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SMART MOPPING ROBOT

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Abstract - *In this present era, people live a very busy life. People in megalopolis have irregular and long working times. In such a situation people find hard to save their time. Especially for working women and old age people required floor cleaning type service robots. Floor cleaning is a typical service robot application. The algorithm derived in this paper is used to design a fully autonomous Service Robot. It able to navigate by detecting obstacles and manipulates its direction with the help of inputs from ultrasonic sensors. The hardware efficient methods are used to accomplish the task. The uniqueness of this algorithm apart from being autonomous is that obstacle avoidance like stairs, Walls.*

***Key Words*: Service robots, Floor cleaning Algorithm, Total area coverage, Ultrasonic Sensor.**

1. INTRODUCTION

Even though there is considerable work done in this application of robotics, none of it concerns with the cleaning of both dry and wet floors by respective detection. The conventional vacuum cleaner consists of large mechanical and electrical parts which are more costly and consume more power whereas the autonomous cleaner robots consists of low power consumer electronics and mechanical parts and it can operate during power outage period and does not need any human guidance.

Robotic cleaners are basically distinguished on their cleaning expertise like floor mapping, dry vacuum cleaning etc. The motto of this project is to valuate cost efficient, light weight, less noisy and low maintenance robotic system. Simultaneously having the facility of automatic avoidance of any obstacles and capable of finding its way around after detecting the obstacles. A couple of spinning brushes are attached to the underneath of the cleaning machine to accumulate dirt, during the move along the way. Robot can clean along edges and into other hard-to-reach places.

They are guided by certain algorithms for path planning and navigation, accordingly robot cleans the surface. Sensors present in it are used for obstacle detection. The robot's bumper prevents it from bumping into walls and furniture by reversing or changing path accordingly.

When the battery percentage is below a certain percentage, as well as when the water level is low it will give a buzzer to the user.

2. LITERATURE REVIEW

A robotic vacuum cleaner is an autonomous electronic device that is intelligently programed to clean a specific area through a vacuum cleaning assembly. Some of the available products can brush around sharp edges and corners while others include a number of additional features such as wet mopping and UV sterilization rather than vacuuming. Some of the available products are discussed below,

A. IRobot [2] in 2002, iRobot launched its first floor vacuum cleaner robot named, Roomba. Initially, iRobot decided to manufacture limited number of units but Roomba immediately became a huge consumer sensation. Due to its increased market demand, a series of following robots have been launched in the market:

1. Roomba

- Launch Date: 2002
- Manufacturer: iRobot (American)
- Type of Use: Dry Vacuum
- Technology: IR, RF and auto-charging mechanism
- Price: $500

2. Scooba

- Launch Date: 2005
- Manufacturer: iRobot (American)
- Type of Use: Wet Washing of Floor
- Technology: IR with virtual wall accessories
- Price: $500

3. Braava

- Launch Date: 2006
- Manufacturer: iRobot, KITECH, Sony
- Type of Use: Floor moping for hard surfaces/Dry clean
- Technology: IR with virtual wall accessories for industrial cleaning

• Price: $700

B. NEATO Robotics[3]

With the advent of robotic vacuum cleaners, many countries had started manufacturing robotic leaners. China also started manufacturing these robots with more reliable technology and advanced features.

1. Neato XV-11

• Launch Date: 2010

•Manufacturer: Neato-Robots XV series (California)/China

• Type of Use: Vacuum Cleaning

• Technology: Laser range finder technology, SLAM (Simultaneous localization and mapping) and auto-charging

• Price: $399

C. Dyson[4]

In 2001, Dyson built a robot vacuum known as DC06 which was never released to the market due to its high price. In 2014, Dyson launched a new product named as Dyson 360 Eye which uses a

Different technology for path finding as compared to products manufactured by NEATO Robotics or Robot.

1. EYE-360[5]

• Launch Date: 2016

• Manufacturer: Dyson (UK)

• Type of Use: Vacuum Cleaning

• Technology: It uses a 360 degree panoramic vision camera to monitor its environment in real time and a turbo brush for efficient cleaning along with an auto-charging mechanism (Benchmark in history of cleaning robots)

• Price: $1000 (approx.)

3. Problem Identification

Table-1 problem identification

Company	Robot name	Launch Date	Type of Use	Problem
iRobot	Roomba	2002	Dry Vacuum	Wet cleaning and collision avoidance
	Scooba	2005	Wet Washing of Floor	Dry cleaning
	Braava	2006	Dry clean for hard surface	Sound and not cost efficient
NEATO Robotics	Neato XV-11	2010	Vacuum Cleaning	More sound and not cost efficient
Dyson	EYE-360	2016	Vacuum Cleaning	More sound and not cost efficient

4. METHODOLOGY

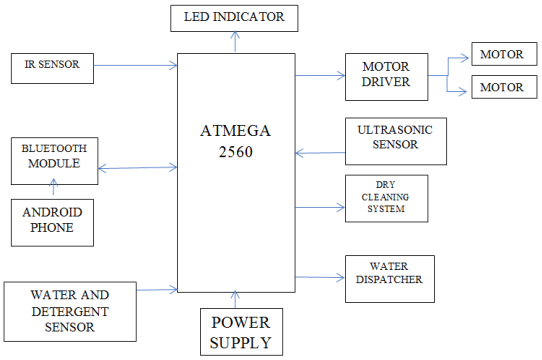

Fig 1: Block diagram of Smart Mopping Robot

This block diagram consists of 12v DC motor, LM293D IC, IR Sensor, Bluetooth module, cleaning mechanism(contains both dry and wet) ,water level sensor ,and Arduino UNO .The power supply is given to the Arduino UNO . Here we use L239D drivers for driving dc motors to move in forward and backward direction. Bluetooth module is used to control the robot using mobile phone application within a range. The IR sensor used here is to detect the obstacle and gives indication of an obstacle using buzzer.

