A

Minor Project Report

On

COVID PROTECTIVE ROBOT PHASE-II

Submitted to

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL (M.P)

In Partial fulfilment for the award of degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS & COMMUNICATION

By

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DECLARATION

We hereby declare that the work, which is being presented in this dissertation entitled "**COVID PROTECTIVE ROBOT PHASE-II**" in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Electronics & Communication, is an authentic record of work carried out by us.

The matter embodied in this dissertation has not been submitted by us for the award of any other degree.

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CERTIFICATE

This is to certify that the dissertation entitled. "**COVID PROTECTIVE ROBOT PHASE-II**" submitted to RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA (RGPV), Bhopal (M.P.) in the Department of **Electronics and communication** Engineering by

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with date	**with date**

Acknowledgement

The success and final outcome of this project required a lot of guidance and assistance from many people and we are extremely fortunate to have got this all along the completion of our project work. Whatever we have done is only due to such guidance and assistance and we would not forget to thank them.

We owe our profound gratitude to our project Coordinator Mr. Ravi Yadav, who took keen interest on our project work, us all along, till the completion of our project work by providing all the necessary information, constant encouragement, sincere criticism and sympathetic attitude. The completion of this dissertation would not have been possible without such guidance and support.

We owe our profound gratitude to our project Guide Mr. Pranav Paranjpe, who took keen interest on our project work and guided,

We extend our deep sense of gratitude to our, Mr. Ankit Jain, HOD, Department of Electronics and Communication for his support and suggestions during this project work.

We respect and thank to our Hon'ble Principal Dr Keshav Patidar, for giving us an opportunity to do the project work in campus and providing us all the necessary resources, support and constant motivation which made us to complete the project on time.

we are thankful to and fortunate enough to get constant encouragement and guidance from all teaching staffs of department of Electronics and Communications which helped us in successfully completing our project work.

We would like to extend our sincere regards to all the non-teaching staff of department of Electronics and Communications for their timely support.

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ABSTRACT

Since 2019 COVID is spreading all over the world and day by day cases of covid are increasing or decreasing. No one knows when it will end. The COVID-19 pandemic has caused significant disruption to daily life around the world. As of August 10, 2020, there have been 19.8 million confirmed cases worldwide with more than 730 thousand fatalities. Furthermore, this pandemic has caused significant economic and social impacts. At the moment, one of the best ways to prevent contracting COVID-19 is to avoid being exposed to the coronavirus. Organizations such as the Centres for Disease Control and Prevention (CDC) have recommended many guidelines including maintaining social distancing, wearing masks or other facial coverings, and frequent hand washing to reduce the chances of contracting or spreading the virus.

Broadly, social distancing refers to the measures taken to reduce the frequency of people coming into contact with others and to maintain at least 6 feet of distance between individuals who are not from the same household. Several groups have simulated the spread of the virus and shown that social distancing can significantly reduce the total number of infected cases. As communities reopen and people are more often in public, the term “physical distancing” (instead of social distancing) is being used to reinforce the need to stay at least 6 feet from others, as well as wearing face masks.

Historically, social distancing was also used interchangeably to indicate physical distancing which is defined below. However, social distancing is a strategy distinct from the physical distancing behavior. 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. So, looking to these problems our team has got the idea to make robot to minimize problems. To ensure social distancing in queues we hereby design a **COVID PROTECTIVE ROBOT.**

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1. INTRODUCTION

Since 2019 COVID is spreading all over the world and day by day cases of covid are increasing or decreasing. No one knows when it will end. The COVID-19 pandemic has caused significant disruption to daily life around the world. As of August 10, 2020, there have been 19.8 million confirmed cases worldwide with more than 730 thousand fatalities. Furthermore, this pandemic has caused significant economic and social impacts.

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2. LITERATURE SURVEY

The COVID-19 disease is highly contagious which put all contacts of the patients in danger, including the medical personnel. So, robots, which are immune to infection and easy to be disinfected, are recommended to play a vital role in the war against the pandemic. More research efforts are invested in the robotic applications during the pandemic. Until Nov 2020, there have been 280 publications in this area. Before 2020, there were only several research proposals in this area. Naturally, the majority of the papers were published in 2020 after the breakout of COVID-19. The publication trend is compliant with the one for infectious diseases shown in Section 3, and the number is also increasing rapidly when this literature survey is conducted.

