ANTI-COLLISION SYSTEM FOR UNMANNED MOBILE ROBOT SYSTEM

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***ABSTRACT*:** *In the world of leading edge, modern, hi-tech product vary has been designed to fulfill the requirements of users nowadays. Merchandise out there on the market designed to resolve human issues. This includes merchandise that may facilitate students in electronic engineering studies. for college students UN agency take subjects concerning the motor theory within the room isn't decent for understanding the conception of movement and control, speed and then on. So, the project is termed Anti-Collision Mobile will facilitate students perceive the sensible in subjects concerning the motor system. This robot could be a mobile machine that may sight and follow the road drawn on the ground. Generally, the trail is predefined and might be either visible sort of a black line on a white surface with a high contrasted color or it will be invisible sort of a force field. Therefore, this type of robot ought to sense the road with its heat ray (IR) sensors that put in beneath the robot. After that, the info is transmitted to the processor by specific transition buses. Hence, the processor goes to make your mind up the correct commands and so it sends them to the driving force and therefore the trail are going to be followed by the road follower robot. This line follower robot designed to following the road with in anti-collision. The project gift contributes proposing anti-collision strategies supported the employment of infrared as distance sensors. A protecting barrier, observed as virtual wall, is constructed around associate obstacle, and is ready to come back a virtual force supported the detected distance.*

Keywords: Auto Drive, Anti-Collision, Mobile System, PIC.

1. INTRODUCTION

A line follower mechanism is largely a mechanism was designed to follow a line or path already planned by the user [1]. This line or path is also a physical mark on the ground. Line tracer can trace a black line on a white surface or the other way around [1,2]. The sensors offer the quality of the mechanism, that works with analog signals from the microcontroller and therefore the digital input is employed to drive the motors [3]. The motor works in step with the detector motor driver in addition as supported the programming that has been worn out the microcontroller. These types of mechanism notice its application, from the trade purpose of read, in semi to totally machine-driven plants [1]. During this setting, this mechanism functions as a fabric carrier to deliver the product from one producing purpose to a different wherever rail, conveyor and framing solutions don't seem to be doable. Most of the lines following robots were designed with totally
different concepts for amusement purpose, mechanism races and different purpose. Among those styles, only a few were used for specific applications.

2. EXPERIMENTAL

2.1 Components' Selection

Furthermore, for the hardware half, which incorporates electronic choice of appropriate and applicable elements used for the complete project was disbursed and buying of all the things was needed. The flow of the circuit and operation of all elements was understood before the development of the circuit begun, to avoid at the circuit may perform well and forestall failure occurred if there was a brief circuit because of wrong association. Data looking out like the specifications, options and functions of all elements, as well as IR device, DC motor and comparator was done. Moreover, programming using PIC16F877A microcontroller, circuit construction of the IR device circuit to the microcontroller and output like servo motor was studied

2.2 INPUT SECTION

A. Voltage Regulator (LM7805)

All circuits need a main power supply which will provide a set voltage to those circuits. The LM7805 transformer IC is employed to convert from 7.4 V battery input potential unit age to five-volt output voltage.

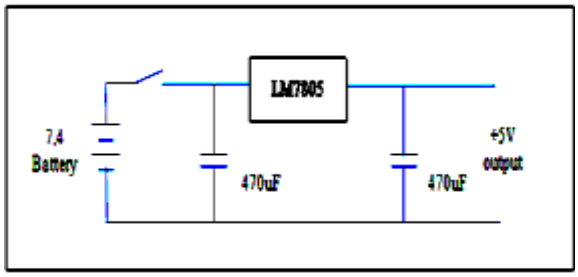

Figure 1: Circuit connects to comparator LM339.

