Real Time Health And Security Monitering Device For Dementia Affected Elders

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***Abstract*—As a consequence of the increase in life expectancy, the healthcare needs faced by the elder generation are growing. As such, new applications using emerging technologies are needed to contribute for their safety and well-being. This proposed project presents a low-cost GPS tracking system focused on Dementia patients which relies on a GPS functionality allowing to track and locate patients in near real-time. As our focus is Dementia, specific preventive functionalities as well as health monitoring technologies were taken into account such as they give flexibility and peace of mind for the caregivers with affordable cost. Some interesting data on dementia awareness in India is available from the 10/66 Dementia Research Group. This group is a part of Alzheimer's Disease International. According to the 10/66 study, while the symptoms of dementia are widely recognized, they are considered a normal, anticipated part of ageing and not as an organic brain syndrome, or indeed as any kind of medical condition. Till recently, the consensus figure for prevalence of dementia in India was used from a Lancet paper giving a Delphi consensus study. This paper gives the 2010 dementia population of India as 3.7 million. According to the paper, this is set to increase by more than 300% by 2040 (that is, it is estimated to reach six million). As the report explains, this general lack of awareness has important consequences, because there is no structured approach to study or manage it, and a stigma is attached to the person with dementia, and/ or to family members who are held responsible for this state of the person.**

Keywords*— *Arduino UNO, Heartbeat Sensor, RTC, SOS, Camera Module, GPS/GPRS, Buzzer

I. INTRODUCTION

As we grow older, our brains change, and we may have occasional problems remembering certain details. Dementia is a general term for a decline in mental ability severe enough to interfere with daily life. Alzheimer's is the most common type of dementia. However, Alzheimer's disease cause memory loss and other symptoms serious enough to interfere with life on a day-to-day basis.

Wandering is a common symptom of Dementia a result, individuals with Dementia can go missing or experience critical incidents when they leave home alone and are unable to find their way back. For Dementia affected peoples there is also increased risk of injury or death from traffic accidents, hypothermia, dehydration, falls, fractures, and drowning.

People with Dementia may also become lost while driving or taking public transportation where a much larger territory may need to be covered in a search to find them. For caregivers, wandering can lead to stress as well as safety concerns. Fortunately, GPS tracking and health monitoring technologies have introduced a new way for caregivers and families to prevent the dangers of wandering.

In our proposed project we will be implementing a wearable device which has low cost, high efficiency, energy efficient and easy to use.

In this proposed wearable device. we make use of highly accurate GPS module which can detect the person's location both inside as well as outside of building sand send the location to the computer. When the elderly person goes out of the area set in the sensor, the sensor automatically sends the wandering elderly person's location. The computer informs the caregiver by the notification on the website.

The wearable sensor can capture images of the surroundings of that the wandering elderly person whenever it detects a fall. This image can be used to identify condition of wandering elderly person's in case of any emergencies

Heart beat sensor will also be implemented to monitor health status of the elderly person this health status can be monitored by the caregiver and essential reading can retrieved whenever consulting doctor needs it. Panic button will be available and also an RTC module is used set the time of having tablets and a buzzer in the module make sound whenever the time comes to have tablets if person don't take it. The module will send a notification on the website

A. *Arduino UNO*

The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller. In order to get started, they are simply connected to a computer with a USB cable or with a AC-to-DC adapter or battery.

Arduino Uno Board varies from all other boards and they will not use the FTDI USB-to-serial driver chip in them. It is featured by the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Fig. 1. Arduino Uno Board

Arduino is a single-board microcontroller meant to make the application more accessible which are interactive objects and its surroundings. The hardware features with an open-source hardware board designed around an 8-bit Atmel AVR microcontroller or a 32-bit Atmel ARM. Current models consists a USB interface, 6 analog input pins and 14 digital I/O pins that allows the user to attach various extension boards. The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller. In order to get started, they are simply connected to a computer with a USB cable or with a AC-to-DC adapter or battery. Arduino Uno Board varies from all other boards and they will not use the FTDI USB-to-serial driver chip in them. It is featured by the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

B. *Heart beat sensor*

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly opaquer and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated by a LED which blinks on each heartbeat.

