Cleaning Robot Based on PIC Controller

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Abstract— In this paper, we implemented a human-friendly cleaning robot system for the domestic ubiquitous environment. Though conventional automatic cleaning robots already exist, these robots do not work in sync with humans. These robots' cleaning operations often obstruct a person in the home. Therefore, a robot that does not interfere with human activity in the home is required. What indicates human activity most in the home is the usage status of home appliances such as electrical appliances, doors, and lights. In our system, a robot can identify where humans are active by receiving the usage status of home appliances via a network. The usage status of home appliances changes the robot's running pattern and consequently the robot avoids humans and cleans without causing obstruction. We conduct an operational experiment of our prototype system in a room in which some sensors are installed to create an experimental environment. We then measure the execution time of the prototype system. From the results of experiments, it is found that a cleaning robot system which works through interaction with equipment in the home and does not disturb humans can become a reality.

Key words: cleaning robot; obstacle avoidance: rectangular path algorithm; sensors

I. INTRODUCTION

In the present era, people live a very busy life. People in cities have long and irregular working schedules. For carrier oriented and working women it becomes challenging to handle home and office work together. For saving the time the requirement was of House Cleaning Robot, which is an automatic system that works and cleans on its own without human control/intervention. The idea of cleaning robot is not a new idea but it is very vast. [1] An implication on cleaning robot was done by using various techniques such as by using Rasp-berry Pi, Arduino also by using the 8051 microcontroller. Every implication was having advantages and limitations too. On the basis and study of those limitations new inventions were carried out. Here in this project we are using PIC controller. The innovation in this project is obstacle avoidance. Here we are using sensors to detect the obstacles. The cleaning robot uses a microcontroller to detect obstacles and manipulates its direction as per the input from sensors mounted in front; right and left of the robot and the distance will be rerouted automatically. [4]

II. ROBOT DESIGN PROCESS

A. Problem Description

To find out and design an autonomous robot that will help people at home who are very busy for daily or weekly or cleaning, especially for families with children. In particular for the elderly who live by themselves or in old age homes and do not have the strength or ability to clean. Robotic vacuum cleaners available in the market are expensive and inefficient in terms of cleaning time and cleanness. The goal is to design the robot with infrared sensors, bristle brushes on every side to improve the cited cleaning performance problems using PIC controller. [2]

B. Implemented Design

In this phase, the requirement is to specify the details of the implemented design should have.

- What is the total Power Requirement?
- What types of sensors are used?
- How it can be controlled?

C. Fabrication of Robot

It is designed to move the robot in forward, right, left and reverse direction. The controller and vacuum cleaner attached to the robotic arm are processed locally.

D. Programming Required

Following the fabrication process stage, it is required to program the PIC controller in C language. The programming also involves the design of interface of various secondary components required.

E. Power Scheme

The robot would be operated by using carrier mounted batteries and power two power supplies. Two batteries are connected in series to supply to DC motors driving the wheels. 12V supply is converted to 5V (for circuitry) voltage regulator. [3]

III. BLOCK DIAGRAM OF MODEL

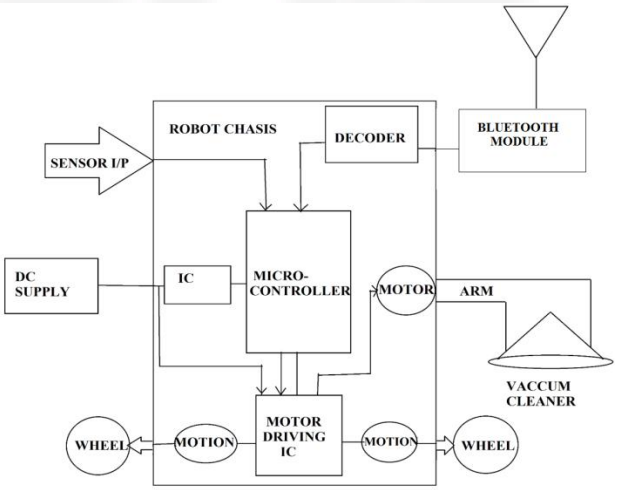

Fig. 1: Block Diagram

The block diagram is shown gives pictorial representation of implemented robot. It shows how the components must be connected to fulfil the desired task. It describes the circuitry and clarifies the idea of the robot chassis. It shows the main structure of cleaning robot which consists of power sources, dc motors, rotating brushes, vacuum cleaner. The heart of the robot is microcontroller. Microcontroller reads data from sensors and accordingly action has been taken. It is given dc supply as an input, an IC is used to smooth dc input to the

