

## GPS Monitoring System for Dementia Care

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**Abstract** - Dementia may be a condition within which an individual deals with memory loss/ forgetfulness problems that build the members of the family to be undergone towards them, by observance incessantly with a concern of losing them in obscurity. In line with a survey there are quite ten million cases per year of individuals escorted by insanity (India). Thus to develop a system which will build their members of the family less accountable is a necessity.

In order to beat the problem featured by folks coping with dementia we have a tendency to come up with associate degrees wear: a solution using embedded system which can be integrated with GPS module to trace the placement incessantly and causing their live location status to their members of the family via GSM module and show the placement on an android application. Main motive of our project is to develop a system so as to assist folks coping with this problem to travel around severally. Additionally, we built this method compact in size. So, that it'd be user handy and price economical.

**Key Words:** memory loss, embedded system, GPS module, trace live location, GSM module, android application, Dementia

### 1. INTRODUCTION

Dementia is a neurological disease that affects communication and performance of daily activities. It is characterized by a decline in memory, language, problem-solving and other cognitive skills that affect a person's ability to perform everyday activities. It makes it impossible for people plagued by it to travel independently, also the relatives of patients always have to be the cause of them. Also they need to stay in their company all the time. During this rapidly moving busy scheduled world it's needed that there should be a system where relatives monitor to assist patient's location for safety and also in order that they will travel independently.

The disorientation of the sickness makes even well-known environments become unfamiliar, creating numerous people with dementia to wander and find themselves into

risky circumstances which will prompt serious harm or death. The chance to think about this disease is increasing in age; it affects more folks that are 60 or above. These patients are usually kept in nursing homes but there's also a risk of patients wandering outside. Reception for the people with little of an improved condition going out independently continues to be a risk. This technique monitors the placement of the person and sends the data to their relatives. Users can even set a predetermined range and if the patient crosses that range the system sends the user an alert message.

The GPS monitoring system was previously developed by my researchers for vehicle tracking and in military operations. A system with an application to display the placement onto the map on the user device is required to be developed. Previously developed systems work for Alzheimer patients at nursing homes.

This project proposes system made using GPS and GSM technology embedded system which is able to be integrated with GPS module to trace the placement continuously and sending their live location status to their members of the family via GSM module and display the placement on an android application

The organization of the paper is as follows, Section 2 Provides the literature survey that is the summary of related works Section 3 explains the proposed system. Section 4 States the Methodology of the System. Section 5 elaborates the results obtained from the system. Section 6 concludes the paper including the future scope.

### 2. LITERATURE SURVEY

People with dementia wandering independently are a risk for them and worrisome thing for caregiver:

A system to track the location of Alzheimer's patients to send the location of patients to the caregivers at the nursing home is developed using GPS GSM technologies. There are developed systems for wandering patients at the nursing homes focusing more on the elder aged patients. (2)

The latest microprocessor and telecommunication technologies are being used to create a multipurpose vehicle tracking system. The monitoring system receives GPS location and bearing information from the vehicle system. A map matching algorithm combined with the GPS location and heading at the monitoring system reliably determines and displays the road segment on which the car drives. Using data from accelerometers and pressure sensors, the tracking system also alerts the user in the event of an accident. It is also equipped to stop the vehicle through an ignition switching mechanism created with relays. (3)

Wearable smart locator band is an electronic gadget that can be worn on a child's wrist to track and monitor them. In this proposed system as the number of mishaps with children is increasing, it is a must to keep them safe. ZigBee, GPS is used to monitor the patient. A ZigBee device is used which is connected with the dementia patients. (4) MIWI bolsters low information rate and aids in making minimal effort systems. A proposed system with a patient and caretaker module uses MiWi transmitter, GPS, GSM and heartbeat sensor and MiWi receiver, microcontroller, LCD Display respectively. (5)

An android application to monitor the vehicle location using GPS and GSM technology is developed, (6) here in order to track the vehicle, the mobile user has to call on the The SIM number that is stored in the device's GSM module. The Android app can display the coordinates of the place received in the SMS.

