OBSTACLE AVOIDANCE ROBOT

PROJECT REPORT

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Under the guidance of

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In partial fulfilment for the award of the

degree of

BACHELOR OF TECHNOLOGY

In

INTRODUCTION TO ROBOTICS

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BONAFIDE CERTIFICATE

This is to certify that the major project report entitled

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In partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology in **Introduction to Robotics** is a Bonafide record of the work carried out under my guidance and supervision at Amrita School of Engineering, Chennai.

Signature

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OBSTACLE AVOIDANCE ROBOT

Abstract:

Obstacle rejection is one among the foremost vital aspects of mobile AI. Without it, golem movement would be terribly restrictive and fragile. This project proposes robotic vehicle that has Associate in Nursing intelligence in-built it specified it directs itself whenever Associate in Nursing obstacle comes in its path. So, to safeguard the golem from any physical damages. this could be style to make Associate in Nursing obstacle rejection robotic vehicle mistreatment unbearable sensors for its movement. A micro-controller (AT mega 328P) is employed to realize the specified operation. Associate in Nursing unbearable detector is employed to sight any obstacle sooner than it and sends a command to the micro-controller. counting on the sign received, the micro-controller redirects the golem to maneuver in Associate in Nursing alternate direction by causative the motors that area unit interfaced to that through a motor driver. An obstacle avoiding robot is a device that is designed to navigate through an environment while avoiding obstacles that may be present. These robots can be used in a variety of applications, including search and rescue operations, inspections of hazardous environments, and exploration of unknown or inaccessible areas. The design of an obstacle avoiding robot typically involves the integration of sensors that are used to detect the presence of obstacles, as well as a control system that processes this sensor data and directs the robot's movements accordingly. The control system may use a variety of algorithms, such as obstacle avoidance algorithms or path planning algorithms, to determine the best way for the robot to navigate through the environment. One of the key challenges in the design of obstacle avoiding robots is the development of robust and reliable sensor systems that can accurately detect and classify obstacles in a variety of conditions. In addition, the control system must be able to quickly and accurately process this sensor data and generate appropriate control signals to guide the robot's movements.

Overall, the development of obstacle avoiding robots represents an important area of research and engineering, as these devices have the potential to significantly improve our ability to explore and interact with the world around us.

INTRODUCTION

An obstacle avoiding robot is a type of robot that is designed to navigate around its environment and avoid obstacles that it encounters. These types of robots are often used in a variety of applications, including search and rescue missions, military operations, and automated manufacturing processes. Obstacle avoiding robots typically use sensors to detect obstacles in their path and then adjust their course accordingly to avoid them. These sensors can include infrared sensors, ultrasonic sensors, laser scanners, and cameras, among others. The type of sensor used will depend on the specific requirements of the application and the environment in which the robot is operating. Once an obstacle has been detected, the robot will typically use algorithms to determine the best course of action to avoid it. This may involve stopping and waiting for the obstacle to move, changing direction, or using an alternate path. An obstacle avoiding mechanism is associate intelligent device, which might mechanically sense and overcome obstacles on its path. Obstacle dodging could be a robotic discipline with the target of moving vehicles on the premise of the sensory info. the employment of those ways front to classic ways (path planning) could be a natural various once the situation is dynamic with hit and miss behaviour. In these cases, the environment don't stay constant, and so the sensory info is employed to observe the changes consequently adapting moving. it'll mechanically scan the encompassing for any path.

This project is basic stage of any automatic mechanism. This mechanism has comfortable intelligence to hide the most space of provided area. it's a supersonic detector that area unit accustomed sense the obstacles coming back in between the trail of mechanism. it'll move during a explicit direction and avoid the obstacle that is coming back in its path. we've got used 2 D.C motors to offer motion to the mechanism. the development of the mechanism circuit is straightforward and little. The natural philosophy elements employed in the mechanism circuits area unit simply offered and low-cost too.

Overall, obstacle avoiding robots are useful for a wide range of applications where it is important for a robot to be able to navigate safely and efficiently through its environment.

