

CROWD MANAGER : A Solution for Covid 19 Community Spread

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Abstract - Corona, the pandemic is killing the world like a “war”. The best antidote to block the spreading of this disease is “practice social distancing”. We being a social gene, are used to being in a social attachment and physical nearness in greetings and in love, respect, and gratitude. We, knowingly or unknowingly follow these habits and it continues throughout our lifespan. But, in these days, we have to be deliberate in changing our habit and “keep distance”. We skip social distancing because it has developed into a habit; mostly kids, elderly and specially challenged people are the ones who are more prone to this disease. This pandemic not only affects them physically, but also mentally. In order to imbibe the significance of social distancing, we have proposed a device that can ensure safe social distancing among the common people. In addition, its installation can even cut the cost of fuel and even save time. The device can be used shopping centres, hospitals, institutions, banks, airports, hotel, public toilets, conference halls and even in homes. Installation of the device consciously reminds one to follow social distancing wherever they go and thus ensure a healthy living.

Keywords: Corona, Covid19, pandemic, social gene, keep distance, social distancing, community spread

I. INTRODUCTION

In December 2019, a deadly virus spread across China, later taking a toll on billions of lives across the world. Initially, the virus was named as severe acute respiratory syndrome (SARS CoV-2). Later, WHO named it as COVID-19. Certain studies found that the virus has evolved into two strains L and S[1]. The visible symptoms of covid-19 include cough, shortness of breath, fever, chills, muscle pains, sore throat and loss of taste and smell. Another of its critical symptoms include increased heart rate and lower oxygen saturation level in blood[2]. Covid-19 can be diagnosed by conducting various radiology based tests and even by digital photography and CT scan. But, all these can

prove detrimental to the health of radiologists, technologists and doctors[3][4].

As of now, there are no specific drugs. But, drugs like chloroquine, hydroxychloroquine, lopinavir/ritonavir, remdesivir, favipiravir are given on a test basis[5]. Even therapies like plasma therapy are being executed, but with lesser success rates. So, according to WHO, a strategy to overcome this pandemic scenario is to ensure decrement in transmission rate alongside controlling the mortality rate as well. But, different countries are in different pages of economic growth. So, they may have to strive hard to achieve the goal. According to WHO, a covid positive patient must be subjected to isolation and proper treatment. But, we are aware that prevention is better than cure. Hence, certain precautionary measures have been adopted. One among it is lockdown. It can prevent the prevalent spread of this pandemic. Since the lockdown has brought up its flip side on the economic status of a country, the lockdown has been lifted. Thus, as a successive measure, it becomes our obligation to take care of our health by adopting social distancing measures along with handwashing, respiratory etiquette etc[6]. Since social distancing is not a familiar measure, it becomes necessary to invent a device in order to practise it. Our device intends to measure the count of people inside and outside a premise where the device is placed, thereby managing the crowd. Even, the police officers and health authorities can monitor the crowd in and out of a building without having to visit the exact location. Thereby saving the time, cost and fuel.

II. LITERATURE REVIEW

In 2020, Jose M Cecilia et al and his colleagues discovered a technique of crowd sensing using mobile

phones. It uses 2 approaches: one of the approaches is the information obtained from social media and the other approach is information obtained from the sensors attached. It is labelled as one of the smart approaches to social distancing[7].

In 2017, Hara Prasad Tripathy et al and his colleagues discovered a zinc oxide based ultrasonic piezoelectric MEMS for testing of blood glucose levels. This method is proven to be simultaneously accurate and cheap[8].

In 2014, Abhisek Basak and his colleagues proposed an ultrasonic imaging system for continuous monitoring of internal organs. The device can be implanted into the body thereby enabling continuous monitoring of the organs. This system can help in early detection of tumors and other growth factors[9].

In 2010, Serena H Wong et al and her colleagues used capacitive micromachined ultrasonic transducers for therapeutic applications. Through the paper they proposed the design and prototype of the concentric ring. It was mainly intended to treat cancer of the upper abdominal region. First they stimulated an array of 4 elements with output power 680 W/cm^2 at 2.5Mhz. The cell designs were fabricated to be 2.5mmX2.5 mm and used as test transducers. They were found to operate at a frequency of 2.5 Mhz with an output of 16.3 W/cm^2 . Thus, a 8 element array was created[10].

