CENTER FOR DEVELOPMENT OF ADVANCED COMPUTING

Under the guidance and mentorship of Mr. Saishiva Reddy Gatla, Project Engineer at CDAC Hyderabad, we developed the -

SMART ASSISTIVE DEVICE FOR DEMENTIA PATIENTS

Project Field – Embedded Systems Design

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Teammates -

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PROBLEM STATEMENT

Dementia patients often struggle with memory loss and confusion, making it easy for them to wander off and get lost. This puts their safety at risk and makes caregiving stressful, as constant supervision is required. Existing solutions are not always reliable, lacking real-time tracking and instant alerts, making it difficult to respond quickly in emergencies.

SOLUTION

The **Smart Assistive Device for Dementia Patients** is a wearable device that helps keep patients safe by tracking their location and health in real time. It uses geo-fencing technology to set a safe area, and if the patient moves beyond it, caregivers receive an instant alert. The device runs on low-power, long-range communication, ensuring reliable performance without frequent charging. This helps caregivers reduce stress while ensuring the patient's safety and well-being.

ABSTRACT

Dementia makes daily life difficult by causing memory loss and confusion, often leading patients to wander off and get lost. This creates a huge challenge for caregivers, who need to keep a constant watch to ensure their safety.

This project introduces a Smart Assistive Device—a wearable gadget that helps dementia patients stay safe while making caregiving easier. The device tracks the patient's location and health in real time and sets up a safe zone using geo-fencing. If the patient moves outside this area, the system immediately alerts caregivers, allowing them to respond quickly.

Designed with long-range, low-power communication, this device works reliably in homes, assisted living centers, and healthcare facilities. By providing real-time tracking and instant alerts, it reduces caregiver stress while helping dementia patients stay safe and independent.

PROJECT COMPONENT

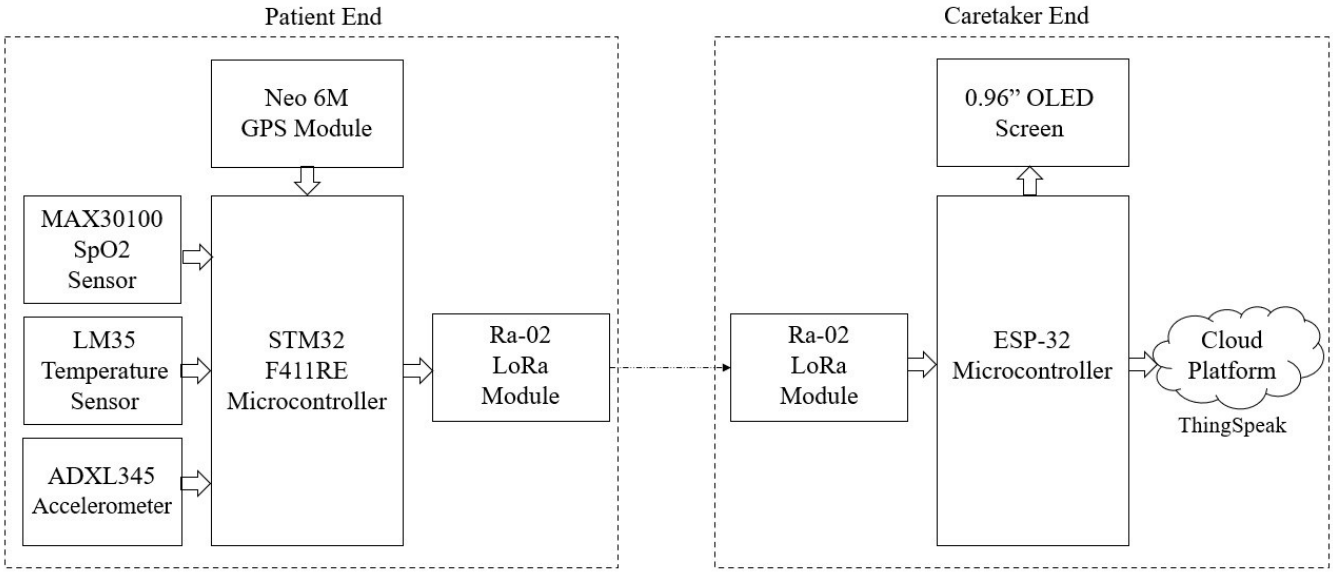
- ***Neo 6M GPS Module***
- ***MAX30100 SpO2 Sensor***
- ***LM35 Temperature Sensor***
- ***ADXL345 Accelerometer***
- ***STM32 F411RE Microcontroller***
- ***ESP-32 Microcontroller***
- ***Ra-02 LoRa Module***
- ***0.96" OLED Screen***
- ***Breadboard***
- ***ThingSpeak***

PURPOSE OF USED COMPONENT

- **Neo 6M GPS Module** – Continuously tracks the real-time location of the dementia patient, helping caregivers monitor movements and detect wandering. It ensures accurate positioning and allows quick intervention in case the patient moves outside the safe zone.

