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Keep me in Distance: An Internet of Things based Social Distance Monitoring System in Covid19

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ABSTRACT

Despite, the fact, the observable benefits of the Internet of things (IoT) have been expanded to healthcare for automation, very few studies have been shed light on the wearable IoT to keep distance from human to human. In the Covid-19 situation, in general, it is advisable to keep a social distance to avoid the possibility of infection. Research from Wearable IoT sensor-based healthcare, IoT provides a pathway how citizens can keep them ata distance as IoT offers a myriad of sensors. Realizing the practical problem, in this research a social distance model is developed using wearable IoT. This proposed technique is easily implementable on wearable devices. Our proposed system is cost-effective, which is expected very suitable for the low-income regions of the world to monitor appropriate social distance.

Keywords - **Social distance, Arduino, IoT, ultrasonic sensor, COVID-19.**

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1. INTRODUCTION

The term "internet of things" refers to the ever-growing network of physical items equipped with an IP address for internet access, as well as the communication that takes place between these objects and other internet-connected devices and systems. The internet of things is a network of physically linked items that are accessible via the internet [1]. The devices are in the IoT architectures are the sensors, actuators, gadgets, appliances, or machines, that are programmed for certain applications and can transmit data over the internet or other networks. A significant portion of existing IoT networks is under the umbrella of ad-hoc and quasi ad-hoc networks [2].A piece of general advice from the World health organization (WHO), governments, and medical practitioners is that citizens should keep a social distance from the possibilities of infections in the Covid 19 situation [3]. Social distance is required to avoid such covid19 like infectious diseases. Social distancing is a critical tool for preventing disease transmission, even more so in densely populated indoor spaces. Citizens' movements should be monitored or driven to avoid crowding, especially in small spaces to prevent the spread of this disease.

IoT is very effective in keeping distance and monitoring crowds using its sensors and other possible devices. IoT has provided a much simpler solution for remote monitoring. Furthermore, the concept of a wearable device, an expansion of IoT using wearable body sensors network has revolutionized healthcare, entertainment, transportation, retail, business, and emergency services control. By combining wireless sensors and sensor networks with modelling on intelligent systems, a multidisciplinary concept IoT enabled wearable devices has been established. In the case of COVID-19, an IoT-based wearable body sensor may aid in pandemic containment by directing enabled/connected devices toward individuals for early diagnosis, monitoring during social isolation, quarantine, and recovery.

The initial literature review performed in this study suggests that there is a need for IoT based wearable research specifically targeting Covid19 germs. The observations motivate the researchers of this study, a research question, therefore, posits: *Can IoTbe used to develop a wearable device that will keep us in distance, from human to human?* The study aims to develop anIoT based social distance monitoring system to mitigate the spread of contagious viruses. Tinkercad is used to develop the IoT system for its' versatility. All Tinkercad's IoT devices may execute standard programs or be modified using the C or C++ programming languages. This device enables the development of a safe zone around users by alerting them in the form of notification and vibration.

The paper is broken into seven parts, each of which is organized as follows: Section 1 contains an introduction, followed by a brief survey of relevant works on the use of IoT in section 2, section 3 contains the methodology, section 4 has the experiment and result, section 5 contains

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the discussion of the findings of this research, section 6 is filled with conclusion and future works and lastly acknowledgement is in section 7.

2. LITERATURE REVIEW

In this study [3], the authors propose a novel pattern traffic monitoring method namely Trend-based Online Network Traffic Analysis for ad-hoc IoT networks to monitor network performance. The argument is since IoT network is under the umbrella of ad-hoc and quasi ad-hoc networks, both approaches suffer from the lack of resource-rich network infrastructures. Therefore, the network cannot perform heavyweight network management tasks using, e.g. machine learning-based Network Traffic Monitoring and Analysis.The authors of the study [4] provided a concept of a device that will give an alert to the person if someone is in the critical range of six feet around him. The method is reasonably accurate and can be very useful in maintaining social distancing. The sensor model used is described, and the expected errors in distance estimates are analyzed and modelled.

