IoT Based Social Distancing Monitoring Robot for Queue

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Abstract: Social Distancing has becomea very necessary situation these days as it limits the spread of covid – 19 pandemic. To ensure the social distancing in the queues we design this "IOT BASED SOCIAL DISTANCING AND MONITORING ROBOT FOR QUEUE". It is a robot consisting of wheels and using the line following principle to make sure it monitors the social distancing in the queues. To move 'to and fro' it uses IR sensors and for obstacle avoidance, it uses ultrasonic sensors in addition to that it also calculates the minimum distance between people. It sends the alerts in the case of defiance as well as it sends the pictures to the authorities through the Wi-Fi module over IoT.

KEYWORDS: Social Distancing, Raspberry pi 3 model b, Ultra-sonic sensor, IR sensors, Voltage regulators, Driver motor L293D.

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INTRODUCTION

Coronavirus disease (2019) is also called covid-19 is a contagious disease caused by SARS-CoV-2. Now, it is spread worldwide and now it became a pandemic. World health organization has identified it as a pandemic in the year 2020. It crashed the worlds' economy too. World Health Organization has given preventive measures to stop the spread of the covid-19. They are physical or social distancing, the use of face masks, quarantining, and isolating ourselves if we have any of the mentioned symptoms. The development of rules and techniques to enforce these social distance restrictions in public or private events, whether indoors or outdoors, is a critical problem.This poses several challenges, including establishing reasonable rules that people can follow when they visit public places such as supermarkets, pharmacies, train and bus stations, recreational areas, and places where essential work is performed, as well as motivating people to follow the new rules.It's also critical to recognize when such regulations are broken so that proper countermeasures may be taken. Detecting violations of social distance might also aid in contact tracking. This restricts their value for monitoring crowds and mainly in queues and social distance norms in general contexts or public spaces, and may make counter-measures more difficult to implement.

Social distancing measures are very effective when the infectious disease spreads via one or more of these methods namely droplet contact, physical contact and also like airborne transfer, etc. Hence, we come up with our robot which monitors the social distancing in the queue.

OBJECTIVES:

The main objective of this robot is to stop the spread of coronavirus pandemic also covid-19 by maintaining the social distancing and monitoring it with the help of the robot as if a person is allotted to monitor the social distancing, the person has a very high risk and that person may become the carrier of the virus.

In such cases, we cannot stop people from getting their requirements, so it is necessary to monitor the social distancing with the help of the robot to flatten the curve.

STRUCTURE OF THE PAPER :

The paper is classified as follows: In Section 1, Along with the introduction, the structure of the paper, Objectives, and all required elucidations are present. In Section 2, we come across Related work. In Section 3, we have proper information about hardware. In section 4 we have: methodology, the process involved, and in section 5 we come across the future scope and the conclusion along with the references.

RELATED WORK:

In this section, we analyze the related work and the groundwork which is done to build up the robot such as the effectiveness of social distancing, Upcoming technologies for social distancing, the solution for collision avoidance through IoT.[1][2][3]

Effectiveness of social distancing **[1]:**

The covid-19 pandemic has resulted in the demolition of many jobs which resulted in an increased rate of unemployment. Addedly covid-19 lead to the scarcity of treatment and hospitals along with oxygen supply. The only way to overcome these things is by maintaining socialdistancing. The WHO says that the spread of the covid-19 pandemic curve is flattened by maintaining social distancing.

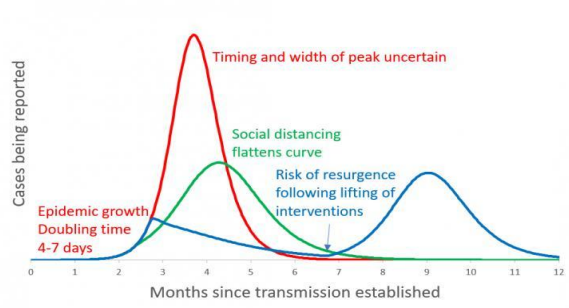

Figure 1: showing the results that flattering in the curve when social distancing is maintained.

Upcoming technologies for social distancing **[2]:**

Many methods for detecting excessive crowding or undertaking contact tracing have been developed, and the majority of them utilize some sort of communication.Wi-Fi, Bluetooth, cellular connectivity-based tracking, RFID, and Ultra-Wide Band (UWB) are all examples of this type of communication. The majority of these technologies are primarily useful in indoor settings, however, cellular has been used to follow pedestrians outside.

Furthermore, several of these technologies, such as RFID and UWB, need the installation of extra infrastructure or sensors to monitor individuals indoors.In other situations, technologies like Wi-Fi and Bluetooth help track just those persons who are utilizing wearable devices or cellphones to connect to the technologies. Many companies like Google, Microsoft are creating applications that track the positioning of the other person from you.