- **MAX30100 SpO2 Sensor** – Measures blood oxygen levels and heart rate to monitor the patient's vital signs. It helps detect early signs of health issues such as hypoxia or irregular heartbeat, providing essential data for caregivers.
- **LM35 Temperature Sensor** – Monitors the patient's body temperature to detect fever or abnormal temperature fluctuations. This helps in identifying potential health problems like infections or hypothermia, allowing timely medical attention.
- **ADXL345 Accelerometer** – Detects movement patterns, posture, and sudden falls, triggering alerts for emergencies. It helps caregivers take immediate action if a patient falls or moves in an unusual way, reducing the risk of injuries.
- **STM32 F411RE Microcontroller** – Acts as the brain of the patient-side system, processing sensor data and managing communication. It ensures real-time operation by collecting health and location data and transmitting it via LoRa.
- **Ra-02 LoRa Module** – Enables long-range, low-power wireless communication between the patient and caregiver ends. It ensures reliable data transmission over long distances, making it suitable for outdoor and large-area monitoring.
- **ESP-32 Microcontroller** – Receives data from the patient module, processes it, and updates the caregiver's display and cloud platform. It also supports Wi-Fi connectivity for seamless cloud integration and remote access.
- **0.96" OLED Screen** – Displays real-time health and location data for easy caregiver monitoring. It ensures that caregivers can quickly check patient status without needing additional devices or cloud access.
- **Cloud Platform (ThingSpeak)** – Stores and analyzes patient data, allowing remote access and historical tracking. It enables caregivers and healthcare professionals to review past trends, improving long-term patient care and safety.

BLOCK DIAGRAM



METHODOLOGY

This project uses the STM32F411RET6 microcontroller to gather information from several sensors, including those that measure blood oxygen (SpO2), body temperature, movement, and location. The system checks the patient's GPS coordinates against a set safe zone. If the patient goes beyond this zone, an alert is sent right away. All sensor readings are then passed on through the LoRa SX1278 module to an ESP32, which shows the data in real time on an OLED screen. Meanwhile, the data is also sent to ThingSpeak, a cloud platform, allowing caregivers to keep track of the patient's status even when they're not nearby.

WORKING

The system uses an STM32F411RET6 microcontroller to collect real-time health data from different sensors, including SpO2, temperature, and motion detection. It also tracks the patient's location using GPS. The collected data is analyzed, and if the patient moves beyond a predefined safe zone, an alert is triggered to notify caregivers.

To ensure smooth communication, the system transmits the collected data using a LoRa SX1278 module, which allows long-range and low-power data transfer. The ESP32 receives this data and updates it in real-time. The health readings and location details are then displayed on a 0.96" OLED screen, making it easy for caregivers to monitor the patient's condition locally without relying on the internet.

For remote monitoring, the system uploads all health and location data to ThingSpeak, a cloud-based platform. Caregivers can check real-time updates from anywhere, reducing the need for constant supervision. If any emergency occurs, instant alerts ensure quick action, making the system a reliable and efficient solution for patient safety.

FUTURE SCOPE

- ***AI Integration:*** Use predictive algorithms to spot potential health issues early.
- ***Mobile App:*** Send instant alerts and updates directly to caregivers' smartphones.
- ***Additional Sensors:*** Expand the system's capabilities by measuring more health parameters.
- ***Battery Improvements:*** Extend battery life for longer periods of continuous operation.
- ***Two-Way Communication:*** Allow caregivers to remotely adjust settings or send commands to the device.

PROS AND CONS

Pros

- ***Continuous Tracking:*** Monitors both health data and location in real time.
- ***Reduced Caregiver Burden:*** Automated alerts mean less need for constant supervision.
- ***Long-Range Communication:*** LoRa technology covers wide areas with low power consumption.
- ***Geo-Fencing:*** Ensures the patient stays within a safe boundary, preventing wandering.

Cons

- ***GPS Limitations:*** Accuracy can suffer in areas with poor satellite coverage.
- ***LoRa Range Constraints:*** Dense urban settings may reduce communication distance.
- ***One-Way Communication:*** Current setup doesn't allow caregivers to send commands back to the device.

CONCLUSION

In essence, this **Smart Assistive Device** is designed to keep dementia patients safe by continuously tracking their vital signs and location. The system’s real-time alerts and cloud connectivity mean caregivers can respond quickly, whether they are nearby or not. With the possibility of adding more sensors, improving communication features, and integrating AI, this device holds the promise of even more efficient and proactive care for those who need it most.