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IOT BASED SOCIAL DISTANCE MONITORING

[1]R. Kanmani,
Assistant Professor ECE, Sri Ramakrishna Institute of Technology, Coimbatore, India.

[2]S. Gowtham,
ECE, Sri Ramakrishna Institute of Technology, Coimbatore, Tamil Nadu, India.

[3]B. Harish Nandhan,
ECE, Sri Ramakrishna Institute of Technology, Coimbatore, Tamil Nadu, India.

[4]V. Kishore Kumar,
ECE, Sri Ramakrishna Institute of Technology, Coimbatore, Tamil Nadu, India.

Abstract - Social distancing plays a vital role in preventing the spread of viral diseases such as COVID-19.In this work, IoT based social distance monitoring systemwhich can be integrated with Passive Infrared sensor (PIRsensor) is proposed. This smart device is handy for maintaining social distancing and thereby the public safety. This device will be useful for law enforcing agencies, authorities or managers of public premises wherepublic crowds. It will also be useful for individuals in order to alert them if someone is close around. Use of Wi-Fi eradicates the need of wired connection and thus improves the utility of the system. In this case the Wi-Fi module (ESP 8266), acts as a gateway to connect the sensors to the Blynk server and those application can be monitored remotely through the Blynk mobile app. The method is reasonably accurate and can be very useful in maintaining social distance.

Keywords: PIR Sensor, Arduino, IOT, Wi-Fi.

1. INTRODUCTION

COVID-19 belongs to a big family of viruses that normally causes moderate to mild upper-respiratory tract ailments. It was first reported in Wuhan, China, at the end of December 2019. The World Health Organization (WHO) has declared COVID-19 as a pandemic, and a global coordinated effort is required to stop the spread of the virus. The transmission of COVID-19 remains unclear, though evidence from other viruses indicates that the disease may spread through direct or indirect contact with an infected person.

During the ongoing COVID-19 disaster, the Internet of Things (IoT) has played a significant role in a diverse range of healthcare applications. In general, IoT networks consist of a number of small-size, low-cost, and low-power consumption devices that can be attached to any person or be embedded in any object. Social distancing is critical for people who are at a higher risk for severe illness from COVID-19.

Social distancing is the maintenance of a safe distance of at least 1 m from other people in indoor and outdoor spaces to minimize the spread of the virus. It also limits close contact with others in outdoor and indoor spaces, as people can spread the virus before they know that they are sick.

Recently, social distancing was proven to be an effective practice to minimize the spreading of COVID-19. Therefore, social distancing has prompted researchers and developers to find technological solutions in order to fight against the spread of the COVID-19 virus. Several mobile applications and IoT devices have been developed recently to work against the spread of COVID-19.

Due to the nature of the virus and the high spread rate, either indoor or outdoor, when human contact exceeds the predefined social distance space, this work presents a system that will assure and 1 monitor the social distance between individuals during runtime with an accuracy of 98% using a smart localization system. The proposed system has been evaluated through several experimental studies[1].

This experiment followed a number of steps, including the technological aspect of building the system (hardware and software), starting with face detection techniques, then gathering and sending information to access points to alert for crowing in the specific area, which include a number of functions to evaluate the spaces and identify whether this obstacle is a person or something else.

In addition, the proposed system was experimentally studied to test the functionality and usability of the proposed device. Usability studies take into account user acceptance, user comfortability, and device operation. The results showed a high acceptance rate of

(96%) and a high ease of use rate of (93.3%), whereas the functional and hardware operation of the device were at a very acceptable level 94% of the time[2].

2. LITERATURE SURVEY

Since the onset of the coronavirus epidemic, many countries have used technology-based solutions to prevent the spread of the disease. A brief literature review on some papers are given below.

[1] M. Cristani, ADBLue, V. Murino, F. Setti and A. Vinciarelli, "TheVisual Social Distancing Problem," in IEEE Access, vol. 8, pp. 126876-126886, 2020, doi: 10.1109/ACCESS.2020.3008370 M.Christani (2020) evaluated a virtual social distancing model that helpspeople to maintain public places.