The authors of [5] have developed an IoT-based wearable quarantine band (IoT-Q-Band). The WHO recommends a COVID'19 quarantine period, considered when designing it. Absconding quarantine subjects are reported and tracked in real-time by this wearable prototype, bundled with a mobile app IoT-Q-Band is a cost-effective method for preventing the spread of COVID-19 in poorer regions.The authors of [6] presented an efficient and cost-effective indoor navigation system. Their solution makes use of an emerging short-range wireless communication technology – IoT-based Bluetooth Low Energy (BLE), and utilizes BLE Beacons in the environment to provide mobile users equipped with a smartphone with hints on how to arrive at the destination. Researchers have developed a new proximity-based navigation system that identifies the user's location based on information sent by Beacons, processes the best route for indoor navigation at the edge-computing infrastructure, and provides it to users via their smartphones. Repurposing existing occupancy sensors and environmental sensors to monitor social distancing and support disease transmission risk estimation was assessed by [7] authors, who contributed to the study. Before the onset of the pandemic in 2017-2018, they analyzed 410 days of CO2 and PIR (passive infrared) motion detector measurements from an innovative, collaborative space. They looked at the overall air quality in the area to see if it could provide information about possible transmission risks. As a result of their research, they discovered how infrastructure-based sensors could be used to identify problematic areas in the space and provide guidelines on how these areas can be modified to be more socially distancing aware. These sensors can also estimate occupancy levels and analyze occupancy patterns within a distance, as they demonstrated.

According to [8] introduced*MySD*, which stands for "My Safe Distance," was developed by the authors using the phone's built-in Bluetooth transceiver and GPS to determine a safe distance and the level of compliance that must be met. [9] Clinical therapies for COVID-19 were used to "reduce" the amount of COVID-19 given to someone else as the patient's supervision under the "liability" of the "devices" and "applications" involved. They used an open computational vision and artificial intelligence to count pedestrians rather than manual measurements. The study [10] proposed a method that consists of numerous intelligent sensors like Temperature, Heartbeat, Eye blink, and SPO2 (Peripheral Capillary Oxygen Saturation) sensors for fetching the patient's body temperature, coronary heart rate, eye movement, and oxygen saturation percentage of the patient. Their proposed system usedthe ARDUINO-UNO board as a microcontroller and Cloud computing concept. Here the accelerometer sensor is used to display the body movement of the coma sufferers. The patient's vital parameters are transmitted to the smartphones and laptops of the legal individual by the use of a cloud server. These records may be saved and analyzed for further evaluation and selection making.

The study [11] proposed a novel framework that helps deliver the recommended prescription to patients on time. The plan to send an email and a text message alert if one of the health parameters crosses the limit esteem also benefits this framework. A notice plan will ensure that the medical professional is aware of the situation. Another major part of the proposed arrangement is creating the ideal environment for the patient's health and well-being. They plan to write a paper on testing health data, including pulse, circulatory strain, breathe rate, body temperature, body development, and saline dimensions.The authors of [12] discussed the role of IoT and wearable body sensor technologies in combating COVID-19 and proposed an IoT-based wearable body sensor architecture to combat the outbreak. An IoT-enabled COVID-19-compliance system capable of monitoring and assisting in social distancing and standard operating procedure compliance was discussed by the authors of [13]. People count, queue distances are maintained, the temperature is kept up-to-date, and any violations are alerted. Additionally, the system stores the data in a cloud for archiving and monitoring purposes. The authors of [14] developed an IoT based smart care infrastructure for elderly and non-critical patients to retrieve their vital signs to predict their health status so that in case of any emergency necessary precautions can easily be taken.

Therefore, there are several existing solutions for social distance monitoring system, which assist in mitigating the mass contamination of Covid. However, our proposed system solely focuses on a cost-effective solution for this problem so that people from the low-income regions can use this system in ease. That is the novelty of this research work.

3. METHODOLOGY

This study follows the qualitative-experimental methodology as this proposed system can be implemented on the wearable device, which will help the users to maintain social distancing in real-time. The main goal of our proposed system is to monitor the human presence and ensure proper social distancing. Once we have integrated

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this architecture into a wearable device, it is time to build the software and flesh out our notion.

3.1. WORKING PRINCIPLES

The sensor will detect the presence of any human within a specific range once the system is launched. When no one is within the Ultrasonic Distance Sensor's maximum range, a single Green LED indicates the NeoPixel Ring 12's status. When someone approaches within the range, the other LEDs begin to blink. The closer the person gets, the brighter the LEDs become, and the color of the LEDs changes under the person's position within the range. Finally, when another person approaches too close, the Buzzer begins to beep, alerting the user to his or her presence.

3.2. REQUIRED COMPONENTS

Table 1. Components list

Name	Quantity
Arduino UnoR3	1
Ultrasonic Distance Sensor	1
NeoPixel Ring 12	1
Buzzer	1
Breadboard	1

The overall architecture of our proposed system is illustrated here.

