Smart Bot

Documentation on Smart Bot

Obstacle Avoidance System

DEDICATION

We dedicate this project to the God almighty, our start and our end.

ACKNOWLEDGEMENTS

This project will be possible, ending successfully as well due to the cooperation, support and undying spirit of guidance amongst the supervisors in such a manner that the student has not only gained exposure within the scope of practice in electrical engineering but also in scholarly and industrial aspects and the student is henceforth grateful to them expressing appreciation for the following individuals:

- DR. KAMAU, the student offers his undying gratitude for your vision of Gearbox Academy and willingness to share your experiences and your wide resource of knowledge and wisdom in various matters appertaining to the field of Engineering as well as business.

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ABSTRACT

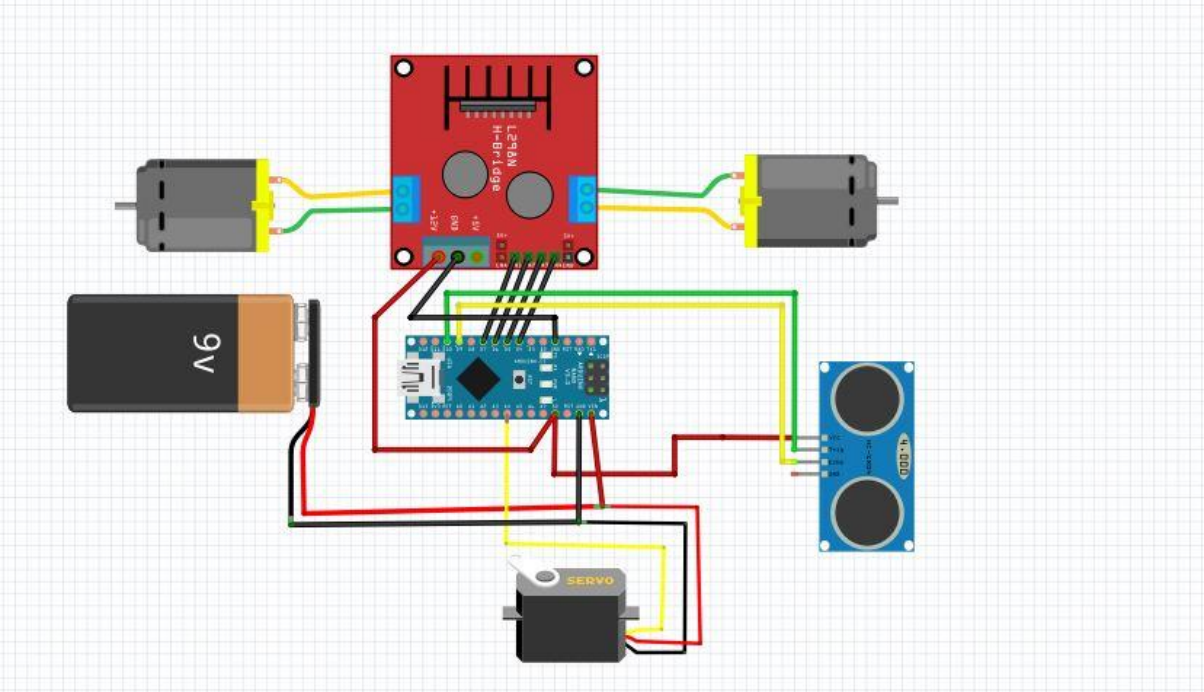
This paper presents a unique real-time obstacle avoidance approach for manipulators and mobile robots based on the artificial potential field concept. Collision avoidance, traditionally considered a high level planning problem, can be effectively distributed between different levels of control, allowing real-time robot operations in a complex environment.

This method has been extended to moving obstacles by using a time-varying artificial potential field. We have applied this obstacle avoidance scheme to robot mechanisms and have used a new approach to the general problem of real-time manipulator control. This method has been implemented in a system using a **Smart Bot 2WD Wheel Chassis** robot. Real-time collision avoidance demonstrations on moving obstacles have been performed by using visual sensing.

