Smart Floor Cleaning Robot

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Abstract- The necessity of the proposed concept or system comes up because of a busy schedule of a working in corporate sector. This has resulted in coming up with an objective of making a automated robotic cleaner. The study comprehend of automated robotic cleaner which is having components to Raspberry pi 3B module, DC motor operated wheels, wiper arm, cleaning dusters, water motor, obstacle avoidance sensor. Other than this it is applications of IOT. The study has been done keeping in mind economic cost of the product.

Keywords – Raspberry pi 3 B, IR Sensor, Water Motor, DC Motor, Wiper, IOT.

I. INTRODUCTION

Robot is an electro-mechanical machine and used for various purposes in industrial and domestic application. Robotic appliances are entering in the consumer market since the introduction of iRobot. Initially the main focus was on having a cleaning device with vacuum cleaner. As the time pass on many improvement were made and more efficient appliance were developed by Jen steffen. Detachable clothes were attached for tracking; mint uses the GPS like indoor location system.

In this proposed system a floor cleaner robot based on the Raspberry pi is developed. This cleaner robot is an electric home appliance which can be accessed from the distance. This floor cleaner is not a vacuum cleaner robot. It performs operation like pushing obstacle aside, sweeping, wet cleaning, drying floor etc. As this is fully automatic robot, it perform all these operation by itself

Initially, when robot starts it moves forward and performs cleaning action. If any hurdle detected then robot try to push that aside. If that obstacle or hurdle is beyond its power limit range then it avoids that hurdle and move forward. For obstacle detection and avoidance IR sensors are used. It follows straight path, to make system wireless Raspberry pi interfaced with IR sensor is used. For user convenience automatic water sprayer is attached which automatically sprayers water for mopping therefore no need to attach wet cloth again and again for mopping. Relays are used to drive all motors and water pump for cleaner. ULM 2003 IC has been used to boosting current to fulfill the current requirements of the motors. All the information related to working of the system displayed on LCD.

II. LITERTURE SURVEY

In recent years, robotic cleaners have taken major attention in robotics research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops, warehouses and universities etc. Basically, robotic cleaners are distinguished on their cleaning expertise like floor mopping, dry vacuum cleaning etc. Some products are based on simple obstacle avoidance using infrared sensors while some utilize laser mapping technique. Each cleaning and operating mechanism of robotic floor cleaners has its own advantages and disadvantages.

A. iRobot,

iRobot launched its first floor vacuum cleaner robot named Roomba in 2002. Initially, iRobot decided to manufacture limited number of units but Roomba immediately became a huge consumer sensation.

1. Roomba
• Launch Date: 2002
• Manufacturer: iRobot (American)
• Type of Use: Dry Vacuum
• Technology: IR, RF and auto-charging mechanism
2. Scooba
• Launch Date: 2005
• Manufacturer: iRobot (American)
• Type of Use: Wet Washing of Floor
• Technology: IR with virtual wall accessories
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

B. NEATO Robotics

With the advent of robotic vacuum cleaners, many countries had started manufacturing robotic cleaners. 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

C. Dyson

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 iRobot.

1. EYE-360
• 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)

III. PROPOSED ALGORITHM

1) .Proposed concept

It is a complete autonomous system that works by itself; IR sensors are used to avoid collision with an obstacle. The advanced specification of this robot is its wiper arm it is provided in front side of the chassis. This wiper continuously rotates forward and reverses in 180 degree so that it is able to push obstacle aside which is within its power limit range for cleaning the portion under object or the obstacle. This robot capable of cleaning the floor of room without any human interaction other than just starting the system all mechanisms work simultaneously.

1.1) General specification:

- Wiper arm for driving obstacle aside.
- Mechanism for avoiding Collision with obstacle.
- Mopping Dusters for cleaning the floor.
- Water pumps Motor for Wet Mopping.
- Air blower for drying the floor.
- Battery operated floor cleaning system.
- System works without any human interaction.
- Cheap cost.

2). Block Diagram

The block diagram of this proposed research work of design and development of floor cleaner robot is as shown in Fig1 for better understanding of the system. It comprises wheel control unit with wiper and cleaning unit. These units consists of raspberry pi B 3 module, DC motor, IR sensor, water motor, air blower, mopping dusters, wiper etc. Raspberry pi 3 B is core of this system which controls all operations and energized with 5v power supply. Its features are 1 GB RAM, 40 GPIO pins, on board Ethernet and Bluetooth connectivity etc. IR sensor for sensing the obstacle is used. Sensors transmitter transmits the rays which will reflects from the obstacle these rays are received by the receiver of the sensor if obstacle is detected than robot will take decision of whether driving the object aside or to avoid that obstacle. There are six DC motors are used in the system. Four motors for driving the wheels. Mf are the front wheel motors and Mb are the motors for the wheels which are backside of the chaises. one motor is used for water pumping another one is used for wiper moment that is used for cleaning action. All these are DC geared motors used to drive this system. ULN 2003 IC is used for amplifying the current required for the motors.

Relay circuit is used to drive all the wheel motors, water pump motor and Wiper which is in normally open contact mode and works on 12v supply. Relay is used because of its efficient switching characteristics and has capability to control high voltage circuit with help of low voltage circuit and also used where single circuit can control more than one circuit.

