IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 9, Issue 6, June 2020

Smart Wearable Device

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Abstract: This document gives formatting instructions for authors preparing papers for publication in the Proceedings of an International Journal. The authors must follow the instructions given in the document for the papers to be published. You can use this document as both an instruction set and as a template into which you can type your own text.

Keywords: Arduino Uno, temperature Sensor, pulse sensor, Accelerometer, piezo electric sensor, node mcu, gps, gsm.

I. INTRODUCTION

Currently, smart watch, Smartphone and smart clothing are the mainstream products embedded wearable technologies with care functions. All of them have attractive advantages for delivering health information. Now comes to our project, It is a smart wearable device aimed for senior citizens and health patients. The data from various sensors such as body temperature sensor, pulse oxymeter, accelerometers are fed to microcontroller and is fetched to the web which can easily be accessed using IoT. This provides a constant health monitoring solution. Our target users are elderly people. Sudden anxiety, alarming pulse rate, or even a fall due to any mishap is some of the major health issues associated with these people.

Our aim is to provide such a technological solution which can be relied upon to track these parameters. Microcontroller we have used in our project is Arduino Uno it is based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 Analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.

II. WEARABLE DEVICES CLASSIFICATION

The classification of the wearable devices is suggested to the main application field of products. According to the application field, wearable device can be mainly divided into: consumer electronics and medical health. Consumer electronics class is basically considered as low risk general products.

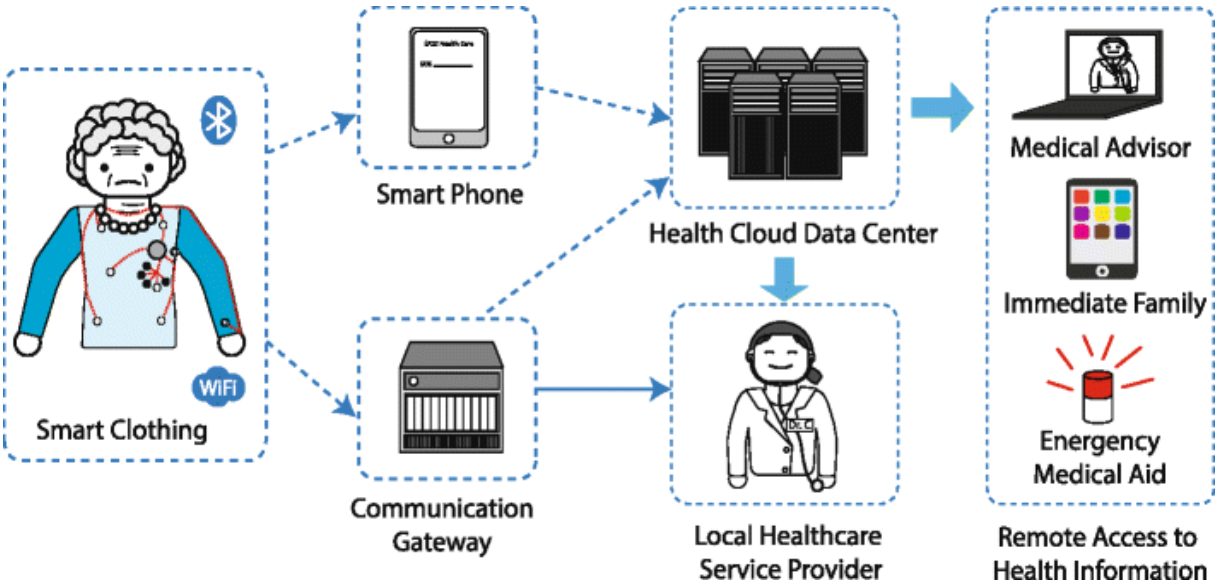

Fig. 1

IJARCCE
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A general wellness product, for the purposes of this guidance, has an intended use that relates to a maintaining or encouraging a general state of health or a healthy activity, or an intended use claim that associates the role of healthy lifestyle with helping to reduce the risk or impact of certain chronic diseases or conditions and where it is well understood and accepted that healthy lifestyle choices may play an important role in health outcomes for the disease or condition. Medical health class is basically considered as medical equipment which directly or indirectly for human instrument, equipment, instruments, in vitro diagnostic reagents and calibration, materials, and other similar or related items, including computer software that is needed. Wearable device is not only a kind of hardware equipment, but also can interact through software and support data exchange, and the cloud to achieve powerful features, such as helping users to sports and health management [6]. It monitors information of users every day, such as sleep time, movement distance data consumption quantity of heat, diet, etc. Data can be transmitted to the Smartphone APP or the cloud through the USB port, or wireless Bluetooth technology. After professional data statistical analysis, to the users receive feedback guidance

