Smart Social Distancing Band

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Abstract: COVID-19 or Coronavirus disease-2019 is a contagious disease, which was first identified in Wuhan, China, in December 2019, and is prevalent all over the world and has tremendous impact on our lifestyles. Ever since social distancing is known to be the best practice to stop spreading of the virus. In order to interrupt or slow down the incidence and duration of disease spread in a population, physical distance between people in crowded places is the need of the hour to control the spread of the virus and to prevent further contamination. This ultimately leads to a reduction in disease transmission, morbidity, and mortality. We have developed a solution to address this issue by combining a smart band feature with a motion sensor to create a multifunctional system that can measure pulse rate and identify people in close vicinity. We used an Arduino UNO, a pulse rate sensor to measure pulse rate, a PIR sensor to detect motion, and an OLED module to interactively monitor pulse rate. The approach used yields precise results, and the sensor is calibrated to match with the physical distance that must be followed (2 hands length or 6 feet distance). Finally, the results are reported.

KEYWORDS: Social Distancing, Arduino Uno, Pulse Rate Sensor, PIR Sensor, OLED, Smart Ban

DOI of the Article: https://doi.org/10.46501/IJMTST0706019

Available online at: http://www.ijmtst.com/vol7issue06.html

As per UGC guidelines an electronic bar code is provided to seure your paper

To Cite this Article: Evani Sai Krishna Karthik; Potu Teja; Vaggu Sridhar and B. Priyanka. Smart Social Distancing Band. *International Journal for Modern Trends in Sceicen and Technology* 2021, *7*, 0706111, pp. 105-110. https://doi.org/10.46501/IJMTST0706019

Article Info. Received: 9 May 2021; Accepted: 2 June 2021; Published: 11 June 2021

INTRODUCTION

In the COVID-19 period, where there is pandemic situation everywhere, and according to the World Health Organization, Social Distancing is a better solution to tackle the situation. Social distancing is nothing but maintaining physical distance between people who are other than households. According to World Health Organization guidelines, we must maintain at least 6 feet physical distance with people other than households. For many people, social distancing has become a way of life since the COVID-19 outbreak. To contain the COVID-19 pandemic, it is frequently stressed the importance of maintaining a safe distance between people.

Related Work

The main paper referred is about the Motion Detection using PIR Sensor. Here the author tried to wirelessly control the lights and fans in a room using radio frequency transmission modules based on changes in temperature detecting human motion. So, he correlated his project to that of an Auto Power Switching System where the signal to control the power is wirelessly carried so that problems arising from wire broken can be overcome. Whenever the PIR sensor is triggered, it means there is some human motion around it and thus the lights and fans turn on upon receiving wireless instructions. And for this they have used Programmable Interface Controller (PIC) which is cheap and easier to program.

In the next paper referred, titled as "Novel Economical Social Distancing Smart Device for COVID 19", the author proposed an innovative method to trace humans' position when they are in outdoors. It especially emphasises on the usage of artificial intelligence techniques for maintaining Social Distancing and detecting COVID positive patients if any, nearby. The model is elaborated and the conjectural outcomes are published.

Next reference is a paper titled as "Health at hand: A systematic review of Smart Watch uses for health and wellness". As a result, the aim of this organized exploration is to classify the use of Smart Watch devices in health-related research and also to identify method-oriented problems related to their usage in our lives.

The following parts make up the remnant of the paper : Describing the strategy of search and data abstraction process, describing the research emphasis, smart watch device types, sensor-based methods, focusing on the most important findings and shortcomings and also the possible future paths.

The final paper referred is "A Comprehensive Survey of Enabling and Emerging Technologies for Social Distancing – Part 1: Fundamentals and Enabling Technologies ". Here, a detailed context on social distancing is provided in part 1, including basic principles, dimensions and models, as well as a variety of social distancing scenarios. We then go through enabling wireless technologies that are useful in social distancing, such as symptom prediction, quarantine detection and tracking, and communication tracing.