Since the late 2019, the COVID-19 disease has been spread worldwide. It leads to critical challenges to almost all countries in the world. Until November 2020, there have been 57,639,631 confirmed COVID-19 cases with 1,373,294 deaths globally, according to the statistics of the World Health Organization (WHO) [1]. Different approaches and technologies are suggested to support the treatment and control of the pandemic, including robotics.

In the past, some researchers briefly summarized the robotic applications during a pandemic. classified the robot utilizations in healthcare in different categories, including receptionist, nurse, ambulance, telemedicine, serving, cleaning, spraying/disinfestation, surgical, radiologist, rehabilitation, food, and outdoor delivery robots. Zeng et al. [7] reviewed the robot applications based on the desired locations, i.e., robots in hospitals, communities, airports, transportations, recreations, hotels, restaurants, attractions and scenic areas. Those reviews have provided an overview of the robotic achievements so far. However, there is still a lack of detailed analysis from the robotic technology's perspective. Therefore, it is necessary to discuss the key robotic technologies combating the pandemic and to identify future research trends. Thus, in this research, a literature survey is conducted, aiming to systematically analyses the research achievements so far.

3. METHODOLOGY

Phase 1

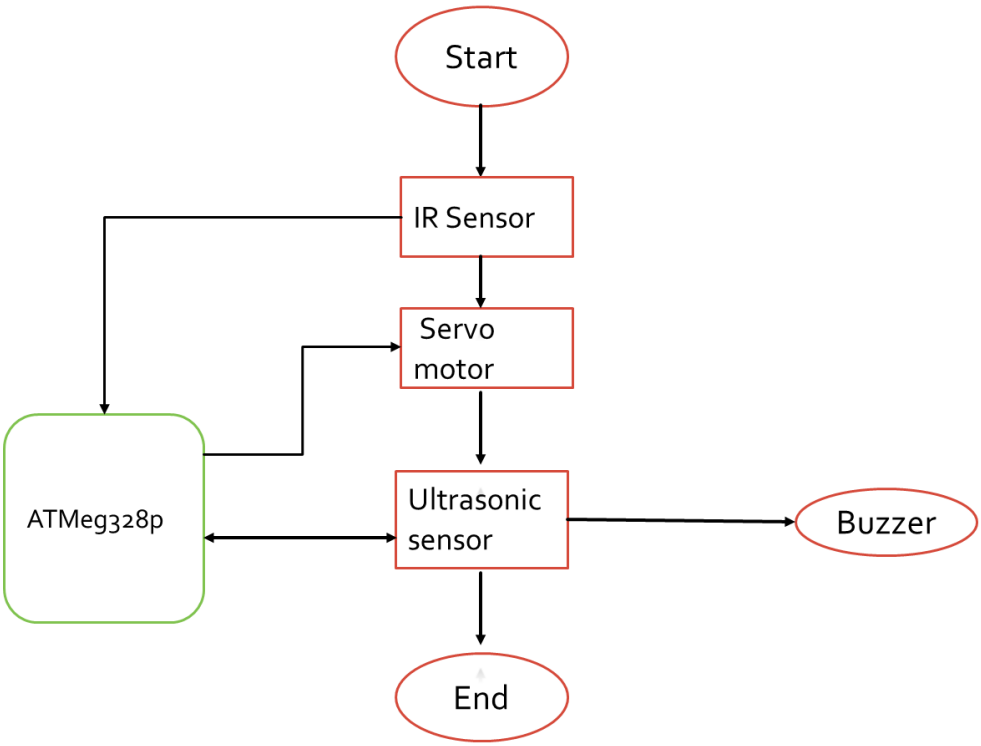
- In this project we are going to make a robot which will be helpful for pandemics.
- The robot consists of a 4 Wheel design system used to drive the robotic vehicle
- It makes use of a line following principle to constantly move along with the queue and ultrasonic sensor for social distance monitoring.

