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Smart Floor Cleaning System: A Review

Shivakumar K.V[1], Shashank Viresh Shetti[2], Prassanna Kumar B. I[3], Shashank Swami[4], Prof. Sudhakara H. M[5]
Department of Electronics and Communication Engineering, Alva's Institute of Engineering and Technology, Karnataka

Abstract: ***The automatic floor cleaner described above integrates a number of components to efficiently travel and clean interior spaces. The main purpose of this device is to utilizing an Arduino microcontroller, synchronize the activities of many sensors and actuators. The ultrasonic sensor serves as the primary instrument for detecting obstacles and determining the cleaner's separation from walls or other objects.***
At the same time, the infrared sensor enhances detection capabilities, particularly when there are surface flaws or low-lying impediments. Communication and control are made easier by the integration of a Bluetooth module, which offers wireless connectivity with a smartphone or other compatible devices. Users can remotely operate the cleaner, adjust its settings, or monitor its condition using a certain smartphone application. The device's rechargeable battery power enables portability and independence while cleaning. The cleaning mechanism is powered by a BLDC (Brushless DC) motor, which is renowned for its dependability and efficiency. When used in conjunction with an electronic speed controller and motor driver, the motor's direction and speed can be precisely controlled. This setup allows the cleaner to adapt its cleaning strategy to shifting environmental conditions or user preferences.
Key Words: Microcontroller, Vacuum, Cleaning, Path Vacuum, Arduino, BLDC Motor

I. INTRODUCTION

Cleaning is a vital but much forgotten task in our daily lives. In an age when time is a valuable commodity and efficiency is essential, the traditional method of cleaning might feel burdensome and time-consuming. As our lives get more hectic, the value of maintaining a clean and healthy environment cannot be stressed. A clean environment is essential for physical health and considerably improves mental well-being and productivity.

To solve these issues, great progress has been made in the development of automated cleaning technologies, particularly floor scrubbers. Historically, many of these robots have had constraints, such as inefficiency or dependency on complex wiring, which can impair their usability and efficacy. However, the launch of the smart floor cleaning system represents a significant advancement in the field of home and business cleaning technologies. This clever floor cleaning device is developed with the user's convenience in mind. Its autonomous control mode enables it to function independently, sparing customers from the tedious task of manual cleaning. This feature not only saves time, but it also saves energy because the machine can do dry cleaning duties simultaneously. By properly managing cleaning procedures, the system allows users to focus on their major activities, such as work, family time, or personal hobbies, without being distracted by housework.

II. LITERATURE SURVEY

1) Kerkar et al., "Automatic floor cleaning robot" This study examines an autonomous floor cleaner that incorporates numerous components for efficient navigation and cleaning of indoor spaces. The system uses an Arduino microcontroller to coordinate sensor and actuator motions. As they explained, the ultrasonic sensor is the primary instrument for detecting obstacles and determining distances, while the infrared sensor is used to improve detection of low-lying impediments or surface abnormalities. The project also includes a Bluetooth module to provide wireless connection, allowing customers to control and monitor the cleaner via a smartphone app. Furthermore, the device is powered by a rechargeable battery, ensuring portability and independence.

2) Ramalingam et al, "Optimal selective floor cleaning using deep learning algorithms and reconfigurable robot h Tetro" The authors worked on a project focused on a novel selected area cleaning framework for indoor floor-cleaning robots, which solves the limitations of frequent cleaning chores that diminish performance and increase the consumption of cleaning accessories such as brushes and mopping pads. Their research employs RGB-D vision sensor-based CCTV networks, deep learning algorithms, and optimal waypoint path planning to ensure that the robot only cleans filthy areas, rather than the entire region. The authors identified selective cleaning spots by observing human traffic patterns with the Simple Online and Real-time observing (SORT) algorithm and detecting stains and garbage with the Single Shot Detector (SSD) Mobile Net framework.