- The robot would have the capacity to detect obstacles in its path based on a predetermined threshold distance.
    - After obstacle detection, the robot would change its course to a relatively open path by making autonomous decision.
    - It would require no external control during its operation.
    - It can measure the distance between itself and the surrounding objects in real-time.
    - It would be able to operate effectively in unknown environment.

LITERATURE REVIEW

Obstacle avoiding robots are an important area of research in robotics, with a wide range of applications including search and rescue operations, inspections of hazardous environments, and exploration of unknown or inaccessible areas. In this literature review, we will discuss some of the key works in the field of obstacle avoiding robots.

One of the key challenges in the design of obstacle avoiding robots is the development of reliable and robust sensor systems that can accurately detect and classify obstacles in a variety of conditions. This has led to the development of a wide range of sensors, including lidar, radar, ultrasound, and vision-based sensors. For example, Chen et al. (2018) proposed the use of a combination of lidar and ultrasound sensors for obstacle detection and avoidance in an autonomous mobile robot. Similarly, Zhang et al. (2019) developed a vision-based obstacle avoidance system for a quadrotor drone using a deep learning approach.

Once an obstacle has been detected, the robot must determine the best way to navigate around it. This can be achieved through the use of path planning algorithms, which generate a safe and efficient path for the robot to follow. Some common path planning algorithms include A* search, Dijkstra's algorithm, and RRT (Rapidly-exploring Random Tree). For example, Liu et al. (2017) used a hybrid A* search algorithm to generate a path for an autonomous ground vehicle to follow in an urban environment.

In addition to path planning algorithms, obstacle avoidance algorithms can also be used to guide the robot's movements. These algorithms typically use sensor data to generate control signals that direct the robot to move away from obstacles or avoid them entirely. For example, Kim et al. (2016) developed an obstacle avoidance algorithm for a self-driving car using a combination of lidar and radar sensors.

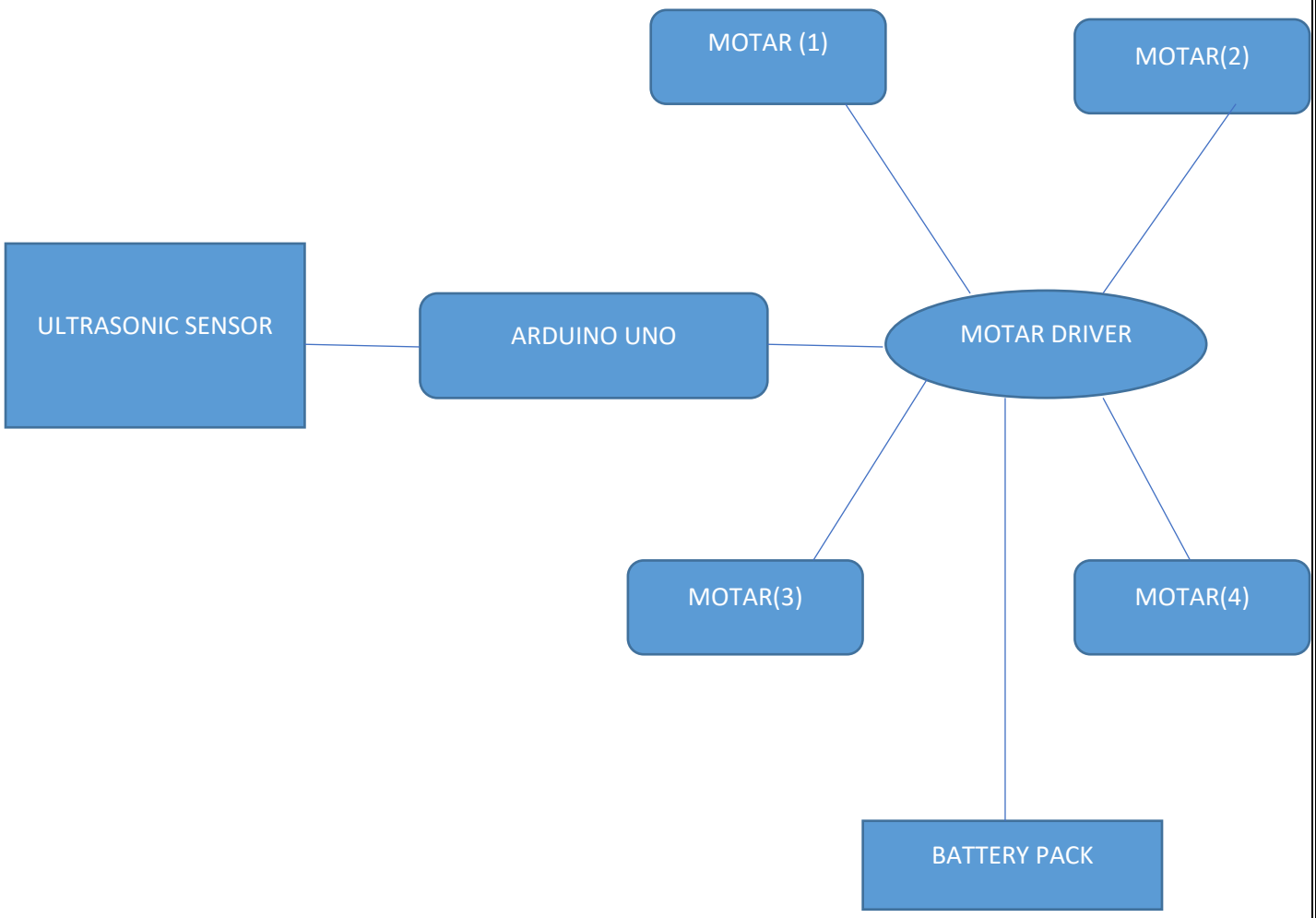
In recent years, there has been an increasing interest in using machine learning techniques for obstacle detection and avoidance. This includes the use of deep learning algorithms to analyse sensor data and make predictions about the presence and location of obstacles. For example, Zhang et al. (2018) used a convolutional neural network (CNN) to classify obstacles in real-time for an autonomous mobile robot.

