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FLOOR CLEANINGROBOT USING ARDUINO-UNO

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Abstract: The Floor Cleaning Robot using Arduino Uno is a robotic system designed to automate the process of floor cleaning. This abstract provides a brief overview of the project, highlighting its objectives, components, and functionality. By leveraging the power of the Arduino Uno microcontroller board, the robot achieves autonomous navigation, obstacle detection, and efficient cleaning capabilities. However, as technology advances, homes are getting more intelligent and automated, which is convenient for the general public. Although there are many various types of vacuum cleaners available, none of them offer wet cleaning and all operate manually. In order to make cleaning considerably easier, autonomous floor-cleaning robot that integrates dry and wet cleaning into a single design. The entire ground cleaning robot is divided into several components, including a servo, a Dc motor with an ultrasonic sensor, a Motor Shield L298 and an Arduino Uno microprocessor. The motor shield L298 pushes the DC motor through the Arduino Uno microcontroller, which uses the ultrasonic sensor as a robotic driver and a DC motor as a distance detector.

Index Terms - Arduino uno, Floor cleaning robot, Arduino Uno, robotics, automation, obstacle detection, cleaning mechanism, autonomous navigation, Arduino programming, DC motors, sensors, cost-effective, user-friendly, efficiency, customization, future enhancements.

I. INTRODUCTION

The Floor Cleaning Robot using Arduino Uno is an innovative solution designed to automate the tedious task of floor cleaning. Traditional manual cleaning methods often require significant time and effort, making them inefficient and exhausting. The Floor Cleaning Robot addresses this challenge by leveraging the power of robotics and microcontroller technology to provide an autonomous cleaning solution.

The cost-effective, user-friendly, and efficient robot that can navigate various floor surfaces and perform cleaning tasks without human intervention. By utilizing the Arduino Uno microcontroller board, the robot can intelligently control its movements, detect obstacles, and activate the cleaning mechanism as needed.

Automated floor cleaning robots offer several advantages. They save valuable time and energy by eliminating the need for manual cleaning. They also provide consistent cleaning performance, ensuring thorough coverage of the floor surface. Additionally, these robots can reach tight spaces and corners that may be difficult for humans to access.

The Arduino Uno, a popular open-source microcontroller platform, serves as the brain of the robot. It provides the necessary computational power and control capabilities to execute the robot's cleaning tasks. By programming the Arduino using the Arduino IDE, developers can implement sophisticated algorithms and logic to achieve optimal cleaning patterns and obstacle avoidance.

The Floor Cleaning Robot incorporates various components such as DC motors for movement, sensors for obstacle detection, and a cleaning mechanism, such as brushes or mops, to effectively remove dirt and debris from the floor. The integration of these components creates a cohesive system that enables the robot to navigate the environment and perform cleaning actions.

II. IMPORTANCE

This project aims to provide an accessible platform for individual, household, and businesses seeking an automated floor cleaning solution. The Floor Cleaning Robot using Arduino Uno can be customized and expanded upon based on specific requirements and preferences. Its modularity allows for future enhancements, such as integrating additional sensors, implementing advanced algorithms, or incorporating wireless connectivity for remote control and monitoring.

The duty of cleaning the floor is significant and time- consuming; occasionally, we assign personnel to the task and pay them. However, as technology develops, dwellings are becoming more automated and intelligent, which offers convenience to the populace. There are many different vacuum cleaners on the market, but they all function manually and do not support wet cleaning. Therefore, the major goal of our project is to create an autonomous floor- cleaning robot that combines dry and wet cleaning into a single design to make the cleaning work much easier. This robot was made to make the task of cleaning simpler. It is meant to clean homes, schools, and offices. The project's goal is to use robotic technology to automate the process and lessen people's workload. To create a user-friendly system that anyone with only the most fundamental understanding can operate. to create a system with a minimal power need. The projects' foundation for operation.

III. LITERATURE SURVEY

The literature survey conducted for the floor cleaning robot using Arduino Uno reveals a range of studies and resources that contribute to the understanding of this field. These works explore different aspects of the design, implementation, and performance of floor cleaning robots, incorporating Arduino Uno as a key component.

