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Design of User & Pocket Friendly Tracking System for Alzheimer Patients

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Abstract—*In India, more than 4 million people have some form of dementia. Worldwide, at least 44 million people are living with dementia, making the disease a global health crisis that must be addressed. These patients have a tendency to wander and as per UK lost and found statistics ,around 1000 patients of dementia goes missing every year .Thus such people tend to get imprisoned in their home's, and a caretaker is required 24-7 to ensure their safety. This gradually affects their mental and physical health adversely. This paper presents a simple and pocket-friendly system to track the patients whenever they step out of a defined safe zone. The registered number gets alert messages along with positions. There is no need for any software, Application or Internet. This makes the people with such problems independent, self reliable and at the same time reduces the tension and stress of their family members.*

1. INTRODUCTION

Alzheimer's disease is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills .Gradually the ability to carry out the simplest tasks deteriorate .The global prevalence of dementia is estimated to be as high as 24 million, and is predicted to double every 20 years through to 2040, leading to a costly burden of disease. Hence this soaring number is a matter of great concern and demands various helping aids.[1] One of the biggest problems with Alzheimer's patients is that they can easily get lost especially when they are out of home and alone. Therefore, having a proper tracking system is vital.[2] As of now the existing technologies related to this are either fleet management software based trackers, or caregiver transmitter receiver set tracker. All such gadgets have constraints of range, a 24-7 caregiver, internet, dedicated software etc. Our system aims to reduce the complexities and constraints and design a simple and pocket friendly tracker.

I. SYSTEM DESCRIPTION

Developed system is able to define a user defined geographical safe zone for the patient. It continously checks the users current location coordinates using GPS module and sends them to the microcontroller, which further computes the distance using Haversine's Formula, and as soon as the patient gets out of the safe zone an alert message along with location is sent to the family member. And whenever the family member member wants to know the location of the patient, they can explicitly send message to the devicee from anywhere round the globe and can get real time location. This process is repeated every 5 minutes till the person returns back to the safe zone.This helps in making the patient independent and track them in real time.

II. Hardware

The proposed system uses Arduino Mega (Atmega 328) as the main microcontroller unit which takes coordinate input from GPS module SKG 13BL and when required receives and sends messages to the family member using GSM module SIM 900.

A. ARDUINO MEGA

Arduino Mega is an open source microcontroller based on ATmega 256 chip with a 16 MHz crystal oscillator. It has 54 digital inputs/output pins which 15 of them can be used as PWM outputs. This microcontroller supports up to 16 analog inputs which we are using to interface GPS module and 4 USARTs ports which we will be using to inetract with the GSM module.This board can be powered using a USB cable or with an AC-DC adapter or battery which should provide at least 5v voltage and 500mA current to work properly.

B. GPS : SKG 13BL

The SKG13BL is a complete GPS engine module that features super sensitivity, ultra low power and small form factor. The GPS signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.[3]

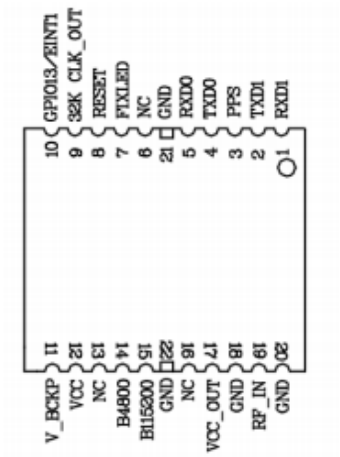

Figure 1: Pin Package of SKG13BL

C. GSM MODULE : SIM 900

The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip(MAX232). The baud rate is configurable from 9600-115200 through AT command. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet etc through simple AT commands.[5]The features of SIM900 are -

Features :

- Dual band GSM/GPRS 900/1800MHz.
- Configurable baud rate.
- SIM card holder.
- Built in network status LED.

