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Alzheimer's Disease Intelligent Mobile Health Monitoring System

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ABSTRACT: This paper presents the Alzheimer's Health Band can be used to monitor or collect data of the patient and help him as a personal assistant while reducing his dependency on his care-taker. The field of wearable electronics has the potential to revolutionize our lifestyle. The aim of the research is to develop a complete package to monitor patient's various physical and health parameters using a wearable band which can interact with mobile devices, display various notifications, remind him to take medicines on time and help the family member to trace the patient if he or she gets lost. The goal of this project is to build, modify, and make cost efficient Health band while maintaining accuracy in the reading. The project includes Arduino Lilypad, 3-axis accelerometer, BMP280, RTC, Pulse sensor and a Bluetooth module, GPS module, OLED display.

KEYWORDS: Arduino Lilypad board, Sensor, BMP280, Temperature, Pulse sensor, Bluetooth module, GPS module, OLED.

I. INTRODUCTION

Image This report describes an effort to make a cost-efficient and low powered Health Band to help an Alzheimer's patient to do his day to day activities enabling him to do various tasks on his own and thus reducing his dependability on his family. The 21st century is the era of smart technology. Wearable technology has evolved to become one of the biggest industries in the world. A study conducted by Statist shows that the total number of wearable users that were connected to the 4G network in 2017 to be 526 million, while the market is expected to grow by 89 million by 2022 connecting over 900 million. Wearable Activity tracker is just a part of this segment, which helps the user to keep a track of your day's activities such as the distance covered and stay in track of your health goals more so when you want to reduce calorie intake and burn fats. In most people with the disease—those with the late-onset type symptoms first appear in their mid-60s. Early-onset Alzheimer's occurs between a person's 30s and mid-60s and is very rare. Few facts by Alzheimer's Association: 1 in 9 people aged 65 and older has Alzheimer's disease Family caregivers spend more than \$5000 (Rs 3,87,000) a year caring for someone with Alzheimer's. For some families, this means missing a vacation. We strongly believe that technology has brought about a massive and welcome change to the healthcare industry. Patients now have access to some of the best tools. By trying to build a product for the medical industry we would like to bring a change on a small level. So, these watches have also made their place in the medical industry wherein these devices now capable of collecting highly accurate health data and connect remotely to the personal physician who A great deal of attention has been given to the development of wearable technology during recent years. There have been successful efforts to build smart watches, virtual visual aids, fitness trackers, and so on. But these were limited to commercial ventures. With the release of the Arduino Lilypad, it has become possible to develop e-textiles on smaller scales without manufacturing it in factories. We were keen on developing e-textiles to monitor Alzheimer's patient health parameters like heart rate, body temperature, steps walked, calories burned, sleep, and hence to provide suggestions to enhance the quality of life and betterment of patients, at the same time reminding the patient to take his medication on time.

Our basic design principle was to make a health station with the least number of components possible while at the same time ensuring ease of use. We decided on a band with an accelerometer for step counting and sleep monitoring, pulse sensor for heart rate calculation, LM-35 for body temperature measurement, Lilypad, and Bluetooth module to communicate with mobile devices and keep the patient's family updated about the condition of the

patient. This ensured that our band was compact while still being feature-packed. We also built an Android application that acts as the front end to make the band easy to use. It has the functionality to calculate distance walked when in walking mode, calories burnt during activities like walking, jogging, running.

Apart from these it can also track various stages of sleep. Our project aims to find a solution that overlaps the healthcare devices and the activity tracker and henceforth serving an Alzheimer's patient to keep track of his activity as well as remind him to take his medications on time and thus fulfilling his healthcare needs. The project throws light on how technology can help in daily life of any Alzheimer's patient.