III. DESCRIPTION OF COMPONENTS USED IN PROPOSED MODEL

i. Arduino Uno:

Arduino is an open-source electronics platform, This is based on easy to use hardware and software Arduino boards are able to read input - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on a LED, publishing something online. Figure 2 shows the Arduino Uno PCB diagram. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Arduino is an electronics prototyping platform based on so flexible, easy to use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

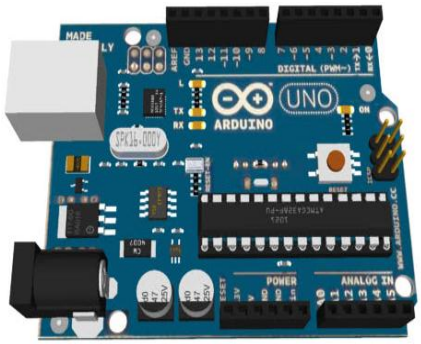

Fig. 2 Arduino Uno

ii. Temperature Sensor:

The **DS18B20** is a 1-wire programmable Temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The constriction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from **-55°C to +125°** with a decent accuracy of **±5°C**. Each sensor has a unique address and requires only one pin of the MCU to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.

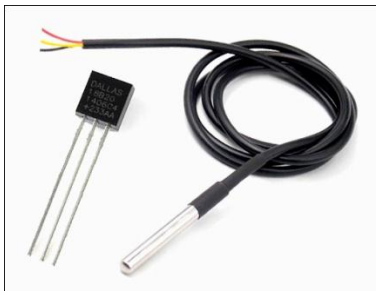

Fig. 3 Temperature Sensor

The working principle of this DS18B20 temperature sensor is like a temperature sensor. The resolution of this sensor ranges from 9-bits to 12-bits. But the default resolution which is used to power-up is 12-bit. This sensor gets power within a low-power inactive condition. The temperature measurement, as well as the conversion of A-to-D, can be done with a

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convert-T command. The resulting temperature information can be stored within the 2-byte register in the sensor, and after that, this sensor returns to its inactive state.

iii. Pulse Sensor:

Heart Rate data can be used in many Electronic design and microcontroller projects. But the heart rate data is difficult to read, however the Pulse Sensor Amped help us to read heart rate. The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings

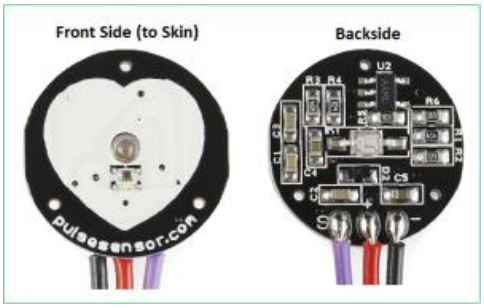

Fig. 4 Pulse Sensor (Sen-11574)

iv. Accelerometer:

An accelerometer is an electromechanical device that will measure acceleration force. It shows acceleration, only due to cause of gravity i.e. g force. It measures acceleration in g unit.

ADXL345 module

- The ADXL345 gives complete 3-axis acceleration measurement.
- This module measures acceleration within range ±3 g in the x, y and z axis.
- The output signals of this module are analog voltages that are proportional to the acceleration.
- It contains a polysilicon surface-micro machined sensor and signal conditioning circuitry.