Phase 2

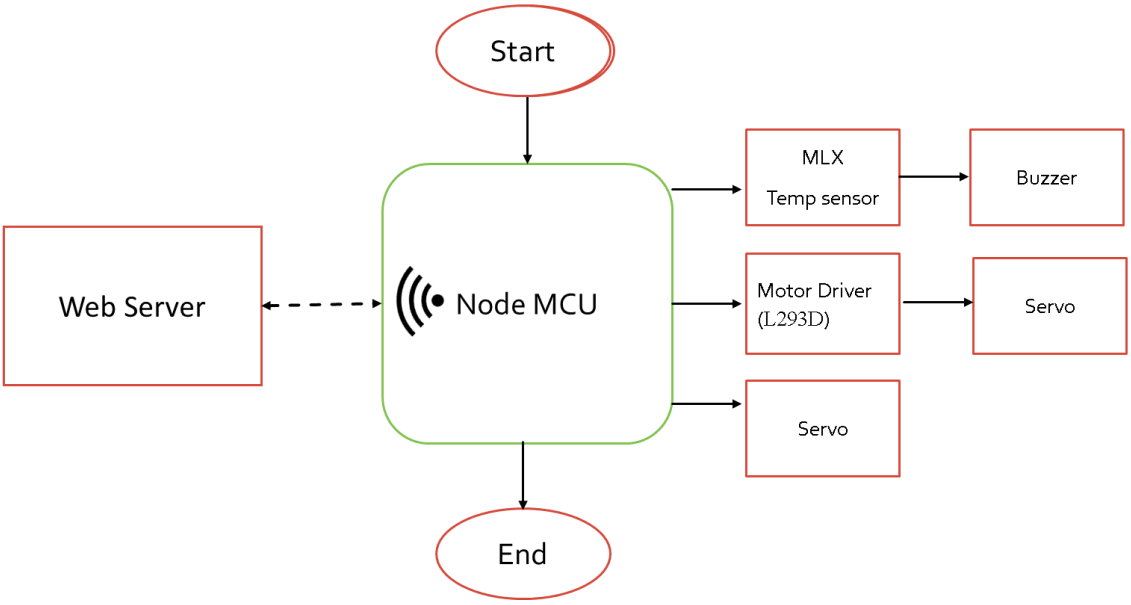
- We use line follower as well as WIFI to control robot.
- If there is no line following path then we use WIFI to control the robot manually.
- We are also add temperature sensor to check temperature and hand sanitizer for sanitization purpose.
- We make web page with the help of HTML, CSS and Java script.

