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IOT SOCIAL DISTANCING AND QUEUE ROBOT

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Abstract: Social Distancing is very vital during the spread of pandamic and to keep safe from any deadly deseases than can break out in the nearing future. It is not confirmed that the pandamic that had occurred in the recent times have completely vanished . As they say prevention is better than cure it is very important to maintain social distancing. To maintain the same it is impossible to station a person for 24x7 to monitor hence forth we have come up with an idea of social distancing Robot which can help monitor social distancing and also the management of Queue. This can be used in heavily Places like Hospitals, Passport office, Adhar office ,Railway stations, Airports etc. This robot mainly consists of 4 tyres with 2 sensors , one buzzer and an LCD display which detects the distance between two members and hence provides details of distance between them and also manages the Queue.

Keywords:- **Distance detection, Alert message, COVID-19, Pandemic, Social Distancing, Automatic hand sanitization, Contactless temperature measurement.**

1. INTRODUCTION

Since the end of 2019, the COVID19 pandemic has spread globally and may become a major health and safety issue for communities, health workers, and health systems around the world 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 . Our goal is to introduce a unique method for mechanically observing a pair of people, in a crowded environment that does not comply with social distancing restrictions. Relative to the distance of two meters between them . In order to test the social distance of the queue, we developed a robot with mandatory social distance. The robot consists of a four wheel frame system used to drive the robotic vehicle. It uses the tail tracking principle to continuously queue and track behaviors that violate social distance. The infrared sensor moves the stern left and right to monitor violations. Currently, the robot is equipped with ultrasonic obstacle detection sensors to detect obstacles in the vehicle path. The robotic vehicle uses another ultrasonic sensor to determine the distance between two people. The distance between people is less than two meters, and the robot immediately beeps and warns of injuries. it also sends these violation notices and camera images via Wi-Fi via the Internet of things to notify.

2. LITERATURE SURVEY

A literature survey on IoT (Internet of Things) social distancing and queue management robots would involve gathering and analyzing existing research, publications, and articles related to the topic. Here's a structured approach to conducting such a survey:

1. **Define Keywords:** Start by defining keywords related to your topic. For example, "IoT social distancing robot," "queue - management robot," "smart city technology," etc.
2. **Search Databases and Libraries:** Look for relevant literature in academic databases such as IEEE Xplore, ACM Digital Library, ScienceDirect, Google Scholar, and others. Also, check university libraries and online repositories.
3. **Filter and Select Relevant Papers:** Narrow down your search results by filtering based on relevance, publication date, and quality. Focus on papers that discuss IoT applications specifically related to social distancing and queue management.
4. **Review Research Papers:** Read through the selected research papers, paying attention to methodologies, findings, and conclusions. Look for insights, challenges, and recommendations related to the implementation of IoT in social distancing and queue management.
5. **Identify Key Technologies and Approaches:** Note the technologies, sensors, algorithms, and communication protocols commonly used in IoT social distancing and queue management systems. Pay attention to any innovative approaches or frameworks proposed in the literature.
6. **Compare and Analyze Studies:** Compare the methodologies, results, and conclusions of different studies. Identify common trends, gaps in research, and areas for further investigation.
7. **Consider Case Studies and Real-World Deployments:** Look for case studies or examples of real-world deployments of IoT social distancing and queue management systems. Analyze their effectiveness, challenges faced, and lessons learned.
8. **Evaluate Limitations and Challenges:** Critically evaluate the limitations and challenges associated with implementing IoT-based solutions for social distancing and queue management. Consider factors such as cost, privacy concerns, scalability, and interoperability.
9. **Summarize Findings:** Summarize the key findings from your literature survey, including important research insights, technological advancements, and unresolved issues.
10. **Draw Conclusions and Make Recommendations:** Based on your literature survey, draw conclusions about the current state of research in IoT social distancing and queue management robots. Make recommendations for future research directions, potential applications, and areas needing further exploration.

By following these steps, you can conduct a comprehensive literature survey on IoT social distancing and queue management robots, providing valuable insights for further research and development in this field.

3. SYSTEM DESIGN

3.1 EXISTING SYSTEM

Several existing systems and prototypes demonstrate the integration of IoT technology for social distancing and queue management. Here are some examples:

- Pepper Robot by SoftBank Robotics: Pepper is a humanoid robot equipped with sensors and cameras that can detect and monitor people's movements. It has been utilized in various settings, including retail stores, airports, and hospitals, to assist with social distancing measures by reminding people to maintain safe distances and managing queues.
- Knightscope Security Robots: Knightscope develops autonomous security robots equipped with sensors, cameras, and IoT capabilities. These robots patrol areas such as malls, corporate campuses, and hospitals, enforcing social distancing guidelines and managing crowds effectively.

- Simbe Robotics' Tally Robot: Tally is an autonomous robot designed for inventory management in retail stores. It can also be equipped with additional sensors and software modules to monitor customer traffic, analyze shopping patterns, and enforce social distancing protocols by alerting staff when areas become crowded.
- Ava Robotics' Telepresence Robot: Ava Robotics offers telepresence robots equipped with cameras, microphones, and displays for remote communication. These robots can be used in various environments, including offices and public spaces, to enable virtual queuing and remote assistance, thereby reducing physical interactions and promoting social distancing.
- IBM Watson IoT Platform: IBM provides an IoT platform that integrates sensors, analytics, and AI capabilities to monitor and manage social distancing in different settings. By deploying IoT devices such as beacons, cameras, and wearables, organizations can collect real-time data on crowd density, analyze patterns, and take proactive measures to ensure compliance with social distancing guidelines.