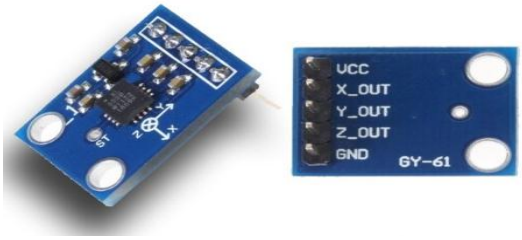

Fig. 5 Accelerometer (ADXL345 module)

v. GPS AND GSM:

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module. Thanks to the data backup battery, the module can save the data when the main power is shut down accidentally. Its 3mm mounting holes can ensure easy assembly on your aircraft, which thus can fly steadily at a fixed position, return to Home automatically, and automatic waypoint flying, etc. Or you can apply it on your smart robot car for automatic returning or heading to a certain destination, making it a real "smart" bot!

Fig.6.1 GPS (Neo 6M)

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GSM (sim900A)

The **SIM900A** is a readily available **GSM/GPRS module**, used in many mobile phones and PDA. The module can also be used for developing IOT (Internet of Things) and Embedded Applications. SIM900A is a dual-band GSM/GPRS engine that works on frequencies EGSM 900MHz and DCS 1800MHz. SIM900A features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4

Fig 6.2 GSM (SIM 900A)

1) Applications
   - Cellular Communication
   - Robotics
   - Mobile Phone Accessories
   - Servers
   - Computer Peripherals
   - Automobile

vi. Wi-Fi -Module (Node MCU):

NodeMCU is a low-cost open source IoT platform.

NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT product. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lua scripting language.

Fig.7 Node MCU

vii. Piezo Electric Sensor:

A **piezoelectric sensor** is a device that uses the piezoelectric effect to measure changes in **pressure**, acceleration, temperature, strain, or force by converting them to an electrical charge.

Fig.8 shock sensor

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The prefix piezo is Greek for press or squeeze. The ability of piezoelectric material to convert mechanical stress into electrical charge is called a piezoelectric effect. Generated piezoelectricity is proportional to the pressure applied to solid piezoelectric crystal materials. Two main sensing materials used for piezoelectric sensors are piezoelectric ceramics (such as PZT ceramic) and single-crystal materials (such as quartz). The sensitivity of ceramic materials is higher than that of natural single-crystal materials, but their high sensitivity degrades over time.

IV. OPERATION AND WORKING

As show in the figure 9, various sensors like accelerometer, gyro sensor, pulse sensor, temperature sensor, shock sensor etc are connected to the Arduino Board, through which we are able to monitor the health condition of the person.

Interfacing of node mcu with Arduino board:

- HTTP (Hypertext Transfer Protocol) is a standard Application protocol which functions as request-response protocol between client and server.
- HTTP client helps sending HTTP requests and receiving HTTP responses from HTTP server.
- It is widely used in IoT based embedded applications like Home Automation, vehicle engine parameter monitoring remotely for analysis, etc.
- NodeMCU is an open source IoT platform. It is a firmware which runs on ESP8266 Wi-Fi SoC. It has on board Wi-Fi available through which IoT applications becomes easy to build.

Here, we are using blynk app for HTTP Client demo purpose.

Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, and it can store data, visualize it and do many other cool things.

Pulse sensor wires connections to the Arduino UNO:

When a heartbeat occurs blood is pumped through the human body and gets squeezed into the capillary tissues. Consequently, the volume of these capillary tissues increases. But in between the two consecutive heartbeats this volume inside capillary tissues decreases. This change in volume between the heartbeats affects the amount of light that will transmit through these tissues. This can be measured with the help of microcontroller. The pulse sensor module has a light which helps in measuring the pulse rate. This pulse can be then conditioned to measure heartbeat and then programmed accordingly to read as heartbeat count using Arduino.

