Design and Development of Floor Cleaner Robot (Automatic and Manual Mode)

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ABSTRACT: Manual work is taken over the robot technology and many of the related robot appliances are being used extensively also. Here represents the technology that proposed the working of robot for Floor cleaning. This floor cleaner robot can work in any of two modes i.e. “Automatic and Manual”. All hardware and software operations are controlled by ARM7 microcontroller. This robot can perform sweeping and mopping task. RF modules have been used for wireless communication between remote (manual mode) and robot and having range 50m. This robot is incorporated with IR sensor for obstacle detection and automatic water sprayer pump. Four motors are used, one for cleaning, one for water pump and two for wheels. Dual relay circuit used to drive the motors one for water pump and another for cleaner. In previous work, there was no automatic water sprayer used and works only in automatic mode. In the automatic mode robot control all operations itself and change the lane in case of hurdle detection and moves back. In the manual mode, the keypad is used to perform the expected task and to operate robot. In manual mode, RF module has been used to transmit and receive the information between remote and robot. The whole circuitry is connected with 12V and 3.3V battery.

Keywords: LCD, KEYPAD, RF MODULE, IR SENSOR

1.INTRODUCTION:
Robot is an electromechanical machine and used for various purposes in industrial and domestic applications. Robot appliances are entering in the consumer market, since the introduction of iRobots. Many related appliances from various companies have been followed. Initially the main focus was on having a cleaning device. As the time pass on many improvements were made and more efficient appliances were developed.

In early, 2010 a new automatic floor cleaner robot “Mint” was developed by Jen Steffen. Detachable clothes were attached for sweeping and mopping purposes. For tracking mint used the GPS-like indoor localization system.

In this research work a floor cleaner robot based on ARM7 have been developed. This cleaner robot is an electric home appliance, which works in two modes as per the user convenience “Automatic and Manual”. Unlike other floor cleaner robots this is not a vacuum cleaner robot; it performs sweeping and mopping operation. Detachable mop is used for mopping. It works on 12V supply. In the automatic mode, robot performs all operations itself. Firstly robot starts it moves forward and perform cleaning action. For obstacle detection and to avoid hurdle IR sensors have been used. If any hurdle detected then robot change the lane automatically, does not stop and starts cleaning action. To make whole system wireless, RF modules have been used in automatic and manual with 50m range. For user convenience automatic water sprayer is attached which automatically spray water for mopping, therefore no need to attach wet cloth again and again for mopping. Fan is used to dry the wet floor. Motor driver circuit have been used to drive the motors. Four motors have been used to performs respected operations like to move the robot, for water pump, for cleaner. Relays have been used to drive the water pump and cleaner motor. LM293D IC has been used to drive wheel motor. All the information displayed on LCD.

In the manual mode, user itself operates the robot. RF module have been used to transmit and receive the signal to operate the robot through remote. In the manual mode, if any hurdle detected, then signal of hurdle detection displayed on the LCD of remote via RF module. Movement of robot is controlled by user itself through keypads therefore user can move the robot in the desired direction. All the information displayed on LCD.

2. RELATED WORKS:
We decided to work on design and development of floor cleaner robot project. For the information we search on internet and some reference books also. When we search on internet we found some IEEE Research papers as follows:

Prof. P. Shuklaand Prof. Simmy S.L. published the paper “Design and inspection of cleaning robot”. Issue volume 3, issue 6 sept 2014 explain this paper. In this paper the robot is based on PIC16F877A and the main purpose of project is that it is used as vacuum cleaner and inspection robot. In this project we can’t use many application at a time due to the low functionality of [1]

Prof. N. Prashar, Prof. T. Thorat, Prof. A. Galande & Prof. R. Durand “Cleaning Robot”, Issued 2012 explain this paper. In this system camera is set in ceiling of room which is to be clean in position in which it can have a complete view of the floor then camera takes the images of the floor and transmits them to uses PC display. Next, the user is provide with two modes of cleaning. Automatic Mode in which robot automatically dust and cleans it. Manual Mode in which user can select a desired position to be cleaned by clicking on it on the image being generated on screen. In automatic mode the first position of robot is estimated and then destination position that is area to be clean calculated. Then click coordinates are forwarded to robot and the robot moves to location. In above paper there is only one main application is provided that is dust cleaning device. [2]
Prof. U. Khalid, prof. M. Baloch, explains this paper. In this paper, “smart floor cleaning robot (CLEAR)” has been designed for consumer/office environments and its each component in accordance with IEEE Standard is discussed. Proposed design is being operated in dual modes. In one of the modes, the robot is fully autonomous and making decisions on the basis of the outputs of infrared proximity sensors, ultrasonic sensors and tactile sensors after being processed by Arduino (mega) controller and control the actuators (2 DC encoder motors) by the H-bridge driving circuitry. [3]