3.2 PROPOSED SYSTEM

Designing a proposed system for IoT-based social distancing and queue management robots involves integrating various technologies to create an efficient and adaptable solution. Here's a conceptual framework for such a system:

- **Robot Hardware:** The robot hardware includes sensors, actuators, cameras, and communication modules. These components enable the robot to perceive its environment, interact with users, and communicate with other devices and systems.
- **Social Distancing Sensors:** Equip the robot with sensors such as LiDAR, ultrasonic sensors, or depth cameras to detect nearby individuals and estimate distances between them. These sensors help the robot assess crowd density and ensure compliance with social distancing guidelines.
- **Queue Management System:** Implement a queue management system that allows the robot to monitor queues, estimate waiting times, and optimize the flow of people. This system can utilize RFID tags, QR codes, or mobile apps to track individuals in the queue and provide real-time updates on their status.
- **IoT Connectivity:** Enable the robot to connect to the Internet and communicate with other IoT devices and cloud- based services. This connectivity facilitates data exchange, remote monitoring, and centralized management of multiple robots deployed in different locations.
- **Edge Computing:** Incorporate edge computing capabilities into the robot to perform real-time data processing and analysis. By processing sensor data locally, the robot can minimize latency and respond quickly to changing situations, such as detecting overcrowded areas or identifying individuals in need of assistance.
- **Machine Learning Algorithms:** Use machine learning algorithms to analyze sensor data and extract meaningful insights about crowd behavior, queue dynamics, and social distancing compliance. These algorithms can continuously learn and improve over time, adapting to evolving environments and user preferences.
- **Human-Robot Interaction:** Design intuitive interfaces and interaction mechanisms to enable seamless communication between the robot and users. This includes voice commands, gestures, and visual displays to convey information, provide instructions, and solicit feedback from individuals in the vicinity.
- **Cloud Integration:** Integrate the robot with cloud-based services for data storage, analytics, and remote management. This allows stakeholders to access real-time dashboards, generate reports, and configure the robot's behavior from anywhere with an Internet connection.
- **Privacy and Security:** Implement robust security measures to protect sensitive data and ensure user privacy. This includes encryption, authentication, and access control mechanisms to prevent unauthorized access to the robot's systems and data.
- **Scalability and Flexibility:** Design the system to be scalable and flexible, capable of adapting to different environments, usage scenarios, and regulatory requirements. This may involve modular architecture, API integration, and support for customization and extension by third-party developers.