B. IR Transmitter and Receiver

There are a 2-unit division component of the devices that area unit front sensor and also the line following sensors. Each sensors use an equivalent infrared transceiver for detection method. Front device employing a combine of infrared transceiver whereas for a line following device victimization four pairs of an equivalent device. The infrared transceivers for line following device area unit placed in parallel below the automobile base. All the output of the infrared transceiver transducers connects to the operational electronic equipment IC or known as comparator.
The IR LED emitting infrared light is put on in the transmitting unit. IR light is emitted from the emitter. This emitted light strikes the surface and gets reflected back. If the surface is white, more intensity of light gets reflected and foe black surface very less intensity of light is reflected. IR Receiver used to detect the intensity of light reflected. The corresponding analog voltage is induced based on the intensity of reflected light, which further compared by the comparator and output send as 0 or 1.

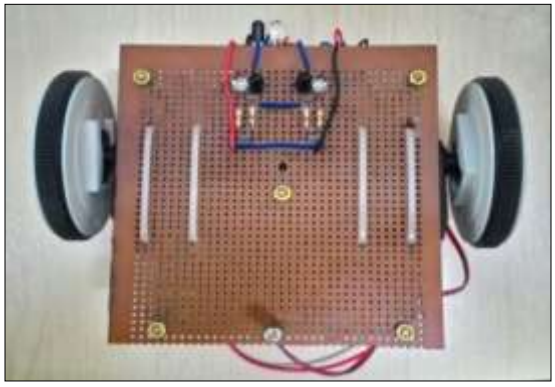

Figure 2: The bottom view of the line following sensor.

C. Comparator (LM339)

The comparator LM339 IC is employed to check the input voltage from the sensors and also the reference voltage. The distinction between these 2 voltages can turn out the logic output voltage either +5V or 0Vstep. These logic pulses connected to the input of the microcontroller as dominant signals.

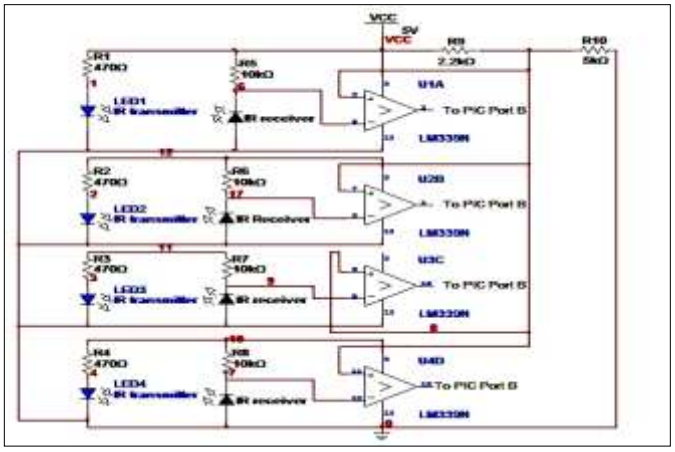

Figure 3: Sensor circuit connects to comparator LM339.

D. Microcontroller (PIC16F877A)

The main necessary a part of the automotive involving microcontroller PIC16F877A. The microcontroller IC is put in on the bottom of the automotive to create the automotive programmable. The microcontroller IC managements the motors at the output relating to the pulse width modulation (PWM) signal for speed control and direction of motor rotation either in forward or reverse direction. This condition operates with relevance the detector detection signals at the input section of the microcontroller IC

Figure 4: PIC16F877A microcontroller IC.

2.3 OUTPUT SECTION

E. Motor Driver (L293D)

Motor Driver ICs are primarily used in autonomous robotics only. Also, most microprocessors operate at low voltages and require a small amount of current to operate while the motors require a relatively higher voltage and current. Thus, current cannot be supplied to the motors from the microprocessor. This is the primary need for the motor driver IC.

The L293D IC receives signals from the microprocessor and transmits the relative signal to the motors. It has two voltage pins, one of them is used to draw the current for working the L293D and the other one is used to apply voltage to the motors. The L293D switches its output signal according to the input received from the microprocessor.

If the microprocessor sends a 1(digital high) to the Input pin of L293D, then the L293D transmits a 1(digital high) to the motor from its output pin. An important thing to note is that the L293D simply transmits the signal it receives. It does not change the signal in any case.