An approach for developing a rescue system along with the tracking system for dementia and elder people (7) a proposed system includes The shoes have a GPS receiver, microcontroller, and a long-range LoRa transmission module, which transmits real-time location, body temperature, and voltage to a gateway device.

### 3. PROBLEM STATEMENT

Dementia is a condition in which a person deals with memory loss or forgetfulness issues. Which makes their family members to be more responsible towards them by monitoring them continuously with a fear of losing them in nowhere. According to a survey there are more than 10 million cases per year of people escorted by dementia (India). So to develop a system which will make their family members less responsible is a necessity. The Project is designed mainly to provide location updates of the people to their families via android application.

### 4. PROPOSED SYSTEM

The planned method is intended to make the lives of those living with dementia easier, as well as to reduce their reliance on their relatives. Both hardware and software are included in the suggested system. The hardware components consist of a GPS module is used to retrieve location information, an STM32 microcontroller is used to operate and monitor system activities, and a GSM module is used to send location information to the application via SMS services. The software component consists of a mobile application that may receive SMS carrying patient position information, which is displayed on the app's map activity and also informs the user if the patient is outside the chosen safe circle.

### 5. METHODOLOGY

#### 5.1 GPS TECHNOLOGY

A GPS is a system of 30+ navigation satellites orbiting around the Earth. We know where they are because they constantly send out signals. A GPS receiver has an ability to receive these signals. Once the GPS receiver calculates its distance from four or more GPS satellites, it can figure out location coordinates.

#### 5.2 DEMENTIA CARE (APPLICATION)

The application is developed for the people dealing with dementia with an aim to make their relatives to be less dependent upon them by keeping an eye on them through the application. The application consists of a signup page for the users who are registering for the first time. Where, their entered details gets saved in the database. In order to receive the location information the user needs to get himself/herself logged in to ensure proper security and authentication. Which is done by entering the phone number along with the secondary phone number (Hardware SIM card) and password. Once, the user is properly authenticated, the application gives access to the user to receive the SMS from hardware and filter out the location information from the SMS. This location information contains latitude and longitude coordinates of the patient which is displayed on the map screen as alerts the user if the patient is not in a distance of 100m from user location.

#### 5.3 GSM TECHNOLOGY

Short message service (SMS) is a supplementary service that allows GSM users and base stations to send alphanumeric pages of limited length, while carrying conventional voice traffic. It is a store-and-forward

method of sending and receiving messages between mobile phones.

### 5.4 IMPLEMENTATION

The whole system relies on 3 major components which are the Neo-6m GPS module, STM32 and SIM800L GSM module. The GPS module compromise of GPS receiver which is used to fetch out the live coordinates of the person dealing with dementia. The GPS module is integrated with the ceramic antenna which has the ability to receive the very high frequency incoming from the GPS satellites. The co-ordinates fetched out by the GPS module is then transmitted to STM32 via serial communication pins. STM32 is the heart of the system which controls and monitors all the activities of the system. After receiving the coordinates from the GPS module, STM32 sends a command to SIM800L GSM module to transmit the location fetched out by GPS module to relatives/desired phone number via SMS.



Figure 1. Actual Hardware System

Later on, this SMS is received by the user’s/relative’s mobile phone. The application processes the received SMS after the user has completed the login process which is done to have proper authentication and security. The coordinates of users/relatives are compared with coordinates received by the latest SMS. If the distance of both the coordinates is more than 200m then application notifies the user that person is not inside the safe circle and the live location of person dealing with dementia is displayed on the application throughout.

### 5.5 COMPONENTS

#### 5.5.1 NEO-6M GPS Module



Figure 2. GPS MODULE

The NEO-6M GPS module is a high-performance full GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna for reliable satellite search. With the power and signal indicators, you can monitor the status of the module and the module has the ability to fetch out coordinates having accuracy within 25 meters.

