# Autonomous Monitoring of Social Distancing Robo on Crowded Scenarios

**Hariprasanth.S[1], Praveenkumar.S[2], Godwin Joy.C[3], Saranya.M [4]**
[1, 2, 3, 4] Dept of Bio Medical Engineering
[1, 2, 3, 4] Mahendra Institute of Technology, Namakkal

***Abstract-*** *Social distancing is of key importance during the current pandemic. It helps limit the spread of covid by observing distance between disease spreading individuals. Now it is not possible to station a person 24×7 at each queue to monitor social distancing violations. Banks, Public Offices, Malls, Schools, Theatres etc usually see long queues for hours every day. To ensure social distancing in queues we hereby design a social distancing monitoring robotThe robot consists of a 4 wheel design system used to drive the robotic vehicle. It makes use of a line following principle to constantly move along with the queue and monitor for social distancing violations. The robotic uses Ultrasonic sensing to travel along with the queue to and fro in order to detect violations. The robot is now equipped with obstacle detecting ultrasonic sensor in order to detect obstacles in the vehicle path.*

***Keywords***- Segmentation, Image acquisition, Feature extraction.

## I. INTRODUCTION

COVID-19 pandemic has quickly become the most dramatic and disruptive event experienced by people all over the world in the year of 2020. People may need to live with the virus for a long time. Practically, one of the most effective measures to minimize the spread of the coronavirus is to promote social distancing. To achieve this goal, several related schemes have been developed that uses existing on-site closed-circuit television (CCTV) systems to detect social distancing. However, the on-site monitoring systems are not ubiquitous in some areas and sometimes may not be able to cover all public corners. Furthermore, although this sort of monitoring systems are capable of detecting social distancing violations, it fails to take any proactive actions to promote social distancing.

Compared to the on-site monitoring systems, the surveillance robots can be flexibly deployed and patrol in the desired public areas. Moreover, the robot can take precautions to promote social distancing rather than simply monitoring them. These potential benefits have been validated by tele-operated robots [1] and hybrid CCTV-robot systems [2]. The hybrid CCTV-robot system introduces external devices such as CCTV to help robots monitoring social distancing. However, there are still several challenges that prevent direct developing a fully autonomous surveillance robot in complex urban environments without any external device. First, to monitor social distances between pedestrians without any external device, an on-board robot-centric real-time perception system is necessary, introducing additional computational complexities to the computationally limited on-board systems. Second, in many urban scenarios, the robot needs to safely navigate through unstructured and highly dynamic environments. Third, more intelligent human-robot interaction schemes need to be designed to improve the efficiency of promoting social distancing.

In this paper, we introduce a fully autonomous surveillance robot to promote social distancing in complex urban environments. To achieve this autonomy, we first build the surveillance system with multiple cameras and a 3D LiDAR on a quadruped robot, which empowers the robot with omni-perceptibility and expands its traversability in complex urban terrains with uneven terrains and stairs that are challenging for normal wheeled mobile robot. Then, we develop an on-board real-time social distancing detection system with the ability to track the robot's nearby pedestrian groups. Next, the CrowdMove [3] algorithm is used to navigate the robot in highly dynamic environments. Finally, we develop a crowd-aware routing algorithm to allow the robots to approach overly-crowded pedestrian groups and to effectively promote social distancing using verbal cues. We also investigate the influence of human voices on the effectiveness and acceptability of quadruped surveillance and social distancing, because it has been reported that a robotic patrolling inspector can be terrifying for general citizen[**]
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## II. LITERATURE SURVEY

In the paper —"**COVID-Robot: Monitoring Social Distancing Constraints in Crowded Scenarios**" [1] Maintaining social distancing norms between humans has become an indispensable precaution to slow down the transmission of COVID-19. We present a novel method to automatically detect pairs of humans in a crowded scenario who are not adhering to the social distance constraint, i.e.

about 6 feet of space between them. Our approach makes no assumption about the crowd density or pedestrian walking directions. We use a mobile robot with commodity sensors, namely an RGB-D camera and a 2-D lidar to perform collision-free navigation in a crowd and estimate the distance between all detected individuals in the camera's field of view. In addition, we also equip the robot with a thermal camera that wirelessly transmits thermal images to a security/healthcare personnel who monitors if any individual exhibits a higher than normal temperature. In indoor scenarios, our mobile robot can also be combined with static mounted CCTV cameras to further improve the performance in terms of number of social distancing breaches detected, accurately pursuing walking pedestrians etc. We highlight the performance benefits of our approach in different static and dynamic indoor scenarios.