III. ALGORITHM AND FLOWCHART

The Proposed system continuously gets geographical location locations from GPS module, this needs scripting as NMEA data strings have multiple data, from which we extract #GPGGA and then further longitude and latitude and extracted .As soon as the microcontroller extracts the coordinates, it converts it to the required format and then uses HAVERSINE's Formula to calculate the geographical distance between the pre-defined centre of the safe zone and the real time current location. Once the distance gets calculated, the microcontroller compares it with the safe zone radius. If the person is in the range, the microcontroller repeats the process. If the person if out of range the co-ordinates in Google Maps format is sent to family member's mobile with and alert message, A timer of 5 minutes if started and again location is sent until the person gets back to the safe zone. In between if the family member wants to know the location then they can send SMS, It is read by the Microcontroller and is treated as an interrupt, location is then sent to them irrespective of the defined safe zone condition.

A. HAVERSINE'S FORMULA : DISTANCE CALCULATION

The haversine formula is an equation important in navigation, giving great-circle distances between two points on a sphere from their longitudes and latitudes. It is a special case of a more general formula in spherical trigonometry, the law of haversines, relating the sides and angles of spherical "triangles".

$$\boldsymbol{Distance} = 2.R.\arcsin\{\sin(Lat1 - Lat2|2) + \cos(Lat2).\cos(lat1).\sin x^2(Long1 - Long2|2)\}$$

we implemented this in three steps –

a = (sin(dlat/2))^2 + cos(lat1) * cos(lat2) * (sin(dlon/2))^2

c = 2 * atan2(sqrt(a), sqrt(1-a))

d = R * c

where,

- R is the radius of the Earth
- dlat is the diffrence between the default (centre of safe zone) and current real time latitude in radians.
- dlon is the diffrence between the default (centre of safe zone) and current real time longitude in radians.

B. COORDINATE FORMAT CONVERSION

Google Map uses decimal degree format for latitude and longitude, whereas GPS receives latitude and longitude from satellite in degree minute format. For distance calculation and futher tracking purpose using Google Map we need to convert the coordinates received from satellite to decimal degree format. The method of conversion is –

Degree minute = 2356.3465 (ddmm.mmmm)

Degree = 23

Minute = 56.345

Decimal Degree Coordinate = Degree + Minute/60

Decimal Degree Coordinate = 23 + 56.3465/60

Decimal Degree Coordinate = 23 + 0.94

Decimal Degree Coordinate = 23.94

We implemented this while extracting latitude and longitude from NMEA format data.

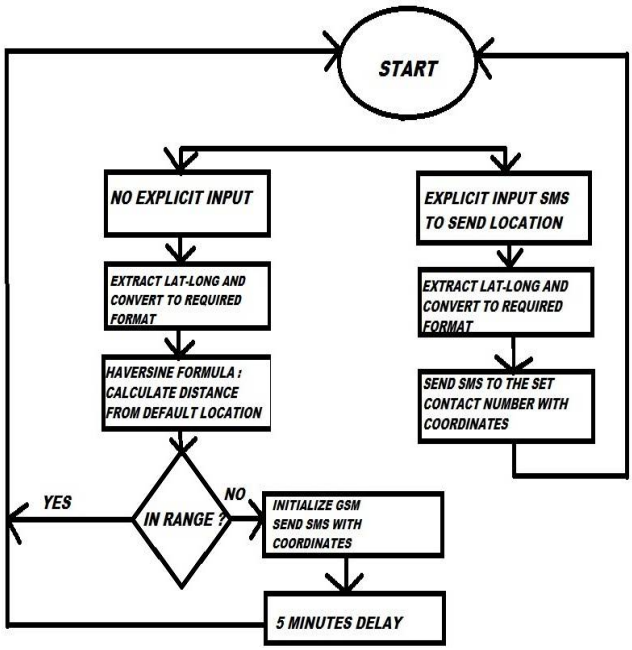

Figure 2: Flow Chart

RESULT

We implemented this system, and as case study, trials were done for 10 different people in different locations and environment. The coordinates i.e latitude and longitude were successfully sent to the registered mobile number of family members when the patients were out of safe range in every 5 minutes. When the patients were within the safe zone, no sms transmission took place. When we tried to explicitly get the real time location by sending track request, we successfully received the SMS with proper real time latitude and longitude.

The received latitude and longitudes can be loaded to Google Maps and track the person trajectory.