They represent four types of vacancy called intimate space, personal space, social space, and public spacing. Based on the distance measurement rule, spaces are measured. The process deals with visual understanding and geometric measurements, homography estimation, metric reference and density estimation, etc. Secondary analysis involves the detection of two-dimensional people and social distance monitoring of multiple angles and face mask detection using deep neural network detection

[2]. L Shi, Z Wan, X Xiong et al., "The Application of Ultrasonic Flaw Detection Technology in the Hydraulic Cylinder Production Process [J]", als, psp. 220-223, 2012 L. Shi (2012) discusses ultrasonic nondestructive testing methods applied in the hydraulic cylinder production process; Cylinder represents the detection of defects of the raw material of the barrel.

With the principle of ultrasonic thickness such as 10 bubbles, cracks, impurities and tests of steel tube thickness; Introduces the method of selecting raw materials through measured thicknesses, detects the defects within the machine process and applies initial qualification tests to the assembled hydraulic cylinders. M.Matsumoto (2017) used to develop a human detection model, an hardware based that approach in which distance measurement using sound wave sensors is used. The distance between the citizenry decided through the variation within the sound waves accumulated to make a distance variable.

[3]. Xin Jin, Soumalya Sarkar, Asok Ray, Shalabh Gupta and Thyagaraju Damarla, "Target Detection and Classification Using Seismic and PIR Sensors", IEEE Sensors Journal, vol. 12, no. 6, JUNE 2012 The signal strength determines the variation within the distance. Normally the signal strength is decided using RSSI (received signal strength value).

The system also tracks the position of the humans with reference to the received value of RSSI. Tsai (2017) defines a system for measuring the temperature through monitoring the radiation of the object in the infrared spectrum. The temperature difference of an object is observed by a long term on a computer is done by Lab View software, using a measuring device passing through a knowledge acquisition interface.

[4]. N. Komninos, E. Philippou and A. Pitsillides, "Survey in Smart Grid and Smart Home Security: vol. 16, no. 4,pp.1933-1954, 2014. This work is about motion sensors and sending the message via IOT. They made the smart home using the Arduino and pir motion sensor the above project was created.

[5]. Who.Int (2020) Mental Health and Psychosocial Considerations During The COVID-19 Outbreak. https://www.who.int/publications/i/item/WHO-2019-nCoV MentalHealth-2020.1. Accessed 30 Apr 2020. According to the Center for Disease Control and Prevention, the Social distancing term is very extensive.

The extensiveness of social distancing is in terms of closing of schools and workplaces, isolation, restricting the movement of people, and the cancellation of mass gatherings.

3. PROPOSED METHOD

In the proposed technique, preventive measures to break the chain of transmission in the vicinity are a prime consideration. In the methodology of maintaining social distancing, the wristband with PIR sensors is proposed. The wristband helps in maintaining 1.5-m distancing and warns. It includes Ultrasonic sensor, PIR sensor, Arduino UNO and LED. We have developed code in Arduino.

Each and every part is explained. PIR sensors are more complicated than many of the other sensors explained in these tutorials (like photocells, FSRs and tilt switches) because there are multiple variables that affect the sensor's input and output.

To begin explaining how a basic sensor works, we'll use this rather nice diagram The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR.

The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors.

When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

Ultrasonic sensors are used to detect the presence of any target and to measure the distance to the target in many robotized processing plants and process plants. This sensor regularly emits a short burst of ultrasonic sound. If the ultrasonic sound hits the object or the person it returns to the echo portion of the sensor and hence the object or the person is detected. Ultrasonic sensors are a great solution for the detection of clear objects.

