PIC CONTOLLED LINE TRACER ROBOT DESIGN

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Abstract

In this study, a mobile robot, which is able to follow a contrast line drawn on the background (a black line drawn on a white background or a white line drawn on a black background), is designed. The data collected via tri sensors on the robot which determine the line position and a forth sensor that senses the obstacles in front of the robot are transmitted to the control circuit designed with PIC 16f84. In accordance with algorithm described with the software it is provided that the robot follows the line via motor drive integrity. Besides, the robot stops, waits and remains at its post whenever there is any possible obstacle sensed by the forth sensor, till the obstacle is being removed and automatically continues following the line from the point it has stopped. Robot's movement is provided with two DC motors fed by 6 Volt accumulators. Software algorithm has been written with PIC BasicPro, collected and by using a programmer transmitted on a serial port to PIC.

Key words: Line Tracing/Following, Mobile robot, PIC programming

INTRODUCTION

The main reason in this study is to design the three wheeled mobile robot which will be able to follow the line on the background. In this study, the cycle is designed where the robot is able to follow a black line drawn on a white background and also the white line drawn on a black background.

It is indicated by the location of the key that which type of line the robot will have to follow. With the help of 3 of CNY70 sensors that are located in front of the robot related line is to be followed and the robot stops as soon as the line finishes. Besides during the following process if there occur an obstacle, the robot stops and waits until the obstacle disappears.

Figure 1 shows the sensors.

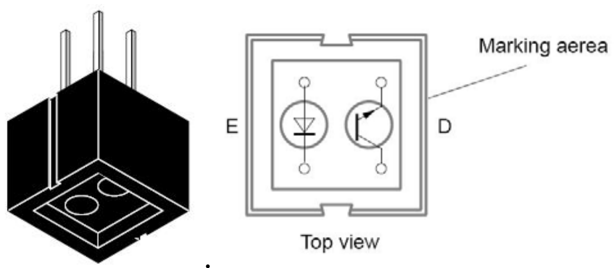

Fig. 1. View of the CNY70 sensor

Figure 2 show the connection between the cycles consist of the robot as a block diagram.

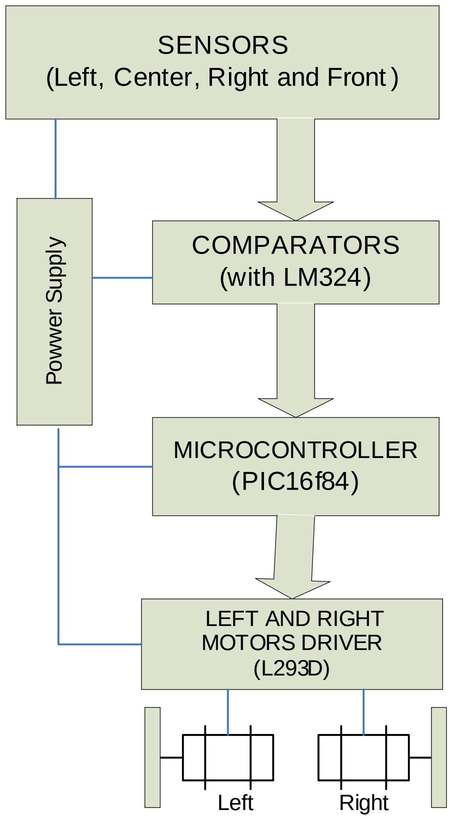

Fig. 2. Block Diagram

It is understood from the photo transistore inside the sensors whether the infrared Led diode that is inside the sensor which senses the line, reflect the light or not due to the line condition. This is shown in figure 3.

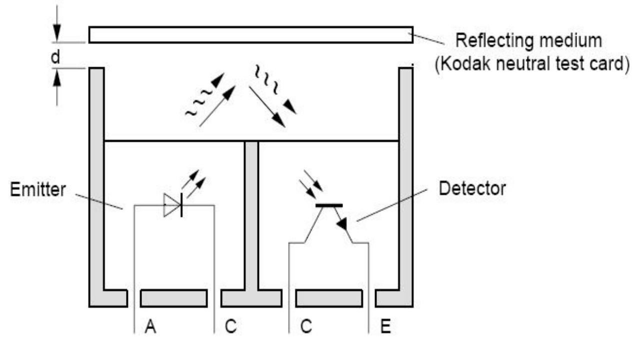

Fig. 3. Working principle of CNY70

To minimize the effecting of the light and provide the reflection stability, a cycle is designed using the LM324 operational amplifier which is shown in figure 5.

For the robot to sense whether there is an barrier or not, the IR diode and IR photo transistors are used instead of CNY70, that is shown in figure 4 which sence the barriers of longer distances.

