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Implementation of a Line Follower Robot using Microcontroller

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Abstract*: Implementation of new idea and new technology are the valuable gift to the recent generation. Utilization of new technology has shrunk the world and brought very easy within our reach. The expansion and growth of the ideas and concepts, are directly linked to the economic growth as well as development of the country. This paper presents microcontroller based line following robot. Successful implementation on control is depend upon the logic utilization and with proper knowledge on the specific design model. Basically a line following robot can easily follow the line as per instructions loaded in the controller.

***Keywords* : Microcontroller, LM358 comparator , IR sensor, DC motor, robot .**

I. INTRODUCTION

Embedded system normally includes many advance technology like interfacing, microcontroller hardware and automatic control and software and all different sensors working knowledge. Project based learning in the subject of embedded system which will help the students learning due to their interest and motivation Line follower robot where one can easily understand the hardware circuits and software implementation as well as the large applied to the system. Now a days in many institutions there is a competition between students as a robot racing , robot war and many more.

During recent years robots are placed in hospitals as it can save time, also save the manpower, work any hostile environment and conditions with good efficiency [1]. 8051 is very good microcontroller which is used for controlling the robot to follow the exact line position [2]. Robot is intelligent programmed to follow the desired path to perform a task in military, construction, manufacturing units [3],[4]. Now a day's android apps are there to control button, voice and line and make very user friendly [5].

Now a day's to encourage students and for educational tool as to increase the confidence and ability to take innovative ideas to implement low cost line follower robots are also available in the market [6]. Robots are also used for different services like drug delivery [7], to increase transportation line follower robot is highly essential [8] even it's advantages are more in industry revolution 4.0.

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Obstacle detection is also an important application of a robot [9]. Carrying cartage in a specific direction is also one application of line follower robot [10]. Importance of Microcontroller is much more in all kind of field [11].

In this paper we describe the proposed procedure in section II ,hardware and proto type implementation in section III and IV,

II. PROCEDURE FOR PROPOSED SYSTEM

A. Motor controller

To control current in the motor, the motor driver IC act like a current amplifier. L293D can have the capabilities to rotate the motor either forward or reverse direction or one can say clockwise and anticlockwise direction. Even it receives low current but it provide adequate amount to the DC motor.

B. Comparator

Comparator is used to compare with the threshold voltage accordingly it will act on the system . infrared sensor basically if any thing comes in between transmitter and receiver then it immediately gives the output. Basically comparator sends the desired signals to the controller, so that controller can take the exact action based on the received signal.

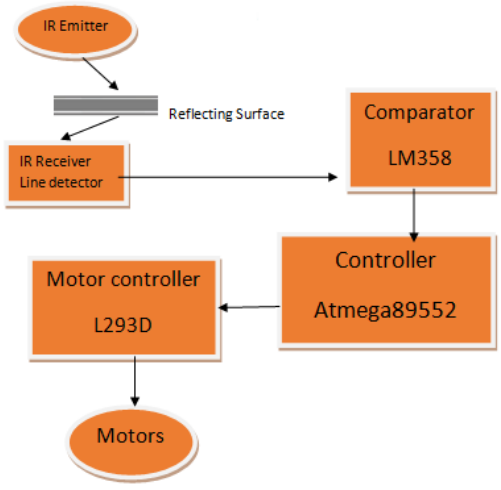

Fig. 1.Propsed block diagram

C. DC Motor

For proper movement of the robot two DC motors has been implemented and a castor wheel is attached.
The reason behind caster wheel to make the easy movement of the robot. Motor driver IC will control the two DC motors. To control the overall line follower robot system ,here we used At89552 microcontroller is used. Also 10 volts DC supply can be provided by battery.

As the proper block diagram is shown in figure 1. Basically we are using five IR sensors named as S1,S2,S3,S,S5. Out of this five S5 which will detect the path. In the back side we have implemented S1 to S4 four sensors out of that S1 and S4 used for angle or turn and whole thing can be controlled by microcontroller.

Figure 2 shows the logic flow diagram of the line follower robot . As per this the 'C' programming can be implemented.

