

Safety System for Dementia Affected Person

Ms. Sterlin Minish T N, Mansi Gour, Manasa S K, Ajay Kiran, Mohsin Imam,
Maroof Hasan

Computer Science Department, Presidency University

Abstract –The wandering of elderly people with dementia is one among the numerous behavioral problems and largest concern for the caretakers and family. As such, new applications using various technologies like Internet of Things (IOT) provides safety and security to dementia effected people. According to the report, 10 million Indian people aged over 65 are suffering from dementia. Report also states that, count may set to increase around 22 million by 2040. Due to lack of awareness in the society, many dementia patients will go missing and even experience critical incidents leading to death. This designed project presents a GPS module especially for the patients suffering from dementia to track their location in real time. Considering health conditions, a well-developed health monitoring technology were taken into considerations as it provides accurate heartbeat and temperature readings. The caretaker can monitor the location and health condition of a person through an android app Blynk. Even alert messages are sent to caretaker through the app via Email. This proposed system is highly efficient that ensures safety and is also affordable. The aim of this project is to design a new system which integrates sensors and satisfies different functionality like fall detection, recording pulse rate, to tracking dementia effected people and also to alert their family members. Also, the object detection part alerts the patient if there is a vehicle or person in front of them.

Keywords– Arduino UNO, Dementia, GPS, Heartbeat Sensor, Tilt Sensor, Wandering

Date of Submission: 16-05-2021

Date of acceptance: 31-05-2021

I. INTRODUCTION

Alzheimer's is the important cause of dementia-decline in mental ability. It is a chronic neurological disorder that causes brain cells to degenerate and die. Decline in mental ability or memory loss has brought many issues in concern such as, elderly might forget their way home or even fall sick and indulge themselves in some sort of danger like accidents or falls. People with Dementia may become lost while driving or taking public transportation where larger territory might have to be covered to search them out. For care takers, losing the elderly person can cause stress as they will be worried for their safety. Dementia is sometimes revealed through 'wandering', which is a pervasive behavioral symptom in dementia patients. It is defined as "a syndrome of dementia-related locomotion behavior having a frequent, repetitive, temporally disordered, and/or spatially-disoriented nature that is manifested in lapping, random, and/or pacing patterns, some of which are associated with eloping, eloping attempts, or getting lost unless accompanied". It may be triggered by various factors such as frustration, the intent for socialization or work, boredom or escaping tendencies; however, it is quite unforeseeable and therefore requires supervision for detection and arbitration. Unattended aimless roaming of a patient may lead to agitation, fatigue, vertigo and in extreme cases physical harm due to falling or colliding with objects in the vicinity. Moreover, wandering has been identified as one of the main reasons for nursing home placement or institutionalization, as it has proven to be too arduous for caregivers to manage in home environments. With the proliferation of IOT, a device is being implemented which tracks the location and monitors the health status of the person which is the best solution for caretakers and families to prevent the elderly from wandering. In this proposed project, with the help of GPS module we can track the patient both inside and outside the house. If the device is taken out of a specified range (house), the caretaker will be immediately notified through an alert message along with the location link. Alert messages are sent with the help of GSM module present in the device via sim. Pulse sensor and Temperature sensor is also incorporated to check the health status of the elderly person which will be monitored by the caretaker and the reading can be retrieved whenever the consulting doctor needs it. Pulse sensor is used to record the heartbeat per second and heart beat can be monitored through the app. Vibration sensor connected to the device is used to detect the fall of the person. Once a fall is detected an alert message is sent to caretaker to further ensure the safety of the patient. The main idea of our project is to ensure the Safety of elderly people suffering from dementia and tension free life for their families. According to Centers for Disease Control (CDC), 1 in 3 seniors in America die with Alzheimer's disease or another kind of dementia. Due to the aging of the baby boomer generation, there has been a huge increase in the number of cases of those suffering from early onset Alzheimer's, with 200,000

Indians out of 5.4 million being under the age of 65. However, alleviating the challenges that the disease brings and reducing the level of decline to memory, cognitive function and general wellbeing is possible. Wandering is the single most critical worry for a caregiver. Those living with Alzheimer's, other forms of Dementia and Memory Loss have a tendency to wander whether they are at home or in unfamiliar surroundings. They are trying to make sense of the world they find themselves in at that moment. Patients will sometimes leave clues that they are about to wander by announcing that it is time to go home, when in fact they are home. They may get dressed to go to work when they stopped working long ago. Their past memories are now present. Without warning, they may start to wander into forbidden or dangerous areas within their own home - and locked doors could just make a wandering situation more severe.

