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Autonomous Robot using MCS-89C51

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Abstract: *This project is basic stage of obstacle avoidance robot. It deals with a obstacle detection. this method performed by a robot using a sensor and a Microcontroller. After detailing our detection strategy and implementation of the developed sensor with our robot. It has infrared sensor which are used to sense the obstacles coming in between the path of robot. It will move in a particular direction and avoid the obstacle which is coming in its path. The contest is to build a small microprocessor-controlled robot vehicle that is able to navigate its way, through an unknown terrain, to the target in the shortest possible time.*

Keywords: Robot, LED, IR sensor

I. INTRODUCTION

Robotics is part of Today's communication. In today's world ROBOTICS is fast growing and interesting field. It is simplest way for latest technology modification. Now a day's communication is part of advancement of technology, so we decided to work on ROBOTICS field, and design something which will make human life simpler in day today aspect. Thus we are supporting this cause.

For a robot performing a navigation-based task in a vague environment, to detect and to avoid encountered obstacles is an important issue and a key function for the robot body safety as well as for the task continuity. Obstacle detection and avoidance in a real world environment – that appears so easy to humans - is a rather difficult task for robots and is still a well-researched topic in robotics.(Mugahed Ghaleb,2018)

This project is basic stage of any automatic robot. This ROBOT has sufficient intelligence to cover the maximum area of provided space. It has infrared sensor which are used to sense the obstacles coming in between the path of ROBOT. It will move in a particular direction and avoid the obstacle which is coming in its path. We have used two D.C motors to give motion to the ROBOT. The construction of the ROBOT circuit is easy and small .The electronics parts used in the ROBOT circuits are easily available and cheap too.

The object of the contest is to build a small microprocessor-controlled robot vehicle that is able to navigate its way, through an unknown terrain, to the target in the shortest possibletime. The target is a yellow coloured square at the centre of the quadrant furthest away from the starting point.

The challenge is to design and build a small vehicle capable of fast controlled motion, and provide it with sufficient intelligence to explore and negotiate around obstacles in the shortest possible time. The purpose of this competition is to provide a technically demanding yet enjoyable problem for the participant.

II. METHODOLOGY OF SYSTEM

2.1 Description of Block Diagram

A. IR Transmitter

The oscillator will be used to generate a square wave at a desired frequency. The wave is fed into a transistor that drives an infrared LED on and off very rapidly. Because the emissions are infrared and very fast, neither is visible to the human eye.

B. IR Receiver

Inexpensive infrared receiver chips are available at 36 kHz, 38 kHz, and 40 kHz. The receivers are sensitive to oscillations several kilohertz to either side, although reception distance improves with a better signal to start with.

If used for object detection, the signal needs to travel the distance to the object, bounce off the object, and then travel the distance back to the receiver. So, distance becomes a factor.

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Because infrared receivers amplify the signal to improve detection, electrical noise generated from the oscillator can leak into the receiver and trigger a false detection.

C. Micro-Controller (89C51)

The 89C51 is low power, high performance and CMOS 8-bit microcontroller with 4KB of programmable, erasable Read Only Memory (PEROM).

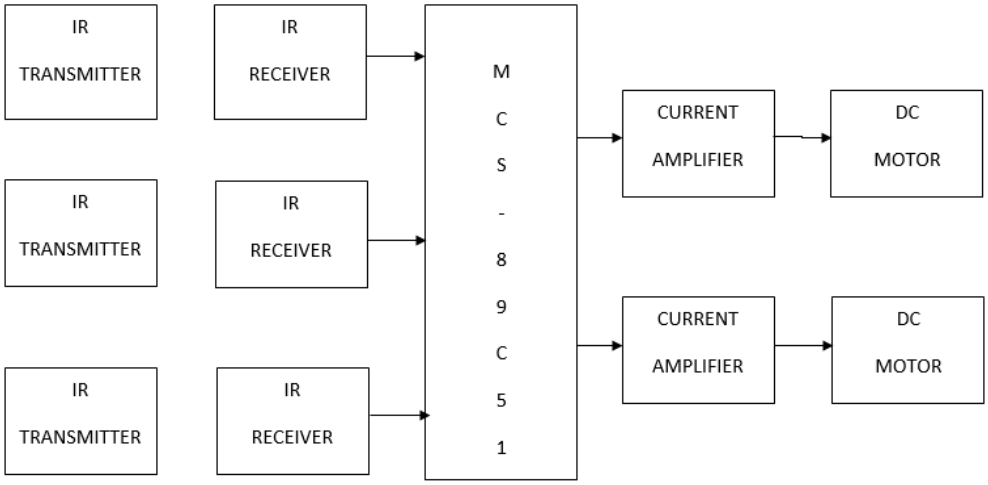
D. Driver Circuit

Output of Micro-controller is unable to drive the Motor's .So that we have to use current amplifier (ULN-2003) as driver circuit for the Motor's.