3.1. Flow chart: -

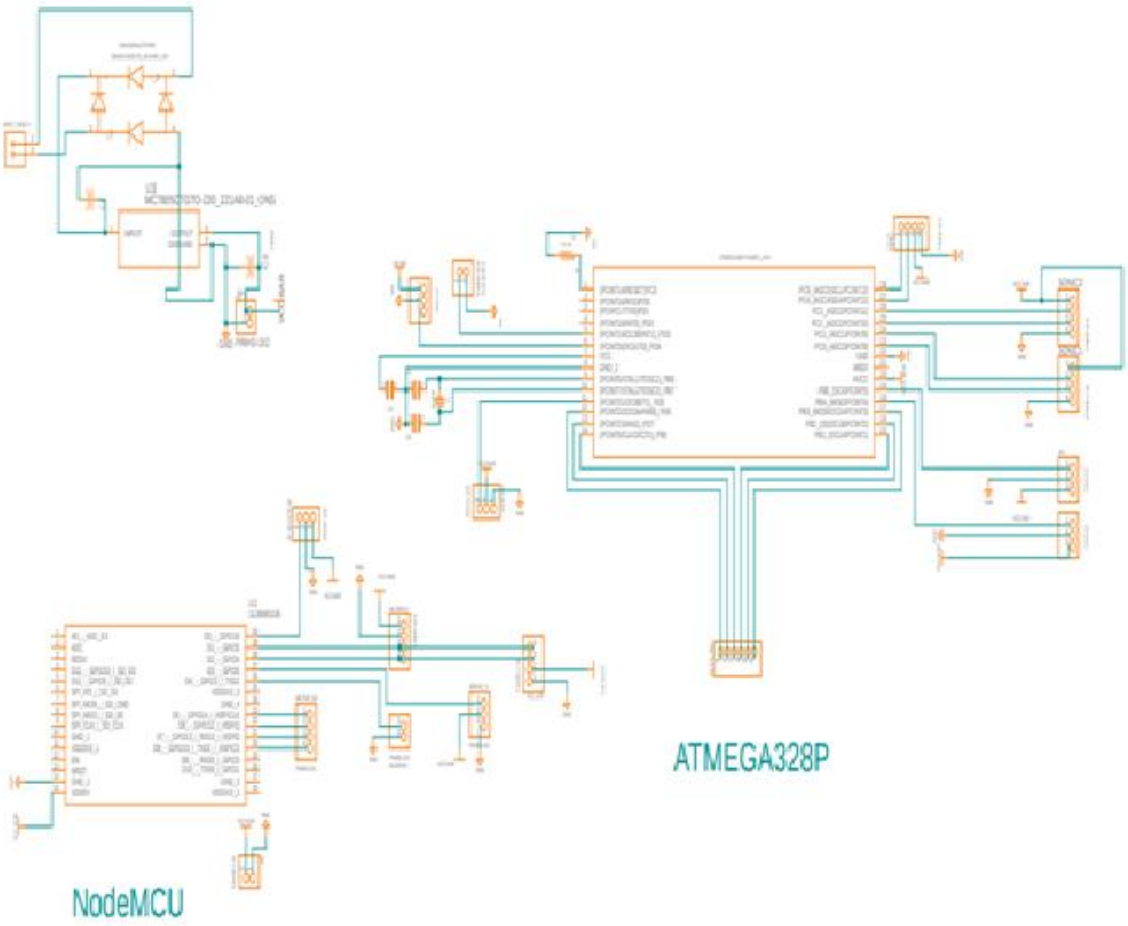
3.1.1. Part 1



3.1.2. Part 2

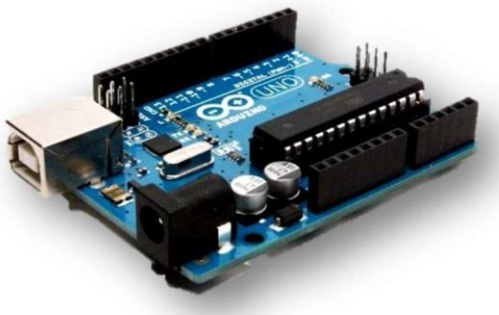

Start
MLX
Temp sensor
Buzzer
Web Server
Node MCU
Motor Driver
(L293D)
Servo
Servo
End

3.2. **Schematic diagram: -**



4. HARDWARE/COMPONENTS/SOFTWARE REQUIREMENTS

4.1. Arduino Uno Atmega328p



Technical Specifications :-

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB of which 0.5 KB used by bootloader
- SRAM 2 KB
- EEPROM 1 KB