II. PROPOSED SYSTEM

We are developing a wearable device using the internet of things (IOT) technology, in which we ensure the safety of elderly people by keeping track of them when they wander off and also monitor their health conditions through android app by including following features:

- ✓ The caretaker will be immediately notified by an alert message when the elderly person goes missing or out of the house.
- ✓ We can keep track of all the sensor reading through android app.
- ✓ Connection between the device (Arduino UNO) and the app is established by supplying internet through WIFI shield (ESP8266).
- ✓ It also consists of sensors to record heartbeat rate Detects the motion (like fall) and movements of the person.
- ✓ This system detects the person's location both within and outside the range.
- ✓ This system detects the object and informs the caretaker about it.

For the safety of elderly suffering from dementia, we are using Internet of Things (IOT), this technology provides the advance techniques like alerting the caretaker immediately when a person goes out of the home, tracking the location and as well as monitoring the health status. One of the main problems faced by the care takers is to locate the elderly person when they go wandering and cannot find their way back home. So, finding them in a larger territory is a tedious task without the knowledge of their exact location. When the elderly is lost, the caretaker cannot predict what kind of health issues they face or what kind of situation they are in. So, this system overcomes the problem of wandering.

III. SYSTEM ARCHITECTURE

The system consists of Arduino UNO, heartbeat sensor, vibration sensor, ESP8266 WIFI shield installed in node MCU, Raspberry pi, Raspberry pi camera module and GPS tracker make up the device.

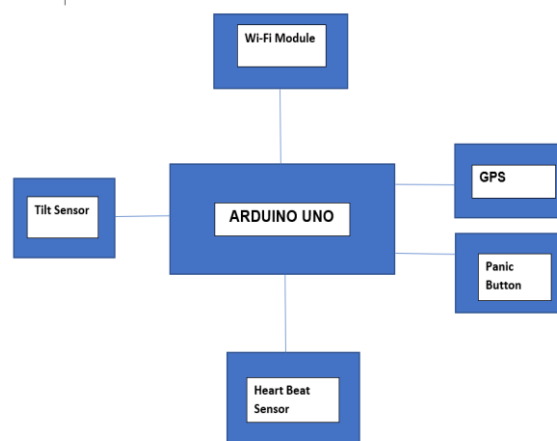


Fig 1. Block diagram of wearable device

A. Arduino:

Arduino enhances the application's interaction with its surroundings and adjacent objects. Arduino is an open-source platform for creating electronic projects of all kinds. It is made up of a hardware circuit and a programming tool that is used to write code and transfer it to the Arduino microcontroller through a cable. Since the Arduino IDE uses a simplified version of C++, it is one of the simplest ways to write code.

Sensors, engines, the telephone, a tablet, and a television can all be regulated by Arduino. The Arduino family includes a variety of boards, but the UNO is one of the most common.

B. Thumb Heartbeat Sensor:

A heartbeat sensor is an electrical device that measures the heart rate, or the pace at which the heart beats. The main things we do to be healthy are monitor our body temperature, heart rate, and blood pressure. Heart rate may be measured in two ways: one by physically checking the pulse at the wrists or neck, and the other by using a Heartbeat Sensor.

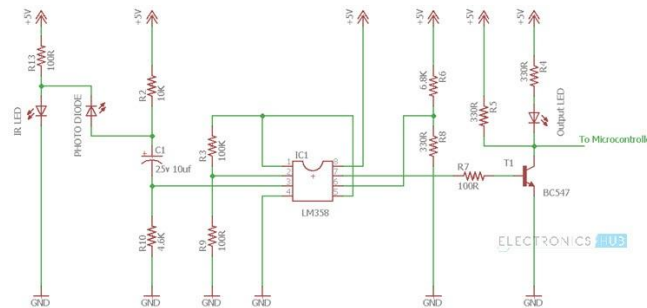


Fig 2. Finger type Heartbeat Sensor

The above circuit shows the finger type heartbeat sensor, which works by detecting the pulses. Every heartbeat will alter the amount of blood in the finger and the light from the IR LED passing through the finger and thus detected by the Photodiode will also vary.

The output of the photodiode is given to the non – inverting input of the first op – amp through a capacitor, which blocks the DC Components of the signal. The first op – amp acts as a non – inverting amplifier with an amplification factor of 1001.

The output of the first op – amp is given as one of the inputs to the second op – amp, which acts as a comparator. The output of the second op – amp triggers a transistor, from which, the signal is given to a Microcontroller like Arduino.

The Op – amp used in this circuit is LM358. It has two op – amps on the same chip. Also, the transistor used is a BC547. An LED, which is connected to a transistor, will blink when the pulse is detected.