Overall, the field of obstacle avoiding robots is a rapidly evolving and active area of research, with many different approaches being explored and developed.

COMPONENTS REQUIRED

- ARDUNIO UNO
- MOTAR
- BREAD BOARD
- ULTRASONIC SENSOR

BLOCK DIAGRAM



The basic block diagram of the obstacle avoiding car is shown in above figure. Mainly this block diagram consists of the following essential blocks.

1) Arduino uno - Arduino Uno is an ATmega 328p Microcontroller based prototyping board. It is an open source electronic prototyping platform that can be used with various sensors and actuators.It is used for controlling all the operation and assign task to each device.

2) Ultrasonic sensor- It is an Ultrasonic Range Finder Sensor. It is a non-contact based distance measurement system and can measure distance of 2cm to 4m. Ultrasonic sensor is mainly use to detect the obstacle.

3) Motor driver - It is a motor driver which can provide bi-directional drive current for two motors.

Working Principle

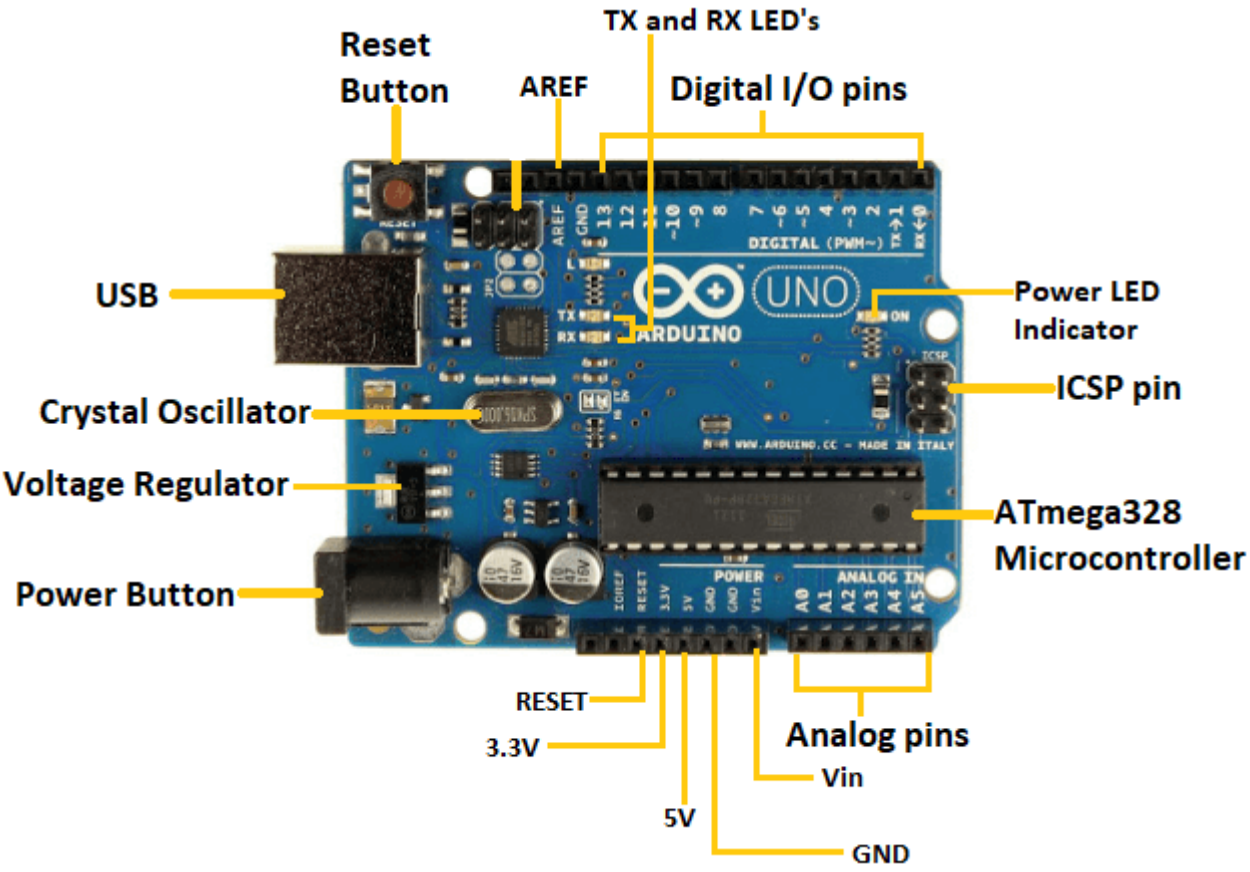
- The obstacle avoidance robotic vehicle uses ultrasonic sensors for its movements. Arduino used to achieve the desired operation. The motors are connected through motor driver IC to Arduino.

