Obstacle circumvent robot based on Mars curiosity rover built by NASA in 2011

Authors Name/s Chandrashekar V
Department of **Information Science and Engineering**
The Oxford College of Engineering
Bangalore 560068, India
Email ID - chandrashekarv766@gmail.com

***Abstract*—this project was proposed on the interest of man kind towards space exploration. An obstacle circumvent is made with an wide lasting technological subject called Arduino's . It is a robot which simulates a rover which avoids obstacles in its path and changes its motion direction to where no obstacle is found. It is done with the help of a control board called the Arduino UNO which controls three essential hardware drivers say- the servo motor, the Ultrasonic sensors and the bo-motors. This controller is supported by a 18650 li-ion battery and a power bank of 2500mAh and can also be recharged. The input is taken from the Ultrasonic sensors which calculates the distance and based on its calculation the Arduino UNO produces the output. Using this principle we can apply this application in major projects like autopilot in Tesla cars etc.**

Index Terms-- *a)The working principle of Arduino UNO is posted at*
https://store.arduino.cc/usa/arduino-uno-rev3
b)The Ultrasonic sensor is posted at:
https://www.tutorialspoint.com/arduino/arduino_ultrasonic_sensor.htm#:~:text=Arduino%20%2D%20Ultrasonic%20Sensor,or%201%E2%80%9D%20to%2013%20feet.

INTRODUCTION

Robotics is employed in many day to day applications,which are embedded with coding, AI(Artificial Intelligence) which can be monitored by its own without any third party. The obstacle circumvent robot is one of the applications of Arduino's exploration[a] towards AI. This robots main application and simulation can also be found in the Mars or Pragyat rovers launched in space exploration and also in Tesla cars. Its main purpose is of to avoid or pass over the obstacles to which its approaching and change its direction of motion to some other place where it finds no obstacles. The OCR (*obstacle circumvent robot in Heading 1)* does not require any external control or manual control to perform its operation. The code is loaded using a USB port and selecting the desired port named COM7. While loading the code we need to make sure the all the hardware's are not in contact with the IC ,so as to not cause damage. By first when the IC is turned on the first operation is carried by the bo-motors and the Ultrasonic sensor[b] simultaneously. When the body starts moving the Ultrasonic sensor starts sensing the surroundings. This Ultrasonic sensors are fixed on top of a servo motor. Servo motor is a hardware device which can rotate in full 360^0. When the sensors sense the object in front of them it sends the distance in(cm) to the IC. The IC then request the motor shield Arduino controller to take the body approx 5cm backward. After this step it passes the request to the servo motor carrying the Ultrasonic sensor and rotates -90^0 and 90^0 to sense the obstacle around it. And then the signal is passed to the motor controller so change the motors rotation direction towards left or right as per the commanding signal received from the Ultrasonic sensors. The OCR is powered with 18650 li-ion battery and one 2500mAh power bank.

ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

figure 1:arduino uno circuit board

From figure[1] "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

SERVO MOTOR

Hobby servos are a popular and inexpensive method of motion control. They provide an off-the-shelf solution for most of the R/C and robotic hobbyist's needs. Hobby servos eliminate the need to custom design a control system for each application. Without hobby servos (hereafter referred to only as servos) you would have to:

• design a control system
• analyze the transient response
• fine tune the feedback loop
• determine the proper gear ratio for the desired speed or efficiency • choose a motor
• build the mechanical sections
• build the amplifier and motor driver
• try to make it fit inside what ever you're trying to control! Although servos are very common, technical information is hard to come by. A search of the Internet will bring up bits and pieces but it is hard to locate a single source for all the information. In this document I will attempt to provide all the information you would need to hack a servo or make your own.

figure 2:servo motor

From figure[2]A servomotor is closed-loop-servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.

The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.The very simplest servomotors use position-only sensing via potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models.More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft[1] and a variable-speed drive to control the motor speed.[2] Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.[3]

ULTRASONIC SENSORS

This article is a guide about the popular Ultrasonic Sensor HC – SR04. We'll explain how it works, show you some of its features and share an Arduino project example you can follow to integrate in your projects. We provide a schematic diagram on how to wire the ultrasonic sensor, and an example sketch to use with the Arduino

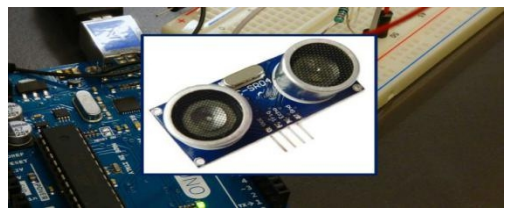

figure 3:ultrasonic sensor

Description

As shown in figure[3] The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules.

