Solar Operated Low Cost Obstacle Avoidance Robot

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Abstract— Obstacle avoidance is the back bone of autonomous control as it makes robot able to reach to destination without collision. Robot generates the shortest path from source to destination on the basis of sensorial information of environment. In this paper, solar operated low cost solution for obstacle avoidance in a robot has been simulated and experimentally tested. Design of the robot, algorithm and simulation ensure the direction of robot and LCD display. Simulation in Proteus 7.7 professional software, programming in Keil_uVision4 software and low cost solar operated 12V solar rechargeable battery have been discussed in the present work.

Key words: Solar Operated Low Cost Obstacle, Obstacle Robot Motor

I. INTRODUCTION

Robot is a programmable device used for performing repetitive job activities like a human. Obstacle avoidance strategy and working of robot is greatly dependent on the detection of obstacles by sensors and accordingly response of robot. The sensors are placed in such a way that they can cover the maximum area in left and right corners (Fig.1).

There are some very famous methods for robot navigation like wall-following edge. One recently introduced commercial system uses wall-following method on a floor cleaning robot for long hallways [2]. There are number of applications of robots. Obstacle avoiding technique is very useful in real life, this technique can also use as a vision belt of blind people by changing the IR sensor by a kinetic sensor ,which is on type of microwave sensor whose sensing range is very high and the output of this sensor vary in according to the object position changes. A more general and commonly employed method for obstacle avoidance is based on edge detection. If we use this technology in the car or any vehicle, it will automatically sense the obstacles then it will take a side to the available free space. An obstacle may be a living things or any object. Autonomous Intelligent Robots are robots that can perform desired tasks in unstructured environments without continuous human guidance.

Fig. 1: Obstacle Robot Motor and Sensors

Increasing cost and import of conventional resources, has bad effect on economy of a country and the only cheaper solution is 'unlimited power' from sun In fact if we harness only 0.0034 percent of the solar energy reaching the earth's surface, the energy need of whole world will be met [1]. Photovoltaic cells, also known as solar cells, which convert light energy directly into electricity, are the primary focus of this work. Solar power can be converted directly into electrical power in photovoltaic (PV) cells, commonly called solar cells. The sun has a surface temperature of about 6,000°C, and its hot gases at this temperature emit light that has a spectrum ranging from the ultraviolet, through the visible, into the infrared. Photovoltaic cells generally consist of a light absorber that will only absorb solar photons above certain minimum photon energy. Solar cells are constructed of materials that turn solar energy into electrical current which can be collected for power generation. To increase the voltage of the electricity generated, solar cells can be wired together in series to create larger arrays, known as solar panels. Solar cells accomplish this energy conversion by the use of semiconductor materials. A solar panel is made up of many solar cells wired together. Depending on the energy required for the specific application, many solar panels can be wired together to create a large array.

The use of solar energy is so far limited in robotic applications. In the present work, two DC motors were used in obstacle avoidance robot. A substitute of electricity run two DC motor of 6W each has been proposed by a solar energy of same light intensity through an experimental set up comprising solar panel, storage battery and rechargeable batteries. It is further established by testing the system that if charged for 6-7 hours in sun light summer, battery is capable to supply stored energy to motors for 4-5 hours. The developed solar energy supply system is cheaper, portable, user friendly and free from maintenance. The paper stresses the need of replacement of conventional electricity supply to DC motor by solar energy for cheaper solution in obstacle avoidance robot.

II. MATERIALS AND METHOD

Motor driver L293D, decides which motor will be in motion or stop in according to the incoming signal from the microcontroller. Two sensors are used to sense the obstacle on left and right side. When obstacle comes in path, IR sensor detect it and reflect it back.

S. No.	Component Name	Specifications
1.	IR Sensor Module	
2.	Microcontroller	AT89S52
3.	16*2 LCD Display	
4.	DC Motors	12V,120rpm
5.	Motor driving IC	L293D
6.	Voltage Regulator	7805
7.	Robot chassis board, wheels	

8.	Crystal Oscillator	11.0592MHz
9.	PCB Board	
10.	Solar rechargeable battery	12V, 0.5A
11.	Capacitors	33pf
12.	Solar panel	15Wh , 13-17V DC