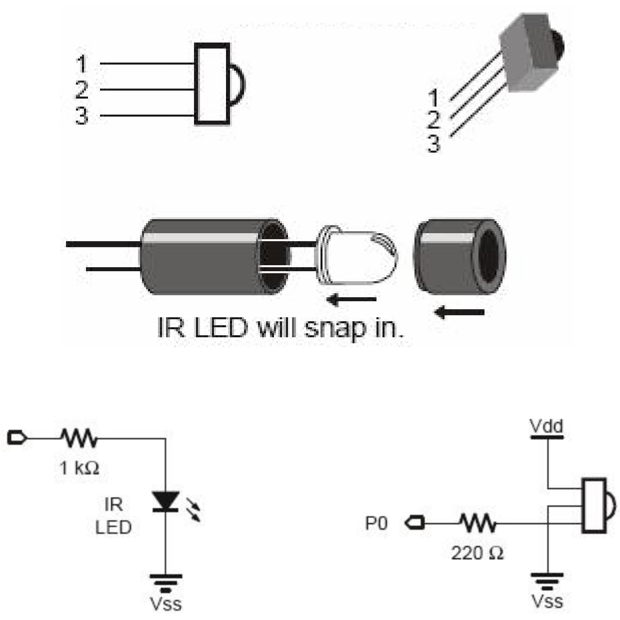

Fig. 4. Infrared detector for sensing front

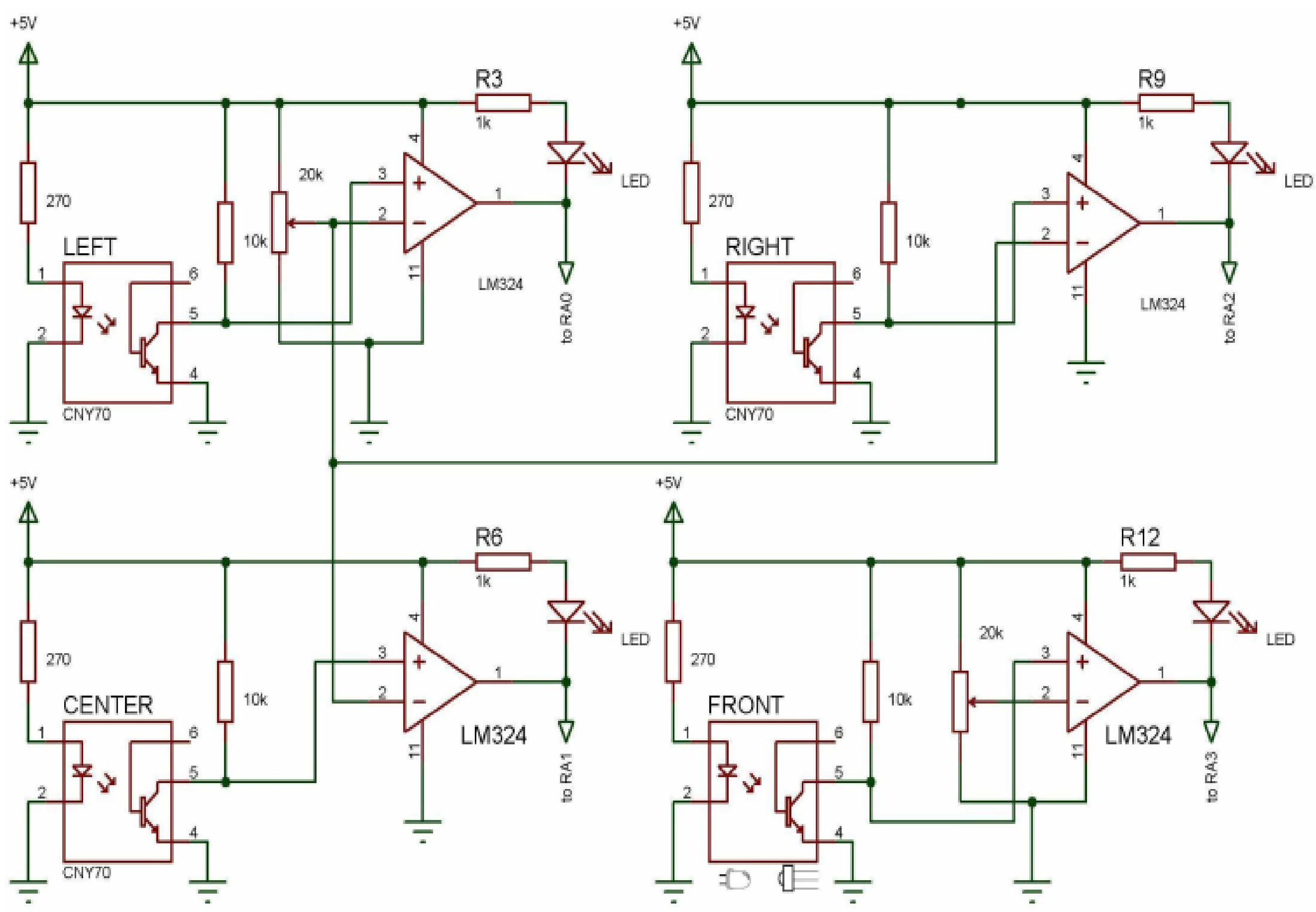

Fig. 5. Principle scheme of the comparators

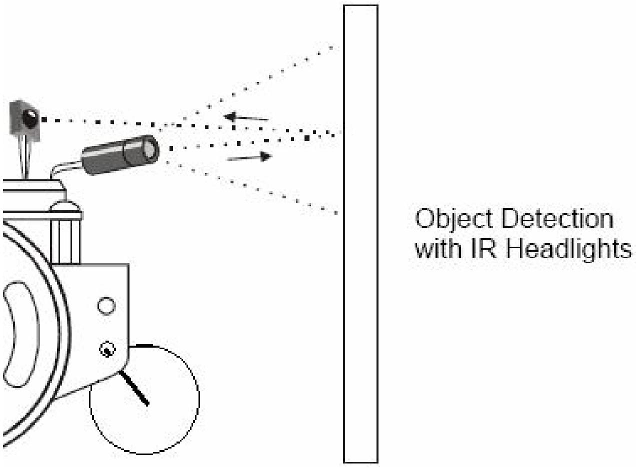

Fig. 6. Working principle of the front sensor

The algorithm that is defined after the information which is accessed from sensors, is processed in comparator, is given to the RA0.. RA3 inputs of the PIC16f84 microprocessor in order to evaluate. The connections of the controller's legs are shown in figure 6.

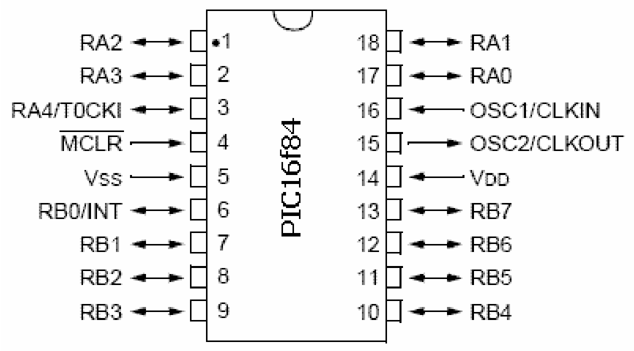

Fig. 7. Pin diagrams of PIC16F84