4. FLOW CHART

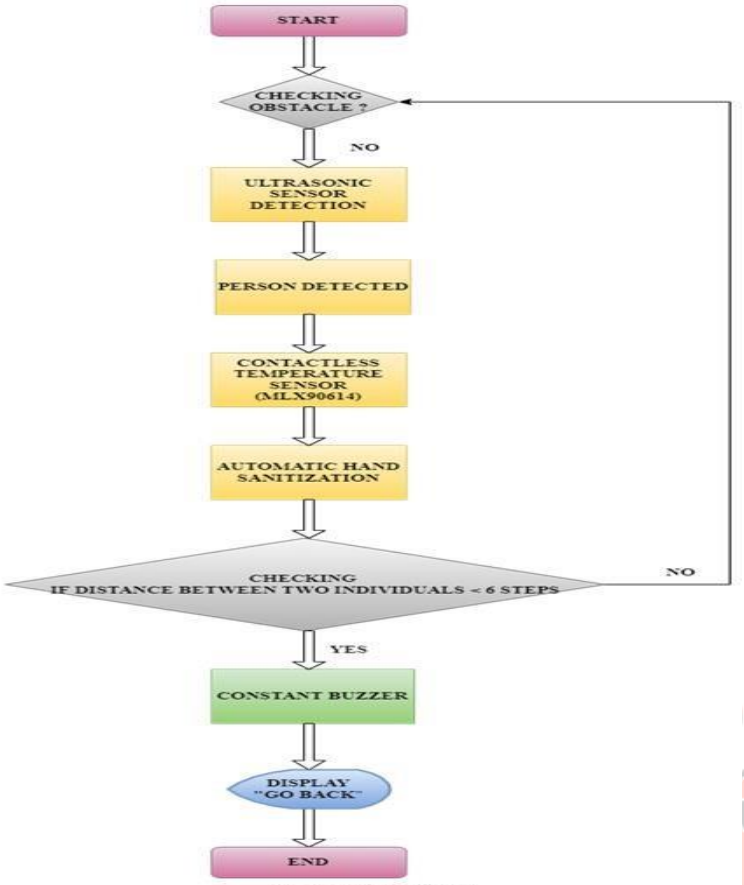


Fig.2 Flow Chart

Fig 1. Flow chart

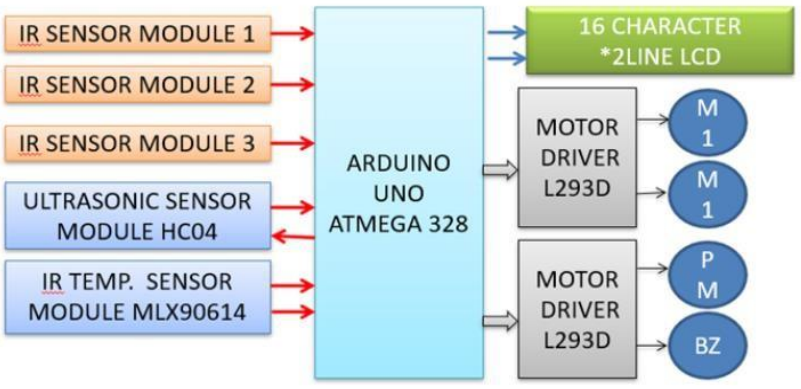


Fig.1 Block Diagram

Fig 2. Block Diagram

4.1 OBJECTIVES FOR THE ABOVE FLOWCHART / BLOCK DIAGRAM

The objectives of an IoT-based social distancing and queue management robot revolve around enhancing public safety, optimizing crowd flow, and promoting compliance with social distancing guidelines. Here are some specific objectives:

- **Enforce Social Distancing:** The primary objective is to ensure that individuals maintain safe distances from each other to minimize the risk of spreading contagious diseases. The robot should actively monitor crowd density, identify crowded areas, and provide gentle reminders or alerts to encourage social distancing.
- **Manage Queues Efficiently:** Another key objective is to streamline the queuing process and reduce wait times for individuals in line. The robot should monitor queue lengths, estimate waiting times, and dynamically adjust queue configurations to optimize throughput and minimize congestion.
- **Provide Real-time Guidance:** The robot should serve as a proactive guide, providing real-time information and directions to users. This includes directing individuals to less crowded areas, suggesting alternative routes, and informing them about queue status and estimated wait times.
- **Collect and Analyze Data:** The robot should gather data on crowd behavior, queue dynamics, and social distancing compliance using onboard sensors and cameras. This data can be analyzed to identify patterns, trends, and areas for improvement in crowd management strategies.
- **Facilitate Communication:** The robot should serve as a communication channel between users and relevant stakeholders, such as venue staff or security personnel. It should be equipped with voice communication capabilities, interactive displays, and mobile apps to enable users to seek assistance or report concerns.
- **Adapt to Dynamic Environments:** The robot should be able to adapt to changing conditions and unexpected events in its environment. This includes dynamically reconfiguring its behavior based on real-time feedback, adjusting to fluctuations in crowd density, and responding to emergencies or disruptions.
- **Integrate with IoT Ecosystem:** The robot should seamlessly integrate with other IoT devices and systems deployed in the same environment. This integration enables data sharing, coordination of actions, and interoperability with existing infrastructure, such as surveillance cameras, access control systems, and digital signage.
- **Promote Public Confidence:** By effectively managing crowds and promoting social distancing, the robot helps instill confidence among the public and encourages them to visit public spaces, such as retail stores, transportation hubs, and entertainment venues, knowing that safety measures are being enforced.
- **Enhance Operational Efficiency:** The robot should contribute to the overall efficiency of crowd management operations by automating repetitive tasks, reducing the need for manual intervention, and freeing up human resources to focus on more complex or critical tasks.
- **Continuous Improvement:** Finally, the objective is to continuously refine and improve the robot's capabilities based on feedback from users, stakeholders, and ongoing evaluation of its performance. This may involve software updates, algorithm enhancements, and incorporating lessons learned from real-world deployments.

5. DESCRIPTION OF HARDWARE COMPONENTS

- Arduino UNO
- Ultrasonic Sensor - HC-SR04 (Generic)
- Bolt IoT Bolt Wi-Fi Module
- Raspberry Pi Camera Module
- Arduino Motor Shield Rev3Arduino Mega
- Jumper wires (generic)
- LED (generic)

6. RESULTS AND DISCUSSION

IoT social distancing and queue management robots have proven to be effective tools in enforcing social distancing guidelines and optimizing crowd flow in various settings. By leveraging sensors, cameras, and AI algorithms, these robots can monitor crowd density, detect violations of social distancing protocols, and dynamically manage queues to minimize congestion and reduce wait times. The integration of IoT

technologies enhances the user experience by providing real-time guidance, clear communication, and proactive assistance in crowded environments. Users generally perceive these robots positively, appreciating their role in promoting public safety and streamlining the queuing process. However, ensuring transparent communication and addressing privacy concerns are essential for maintaining trust and acceptance among users. Despite their effectiveness, IoT social distancing and queue management robots face several challenges, including technical limitations, cost constraints, and ethical considerations. Ensuring the accuracy and reliability of sensor data, addressing algorithmic biases, and maintaining robust cybersecurity are ongoing challenges th at require careful attention. While robots can automate many aspects of crowd management, human oversight and intervention remain crucial, particularly in complex or sensitive situations. Integrating robots with human operators, security personnel, and customer service representatives can enhance coordination and ensure a holistic approach to crowd management. The deployment of IoT robots raises ethical and legal questions regarding privacy, surveillance, and data ownership. Transparent communication, informed consent, and compliance with data protection regulations are essential for addressing ethical concerns and maintaining public trust.