microcontroller. As per the inputs received from sensors, microcontroller drives dc motors and hence the arm by which cleaning operation will be done successfully. [4]

A. PIC18F4550

PIC stands for Peripheral Interface Controller given by Microchip Technology to identify its single-chip microcontrollers. These devices have been very successful in 8-bit microcontrollers.PIC18F4550 have 5 (PORTA, PORTB, PORTC, PORTD and PORTE) 8-bit input-output ports. PortB & PortD have 8 I/O pins each. Although other three ports are 8-bit ports but they do not have eight I/O pins. Although the 8-bit input and output are given to these ports, but the pins which do not exist, are masked internally. [5]

B. Power Supply

As PIC18F4550 needs +5V DC to operate we need +5V DC power supply to be design. For converting 230V AC mains to +5V DC, the Power Supply consists of Step down Transformer, Bridge Rectifier, Filter Capacitor and Regulator IC.

- Step Down Transformer:
  Step down Transformer is used to lower down the voltage levels. Step down Transformer is used to convert the 230V AC into 12V AC.
- Bridge Rectifier:
  Bridge rectifier converts the AC mains in DC. Bridge Rectifier consists of four diodes connected in bridge fashion.
- Filter Capacitor:
  Filter Capacitor removes pulsating DC in the output of Bridge Rectifier. At the output of the filter capacitor pure is obtained. [6]

IV. FLOWCHART

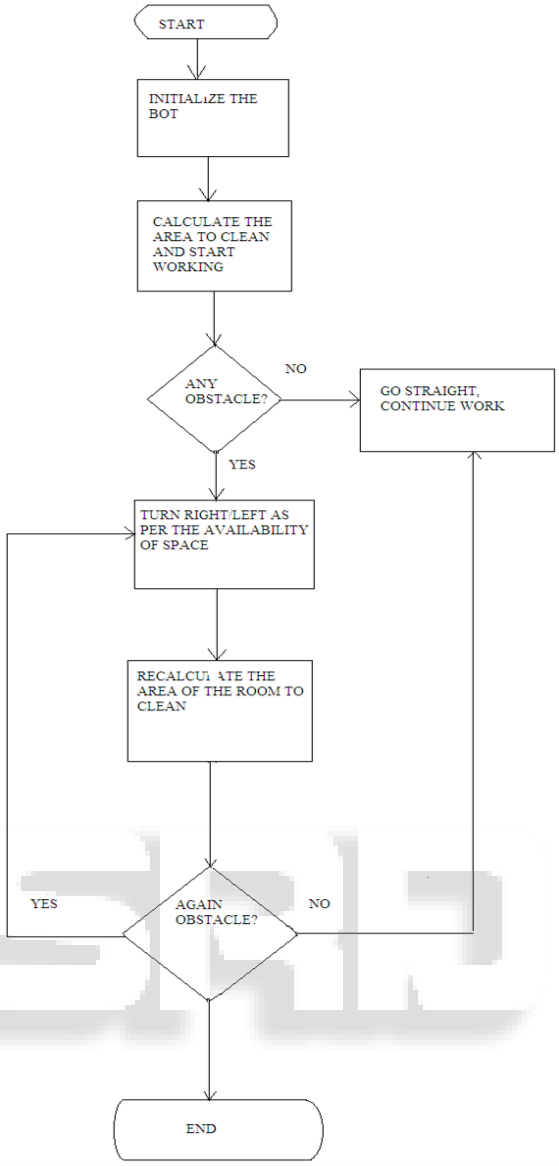

Fig. 2: Flow Chart

V. WORKING

The implemented model of cleaning robot follows the rectangular path for the entire room. When it enters in room it will calculate the area of the room. Once the area gets calculated it will initialize itself to start the operation of cleaning.