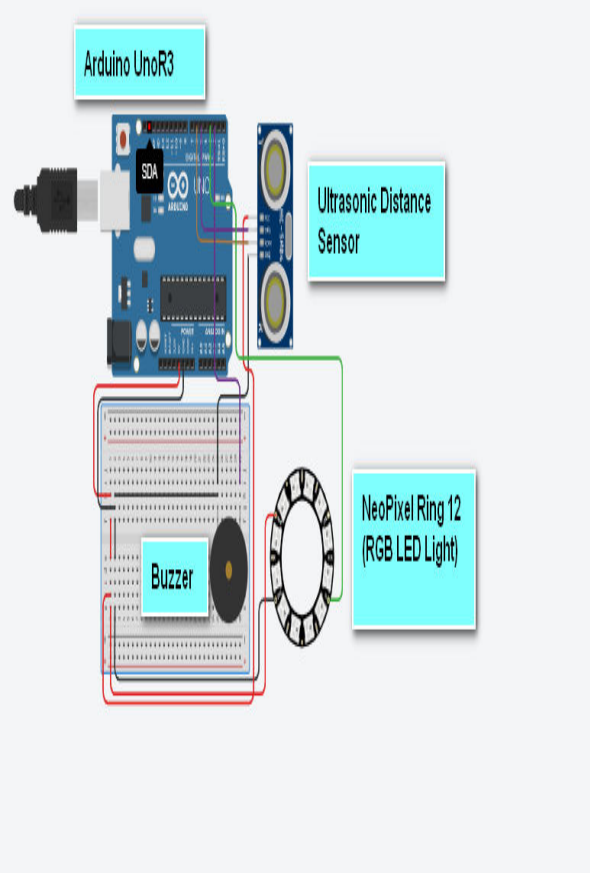

Fig. 1.The architecture of the proposed system

The flowchart for this proposed system is given below-

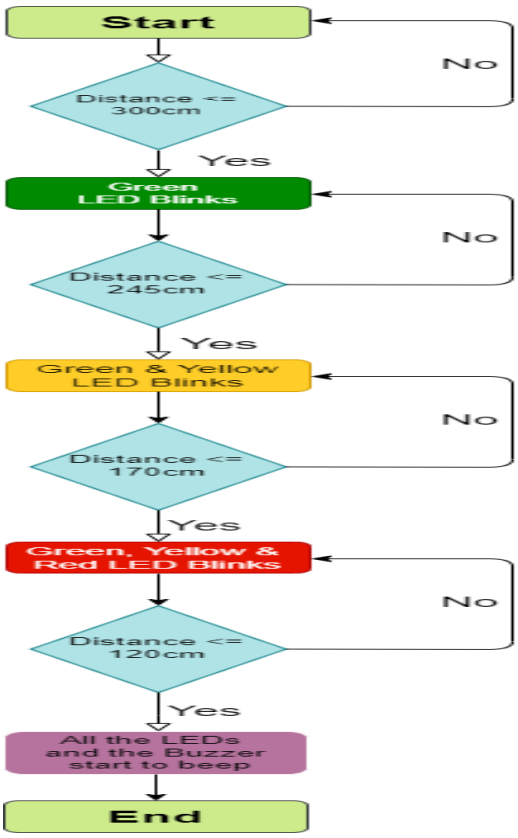

Fig. 2.Workflow for the proposed system

4. EXPERIMENT AND RESULT

This section consists of the results from the simulation. Here, the assumed minimum and maximum distance of the Ultrasonic Distance Sensor is 100cm and 300cm. This distance can easily be altered.

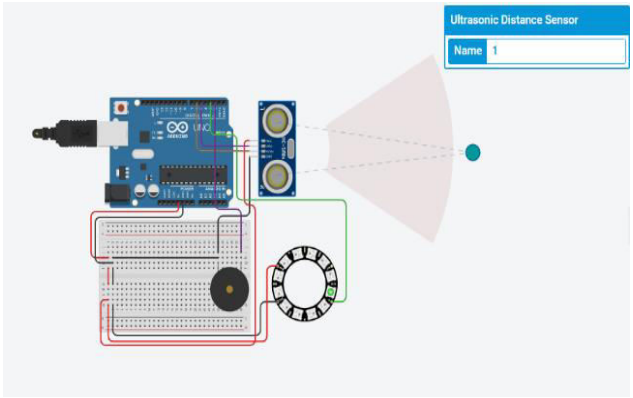

Fig. 3.NeoPixel Ring Status: 1 LED Green, when the person is outside of the maximum range (distance > 300cm)

Initially, when no one is inside the maximum range of the Ultrasonic Distance Sensor, the status of the NeoPixel Ring 12 lit only one Green LED. The other Green LEDs start blinking when someone is inside the maximum distance (300cm). The more the person gets closer, the more the LEDs are lit.