7. CIRCUIT DIAGRAM

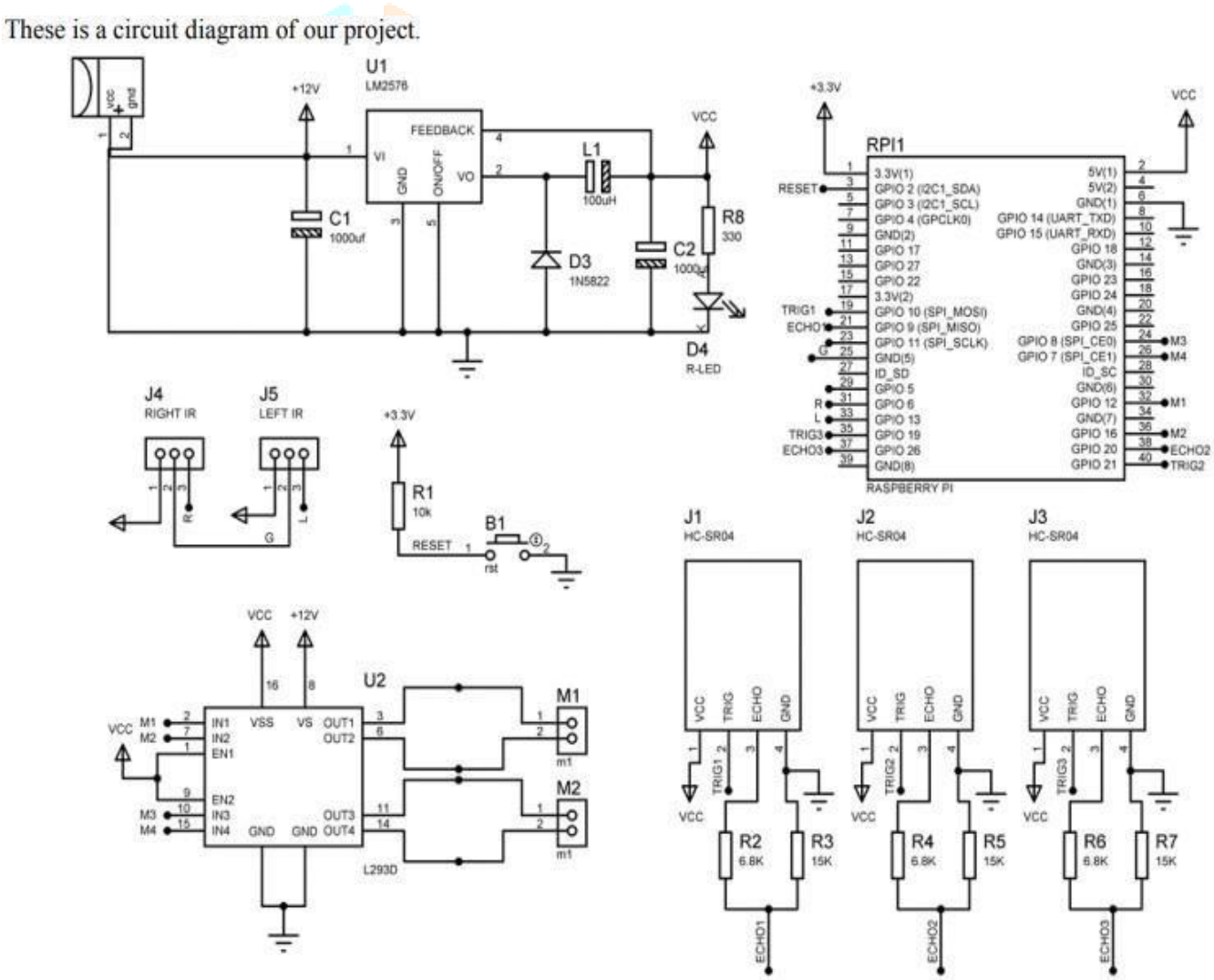


Figure 2: Circuit diagram

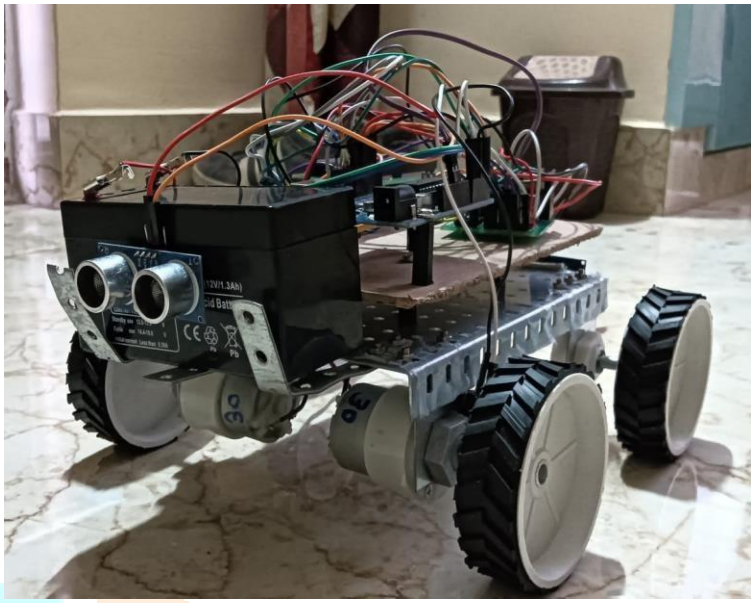


Fig 4. Complete setup of Robot

