A PROJECT

REPORT ON

AUTOMATED AI MOBILE ROBOT

Submitted to
iSMRITI, IIT KANPUR

By

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UNDER THE GUIDANCE OF
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JULY 2019

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CERTIFICATE

This is to certify that the project entitled

"AUTOMATED AI MOBILE ROBOT"

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is a record of Bona fide work carried out by them, in the fulfilment of the requirement for the award of **Summer Internship** at iSMRITI, IIT KANPUR. This work is done during June, 2019 - July, 2019, under our guidance.

Date: 25 / 06 / 2019

Prof. Laxmidhar Behera
Project Guide

ACKNOWLEDGEMENTS

We are profoundly grateful to **Prof. Laxmidhar Behera** for his expert guidance and encouragement throughout to see that this project rights its target since its commencement to its completion. The work is a team effort minus which the completion of this project was not possible.

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ABSTRACT

The project is design to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. A micro-controller is used to achieve the desired operation.
A robot is a machine that can perform task automatically or with guidance. Robotics is a combination of computational intelligence and physical machines (motors). Computational intelligence involves the programmed instructions.
The project proposes robotic vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. This robotic vehicle is built, using a micro-controller of AT mega 8 family. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro-controller. Depending on the input signal received, the micro-controller redirects the robot to move in an alternate direction by actuating the motors which are interfaced to it through a motor driver.

Key Words- IoT (Internet of things), AI (Artificial Intelligence), NodeMCU

CONTENT

INTRODUCTION

An autonomous robot is a machine able to extract information from its environment and use knowledge about its world to move safely in a meaningful and purposive manner. It can operate on its own without a human directly controlling it. Robots can use different kinds of sensors to view their environment and have actuators to perform actions in that environment. Several techniques from the field of Artificial intelligence, such as reinforcement learning, neural networks and genetic algorithms, can be applied to autonomous robots in order to improve their performance. Common tasks of mobile robots are mapping the environment, localization of the robot's position within that environment and navigating through it. Multiple robots can perform tasks more efficient because they can work in parallel, but one has to be careful not to let the robots interfere in each other's work. The popular behaviour-based robotics approach combines specific behaviours defined in the control system of a robot to perform tasks. Animal behaviour serves as an inspiration source for behaviour-based robotics. Pure behaviours consist of stimuli from the robots' sensors that evoke a motor response. Hybrid behaviours also include knowledge in the form of maps or use forms of deliberative reasoning. A new approach in robotic control is evolutionary robotics that uses evolution as a tool to create increasingly better robot controllers. Genetic algorithms, which are search algorithms based on the principles of natural selection and natural genetics, are applied to evolve the robot's controller program. Different programs are evolved and the best program is selected based on an evaluation of its performance.

1.1 Intended Audience

The audience of this system will be:
1. Technical Forums
2. Industry Workers

1.2 Project Scope

The project uses Arduino Uno as the controlling element. It uses an Ultrasonic sensor. When the obstacle comes in the path of the robot the sensor send sound to the obstacle and it reflected from the obstacle then the sensor gives zero voltage to uc. This zero voltage is detected then uc decides to avoid the obstacle by taking left or right turn. If the sensor gives +5v to uc that means there is no obstacle present in it path so it goes straight until any obstacle is detected. The two IR transmitter circuits are fitted on front side of robot. The connections can be given from main circuit to sensors using simple twisted pair cables. Two motors namely right motor and lt motors are connected to driver IC (L298D). L293D is interface with uc. Micro-controller sends logic 0 & logic 1 as per the programming to driver IC which moves motors forward or reverse direction.

1.3 Objective

The mobile industrial robots have many applications that they have been used in already including in the healthcare industry, home and industrial security, ocean and space exploration, the food service industry, and in distribution applications.
So, by this robot we are providing an Artificial Intelligence to the machine for its own decision for our work. This BOT is capable of taking its own decision to change its path irrespective of what obstacle it is facing.