The solution for collision avoidance using IoT [3]**:**

The best and easy solution we have found in the groundwork for collision avoidance using IoT is the use of ultrasonic sensors. Even though there are many sensors available for collision avoidance such as laser range sensors, bump sensors, Ultrasonic sensors. These Ultrasonic sensors have a high capability of detecting obstacles or any objects in both short-range and widerange. These sensors calculate the distance between two objects by using sound waves.

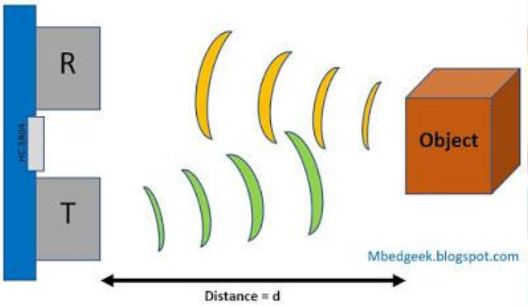

Figure2: The working of an ultrasonic sensor.

HARDWARE

In this section, we come across the main hardware components used to build this robot.

Raspberry Pi 3 Model B and it's set up [1]

The Raspberry Pi-3 model B is a low-cost, credit-card-sized computer that connects to a computer display or television and operates with a conventional keyboard and mouse. It can do all of the functions that a desktop computer can. The Raspberry Pi 3 is the third version of the Raspberry Pi. Raspberry Pi can communicate with the rest of the world.

We'll need to set up the gadget and program it in python or scratch to have it interface with the outside world. We're utilizing the 'New Out of the Box Software' operating system, which is a simple raspberry pi management. The Raspberry Pi will now boot up. FAT32 should be used to format an SD card with a capacity of 4GB or more. (See below for details on how to achieve this.)

Download the NOOBS zip file and extract the contents. (This file may cause problems with Windows' built-in zip capabilities.) If this is the case, another software, such as 7zip, should be used. Copy the extracted files to the SD card you just formatted, making sure that this file is in the SD card's root directory. Please note that it may extract the files into a folder in certain circumstances; if this is the case, copy the files from within the folder rather than from the folder itself. The "recovery" disc will be automatically shrunk to a minimum on the initial boot, and a list of OSes available for installation will be shown.

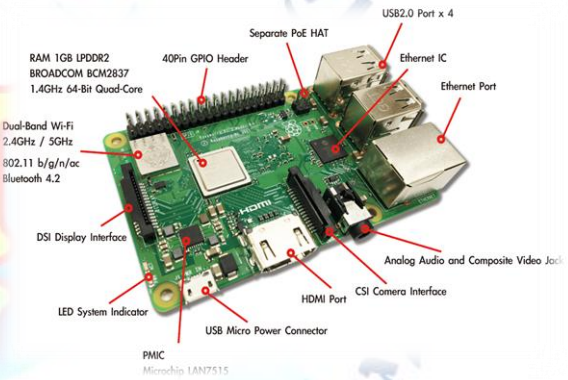

Figure3: Raspberry pi 3 model B

Ultrasonic sensors [2]

Ultrasonic sensors are used to measure the distance between the objects by using sound waves. It contains both transmitter and receiver which is used for transmission and receiving of sound waves. Figure2 illustrates the working of the ultrasonic sensors.

Figure4: ultrasonic sensor

Driver motor-L239D [3]

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers are usedbecause they take a low-current control signal and convert it to a higher-current signal, motor drivers serve as current amplifiers.

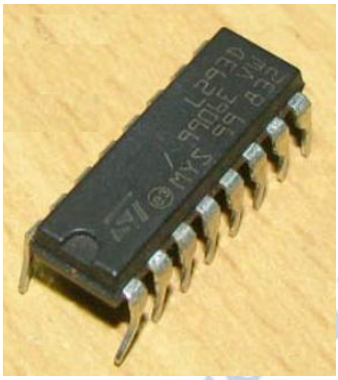

Figure5: Motor driver L239D

DC Motor [4]

DC motor is an electrical device that converts electrical energy into mechanical energy. Here we use the simple DC motor for the 2 wheels of the robot.

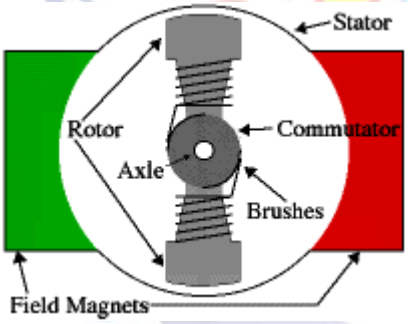

Figure-5: DC motor

METHODOLOGY

IoT-based social distance monitoring robot for queue aims to stop the spread of covid-19 pandemic by checking whether the physical distance is maintained or not between individuals. In the process of achieving the desired output, we use raspberry pi 3 model b along with ultrasonic sensors, camera module, speaker, buzzer, infrared sensors, motor drivers such as L239D, Wi-Fi, Robot body, wheels.