Several papers focus on the design and development of autonomous floor cleaning robots, highlighting the system architecture, hardware integration, and programming techniques. These works provide insights into the challenges encountered during the implementation process and the solutions employed to overcome them. They emphasize the importance of sensor calibration, obstacle detection algorithms, and intelligent path planning for efficient coverage and navigation.

Comparative studies have been conducted to evaluate the performance and effectiveness of various floor cleaning robots, including those based on Arduino Uno. These studies analyze factors such as cleaning efficiency, navigational capabilities, and user-friendliness. They contribute to identifying the strengths and weaknesses of different approaches, helping researchers and developers make informed design choices.

The literature survey also encompasses research on intelligent floor cleaning robots that incorporate advanced technologies alongside Arduino Uno. Some studies explore the integration of Raspberry Pi, machine learning algorithms, and remote control capabilities to enhance the robot's functionality and adaptability.

Furthermore, the surveyed works discuss the cost- effectiveness and accessibility of floor cleaning robots, emphasizing the utilization of Arduino Uno as an affordable and user-friendly microcontroller platform. They highlight the potential for customization and future enhancements, suggesting areas of improvement such as the integration of additional sensors, wireless connectivity, and advanced algorithms.

The literature highlights the key components and functionalities of floor cleaning robots, including DC motors for movement, sensors for obstacle detection, and cleaning mechanisms such as brushes or mops. It emphasizes the importance of intelligent path planning algorithms and obstacle avoidance strategies to achieve efficient coverage and navigation.

Overall, the literature survey on floor cleaning robots using Arduino Uno. It covers various aspects, including system design, obstacle detection, navigation algorithms, cleaning mechanisms, comparative evaluations, and future prospects. The collected resources serve as valuable references for further research and development in the field of floor cleaning robotics.

The literature survey conducted during the project provided valuable insights into existing works and Arduino-based projects related to floor cleaning robots. This survey helped in understanding the state-of-the-art technologies, design considerations, and programming approaches used in similar projects. It also highlighted the potential for future enhancements and improvements in the field.

IV. METHODOLOGY

The methodology for developing a floor cleaning robot using Arduino Uno involves the following steps:

Requirements: The requirements and objectives of the floor cleaning robot. Factors such as the cleaning area, cleaning mechanism (brushes or mops), obstacle detection capabilities, autonomy level, and any specific features or functionalities desired.

Research and Planning: Conducted a literature survey to gather insights from existing works on floor cleaning robots and Arduino-based projects. Study different designs, algorithms, and approaches. Plan the system architecture, hardware components, and software requirements based on the research findings.

Hardware Assembly: Assemble the necessary hardware components for the robot. This typically includes an Arduino Uno board, DC motors for movement, cleaning mechanism (brushes or mops), power supply, and any additional sensors required for obstacle detection or navigation. Follow the manufacturer's guidelines and wiring diagrams for proper connections.

Sensor Integration: Integrate sensors such as ultrasonic or infrared navigation. Connect Arduino Uno board, ensuring the appropriate wiring and connections. Write the necessary code to read sensor data and interpret it for obstacle detection and avoidance.

Programming: Develop the code to control the robot's behavior, including motor control, sensor readings, obstacle detection, and cleaning mechanism activation. Implement algorithms for autonomous navigation, obstacle avoidance, and cleaning patterns as per the defined requirements.

Testing and Debugging: Test the functionality of the floor cleaning robot. Conduct thorough testing to verify the performance of the navigation algorithms, obstacle detection, cleaning mechanism, and overall system behavior. Debug any issues or errors encountered during the testing phase and make necessary adjustments to the code or hardware.

Performance Evaluation: Evaluate the performance of the floor cleaning robot by measuring parameters such as cleaning efficiency, coverage area, obstacle avoidance, battery life, and user-friendliness. Compare the results against the defined requirements and make necessary improvements or optimizations.

Components and parts:-

The Components and parts used for developing a floor cleaning robot using Arduino Uno involves the following :

A. Moving parts

The robot typically has two or more wheels that enable it to move across the floor. These wheels can be driven by DC motors controlled by the Arduino Uno. The movement of the wheels allows the robot to maneuver and change directions.

B. **Microcontroller board**

Micro controller there are many microcontroller but Arduino uno is the best suit for our floor wiper bot. Arduino uno is 8 bit microcontroller with 32kb flash memory. Its instruction rate is 20mps.