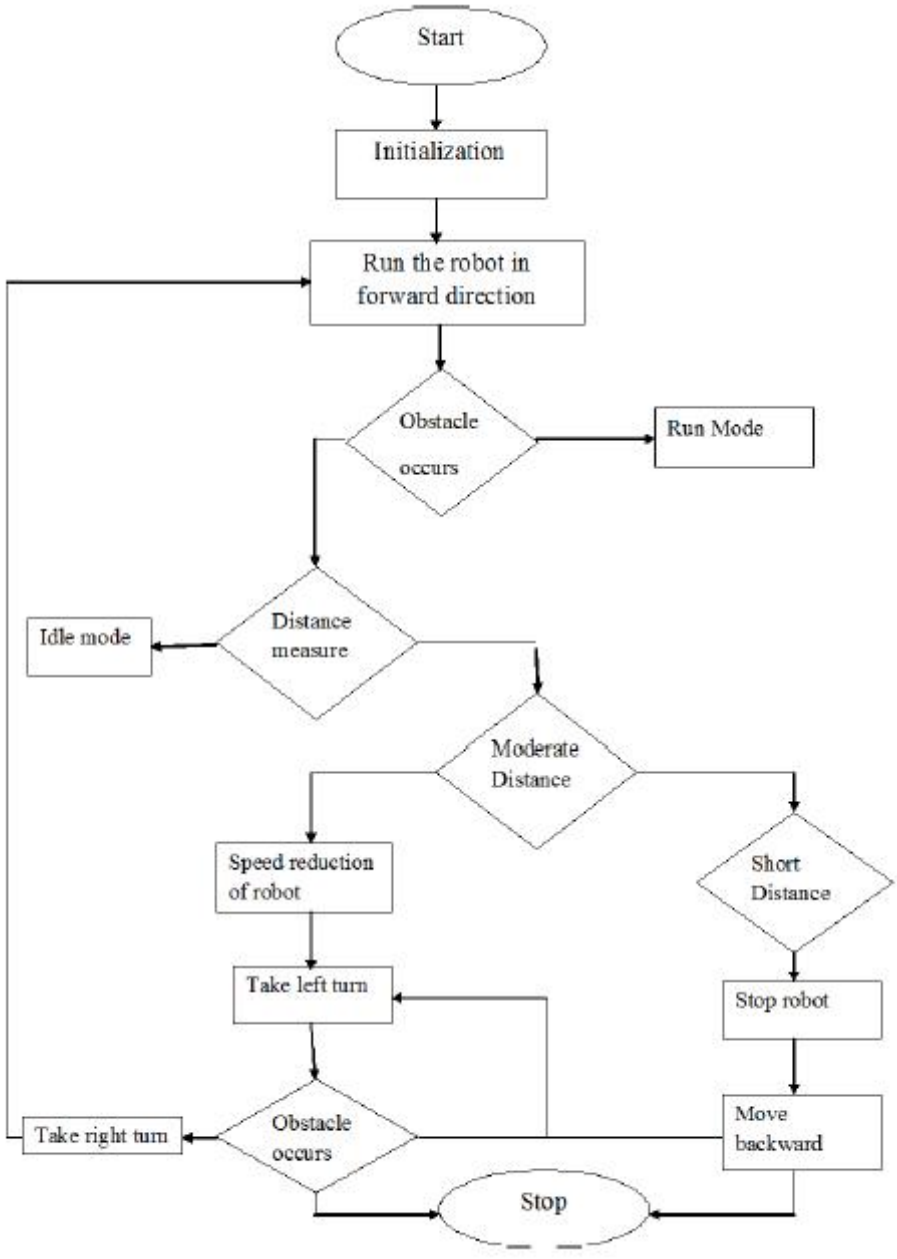
2. OVERALL DESCRIPTION

2.1 Product Perspective

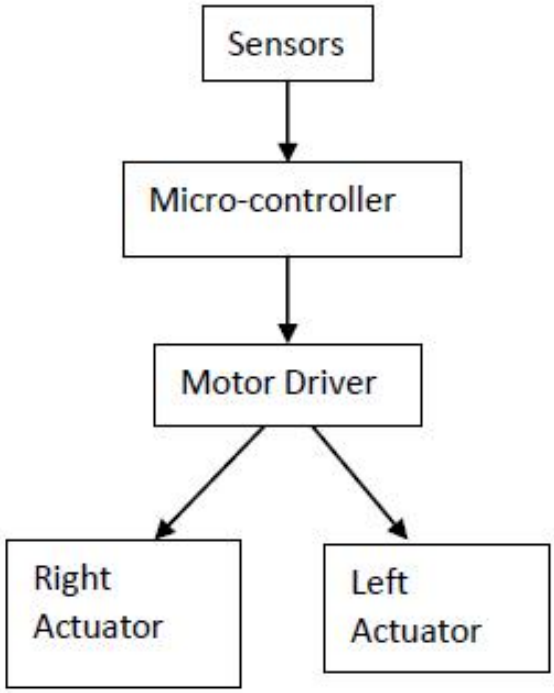
In technical forums and industries, sector uses manual manpower to guide things every day. They spend time to do that during working hours. This AI Automated Robot will help them do this process in an easy way. The main scope of this project is to make human power shift into more important and technical things. This project will help in moving parts or doing that sort of things which are going to take place under some hole or critical place where human reach is hardly possible. Sending our BOT to those places with some additional learnings as per the required work will make the purpose get solved and make things easier and better in many ways.