E. Motor's

We are using DC motor of 600 r.p.m. which required 12V power supply.

III. SYSTEM BLOCK DIAGRAM



IV. CIRCUIT DISCRIPTION

4.1 Main Circuit Diagram Description

TIMER IC-555 is used as an oscillator in astable mode.

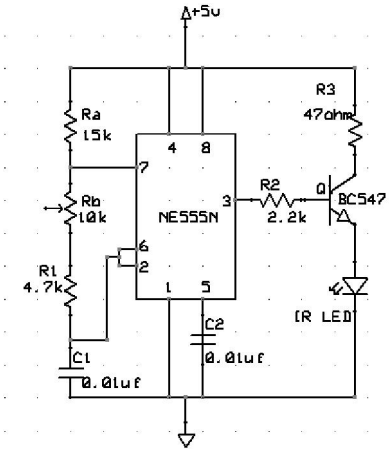


FIG.1 (Transmitter Circuit)

If the circuit is connected as shown in figure 1 it will trigger itself & free run as multivibrator. The external capacitor charges through Ra+Rb & discharges through Rb. Thus the duty cycle may be precisely set by the ratio of these two resistors.

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In this mode of operation the capacitor charges & discharges between 1/3VCC & 2/3VCC as in trigger mode, the charge & discharge times, & therefore the frequency are independent of supply Voltage.

The charge time(output high) is given by-

T1=0.693(Ra+Rb)*C

The discharge time(output low) is given by-

T2=0.693(Rb)*C

Thus the total period is –

T=T1+T2 = 0.693(Ra+2Rb)*C

The frequency of oscillation is-

F =1/T =1.44/(Ra+2Rb)*C

Depending on the resistor value selected in circuit. Oscillations produce at pin no.3 has duty cycle of 50%.this oscillations are given to small signal amplifier (BC-547) which will boost up the output signal in order to drive IR LED. 2.2 Kilo ohm resistor is to limit the base current. 220 ohm, 1Watt is used as current limiting resistor for IR LED.

IR LED will emit the signal having 38 KHz frequency.

4.2 Receiver

If the obstacle comes in between then 38KHz frequency signal is reflected back from obstacle & it will be captured by TSOP-1738.The ckt of the TSOP is design in that way unexpected output pulses due to noise disturbance signal are avoided. A Band Pass Filter & integrated ckt & AGC are used to suppress such disturbances.

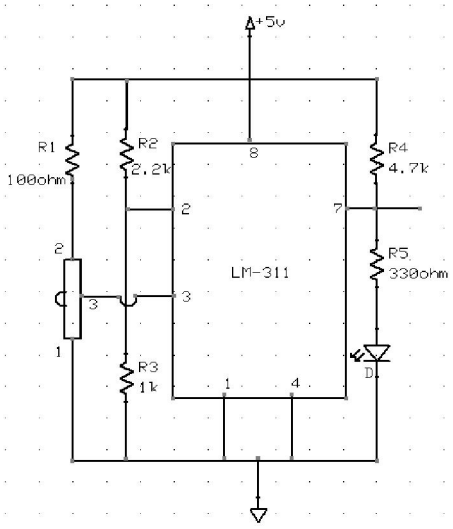

FIG.2 (Receiver Circuit)

The output of TSOP (Pin no.3) is given topinno.3 (inverting input terminal) of LM-311. & to Pin no.2 of LM-311 (non inverting input terminal) reference Vtg. Is set by using Vtg. Divider.100 Ohm Resistor is used as I limiting resistor at Pin no.2 of TSOP.

When obstacle comes IR Ray's reflected from object & fall on TSOP as TSOP IS ACTIVE LOW DEVICE O/p of TSOP will be '0' (logic low) which is compared with reference Vtg. Of (1.78V) Pin no.2 of LM-311, sooutput of LM-311 will be '1' (logic high) which will be indicated by LED.