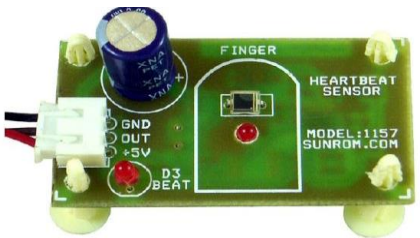

Fig. 2. Heart Bear Sensor

A simple Heartbeat Sensor consists of a sensor and a control circuit. The sensor part of the Heartbeat Sensor consists of an IR LED and a Photo Diode placed in a clip. The Control Circuit consists of an Op-Amp IC and few other components that help in connecting the signal to a Microcontroller. The working of the Heartbeat Sensor can be understood better if we take a look at its circuit diagram.

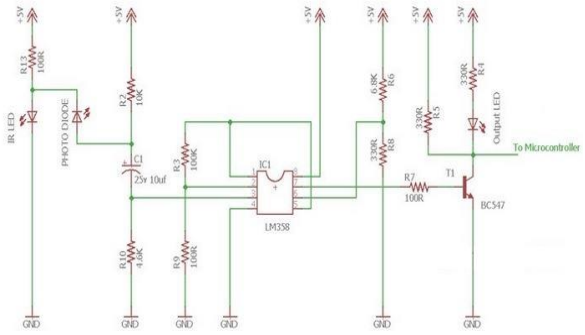

Fig. 3. Control Circut

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 Photo Diode will also vary.

The output of the photo diode 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 cats 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 transistor, will blink when the pulse is detected.

C. *Tilt Sensor*

The tilt sensor is cylindrical and contains a free conductive rolling ball inside with two conductive elements (poles) beneath.

- When the sensor is completely upright, the ball falls to the bottom of the sensor and connects the poles, allowing the current to flow.
- When the sensor is tilted, the ball doesn't touch the poles, the circuit is open, and the current doesn't flow.

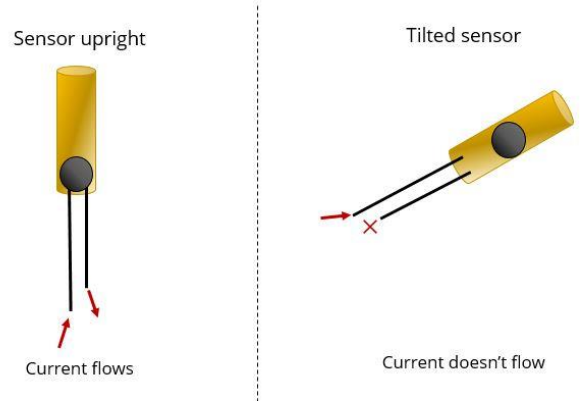

Fig. 4. Sensor sector

This way, the tilt sensor acts like a switch that is turned on or off depending on its inclination. So, it will give digital information to the Arduino, either an HIGH or a LOW signal.

D. GSM/GPRS

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. The MODEM is the soul of such modules. A GSM GPRS Module is used to enable communication between a microcontroller (or a microprocessor) and the GSM / GPSR Network

Fig. 5. GSM circut

E. Real Time Clock

This module has the integrated time keeping system using a crystal oscillator. So the timing is accurate with multiple applications. This module also has a battery backup with which the module can keep track of the time even when the Arduino is programmed or turned off.

F. Camera module

Here we introduced one camera module just purchased online, including the communication of camera module and Arduino UNO, the using ways to take photo via camera module, and so on. This is an Arduino camera module, adopted the Surveillance cameras digital image processing chip-OV0706, specially designed for image acquisition and processing application, based on TTL communication interface, very convenient to connect with Arduino controller, able to read image and data via UART serial port, and then perform some image processing.