Organization

The rest of the paper is organized in the following order. Working of the system is described in Section 2. Required Software and Hardware components are elaborated in Section 3. We have Results following in Section 4 followed by Future Work in Section 5. Finally, Section 7 is the conclusion for the paper.

WORKING

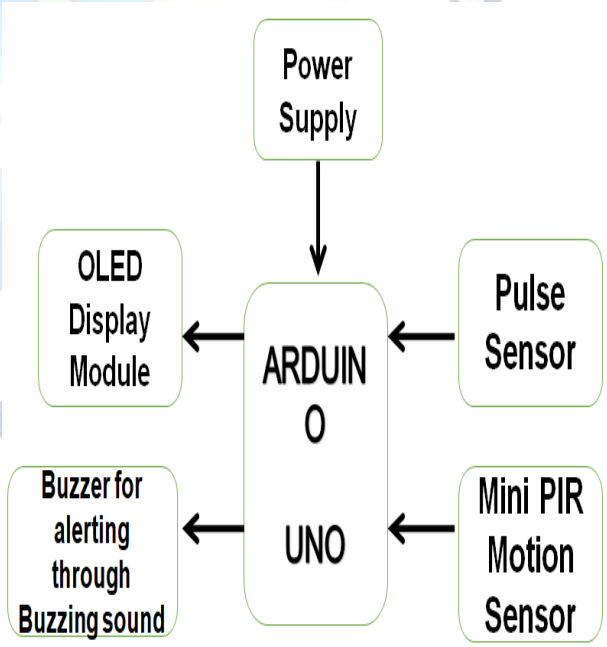

Fig. 1 Block Diagram of Working System

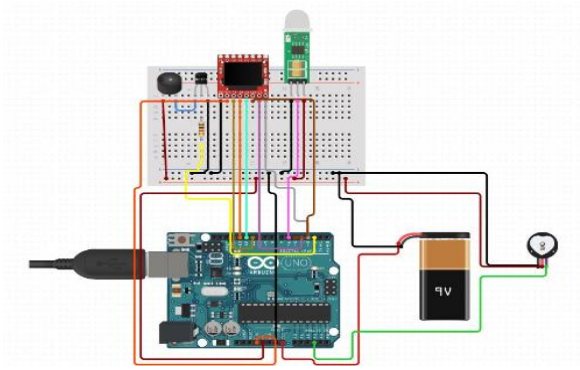

Fig. 2 Circuit Diagram

The Arduino Uno is connected to the Sensors which receives relevant information of the user from the sensor upon using them.

Once we put our finger on pulse rate sensor the OLED module will display the pulse rate as follows: “BPM : <calculated_value>”. After thoroughly studying about the alternatives of Motion Detecting Sensors, we felt that this Mini PIR Motion Sensor perfectly fits into our window. PIR detects if any person comes into the immediate vicinity of the user and acts accordingly by giving a continuous buzzer sound as an alert until the Social Distancing is properly maintained.