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3) Yatmono et al, "Development of Intelligent Floor Cleaning Robot "In this work, the authors described the creation of a smart floor cleaning robot that can travel, clear dust, and polish floors automatically, addressing the time-consuming nature of traditional cleaning operations that frequently result in other responsibilities being missed. The study used Pressman's research and development approach, which included phases of analysis, design, implementation, and testing. The robot, which uses an omni wheel system, comes equipped with a vacuum cleaner and a floor-polishing motor for excellent cleaning. Its control system is based on an Arduino microcontroller, with Bluetooth networking allowing for control from an Android smartphone. The authors stated that the robot could navigate based on human commands from a smartphone and avoid obstacles independently if the distance to a barrier was less than 15 cm.

4) Das et al. in "Robotic Automated Floor Cleaner" discussed their research and development of a Robotic Automated Floor Cleaner designed to provide easy and time-efficient cleaning of indoor spaces while minimizing human labour. Their project emphasizes the growing importance of cleanliness in improving health and the environment, while also addressing the limits of manually operated units that are labour-intensive and time-consuming, as well as fuel-powered machines that are expensive and environmentally destructive. The authors stressed the dangers of dust to human health in a variety of contexts, including homes, hospitals, schools, and hotels, and presented their automated solution as a critical improvement for modern living. Their robotic cleaner promises to reduce labour expenses, save time and money, and meet the unique needs of users.

5) Yadav et al, "Wireless Automatic Floor Cleaning and Safety Indicator Robot" The authors addressed their invention of a multipurpose robotic floor cleaner meant to deliver efficient cleaning via a stable, rapid, and highly functionalized electronic and mechanical control system that operates totally wirelessly. They underlined the necessity of frequent cleaning, particularly in the home, and the need for approaches that can be adapted to different surface types and applications. Their robot, built with a readily upgradeable Foam Board frame, has several revolutionary characteristics. During operation, a temperature sensor detects temperature anomalies in the room and alerts users to potential disasters such as fires or rapid weather changes using an LED indicator.

6) Dhole et al, "Smart Multifunction Floor Cleaning Robot" The author, in this paper, discusses the challenges faced in commercial spaces such as airports, train platforms, hospitals, bus stops, shopping malls, and other public venues regarding floor-cleaning solutions. These issues are especially acute in countries such as India, where frequent power outages, particularly during hot weather, render electrically powered gadgets ineffective, providing severe limits at locations such as bus stops. To address these concerns, the authors propose a solar-powered, mobile floor-cleaning machine as a low-cost and practical alternative to conventional cleaning equipment. The authors describe also how to model and analyser the floor-cleaning machine using commercial software. The machine's components are made of common, easily available materials. Furthermore, a finite element study was performed, indicating that the stress levels in the mobile-operated floor-cleaning machine.

7) Rumane et al, "A Review Paper on Floor cleaning robot" In this work, the author presents the design and operation of a floor-cleaning machine with wireless Bluetooth control. The system is made up of a set of DC motors incorporated into a wheeled plastic container, which has a scrubber linked to one of the motors at the bottom and a reservoir for cleaning solution on top. A CPU fan helps to dry and clean the floor properly. This equipment is intended to be user-friendly, making it appropriate for use in homes, hospitals, schools, and other settings. The system is operated by a Bluetooth module that links to a smartphone app or a remote. Users may easily control and move the machine by directing it via the app. The system is very customizable to user preferences, which increases convenience.

8) Wayker et al, "Smart Floor cleaning Robot Using Android" The author of this paper analyses advances in robotics technology that have considerably improved the ease and comfort of human living. This study describes a low-cost robot built for people who cannot afford or have access to premium amenities. While there are numerous autonomous robots on the market, each with a unique set of capabilities, the majority are prohibitively expensive. The suggested method bridges this gap by including a transmitter application within an Android mobile app, allowing the robot to smoothly follow user orders. The system is based on a microcontroller (Arduino UNO) with fourteen input/output pins and includes components like a cleaning mechanism and a robotic arm. After receiving instructions from the Android device via a Bluetooth receiver, the microcontroller decodes

9) Sudam et al, "Wireless Floor Cleaning Robot" The author of this paper outlines the creation of the Wireless Floor Cleaner Robot, a key invention in home automation and robotics that addresses domestic cleaning issues. This self-driving robot can intelligently traverse and clean a wide range of floor surfaces, including hardwood, tile, and carpet. The robot has an array of sensors, including ultrasonic and infrared sensors, that allow it to recognize and avoid obstructions, assuring safe and efficient operation in congested areas. Its wireless connectivity allows for remote control and monitoring, which adds convenience for

users. By automating the cleaning process, the robot streamlines household duties while also reducing the risks connected with typical corded vacuum cleaners. Furthermore, its adaptability to diverse space layouts and floor kinds emphasizes its versatility,