Fig. 6. Camera used for work

G. Buzzer

A buzzer or beeper is an electrical device that makes a buzzing as a signal. A buzzer is used to warn the blind person against obstacle by generating sound proportional to distance from obstacle.

II. RELATED WORK

''Intelligent assistive technology applications to dementia affected elders". This system reviewed technical literature and identified a wide range of commercially available devices that they argue have potential to reduce the costs of care.[1]

"Health monitoring system with real time tracking". With the advancement of technology in every walk of life the importance of safety of people has been increased. In this paper main priority is given to human's health condition when the accident occurs, so the injured people could be attended in lesser time by rescue team. This paper is designed and implemented to detect the health status of persons along with the tracking of persons from any location at any time. This is a system that utilizes sensing devices to detect fall events, heartbeat rate and vibration. It uses ARM7 microcontroller, GPS, GSM, MEMS sensor, heartbeat sensor and vibration sensors. The current system can be able to provide monitoring process from anywhere. The purpose of this system is to design and integrate a new system which is integrated with sensors, GPS- GSM to provide Fall detection, Heartbeat rate, Vibration and Real time tracking. Therefore we can receive running report quickly. It is completely integrated, and can be worn on wrist so that once it is implemented to people, then it is easy to track persons and condition of a person.[2]

"An Android application for dementia patients". The system has proposed reduced costs by using clients own handheld devices or internet links rather than needing specific or additional connectivity. Both the operation of the proposed device is complicated for users.[3]

"IOT based health monitoring system for active and assisted living". The Internet of Things (IoT) has been widely used to inter connect the available medical resources and offer smart, reliable, and effective health care service to the elderly people. Health monitoring for active and assisted living is one of the paradigms that can use the IoT advantages to improve the elderly lifestyle. In this paper, we present an IoT architecture customized for health care applications. The proposed architecture collects the data and relays it to the cloud where it is processed and analyzed. Feedback actions based on the analyzed data can be sent back to the user. A prototype of the proposed architecture has been built to demonstrate its performance advantages.[4]

"Design and development of an iot based wearable device for the safety and security of dementia elders" .study, though assessed as low quality, did identify that using electronic devices such as movement sensors can permit an approach to care that permits people with dementia to move about freely – the alternative approach being to perceive 'wandering' as problematic, and to lock doors in care facilities.[5]

"safety system for elderly wandering person".Have developed a new mobile phone-based safety support system for transmitting information of a wandering elderly person's location and the environmental sounds around that person. The system consists of a wearable sensor and a conventional desktop PC with Internet access acting as the server computer. The wearable sensor, which is attached behind the neck of the elderly person's shirt, is composed of a low transmitting power mobile phone (W-SIM), a small microphone and a one chip microcontroller. The wandering elderly person's location is identified within 100m from the mobile phone company's antenna ID via the W-SIM. The caregiver sets the elderly person's movement area by specialized computer software. When the elderly person goes out of the area, the sensor automatically records the environmental sound around the wandering elderly person for the presumption of the person's situation with the small microphone. The W-SIM sends both the wandering elderly person's location and the environmental sound to the server computer. The server computer informs automatically the caregiver by the e-mail. The caregiver can monitor the sound and the map of the wandering person's location via Internet. The sound enables the presumption of an accurate location and the situation of the wandering person.[6]

III. METHODOLOGY

The proposed system is to design a real time health and security monitoring device for dementia affected elders . it consists of Arduino UNO heartbeat sensor, real time clock ,camera, SOS, Tilt detector, buzzer.