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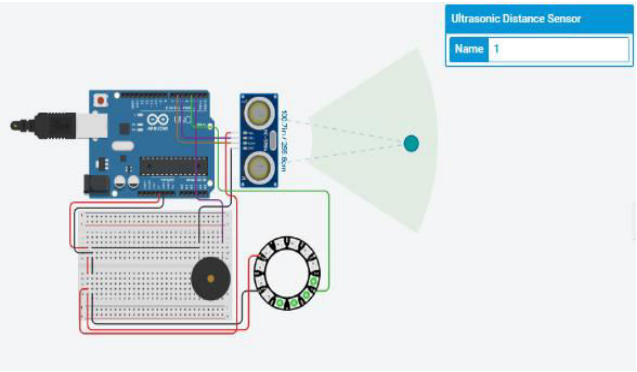

Fig. 4.NeoPixel Ring Status: 4 LEDs Green, when the person is inside 260cm of the sensor

When someone is inside the range of 260cm of the sensor, all the Green LEDs start to blink.

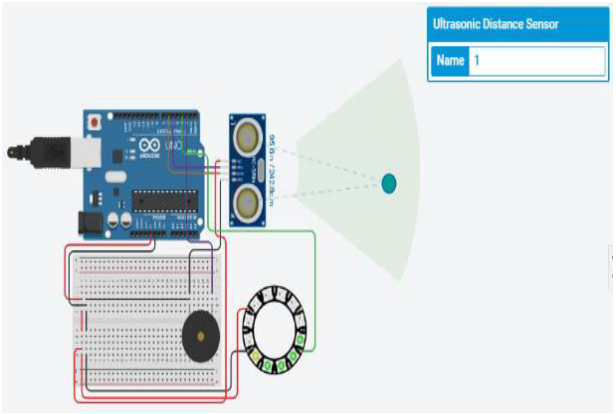

Fig. 5.NeoPixel Ring Status: 4 LEDs Green, 1 LED Yellow, when the person is inside 245cm of the sensor

When someone is inside the range of 245cm of the sensor, the first Yellow LED starts to blink, besides all the Green LEDs.

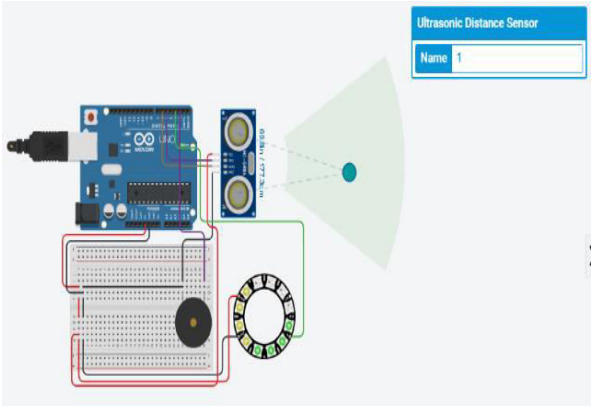

Fig. 6.NeoPixel Ring Status: 4 LEDs Green, 4 LED Yellow, when the person is inside 190cm of the sensor

When someone is inside the range of 190cm of the sensor, all the Green and Yellow LEDs start to blink.

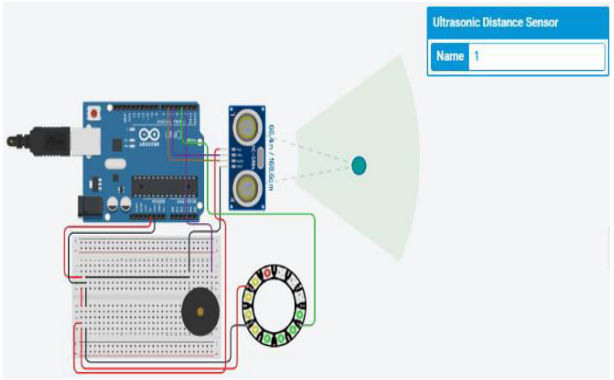

Fig. 7. NeoPixel Ring Status: 4 LEDs Green, 4 LED Yellow and 1 LED Red, when the person is inside 170cm of the sensor

Besides all the Green and Yellow LEDs, the first Red LED starts to blink when someone is inside the range of 170cm of the sensor.