- The ultrasonic sensor is attached in front of the robot. Whenever the robot is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes ahead of it the ultrasonic waves are reflected back from an object and that information is passed to the Arduino.

- The Arduino controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM). When ultrasonic sensor detects the object which is kept inside the path it will send the signal toward the Arduino uno and according to that it will it will rotate the motor M3 & M4 in forward direction and rotate the motor MI & M2 in reverse direction such way that the car get moving in left direction.

- Similarly in every time whenever an obstacle in found to be in path of car it will detect it and rotate the car in left direction to avoid the obstacle.

ARDUINO UNO



The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.Arduino UNO is based on an ATmega328P microcontroller .

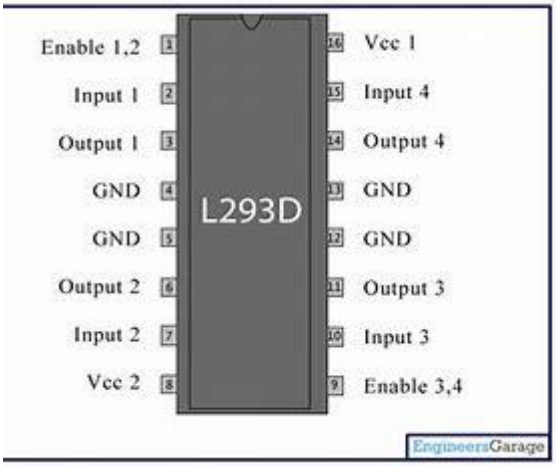
It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.

The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB

connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

The IDE is common to all available boards of Arduino.