SOFTWARE AND HARDWARE DESCRIPTION

Arduino IDE and Arduino Uno

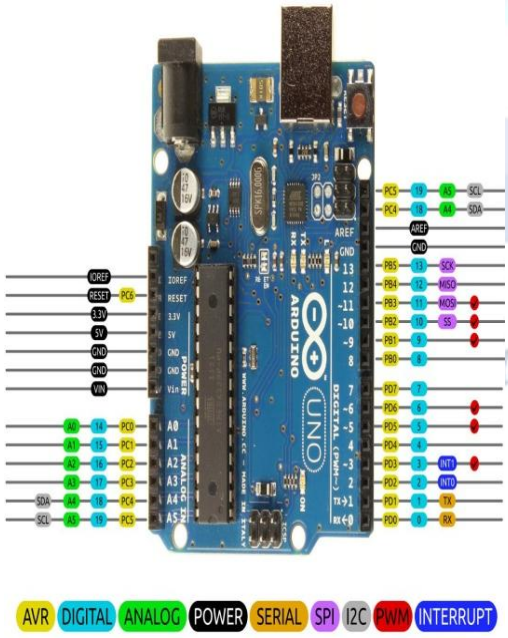

Fig. 3 Arduino Uno

The software used to program Arduino is known as the Arduino Integrated Development Environment in short known as the Arduino IDE. It is an open-source software available on the internet and can be downloaded and used by anyone anywhere free of cost. The software is very simple and easy to use even for a layman. The IDE is used to transfer the software code into the Arduino board as machine-level instructions to perform the intended action by the Arduino board after connecting all the required sensors and devices.

The Arduino Ide sends an instruction set to the Arduino board’s microcontroller which tells the board to what action to perform. This is done by the usage of programming language in Arduino. The Arduino IDE supports a wide range of languages like from basic C programming language to Object oriented languages like the Java and Python.

The Arduino contains a microcontroller mounted on the board, which is responsible for carrying out the instructions in your program. The ATmega328 microcontroller is the brain of the Uno Arduino R3. ATmega 32*8 is a microcontroller of 8-bit from the AVR family. Its internal registers and data-bus architecture are designed to accommodate eight concurrent data signals. In this case, we're looking at a DIP-28 kit.

Passive Infrared Motion Sensor (PIR)

Over many alternatives that we found for Motion Detection we could finalize this particular sensor as this seems to be the best fit for our purpose. Same is the case of OLED Display Module and Pulse Sensor after considering all possible essential aspects of a sensor. Now coming back to PIR, Passive Infrared sensors senses a movement and are frequently used to assess whether or not a human has come in or departed in the range of a sensor. The sensor’s weight is very less and it is inexpensive, consumes less power and is easy to use, and do not wear out. So, they're often found in household and commercial appliances and devices. These sensors are also called as "Passive Infrared," "Pyroelectric," or "IR motion" sensors.

A PIR sensor (pictured below) detects infrared radiation levels in passive infrared sensors. Everything emits some low-level radiation, and the hotter something is, the more radiation it emits. The sensor of a motion detector is separated into two sections. This is due to the fact that humans prefer to detect motion, more than the average Infrared values. The two sections are connected such that they balance each other out. If

one part receives more or less IR radiation than the other, the performance will swing high or low.

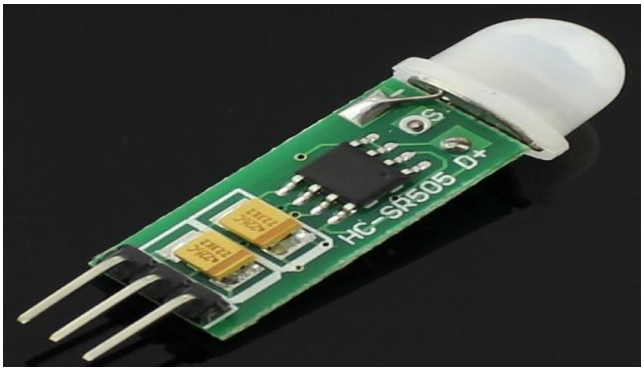

Fig. 4 Mini PIR Motion Sensor

OLED Display Module

SSD1306 is a single chip CMOS based powerful controller which drives OLEDs and is considered the heart of the module. We can interact in both SPI and I2C communication. Since it generates its own light, an OLED display does not need a backlight. This explains the display's good brightness better viewing angles, and ability to display deep black levels. The lack of a backlight decreases the amount of power needed to operate the OLED. The SSD1306 controller's operating voltage ranges from 1.65V to 3.3V, while an OLED panel needs a supply voltage of 7V to 15V. Internal charge pump circuitry meets all of these various power specifications. This allows it to be conveniently connected to an Arduino or any other 5V logic microcontroller. Adafruit's SSD1306 library is used to mask SSD1306 controller's difficulties so that we can monitor the display with simple commands. This Adafruit SSD1306 library performs lower-level functions and is hardware-specific. To view graphics primitives such as points, lines, circles, and rectangles, it must be used in conjunction with the Adafruit GFX Library. This library should also be mounted.