II. RELATED WORK

According to Forbes, there are various wearable technologies which entered the market with an aim to help the caretakers of Alzheimer's patient. In 2015 Toshiba came up with a bracelet aimed at helping caretakers of elders suffering from dementia and Alzheimer's disease. Along with it, Smart socks came into the market which alerts caretakers [1]. A 15-year-old New Yorker named Kenneth Shinozuka created a light-weight sensor at the heel of his grandfather's sock to alert his aunt when he got out of bed. When the user leaves a particular spot, it alerts the Smartphone app connected via Bluetooth. The only problem with this wearable technology is that the user might or might not wear the sock for the whole time, especially for a country like India where the majority of its climate is warm [5]. Then come a smart watch which by Clever Care which defined danger and safety zones and alerts the caretaker if they leave or enter them. Its user interface was simple with bold text and bright colors, resulting in good readability and easy to create task reminders. In addition to the caretaker, emergency calls go to Clever Care's 24-hour call centre which can help direct them from wherever they are—a safety net that can offer peace of mind if nothing else [3]. The problem with this one was that the location of the patient was going to the central authority of the company and not to the caretaker of the patient, which we strongly believe that the caretaker should have easy access to the patient's location so that it is easy for him to find in the neighborhood. There are a few solutions to address wandering and help keep your loved one safe and secure. One way to end wandering in seniors with Alzheimer's is to use a lifesaving location device. Using GPS tracking, these devices allow seniors to be found quickly. The mission of Project Lifesaver is "to provide timely response to save lives and reduce potential injury for adults and children who wander due to Alzheimer's, autism and other related condition or disorders." Seniors who are enrolled in Project Lifesaver are given a personal transmitter that they wear around their ankle. If they wander, the caregiver calls a local Project Lifesaver agency and a trained team will respond. Recovery times average 30 minutes and many who wander are found within a few miles of their home. In addition to the location device, Project Lifesaver works with public safety agencies to train them on the risks associated with wandering.

III. HARDWARE MODEL

The following hardware components are required to setup the Alzheimer's disease monitoring system of the patients.

A. Lilypad

The LilyPad Arduino 328 Main Board is an Arduino-programmed microcontroller designed to be easily integrated into e-textiles and wearable projects. It offers the same functionality you find in other Arduino boards, in a lightweight, round package designed to minimize snagging and profile, with wide tabs that can be sewn down and connected with conductive thread.

B. RTC: DS3231

The DS3231 is an RTC IC developed by Maxim Integrated. This device is cheap in cost and highly accurate RTC IC with communication over I2C Interface. An interesting feature of DS3231 RTC IC is that it has integrated crystal oscillator and temperature sensor and so it doesn't have to connect an external crystal. This device basically is accessible on SO-16 Package. While operation we require 8 pins function in the available 16 pins to the integration of crystal makes the IC bulkier and hence it is packed as a 16-pin IC instead of 8-pin IC. The DS3231 RTC MODULE have the following Specifications, so it can operate on voltage of 2.3V – 5.5V and Consumes 500nA on battery backup as well as the Maximum voltage at SDA, SCL is VCC + 0.3V and ability to withstand with operating temperature: -45°C to +80°C.

C. NEO-6M GPS Module

NEO-6 module is available in different series and belongs from the family of autonomous GPS receivers present the high-performance u-blox 6 positioning engine. It is basically compact device which will tractable and economical receivers provides numerous integration in 16 x 12.2 x 2.4 mm package. Its design is constructed in such a way that the power, memory to run on small battery, these possibility forms NEO-6 modules perfect and use as mobile devices required less space. It consist a 50-channel u-blocs in which 6 positioning engine boasts a Time-To-First-Fix (TTFF) in one sec. in the given acquisition engine.

D. HC-05 Bluetooth Module

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. It is come in the configuration of a master or slave arrangement to perform wireless communication. This version of Bluetooth module is V2.0 basically called pulse Enhanced Data Rate (+EDR) with the speed of 3Mbps data transmission and receiving capability and have 2.4GHz radio transceiver base band. It comes with the MASTER/SLAVE arrangement, but set on SLAVE as default. Aim to configured by AT COMMANDS. Slave module can accept connections from the different communicating channels and only receives a signal.

E. ADXL335

ADXL335 comes out with solo configuration to sense the X, Y, and Z axis. The outcome of all three axis sense orthogonal direction and have cross-axis sensitivity. The mechanical disordered of sensor that passes on the package act as the cross-axis sensitivity. Mechanical disordered can be calibrated and carried out at the system level. Preferably ADXL335 have high temperature compensation, contemporary structure, the ADXL335 have high performance. Finally, because of the non-monotonic actions and temperature hysteresis is very low nearly less than 3 mg over the -25°C to +70°C temperature range.