L293D

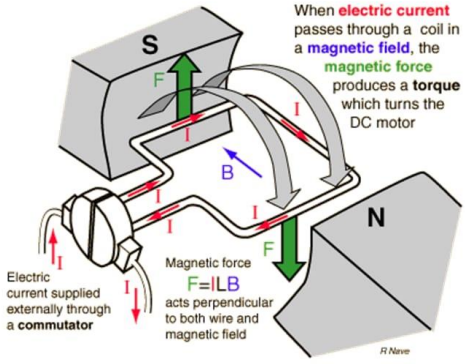


- Motor drivers take a low current control signal but provide a higher current signal, thus acting as a current amplifier. The higher current signal drives the motors. L293D is a motor driver that allows direct current (DC) motor to drive on either direction. It contains two inbuilt H-bridge driver circuits. To rotate the motor in clockwise or anticlockwise direction, voltage need to change its direction. H-bridge is a circuit that allows voltage to be flown in either direction. Hence H-bridge IC are ideal for driving a DC motor.

- Here are 4 input pins for L293d, pin 2,7 on the left and pin 15,10 on the right as shown on the pin diagram Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1. For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0.Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

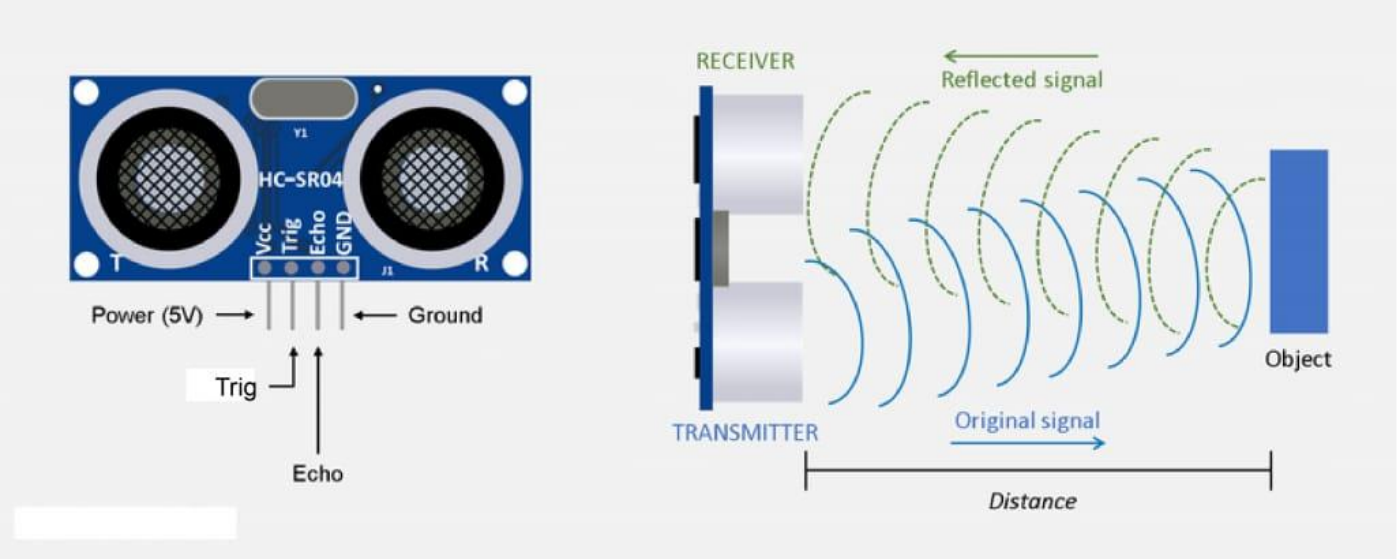
HOBBY GEARMOTOR

- The obstacle detection and avoiding robot uses two 200rpm and 12V DC geared motors. The motor used has a 6mm shaft diameter with internal holes. The internal holes are for easy mounting of the wheels by using screws. It is an easy to use low- cost motor for robotics application .
- An Electric DC motor is a machine which converts electric energy into mechanical energy.
- The working of DC motor is based on the principle that when a current- carrying conductor is placed in a magnetic field, it experiences a mechanical force.



