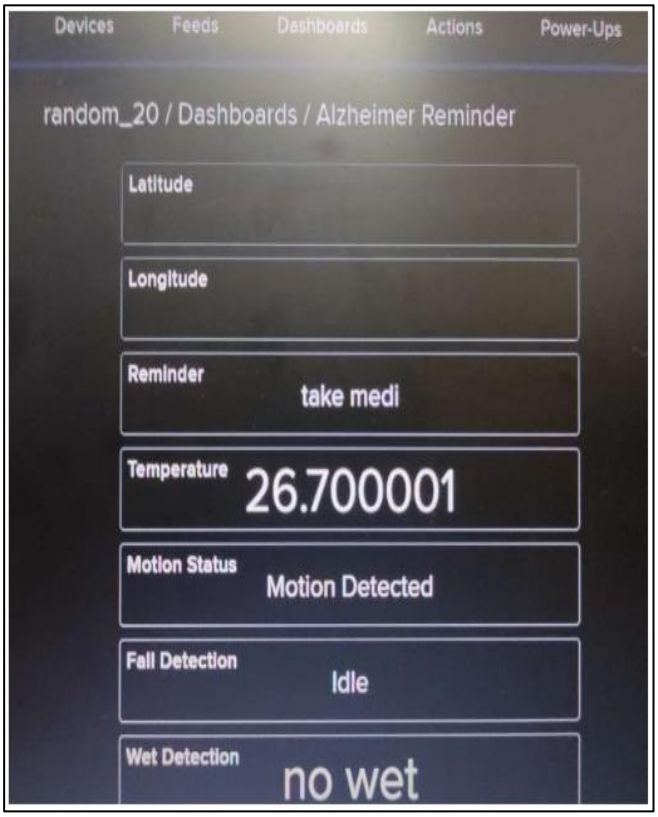

Fig 3 Output in Adafruit IO

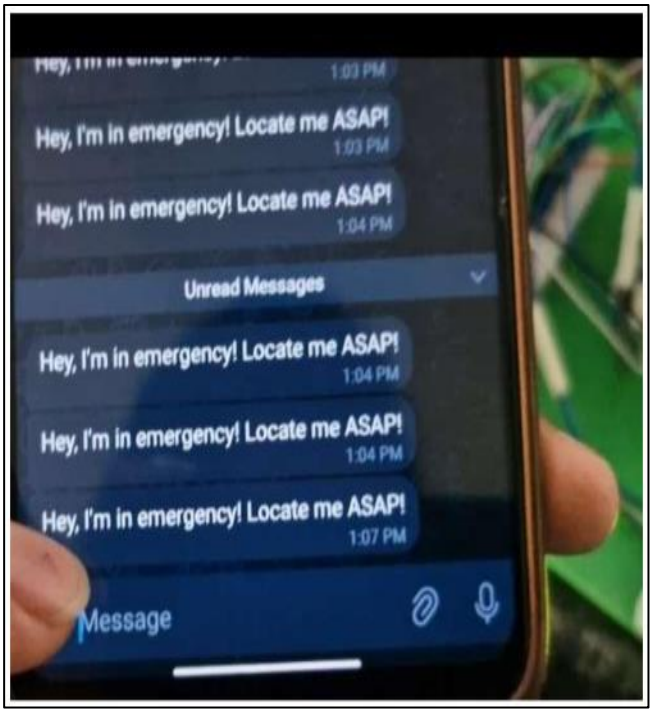

Fig 4 Message Alert

All the sensor readings are displayed on the on-board LCD for immediate feedback and simultaneously streamed on the Adafruit IO cloud platform. This allows caregivers to view the patient status remotely on any internet-enabled device. The system alerts when abnormally occurring conditions are sensed, enabling timely intervention and preventing the possibility of severe harm.

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With testing and simulation, it has been ensured that every sensor works well within its designed parameters, and the system responds quickly to sensor reading changes. Adafruit IO platform correctly shows real-time data and issues alerts as set. All components together provide a cost-effective, scalable, and stable solution for Alzheimer patient monitoring.

Fig 5 Reminder Displayed in LCD

Theoretically, the overall result of the project confirms that the new system can indeed improve quality of care and ensure patient safety, and alleviate caregivers from burdens with uninterrupted and automated monitoring.

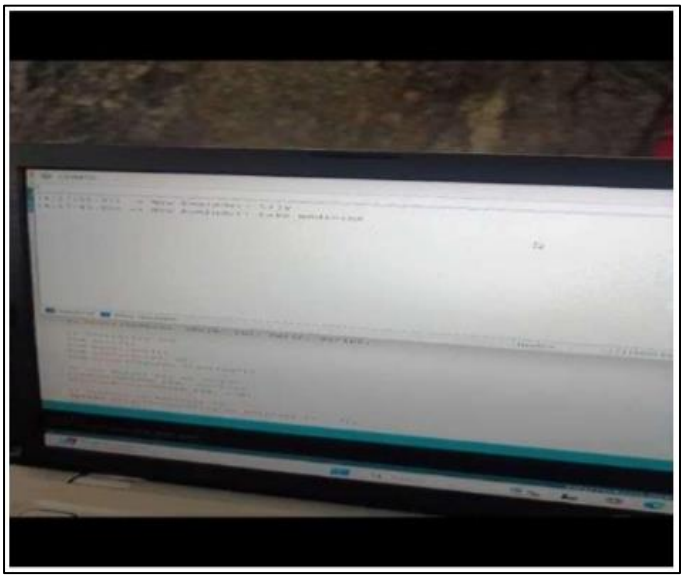
Fig 6 Serial Output

V. CONCLUSION

Alzheimer Patient Monitoring System successfully showcases the integration of different sensors and IoT technology for real- time monitoring of Alzheimer patient safety, health, and environment. The system can detect severe incidents such as falls, moisture presence, and changes in environmental humidity. The system also provides accurate real-time GPSbased location tracking, ensuring security to the patient in the event of wandering.

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