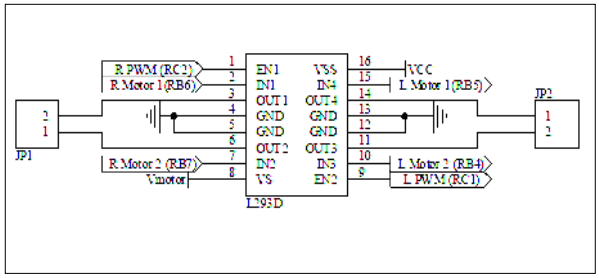

Figure 5: Connection to the motor driver [11]

F. DC Servo Motor

The sign from the microcontroller is connected to the 2 DC motors used and put in with two wheels so as to maneuver the automotive. These 6V DC motors exploitation build-in force gears to create easier for the automotive moving at the start of stationary condition. These gears forestall the motors from hot and save the facility consumption for the low voltage of DC motor operation.

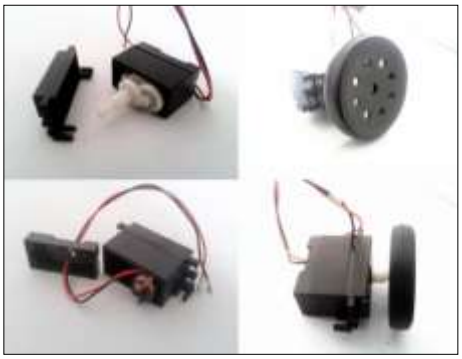

Figure 6: 6V DC motor with inbuilt force gears and a combine of wheel

2.4 DEVELOPMENT OF MICROCONTROLLER PROGRAMMING.

To develop the programming system, it is important to identify the purpose of the mobile working method. In this project, it will point on object coordinate that has been

analyzed it to insert inside the programming. The object has a different location and it will be analyzed all the coordinates of the object. The system will program to move all 2 servo motors and it will actuate based on that command given.

Working Principles

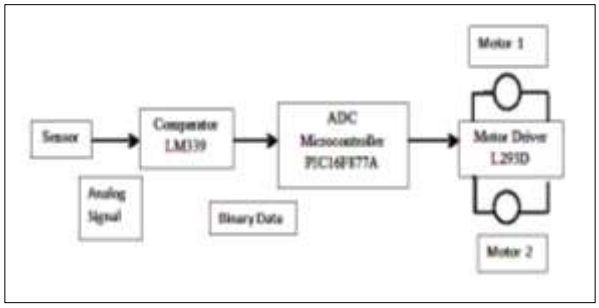

Figure 7: Block Diagram Anti-Collision Mobile

The robot uses IR (infrared) sensors to sense the line. The output of the sensors is an analog signal which depends on the amount of light that reflected back. This analog signal is given to the comparator to produce 0s and 1s which are then fed to the microcontroller. Then microcontroller decides the position of robot in left or right direction. When the left sensor comes in white (for the black line tracer) region, then right motor stops while left motor continue to move so that right turn takes place and robot return on a black line.

First sensor which is to the right will become low as that sensor will be facing the black line and the remaining sensor's response will be high. The right wheel is held constant and the left wheel is made to move freely until the response from the middle sensor becomes low. When the right sensor comes in white region, then left motor stops while the right motor continues to move so that left turn takes place and robot return on a white line.

The middle sensor will always be on the line and as the line is black in color, it will not reflect the emitted radiation back and the response of the sensor will be low and the response of the remaining two sensors will be high as they will be on the bright surface. When both sensors detect on the black line, then the robot moves forward.

3. RESULTS AND DISCUSSION

Result

The overall project has been complete and the desired output has been reached following the target. This system is about a robot that capable to drive according alongside to the specified route, to detect the other robot or obstacles in front and to avoid collision with other robot or obstacles.