F. SSD1306 OLED Display

It is small in size and light in weight than Liquid Crystal Displays 128x64 OLED display is simple dot matrix graphic display. By just turning on/off this pixel's led we can display graphical image of any shape on it. It is a CMOS OLED driver with controller for dot-matrix graphic display system. The display can show the following graphics mainly text, images and different patterns. Another application is on mobile phone sub-display and also used in MP3 player, calculators etc. The display comes with 128x32, 128x 64 regulations.

G. Pulse Sensor

It is also known as heartbeat sensor and widely used. It can be installed on the fingers or ear of the patients by Arduino board. It is fast, durable and economical solution for heart rate calculation. It comes with 24 inches color code cable contains a ear clip, Velcro Dots, and transparent stickers. This cables can connected to Arduino without soldering. Two Velcro dots are available on the sensor at the hook side to be installed at the fingertip to cover the sensor on finger and other on earlobes.

IV. WORKING

The Alzheimer's band and its application work together, they both are interconnected the data is recorded by the different sensors and modules and is interpreted by the Arduino Lilypad and then its response is sent to the application where the patient/caretaker can read it.

1. Login Page Screen

When the application is launched, the login page is displayed where the user has to enter login credentials to access the application. When the credentials are correct the application displays the main screen.

2. Heartrate Screen

The heart rate screen contains a start button to record the heart rate of the patient when the button is pressed the Bluetooth of the android phone send command in the form text "1" to the HC-05 module of the band. This command calls Pulse_Sensor () function, which initializes the pulse sensor to record the heart rate of the patient. The recorded reading is sent to the application via Bluetooth and is shown on the screen.

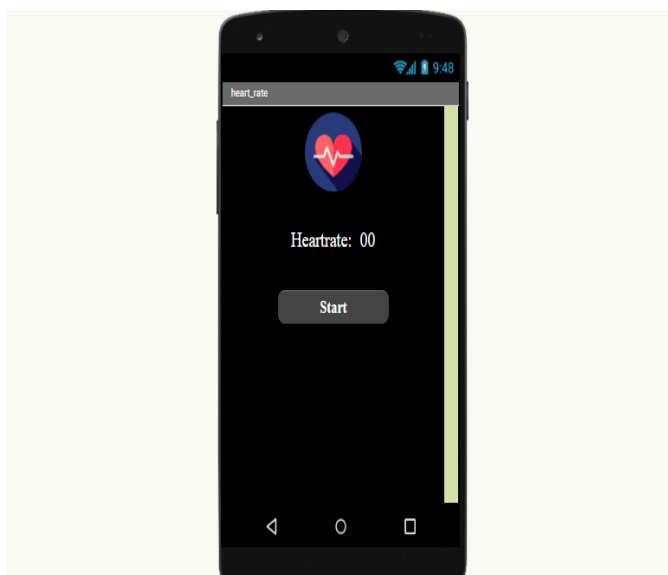


Fig. 1. Screen.02 (Heartrate)

3. Location

The location screen is launched it uses Bluetooth of the android phone send command in the form text "3" to the HC-05 module of the band. This command calls GPS_get Location function, which initializes the GPS -Ublox neo-6M sensor to record the location of the patient. The recorded reading is sent to the application via Bluetooth and is shown on the screen through maps.

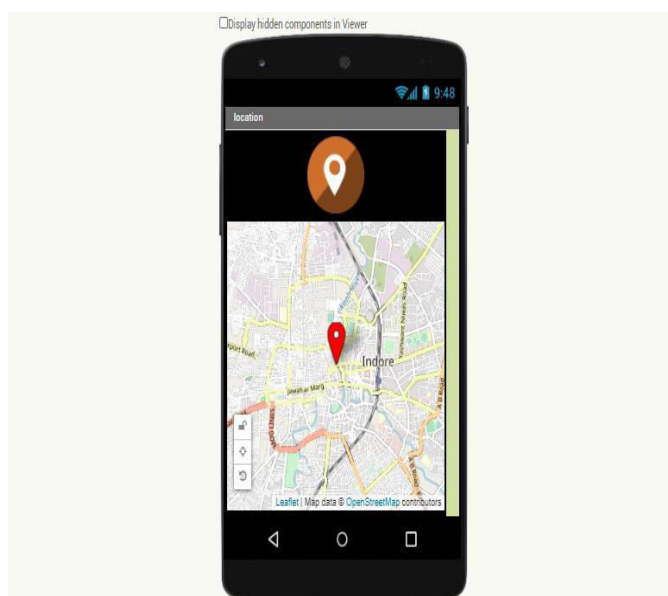


Fig. 2. Screen.03 (location)