#### 5.5.2 STM32F103C Microprocessor -

STM32 is an STMicroelectronics family of 32-bit microcontroller integrated circuits. The Cortex-M3F, Cortex-M7F, Cortex-M4F, Cortex-M3, Cortex-M0+, and Cortex-M0 are all STM32 processors that are based on the same 32-bit ARM processing core. In comparison to official Arduino boards, these boards are extremely inexpensive, and the hardware is open source. STMicroelectronics STM32F103C8T6 microcontroller is mounted on top of it. Aside from the Microcontroller, the board contains two crystal oscillators, one of which is an 8MHz crystal and the other a 32 KHz crystal, both of which can be used to power the internal RTC (Real Time Clock).

Meaning behind the name STM32F103C8T6	
STM	manufacturers name STMicroelectronics
32	32-bit ARM architecture
F103	architecture ARM Cortex M3
C	48-pin
8	64-by flash memory
T	LQFP package type
6	operating temperature -40°C to +85°

Table 1 Meaning of SRM32F103C8T6

Figure 3. STM32F103C SPECIFICATIONS



Figure 4. STM32F103C

### 5.5.3 SIM800L GSM Module-

The SIM800L is a small cellular module that can send and receive GPRS data, send and receive SMS, and make and receive voice calls, connecting to the internet through GPRS, TCP/IP, and more. To top it off, the module is compatible with a quad-band GSM/GPRS network, which means it can be used almost everywhere in the world. The SIM800L GSM cellular chip from SimCom is at the core of the module. The chip's operational voltage ranges from 3.4 to 4.4 volts, making it an excellent choice for direct LiPo battery power. As a result, it's a fantastic fit for projects that don't have a lot of room.



Figure 5. GSM MODULE

- Recommended supply voltage: 4V
- Supply voltage: 3.8V - 4.2V
- Power consumption:
  - sleep mode < 2.0mSupplyA
  - idle mode < 7.0mA
  - GSM transmission (avg): 350 mA
  - GSM transmission (peek): 2000mA
- Module size: 25 x 23 mm