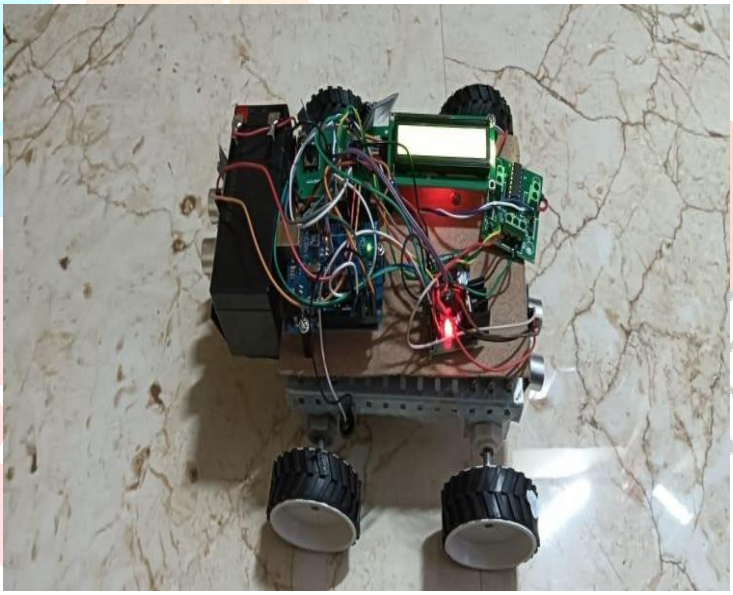


Fig 5 Top view of Robot

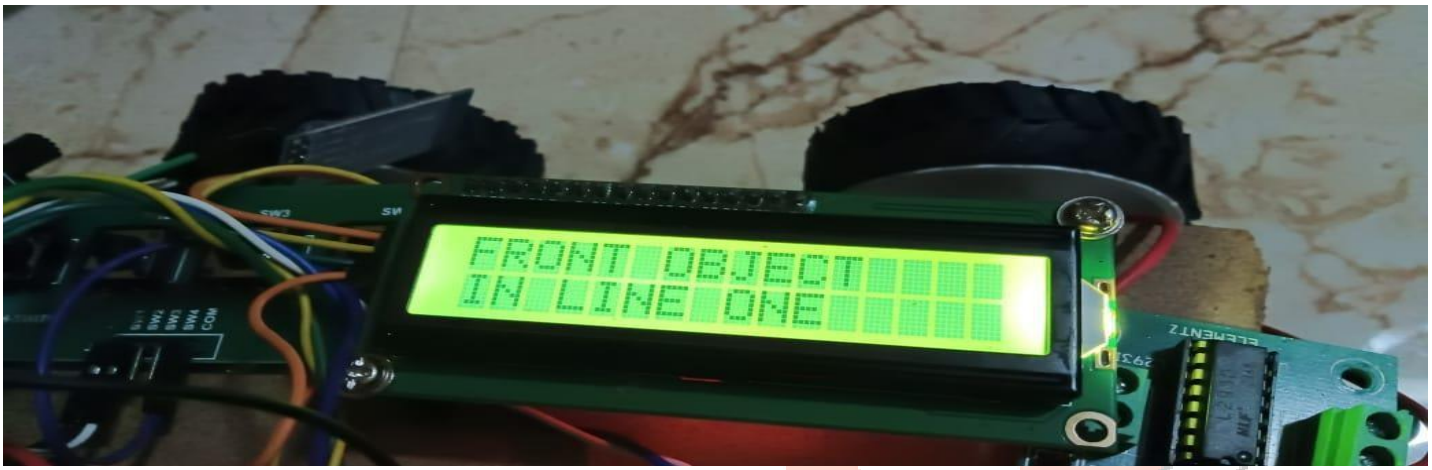


Fig 6. Front line object detected in line 1