4. Temperature

The Temperature screen contains a start button to record the Temperature of the patient when the button is pressed the Bluetooth of the android phone send command in the form text "2" to the HC-05 module of the band. This command calls BMP_Temperature function, which initializes the BMP 280 sensor to record the temperature of the patient. The recorded reading is sent to the application via Bluetooth and is shown on the screen.

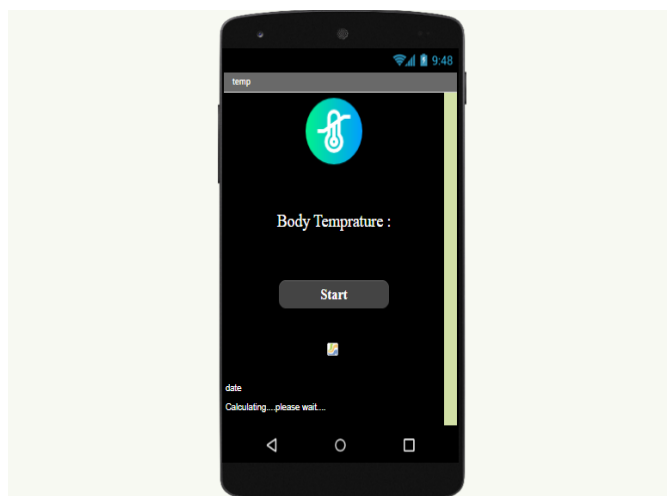


Fig. 3. Screen.04 (Temperature)

5. Emergency Screen

The location screen is launched it uses Bluetooth of the android phone send command in the form text "7" to the HC-05 module of the band. This screen starts a timer of 10 seconds whenever it is launched, when 10 seconds are completed then a message is sent to the caretaker of the patient or the doctor which is a default receiver of the patient's data that something is wrong with the patient. The screen also contains a Stop button to stop the timer so the user can stop the application from sending messages when not required to the caretaker.

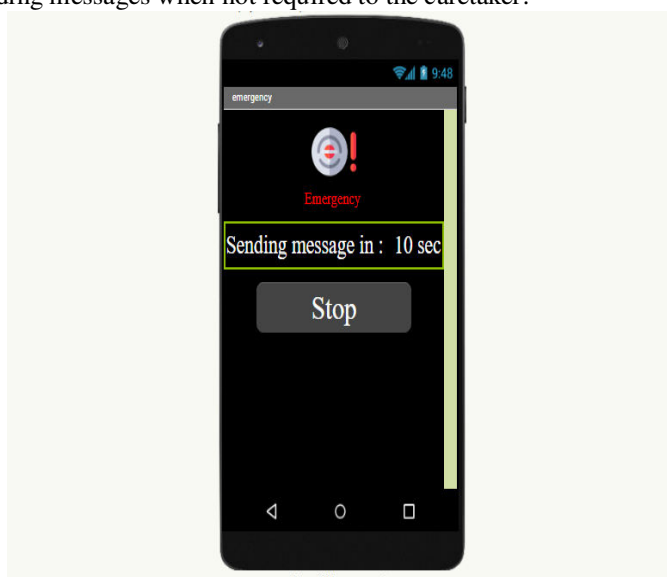


Fig. 4. Screen.4 (Emergency)

V. CONCLUSION

In presented work, our approach to focus on the elderly patients by supporting them with wearable technology it helps them during clinical trials and management. Digital technology, including sensors worn on the body, has the potential to transform how we assess mobility and identify life-changing conditions. This will enable medical teams to intervene earlier and offer treatment to extend healthy life. Recently Alphabet's life science subsidiary Verily developed a Caregivers of Alzheimer's disease demand virtual reality training as in how to handle their patients in a better way. In this research, we show the monitoring of the patients with the help of IOT based solution to provide assistance during cause.



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