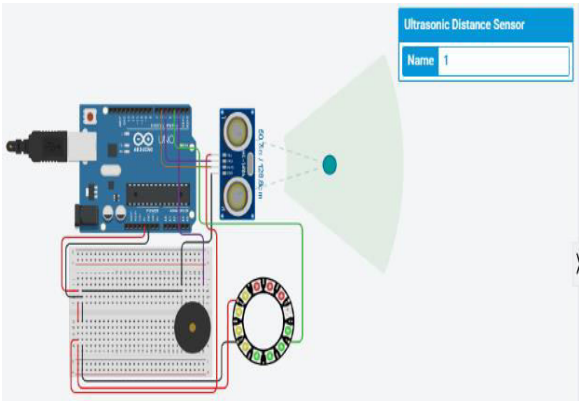

Fig. 8.NeoPixel Ring Status: 4 LEDs Green, 4 LED Yellow, and 3 LED Red, when the person is inside 135cm of the sensor

When someone is inside the range of 135cm of the sensor, all the Green, Yellow, and 3 Red LEDs start to blink.

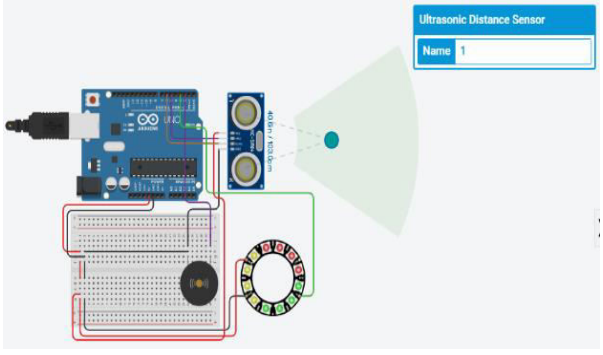

Fig. 9.NeoPixel Ring Status: 4 LEDs Green, 4 LED Yellow, and 3 LED Red and the buzzer rings, when the person is inside 120cm of the sensor

Finally, besides all the Green, Yellow, and Red LEDs, the Buzzer starts to ring when someone is inside the range of 120cm of the sensor.

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5. DISCUSSION

This study aims to examine a system for monitoring social distances in IoT projects utilizing a number of sensors and an Arduino. The Ultrasonic Distance Sensor will measure the distance of a person by using ultrasonic waves within a specific range. The sensor head generates an ultrasonic signal and detects the reflected signal from the target. Ultrasonic Sensors determine the distance to a target by determining the time interval between emission and reception. 12 ultra-bright smart LEDs NeoPixels are grouped in a circle with an outside diameter of 1.75" (44.5mm). The rings are 'chainable'; it just needs to connect one's output pin to another's input pin. Each LED may be addressed individually because the driver chip is included inside the LED. These rings will notify the user about other persons when they are getting within the specific range of the user by blinking the LEDs. The Buzzer will start to beep when someone is excessively close to the sensor. This suggested approach is simply implementable on wearable devices at a low cost. This proposed system aims to monitor social distance and develop an IoT system capable of mitigating the transmission of dangerous viruses such as COVID' 19. As the world faces the most significant threat of the century, we must battle the Coronavirus effectively and intelligently. Social isolation can never be a sufficient answer to this problem, as individuals must go outdoors to perform vital tasks. As a result, the possibility of contamination continues. However, our suggested method may readily mitigate this danger by informing the user of his surroundings. This system can be implemented on wearable devices to get real-time notifications if someone gets too close to them.Thus, social distancing can be effectively maintained in this manner. Additionally, this technology may be easily deployed at a low cost, making it mass manufactured and affordable to the public.

6. CONCLUSION AND FUTURE WORKS

Considering the critical role of IoT implication in social distance managing and preventing the spread of COVID-19 disease. Moreover as, which can cause the healthcare system to collapse due to a high patient load, our proposed approach can provide a smart solution to the public by monitoring and reminding them to maintain a safe distance when in public areas. This proposed system can easily be implemented on wearable devices at a very affordable price.

One can also criticize that the study is not empirical; rather a concept is simulated by packet tracer. However, the defence is that the observable benefits of IoT success in wearable devices address the need for the development of wearable devices by providing a conceptual introduction to IoT based wearable devices as a practical guide for the researchers and industry practitioners.

Future works and aims are, therefore, implemented in a real-life scenario and examining the outcomes using qualitative or quantitative judgement. Climate-related adverse and supportive particulars should be a subject of study using IoT based sensors. Artificial intelligence might compound with IoT to address the SDGs goals. Limitations of IoT devices and communication in wearable devices can be also a subject for further study. In the future, we plan to implement this system within a smart phone, which can be operated through an app, so that people will not have to carry an extra wearable device with them for this purpose. This proposed system is minimalist in design, considering cost and the WHO's suggested average quarantine duration. This monitoring system enables detecting and tracking absconding COVID-19 quarantine patients in real-time. As a cost-effective solution, our suggested approach could aid low-income parts of the world by being used to monitor proper social distancing.

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