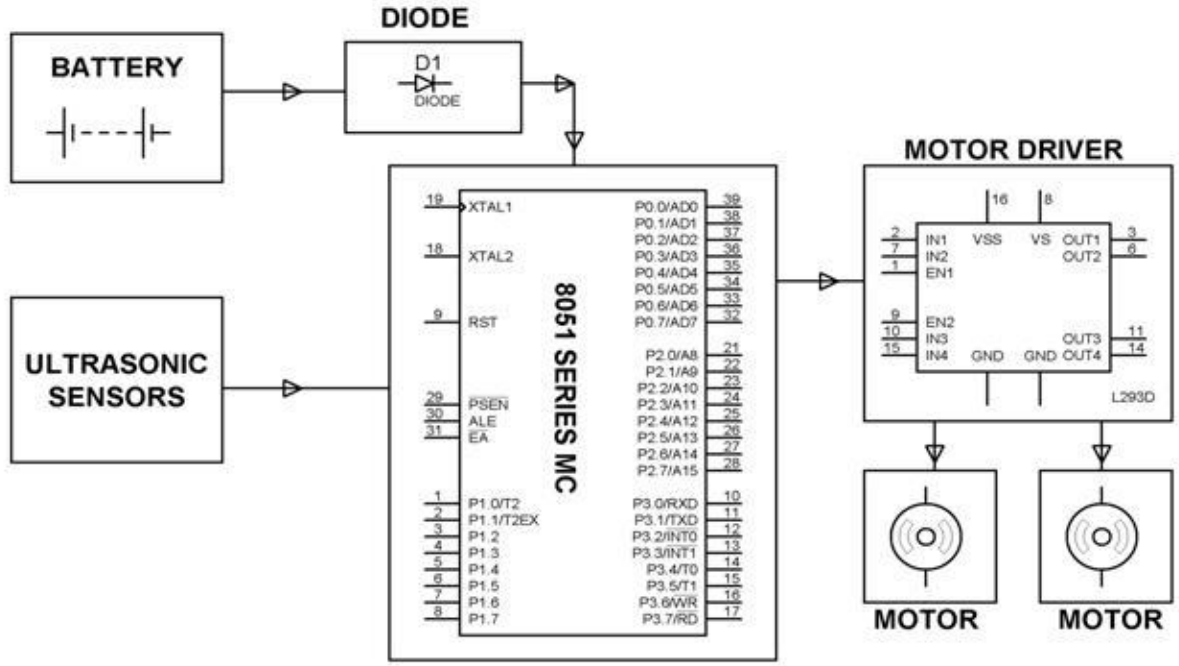
Obstacle Avoiding Robot is an intelligent device which can automatically sense the obstacle in front of it and avoid them by turning itself in another direction. This design allows the robot to navigate in unknown environment by avoiding collisions, which is a primary requirement for any autonomous mobile robot. The application of Obstacle Avoiding robot is not limited and it is used in most of the military organization now which helps carry out many risky jobs that cannot be done by any soldiers.

WORKING PRINCIPLE

This project will combine the resources of several components to eventually materialize into the Smart Bot.



SCHEMATIC DIAGRAM



Applications

1. **Obstacle detection (IR sensor):**
   The IR sensors are used for obstacle detection.The sensor output signal send to the microcontroller. The microcontroller controls the vehicle (forward/back/stop) by using the DC motor which is placed in vehicle. If any obstacle placed in line the IR sensor fails to receive the light rays and gives signals to the microcontroller. The microcontroller will stop the vehicle immediately and siren will on. After one minute the robot will be check the path status, if obstacle is removed the robot move far word else the robot will return back to move starting place. The sensor detects objects by emitting a short ultrasonic burst and then listening for the eco. Under control of a host microcontroller, the sensor emits a short 40 KHz explosion. This explosion ventures or travels through the air, hits an article and after that bounces once again to the sensor. The sensor provides an output pulse to the host that will terminate when the echo is detected; hence the width of one pulse to the next is taken into calculation by a program to provide result in distance of the object.
2. **Path detection (proximity sensor):**
   The normal case both sensors giving the guidelines and robot follows it going straight on path. When the line is end at that time the robot reverse at 180 and turns back the same place. The proximity sensors are used for path detection. When the right sensor is not detected the curve line, the microcontroller activates the left motor to turn left until the signal from right sensor. Once signal is detected right sensor, the two motors are activated to go forward. When the line is end at that time the robot reverse at 180 and turns back the same place.

3. **Military Applications:**
   Avoiding landmines left during Military Training Exercises.
4. **Plant Applications:**
   Deliver Parcels within a parcel.
5. **Search and Rescue:**
   Help Survivors in a disaster.

Servomotor

A **servomotor** is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.[1] It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor, although the term *servomotor* is often used to refer to a motor suitable for use in a closed-loop control system.

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

Basically a servo motor is a closed-loop servomechanism that uses position feedback to control its motion and final position. Moreover the input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft .

The motor is incorporates some type of encoder to provide position and speed feedback. In the simplest case, we measure only the position. Then the measured position of the output is compared with the command position, the external input to controller. Now If the output position differs from that of the expected output, an error signal generates. Which then causes the motor to rotate in either direction, as per need to bring the output shaft to the appropriate position. As the position approaches, the error signal reduces to zero. Finally the motor stops.