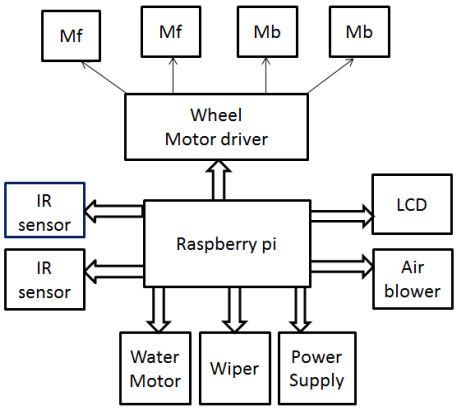

Fig1. Block Diagram of Smart Floor Cleaning Robot

B. Flowchart

Below Fig2 shows the software methodology of the floor cleaning robot. Software checks that data is initialized or not if data is initialized robot starts moving and cleaning operation. If any hurdle or obstacle comes in front of robot then there will be two conditions one is try to push that obstacle aside and second is avoid that obstacle. Firstly robot tries to push that obstacle aside if it is beyond its power limit range and doesn't move then it goes for the second condition avoid that obstacle continues moving and cleaning.

For cleaning the floor mopping dusters are provided at the bottom of chasses. Water motor is also provided for efficient mopping. Floor becomes wet after wet cleaning the air blower is attached at the back side for drying the floor.

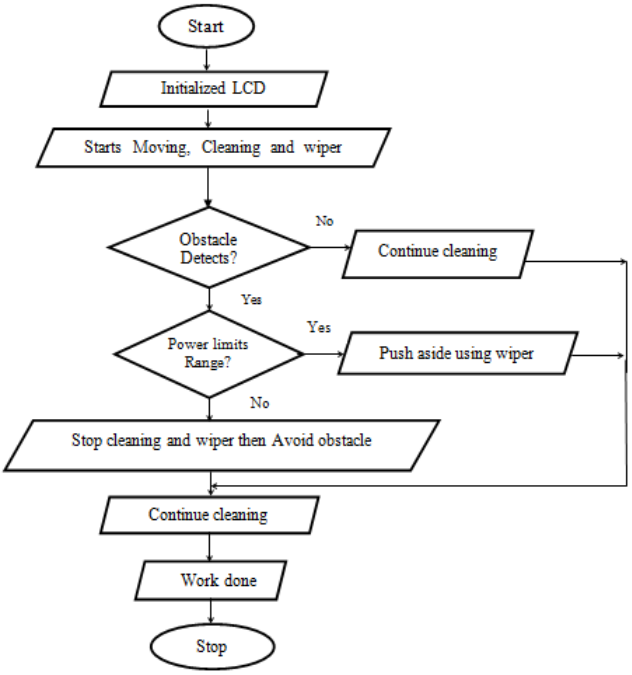

Fig2. Flowchart of Smart Floor cleaning Robot

B.1) Robot Programming

RPI can be programmed using any of the programming languages but for this system, Python is used. An operating system makes Raspberry Pi run. Since Raspberry Pi is a credit sized computer that is based on Linux, optimum performance of RPI can be achieved if it is therefore operated in this environment. Raspbian provides more than a

pure OS: it comes with over 35,000 packages; precompiled software bundled in a nice format for easy installation on RPI. Important to note is that the Raspberry Pi does not operate in a Windows environment.

IV. RESULT & DISCUSSION

Initially, when system is switched ON it will displays the name of the system as “Smart Floor cleaning Robot” on the LCD provided on it as shown below in Fig3.

(a).Initial output of the system

If there is no obstacle within the range of the sensor then it will displays on the LCD as “No Obstacle Detected” shown below in Fig4. Then robot starts moving and cleaning operation.

(b) Output of the sensor when NO obstacle present

It there is hurdle detected within the range of the sensor then system will display it as “Obstacle Detected”. As soon as the obstacle detected robot will stop moving and also stops all the operation related to the cleaning.

(c) Output of the sensor in presence of the hurdle.

ig5If both the sensors detect the obstacle then it will display “Wall Detected” as shown in Fig.6. It happens probably when the obstacle is bigger in size and it is not possible to avoid that obstacle to the robot in such case robot will turn back.

(d) Output of the sensor when both sensors detects obstacle.

V.CONCLUSION

This system unclogs the cleaning of floor in presence of the hurdle and makes the cleaning efficient. Since in the system the Raspberry pi is incorporates with different devices like DC motors, IR sensor, Water Motor etc. Robotic cleaner simultaneously and selectively performs operations like automatic floor cleaning, driving obstacle aside and also avoiding hurdles. It is easy to handle this system it also saves time and work automatically for cleaning purpose at home and offices.

With simple algorithm and program, the cleaner will be able to cover large floor areas as well as find its way into and out of small corners. As the cleaner traverses the room, the sweeper installed in it will manage to clean a significant amount of dirt. Manual Sweeping might not be that effective as it will not be picking up everything in as it is not in sight but using the automatic floor cleaner it can be done easily.

Smart Floor Cleaning robot will be superior to an ordinary cleaner because it is more convenient to use and it can save more time when it works. The whole cleaning process doesn't need a person to control and it reduces the burden on the operation. The noise will be smaller than the general vacuum cleaner when it is working. Its structure is compact and lightweight. It is a environmentally friendly, healthy, intelligent service robot with a good prospect.

V. REFERENCE

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