In the paper —"**Autonomous Social Distancing in Urban Environments using a Quadruped Robot**" COVID-19 pandemic has become a global challenge faced by people all over the world. Social distancing has been proved to be an effective practice to reduce the spread of COVID19. Against this backdrop, we propose that the surveillance robots can not only monitor but also promote social distancing. Robots can be flexibly deployed and they can take precautionary actions to remind people of practicing social distancing. In this paper, we introduce a fully autonomous surveillance robot based on a quadruped platform that can promote social distancing in complex urban environments. Specifically, to achieve autonomy, we mount multiple cameras and a 3D LiDAR on the legged robot. The robot then uses an onboard real-time social distancing detection system to track nearby pedestrian groups. Next, the robot uses a crowd-aware navigation algorithm to move freely in highly dynamic scenarios. The robot finally uses a crowdaware routing algorithm to effectively promote social distancing by using human-friendly verbal cues to send suggestions to overcrowded pedestrians. We demonstrate and validate that our robot can be operated autonomously by conducting several experiments in various urban scenarios.

According to paper —"**Robotics Applications in COVID-19: A Review**" [3] by The COVID-19 outbreak has resulted in the manufacturing and service sectors being badly hit globally. Since there are no vaccines or any proven medical treatment available, there is an urgent need to take necessary steps to prevent the spread of this virus. As the virus spreads with human-to-human interaction, lockdown has been declared in many countries, and the public is advised to observe social distancing strictly. Robots can undertake human-like activities and can be gainfully programmed to replace some of the human interactions. Through this paper, we identify and propose the introduction of robots to take up this challenge in the fight against the COVID-19 pandemic. We did a comprehensive review of the literature to identify robots' possible applications in the management of epidemics and pandemics of this nature. We have reviewed the available literature through the search engines of PubMed, SCOPUS, Google Scholar, and Research Gate. A comprehensive review of the literature identified different types of robots being used in the medical field. We could find several vital applications of robots in the management of the COVID-19 pandemic. No doubt technology comes with a cost. In this paper, we identified how different types of robots are used gainfully to deliver medicine, food, and other essential items to COVID-19 patients who are under quarantine. Therefore, there is extensive scope for customising robots to undertake hazardous and repetitive jobs with precision and reliability.

## III. PROPOSED SYSTEM

During the pandemic, there are plans to use robots around the world to improve patient care and reduce the burden on the medical system. People may have to coexist with the virus for a long time. In fact, one of the most important effective measures to control the Maintaining social distancing performs a important function in stopping the unfold of infectious diseases. Diseases much like COVID19. spread of the coronavirus is to maintain social distancing. By minimizing close physical contact between people, we reduce the chance of contracting the virus and spreading it throughout the community. Observing the norms of social distancing between people has become an important measure to prevent the spread of COVID19

**Proposed Block Diagram**

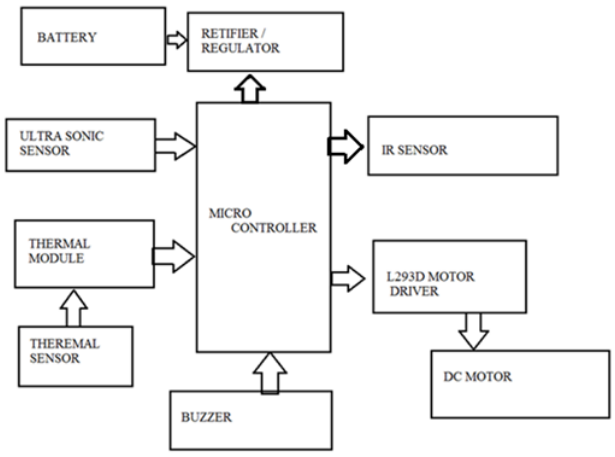


**FIG 1.1 Proposed Block Diagram**

## IV. HARDWARE IMPLEMENTATON

### 1. Battery


**FIG 1.2 Lead Acid Battery**

The battery is an essential component of almost all aircraft electrical systems. Batteries are used to start engines and auxiliary power units, to provide emergency backup power for essential avionics equipment, to assure no-break power for navigation units and fly-by-wire computers, and to provide ground power capability for maintenance and preflight checkouts. Many of these functions are mission critical.

### 2. Fixed Voltage Regulators

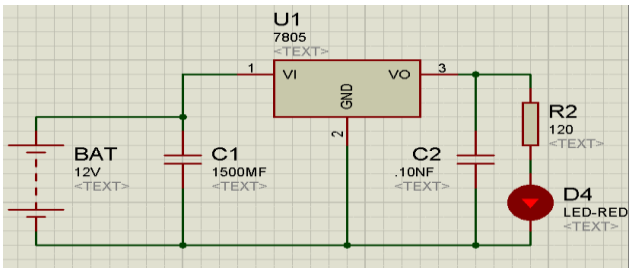


**FIG 1.3 Voltage Regulator**

The series 78 regulators provide fixed regulated voltages from 5 to 24 V shows how one such IC, a 7812, is connected to provide voltage regulation with the output from this unit of +12V Dec. An unregulated input voltage VI is filtered by capacitor C1 and connected to the IC's IN terminal. The IC's OUT terminal provides a regulated + 12V which is filtered by the capacitor C2 (mostly for any high-frequency noise). The third IC terminal is connected to ground (GND).