- Clock Speed 16 MHz
- Manufacturer part number: ATmega328P-PU

4.2. **Ultrasonic Sensor (HC-SRO4):** -

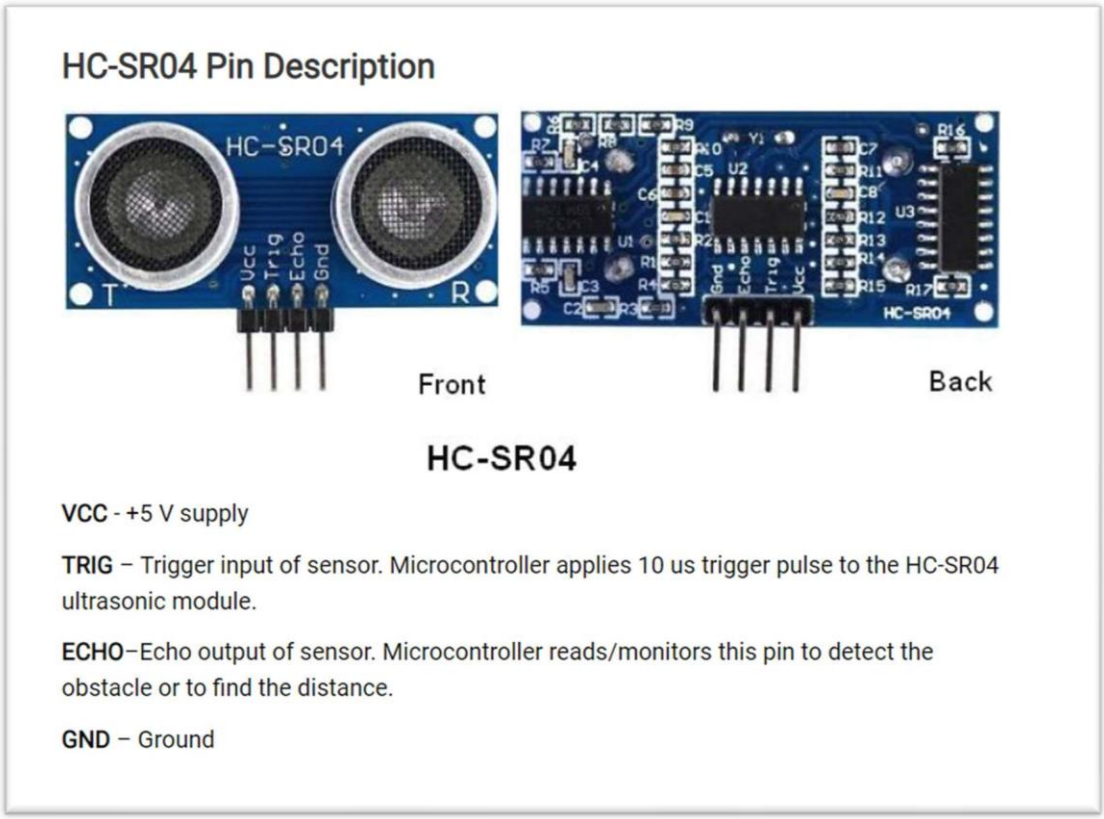
Ultrasonic transducers and ultrasonic sensors are devices that generate or sense ultrasound energy. They can be divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound, receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound.

In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is ,

$$\text{Total Distance} = \frac{(\quad)}{\qquad}$$

Total distance is divided by 2 because signal travels from HC-SR04 to object and returns to the module HC-SR-04.

For example, if a scientist set up an ultrasonic sensor aimed at a box and it took 0.025 seconds for the sound to bounce back, the distance between the ultrasonic sensor and the box would be:



Technical specifications: -

- Input Voltage: 5V
- Current Draw: 20mA (Max)
- Digital Output: 5V
- Digital Output: 0V (Low)
- Working Temperature: -15°C to 70°C
- Sensing Angle: 30° Cone

- Angle of Effect: 15° Cone
- Ultrasonic Frequency: 40kHz
- Range: 2cm - 400cm
- Dimensions: - Length: 43mm

  Width: 20mm

  Height (with transmitters): 15mm

  Centre screw hole distance: 40mm x 15mm

  Screw hole diameter: 1mm (M1)

  Transmitter diameter: 8mm

4.3. **IR Sensor: -**

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.

These types of radiations are invisible to our eyes, which can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

Technical specifications: -

5V DC Operating voltage

- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable Sensing range
- Built-in Ambient Light Sensor
- 20mA supply current

- Mounting hole

IR Sensor Module Pinout Configuration

Pin Name	Description
VCC	Power Supply Input
GND	Power Supply Ground
OUT	Active High Output

4.4. **LCD 16x2**: -

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

The 16×2 LCD pinout is shown below.

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).

- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only

four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.

- Pin15 (+ve pin of the LED): This pin is connected to +5V
- Pin 16 (-ve pin of the LED): This pin is connected to GND.