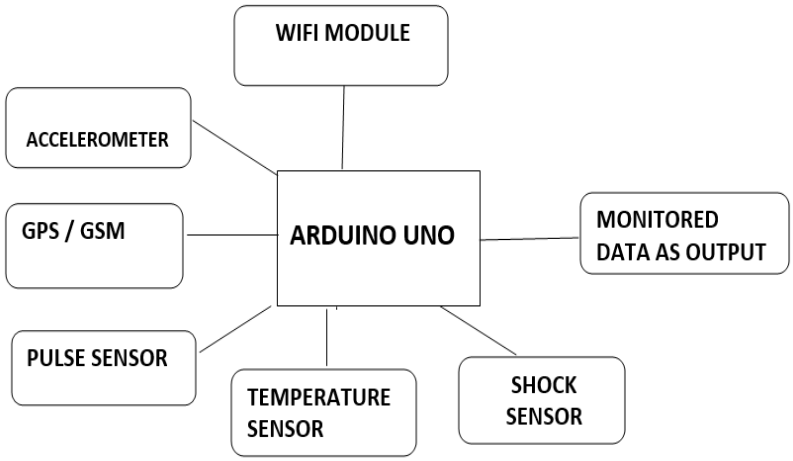

Fig.9 Shows the block diagram

The device aims at accident detection and alert system. The system consists of two modules namely an accelerometer cum gyroscope and GPS (Global Positioning System) cum GSM (Global system for Mobile) module with a piezo electric sensor. The gyroscope keeps on checking if the tilt of the person is greater than 60°. Similarly, accelerometer checks whether there is any deceleration occurrence of greater than 3 m/s^2; along with these two modules, the piezo electric sensor monitors if there is any excess force exerted on the, if it is so, then the system confirms that crash has occurred. At this instance, the GSM module present in the system, retrieves the vehicle location from the GPS module and sends it to the emergency contact which is initially saved in the GSM module. Then using Google API, nearby hospital can be routed and alerted for fast medical help. The outstanding feature of the device is that all this is done without actually using gsm or gps module. This is done with the help of IFTT. So the device is compact and cost efficient.

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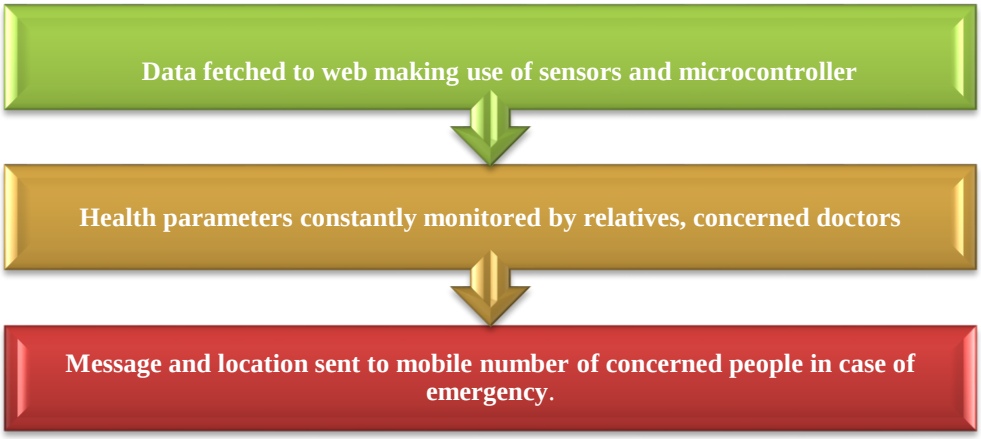

V. FEATURES OF PROPOSED MODEL

- Data can regularly be monitored
- No need to visit doctors on regular basis
- Message can be sent to mobile in case of emergency
- Fast response.
- Efficient and low-cost design.
- Low power consumption

VI. CONCLUSION

In this paper, we proposed a quality characteristic based evaluation method for wearable devices. The project "Smart Wearable Device" is a device aimed for senior citizens and health patients. The data from various sensors such as body temperature sensor, pulse oxymeter, accelerometers are fed to microcontroller and is fetched to the web which can easily be accessed using IoT. This provides a constant health monitoring solution.

VII. ACKNOWLEDGEMENT

Before we get into thick of things, I would like to add few heartfelt words for the people who are part of our team as they have been unending contribution right from the start of construction of the project. Apart from the team, I can indebt to the number of persons who has provided helpful and contributed guidance in the draft of material. I acknowledge with deep sense of gratitude towards the encouragement in the form of substantial assistance provided each member of my team. I would like to extend my sincere thanks to our guide **Prof. Praveen Chaurasia**, Project coordinator **Prof. Ram Sewak Singh** & Head of Department of Electronics & Communication **Prof. R.P.S Chauhan**.

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