Firstly robot starts, and then it moves forward and performs cleaning action. For obstacle detection and to avoid hurdle ultrasonic sensor modules have been used. If any hurdle detected then robot change the lane automatically, does not stop and starts cleaning action. It follows zigzag path. For user convenience automatic water sprayer is attached which automatically sprays water for mopping, therefore no need to attach wet cloth again and again for mopping. Motor driver circuit has been used to drive the motors. Four motors have been used to perform respective operations like to move the robot, for water pump, for cleaner. All the required information will be indicated through LED. All the information indicated on the LED itself operates the robot.

5. ALGORITHM FOR FLOOR CLEANING

The main aim of any floor cleaning robot is to cover the maximum area irrespective of the distance travelled. The proposed algorithm is Arduino based hardware scheme. It is deployed for parallel processing and localizing.

The robot designed based on this algorithm works autonomously responding to both static and dynamic obstacles. There is a predefined path for the robot to transverse. Although the path is defined, the room dimensions and shape are not defined which means it can work in any environment. This algorithm is designed as a navigation algorithm using the below behaviors:

Navigation Algorithm Behavior-based approach is utilized to control the robot in a working area. This is idea designed for controlling behavior as follows. It is the behavior for the moving of the robot from one peer to another peer point. By

moving around, the robot follows path according to the data from its sensors. It records the position from detecting the obstacles and the places that already visited through continuous following of the same path. It uses sensor information and the code given to the robot combined to decide the path to deviate from its original path concurrently. It can move in four directions: left, right, up, down.

Obstacle Avoidance by the robot: It is the behavior to avoid obstacles such as walls, objects of different shapes and sizes etc. It uses sensors to detect obstacles and check continuously with the program instructions so as to not fall in a dead loop. When the obstacle is present, the algorithm proves many ways and diversity of cases to identify the shape of the obstacle.

Measuring the angle of rotation by the robot. The most important factor of consideration is that the angle of rotation. Fig 2 shows Angle of rotation is carried out by knowing the

Length = 2*pi*radius*(angle)

Here let one complete revolution of wheel = 180 Rotation of the robot.

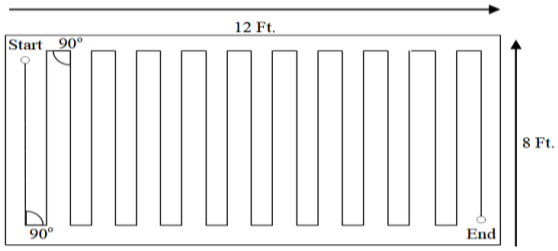

Fig 2:mopping without obstracle.

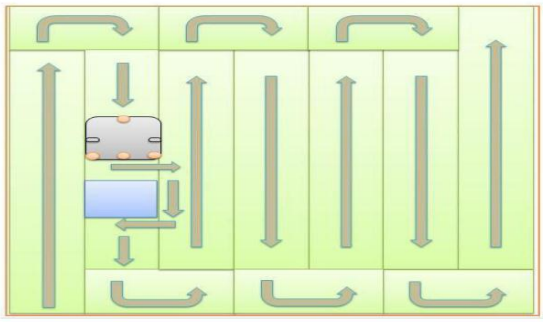

Fig 3:mopping with obstracle.

6. MECHANICAL DESIGN

Mechanical design consists of chassis, brushes, vacuuming and dirt disposal.

- Chassis- Especially designed fibre rectangular chassis with 45cm length and 25cm diameter, single floored has been used as a base to mount all the components of the robot.
- Brushes- The robot is fitted with two rotating brushes Parallel to the cleaning surface and rotating in opposite Directions such that the dust in the way is collected and Fed to the vacuum mouth which is just behind the rotating brushes.
- Wet sponge mop- When the wet surface is to be cleaned then the sponge mop will be energized of robotic assembly to clean the wet surface. The wet sponge is connected by a solid contact.

Vacuum and dirt disposal- When the two brushes rotate in the opposite direction parallel to the cleaning surface, dust collected is fed to the inlet of vacuum which is located right behind the brushes. The collected dust is then accumulated in a dirt container which can be emptied as needed.

7. APPLICATION

Home automation is one domain that has been target of all robotics companies, large and small. Soon a time could come when you clean your home using a robot just like the one we've given life here. These could make the task of cleaning all those rooms, into a few minutes work.

Cleaning your home would no longer be the same. This robot is used to clean the dirt particles with different types of obstacles, they are basically used to clean floor in house and this kind of robotic application are also used in restaurants and they are also compatible with some kind of hospitals also.

CONCLUSION

Therefore we have developed an Smart mopping robot that performs dry cleaning as well as wet cleaning. This robot operates in an autonomous mode and manual mode. This robot is more versatile and cost efficient than the existing systems. As it has manual mode feature which is being operated by an android app makes this system more user friendly. This robot is designed for the handicapped people having mobility issues for cleaning purpose without any external help. It can be used in industries and for other commercial purposes to save the time and also to enhance the lifestyle.

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