DEVELOPMENT OF AN AUTONOMOUS FLOOR CLEANING ROBOT USING ANDROID APPLICATION

College   : *Atria Institute of Technology, Bengaluru*
Branch   : *Department of Information Science and Engineering*
Guide(s)   : *Prof. Omprakash B.*
                      Dr. Ananda Kumar K. S
STUDENT (S)   : *Ms. Swathi G. S.*
                      Ms. Rakshitha D. M.
                      Ms. Rakshitha S

Keywords: Floor cleaning robot, Sweeping, Mopping, Android application, Navigation, Smart home, Robotics.

Introduction:

A floor cleaning robot is an innovative and automated device designed to clean various types of floors autonomously. It has revolutionized the way we maintain cleanliness in our homes, offices. These smart machines can combine cleaning mechanisms to efficiently sweep and mop the floor. In today's world, Cleanliness having a great importance. Cleanliness means that there is no dirt, no dust, no stains, no bad smells. The goals of cleanliness are health, beauty, absence of offensive odor and to avoid the spreading of dirt and contaminants to oneself and others. With the help of cleanliness, we can keep our physical and mental health clean, which will make us feel good. Cleanliness gives rise to a good character by keeping body, mind, and soul clean and peaceful. Maintaining cleanliness is the essential part of healthy living because it is the cleanliness only which helps to improve our personality by keeping clean externally and internally. It is everybody's responsibility and one should keep themselves and their surroundings clean and hygienic. It also brings good and positive thoughts in the mind which slows down the occurrence of diseases. There are lots of options are available for floor cleaning. Available options include manual &semi-automatic cleaning.

Objectives:

1. **Developing the floor cleaning robot using an android application:**

The main goal is to automate the floor cleaning process, allowing the robot to perform cleaning tasks. This frees up users' time and effort, making floor cleaning more convenient and efficient. It involves integrating both hardware and software components. And it can be controlled and monitored through an android application. The integration of the both robotics and the mobile technology aims to enhance the user experience and convenience in maintaining cleanliness in indoor spaces.

2.Add of Components:

To develop a floor cleaning robot, several key components must be integrated to ensure efficient and reliable operation. The robot's locomotion system is crucial, typically achieved through motorized wheels or tracks, allowing it to navigate on surfaces. The robot is equipped with brush or roller designed to capture dust and dirt from the floor surface. A mop is attachment to integrated into the device, allowing it to wet the mop clean the floor.

3.Bluetooth Connectivity for operating the robot:

Establish a secure and reliable Bluetooth connection between the Android application and devices for communication. The Bluetooth connectivity plays a pivotal role in enabling seamless communication between the robot and its controlling device. By integrating Bluetooth technology, users can remotely operate the robot. as it eliminates the need for physical tethers or direct line-of sight control.

Methodology:

The floor cleaning robot project utilizes a blend of hardware and software components to achieve efficient cleaning operations. The architectural representation involves two main modules: the physical robot and the controlling Android application. The physical robot comprises essential components such as motors for movement, cleaning mechanisms (like brushes or mopping systems), and a microcontroller for processing commands. Instead of relying on sensors for navigation, this robot can follow predefined paths or respond to commands sent from the Android application.

The Android application serves as the primary interface for users to interact with the robot. It is designed with a user-friendly graphical interface that allows users to initiate cleaning tasks, specify cleaning areas, and monitor the robot's status. The application communicates with the robot through a wireless connection, typically using Bluetooth connection. In terms of functionality, the Android application sends commands to the robot based on user inputs, such as start cleaning, stop cleaning, or adjust cleaning parameters. These commands are translated into control signals understood by the microcontroller on the robot, enabling it to execute the desired actions.
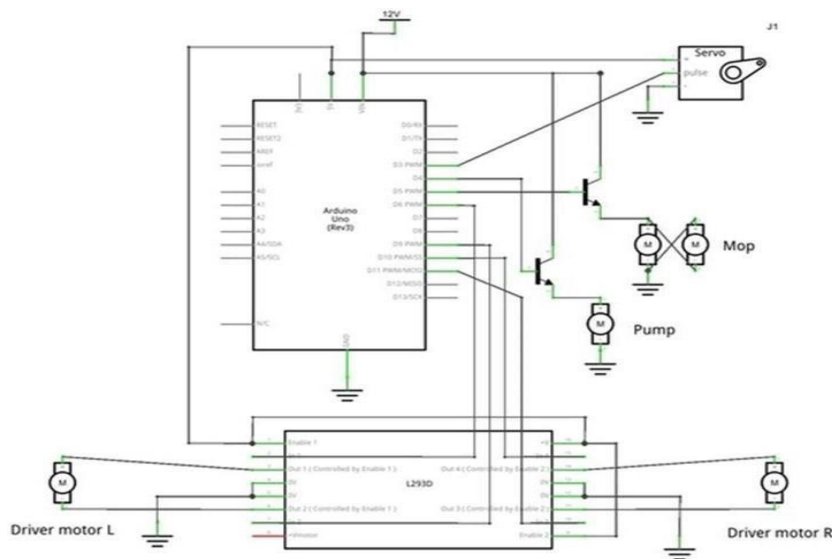