Technical specifications: -

- The operating voltage of this display ranges from 4.7V to 5.3V
- The operating current is 1mA without a backlight
- HD47780 controller
- LED color for backlight is green or blue
- Number of columns – 16
- Number of rows – 2
- Number of LCD pins – 16
- Characters – 32

4.5. **Micro Servo Motor**: -

Servo motors (or servos) are self-contained electric devices that rotate or push parts of a machine with great precision. Servos are found in many places: from toys to home electronics to cars and airplanes. If you have a radio-controlled model car, airplane, or helicopter, you are using at least a few servos. In a model car or aircraft, servos move levers back and forth to control steering or adjust wing surfaces. By rotating a shaft connected to the engine throttle, a servo regulates the

speed of a fuel-powered car or aircraft. Servos also appear behind the scenes in devices we use every day.

The simplicity of a servo is among the features that make them so reliable. The heart of a servo is a small direct current (DC) motor, similar to what you might find in an inexpensive toy. These motors run on electricity from a battery and spin at high RPM (rotations per minute) but put out very low torque. An arrangement of gears takes the high speed of the motor and slows it down while at the same time increasing the torque. The gear design inside the servo case converts the output to a much slower rotation speed but with more torque (big force, little distance). The amount of actual work is the same, just more useful. Gears in an inexpensive servo motor are generally made of plastic to keep it lighter and less costly.

Technical specifications: -

- Pulse Width: - 500µs - 2400µs
- Rotation/Support: - Bushing Shaft Diameter: - 4.5mm o Speed: - 0.32 oz (9.0 g)
- Torque 4.8V: 25.0 oz-in (1.80 kg-cm)
- Gear Type: - Plastic
- Modulation: - Analog
- Motor Type: - 3 Pole Servo Motor
- Range: - 180°
- Power Supply
- Phase Voltage 5V

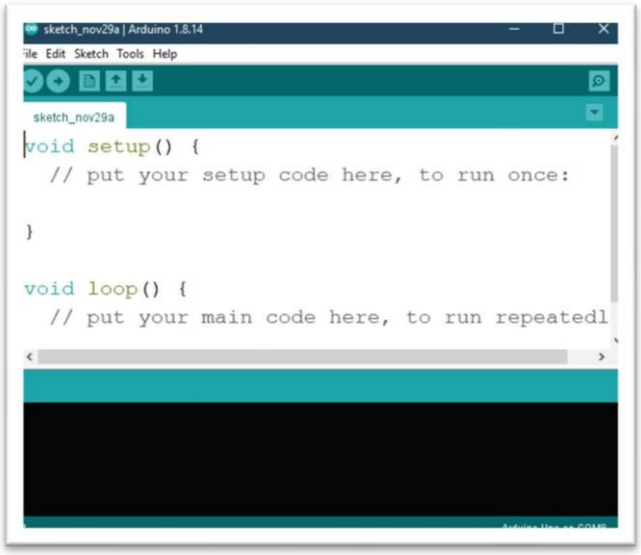
4.6. **DC Motor and Wheels**: -

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation.

DC motors use magnetic fields that occur from the electrical currents generated, which powers the movement of a rotor fixed within the output shaft. The output torque and speed depend upon both the electrical input and the design of the motor.

4.7. **Arduino IDE (1.8.16) Software**: -

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.



The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, argued is used as the uploading tool to flash the user code onto official Arduino boards.

Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework.

With the rising popularity of Arduino as a software platform, other vendors started to implement custom open-source compilers and tools (cores) that can build and upload sketches to other microcontrollers that are not supported by Arduino's official line of microcontrollers.

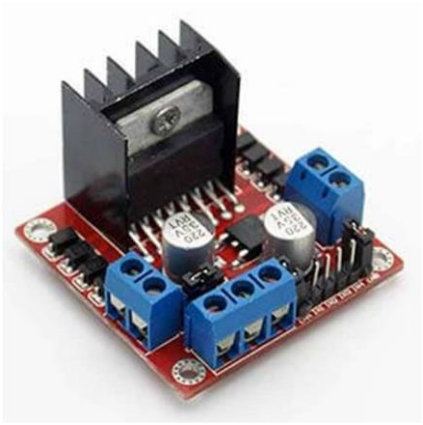
4.9. **ESP8266 (Node MCU): -**

The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use. Programming NodeMCU with the Arduino IDE will hardly take 5-10 minutes. All you need is the Arduino IDE, a USB cable and the NodeMCU board itself.