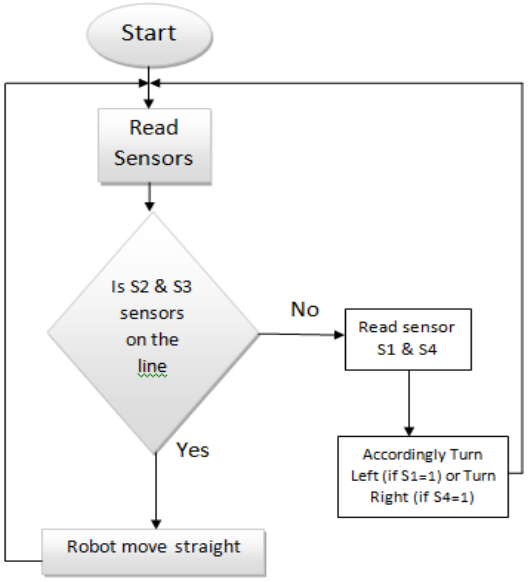

Fig. 2.Flow chart for line follower Robot.

III. POSIBILE ROBOT DIRECTION

Here we control the robot with specific mentioned line. Normally in manufacturing plant pick and placement or we can say pick and drop capabilities are used. To follow a specific location and keep them on required or desired location/place. For this a specific path to be taken for consideration for smooth performance. Using a feedback mechanism in control system there will be no chance of wrong movement.When there will be any sensed signal goes to the controller then it immediately gives to the motor driver IC for appropriate speed and voltage. A programming instructions is given to the robot so that as per the instructions it can turn right or left or move forward.

