Hybrid Floor Cleaner Robot

Remya Ramachandran[1], Amal MA[2], Jerom Mathew Paul[3], Shahid S[4], Sumith PS[5]

[1] *Assistant professor, Dept of Mechatronics Engineering* [2, 3, 4, 5] *Dept of Mechatronics Engineering*
[1, 2, 3, 4, 5] *Nehru College of Engineering and Research Centre, Thrissur, Kerala, India*

ABSTRACT: Households of today are becoming smarter andmore automated. Home automation delivers convenienceand creates more time for people. Domestic robots areentering the homes and people's daily lives, but it is yet arelatively new and immature market. However, a growth ispredicted and the adoption of domestic robots is evolving. Several robotic vacuum cleaners are available on the marketbut only few ones implement wet cleaning of floors. Thepurpose of this project is to design and implement a HybridFloor Cleaner Robot, Autonomous and Manual via PhoneApplication. The main objective of this project is to designand implement a vacuum robot prototype by using ArduinoMega, Motor Shield L293D, Ultrasonic Sensor, and IR Sensorand to achieve the goal of this project. Hybrid Floor CleanerRobot will have several criteria that are user-friendly.
Keywords: Microcontroller, Motor Driver, Ultrasonic Sensor, Vacuum Unit, IR Sensor, Bluetooth Module.

I. INTRODUCTION

Floor Cleaning has always been an integral part of the daily health and hygiene routine, be it a household or an industry. In the recent years, robots have been used for various cleaning purposes. Robots have various cleaning expertise like mopping, picking up the waste, wet floor cleaning, dry vacuum cleaning etc., Depending on the cleaning mechanism, these robots may have some advantages and disadvantages.

In our research we developed a hybrid floor cleaner (vacuum and mopping), it performs all tasks automatically as well as manually. Mainly we use Arduino mega as controller which works with sensing devices IR sensor and ultrasonic sensor. It uses 2 motors of 200 rpm for wheels. Vacuum unit is at the front of robot to suck all the dust particles. Motor driver IC LM293D is used for driving the motors and 12 V battery is used as power source. IR and ultrasonic sensors is used for sensing obstacles in way of robot. Robot is operated by an advanced developed algorithm which incorporates the action

of sensors and motors. By this project, we tried to reduce the cost of mopping robot as compare with other mopping robots.

II. LITERATURE REVIEW

A robotic vacuum cleaner is an autonomous electronicdevice that is intelligently programed to clean a specific areathrough a vacuum cleaning assembly. Some of the availableproducts can brush around sharp edges and corners whileothers include a number of additional features such as wetmopping and UV sterilization rather than vacuuming. Someof the available products are discussed below.

Electrolux Trilobite by the Swedish household andprofessional appliances manufacturer Electrolux.in was thefirst floor cleaner robot introduced in 1997, one of thetrilobite vacuum was featured on the BBC's scienceprogram, TOMORROW'S WORLD.

Roomba is a series of autonomous robotic vacuum cleanerssold by iRobot. Introduced in September 2002. Roomba features a set of sensors that enable it to perform its tasks.

The Roomba units have a range of models with the 400 to900 series, which provide several different features, such asfaster speed, separate sweep canister, 5x stronger vacuum,obstacle avoidance, or performance maps displayed via aphone app.

In 2014, Dyson launched a new product named as Dyson360 Eye which uses a different technology for path findingas compared to products manufactured by NEATO Roboticsor iRobot.

III. DESIGN METHODOLOGY

A number of software and hardware implementationtechniques were used to design and develop the system. Fig. 1 shows the block diagram of system. We used a 12VDC motor, L293D IC, Different Sensors, Vacuum mechanismand Arduino to develop our system.
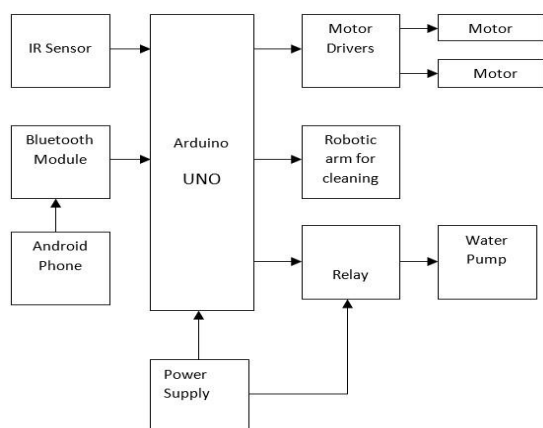
Figure 1 : Block Diagram

IV. WORKING

Working of the robot is basically dependent on the sensors and microcontroller and algorithm fed to it. Basicallythe data acquisition system (here sensor) first collects the datafrom the environment and feeds to microcontroller . Themicrocontroller uses two algorithms.