THE PROCESS INVOLVED:

The block diagram below explains the working of the robot more clearly:

- The robot contains a compatible battery in it which has a capacity of 5V. It acts as a power supply to the robot. It is fabricated to the speaker, motor driver, raspberry pi, DC motors.
- The raspberry pi is fabricated with the components like the 4 IR sensors, speaker, ultrasonic sensors, and the USB jacks of the raspberry pi are connected with the audio jack of the speaker and another with the camera module jack.
- There are 4 wheels in which two of them are connected with the 2 DC motors which are fabricated onto voltage regulator. Then, each pair of wheels are covered with a belt to move to and fro.

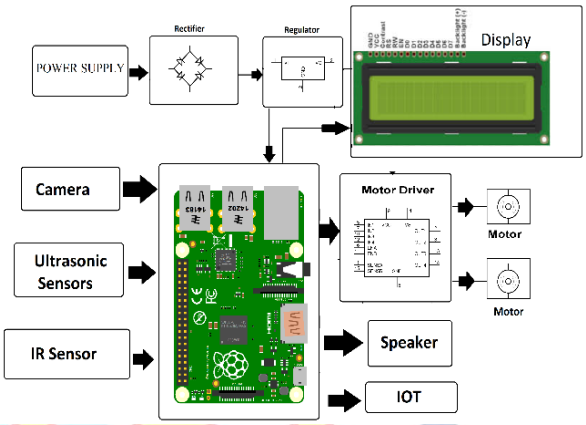

Figure6: Block diagram of the robot.

- As the robot follows the line following principle it is contained with 4 IR sensors as they identify the path to move along with.
- The ultrasonic sonic sensors present here are 3, 2 of them help in collision avoidance. If any obstacle occurred in the path, it identifies and instructs the outside world with the voice commands through the speaker which is predetermined in the program given to the raspberry pi module.
- And the other ultrasonic sensor calculates the distance between two individuals and (here we set 6feet) sends the alert in the case of violation, in addition to that it also sends the snapshot of the scene to the authorities or the device connected to the raspberry pi through WI-FI interface. Later, it continues to and fro with the compatible battery until it discharges.
- We can charge the battery or we can connect it to the external power supply.
- The output of the snapshot which is sent through the Wi-Fi is shown in figure 7.
- The front view, top view, and side view of the robot are shown in figures 8,9,10.

Figure7: A snapshot of the violation of social distancing in a queue.

Figure8: Front view of the robot.

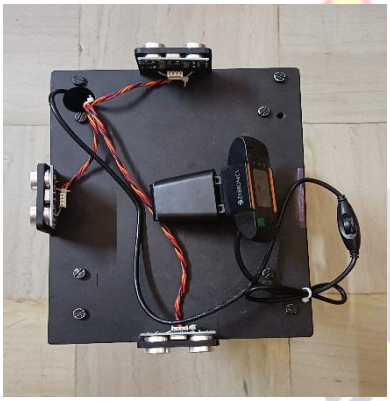

Figure9: Top view of the robot.

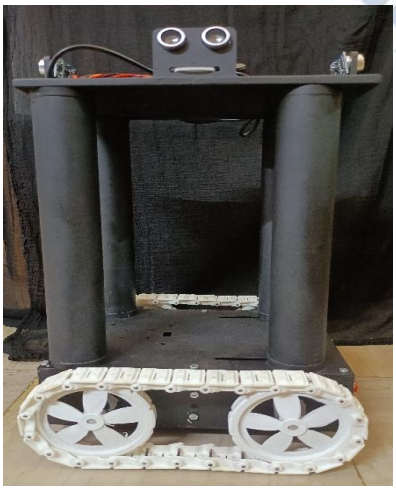

Figure10: Side view of the robot.

FUTURE SCOPE AND CONCLUSION:

To make it work more efficiently we can add many things like post the violated scenario on the website, recording, sending a message to the phone if anything wrong is detected. In another way, we can add the long capacity to the battery with the result that it lasts longer for more hours and we can also install the fan to cool down the external fan setup to cool down the raspberry pi as well DC motors.

We can also install this with thermal sensors and we can also identify the temperature of each person standing in the queue and report to the authorities. We can adjust with high-resolution cameras for more quality content.

The covid-19 pandemic is vastly growing furthermore mutating and becoming more dangerous day by day. It is very important to stay at home and come out only if it is necessary in such a case it is predominant to maintain social distance.

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