- · The direction of mechanical force is given by Fleming's Left-hand Rule and its magnitude is given by F = BIL Newton. DC motors are seldom used in ordinary applications because all electric supply companies furnish alternating current.

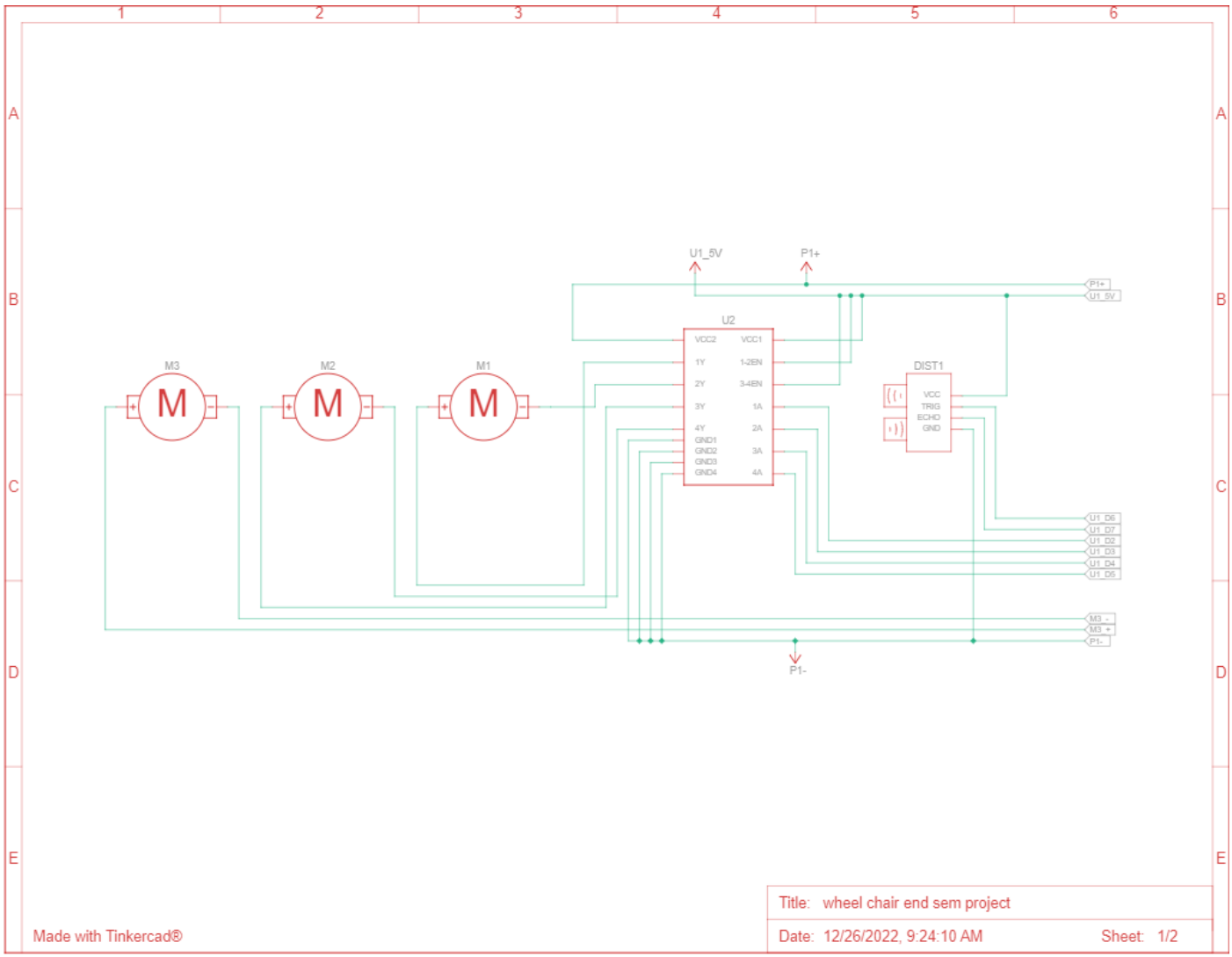
ULTRASONIC SENSOR



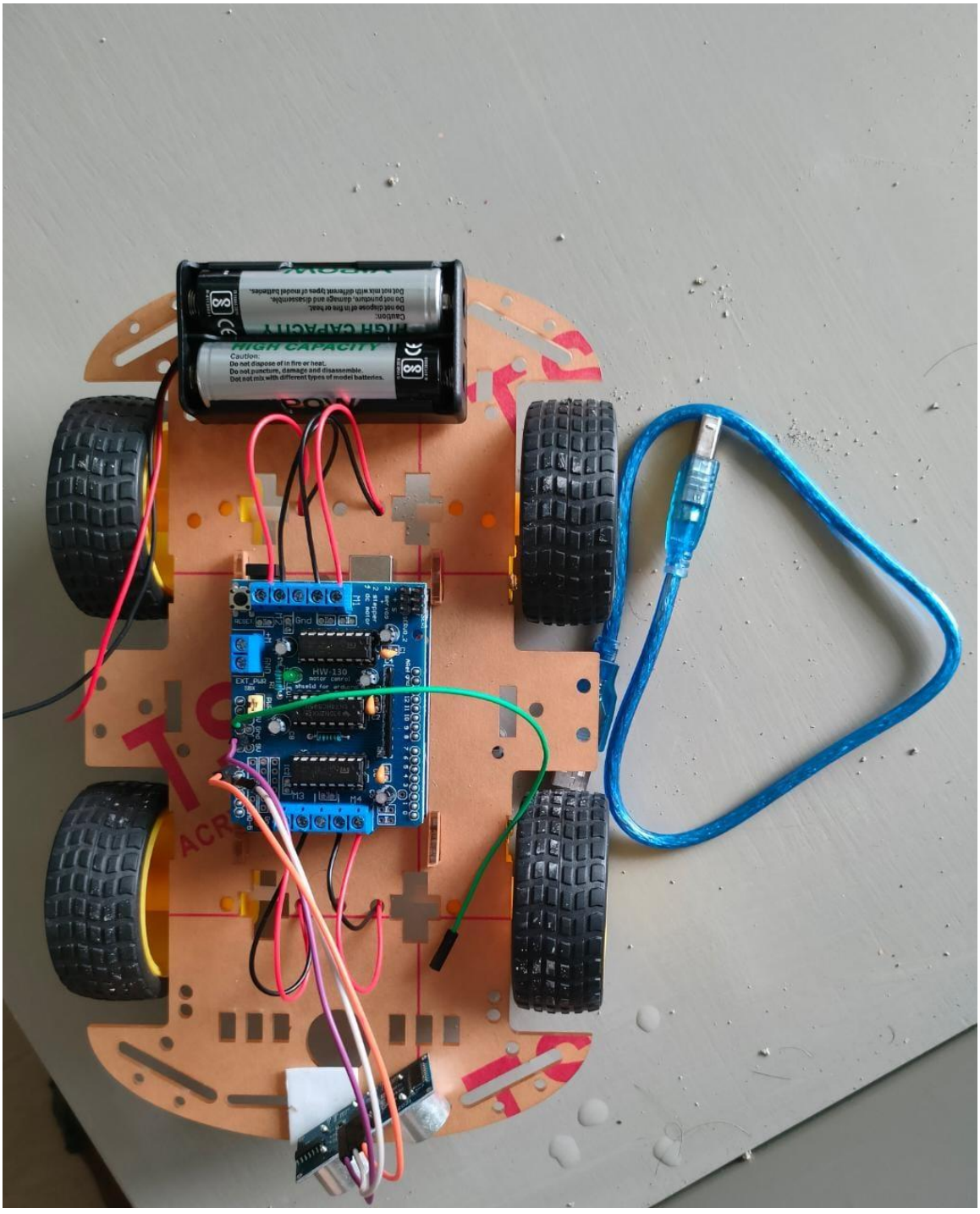
- An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.
- . It emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

  - The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.
- In order to generate the ultrasound, you need to set the Trig on a High State for 10 µs. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo pin. The Echo pin will output the time in microseconds the sound wave travelled.