The two algorithms are:
(1) Spiral motion
(2) Random Straight path following

1. SPIRAL MOTION

Basically after sensing the obstacle distance from outside environment, if the robot has sufficient space on its 4 sides it will move in spiral path at first half of its running. The spiral path can be anti-clockwise and clockwise .The spiral path can be generated by the decreasing ratio of left motor encoder and right motor encoder.

2. RANDOM STRAIGHT PATH FOLLOWING

Basically random straight path searches from one node to another by the help of natural heuristic search. After the spiral motion the robot if detects a collision then it follows the edge of the wall until it gets enough free space for spiral motion again. After some moment if it doesn't get any specific clear area for spiral motion then it will move in random path for some time and the obstacle detection and avoidance system will be carried out by the help of ultrasonic sensors. After that robots stop rotating if the timer is over. In this process we can divide a particular area in the floor as grids and move accordingly so that it will have very confine control over the robot. So it will have grid based search over the floor for movement.
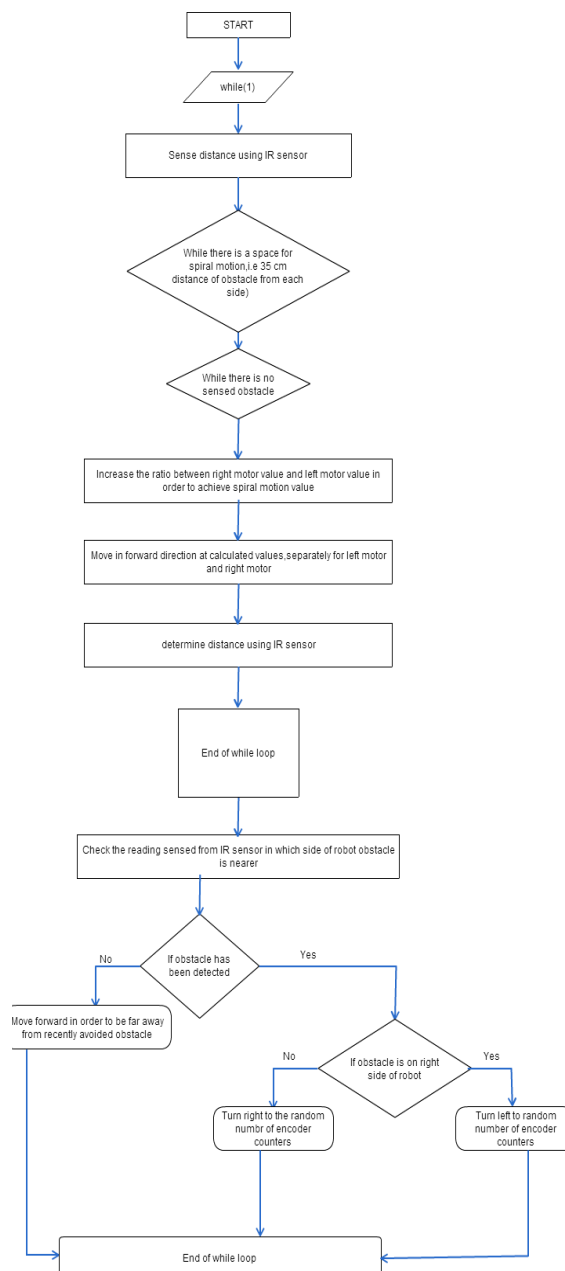