C. GPS Module:

The term GPS refers to the global positioning system. A GPS tracker is a navigation device that may be used to track a person's, vehicle's, or animal's whereabouts. The information gathered by the gadget is saved and transferred through a wireless network.

On the map, the person's or vehicle's position is displayed in real time. All smart phones will be able to access the tracking software. To determine one's location, a GPS receiver in our device checks for signals given by satellites.

D. Blynk App (Android app):

It's a new platform that enables users to easily create interfaces for coordinating our hardware projects from an Android mobile. We can connect the blynk app to our device WIFI through ESP8266 and construct project dashboards, button positioning, and UI design once we have downloaded the app.

E. Node MCU:

Node MCU is a micro-controller board which provides WIFI that enables it to connect all the nearby devices to the internet. In this project we are using node MCU of type ESP8266 which provides WIFI to connect the system with the blynk app. Blynk app requires internet connection with the system to view all the sensor's reading in the app. ESP8266 provides stable internet connection to the app.

IV. METHODOLOGY

By tracking dementia patients' whereabouts and health state, the technology ensures their protection and protection. The gadget will be activated automatically when the power supply is turned on. The following are the major goals for designing a system for old people:

- Tracking location
- Motion detection
- Monitoring health
- Health surveillance
- Accident prevention
- Access to GPS
- Panic button

Tracking Location:

When the elderly person's location is detected outside of the provided range, the caretaker will be alerted by an SMS that will be sent to his number with the help of GSM module. Range is taken into account when phone's hot spot gets disconnected from the WIFI of the device. The system sets the area of the elderly person to the micro- controller and requests the location to the mobile networks. Once the required location data is retrieved, caretaker will immediately receive the location link to their phone.

Considering the safety of dementia patients, caretaker on receiving the location link scans the nearby police station and phone number. Once that is done caretaker can send the location along with its details as an SMS to them through GSM module.

Motion Detection:

When the elderly person wanders off, he/she can face serious issues like traffic accidents, fall and Dehydration. In such cases this designed system immediately detects the fall with the help of vibration sensor and sends alert message to caretaker along with the location. Further caretaker can take any action to ensure safety of the person.

Monitoring health:

Heart Beat Sensors is used to record number of heart beats per second is considered to be the monitoring unit where each pulse rate of the person is recorded and displayed to the caretaker. If the normal heart beat rate per minute decreases beyond 120, then immediate alert message will be sent to the caretaker. The temperature sensor measures the temperature and converts into electrical signal which is further processed by ordinand its software. It is further monitored through the app. If the temperature reading crosses the range of 36 - 40degree Celsius scale, then it will send an alert message to the Caretaker. Caretaker can monitor health status through the app.

In case of wandering if caretaker notices sudden pulse drop, fall or decrease in body temperature, he/she will immediately take the person's location and scan nearby hospital number. Once it is done caretaker will send alert message to the hospital.

All the sensor's data are stored and displayed in the app as the app is connected to the device using WIFI shield (ESP8266).

Health surveillance:

The number of heart beats per second is recorded using Heart Beat Sensors. The app is regarded as a monitoring device that records and displays each person's pulse rate to the caregiver. If the typical heart rate per minute falls below 120, the caregiver will receive an urgent alarm message.

Accident prevention:

Object detection is handled by the Raspberry Pi module. For detecting automobiles, we are using OpenCV. When an automobile is identified, the patient will be informed by a beep sound.

Access to GPS:

The caretaker may use the Blynk app to check the patient's whereabouts at any moment. The GPS module and the Node MCU are used to accomplish this.

Panic button:

In an emergency, a specialised Panic button comes in handy. When it is pressed, an alert is sent to the caretaker via email, allowing prompt action to be done.