In 2007, Tung Sui et al. and his colleagues introduced a micro-mechanical electrical system based micro-ultrasound transducer to increase drug uptake in cancer treatment. The effectiveness of this method compared to conventional ones was 30%-70%[11].

In 1996, JL thomas et al and his colleagues proposed an idea for transskull therapy using time reversal mirror and ultrasonic system. The time reversal mirrors are capable of sampling, time reversing and remitting the incident field. Another advantage of the time reversal method is that it corrects phase and amplitude compared to other methods. In this technique time reversal mirror is combined with a sensor to correct the abnormalities in the skull. But, this method proved to be ineffective. Therefore, amplitude modulation inversion followed by time reversal is done to make it more effective[12].

In 1989, B. Maqueira et al and her colleagues proposed usage of ultrasonic sensors for tracking of robot paths. It calculates the deviation of joints from the actual path etc. A transducer is used to track the movements of the robot. The system uses a special algorithm for this[13].

III. PROPOSED SYSTEM

Crowd manager is a social distancing alert device. It keeps track of the people entering and leaving a premise. If the number of people exceeds a certain limit it alerts them by giving signals. The device is cheap yet effective. It is composed of an ultrasonic sensor, microcontroller and a buzzer. IOT is also implemented to take advantage of it as a whole.

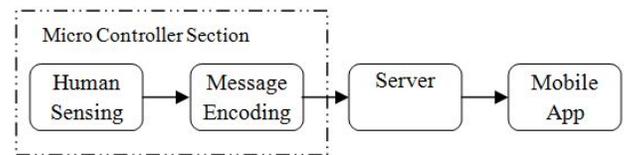


Fig 1. Block Diagram of the proposed system

IV. METHODOLOGY

This system has two parts. (i) Firmware Section and (ii) Data Management System. The firmware system mainly consists of a microcontroller and sensors. The main function of this unit is to detect and count the persons and send them to the data management system. Data management system is a server based system. It collects and stores the information from the firmware section in a standard format. This data can be used to manipulate for analysis. A mobile application with this system shows the live status of crowd management.

(i) **Firmware Section** : Firmware section fixes in the crowd manager panel to sense human movement. Different sensors can be proposed to detect these actions ie : camera , PIR, IR, LDR, LIDAR, Ultrasonic sensor . From the analysis , the Ultrasonic sensor is selected to sense the activity because of its speed , accuracy, size, ease of implementation and cost. The main function of crowd

manager is to count the humans in the bidirectional path. For this purpose , multiple sensors are used with the panel. This panel also consists of Display and buzzer for visual and buzz alert. This system also manipulates the number of persons inside the premise with entry and exit counts. A wifi module is also needed to communicate this data to the data management system. The design constraints of this wireless sensor network is based on for low cost, number of sensors, deployment, lifetime, maintenance, and quality of service[14]

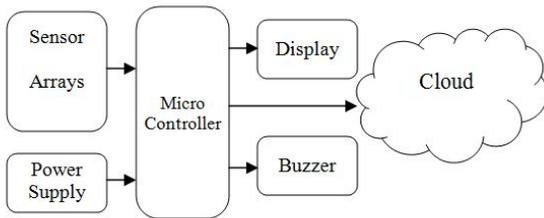


Fig 2. Firmware Section

This system needs configuration at the time of installation. A bluetooth based RTOS can be used to configure the wifi username and password. Additional settings can also be included according to the space where it is to be implemented. For the better understanding of the data management system , a data framework is adopted for communication. The data framework consists of a header, device id , count , mode , packet number and checksum code[15] .

Header	Id	count	mode	Packet	Checksum
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Table 1: Data frame work for the communication

Header : Name of the device eg: CM
 Id : Device Number eg: 1001
 count : Number of persons entered/exited eg: 2
 mode : Entry /Exit
 packet : Number of data sent to the server
 Checksum : Sum of all the values

(ii) **Data Management System** : The data management system is designed for a large number of users. The server is designed to meet performance, scalability, security,

availability, and connectivity. The server has been powered with a database to retrieve and manipulate the data for a mobile application in synchronizing manner. Internet of Things (IoT) technology with mobile application ensures real-time monitoring of the device interactions. Interaction with multiple devices results in optimum resource utilization and improved efficiency[16].