Figure 1: Arduino UNO Circuit Diagram

The figure 1 shows the project's Arduino UNO Circuit Diagram snapshot. This section shows that connections of different components to the Arduino UNO through the wires which make the operations like sweeping and mopping of floor.
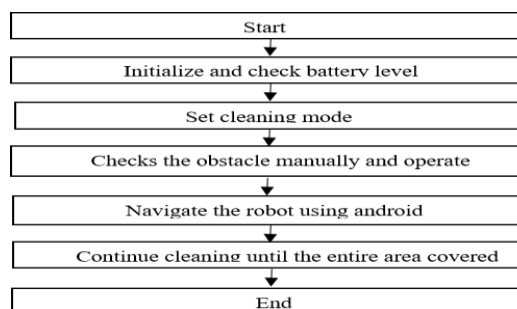

Figure 2: Flow Process.

Understanding the Target Market and Requirements First, we'll need to research and understand the target market for the floor cleaning robot. Conceptualizing and Designing the Robot With the requirements in mind, we can start conceptualizing and designing the floor cleaning robot. In this size and shape can be determine. The cleaning mechanism is also key will it use sweep, mops. Building the Hardware Next, we'll construct the physical components of the robot, including the motors, and cleaning mechanisms. Developing the Software Finally, we'll create the software to power the robot's autonomous navigation and cleaning. This will involve programming the robot's movements, cleaning patterns.

Design an intuitive interface for controlling the robot, whether through physical buttons, a remote control, or a smartphone. This interface should allow users to start, stop. Thorough Testing and Refinement: Conduct extensive testing to evaluate the robot's performance. Assess its ability to navigate different floor types, and effectively clean the designated area. The robot should have safety features to prevent harm to users or itself. Once the design and functionality are finalized, begin manufacturing the floor cleaning robot for large-scale production. The goal is to design floor cleaning robot that is effective, efficient, and easy for users to operate. By carefully considering the requirements and bringing together the hardware and software, we can create high-quality, practical cleaning solution.

Working of Model:

➤ GET THE BASE READY:

The First step is to prepare the base on which the parts will be placed. After this, drill two holes each at the back for both the motor clamps. Make proper measurements such that both should be parallel to each other. Fix them in place using some screws then attach the motors to the clamps.

➤ MAKE THE FLOOR MOPPERS AND ATTACH THEM TO BASE:

Use old compact disks along with a piece of cloth. First mark a circle on the cloth which should be bigger than the CD. Cut it using a pair of scissors. Take a needle and thread and start sewing and making folds to the cloth in such a way that it

surrounds the entire CD.

➢ THE WATER SUPPLY MECHANISM:

This consists of a 12V water pump which carries the to the inlet of pump to take water from the reservoir water from the reservoir and spills it near the mops on from the pump and the second one will be used to take the Floor.

➢ CONNECTIONS:

Now this is always the typical part. You have to be accurate. For making it a bit easier, I always use jumper wires which can be swapped or removed any time. Before that, drill some holes and x your Arduino in place using some screws.

➢ FINISHING:

Keep all the circuit boards, wires, tubing's in place with hot glue. It should look neat, the wires shouldn't entangle and the connections shouldn't break, which can be irritating.

➢ UPLOAD THE CODE:

Remove the Rx and Tx cables from Arduino before uploading! Connect the board to a pc and program it with the code. Set the correct COM port and Board under Tools. After it's done, replace the Rx and Tx wires. Remove them every time you upload the code.

➢ ATTACH THE BATTERY

For the power source attach the battery. The voltage should be 12V, a single lead acid battery.

➢ CONFIGURE THE APP AND CONNECT

Go to the google play store and get this app called 'Bluetooth Serial Controller' which lets you set your own control buttons and commands. After opening the app, click on 'settings' and then 'visibility' Turn o visibility.
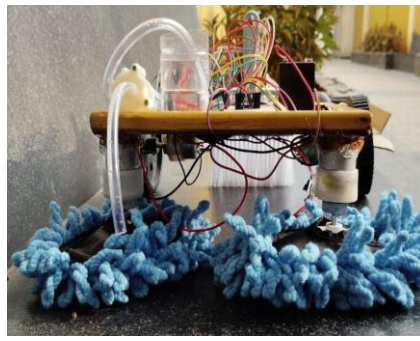
Figure 3: Cleaning Robot Mopping Section by Using Water

The figure 3 shows the project's Cleaning Robot Mopping Section snapshot. This section shows that the mop attached to the robot through the motor and wheels which is used to mop the floor with the help of water.

Figure 4: Cleaning Robot Sweeping Section

The figure 4 shows the snapshot of project's Cleaning Robot Sweeping Section. This section shows that the sweeping component is attached to the robot to sweep the floor.