Technical Specifications: -

- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects.

4.10. L298N Motor Driver Module: -



This dual bidirectional motor driver, is based on the very popular L298 Dual H-Bridge Motor Driver Integrated Circuit. The circuit will allow you to easily and independently control two motors of up to 2A each in both directions. It is ideal for robotic applications and well suited for connection to a microcontroller requiring just a couple of control lines per motor. It can also be interfaced with simple manual switches, TTL logic gates, relays, etc. This board equipped with power LED indicators, on-board +5V regulator and protection diodes.

Technical Specifications: -

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance

- Power-On LED indicator
- Dimensions: - 43 x 43 x 26mm
- Weight: - 26g

4.11. Cell 12volt (Lithium-ion): -

A lithium-ion cell or Li-ion battery (18650) is a type of rechargeable battery in which lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge and back when charging. Li-ion batteries use an intercalated lithium compound as the material at the positive electrode and typically graphite at the negative electrode.

Li-ion batteries have a high energy density, no memory effect (other than LFP cells) and low self-discharge. Cells can be manufactured to either prioritize energy or power density. They can however be a safety hazard since they contain flammable electrolytes and if damaged or incorrectly charged can lead to explosions and fires.

4.12. MLX 90614(Temperature Sensor): -

The MLX90614 is a **Contactless Infrared (IR) Digital Temperature Sensor** that can be used to measure the temperature of a particular object ranging from -70° C to 382.2°C. The sensor uses IR rays to measure the temperature of the object without any physical contact and communicates to the microcontroller using the I2C protocol.

MLX90614 Pinout Configuration

Pin No.	Pin Name	Description
1	Vdd (Power supply)	Vdd can be used to power the sensor, typically using 5V
2	Ground	The metal can also act as ground
3	SDA – Serial Data	Serial data pin used for I2C Communication
4	SCL – Serial Clock	Serial Clock Pin used for I2C Communication

Technical Specifications:-

- Operating Voltage: 3.6V to 5V (available in 3V and 5V version)
- Supply Current: 1.5mA
- Object Temperature Range: -70° C to 382.2°C
- Ambient Temperature Range: -40° C to 125°C
- Accuracy: 0.02°C
- Field of View: 80°
- Distance between object and sensor: 2cm-5cm (approx.)

4.13. Battery socket : -

4.14. Metal Gear Servo:-

MG995 Metal Gear Servo Motor is a high-speed standard servo can rotate approximately 180 degrees (60 in each direction) used for airplane, helicopter, RC-cars and many RC model. Provides 10kg/cm at 4.8V, and 12kgcm at 6V.

It is a Digital Servo Motor which receives and processes PWM signal faster and better. It equips sophisticated internal circuitry that provides good torque, holding power, and faster updates in response to external forces. They are packed within a tight sturdy plastic case which makes them water and dust resistant which is a very useful feature in RC planes, Boats, and RC Monster Trucks etc. It equips 3-wire JR servo plug which is compatible with Futaba connectors too.