V. RESULT

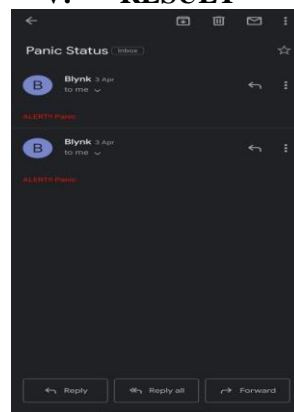


Fig 3. Alert Message

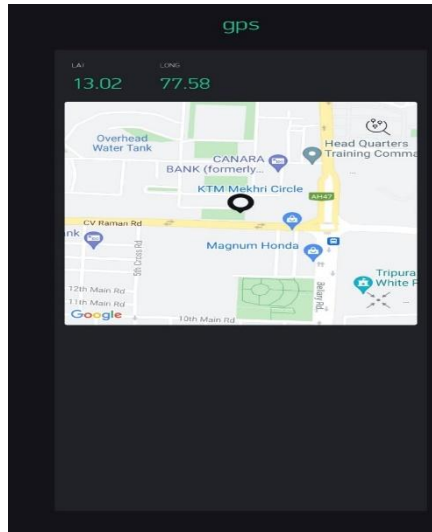


Fig 4. Location using GPS Module

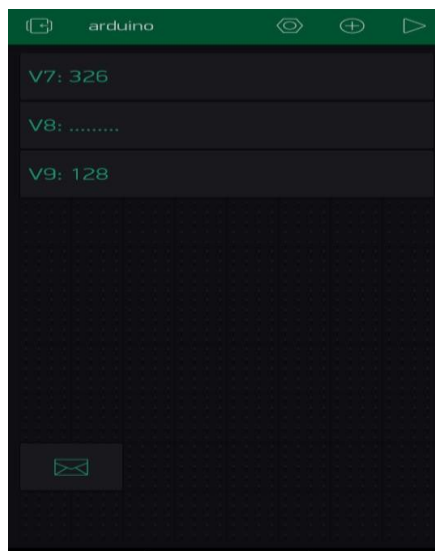


Fig 5. Pulse rate of the patient

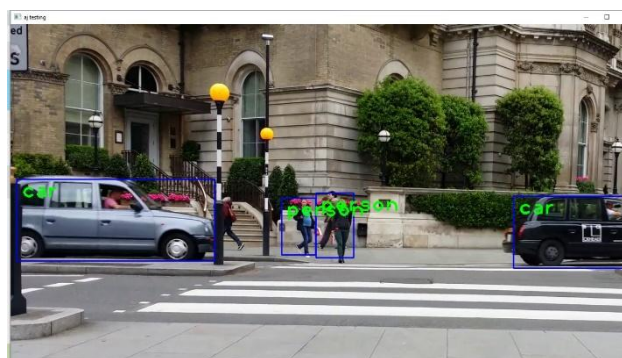


Fig 6. Object Detection

VI. CONCLUSION

The system designed provides safety of the elderly person suffering from dementia. The proposed design will accommodate critical issues faced by dementia affected elderly person within the recent past and helps them. This paper showcases the design in regard to the critical issues faced by dementia affected elderly nowadays and will help them technologically with compact equipment and new ideas. In the system it includes mechanisms like motion detection such as fall, recording body temperature, sending an alert SMS along with the location of the elderly using GPS/GPRS and also monitoring all the sensors reading through an app. This

method helps the dementia affected elders within the country to get over their fear in regard to their safety and security. Object detection is a computer vision technique that allows us to identify and locate objects in an image or video. With this kind of identification and localization, object detection can be used to count **objects** in a scene and determine and track their precise locations, all while accurately labelling them.

ACKNOWLEDGEMENT

We are so much thankful for our project guide, Prof. **Ms. Sterlin Minish T N** who supported us during the project completion and also helped us to improve the manuscripts significantly

REFERENCES

- [1]. Teri L, Larson EB, Riffler BV. Behavioral disturbance in dementia of the Alzheimer's type. *J Am Geriatr Soc.* 1988;36:1e6.
- [2]. Ballard CG, Mohan RNC, Bannister C, et al. Wandering in dementia sufferers. *Int J Geriatr Psych.* 1991;6:611e614.
- [3]. Klein DA, Steinberg M, Galik E, et al. Wandering behavior in communityresiding persons with dementia. *Int J Geriatr Psych.* 1999;14:272e279.
- [4]. Chan DC, Kasper JD, Black BS, et al. Prevalence and correlates of behavioral and psychiatric symptoms in community-dwelling elders with dementia or mild cognitive impairment: the Memory and Medical Care study. *Int J Geriatr Psych.* 2003;18:174e182. [5] Hope T, Tilling KM, Gedling K, et al. The structure of wandering in dementia. *Int J Geriatr Psych.* 1994;9:149e155.
- [5]. UK Alzheimer's Society. Electronic tagging - enabling or disabling people with dementia? http://www.alzheimers.org.uk/site/scripts/news_article.php?newsID%4239. Accessed 15.04.13.
- [6]. Hope R, Fairburn C. The nature of wandering in dementia: a community based study. *Int J Geriatr Psych.* 1990;5:239e245.
- [7]. Algase DL, Beel-Bates C, Beattie ERA. Wandering in long-term care. *ALTC.* 2003;11:33e39.
- [8]. Siders C, Nelson A, Brown LM, et al. Evidence for implementing nonpharmacological interventions for wandering. *Rehabil Nurs.* 2004;29:195e206.
- [9]. Buchner DM, Larson EB. Falls and fractures in patients with Alzheimer-type dementia. *JAMA.* 1987;257:1492e1495.