Fig 7.LCD Display of the Robot

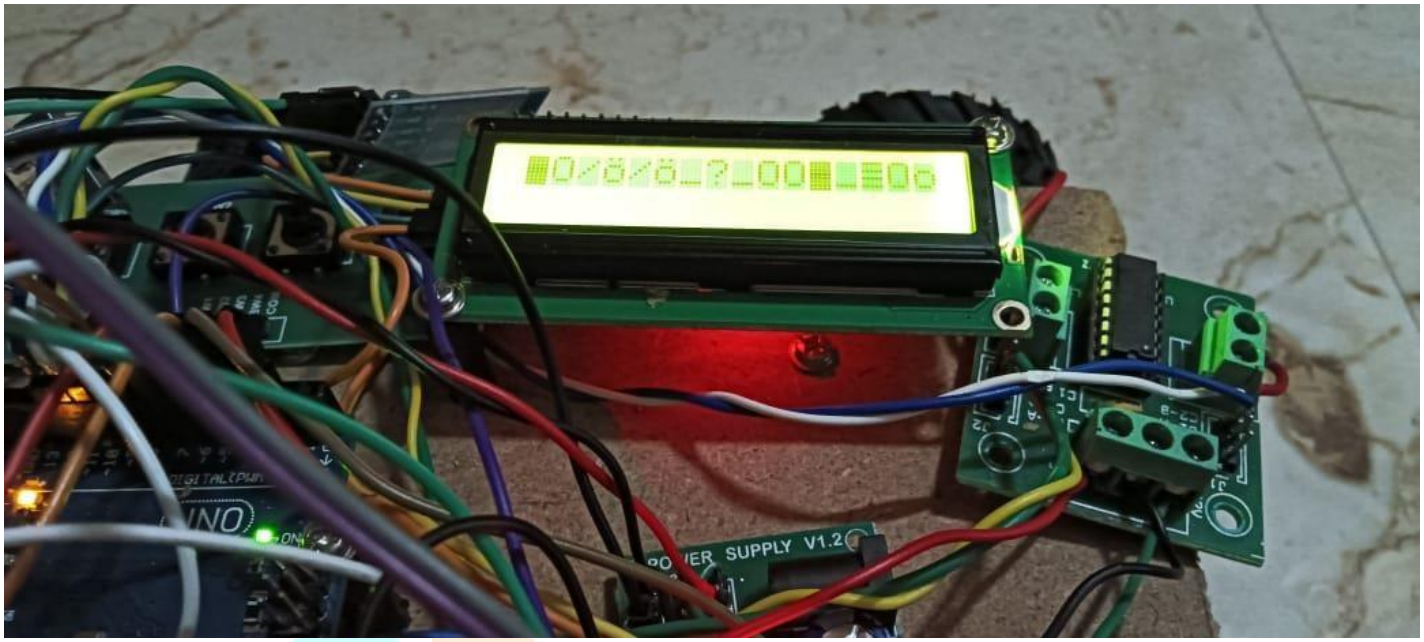


Fig 8. Numeric display in LCD

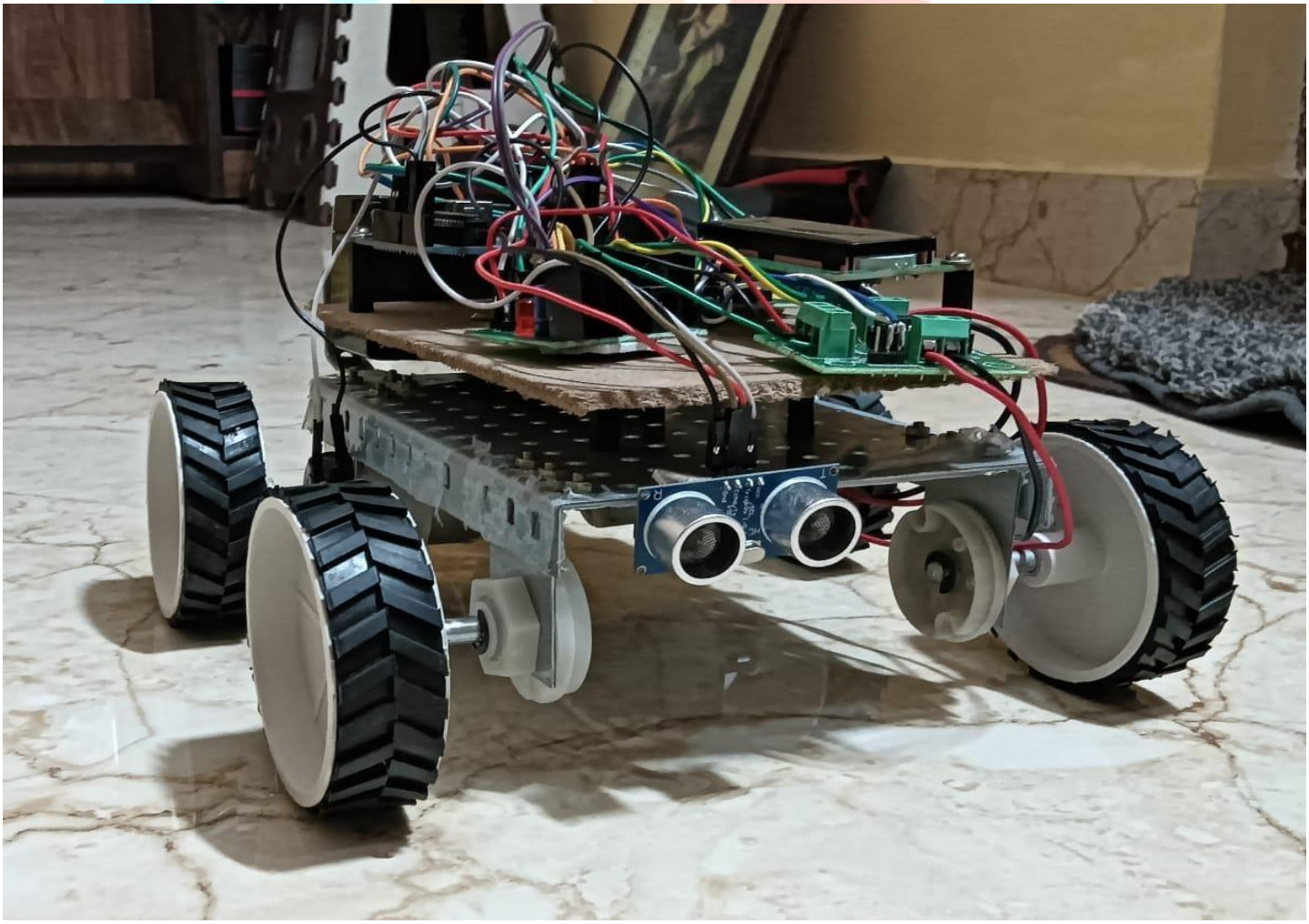