To run the direct current motors, the L293D integration is used. This integration can run between 4.5V and 36V besides it can easily run the motors with the 1.2A current.

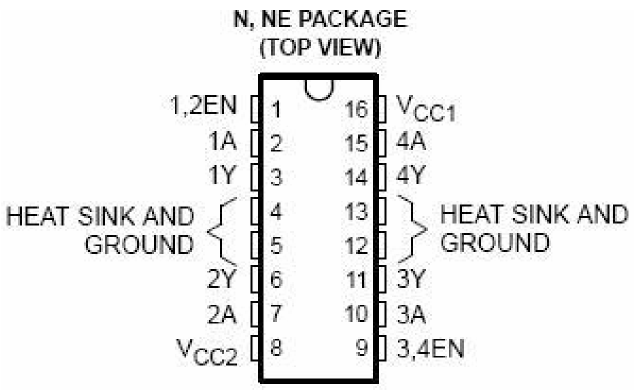

Fig. 9. Pin diagrams of L293D

The mechanism inside the DC motor driver integrated circuit is shown in figure 10. It can easily be seen from the figure that we should give the logic level 1 to the legs number 1 and 9 to run the motors.

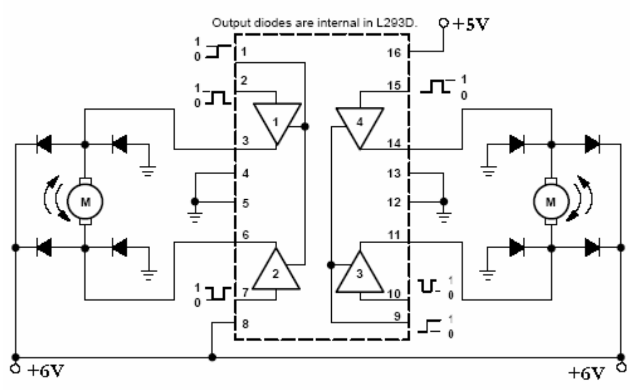

Fig. 10. Block diagram of L293D

The logic diagram is taken into consideration to control the driver integration by PIC16F84.