When obstacle is not present IR Ray's willnot fall on TSOP therefore output of TSOP will be high & i.e. compared with the reference Vtg. Which will produce'0' at Pin no.7 of LM-311. 4.7KOhm resistor is used as pull-up resistor as LM-311 has open collector transistor structure at output.

4.3 Microcontroller and ULN-2003

Output of LM-311 is fed to MC Port.1 is as follows:

Front Sensor=P1.1

Left Sensor=P1.0

Right Sensor =P1.2

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Output Port 0 is connected to ULN-2003.as output of Microcontroller is having a small current rating which can't drive motors therefore in order to increase current rating we are using ULN-2003 as a current amplifier ckt.

4.4 Relay's and Motor

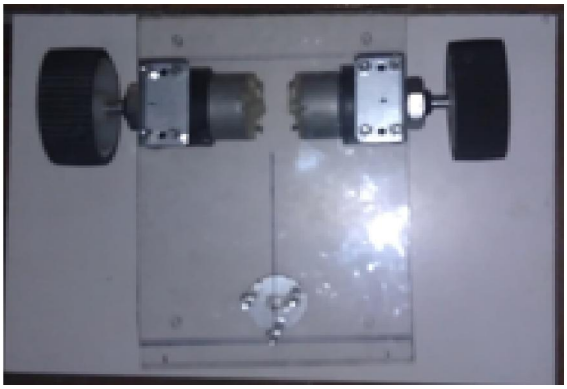
CONDITIONS:

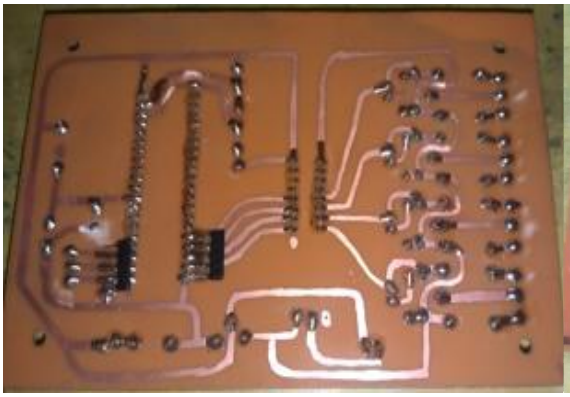
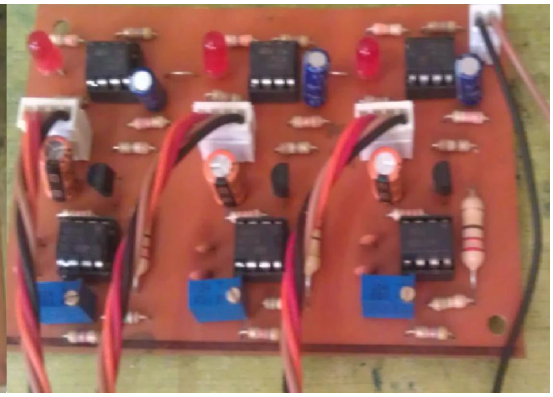
1) FORWORD =[1 0 1 0]
2) REVERSE =[0 1 0 1]
3) LEFT =[1 0 0 1]
4) RIGHT =[0 1 1 0]

When there is no obstacle present in front of ROBOT ,input from sensor board to MC (Port 1) will be '0'.Output Port (P 0) of MC will produce '1 0 1 0' in that case our ROBOT will move in
Forward direction. '1 0 1 0' condition signal is given to ULN-2003 (i.e. Pin no.-1,2,3,4).As ULN is inverting the output signal (at Pin no.-16,15,14,13) respectively will produce '0 1 0 1'.
When '0' is produce at (Pin no.-16) output of ULN, Relay 1 will turn ON as it gets GND. Similarly for Relay 3.
At Pin no.-15 it produces logic '1' which causes Relay 2 to turn OFF because it can't get GND. Similarly Relay 4 will be off. Connections of Relay 1&2 is given to motor 1 & connection of Relay 3&4 is given to motor 2.so that to move a motor there should be [0 1/1 0] signal produce by Relay
If there is obstacle in front of ROBOT corresponding sensor will produce (high logic) '1'& that is given to MC. According to code will ROBOT will move its direction.
Suppose there is obstacle in front side then it will check for right & left direction .If there is obstacle in left side it will move to right & vice a versa & if obstacle is in all three direction (Front ,Left, Right) it will move round & round & then check for front side obstacle & process will continued.

