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ORIGINAL ARTICLE

IOT Based secured Low-cost Visitor Tracker using smart Application

Rastreador de visitantes seguro y de bajo coste basado en IoT mediante una aplicación inteligente

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ABSTRACT

Since the end of 2019, the world has been reeling with the COVID-19 pandemic. The drastic and dramatic spread has affected human lives and livelihoods as well as businesses across the world. Organizations across the world are uniting and coming forward to minimize the seriousness of healthcare. The survival of the human community should be the top priority during this time. To control spread, respective higher authorities impose restrictions on public gatherings, with strict action taken against those who exceed the maximum allowed people in public gatherings. Our IOT-based project aims to limit the number of people entering the academic blocks during COVID-19 in order to monitor overcrowding in these buildings. Our electrical circuit or device will monitor the number of people entering the academic blocks, and once the maximum allowed number of people is reached, the next person will not be allowed to enter the building, and the electrical circuit will ring a siren. This will also ensure that social distancing is maintained. Our project is based on Arduino. Several electrical components, such as an Arduino Uno, a prototype, a breadboard, a piezo-buzzer, ultraviolet sensors, and jumper wires, were used. Software simulations were carried out in the well-known online electrical circuit compiler, Tinkercad. A hardware simulation of our project was also made.

Keywords: COVID-19; IOT; Arduino; Social Distancing; Sensor; Tinkercad.

RESUMEN

Desde finales de 2019, el mundo se tambalea por la pandemia de COVID-19. La drástica y dramática propagación ha afectado tanto la vida cotidiana como los medios de subsistencia de particulares y empresas de todo el mundo. Organizaciones mundiales se han unido para minimizar la gravedad de la atención sanitaria. La supervivencia de la humanidad debe ser la máxima prioridad en estos momentos. Para controlar la propagación, las autoridades superiores respectivas imponen restricciones a las reuniones públicas, y se toman medidas estrictas contra quienes superan el máximo de personas permitidas en las mismas. Nuestro proyecto basado en la IoT pretende limitar el número de personas que entran en edificios académicos durante COVID-19 con el fin de controlar el hacinamiento en dichos lugares. Nuestro dispositivo eléctrico controlará el número de personas que entran en los edificios institucionales y, una vez que se alcance el número máximo de personas permitido, no se permitirá que la siguiente persona entre en el edificio debido a que sonará una sirena. Esto también garantizará que se mantenga el distanciamiento social. Nuestro proyecto se basa en Arduino. Se utilizaron varios componenteseléctricos, como un Arduino Uno, un prototipo, una protoboard, un piezo-zumbador, sensores ultravioleta y cables de puente. Las simulaciones de software se realizaron en el conocido compilador de circuitos eléctricos en línea, Tinkercad. También se realizó una simulación de hardware de nuestro dispositivo.

Palabras clave: COVID-19; IoT; Arduino; Distanciamiento Social; Sensor; Tinkercad.

INTRODUCTION

The entire world has been reeling from the COVID-19 pandemic, which has forced people to stay at home. In December 2019, this pandemic was declared. COVID-19 is a fast-spreading disease that can be spread among communities. To mitigate or avoid the community spread of COVID-19 various measures like social distancing; wearing masks, and regularly sanitizing hands have been implemented.[1]

As a result of people congregating in one location, the disease can spread. A survey was carried out to get information about public gatherings at one place. As per the report, 1338 people participated in the survey, of which 536 cases were COVID-19 confirmed. Along with that, 514 people presented COVID-19 antibodies. According to this survey, mass gatherings are the primary source of COVID-19 transmission.[2]

To control the disease among people, distancing and wearing mask policies have been adopted by almost all countries. A survey was conducted to determine the significance of social distance in limiting the spread of COVID-19. Over the course of a few weeks, it became clear that the social distancing policy prevented a higher proportion of potential COVID-19 cases than the no-social-distancing policy did. It also prevented 66 % of the potential fatalities.[3]