### 3. Micro Controller

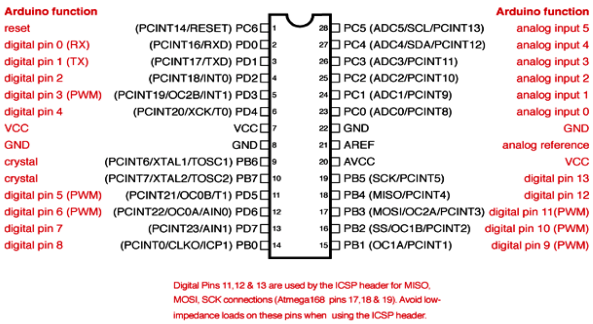


**FIG 1.4 ATMEGA 328**

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 16KB ISP flash memory, 1KB SRAM, 512B EEPROM, an 8-channel/10-bit A/D converter (TQFP and QFN/MLF), and debug WIRE for on-chip debugging. The device supports a throughput of 20 MIPS at 20 MHz and operates between 2.7-5.5 volts.By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed

### 4. L293D MOTOR DRIVER

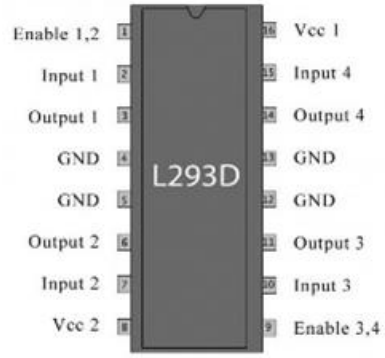


**FIG 1.5 L293D Motor Drivers**

Even the simplest robot requires a motor to rotate a wheel or performs particular action. Since motors require more current than the microcontroller pin can typically generate, you need some type of a switch which can accept a small current, amplify it and generate a larger current, which further drives a motor. This entire process is done by what is known as a Motor driver.

### 5. LCD Display

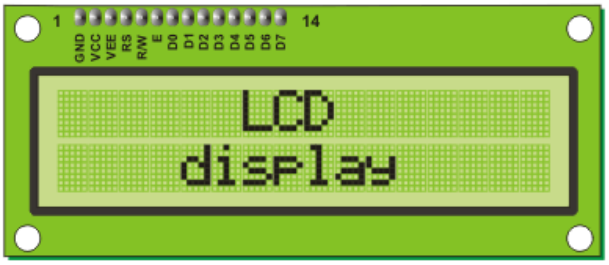


**FIG 1.4 LCD Display**

The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source(backlight) or reflector to produce images in color or monochrome. Liquid crystals were first discovered in 1888.

## 6. CIRCUIT DIAGRAM

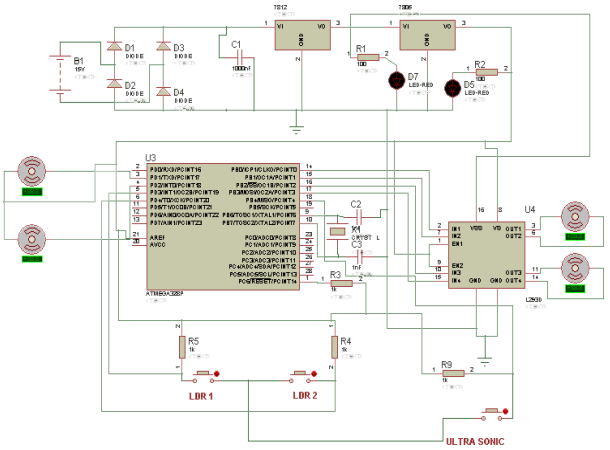


**FIG 1.5 Circuit Diagram**

## V. CONCLUSION

We present a novel method to detect breaches in social distancing norms in indoor scenes using visual sensors such as thermal sensor. We use a mobile robot to attend to the individuals who are non-compliant with the social distancing norm and to encourage them to move apart by displaying a message on a screen mounted on the robot. We demonstrate our method's effectiveness in localizing pedestrians, detecting breaches, and pursuing walking pedestrians. We conclude that the thermal Sensor + robot hybrid configuration outperforms configurations in which only one of the two components is used for tracking and pursuing non-compliant pedestrians. Our method has a few limitations. For instance, our method does not distinguish between strangers and people from the same household. Therefore, all individuals in an indoor environment are encouraged to maintain a 6-foot distance from each other.

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