Table 1: Components Description

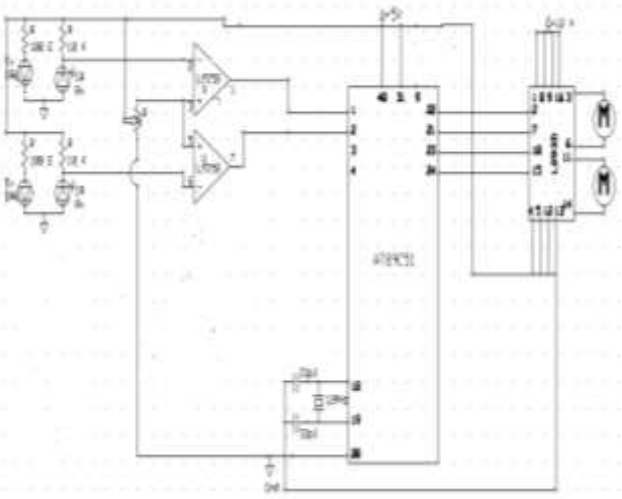

Fig. 2: Circuit Diagram

III. SIMULATION

Movement of robot for obstacle avoidance is governed by following algorithm:

1) Start
2) Initialize the input port P1 and output ports P2 and P3.
3) Read the data from port P1.
4) If the bit is present at P1.0 only, move right motor in forward direction and stop the left motor, else go to step 5.
5) If the bit is present at P1.1 only, move the left motor in forward direction and stop the right motor, else go to step 6
6) If both bits are present stop both the motors.
7) Again go to step 3

Simulation of robots for checking the program and circuit was done by Proteus professional 7.7 software version. Simulation (Fig.3) proceeded as per algorithm.

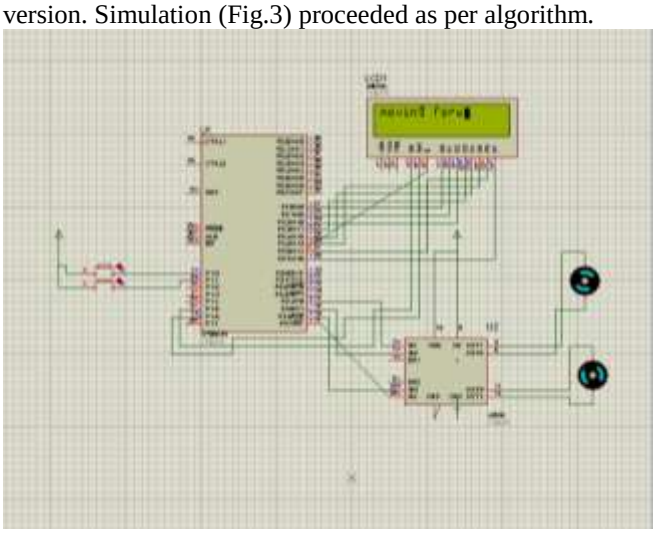

Fig. 3: Simulation of the Robot Circuit

IV. RESULTS AND DISCUSSION

As the robot is switched ON, it will in forward direction, then the robot continuously check any obstacle in path. If there is no obstacle then robot will go straight. If any obstacle will found in left side then the controller send a command to the motor drive to stop the right motor & move the left motor and just opposite as obstacle found in right side.

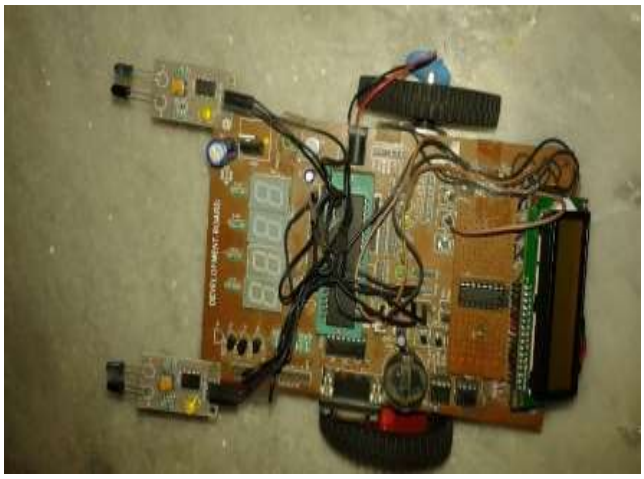

Fig. 4: Fabricated robot

The biggest advantage of using Solar Power is that it is an inexhaustible source of energy. Once you have installed the solar panel and battery, it can work without electricity because the sun is always going to be there. The next advantage is that there is no release of any emissions into the atmosphere while generating electricity. Total cost of solar electromechanical device was Rs.3000 which includes Rs.2000/-for solar energy rechargeable system and Rs.1000/- for parts of obstacle avoider robot but there was no running cost.

V. CONCLUSIONS

A low cost solar obstacle avoidance robot has been designed, fabricated, simulated and tested in the present work to achieve its objectives. Developed robot had a very good intelligence and capable to sense the obstacle by processing the signal coming from the sensor. It was perfectly avoiding the obstacle coming in between the path and taking turn in according to the sensing signal with the help of the two motor which makes the movement of the robot smooth .Solar power was stored in battery and each fully charged battery provided back up to two rechargeable battery for 4-5 hours to run two DC motors. There was no operating cost as it was running from solar energy.

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