Lockdown has severely affected the economy as well as disrupted the normal functioning of all the countries. On the other hand, lockdown has impacted greatly to curb the spread of COVID-19. A survey was conducted to study the impact of lockdown to curb the spread. Among all the countries, only 27 countries were selected to collect information about the situation of COVID-19. According to the survey results, there was a downward trend in daily COVID-19 cases shortly after the lockdown.[4]

Because vaccination is critical to overcoming the COVID-19 pandemic, many countries have approved its use once it has been proved safe and effective. Many countries began by prioritizing high-risk individuals, such as healthcare workers and people over 60 with co-morbidities. A survey was conducted to study the impact of the COVID-19 vaccination on reducing the positivity rate as well as the hospitalization and death rates. As per the report, vaccination had reduced the positivity rate from 9,0 % to 4,6 % over the span of 300 days.[5]

Vaccination is the key for the world to overcome this pandemic caused by COVID-19. Within a span of almost a year, several vaccines were made available for public use. Multiple nations are in the process of introducing COVID-19 vaccination passports. This passport should be scientifically valid. These COVID-19 vaccination passports would certify that the passport holder cannot become a source of infection for others.[6]

Vaccination has reduced the rate of infection as well as the rate of hospitalization and deaths. As the rate of infection increased, there was a prediction that people would tend to change their attitudes toward vaccines. However, when the COVID-19 vaccine became available, it was widely observed that people declined to obtain it.[7]

To control the spread among communities, social distancing is one of the essential measures. Mass gathering is one of the major causes of the transmission of COVID-19. There must be a few meters between them, say. In order to ensure social distancing in the academic blocks, an IOT based solution was proposed in this paper where an ultrasonic sensor was used for detecting and counting the number of people entering the academic building. Once the number of people reaches the threshold number no one will be allowed to enter the building, an alarm, integrated with the piezo buzzer, will ring. We used arduino uno to set the number of people allowed in the academic block and to provide other functionalities as well.

Related Works

In the ongoing COVID-19 pandemic, several guidelines have been issued to curb the spread of the virus. Among these measures, social distancing is one of the major preventive practices implemented by all countries. According to the recommendations, people should maintain at least one and a half meters of distance between them, but even after strict measures, social distancing norms are not followed properly.

Thus, to overcome this situation, we proposed an IOT based solution in this paper where a PIR sensor was used to detect a target in the vicinity of 1,5 m, triggering an audio alarm upon violation of social distancing norms and detection of the target object. The suggested portable device would also notify the person violating the 1.5m norm. Hence, it was expected that the proposed device would minimize the transmission and infection rate due to COVID-19. (8)

In this research paper, with the help of artificial intelligence, we proposed a novel smart device which could be handy for maintaining social distancing norms as well as detecting people with COVID symptoms and hence ensuring safety. We came up with this idea based on the fact that during these COVID times, people on the roadside watched their front but were not able to look at what was going on behind them. Therefore, to overcome this problem, the device will give an alert to the person if someone is in a critical range of six feet around him. Hence, this device is fairly accurate and can be extremely useful in maintaining social distancing.[9]

This paper discusses how the Internet of Things (IOT) and 5G-related technologies can be developed and applied to combat the COVID-19 pandemic. A few use-cases on how 5G and IoT can empower agents to provide creative solutions in the areas of telehealth, contact following, schooling, retail and supply chains, e-government/far off office/data sharing, brilliant assembling and industrial facility mechanization, e-the

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travel industry, and diversion are presented, along with their specialized prerequisites and challenges. It is imagined that the proposed arrangements will be instrumental to work with the standard way of life, work, and other everyday exercises of people in the post pandemic world.[10]

The Internet of Things (IoT) is being used in pervasive healthcare. For identifying the abnormal behavior of a person, the Wireless Sensor Networks are used. To develop a sensing system that captures and detects the occurrence of a fall, a discrete sampling method is deployed. To detect the variation of thermal flux, Pyroelectric Infrared (PIR) sensors are used. HMM is used to model PIR signals and detect human activities.[11]