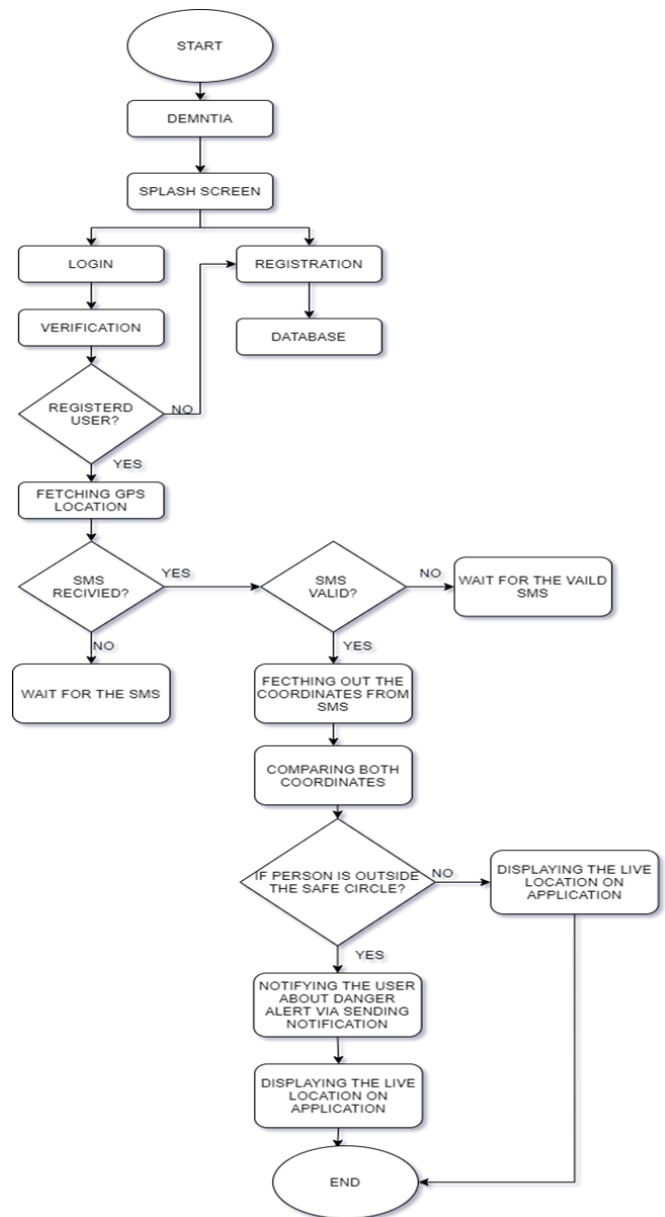


Figure 6. Flowchart

The application consists of following parts:

- 1) Registration: The user has to register into the app with their name , mobile number and a unique password .
- 2) Login: login activity used to carry out proper authentication and verification of the user..
- 3) Map page: The live location of the patient is displayed on the map screen of the application.
- 4) Range: To alert the user if the patent is not in the range of 200m i.e safe circle, from the location.

a) Android Studio

Android Studio is the official integrated development environment (IDE) for Android application development. It's based on IntelliJ IDEA, a Java integrated development environment for software development that includes code editing and developer tools. To aid application development on the Android operating system, Android Studio uses a Gradle-based build system, emulator, code templates, and Github integration. One or more source code and resource file types are included in every Android Studio project. Among these modalities are Android app modules, Library modules, and Google App Engine modules. Code completion, refraction, and analysis are all features of a code editor that assist programmers in writing code. Android Studio applications are subsequently compiled into the APK format for submission.

b) Firebase

The Firebase Real-time Database is a database that is hosted in the cloud. Data is saved in JSON format and synchronized in real time across all connected clients. When you use our iOS, Android, and JavaScript SDKs to create cross-platform apps, all of your clients share a single Real-time Database instance and are automatically updated with the most recent data. By giving secure access to the database directly from client-side code, the Firebase Real-time Database allows you to create complex, collaborative apps. Data is saved locally, and real-time events continue to occur even when the user is not connected, ensuring a responsive experience. Firebase is used as the main server which stores the user entered information during registration.

6. RESULTS AND ANALYSIS

Network range plays an important role in this system. According to the proposed plan, the final outcome of this leads to the development of the GPS monitoring system. The System consists of a hardware device for the patient to carry and an application for caregiver or the relative of the patient. Longitude and the latitude is determined by the GPS module which is further sent to the caregiver using the GSM module. The message is displayed on the mobile screen of the user and the conditions are.

- If the person or the device is not in the predefined location range then an alert message is displayed on the screen and the track option appears to track the location of the device.

- If the person or the device is in the predetermined location range then the location is directly displayed onto the mobile display.