3. BLOCK DIAGRAM:

The block diagram of this proposed research work “Design and development of floor cleaner robot (automatic and manual) has consist of two parts: one for automatic (robot) and another for manual (remote) mode. The automatic part is integration of power (12V), ARM7, LCD, RF modules, dual relay circuit, LM293D, IR sensors. ARM7 is core of this system which controls all operations and energized with 3.3V power. ARM7 is used because of better features like: it is low power, high performance 32-bit RISC processor (32-bit data & address bus) microcontroller, Fully static operation ideal for power-sensitive applications 32 I/O lines, low power idle and power-down mode. RF module provides wireless communication between remote and robot and operates at 5V supply and its operating range is 50m. IR sensors used for obstacle detection. If any object appears in the robot way then IR sensor detect the object and send signal to microcontroller and robot change the lane automatically and then start cleaning operation again and its range is 1 ft. 4 motors are used in this system; 2 motor used to drive the wheels, 1 motor used for water pump and 2 motors used for cleaning action. DC gear motors are used to drive the robot. L293D IC used to drive the wheel motor because of better features like: 600ma output current capability per channel, 1.1A peak output current, inbuilt diodes, over temperature protection and having high noise immunity and it requires 12V power to work. Dual 9V relay circuit is used to drive the cleaner motor and water pump motor which is in normally open contact mode and works on 9V supply. Relay is used because of its efficient switching characteristics and has capability to control high voltage circuit with the help of low voltage circuit and also used where single circuit can control more than one circuits. In automatic part two batteries are used to operate the robot. Power supply consist of 1 voltage regulator 7805 3PIN, 1 shunt capacitor (1000uf), 1 led indicator and a 1K resistance. All the signals and results displayed on LCD. Now the second part i.e. manual mode which is controlled by user itself and consist of power (12V), ARM7, LCD, keypad, RF modules. ARM7 is main part of the manual mode, all the signals controlled by microcontroller and it takes 3.3V power to work. RF module is used to transmit and receive the signal. If any hurdle detected in the manual mode then robot send the signal through RF module of hurdle detection to remote. RF module has 50m range and operating frequency 2.4 GHz. Keypad is used to give the direction to robot and user through keypad user can control all the operation like; movement of robot, cleaning action to on or off the cleaner and water pump etc. All the information displayed on LCD.
4. FLOWCHART

![Flowchart of Automatic Mode](image1)

![Flowchart of Manual Mode](image2)

5. COMPARISON WITH PREVIOUS WORK

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Features</th>
<th>Previous Work</th>
<th>Present Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>RF module</td>
<td>Not available.</td>
<td>Available for wireless communication.</td>
</tr>
<tr>
<td>4.</td>
<td>Automatic water sprayer</td>
<td>No</td>
<td>Yes</td>
</tr>
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<tr>
<td>5</td>
<td>L C D</td>
<td>Not available</td>
<td>Available to operate on such tasks</td>
</tr>
<tr>
<td>6</td>
<td>IR Sensors</td>
<td>No.</td>
<td>No, for obstacle avoidance</td>
</tr>
<tr>
<td>7</td>
<td>Mode of operation</td>
<td>Only automatic</td>
<td>Automatic and manual both</td>
</tr>
<tr>
<td>8</td>
<td>Fan</td>
<td>Not Available</td>
<td>Available</td>
</tr>
</tbody>
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6. ADVANTAGES:

1. It reduces human energy and efforts. People in cities have irregular and long working times. In such a situation a person will always find ways of saving time.

2. Helping physically disable person is also advantage of this project. Automatic mode of this robot helps physical disable person.

3. We can use this robot in Automatic and Manual mode also. Easy mounting and easy to operate. Due to that, it is user friendly.

7. APPLICATIONS:

1. Main purpose of this project is Cleaning.
2. We can save our time by using this robot.
3. Able to go under furniture and around corners

8. CONCLUSION:

This research facilitates efficient floor cleaning with Sweeping and mopping operations. This robot works in two modes automatic and manual for user convenience. This proposed work provides the hurdle detection in case of any obstacle that comes in its way.

REFERENCES


Prof. Nikita Prashar, Prof. Tejashri Thorat, Prof. Abhishek Galande, Prof. Ritesh Durande “Cleaning Robot.” [2]

Uman Khalid, Muhammad Faizan Baloch, Haseeb Haider, Muhammad Usman Sardar, Muhammad Faisal Khan, Abdul Basit Zia and Tahseen Amin Khan Qasuria “Smart Floor Cleaning Robot (CLEAR)” [3]