

HOME CLEANER

INTRODUCTION

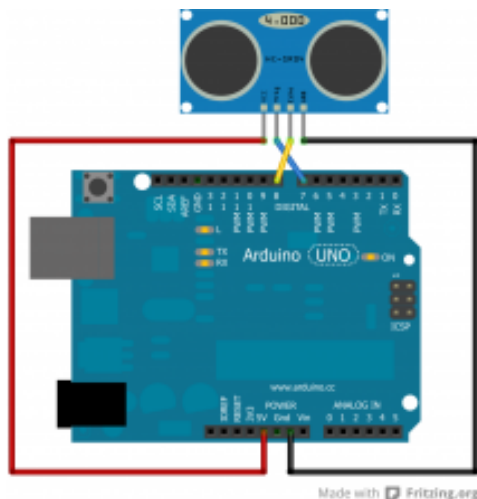
Our aim was to develop an **Autonomous Home Cleaner** bot. The basic idea was to clean the room with microfiber cloth. Our bot also has a compartment made of plastic in which water can be filled and the bot can also be used to wet wipe the floor.

MOTIVATION FOR PROJECT

Our project was inspired by this room-cleaner bot Braava available in the market. Have a look at this youtube link: <https://youtu.be/gy2sqoWtCCQ>

CONCEPTS BEHIND THE PROJECT

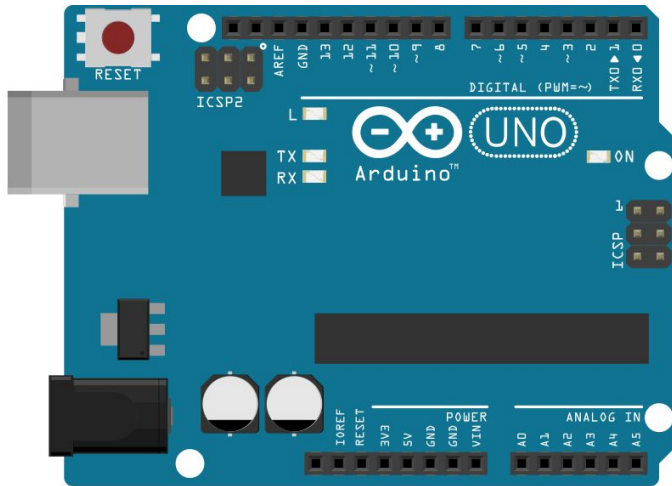
1. PROXIMITY SENSOR



We have used HC-SR04 ultrasonic sensor to calculate the distance of an obstacle. It is controlled using Arduino.

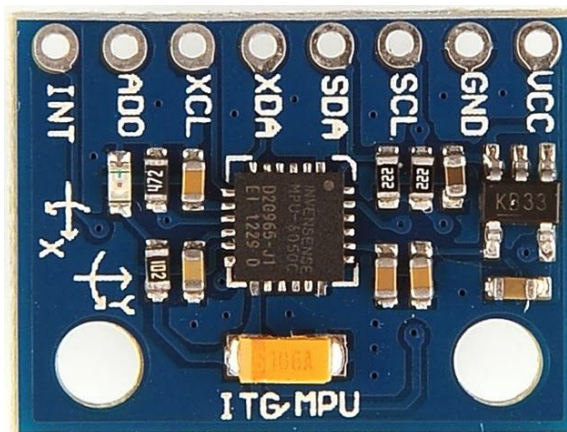
To start measurement, Trig of SR04 receives a pulse of high (5V) for at least 10 μ s. This initiates the sensor which transmits out 8 cycles of ultrasonic burst at 40 kHz and waits for the reflected ultrasonic burst and sets Echo pin to high. When the receiver receives the reflected wave, the Echo pin is set to low. The distance thus can be obtained by the equation. **Distance in centimeters = (Time/2)/29** (where Time = time during which the Echo pin was high in microseconds and sound takes approximately 29 microseconds to travel a centimeter).

2. Arduino UNO



We have used Arduino Uno in our project. The **Arduino Uno** is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

3. MPU-6050 (3 AXIS GYRO + 3 AXIS ACCELEROMETER)



The **MPU-6050** is a 6 DOF (Degrees of Freedom) or a six axis IMU sensor, which means that it gives six values as output. In our bot we have just used the gyroscope to make the bot turn accordingly.

PLAN OF ACTION

Week 1:

Planned:

Research mechanical design and finalize components of the bot

Accomplished:

Research mechanical design and finalize components of the bot

Week 2:

Planned:

Finalize solidworks and buy components. Start making bot.

Accomplished:

1. Solidworks basic model completed
2. We bought the components required and started learning how to use them.

Week 3:

Planned:

Finish the electrical work of the bot and start mechanical work.

Accomplished:

1. We learnt how to use them individually in the first few days of the week.
2. The latter part of the week we worked on putting all the components of the bot together(coding part basically).

Week 4:

Planned:

Complete mechanical work and calibrate the bot.