For liquid level measurement, applications that use infrared sensors, for instance, struggle with this particular use case because of target translucence. For presence detection, ultrasonic sensors detect objects regardless of the color, surface, or material (unless the material is very soft like wool, as it would absorb sound.) To detect transparent and other items where optical technologies may fail, ultrasonic sensors are a reliable choice.

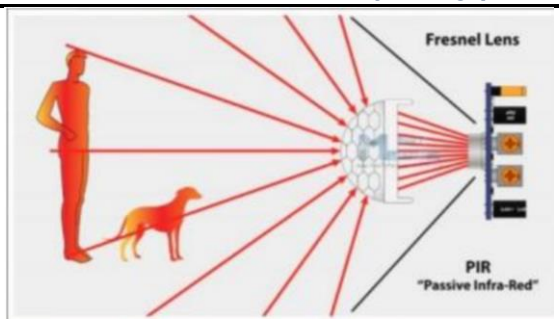

Fig 1-A Burglar Alarm Based on PIR Sensor With SMS Alert Using 8051

grayscale image is calculated by the cumulative sum of a corresponding input pixel with all pixels above and to the left of the input pixel. Calculation of average intensity of any rectangular portion of an image will be calculated with the help of only four pixels at a time.

The extracted faces are sent to LBPH classifier LBPH comprises of following steps

1. Training the dataset - First we have to train our dataset which is the input of our algorithm. Dataset contains Images of human faces that who has to cast their vote. Each face in the dataset is assigned with a unique id. Same face must have same id. This process is done in advance with the dataset
2. Create Intermediate image –it is the main starting step of this algorithm. Intermediate image is created which Describes all important facial features of original image. this is done using a sliding window, based on the Parameters such as radius and neighbors.
3. Extracting the Histograms – the output of the second step which is generated image is used to divide the image into multiples grids.
4. Extraction of Histogram- now we can extract the histogram of every region as follows
5. Comparison is made between histogram of input image and Histogram stored in database.

3.1 Hardware

The Hardware Platform that has been used here are

- **Arduino Board:**

Arduino/Genuino Uno is a microcontroller board 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 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 a 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.

Fig 2-Arduino Board

- **PIR Motion Sensor:**

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.

PIR sensors are commonly used in security alarms and automatic lighting applications. PIR sensors detect general movement, but do not give information on who or what moved. For that purpose, an imaging IR sensor is required. PIR sensors are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector".

The term passive refers to the fact that PIR devices do not radiate energy for detection purposes. They work entirely by detecting infrared radiation (radiant heat) emitted by or reflected from objects.

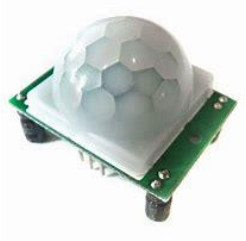

Fig 3- PIR Motion Sensor

- **Ultrasonic Sensor**

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear).

Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). 25 In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver.

Fig 4- Ultrasonic Sensor

3.2 Software

This project uses the C++ programming language, which is a high-level programming language and it is the most efficient language for Arduino programming. In the default Arduino IDE one can only use the C++ programming language.

- **C++ PROGRAMMING**

C++ is a highly portable language and is often the language of selection for multidevice, multi-platform app development. C++ is an object-oriented programming language and includes concepts like classes, inheritance, polymorphism, data abstraction, and encapsulation which allow code reusability and makes programs very maintainable. C++ uses multi-paradigm programming.

The Paradigm means the style of programming paradigm concerned about logic, structure, and procedure of the program. C++ is multi-paradigm meaning it follows three paradigm Generic, Imperative, Object Oriented. It is useful for the low-level programming language and very efficient for general-purpose.

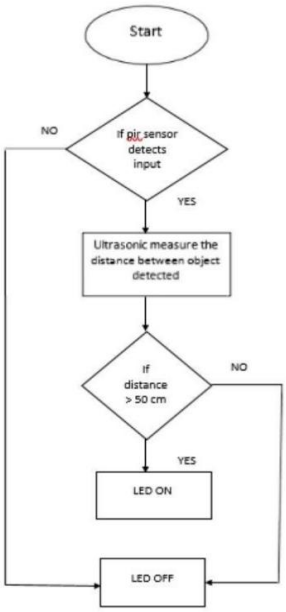

Fig 5-Flowchart

3.3 Operation

A PIR sensor can detect changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor.[2] When an object, such as a person, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again.