A cloud is a network for exchanging data with different systems within the device. There are 3 functions performed in an IoT, they are things that gain information and send it, things that receive information and act on it and the things that can do both these functions. In our project the network is established by use of a smartphone or a computer. IoT makes our life a lot more easier. IoT is helping the healthcare sector to make big leap in the century. Thereby, allowing patients to be monitored even at the convenience of doctors miles and miles away. Still, usage of IoT is not completely safe because it can leave users prone to hackers. Various studies are still ongoing on the security issue of IoT and several notable methods have come up.

V. IMPLEMENTATION OF THE SYSTEM

a) Ultrasonic Sensor

The ultrasonic sensor plays the role of determining the target distance by letting out ultrasonic signals. Compared to audible sound, ultrasonic waves travel faster. They convert ultrasonic signals to electrical signals. They can be used to detect position, distance, presence and level. They are independent of light, smoke, dust, colour and material. Compared to infrared sensors, ultrasonic sensors are on the higher side, because they are not affected by smoke and other black materials in it. But, on the other hand ultrasonic sensing is not applicable to the soft materials. There are 2 sensors in our device, one plays the function of detecting the count of people going inside and the other sensor detects the count of people going out.

b) ESP-32 Microcontroller

A microcontroller is a small computer embedded on a single chip[17]. It includes processor, memory, I/O chip. It controls a specific function of a system. It is cheap and easy to replace. It can function effectively in temperatures ranging from -40 degree celsius to +125 degree celsius. It can be used for the implementation of biomedical devices, medical devices and IoT based

applications. It is integrated with Wi-Fi and bluetooth through different interfaces like SPI / SDIO or I2C / UART. ESP32 has also got in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. It consists of both OLED and buzzer.

c) OLED Display

The display is OLED made. OLED refers to organic light emitting diode. They can provide precise and bright displays with lesser amount of energy compared to LED and LCD. They are composed of pixels and the output is obtained when current is applied to the anode and cathode of the system. They can be used in mobile phones, televisions etc. OLEDs are cheap with high picture quality, good power efficiency, flexibility and fast response time. The OLED displays the count of people increasing and decreasing in the premise where the system is being placed.

d) Buzzer

A buzzer is a device that gives off alert in terms of audio. Buzzer can be mechanical, electromechanical and piezoelectric. It is a very small system with two pins, hence making it useful in breadboards and different systems. There are two kinds of buzzers present here, one is the readymade buzzer and the other is the simple buzzer. The simple buzzer functions by giving off a constant alert sound whereas, readymade buzzer functions by giving off an inconstant alert sound. Buzzers are usually used in automobile electronics, communication devices, alarming circuits and portable devices.

e) Power supply

Power supply provides the necessary power required for the device to function. They are also referred to as electric power converters because they convert the source current to required values in terms of voltage, current and frequency. Some power supplies have to be separately added, while in some devices they are inbuilt.

V. RESULTS AND DISCUSSIONS

The experiment was carried out in a clinic premise. The device was placed outdoors and the count of the patients were tracked and displayed on an OLED screen. As the number of people moved inside, the count increased and further, exit of the patients caused a decrease in count. Usage of IoT also made it possible to display the count on a mobile

phone. When a limit was exceeded the buzzer gave an alert. The device was found to be very effective in increasing the awareness for social distancing among the people.



(a)



(b)

Fig 3 : (a) Sensors (b) display arranged in the panel



Fig 4 : Installation of Crowd manager in front of a Clinic



Fig 5 : Display shows the number of persons inside



Fig 6 : Mobile Application design



Fig 7: Live Testing [18]

VII. CONCLUSION AND FUTURE ENHANCEMENT

In the current scenario, it is assured that our device would definitely prove to be a boon to society, by ensuring that proper social distancing is maintained. Based on the analysis, it's certain that we can make several changes. We can incorporate additional functionalities like thermal scanning, hand sanitiser, glove dispenser, mask dispenser, distance sensing bands (social distancing) into the device. It would help the system to function more effectively.

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