5. WORKING

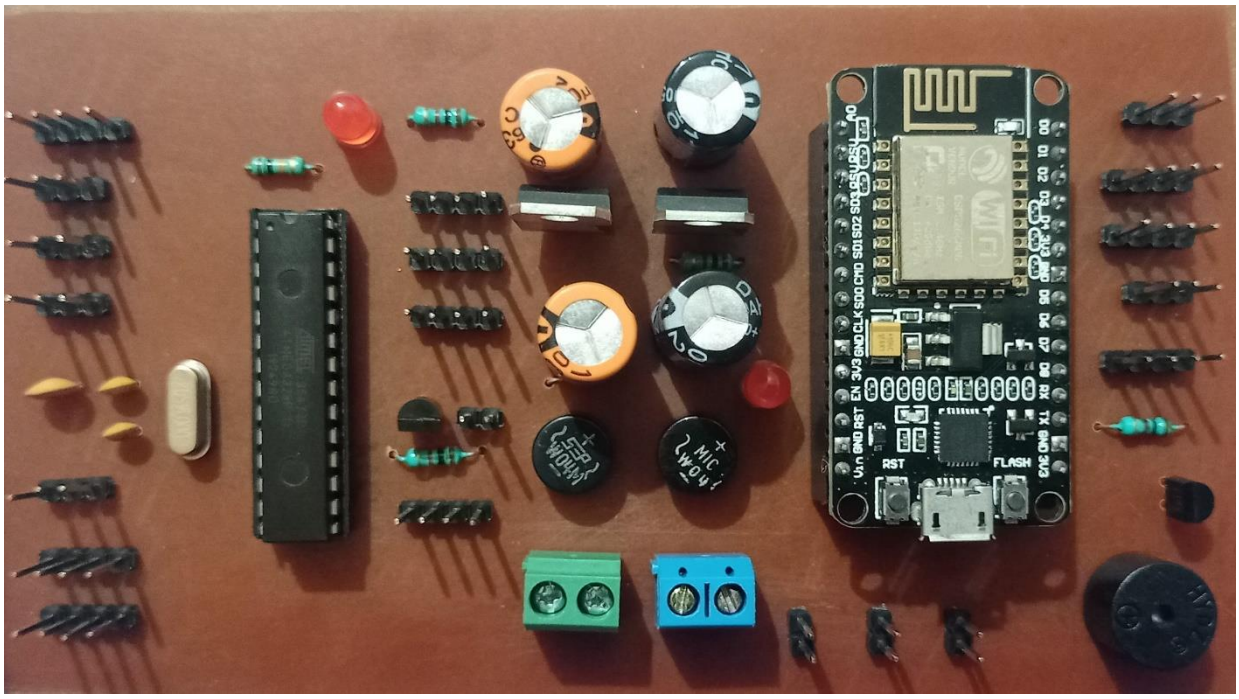
Before going to working of the project, it is important to understand how the ultrasonic sensor works. The basic principle behind the working of ultrasonic sensor is as follows:

Using an external trigger signal, the Trig in an ultrasonic sensor is made logic high for at least 10µs. A sonic burst from the transmitter module is sent. This consists of 8 pulses of 40KHz. The signals return back after hitting a surface and the receiver detects this signal. The Echo pin is high from the time of sending the signal and receiving it. This time can be converted to distance using appropriate calculations. Here, An Arduino Uno microcontroller is used since it is easy to program, has inbuilt ADC, DAC. The input to the Arduino is given using an ultrasonic sensor, which is used to sense the distance, it emits ultrasonic frequency from one side and the notes the time taken by sound wave to get reflected back. On the top of servo motor two ultra-sonic sensor mounted. It takes readings at certain levels and check certain conditions (perform certain algorithms) to know whether the social distancing is monitoring or not. We have used two IR sensor along with DC motor connected to NodeMCU which is another microcontroller for following the path to robot.

In give two ultrasonic sensor name s1 and s2. If micro servo motor rotates at certain angle. If s1 sense object and s2 will not sense object this means social distance not following. If s1 sense object and s2 is also sense object this means that social distancing not follow.

In phase 2 We use line follower as well as WIFI to control robot . If there is no line following path then we use WIFI to control the robot manually. We are also add temperature sensor to check temperature and hand sanitizer for sanitization purpose. We make web page with the help of HTML, CSS and Java script.

5.1. PCB PHOTO



6. APPLICATIONS

1. Social distancing is crucial for preventing the spread of contagious illnesses such as COVID-19 (coronavirus). COVID-19 can spread through coughing, sneezing and close contact. By minimizing the amount of close contact by robot, we reduce our chances of catching the virus and spreading it to our loved ones and within our community
2. It can be used in hospitals, colleges, schools, work places, at home, shopping malls and many more such places i.e., almost everywhere there we need to monitor social distancing.

7. Conclusion

COVID-19 Since, it has currently turned out to be a global challenge, technologically advanced countries can aid others by donating support equipment and robotic infrastructure to enable a good outcome in controlling this disease. This review substantiates that the introduction of medical robotics has significantly augmented the safety and quality of health management systems compared to manual systems due to healthcare digitization

8. References

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