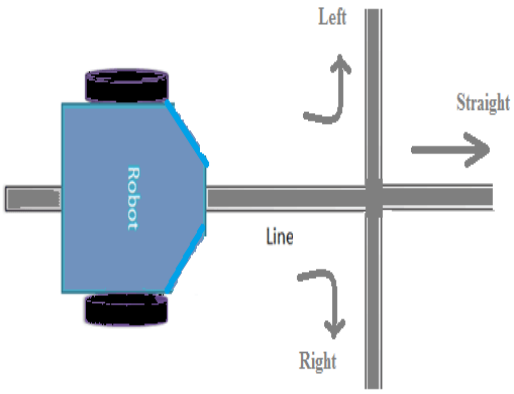

Fig. 3.Robot folowing a normal line

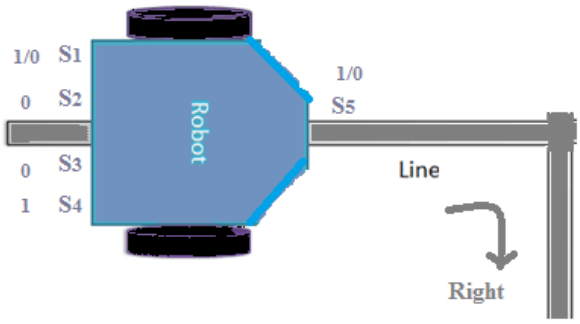

Fig. 4.Case 1 for right movement

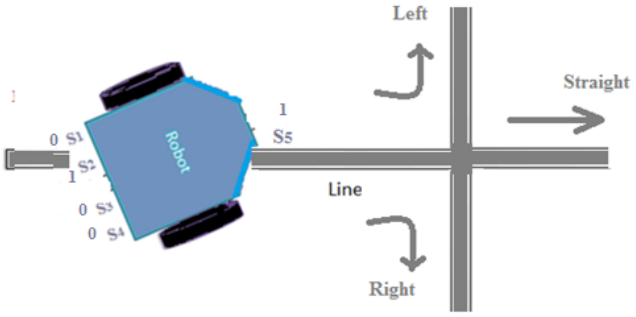

Fig. 5.Case 2 for sudden left of robot

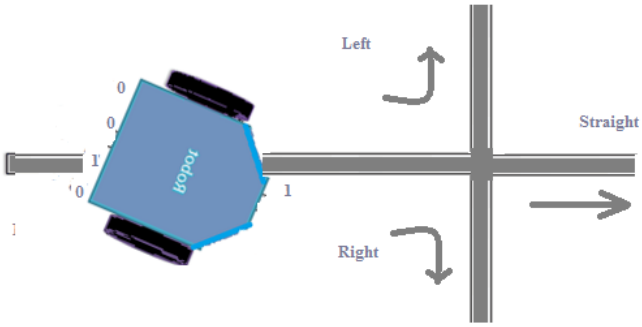

Fig. 6.Case 3 for sudden right of robot

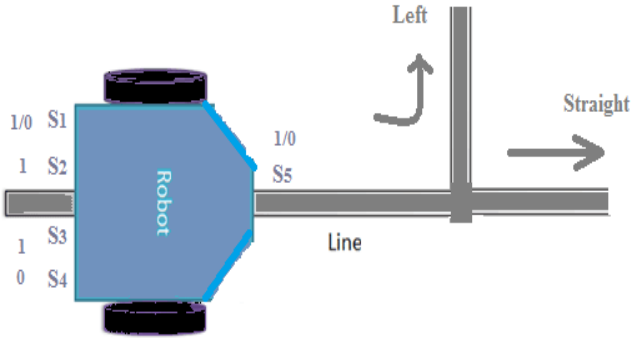

Fig. 7.Case 4 for go straight

Here we can say the robot direction may be straiht , right,left or turning left or turning right can be possible, which is shown in figures 4,5,6,7. Actually in competition they set the destination and one have to set the coding according to the sortest path to reach the destination.

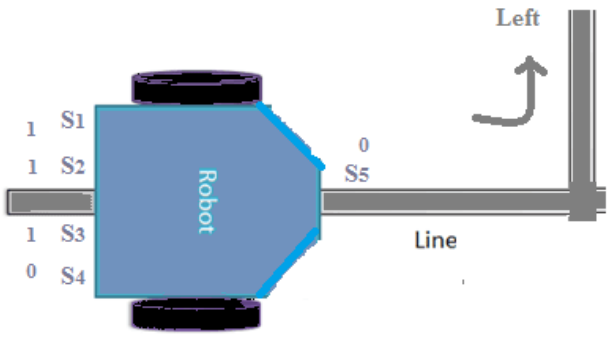

Fig. 8.Case 5 for go left

IV. PROTOTYPE IMPLEMENTATION

Before prototype implementation software verification is important. Because before implementing it should be properly run by the simulation, which is very important to find the silly fault in the coding or idea implementation. For this we are using proteus software and after proper implementation of motor driving direction, one can easily implement or drive further in hardware . Figure 9 indicates the proteus analysis of the output. Figure 10 and figure 11 as proto type implementation and final touch of the model. Table 1 indicates the robot direction as per sensor indication.

Table- I: Different cases and movement of robot

TYPES	Input					Movement of Robot
	Four Back IR Sensors				*One Front IR Sensor*	
	S_1	S_2	S_3	S_4	S5	
Case-1	1/0	0	1	1	1/0	Right turn
Case-2	0	1	0	0	1	Adjustment Right
Case-3	0	0	1	0	1	Adjustment Left
Case-4	1/0	1	1	0	1	Straight over left
Case-5	1	1	1	0	0	Left turn

V. USEFUL APPLICATION

There will be automatic movement of the robot , once properly instruction set to the controller. Secondly if the prototype model will be successful then one can use real time implementation by assigning to the robot as some work and can sit as with no matter about that work. Microcontroller based model is also cost effective and due to it's simplicity it may be very good guidance in the shop floor in the market complex.

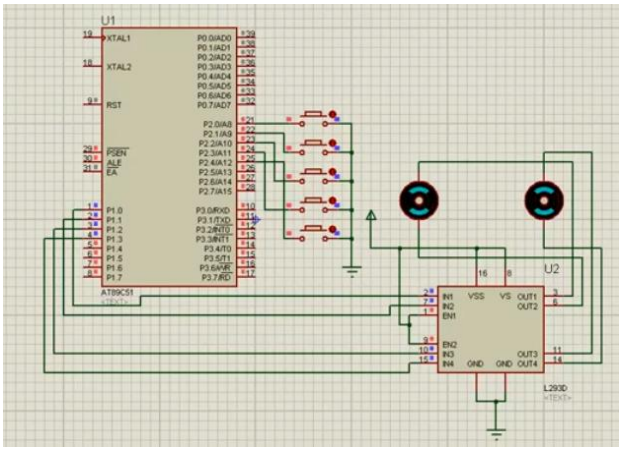

Fig. 9.Proteus analysis for the movement of robot back wheels.