The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection. Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well.[3]

PIRs come in many configurations for a wide variety of applications. The most common models have numerous Fresnel lenses or mirror segments, an effective range of about 10 meters (30 feet), and a field of view less than 180°. Models with wider fields of view, including 360°, are available, typically designed to mount on a ceiling. Some larger PIRs are made with single segment mirrors and can sense changes in infrared energy over 30 meters (100 feet) from the PIR.

There are also PIRs designed with reversible orientation mirrors which allow either broad coverage (110° wide) or very narrow "curtain" coverage, or with individually selectable segments to "shape" the coverage.

4. RESULTS AND DISCUSSION

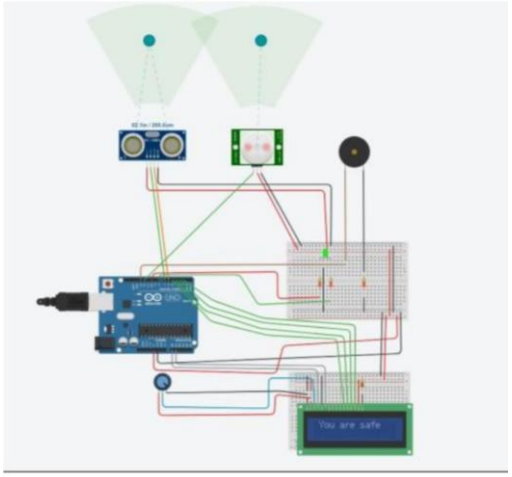

Fig 6- Detection process 1

As shown in fig 6 here in the Detection process 1 we have used Arduino uno board works as central processing unit and ultrasonic sensor to detect the person and we have used PIR motion sensor to calculate the distance and lcd display to display the status and indicates that “You are safe”.

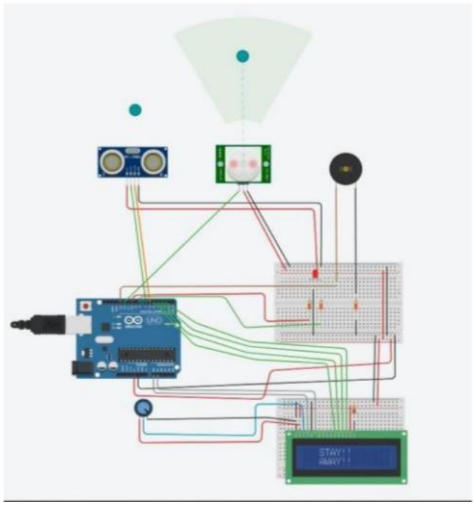

Fig 7- Detection process 2

As shown in fig7 here in the Detection process 2 we have used Arduino uno board works as central processing unit and ultrasonic sensor to detect the person and we have used PIR motion sensor to calculate the distance and lcd display to display the status and indicates that “STAY!! AWAY!!”.

5.CONCLUSION

This project objective is to design an IOT based smart device which helps in maintaining social distance. The proposed device was developed and tested.

This device alerts on violation of social distancing norms on all sides. This device is made as a wearable band which can be worn when the person is in a public place. When someone comes near the person, the sensor detects and sends a signal to the microcontroller. When the microcontroller receives a signal, it gives an alert through an LED or a buzzer. Simultaneously, the controller sends a notification to the Blynk application through Wi-Fi. The information is sent through mail through the Blynk application which can be accessed later as reference.

This device helps in maintaining social distance and thereby people's safety. Consequently, the impact of these types of disease including the infection, and hospitalization, and death rate can be significantly reduced.

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