10) Rathee et al, "Automatic Floor Cleaning Robot Using Arduino-UNO" The author of this paper describes the creation of a smart floor-cleaning robot that cleans floors efficiently based on user directions. This unique robot simplifies the cleaning process by allowing for quick and efficient operation, with commands supplied wirelessly via an embedded Bluetooth module. Users may easily operate the robot with their smartphones to accomplish chores like moving in different directions and washing the floor. The author highlights that this system is both cost-effective and low-maintenance, requiring substantially less human work. This makes it a dependable and practical solution for modern households, meeting the demand for automation and simplicity in daily cleaning

III. OBJECTIVE

1) To simplify human life.
2) To Avoid time wastage during clean
3) To identify the specification no each components.

IV. BLOCK DIAGRAM

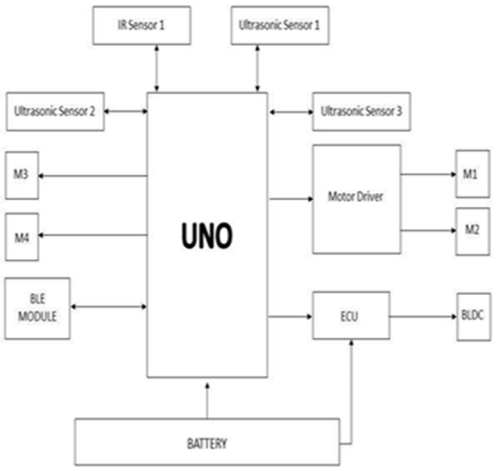


Figure 1 Block diagram

The Smart Floor Cleaner's block diagram depicts a complete system in which the Arduino UNO acts as the central microcontroller, coordinating inputs and outputs. It has an infrared sensor for edge detection as well as several ultrasonic sensors for obstacle identification and distance measurement, enabling safe and efficient navigation. The motor driver manages the DC motors (M1, M2, M3, M4) that drive movement, whereas a BLDC motor is handled by an Electronic Control Unit (ECU) for improved performance. A BLE (Bluetooth Low Energy) module enables wireless connectivity and allows consumers to manage the cleaner remotely via a smartphone application. The system is powered by a battery that provides energy to all components, allowing for smooth functioning. This design provides excellent cleaning with accurate navigation and user-friendly remote control functions.

V. METHODOLOGY

The Smart Floor Cleaning System is designed in a systematic manner to meet the demand for innovative home cleaning solutions. The hardware, which includes an Arduino UNO, an L298N motor driver, a Bluetooth module HC-05, servo motors, and a water pump, is assembled to form a dependable robotic base. Ultrasonic distance sensors and infrared sensors for edge identification and fall prevention improve navigation and obstacle recognition. This sensor integration enables fast navigation, real-time course changes, and extensive cleaning coverage.

The control system is flexible, with manual operation via a keypad or Bluetooth app, as well as an automatic self-cleaning option. Users can effortlessly switch between modes to customize their cleaning experience.

A. *Arduino UNO*

The Arduino UNO is a microcontroller board based on the ATmega2560 with 16 analog pins and 14 digital I/O pins. It features a PWM output, hardware serial ports, a 16 MHz crystal oscillator, a USB connection, a power jack, and a reset button.

B. *IR Sensors*

IR sensors detect heat and turn it into electrical impulses. These sensors, which can detect fluctuations in infrared light, are widely employed in electronic gadgets, security systems, and appliances for functions such as proximity sensing and remote control.

C. *Motor Driver L298N*

The L298N is a dual H-bridge motor driver IC that allows for bidirectional control of two DC motors or one stepper motor. It runs between 4.8V and 46V, with a peak current of 2A per channel. It also features built-in protection diodes and allows for PWM motor speed control.