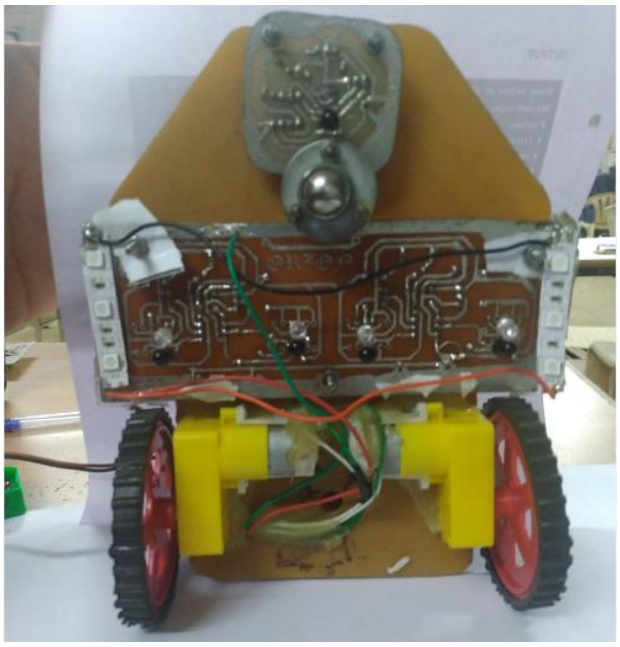

Fig. 10. Back side of the prototype Model

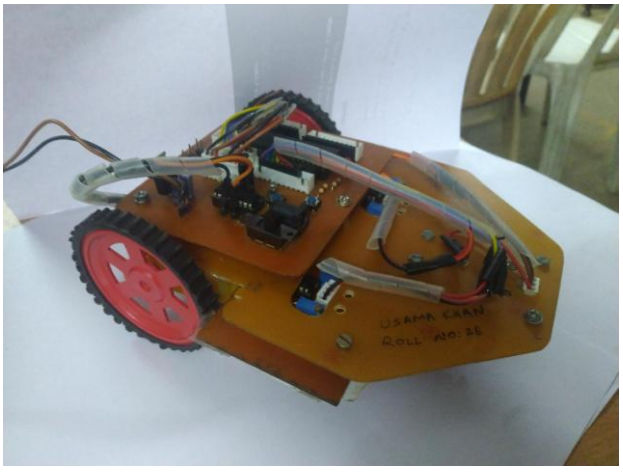

Fig. 11. Prototype implementation.

VI. RESULT AND DISCUSSION

The line or path following robot can implemented successfully. It runs over a specific path with the help of sensors and specific logic used in the controller. Initially it will take some time for PCB designing, printing and hardware debugging.

1) Big size robot can change the role play of worker like supplying material to the architectural high rise construction building .
2) The role also may change in hospital like supplying medicines to all the patients within the proper time. Even more smarter robot can send the emails within the office and can also deliver the news paper, magazines, foods to the office workers in time.

VII. CONCLUSION

Now a day's health care systems greatly depend upon different robotic machinery for the cost and best accuracy point of view. The programming and interfacing was the master key during final stage and also successfully complete of this work. For perfect performance one should check the battery activities in the designed circuit properly.

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Badri Narayan Mohapatra started his research on communication in Centurian University, Odisha. He did his B.E. from Berhempur University and M.Tech from Biju Pattnaik University of Technology. His research area covers Light Propagation, Digital Signal and Image Processing. He has 13 years of teaching experience and currently, he is working in AISSMS IOIT, Pune, India.

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Rashmita Kumari Mohapatra has started her research on communication and signal processing field. She did her BE and Mtec from Berhampur University. She is currently working in TCET, Mumbai. She has 14 year's of experiences and she has more then 10 publication's in various international journals and conferences.