3. DIAGRAMS

1.1 Obstacle Avoidance Flow Chart



1.2 **Block Diagram:**



4. TOOLS AND TECHNOLOGIES USED

4.1. **NodeMCU:**

NodeMCU v3. NodeMCU v3 is a development board which runs on the ESP8266 with the Espressif Non-OS SDK, and hardware based on the ESP-12 module. The device features 4MB of flash memory, 80MHz of system clock, around 50k of usable RAM and an on-chip Wi-Fi Transceiver.

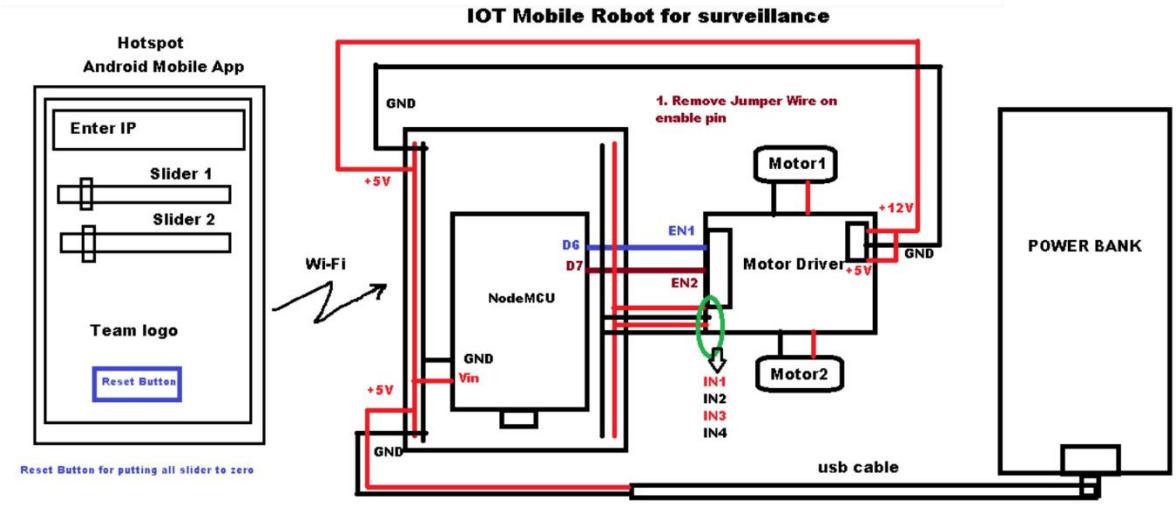
4.3. **Ultrasonic Sensors**

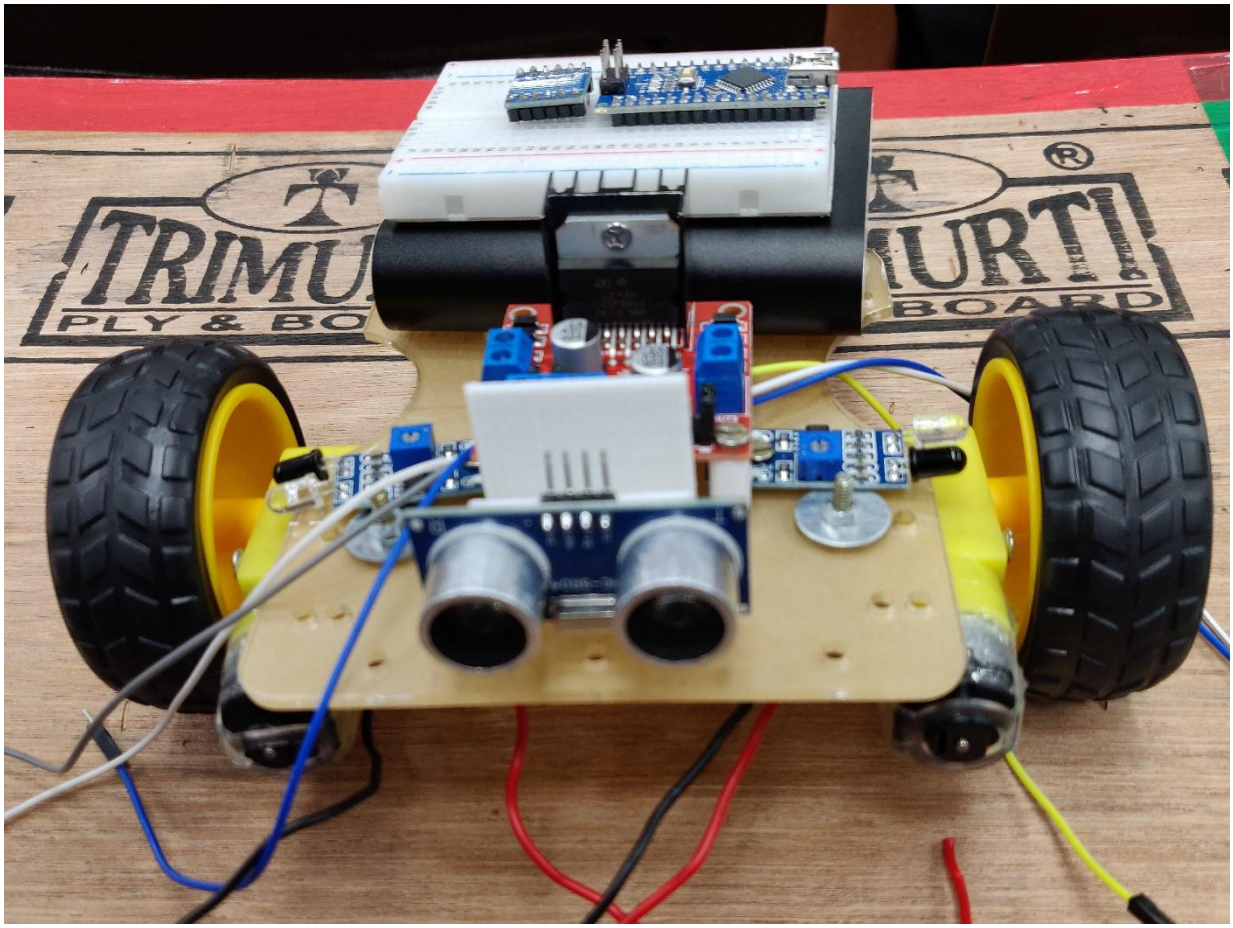
Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.