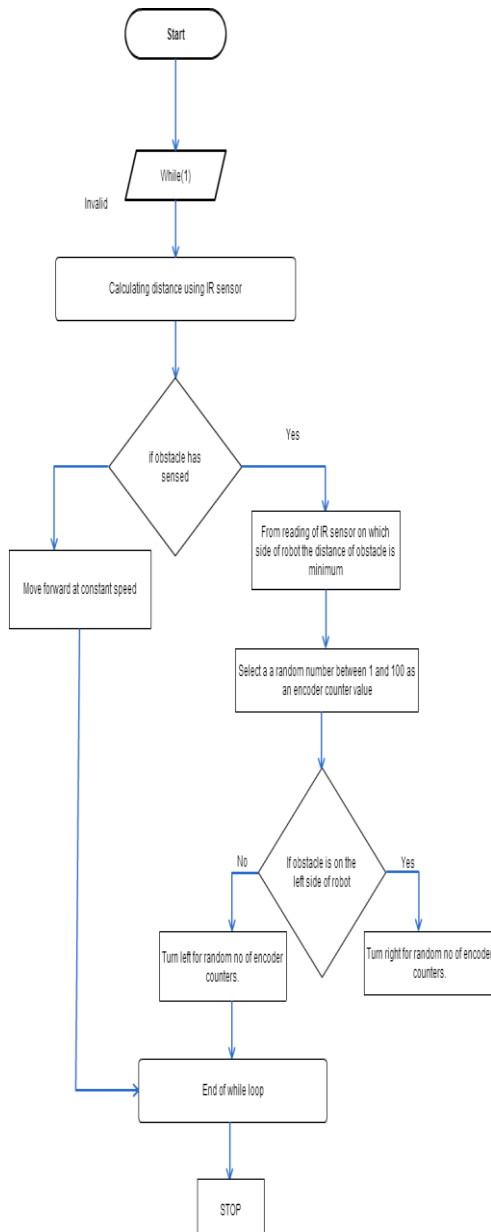*Figure 2 : Spiral Motion - Flow Chart*

Figure 2 : Random Straight Path Following - Flow Chart

V. CONCLUSIONS

This paper facilitates efficient and economical floorcleaning. A cheaper and user friendly Hybrid Floor Cleanerrobot can be developed with two different mode of controlling (Manual and Autonomous mode) using an Arduino Board with more electronics functionality.

Battery monitoring, self-charging, lighter body weight and to set alarm on/off time manually are the future scope ofthis project.

REFERENCES

[1]. IEEE Standard for User Interface Elements in PowerControl of Electronic Devices employed in Office/Consumer Environments, IEEE Standard 1621,2004(R2009)

[2]. Irobot.com, 'iRobot Corporation ', 2018. [Online]. Available: https://www.irobot.com/.

[3]. Dyson 360 Eye robot, 'Dyson 360 Eye robot', 2018. [Online]. Available: https://www.dyson.com/.

[4]. N.-J. L. Doh, C.-K. Kim, and W.-K. Chung, "A practical path planner for the robotic vacuum cleaner in rectilinear environments," IEEE Trans. Consum. Electron., vol. 53, no. 2, pp. 519-527, May 2007.

[5]. Joseph L. Jones, Newton E. Mack, David M. Nugent, Paul E. Sandin, "Autonomous floor-cleaning robot," U.S. Patent6883201 B2, April 6, 2005.

[6]. http://www.tutti.ch/thurgau/spielzeugebasteln/modellbau/angebote/experimentier-board-arduino-unor3_19193472.htm(arduino)

[7]. L293D datasheet. Website (www.ti.com)

[8]. ttp://henrysbench.capnfatz.com/henrysbench/arduino-sensors-and-input/arduino-ir-obstacle-sensor-tutorial-and-manual/(IR)

[9]. T. Palleja, M. Tresanchez, M. Teixido, J. Palacin"Modeling floor-cleaning coverage performances ofsome domestic mobile robots in a reduced scenario", Robotics and Autonomous Systems (2010) 58 37-45.

[10]. Y.-W. Bai and M.-F. Hsueh, "Using an adaptive iterative learning algorithm for planning of the path of an autonomous robotic vacuum cleaner," in Proc. IEEE Global Conference on Consumer Electronics,Tokyo, Japan, pp. 401-405, Oct. 2012.

[11]. H-.J. Kim, H-.J. Lee, S. Chung, and C.-S. Kim, "User-centered approach to path planning of cleaning robots:

[12]. analysing user's cleaning behavior," in Proc. ACM/IEEE International Conference on

Human robot interaction, Washington D.C., USA, pp. 373-380, Mar. 2007.

[13]. Michael Dooley, James Philip Case, and NikolaiRomanov,"System and method for autonomous mopping of a floor surface," U.S. Patent 8 892 251 B1, November 18, 2014.

IJAEM

www.ijaem.net

Email id: ijaem.paper@gmail.com