V. HARDWARE TESTING

5.1 Step by Step Testing of Various Modules



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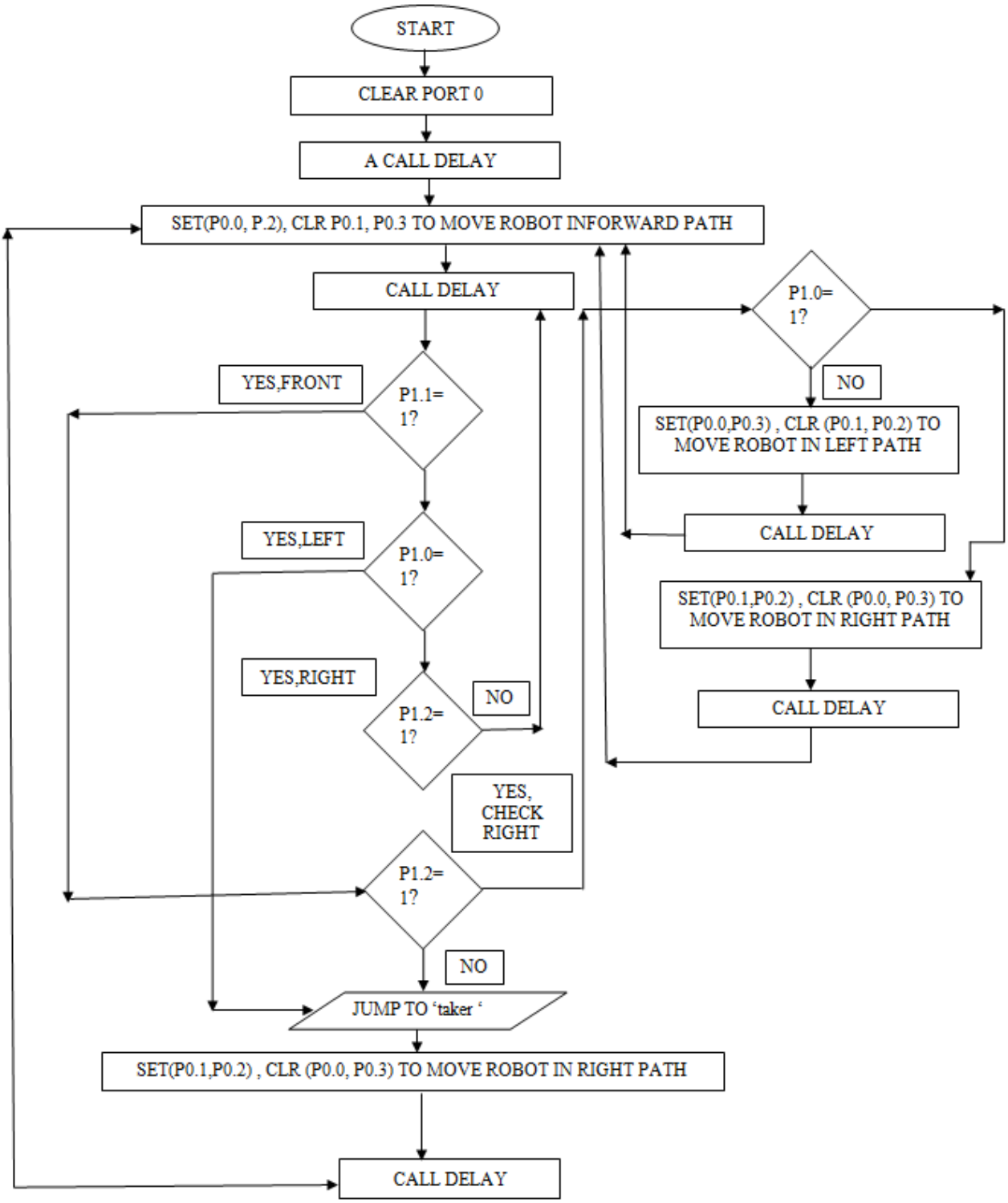
VI. FLOW CHART



VII. CONCLUSION

- Based on above study, we dealt with a obstacle detection and avoidance method performed by an robot using a sensor and a Microcontroller. After detailing our detection strategy and implementation of the developed sensor with our robot, We also introduced the basic algorithm of our avoidance method.

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- We confirmed the originality of our approach with results of an obstacle avoidance experiment. Reducing obstacle detection failures in well-lighted environment, due to the sun light for instance, and improving our avoidance algorithm for moving obstacles are the topics of our future work.

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