4.4.**MIT App Inventor**

MIT App Inventor is an online platform designed to teach computational thinking concepts through development of mobile applications. Students create applications by dragging and dropping components into a design view and using a visual blocks language to program application behaviour.

5.WORKING MODEL





BOT assembled with all the components

6. IMPLEMENTATION

BOT_MCU Code:

```
#include<ESP8266WiFi.h>
#define EN1 D6
#define EN2 D7
int x=0;
long duration=0;
const int trigP=D1;
const int echoP=D2;
int LS=0;
int RS=0;

void Setup()
{
        Serial.begin(11500);
        pinMode(EN1,OUTPUT);
        pinMode(EN2,OUTPUT);
        pinMode(trigP,OUTPUT);
        pinMode(echoP,INPUT);
}

void loop()
{
        digitalWrite(trigP,LOW);
        delayMicroseconds(2);
        digitalWrite(trigP,HIGH);
        delayMicroseconds(10);
        digitalWrite(trigP,LOW);
        duration=pulseIn(echoP,HIGH);
        x=duration*0.034/2;
        if(x>70)
        {
                LS=1000;
```

```
                RS=1000;
            }
            else
            {
            LS=1.49404141e+02*x-1.16743968e-02*x*x-3.40756256e-04*x*x*x;
            RS=3.36418399e+02*x+2.05632547e+00*x*x-2.47270951e-03*x*x*x;
            }
            LS=LS-(LS%100);
            RS=RS-(RS%100);
            analogWrite(EN1,LS);
            analogWrite(EN2,RS);
}
```

BOT_TRAIN Code:

```
import pandas as pd
from sklearn.model_selection import train_test_split
from google.colab import files
uploaded=files.upload()
import io
data=pd.read_csv(io.BytesIO(uploaded['Train_data.csv']))

x=data.VL
y=data.VR
s=data.US

import numpy as np
D=2;

def createA(s, D):
    arr = []
    temp = []
    for elem in s:
        for count in range(D+1):
            temp.append(float(elem**count))
            arr.append(temp)
```

```
                    temp = []
                    return np.array(arr)
A=createA(s,D)

def train_w(A, actual_data):
        w=np.linalg.inv(A.T.dot(A)).dot(A.T.dot(actual_data))
        return w
w_x=train_w(A,x)
w_y=train_w(A,y)
print(w_x)
print(w_y)

def predict_y(w, actual_data):
        C=len(w)
        A=createA(actual_data,C-1)
        pred_y=A.dot(w)
        return pred_y
pred_yforx=predict_y(w_x,x)
pred_yfory=predict_y(w_y,y)


def trainModel():
        x=np.array([0.6,0.5,0.3,0.2])
        yd=np.array([10,9,7,4])
        A=createA(x,2)
        w=train_w(A,yd)
        y=predict_y(w,x)
        return w
```

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