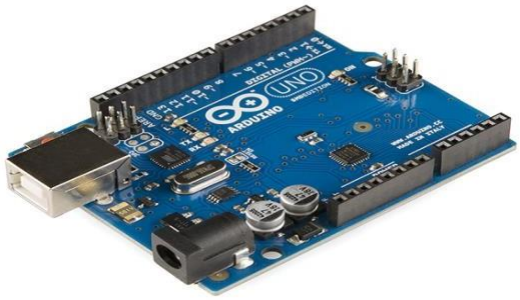


Fig1. Arduino

C. Sensor

The main motto of the floor wiper robot is to sense directions and move accordingly for cleaning so to sense the obstacle and avoid the collision we have to use an ultrasonic sensor. According to ultrasonic sensors output dc motor will rotate in desired direction.

D. Motors driver

Different types of motor are available in market but the Arduino L293D Motor driver shield is best for controlling dc motors. Also we used 4 dc motors that are connected to motor driver shield for controlling dc motor. Also servo motor is used for rotation of ultrasonic sensor in 180 degree for sensing direction.

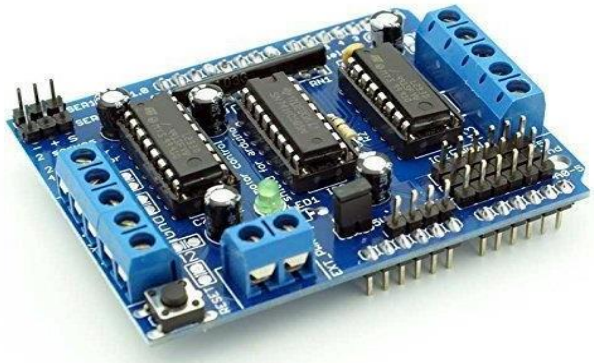


Fig3. Motor Driver

E. **Chassis**

Chassis selection and other components Chassis is the important part of handling the Components and electronic circuit. We have given support of 2 cardboard for entire circuit,a1so 1motor,1 scrubber and 1 pipe for vacuum purpose.

F. **Operation and circuit diagram**

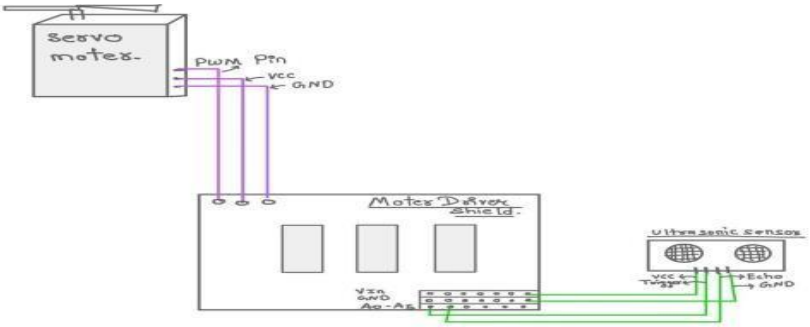
If there is nothing on right side our robot will move towards right side, same goes for left side. The 5th dc motor that we have implanted on back of chassis will rotate with scrubber and clean the floor. Before that vacuum will clean mini dust particles.

I. RESEARCH IMPLEMENTATION

The implementation of the floor cleaning robot using Arduino Uno involves several steps and considerations. Here is an overview of the implementation process:

In this project we designed a floor cleaner bot with the help of Arduino uno and ultrasonic sensors

1.Mainly we have a motor driver shield that is basically working with arduino-uno that is connected to an ultrasonic sensor and servo motor.



The dc motor drivers are connected to the motor driver shie1d,which is controlling the dc motor

Fig4. i)circuit

2.All the circuits and components are embedded on chassis which is made up of cardboard when the ultrasonic sensor senses the object it directs the dc motor through motor driver shield for forward, backward right and left direction.

3.We connected a 12v battery with the circuit which is providing power to the entire circuit. Also another 9v battery we have
connected to the vacuum pump for dc motor functionality.