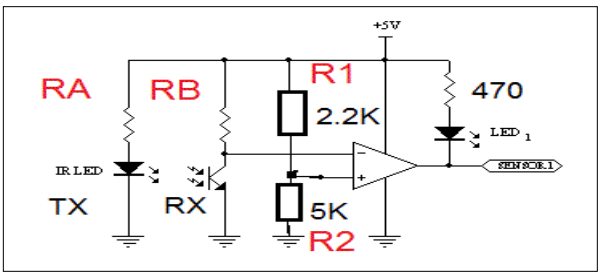

Figure 8: Infrared Sensor Circuit Diagram

Sensor Detection

The range of detection length for the road following detector detection is calculated by considering between 2 resistances values at the transmitter (TX) and receiver (RX) section.

The transmitter resistance worth, RA ought to be smaller than the receiver resistance worth, RB. The table (1) shows the characteristic of the resistance worth of the road following detector.

Table 1: Line following sensor

Resistance	Higher	Lower	Typical value used
Transmitter resistance, RA	Low transmitted power	High transmitted power	470 Ohm
Receiver resistance, RB	Decrease the range of detection	Increase the range of detection	10 kilo ohm

The vary of detection for the road following device ought to be nearer as a result of the device solely detects concerning 1cm between the device at the bottom of the automotive and therefore the track. For the front device, the detection vary of Associate in Nursing obstacle device ought to be a lot of distance compared to the road following device concerning five cm.

Table 2: Front sensor

Resistance	Higher	Lower	Typical value used
Transmitter resistance, RA	Low transmitted power	High transmitted power	470 Ohm
Receiver resistance, RB	Decrease the range of detection	Increase the range of detection	10 kilo ohm

To adjust the sensitivity of the sensors, the resistance values at the comparator is varied to get the fine reference voltage.

Table 3: Op-amp comparator sensitivity.

Resistance	Higher	Lower	Typical value used
Transmitter resistance, R1	Less sensitive	More sensitive	2.2 kilo Ohm
Receiver resistance, R2	More sensitive	Less sensitive	5 kilo ohm

Where the reference voltage is calculated by,

Reference Voltage= R2/(R1+R2)×V_CC

Reference Voltage= 2.2k/(5k+2.2k)×5

Reference Voltage= 1.528V

i. **Moving and Navigation.**

ii. There are many factors that affects the moving of the road follower automobile, consistent with the condition of the route or track. Because the result, whereas the automobile moving on the flat track surface, the speed of the automobile remains stable. But, once the automobile moves to the upward inclined track, the speed of the automobile shriveled. Otherwise, the speed of the automobile shriveled once the automobile moves to downward inclined track. The automobile is also set to decrease the speed (named as speed_slow_balanced) before the downward inclined track.

iii. Speed Calculation

In order to make the movement of the robot smoothly and follow the route, the maximum PWM frequency of 40 kHz can be controlled. This means, the larger value of frequency, PWM will be slow. A PWM output has a time base (period) and a time that the output stays high (duty cycle). The frequency of the PWM is the inverse of the period (1/period).
Time delay= 1/Frequency

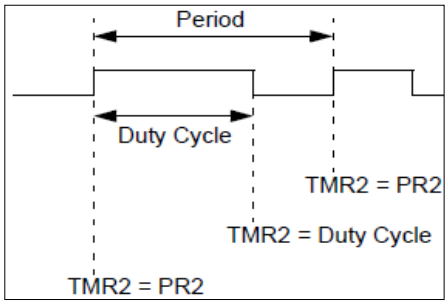

Figure 9: PWM Output

```
// PWM SETTING
void timer_init(void)          //PWM Timer 2 Subroutine
{
T2CON=0b00000000;
PR2=249;                       // set period register
TMR2=0;                        // duty cycle value latch into CCPR1H when PR2 equal to zero (PR2 match with TMR2).
}
void PWM_CON(void)
{
CCP1CON=0b00011100;            // config for RC1 to generate PWM
CCP2CON=0b00011100;            // config for RC2 to generate PWM
}
```

Figure 10: PWM Output Configuration Programming

The PWM period can be calculated using the following formula:

PWM Period=(PR2+1) x 4 x T_OSC x Prescaler
PWM Period=(249+1) x 4 x 1/(20x〖10〗^6) x 16
PWM Period=8x〖10〗^(-4) s=0.8ms
PWM Frequency=1250 Hz=1.25kHz

4. DISCUSSION

i. Sensor detection

For the resistance value at the receiver should be greater than the transmitter resistance. For line following sensor, the selected resistance value is important to be analyzed first in the way to get a better detection and differentiate between two contrast colors (black and white). This boundary voltage called threshold voltage. The ideal detection should be in the range of 1cm between the sensor at the below of the car base and the track. Otherwise for the obstacle sensor, the resistance value of the receiver only considered in the range of distance and no need to find for the fine threshold voltage on the way to detect contrast colors. Op-amp comparator is used to compare the signal voltage from the sensor and the reference voltage. The reference voltage has been set by making a voltage divider. The ratio between R1 and R2 determine the sensitivity level for the sensor and the output voltage produced by the op-amp either 5V (logic 1) or 0V (logic 0).

ii. Moving and navigation

In order to maneuver the automotive, the polarity of the motor should be outlined properly. Half C is that the address to outline the motor within the program. The mix of the 2 DC motors polarities will confirm the movements of the mechanism either forward, turn left, flip right or stop. This can be a crucial section during this project to see the movement of the mechanism. The polarity testing is completed by strive a blunder to outline as RD0 and RD1 is connected with left motor tire whereas RD2 and RD3 is connected with the proper motor tire. The figure below shows the declaration program and also the polarity of the motor one and motor a pair of to maneuver forward, stop, left or right as shown within the table (4)below.

Table 4: Polarity of the Motor 1 and Motor 2 for the Instruction.

		FORWARD	RIGHT (90O)	LEFT (90O)	STOP
Motor 1 (Right)	MR0	0	0	1	0
	MR1	1	1	0	0
Motor 2 (Left)	ML0	1	0	1	0
	ML1	0	1	0	0

The car has two motors, which is motor 1 and motor 2. Motor 1 is located on the right side and motor 2 is located on the left side. To move forward, the motor 1 in anti-clockwise rotation and motor 2 in Clockwise rotation making the car moving forward. To make the car turns RIGHT to 90 degrees, the polarity was changed to make motor 1 rotate, reverse (clockwise rotation) and the motor 2 rotates forward (clockwise rotation). So, this situation will make cars turn right quickly and similar for condition turn LEFT, where the polarity also changed with motor 1 will rotate forward (anti-clockwise rotation) and motor 2 rotates reverse (anti-clockwise rotation).

iii. Problem to detect the line and the obstacles

In order to make the line follower car move through the following the line, to make a turning direction (either left or right) or to stop, two additional sensors (left sensor, SL and Right sensor, SR) have been placed beside the line following sensors at the below of the base car. These front sensors will detect the obstacle and then send the signal to the PIC for further instruction to be made.

iv. Drawback in leveling the speed of each servo motors

During the testing session, there's a retardant to synchronize the speed of each motor and alignment. each of the motor don't seem to be turned with same speed once identical price of duty cycle was applied in each of the motor as a result of to maneuver forward the left motor aspect should in dextrorotation and also the alternative right motor aspect in anticlockwise rotation. The anti-clockwise aspect rotation is slower than the clockwise aspect rotation. This condition consequences build the automotive won't go straight and heaps of troubleshoots are done to see the acceptable price of duty cycle for each motors so as to form the mechanism run swish and straight. to regulate the speed of the motor, the time delay are going to be adjusted till the mechanism can go straight

5. CONCLUSION

The within the overall project was Anti-collision Mobile achieved the objectives set at the start of constructing this project roaring Anti-collision Mobile through drive according the required route and victimization PIC circuit because the feedback loop for dominant the movement. Various studies are applied to complete the project Anti-collision Mobile and

has with success completed following a planned time. By constructing this project, information of the many aspects has been applied cherish physical science and programming. This knowledge's are accustomed style electronic circuit, hardware, and programming so as to construct and troubleshoot the project once it doesn't work properly.

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