Features

Here's a list of some of the HC-SR04 ultrasonic sensor features and specs:

- Power Supply :+5V DC
- Quiescent Current : <2mA
- Working Current: 15mA
- Effectual Angle: <15°
- Ranging Distance : 2cm – 400 cm/1″ – 13ft
- Resolution : 0.3 cm
- Measuring Angle: 30 degree
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

The ultrasonic sensor uses sonar to determine the distance to an object. Here's what happens:

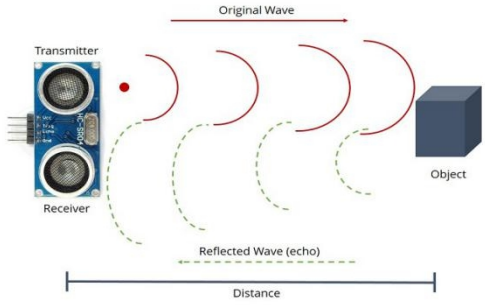

figure 4:reflected wave

1. The transmitter (trig pin) sends a signal: a high-frequency sound.
2. When the signal finds an object, it is reflected and…
3. … the transmitter (echo pin) receives it.

BO MOTOR'S

DC motor (BO) Battery Operation. Dc motor converts electrical energy into mechanical energy. Why DC gear motor used in robot Motor control circuit. DC MOTOR concept is where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. In DC motor is assembled with multiple gear setup. Speed of motor is counted in terms of rotations of the soft per minute is called RPM. RPM means Revolution Per/ Minute. The setup assemble helps to increasing the torque and reduce the motor speed.
All micro-controller based Robots this type of DC motor can be used.

TYPES OF BO-MOTORS

1. Straight BO-Motor(150-RPM)
2. L-Shape BO-Motor(150-RPM)
3. Dual Shaft Stright BO-Motor(150-RPM)

figure 5: BO motor

. Straight BO-Motor(300-RPM)
. L-Shape BO-Motor(300-RPM)
. Dual Shaft Stright BO-Motor(300-RPM)

18650 li-ion battery

heir proper name is "18650 cell". The 18650 cell has oltage of 3.7v and has between 1800mAh and 500mAh (mili-amp-hours). There are two types; otected and unprotected. We absolutely recommend otected 18650 batteries. The average 18650 battery harge time is about 4 hours. Charge time can vary with mperage and voltage of the charger and the battery pe.Most 18650 batteries will last between 300 and 500 harge cycles, but battery lifetime can be extended far eyond those numbers if charged regularly before mplete discharge. All batteries degrade over time, but ou'll often get over a year or two of life from an 18650 epending on your use.from figure[6]Lithium batteries are great option for today's high-end electronics as these lls typically have higher capacities than their alkaline ounterparts. Although rechargeable batteries tend to cost little more than standard alkaline batteries up front, these osts have reigned in because you won't need to replace chargeable batteries nearly as often as alkaline cells.

figure 6:18650 li-ion battery

f course, these upfront costs are lower when you urchase your rechargeable batteries at Battery Junction. ur selection of 18650 rechargeable batteries from the itanium Innovations, Samsung, LG, and Nitecore brands e typically priced well below retail and can be even heaper when purchased in bulk.
/e have just about every size of rechargeable battery that ou need, with products including protected and on-protected cells. The protected cells feature a patented ternal PCB protection against under voltage and over oltage. These protected cells are best used in single cell pplications because the protection is based on the correct oltage of a single cell.
you attempt to bundle protected cells as a battery pack, is defeats the purpose of the protection. Battery Junction

also has rechargeable batteries in stock that do not have PCB protection and these batteries are perfect for pack building. The bottom line is that if you are a remote control car or airplane enthusiast in need of batteries to build battery packs for these devices, or if you have a high-quality Nitecore or Fenix flashlight that you need to power, Battery Junction is your best source for very high-quality rechargeable batteries available at very reasonable prices with fast shipping on most items.

CODING

Arduino programs are written in the Arduino Integrated Development Environment (IDE). Arduino IDE is a special software running on your system that allows you to write sketches (synonym for program in Arduino language) for different Arduino boards. The Arduino programming language is based on a very simple hardware programming language called processing, which is similar to the C language. After the sketch is written in the Arduino IDE, it should be uploaded on the Arduino board for execution.The first step in programming the Arduino board is downloading and installing the Arduino IDE. The open source Arduino IDE runs on Windows, Mac OS X, and Linux. Download the Arduino software (depending on your OS) from the official website and follow the instructions to install.

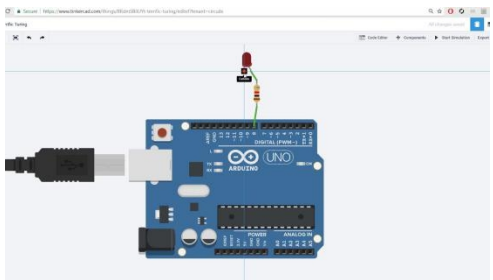

figure 7:coding an Arduino UNO

The coding for the OCR is given in the following link : https://drive.google.com/drive/folders/1Z76ygf0MzDwnAzWIwCSsMswp7HtEAoln?usp=sharing

ACKNOWLEDGEMENT

1) My sincere thanks to my parents who helped me in making this OCR

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RESULT

Video is uploaded in the following link:
https://drive.google.com/file/d/1VxJAaeABr5zu_e1mIKg5ri2Dh-meQOef/view?usp=sharing