D. *100 RPM Motor*

This low-speed electric motor with 100 revolutions per minute (RPM) capacity is ideal for robotics and automation applications that require precise, controlled movements. It is efficient and dependable for small-scale

E. *Bluetooth Module HC-05*

The HC-05 Bluetooth module is used in electrical projects to provide wireless communication via Bluetooth 2.0/2.1 and Serial Port Profile (SPP). It allows for serial communication between microcontrollers such as Arduino and cellphones or other devices across a 10-meter range.

F. *BLDC motor*

The Brushless DC (BLDC) motor uses electronic commutation instead of brushes, resulting in increased durability, efficiency, and precision control. These motors are frequently employed in applications like as drones, electric cars, and appliances, resulting in longer lifespans and lower maintenance requirements.

G. *Ultrasonic Sensor*

An ultrasonic sensor is an electrical device that measures distance or detects things without physical touch. It sends out ultrasonic sound waves and measures how long it takes for the echo to return after hitting an item.

VI. CONCLUSION

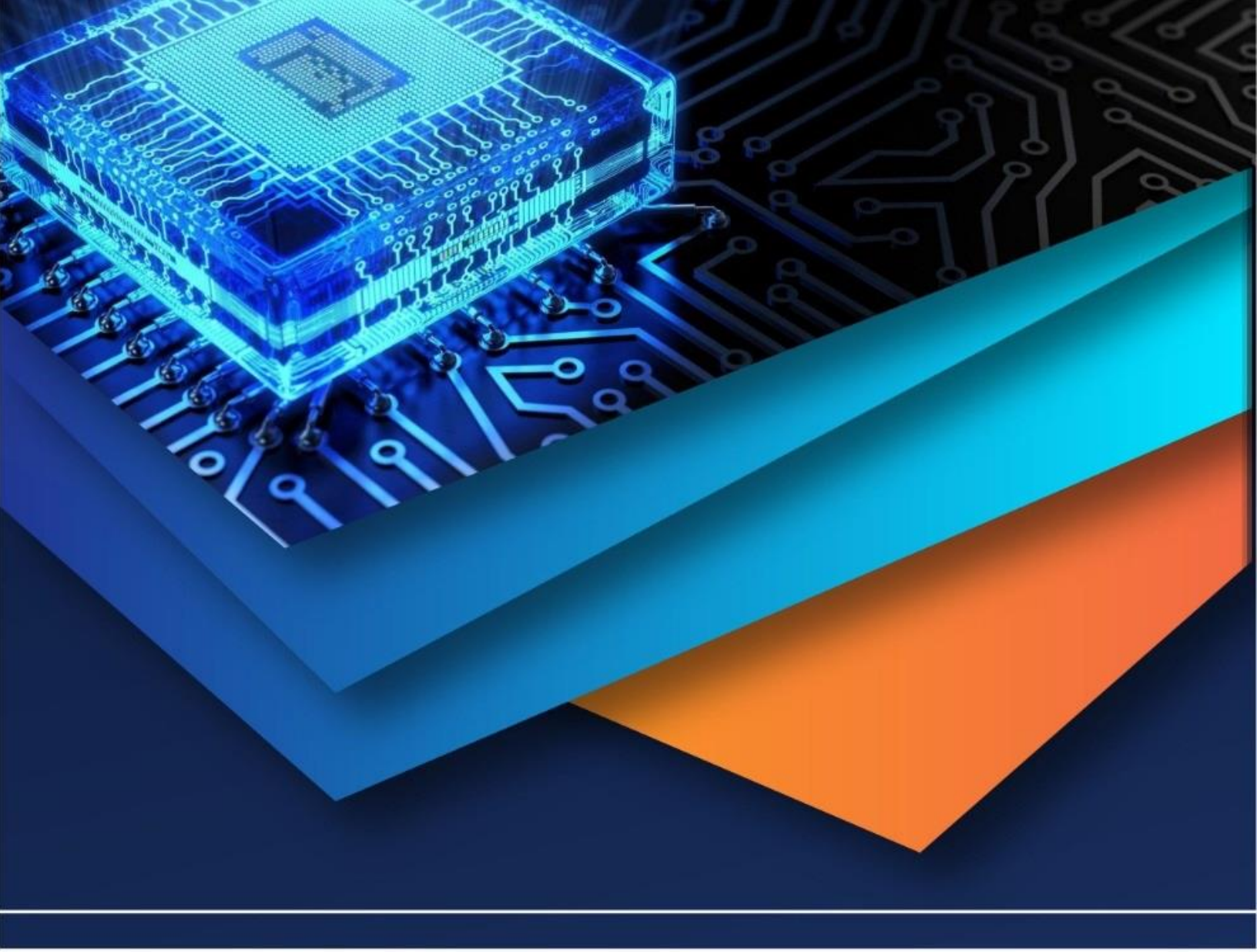
The Smart Floor Cleaning System is a significant advancement in automated cleaning technology, effectively addressing the challenges of traditional cleaning methods by integrating a variety of components such as Arduino microcontrollers, sensors, and Bluetooth connectivity. This unique technology not only improves cleaning efficiency and user convenience by operating autonomously and remotely via a smartphone app, but it also contributes to a cleaner and healthier living environment. The system adapts to diverse cleaning settings by using a multi-sensor technique for navigation and obstacle recognition, allowing users to free up valuable time for more vital activities while ensuring their environments remain tidy and well-maintained. The Smart Floor Cleaning System is intended to improve how we handle domestic cleaning duties. The device can navigate difficult surroundings by utilizing advanced technology such as ultrasonic and infrared sensors, avoiding obstructions and providing complete coverage of the cleaning area. The use of a Brushless DC (BLDC) motor improves the device's efficiency and reliability, allowing for excellent cleaning without the noise and maintenance difficulties that come with regular motors. Furthermore, the rechargeable battery allows you to clean diverse locations without being attached to a power source. The user-friendly Bluetooth interface allows customers to adjust cleaning schedules and settings, making it more responsive to personal preferences.