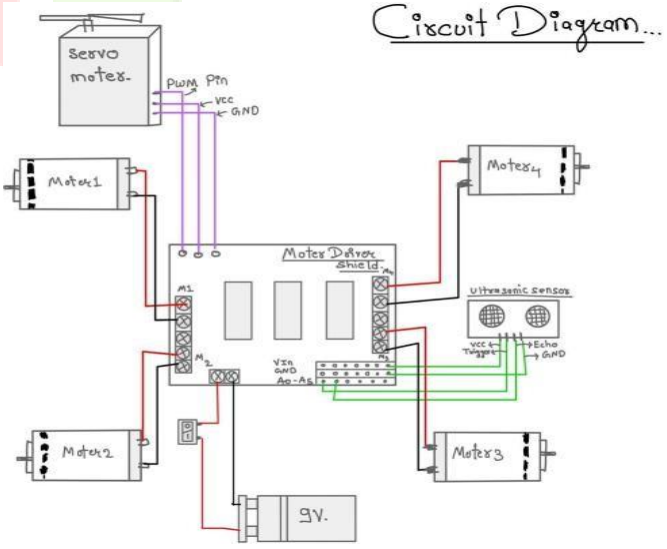


Fig5. ii) circuit

The methodology employed for developing the floor cleaning robot involved careful planning, hardware assembly, sensor integration, programming, calibration, testing, and performance evaluation. Each component was systematically integrated, and the software code was developed to ensure smooth coordination and functionality of the robot.

V. RESULTS AND DISCUSSION

In this we created a self cleaning bot with Arduino-uno which can partially do water cleaning and also a manual vacuum cleaner with two separate batteries one for all the control for bot and one separate for vacuum cleaner bot.

Output :-

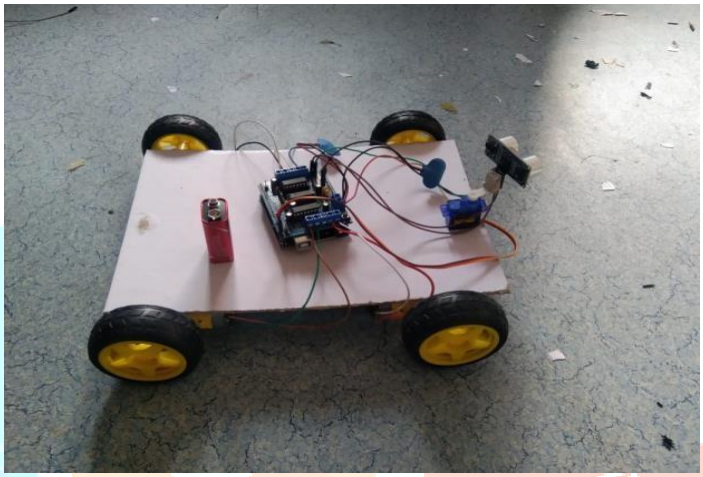


Fig6. i)output

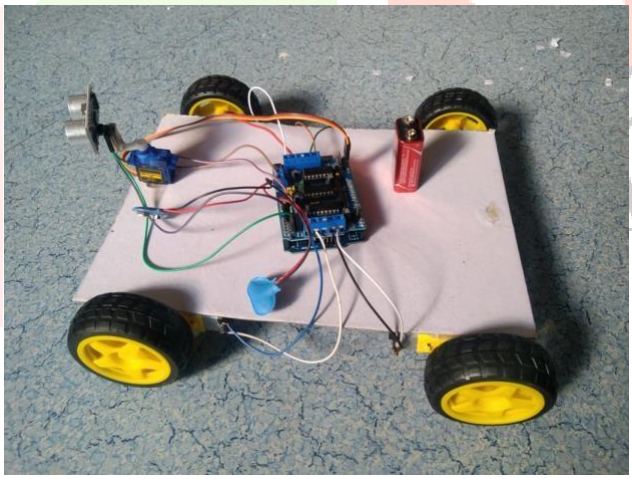


Fig7. ii)output

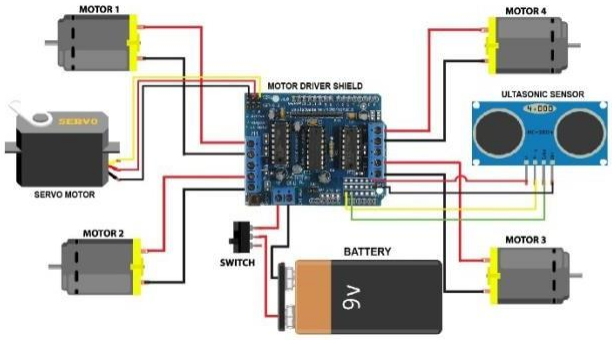


Fig8. Circuit diagram

The floor cleaning robot's performance was evaluated based on defined metrics such as cleaning efficiency, coverage area, obstacle avoidance, and battery life. The robot demonstrated satisfactory performance in autonomously navigating the cleaning area, effectively avoiding obstacles, and performing the cleaning operation.