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FUNCTION TABLE
(each driver)

INPUTS†		OUTPUT
A	EN	Y
H	H	H
L	H	L
X	L	Z

H = high level, L = low level, X = irrelevant, Z = high impedance (off)

† In the thermal shutdown mode, the output is in the high-impedance state, regardless of the input levels.

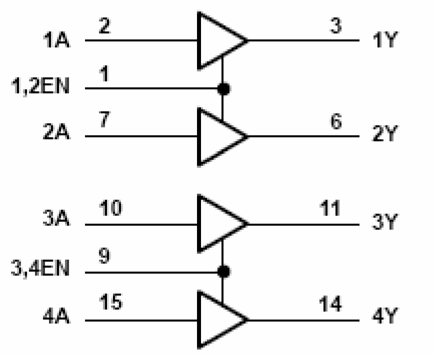

Fig. 11. Logic diagram of L293D

The principle schema is shown in figure 12. It is sent to the software algorithm whether the line and the switch seen in the figure are black or white (pin number 3).

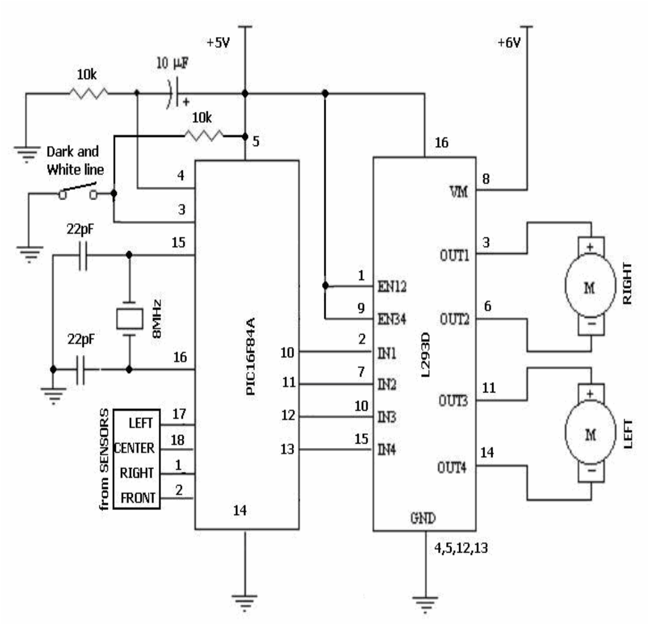

Fig. 12.Principle scheme of the line tracer

Preparing of the software algorithms is based on the information that is coming from the 4 sensors and the switch. If the line is white and the background is black, switch turns on. Thus out of the 10 k resistance the logic level 1 is transferred to the pin number 3. If the line is black and consequently the background is white, the switched is turned off. Thus the logic level 0 is transferred to the pin number 3. The consideration of the information coming from the 3 sensors that are located on the front of the robot is based on this information. The comparator outputs are designed to give 0 from the correlated logic level when there is reflection from the sensors.

Keeping the robot on the black line at the white background depends on controlling the right and the left motors so that 1's data will be come as it is seen in Figure 13. Both two motors are stopped when the 0 data seen on every 3 sensors which means that the line ends. Furthermore when the barrier data is perceived from the barrier sensor in the front there happen to be such conditions as seen in figure 13 (when the logic level of PIC's number 2 pin is to be 0) both two motors are being stopped until the barrier disappears (until comparator output logic level shows 1). Switch should be turned off in such conditions.

Logic 1 is applied to the PIC's number 3 pin turning on the switch when the line is white and the background is black. Using this information the bits are being inversed by the software as it is shown in figue 14, thus, the robot will be able to controlled like it is in the same conditions as in figure 13. Both 2 motors are powered because of the conditions that the robot is on the line as in figure 13-a. The conditions like in figure 13-b will occur if the robot goes to the right side of the line. In such a case the robot should be moved to the left stopping the motor in order to make it come back on to the line.

Figure 13-c will occur if the robot goes to the left side of the line and the right motor should be stopped in order to make the robot come back to the line.