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[3] S Yatmono, M Khairudin, H S Pramono and A Asmara Electrical Engineering Education Department, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia.

[4] Rhutuja Patil1, Mohini Kulkarni2, Sejal Mhadgut3, Prashant Titare4, D.G. Khairnar5 1-5Department of Electronics & Telecommunication Engineering, D Y Patil College of Engineering, Akurdi, Pune.
[5] Nabamita Ramkrishna Das, Rashmi Daga, Sneha Avte, Prof. Kavita Mhatre, Department of Electronics and Communication Engineering, Usha Mittal Institute of Technology, SNDT University, Santacruz. Mumbai, Maharashtra, India
[6] Ankit Tejbahadur Yadav, Sushant Anand Sarvade, Rahul Ramesh, Suryamani Yadav,Student, Department of Electronics and Telecommunications Engineering, K. J. Somaiya Institute of Engineering and Information Technology, Mumbai, India,
[7] Dr. Akash Rathee, shant Jalan, Lakshita Nandwani, Tanya Sharma Associate Professor, ECE Department,ECE (Final Year), Bhagwan Parshuram Institute of Technology, Sector-17, Delhi, India.
[8] Prof. A.S. Shirkande, Chavan Aniket Nitin, Bhosale Gorakh Sudam,Parekar Datta Ashroba, Savitribai Phule Pune University, Department Of Electronics And Telecommunication Engineering, S.B. Patil College Of Engineering, Indapur, Maharashtra, India.
[9] Mrs .Shritika Wayker(Asst.Proffesor), Prashant Tiwari, Vishal Kumar, Kunal Limbu, Amay Tawade, Mrs .Shritika Wayker(Asst.Proffesor)1, Prashant Tiwari, Vishal Kumar, Kunal Limbu, Amay Tawade,Deparatment of Electronics and Telecommunication, Dr D.Y. Patil Institute of Engineering Management and Research Akurdi, Pune, Maharashtra, India.
[10] Priyanka Rumane, Kranti Kshirsagar, Sonawane Akshay, Mr. Bhagvan.Bodke, Electronics and telecommunication Department, Savitribai Phule Pune University
[11] Prof. Vaishnavi Dhole1, Palash Lakhe2, Vinod Lanjewar3, Mayur Bowade4, Mayuri Jaypurkar5 1Project Guide, 2, 3, 4, 5Projectiles, Department of Electrical; Engineering, Govindrao Wanjari Collage of Engineering and Technology, Nagpur

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