The system prototype is shown in figure 4–

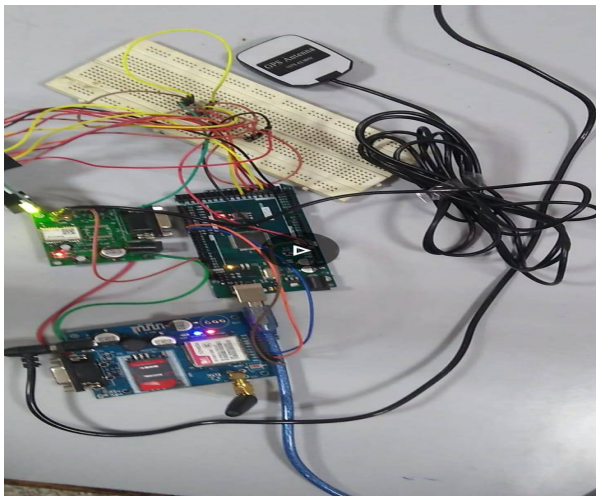

Figure 3: System Prototype

Figure 5 shows the received messages with proper time interval-

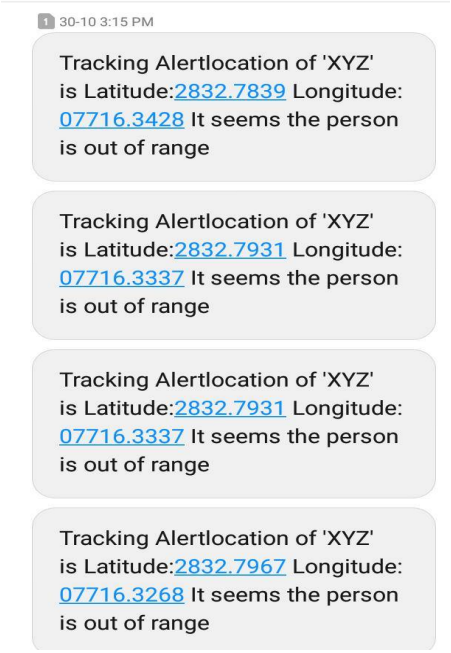

Figure 4: Received Messages

This system has some major advantages over the existing similar technologies, few of them are mentioned below-

- Solo system, No transmitter - receiver device is required .
- Range is no bound, existing system have range issues.
- No dedicated software is required
- No smart device is required, can be used by people of any economic strata.

Further this system can be extended as a proper healthcare device with various biomedical sensors, which can monitor the patient's health continuously, and any deviation from acceptable range in parameters could be sent to the doctors for immediate action.

REFERENCES

[1] C. Reitz, C. Brayne, and R. Mayeux, "Epidemiology of Alzheimer disease," Nature Reviews Neurology, vol. 7,no. 3,pp. 137-152, 2011.

[2] Omid, Toutian & Moshayedi, Ata Jahangir. (2015). Design and Development of Arduino Healthcare Tracker System for Alzheimer Patients. International Journal of Innovative Technology and Exploring Engineering (IJITEE). 5. 2278-3075

[3] SKYLAB,GPS Module Datasheet http://sensorembedded.com/product_extra_files/skg13bl.pdf

[4] ARDUINO, Arduino Mega, https://store.arduino.cc/usa/arduino-mega-2560-rev3

[5] Research Design Labs, GSM SIM900A , http://forum.researchdesignlab.com/datasheet/modules/GSM%20sim900.pdf.
[6] Rapid Tables, https://www.rapidtables.com/convert/number/degrees-minutes-seconds-to-degrees.html
[7] M. B. Mendoza, C. A. Bergado, J. L. B. De Castro and R. G. T. Siasat, "Tracking system for patients with Alzheimer's disease in a nursing home," *TENCON 2017 - 2017 IEEE Region 10 Conference*, Penang, 2017, pp. 2566-2570. doi: 10.1109/TENCON.2017.8228294
[8] SaraPaiva, CarlosAbreu. "Low Cost GPS Tracking for the Elderly and Alzheimer Patients." Procedia Technology (Elsvier) 5 (2012): 793-802.

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