The very simple servomotors can position only sensing via a potentiometer and bang-bang control of their motor. Further the motor always rotates at full speed. Though this type of servomotor doesn’t have many uses in industrial motion control, however it forms the basis of simple and cheap servo used for radio control models.

Servomotors also find uses in optical rotary encoders to measure the speed of output shaft and a variable-speed drive to control the motor speed. Now this, when combined with a PID control algorithm further allows the servomotor to be in its command position more quickly and more precisely with less overshooting.

SG90 Servo Motor

IMPLEMENTATION

With the servo motors, we give command input according to the position of shaft. If the feedback signal differs from the given input, an error signal alerts the user. We amplify this error signal and apply as the input to the motor, **hence** the motor rotates. And when the shaft reaches to the required position, the error signal becomes zero, and hence the motor stays standstill holding the position. In this case, the servo motor will be rotating the ultrasonic sensor attached to it as per the commands given to it.

ULTRASONIC SENSORS

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves.

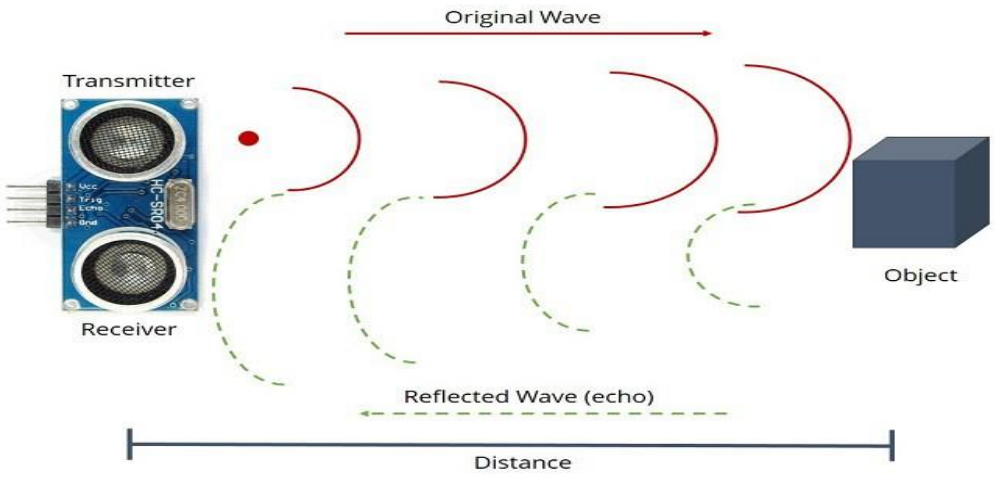
An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

High-frequency sound waves reflect from boundaries to produce distinct echo patterns.

Ultrasonic sound vibrates at a frequency above the range of human hearing.

Transducers are the microphones used to receive and send the ultrasonic sound.

Ultrasonic sensors use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. The time between the transmission and reception of the signal allows us to know the distance to an object. This is possible because we know the sound's velocity in the air.



The transmitter (trig pin) sends a signal: a high-frequency sound.

When the signal finds an object, it is reflected and the transmitter (echo pin) receives it. The Ultrasonic sensor module sends the sound waves and detects reflection of sound waves that is ECHO.

The ultrasonic sensor module is triggered to transmit signal by using the microcontroller and then waits to receive ECHO. The microcontroller then reads the time between triggering and received ECHO.

IMPLEMENTATION

The ultrasonic sensors will constantly be transmitting and receiving ultrasonic pulses so as to detect objects ahead. With this as the **main** component governing how the Smart Bot will work, it will be able to avoid obstacles along its path.

Motor Driver Module

The Motor Shield is based on the L298, which is a dual full-bridge driver designed to drive inductive loads such as relays, solenoids, DC and

stepping motors. It lets you drive two DC motors, controlling the speed and direction of each one independently.