Figure 5: Snapshot of Bluetooth Serial Controller

The figure 5 shows the snapshot of project's Bluetooth connection between

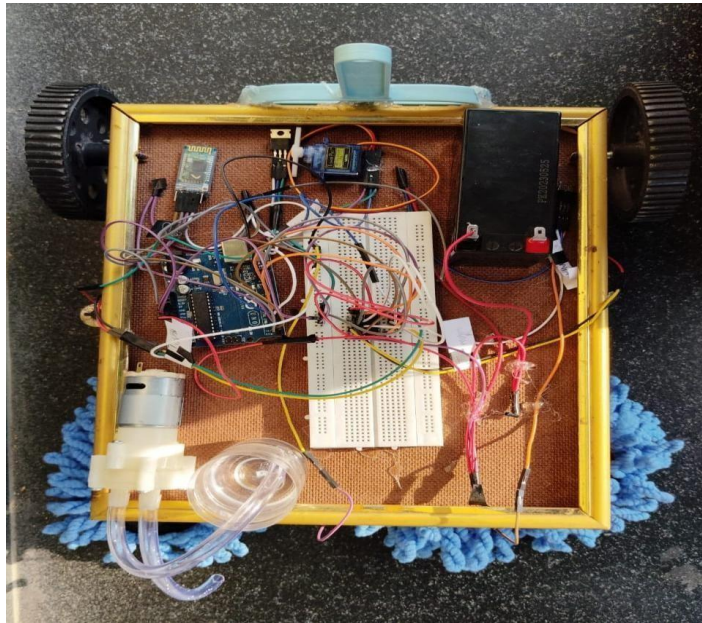robot and mobile application to operate the robot by user.

Figure 6: Overview of Floor Cleaning Robot System Architecture

The figure 6 shows the project's the Floor Cleaning Robot system architecture snapshot, illustrating the interconnection between hardware components, software modules, and user interface elements. At the core of the system lies the Floor Cleaning Robot itself, equipped with essential components such as motors for movement, cleaning mechanisms, and a microcontroller for processing commands.

Results and Discussion:

Throughout the development and implementation of the Floor Cleaning Robot controlled by an Android application, significant strides were made in realizing a functional and user-friendly solution for automated floor cleaning tasks. This section presents a detailed analysis of the results obtained during various stages of the project, including hardware integration, software development, and testing procedures. By examining the performance metrics and system behavior, a comprehensive understanding of the robot's capabilities and limitations is achieved. Moreover, the results highlight the effectiveness of the chosen design

approach and provide valuable insights for future enhancements and iterations of the system. The demonstrating the feasibility of a sensor-less approach to automated floor cleaning tasks. Throughout the development and testing phases, the system exhibited reliable performance in executing cleaning commands initiated through the Android application.

Innovation in the Project:

The project "Development of an Autonomous Floor Cleaning Robot Using Android Application," which integrates both sweeping and mopping functionalities, stands out as a significant innovation in the field of home automation and robotics. This initiative combines cutting-edge technology with practical solutions to enhance household cleanliness and convenience. Here are the key innovative aspects of the project:

➤ Integration of Sweeping and Mopping Functions:

Traditionally, floor cleaning robots are designed to perform either sweeping or mopping, requiring users to invest in multiple devices for comprehensive cleaning. Our project innovatively combines both sweeping and mopping functionalities into a single robot, allowing for a seamless transition between dry and wet cleaning tasks. This integration not only saves time but also reduces the cost and space requirements associated with maintaining multiple cleaning devices.

➤ User-Friendly Android Application Control:

One of the most user-centric innovations is the integration of an Android application that allows users to control and monitor the robot remotely. The application provides a simple and intuitive interface for scheduling cleaning sessions, selecting cleaning modes, and viewing real-time progress. It also offers customization options, enabling users to define specific areas for focused cleaning or set no-go zones. This level of control and convenience is a significant leap from traditional cleaning methods.

➤ Enhanced Battery Life and Smart Charging:

The robot features a high-capacity battery designed for extended cleaning sessions, allowing it to cover larger areas without frequent recharging. When the battery is low, the robot autonomously returns to its charging dock and resumes cleaning once recharged. This smart charging capability ensures uninterrupted

cleaning operations and enhances user convenience.

Scope for Future Work

➢ Floor cleaning robots could be further enhanced with advanced AI and machine learning algorithms. These technologies would enable the robots to learn from their cleaning experiences, adapt to different environments, and optimize their cleaning patterns based on specific floor types and dirt patterns.

➢ Future floor cleaning robots may include more sophisticated sensors, cameras, and mapping capabilities. This would allow them to create detailed floor maps and navigate through complex environments with increased efficiency, avoiding obstacles and cleaning hard to-reach areas more effectively.

Manufacturers may develop floor cleaning robots capable of handling multiple floor surfaces seamlessly. For instance, a robot could transition between hardwood, carpet, tiles, and other types of flooring without any manual adjustments.