Accomplished:

1. Completed the coding part in this week
2. Purchased the extra mechanical parts required for cleaning and mopping.

Week 5:

Planned: Nothing

Accomplished:

1. Calibrated the bot for proper turns without crashing.
2. Testing of bot done in various rooms.

OUR TEAM

1. AKASH KONDA (akrocks97@gmail.com)
2. SHUBHAM GUPTA(shubhamg763@gmail.com)
3. LAKSHYA BANDHU (lakshyabandhu25@gmail.com)

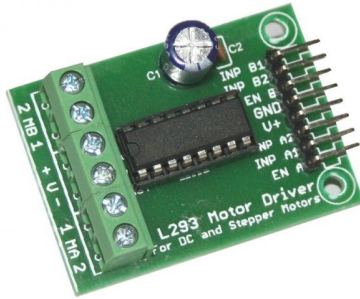
THEORY INVOLVED

1. PROXIMITY SENSOR



1. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm.
2. The transmitter sends sound wave to an obstacle and calculates the time required by the receiver to receive the reflected sound wave.
3. The distance between the sensor and the obstacle thus can be calculated by using the speed of sound and the time required.

2. L293D MOTOR DRIVER



1. L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction.
2. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit

3. MICROFIBER CLOTH



Visit the following link to know about how microfiber cloths work.

<http://www.explainthatstuff.com/microfibercloths.html>

4. Arduino

1. We are using Arduino Uno
2. The Uno is a microcontroller board based on the ATmega328P.
3. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.
4. We are controlling 2 motors ,4 HC SR04 ultrasonic sensors and 1 MPU 6050 IMU chip with this Arduino uno.

5. MPU 6050

1. The InvenSense MPU-6050 sensor contains a MEMS accelerometer and a MEMS gyro in a single chip.
2. It is very accurate, as it contains 16-bits analog to digital conversion hardware for each channel.
3. Therefore it captures the x, y, and z channel at the same time. The sensor uses the I2C-bus to interface with the Arduino.

PROJECT DETAILS

● DISCUSSION

- We had a brief discussion whether to use Arduino uno or Arduino mega.
- Finally we decided that we will first see the number of pins required (by connecting it to our friend's Arduino uno). We felt that the UNO was enough for us and we decided to go for the Arduino UNO.
- We discussed the algorithm for the bot to cover the whole room. We finally decided to go with the zig zag motion as it was most effective.
- We initially decided to use 12V lead acid battery, but it was quite heavy. Our friend suggested the use of Li-po (lithium polymer) battery. It was very light compared to lead acid so we shifted to it.

● LEARNING

- We learnt about the use of HC-SR04 sensor using Arduino Uno.
- We learnt the use of IMU chip MPU 6050 in c++ language.
- We learnt how to program chips such as MPU 6050, L293D Motor Driver, HC-SR04 on Arduino Uno for input/output.

● PROBLEMS FACED

- Our Arduino UNO got fried while driving the 12V motors (We accidentally connected the battery and the laptop both simultaneously to it :(). So we were forced to buy another Arduino UNO.
- We were stuck at MPU6050 for several days. We were able to see the readings in serial monitor but we could not make use of those readings to turn the bot at 90.

- Finally we made a function of the whole MPU code and called it repeatedly for the reading. This caused certain delay but that did not matter much in our usage.

COMPONENTS

Components Purchased from Bombay Electronics(Lamington Road) :

- Arduino Uno (With cable) - 430/-
- 2 DC Motors (300 RPM, 5 kg/cm Torque) - $110 \times 2 = 220/-$
- 3 HC SR04 Sensors - $100 \times 3 = 300/-$
- 2 Motor Clamp - $10 \times 2 = 20/-$
- 2 Castor Wheel - $15 \times 2 = 30/-$
- MPU 6050 - 250/-
- L293D Driver - 110/-

Total (Including VAT) = Rs. 1435/-

Components Purchased from Mangaldeep(Lamington Road) :

- 1 HC SR04 Sensor - 130/-
- 2 Wheels (7 cm diameter) - $25 \times 2 = 50/-$
- Double Sided Tape - 30/-
- Nuts and Bolts - 13/-
- Adapter for recharging - 200/-
- Female Jack - 30/-
- Crocodile Clips - 12/-
- Battery - 400/-
- Velcro (1 metre) - 10/-

Total = Rs. 875/-

Components Purchased from Sanjay Engineers(Vikhroli) :

- M.S.C "C" Shaped Compartment - 200/-

Total = 200/-

Losses and purchases without bill:

- Fried Arduino - 430/- (Loss)
- Microfiber cloth - 50/- (Without bill)
- Black Oil paint - 25/- (Without bill)
- Foam - free/-
- Stationary(Fevi stick and other stuff) - 30/- (Without bill)

Total Cost = 2510/- (3045/- including losses and purchases without bill)

YOUTUBE, GITHUB, PRESENTATION LINKS

Youtube : <https://youtu.be/0yJXlv218ug>

GITHUB : <https://github.com/akrocks97/Home-Cleaner>

Presentation :

<https://docs.google.com/presentation/d/14h72BxDcWSqa7tp6MQ0arWLUOoH600WInl62nQ5peQg/edit?usp=sharing>

REFERENCES

For the completion of your project , We are strongly thankful to **STAB IIT-B**.
We also referred to the following sources for help(Click on the name to open the link in new tab):-

1. [Instructables](#)
2. [Arduino](#)
3. [Arduino Stack Exchange](#)
4. [Youtube](#)
5. [Google](#) (Best search engine :p)
6. <http://diyhacking.com/>