CIRCUIT DIAGRAM



OUTPUT/RESULTS



APPLICATIONS

- Obstacle avoiding robots are designed to navigate through an environment while avoiding obstacles that may be present. These robots have a wide range of applications, including:

- Search and rescue operations: Obstacle avoiding robots can be used in search and rescue operations to explore hazardous or inaccessible areas and locate individuals who may be in danger. These robots can be equipped with sensors and cameras to gather information about the environment and transmit it back to a remote operator.

- Inspections of hazardous environments: Obstacle avoiding robots can be used to inspect hazardous environments, such as nuclear power plants, chemical plants, and oil refineries, without putting human workers at risk. These robots can be equipped with sensors and cameras to gather data about the environment and transmit it back to a remote operator for analysis.

- Exploration of unknown or inaccessible areas: Obstacle avoiding robots can be used to explore unknown or inaccessible areas, such as caves, mines, and the deep sea. These robots can be equipped with sensors and cameras to gather data about the environment and transmit it back to a remote operator for analysis.

- Military and security applications: Obstacle avoiding robots can be used in military and security applications to detect and avoid obstacles while performing tasks such as patrolling, surveillance, and reconnaissance.

- Manufacturing and logistics: Obstacle avoiding robots can be used in manufacturing and logistics operations to move materials and products around a facility while avoiding obstacles. These robots can be equipped with sensors and cameras to gather data about the environment and transmit it back to a remote operator for analysis.

CONCLUSION

In conclusion, obstacle avoiding robots are an important area of research in robotics, with a wide range of applications including search and rescue operations, inspections of hazardous environments, and exploration of unknown or inaccessible areas. These robots are designed

to navigate through an environment while avoiding obstacles that may be present, and can be equipped with a variety of sensors and control systems to facilitate this process.

One of the key challenges in the development of obstacle avoiding robots is the accurate detection and classification of obstacles, which requires the use of reliable and robust sensor systems. In addition, the robot must be able to effectively process this sensor data and generate appropriate control signals to guide its movements.

Overall, the development of obstacle avoiding robots represents an important area of research and engineering, as these devices have the potential to significantly improve our ability to explore and interact with the world around us.

REFERENCES

- Here are some references you might find helpful for designing and building an obstacle avoiding robot:

- "Design and Development of an Obstacle Avoiding Robot" by M.A. Hossain and M.M. Hossain, published in the International Journal of Scientific and Engineering Research (IJSER). This paper presents the design and development of an obstacle avoiding robot using ultrasonic sensors.
  https://www.alldatasheet.com/view.jsp?Searchword=LM324&gclid=CjwKCAiAhqCdBhB0EiwAH8M_Ghdtmo6tpaTFotANBPgeBazDeihVkYVaBerZCbU3cwawpOTrLHbNPBoCwkcQAvD_BwE

- "Design and Implementation of an Obstacle Avoiding Robot Using Microcontroller" by M.E. Oladimeji, O.O. Akintoye, and O.A. Alao, published in the Journal of Engineering and Applied Sciences. This paper describes the design and implementation of an obstacle avoiding robot using a microcontroller and infrared sensors.
  http://www.datasheetcatalog.com

- "Design and Implementation of an Obstacle Avoiding Robot Using Raspberry Pi" by K. Gunasekaran and K. Manikandan, published in the International Journal of Science and Research (IJSR). This paper presents the design and implementation of an obstacle avoiding robot using a

Raspberry Pi and ultrasonic sensors. https://en.m.wikipedia.org/wiki/Obstacle_avoidance

- "Design and Implementation of an Obstacle Avoiding Robot Using Arduino" by S.P. Patil and P.V. Patil, published in the International Journal of Scientific and Engineering Research (IJSER). This paper describes the design and implementation of an obstacle avoiding robot using an Arduino microcontroller and infrared sensors. https://science.howstuffworks.com/

- "Obstacle Avoiding Robot: A Review" by V.K. Jain, R.K. Singh, and V.K. Jain, published in the International Journal of Scientific and Engineering Research (IJSER). This paper provides a review of various approaches to designing and building obstacle avoiding robots, including the use of ultrasonic sensors, infrared sensors, and laser sensors. https://www.instructables.com/Obstacle-Avoiding-Robot-Arduino-1/