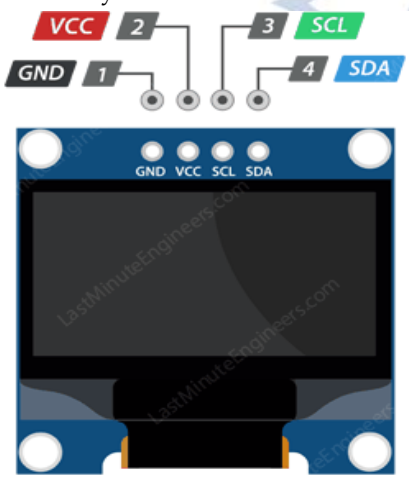

Fig. 5 OLED Display Module

Pulse Sensor

Knowing the heartbeat rate is extremely useful when exercising, training, and so on. However, calculating the heartbeat rate can be difficult. The pulse sensor, also known as a heartbeat sensor, is used to solve this issue. This is an Arduino-compatible plug-and-play sensor that can be used by makers, students, developers, and artists to incorporate heartbeat data into their projects. To make a circuit, this sensor uses a simple optical pulse sensor, as well as amplification and noise cancellation. The finger is placed on the LED such that the light spreads on the vein of a person, but the placement should be perfect as it allows light to spread more. When the led is positioned on the vein, it begins emitting light. The veins allow flow of blood until the heartbeat starts. As a result, the heartbeat can be measured with the help of blood flow.

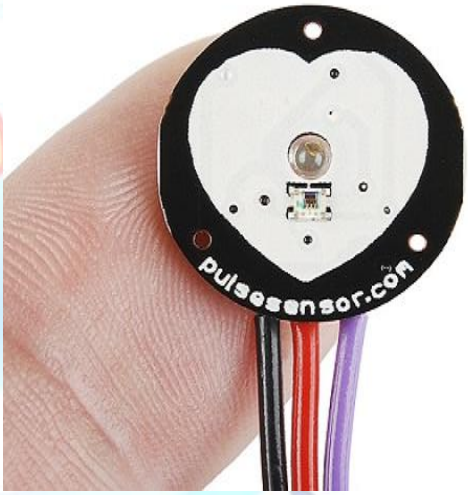

Fig. 6 Pulse Sensor

Buzzer

A device called buzzer is tiny in its look but it is a very important aspect of the project as it produces the most important audio aspect to the project. The size of the buzzer used is so small that it can be fit onto a small breadboard perfectly and it is a very good choice for the projects which includes audio effect, like the one used in the social distancing project. In the market, there are 2 kinds of buzzers available for practical usage and for the purpose of development projects. The one we used is a very simple one, which is used to produce the beep sound continuously. The sound is generated due to the presence of an oscillatory circuit.

The buzzing device, buzzer is very simple to use as it has only 2 pins, we can connect them directly to a dc battery or a power supply to get the sound out of it. The voltage required to make the buzzer working is 5-6

volts. In most of the cases, the buzzer is connected to a switching type of circuit, so that it can be made on or off depending on the requirement.