Digital technologies play an important role in curbing the spread of COVID-19 in the community. Internet of Things(IOT) technologies can help maintain the social distance as well as decrease the rate of spread of COVID-19. IOT helps find efficient solutions through remote monitoring and automation of health. Artificial Intelligence (AI) and blockchain can also help in mitigating the impact of COVID-19 through online disease surveillance and risk prediction.[12]

Arduino helps in the development of the sensors on the VLSI test bench. Arduinos process quickly and have a user-friendly interface. Open-source software has low operating costs and high dependability.[13]

Smart alert systems can also be developed using the Internet of Things (IOT). An ultrasonic sensor, that is interfaced with the Arduino Uno, is used in smart alert systems. This alert system can be interfaced with the web server using an Android application. The notifications can be sent to Android applications using the WiFi module. This process can be integrated with RFID and IOT.[14] Furthermore, the Automatic Heart Rate monitoring system is one of the most important innovations of this new era. As a stethoscope requires a quiet environment and hearing sensitivity, the automatic heart rate monitoring system proves to be user-friendly when used properly. A Piezoelectric sensor and an Arduino microcontroller are the main components used in building this system.[15]

Due to the ongoing pandemic, all academic activities have been shifted to online mode. It is quite difficult for the electrical circuits to be built up at home and compile them. Therefore, we used Tinkercad, an online platform, to compile the electrical circuits virtually.

Several electrical components can be used and compiled using this software, such as: sensors, breadboard, resistors and arduino uno.[16] We also used PIR motion sensor Arduino for the automated gate system.[17]

There are always fluctuations in electrical quantities like voltage, current, and power. These fluctuations must be handled carefully and immediately to prevent a serious problem. By using Internet Of Things (IOT), an online monitoring system was developed. Current sensors to sense current and voltage sensors to sense voltage were used. It is a web-based application where the fluctuations are being displayed.[18]

Solar energy is the new trend at present. This paper shows the use of solar energy to save electricity. In addition, to fabricate the device proposed, various components were used like photovoltaic as source, rechargeable battery to store the solar energy and PIR sensors for sensing the sunlight.[19]

As the population is increasing exponentially day by day, there is also an increase in the use of electricity. Using the Internet Of Things (IOT) and robotics, we present a model for generating electricity. This electricity can be used in rural as well as urban areas. The robotic technology is also being used in the model.[20]

Architectural Diagram

Circuit Diagram:

Figure 1 depicts a circuit diagram ofthe proposed electrical circuit.

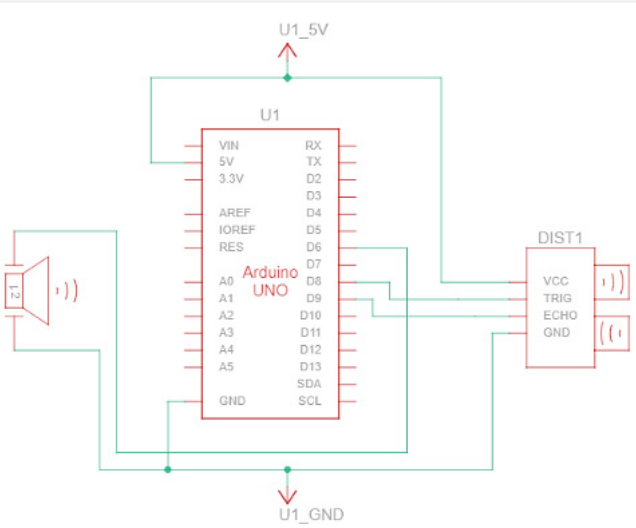

Figure 1. Blueprint of Circuit Diagram

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Components Required

Software Requirements:

The various softwares required for compiling the electricalcircuits are:

- Tinkercad for simulation.
- Windows 8 or higher version.
- Arduino IDE 1.8.19 Software.