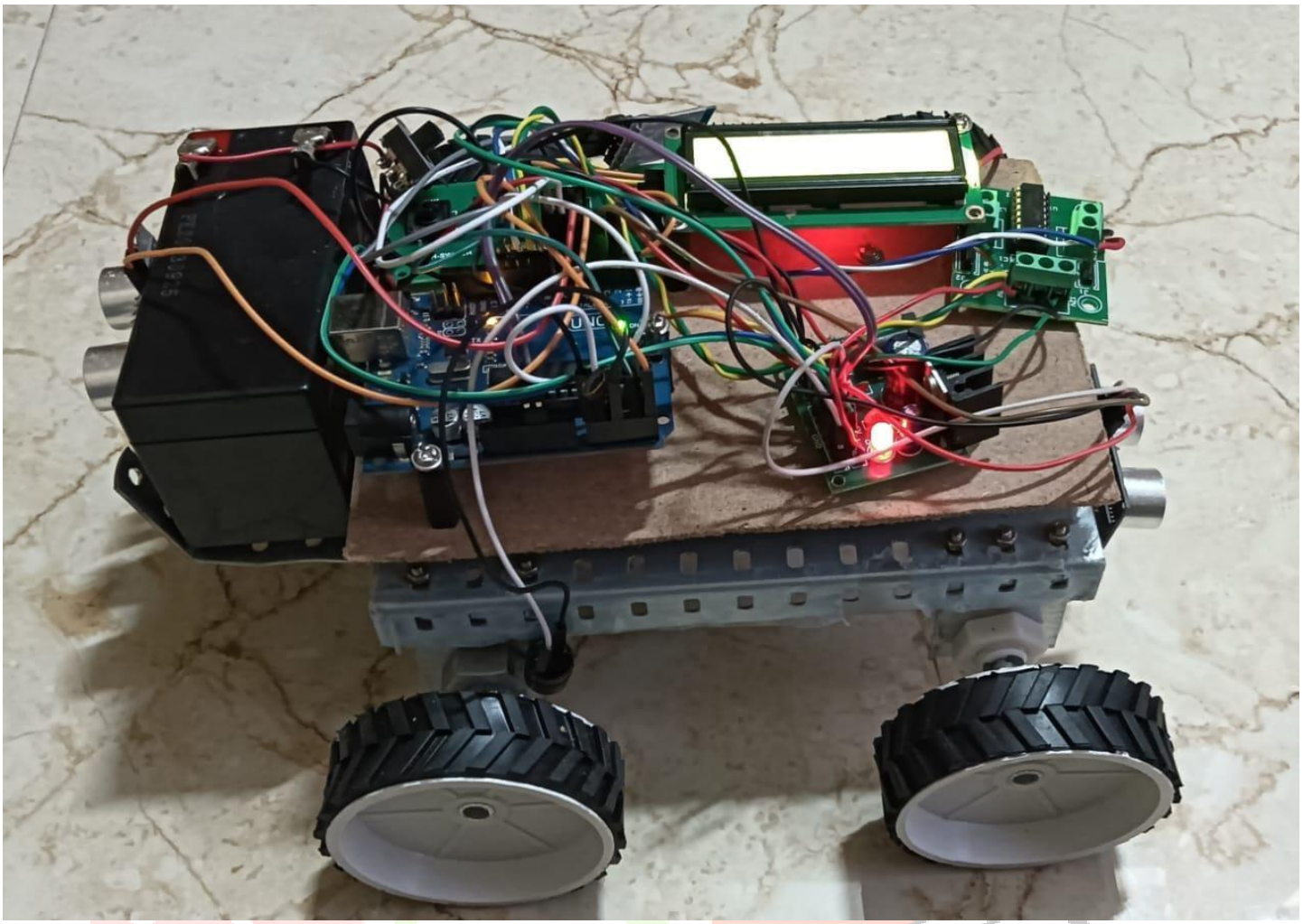


Fig 9 Backward view of the Robot



g 10. Buzzer alarm indicating the distance between 2 people maintaining Social Distancing