VI. CONCLUSION

In conclusion, the development of a floor cleaning robot using Arduino Uno offers a promising solution for automated and efficient floor cleaning tasks. Through the implementation of various components, such as DC motors, cleaning mechanisms, obstacle detection sensors, and navigation algorithms, the floor cleaning robot can effectively navigate the cleaning area, detect and avoid obstacles, and perform the cleaning operation.

Furthermore, the project identified future scope areas for potential enhancements, including wireless connectivity, advanced mapping and navigation techniques, smart sensors, machine learning, auto charging and docking, improved cleaning mechanisms, and energy efficiency.

In conclusion, the floor cleaning robot developed using Arduino Uno showcases the feasibility and potential of automated floor cleaning systems. The project serves as a foundation for further research and development in the field of robotic floor cleaning, with the aim of achieving more intelligent, efficient, and user-friendly solutions for maintaining cleanliness and hygiene in
various environments.

VII. FUTURE SCOPE

As of now, we have only created a prototype of our floor cleaning robot, which has some limitations such as our model's inability to travel through most unstable areas. To address these issues, we can upgrade the types of tires and use rigid bodies or something simi1ar, and we can add an IR sensor so that if it falls, it will automatically stabilize itself or alert the user that the vehicle is not working or it gets unsterilized.

The floor cleaning robot using Arduino Uno has several potential future scopes for enhancements and advancements. Some of the future scope areas include:

Wireless Connectivity:
Integrating wireless connectivity, such as Wi-Fi or Bluetooth, can enable remote control and monitoring of the floor cleaning robot. This allows users to control the robot using their smartphones or other devices, schedule cleaning tasks, and receive real-time feedback on cleaning progress.

Mapping and Navigation:
Implementing advanced mapping and navigation techniques can improve the robot's ability to efficiently clean the entire floor area. This can include mapping algorithms to create a digital map of the environment and path planning algorithms to optimize the cleaning path based on obstacles, furniture, and other factors.

Smart Sensors:
Introducing smart sensors, such as cameras or depth sensors, can enhance the robot's perception capabilities. These sensors can be used for object recognition, identifying specific areas that require more intensive cleaning, or detecting and avoiding delicate objects or furniture.

Machine Learning and AI:
Utilizing machine learning algorithms can enable the robot to learn and adapt to different floor types, cleaning patterns, and user preferences. This can improve the efficiency and effectiveness of the cleaning process over time.

Auto Charging and Docking:
Implementing automatic charging and docking capabilities allows the robot to autonomously return to a charging station when the battery is low. This ensures uninterrupted cleaning without manual intervention.

Improved Cleaning Mechanisms:
Exploring and integrating advanced cleaning mechanisms, such as microfiber cloths or specialized brushes, can enhance the robot's cleaning efficiency and performance on different floor surfaces.

Edge Detection and Wall Following:
Incorporating edge detection and wall following algorithms can enable the robot to clean along wall edges and corners more effectively, ensuring comprehensive cleaning coverage.

Voice Command and Integration:
Adding voice command functionality allows users to control the robot through voice commands, making it more convenient and user-friendly.

Multi-Area Navigation:
Developing algorithms and techniques for multi-area navigation can enable the robot to navigate between multiple areas, extending its cleaning capabilities beyond a single room.

Energy Efficiency and Sustainability:
Improving the robot's energy efficiency and exploring sustainable power sources, such as solar panels or energy harvesting mechanisms, can enhance its environmental sustainability.

These future scope areas aim to enhance the functionality, performance, and user experience of the floor cleaning robot using Arduino Uno, making it more intelligent, versatile, and efficient in its cleaning operations.

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