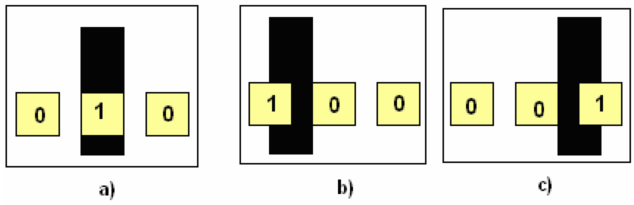

Fig. 13.State of comparator outputs for black line

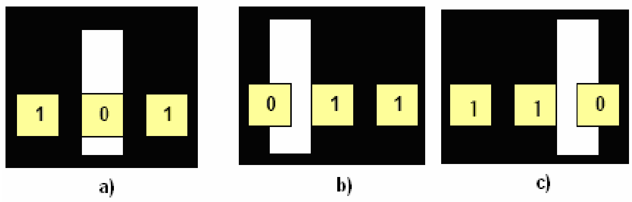

Fig. 14.State of comparator outputs for white line

PIC BASIC control program is written due to the software algorithm shown in figure 16 and the HEX file which is compiled is sent to the PIC with the help of WinPic800 whose interface is shown in figure 15.

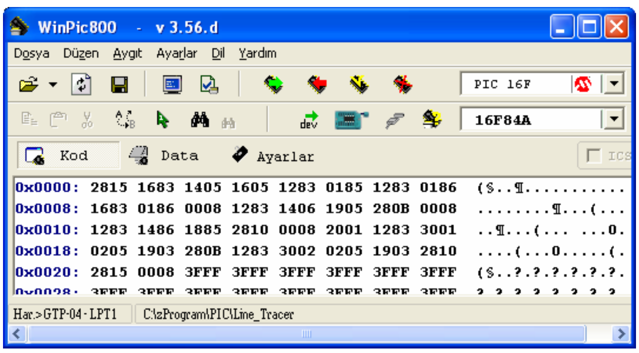

Fig. 15. View of the PIC programmer software

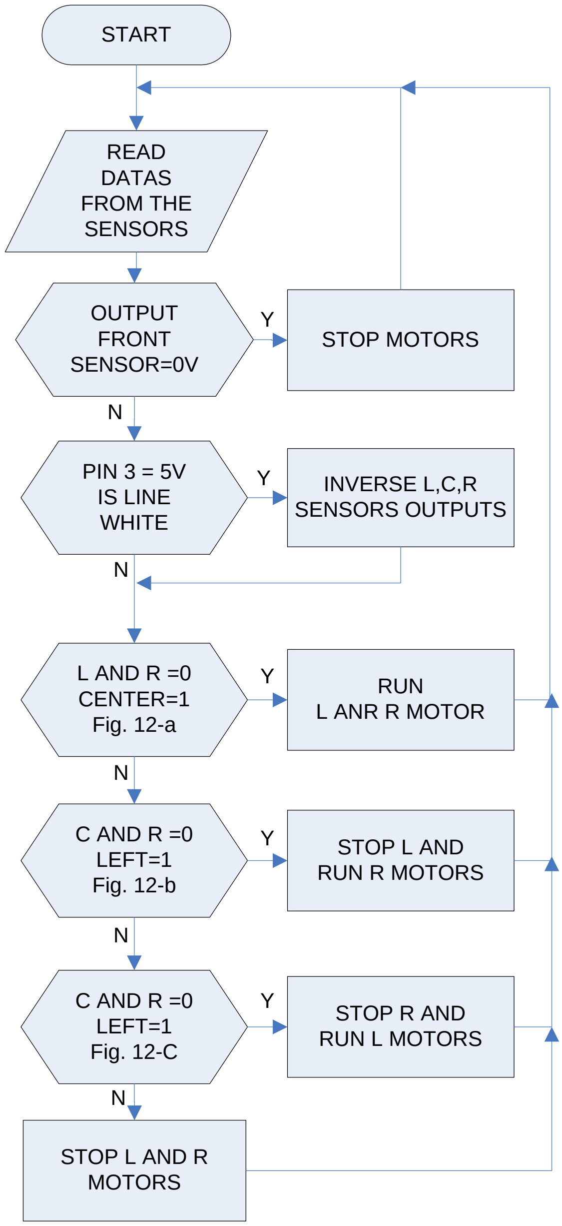

Fig. 16. Flowchart of the control software

CONCLUSION

This study helps the 2 different lines to be followed. If the radiuses of wheel are longer than it is needed, the speed of the robot will increase, thus, it will go out of the line. The right length of the radius helps the robot to stay on the line without a decrease of the speed. The L293D integrated driver is inadequate when the bigger motors are driven; hence, we use the integrated of L298. When the speed is high, to achieve the stability of the pursuit of the line, some more sensors must be put parallel to the right and left sensors that are on the front of the robot.

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