Hardware Requirements:

- Arduino UNO: Microcontroller board for integration. To control led's, motors etc as the output. The board also contains a usb interface to connect the board to our computer and then program it using the Arduino IDE.
- Piezo Buzzer: Buzz at a predefined frequency (2300 ±300 hz) on its own just apply steady dc power.
- Ultrasonic Distance Sensor: It has transmitter and receiver which is used to determine the distance of the object.
- Breadboard: It can be seen as the construction base that is used for developing the electricalcircuit for wiring the various components with the Arduino.
- Jumper Wires: Connecting wires used to connectthe various components.

Software Implementation

Circuit Diagram:

The below Figure 2 depicts the proposed electrical circuit for our project.

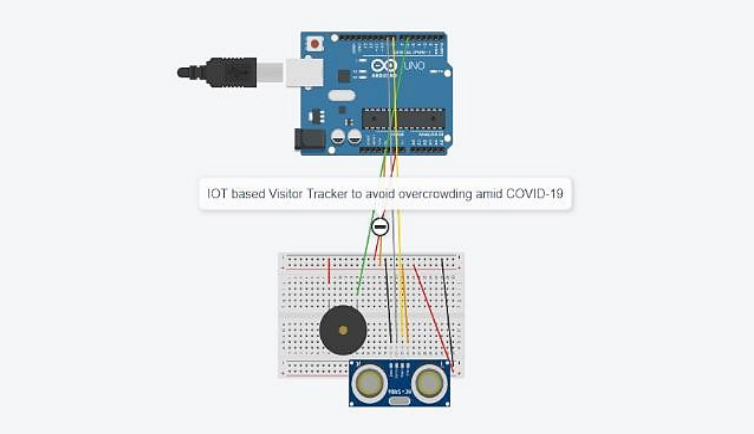

Figure 2. **Electrical Circuit Diagram in Tinkercad**

Compilation:

Piezo buzzer starts ringing when the number of people entering the block exceeds the threshold number of people allowed to enter the block, as shown in figure 3.

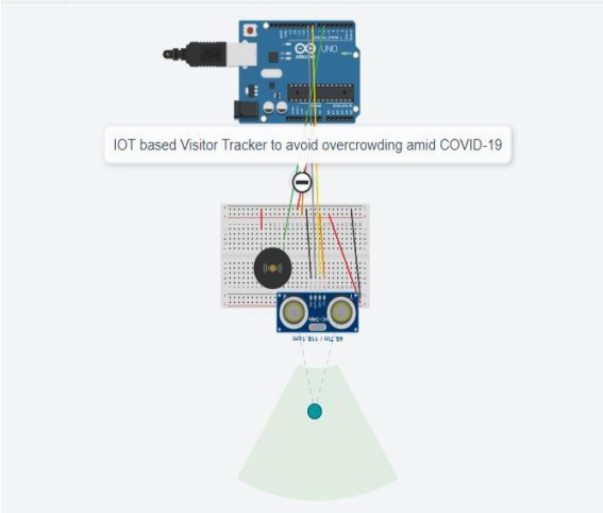

Figure 3. Piezo Buzzer ringing

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Piezo buzzer doesn't ring when the number of people entering the block is less than the threshold number of people allowed to enter the block, as shown in the figure 4.

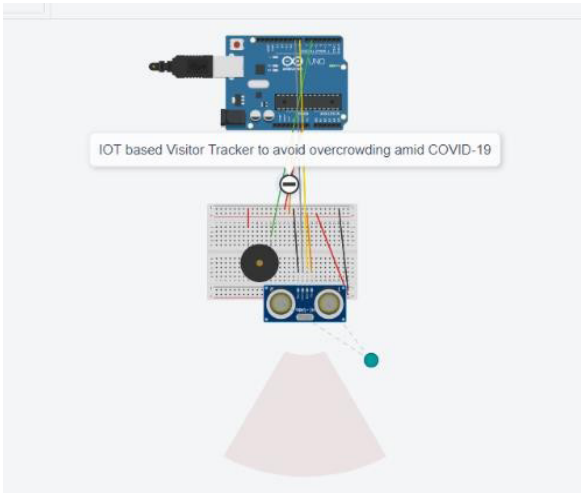

Figure 4. Piezo Buzzer not ringing.