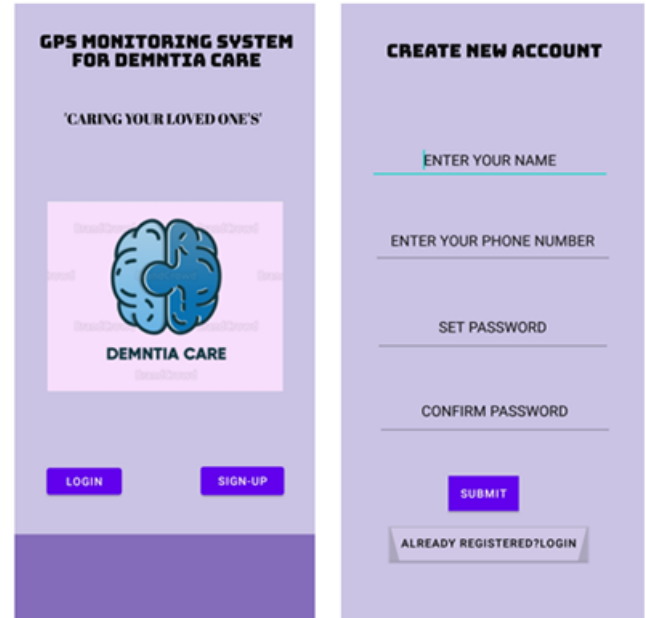


Figure 7 Splash Screen. Registration page

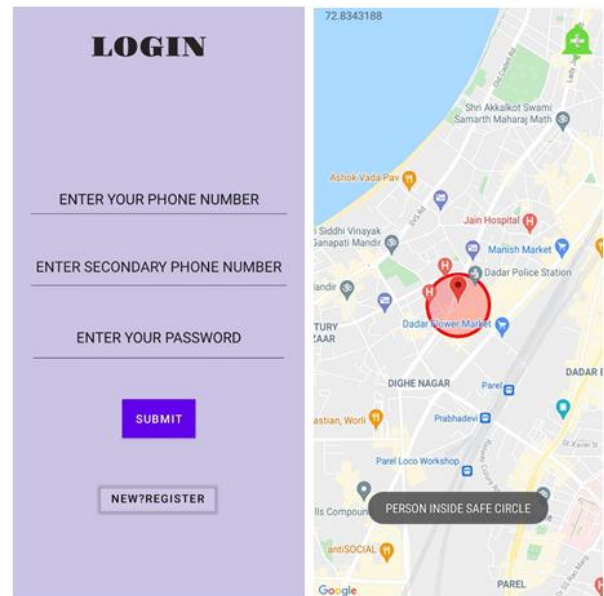


Figure 8 Login page, Location tracking

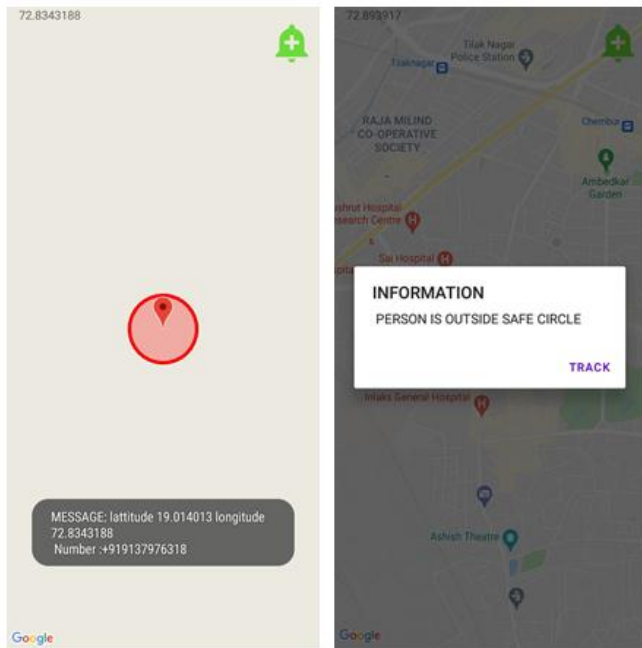


Figure 9. SMS receiving , Alert Message



Figure 11. Hardware



Figure 10. Traced location

## 7. CONCLUSIONS

The number of patients with dementia continues to grow, causing a heavy stress in the families. In order to solve the problem of loss of dementia patients and reduce stress of the caregiver we propose the GPS Tracking system for dementia care which provides real time location of the patient with help of a GPS module and sends the location, via SMS, to the Caregivers.

The system has an easy to use android application which displays location on the map and also displays the alert messages. This is great help to patients' caregivers and can be used by nursing homes for wandering patients too.

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