IMPLEMENTATION

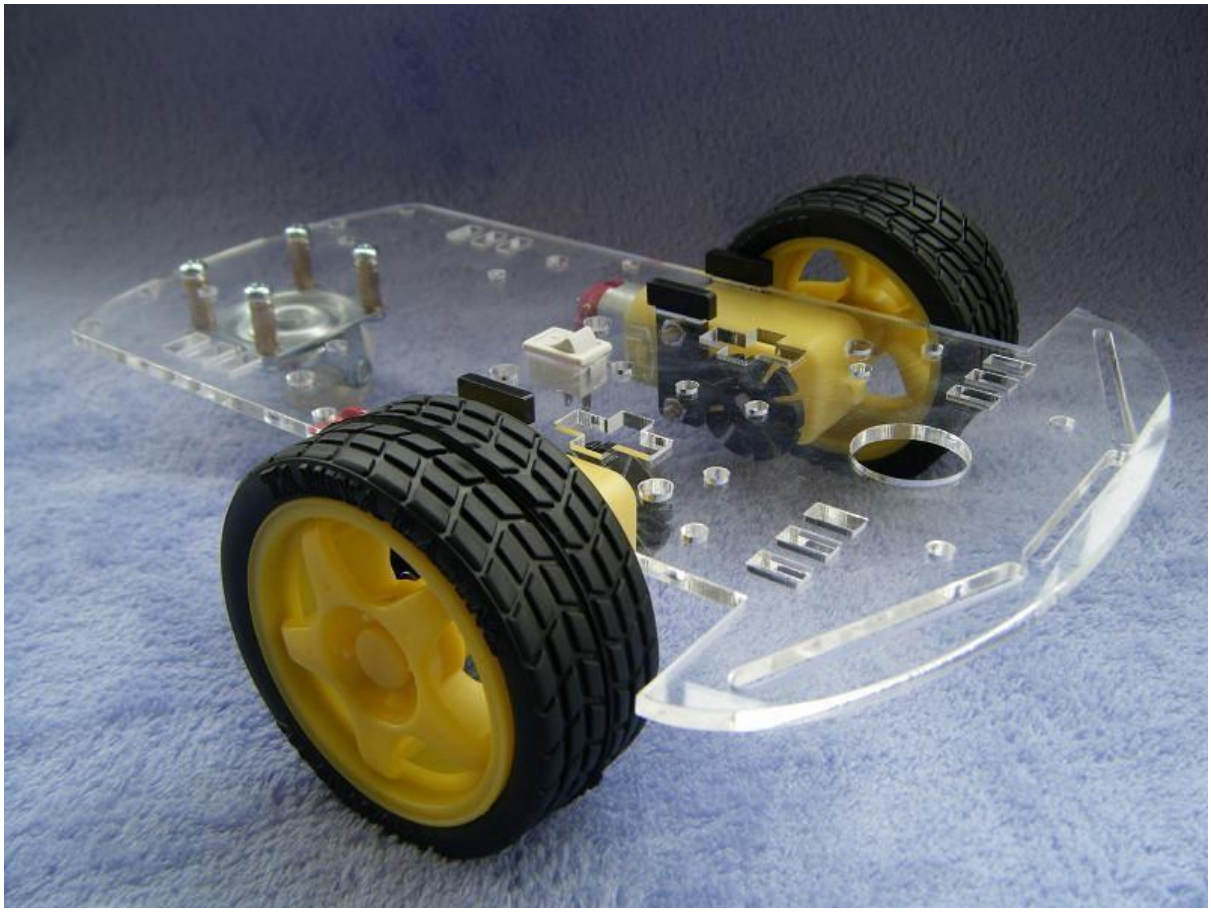
The Motor Driver Module will be used to control the DC motors which will be connected to the wheels of the Smart Bot.

BILL OF MATERIALS (B.O.M)

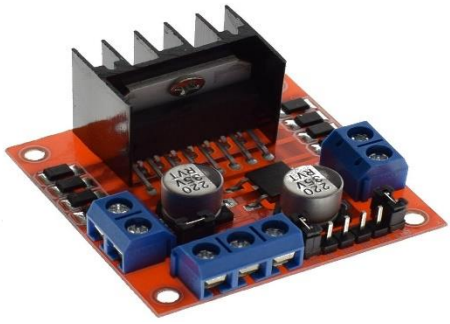
NAME	DESCRIPTION	QUANTITY	PRICE	LINK
Arduino Nano	Arduino Nano V3.0	1	1000	https://pixelelectric.com/arduino-nano-v3-0/
Ultrasonic sensor	HC-SR04 Ultrasonic Module	1	200	https://pixelelectric.com/hc-sr04-ultrasonic-module/
Motor Driver Module	L298 Dual H-Bridge Motor Driver	1	500	https://pixelelectric.com/l298-dual-h-bridge-motor-driver/

Chassis	Main Body of the smart bot	1	1800	https://pixelelectric.com/smart-bot-2wd-wheel-chassis/
Jumper Wires	Male to Male wires	1 x 65	150	https://store.nerokas.co.ke/index.php?route=product/product&product_id=120&search=jumper+wires&description=true
Servo Motor	SG90 Servo Motor	1	250	https://pixelelectric.com/micro-servo-motor-180-degree/
9V Battery Holder clip	Battery holder clip	1	20	https://pixelelectric.com/9v-battery-holder-clip/
9V Battery	Long Life Alkaline 1604b1 9v Varta	1	325	https://www.jumia.co.ke/varta-long-life-alkaline-1604b1-9v-varta-16865839.html

CHASSIS



L298 Dual H-Bridge Motor Driver



Arduino Nano V3.0

Ultrasonic Sensor
HC-SR04