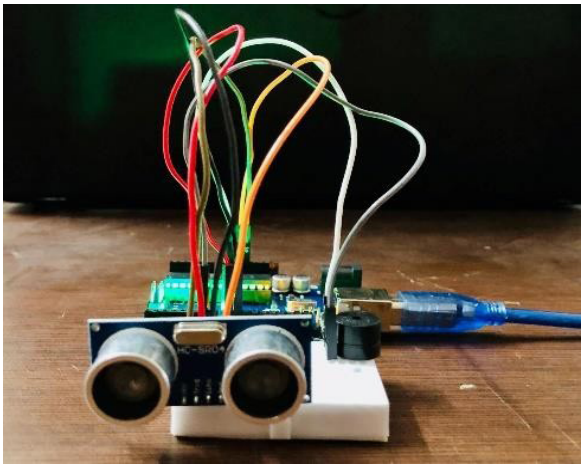

Figure 5. Ultrasonic sensor detection and piezo buzzerringing

Hardware Implementation

Circuit Diagram:

Figure 6 depicts the proposed electrical circuitfor our project.

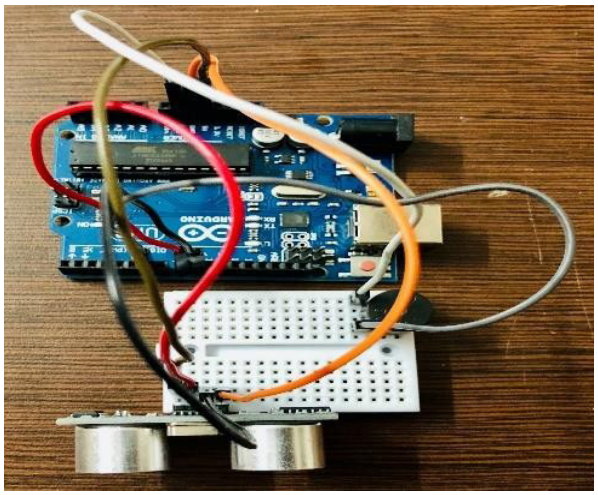

Figure 6. Electrical circuit diagram.

Compilation:

In figure 7 when the number of people detected by the ultrasonic sensor exceeds the threshold, the piezo

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buzzer starts ringing.

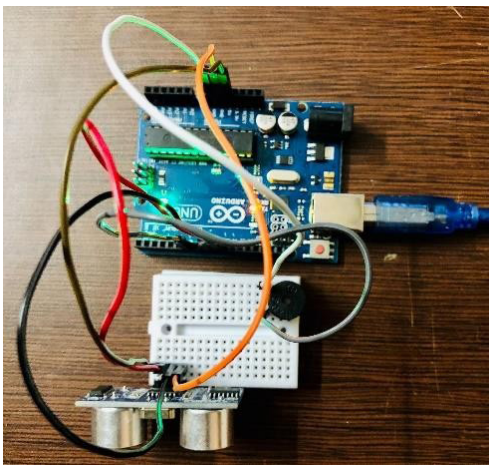

Figure 7. Compiled circuit diagram

CONCLUSION

Since the end of 2019, the COVID-19 pandemic has erupted, and due to its drastic and dramatic spread, it has severely affected lives and livelihoods across the world. It has also affected the educational system across the globe. Every sector has been affected. Our project, IOT Based Visitor Tracker to Avoid Overcrowding Amid COVID-19 In Academic Blocks, will ensure social gatherings take place only with the threshold number of students / faculties allowed. Our project will assist in monitoring the number of students / faculty members entering academic blocks, and once the maximum allowed number of members is reached, the circuit will sound a siren to alert the situation.

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CONFLICTS OF INTEREST

None.

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None.

AUTHORSHIP CONTRIBUTION

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Writing - Review & Editing: Nagaraj Doddam Reddy, Ganesh Narasimhan.