FABRICATION OF MOBILE ROBOT USING ATMEL89C51 MICROCONTROLLER TO OBTAIN COLLISION FREE PATH IN A STATIC KNOWN ENVIRONMENT

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Abstract This research work, deals with the development of a suitable methodology for mobile robot path planning with obstacle avoidance in a static known environment. Here, a mobile robot is fabricated with ATMEL89C51 microcontroller. The fabricated mobile robot is a non-holonomic robot with simple skeleton structure. This work comprises of four modules, first, a suitable skeleton has been developed to suit with plane rectangular surface. In the second module, a printed circuit board is fabricated. In third module, a microcontroller program is written using ATMEL89C51 for the navigation is mobile robot. Finally, all the components are assembled for the fabrication of a non-holonomic mobile robot.

I. INTRODUCTION

Robotics is the clustering of mechanical, electrical and computer science engineering domain that mainly deals with the design, construction, operation, and application of robots, as well as control system, sensory feedback, and information processing. These technologies deal with automated machines that can take the place of human in dangerous environments or manufacturing processes. Now-a-days, robotics is a rapidly growing field, as technological advances continue, research, design, and building new robots serve various practical applications.

II. RELATED WORKS

VivekHanumante et al. [2013] have described a low cost solution to obstacle avoidance for a mobile robot. It presents a dynamic steering algorithm which ensures that the robot doesn't have to stop in front of an obstacle which allows robot to navigate smoothly in an even in an unknown environment. Alabagul et al. [2011] have proposed a design and fabrication of climbing robots using vacuum pump with servo motors. The suction force is used to climb the wall. Arunkumar et al. [2011] dealt with design and fabrication of mobile robot using potential field algorithm navigation purpose. They have used ATMEL 89C51 microcontroller with IR sensor to identify obstacle and RF sensors to sense the target. Hossein Adeli et al. [2011] proposed a methodology about Path Planning for Mobile Robots using iterative Artificial Potential Field Method. This algorithm is based on Artificial Potential Fieldmethod .The algorithms is built upon new potential functions based on the distances from obstacles, destination point and starts point and perform a simulation test for results.

Santiago Garrido et al. [2011] proposed a new sensor based path planner which results in a fast local or global motion planning able to incorporate the new obstacle information. The proposed method is able to deal simultaneously with both local and global planning requirements.Chitradevi et al. [2011] described about a knowledge based reinforcement learning robot in maze environment. The artificial intelligence concept like reinforcement learning technique is utilized by the robot to learn for new environment. The robot travels through the environment and identifies the target by following set of rules. After reaching the target, the robot returns back through the optimum path by avoiding dead ends. Klahold et al. [2001] deals about the energy resources of a mobile robot into account, only one transmitter is used to fabricate robot for obstacle avoidance application. Ya-Chun Chung [2008]

developed a path planner based on the potential field method. Through the Hough transformation the obstacle detection is accomplished. The local minima problem has been solved by redefining the repulsive potential field.

III. FABRICATIONOF MOBILE ROBOT

The components used to fabricate the mobile robot are ATMEL89C51 microcontroller, IR and RF sensors and gear motors.

3.1 Design of Hardware

The skeleton of the mobile robot is consisting of platform, wheels, gear motor and battery. The schematic diagram of mobile robot is shown if Figure 3.1. The approximate size of the fabricated mobile robot is 200 x150 mm. Two wheels which are in the rear end of the robots and a castor wheel is fixed in front end. The PCB is at the top of the platform which consisting of all the electronic connections which going to control the mobile robot. The power supply is given by 9V battery which placed at the front end. The two IR sensor are placed at front ends which will detect the obstacles.