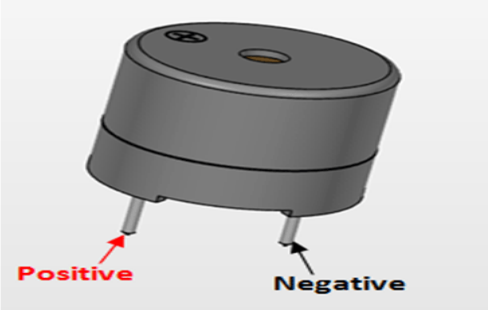

Fig. 7 Buzzer Pin Out

RESULTS

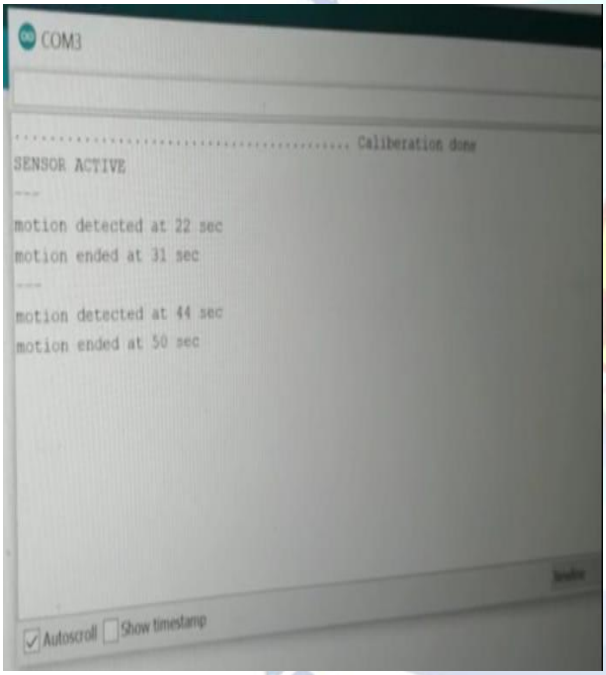

Fig. 8Result in the software (ARDUINO IDE)

Fig. 9Result on the OLED display (BPM through Pulse Count is Displayed)

It is evident from both the images above that after calibration of the PIR Motion Sensor, motion is detected and ended at certain intervals which are displayed next to it on the Serial Monitor of the Arduino IDE. To alert the user we have kept a buzzer that tones during that interval. Similarly BPM is recorded when a user places his finger on the sensor and thus his/her BPM is displayed on the OLED Display space.

FUTURE SCOPE

Thescope of our project in future includes integrating the current band with other useful sensors and reducing its size to an actual smart band size. The sensors we would like to integrate for a more advanced band are pulse oxy sensor - MAX30100, Bluetooth module – HC-05, GPS module and activity tracking sensors. These sensors and modules are useful to collect data and process them to give useful results to understand health of the user. The data we collect through the sensors will be sent to smartphones using Bluetooth module and by using some advanced machine learning and deep learning models we can understand the anomalies in health and by using GPS module we can implement contact tracing, find the probability of virus infection.

CONCLUSION

This paper was aimed to propose a multi-purpose smart social distancing band. The key to stay safe is to maintain social distance until this is all over. As technology is advancing, we need to use it in a proper way to make the most out of it. The idea of using a smart band to maintain social distancing has its own advantages and disadvantages but the main perk of using it is we can avoid a significant amount of risk of infection with a single wearable. In this report, we have presented a way to maintain social distancing by alerting the person by detecting close contact of people around by using PIR sensor and sending feedback through a buzzer. We also integrated pulse sensor and an OLED module for checking pulse and displaying it on the OLED module in an interactive way. Checking pulse frequently can detect any anomalies in the pulse rate and can give an opportunity to act well before anything happens. We have also stated about how improved version of our project helps to provide contact tracing and other important information.

ACKNOWLEDGMENT

Firstly, we are grateful to Sreenidhi Institute of Science and Technology for giving us the opportunity to work on this project. We are fortunate to have worked under the supervision of our guide Mrs. B. Priyanka. Her guidance and suggestions helped us a lot in this work. We are also thankful to Dr. Syed Jahangir Badashah for being the In Charge and Coordinator for this project and its reviews. We are also thankful to the HOD of Electronics and Communication Engineering [ECE], Dr. S. P. V. Subba Rao for giving permission and access to all the resources whatever needed in building this project.

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