If there is an obstacle in its path the sensors will give the acknowledgement about it to the microcontroller, accordingly the bot will move itself and the area around that obstacle gets cleaned. After that bot will continue itself in its calculated manner. If again there is an obstacle it will follow the same procedure as per described.

VI. RESULT

PREVIOUS METHODS	1) AT89S52 microcontroller 2) RF modules for wireless comm. 3) Arduino 4) Ultrasonic Sensors, etc.
DISADVANTAGES FACED	1) RFID tags were complex and costly. 2) Bot was unable to find its direction after avoiding the obstacle.

	3) Sensors were not effective in movement of bot around boundary. 4) Robot was unable to reach in areas at corners and along the boundary. 5) Robot made were not effective in both wet and dry cleaning at the same time.
IMPLEMENTED METHOD	We have implemented the project using PIC 18F4550 micro-controller and controlled it using Bluetooth module using a Mobile app.
ADVANTAGES	1) Robot can easily find the direction as it is being controlled by the user. 2) Sensor are effective in avoiding the obstacles. 3) Robot can easily reach in all the corners and boundaries. 4) Implemented robot can efficiently do both the wet and dry cleaning of an area simultaneously.

Table 2: Result

VII. CONCLUSIONS

In this paper, rectangular algorithm with low-cost sensors is presented for efficient cleaning purpose. The results presented in this work have been obtained using only one robot manually build and thus no generalization can be directly assumed for an hypothetic industrial massive production. However, the results for this particular realization shows the good accuracy of the designed ultrasonic driver that has been tested and used for lateral positioning error correction and map building. A, prototype of the rotating brush device is made manually to ensure the cleaning effect of the proposed system.

VIII. FUTURE SCOPE

As a future scope this project can be controlled automatically instead of manually. This will avoid human intervention in the working of robot. This will also insure the space to be clean at every corner efficiently and avoiding the obstacle.

As the power source in our case we have used the battery which can be replaced in future with solar cell panels, which will be most energy efficient and will also enable the robot to clean the area outside houses also.

We can also use this robot in public as well as in private areas to clean the environment like Commercial malls, Railway station, Airport, etc. without any manual support.

REFERENCES

[1] Marneet Kaur, Preeti Abrol,``Development of floor cleaner robot (automatic and manual)'' International Journal of Computer Applications (0975-8887) Volume 97-No.19,July 2014
[2] Abhishek Pandey, Anirudh Kaushik, Amit Kumar Jha,``A Technologinal survey on Autonomous Home Cleaning Robot", International journal of Scientific and Research Publications, Volume 4, Issue 4, April 2014
[3] J. Palacin, J.A. Salse, ``Building a Mobile Robot for a Floor-Cleaning operation in Domestic Enviornments", IMTC 2W3-Instrumentation Technology Conference Vail.Co.USA,20-22 May 2003
[4] PIC Microcontroller and Embedded Systems : Using Assembly and C by Muhammad Ali Mazidi, Rolin McKinlay, Danny Causey
[5] www.electrosome.org
[6] Priya Shukla, Mrs Shimi S.L, ``Design of Inspection and Cleaning Robot", International journal of Scientific and Research Publications, Volume3, Issue6. September2014
[7] Zhangjun Song, Huifen Liu, jianwei Zhang, Liwei Wang, Ying Hu,``A Localization Algorithm for Low-Cost Cleaning Robots Based on Kalman Filter",Preecedings of 8th World Congress on Intelligent Control and Automation, July 6-9 2010, Jinan, China
[8] Ya Wang, Jianhua Zhang,``Autonomous Air Duct Cleaning Robot System",1-4244-0173-9/06/2006 IEEE.