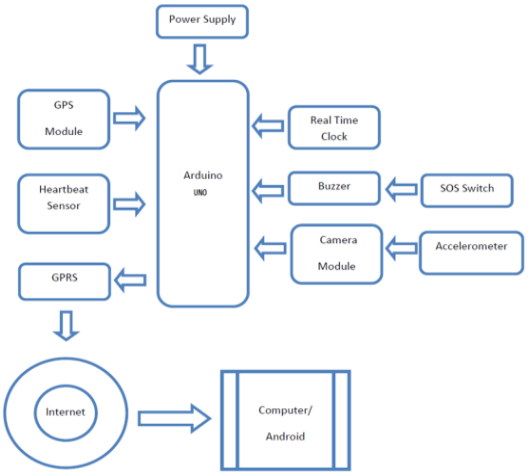

Fig. 7. Block Diagram of Wearable Sensor

When the switch is pressed the device will get activated automatically with in a fraction of milliseconds. Immediately the location of the dementia affected elders will be tracked and messages will be sent to the caregivers using GPS/GPRS module. Real time clock is used as an alarm to remind the dementia person to take there tablets on time . Heart Beat Sensors is used to count the number of pluses and collect the data to send it to computer of caregivers. Accelerometer which is fall and tilt detector alerts the camera module and the surrounding images will be captured and stored in the sd card. This images can be retrieved by the caretaker for sd card. Save our source (SOS)switch is normal switch which is used in case of emergency by the wanderly person. When the signal is passed from SOS the buzzer get alert .computer/Arduino gets the notification using HTML which is a scripting language.

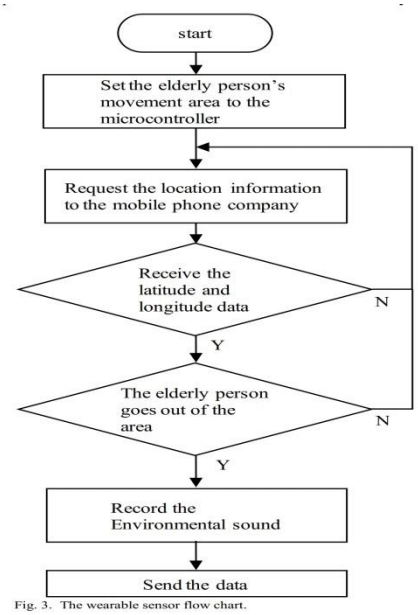

Fig. 3. The wearable sensor flow chart.

Fig. 8. Flow chart of wearable sensor

IV. RESULT

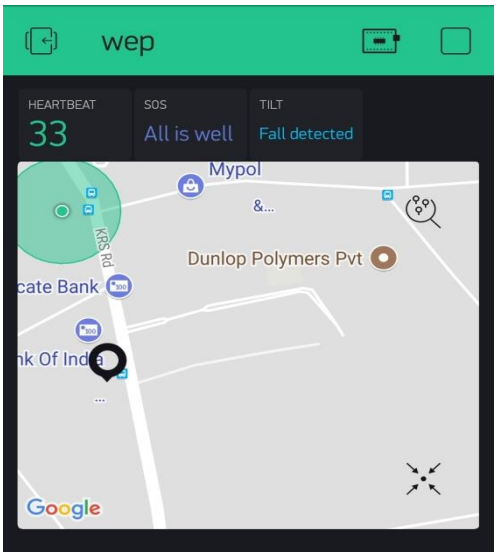

Fig. 9. Result Obtained

V. CONCLUSION

This type of an idea being the first of its kind plays a crucial role towards ensuring dementia affected elder's safety in the fastest way possible automatically. The proposed design will deal with critical issues faced by dementia persons in the recent past and will help solve them. The paper presents designing about the critical issues faced by wandering elders at present days and will help to solve them technologically with compact equipment and ideas. In the system it include mechanisms like real time clock which alerts for taking medicines on time using buzzer, heart beat sensing, capturing images by camera module and also alerting and sending the messages with the location using GPS/GPRS. This system can overcome the fear that scares every dementia affected elders in the country about their safety and security. With further research and innovation, this project can be implemented in different areas of security and surveillance.

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