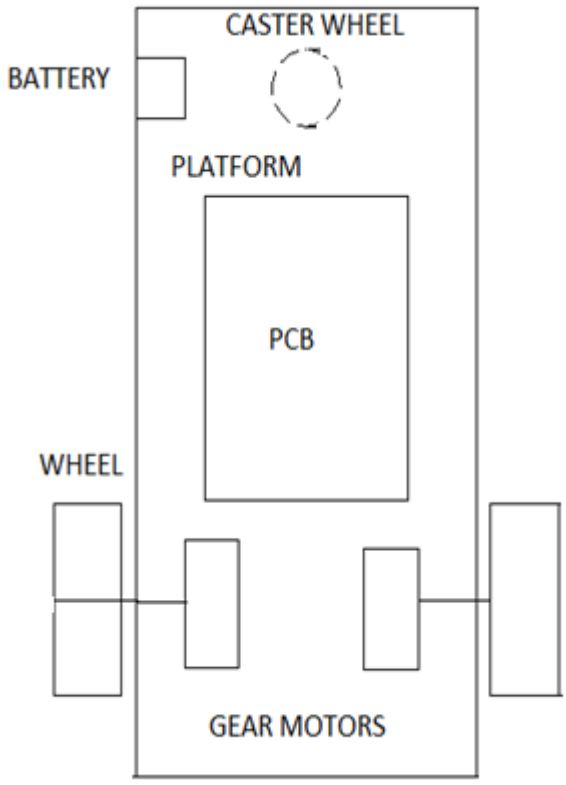

Figure 3.1: Schematic Diagram of proposed mobile robot

3.2 Design of Electronic Circuit

All the components required for the fabrication of PCB is mounted using suitable board. Here, two 9V batteries are used for the power supply and ATMEL89C51 is used as controller. Four IR sensors are used to detect the objects. First pin of the IR sensor is connected to the power supply. The second pin of ATMEL89C51 is connected to the ground. And then third pin is connected to the microcontroller. The robot has three wheels. One of them is caster wheel. And another two wheels are controlled by

the two gear motors. That two gear motors are controlled by a single driver IC which is called IC L293. Gear motor has two wires. That two wires are connected to the respective pins of the driver IC. Two pins of the driver ICs are connected to the pin number twenty one and twenty two of the microcontroller.

Two voltage regulators 7805 and 7812 are used to control the voltage of the battery. The regulator 7805 is used to control the output of the 9V battery under 5V. Then, the output of that regulator is connected to the microcontroller power supply and the IR sensors power supply. Another regulator 7812 is used to control the output of the 9V battery under 12V. Then the output of this regulator is connected to the power supply of the driver IC of the gear motors. A crystal which is used to safe guard the microcontroller is also suitable fixed. The pin configuration used in this design is given in the Table 3.1.

Table 3.1: Details of PIN connection of ATMEL89C51

PIN No.	Description	Connected to
21	VCC	connected to driver IC-L293
22	P0.0(AD0)	connected to driver IC-L293
36	P2.4(AD12)	connected to IR sensor
37	P2.3(AD11)	connected to IR sensor
38	P2.2(AD10)	connected to IR sensor
39	P2.0(AD9)	connected to IR sensor
40	P2.0(AD8)	connected to voltage regulator

3.3 Design of Microcontroller Code using ATMEL89C51

When the battery is switched on the robot starts sensing and running. While the robot is running in the environment the IR sensors senses the environment by emitting and/or detecting the infrared signal. If any obstacle in the environment, the sensor senses the obstacle and sends the signal to the microcontroller. Then the controller stops the two motors of the robot suddenly by sending the signal to the motors. Then it has to send the signal to the motor for rotate in reverse direction for two seconds. And then the robot has to turn left or right side depends upon the input given in the program. For that power supply should be sent to the one motor only and another motor should not be given power supply. Totally, six combination of motor movement is coded with microcontroller like forward, reverse, forward_right, forward_left, reverse_right and reverse_left.Then again the IR sensor senses the environment for any obstacle. Above procedure will be repeated again and again until the mobile robot reaches the target. If suppose robot comes under the problem of deadlock, the IR sensor senses the environment and controller rotates the robot for five minutes, then after another five minutes duration, the robot power supply will be switched off automatically.

IV. CONCLUSION

In this work, a simplified procedure is dealt for the development of a simple mobile robot could be used for application in a plane rectangular environment. The different hardware components required for mobile robot are suitable selected and fabricated. Here, ATMEL89C51 microcontroller is used to write a code to control the motors of the mobile robot. The IR and RF sensor are used to detect the obstacle and target with in the working environment. Six, microcontroller functions are developed to navigate the mobile robot in order to reach the target with avoiding the obstacles present inside the working environment.

V. REFERENCES

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