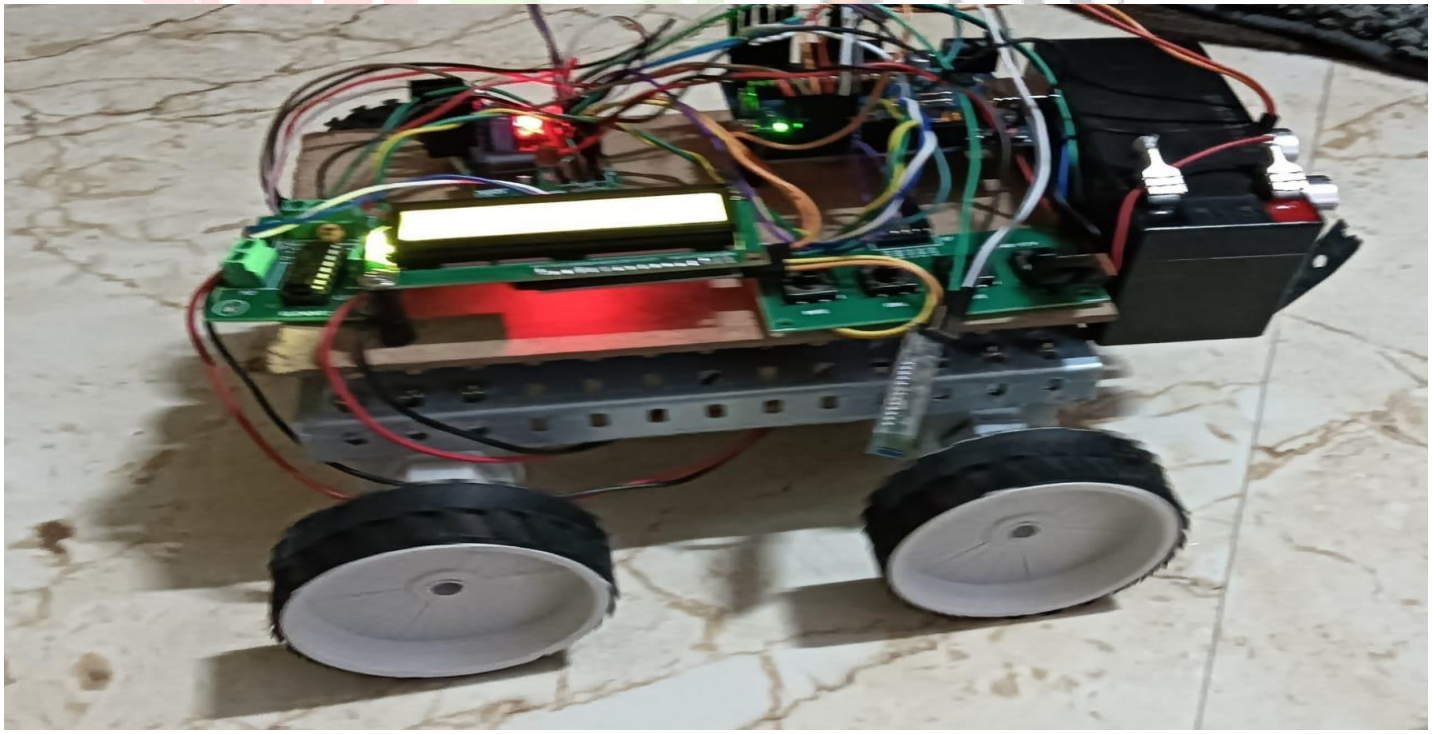


Fig 11 . Forward motion of the Robot

8. CONCLUSION

An IOT-based model for controlling the current pandemic was developed .By monitoring the distance between people who spread the disease, it helps limit the spread of Covid. Robotic vehicle moves beside the queue and monitor social distance violations. It detects the distance between two people in the queue. If the two are found to be less than 3 feet apart from each other, then the robot will immediately sound the buzzer with a warning message "Keep a distance" to notify you of the violation. It also captures an image of the offending person and sends it via IOT to notify the authorities. It will also take temperature of people standing in the queue and report any irregular temperature to the authorities through IOT. Shielding like social distancing is recommended to prevent the spread of Covid19. To prevent the current pandemic, we\'ve presented a social distancing and monitoring robot. It contributes in limiting Covid\'s transmission by monitoring the distance between disease-spreading individuals. This robot is specifically designed with the purpose of maintaining distance between individuals in queues. If two people are found to be within 6 steps of each other in queues, the robot immediately sounds a buzzer to alert about the violations. Also, Sanitation and temperature measurement were also used as preventive measures around the world during the COVID-19 epidemic. Therefore, this robot also includes a contactless temperature measurement and automatic hand sanitizer.

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] Mohammad Shamiur Rahman Al Nahian, Arnab PiushBiswas(2020). An Automated Obstacle Detector and Path Finder Robotic car. May 2020International Journal on Informatics Visualization, Vol.4,DOI: 5. Improving the robot's ability to interact with humans in a more natural and user-friendly manner. This could include speech recognition, natural language processing, and gesture-based communication. 6. Enhancing the robot's autonomy and navigation capabilities to handle complex environments. This may involve integrating technologies like SLAM (Simultaneous Localization and Mapping) for precise mapping and navigation. 7. Implementing energy-efficient technologies to prolong the robot's operational time and reduce the need for frequent recharging. Energy Efficiency:
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