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Automatic Floor Cleaner

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Abstract:

This paper describes the creation of a floor-cleaning robot that you can control with Bluetooth. The robot uses sensors to navigate and clean, and you can manage it through a mobile app. An Arduino controller is used to steer the robot, avoid obstacles, and change direction. The robot moves with three DC motors, controlled by an L298D Motor Driver Board, and another motor adjusts the cleaner's speed and operates a fan to dry the floor. Bluetooth is used to establish a wireless connection between the robot and the remote control. A 12V rechargeable battery powers the robot, and an Arduino UNO with an ATmega328P microcontroller is the brain of the system. This study looks into how Bluetooth communication can be used in robots, highlighting its benefits, challenges, and possible uses for home automation.

Keywords **— Arduino Uno, Bluetooth, Motor driver, Fan and motor.**

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I. INTRODUCTION

The development of autonomous robots for household chores has significantly progressed in recent years, driven by the growing demand for convenience and efficiency in daily life. One of the most popular applications of this technology is in floor-cleaning robots, which offer the ability to maintain clean living spaces with minimal human intervention. These robots are equipped with advanced navigation systems and cleaning mechanisms that allow them to operate independently, navigating around obstacles and adapting to different floor types.

In this study, we focus on the design and implementation of an autonomous floor-cleaning robot that is controlled via Bluetooth technology. Bluetooth provides a simple, low-cost, and energy-efficient way to control and monitor the robot using a smartphone application. This makes it easier for users to start, stop, and schedule cleaning tasks, as well as to control the robot's movements and monitor its status remotely.

The robot is powered by an Arduino-based system, which is responsible for managing the various components and functions of the robot. It uses a combination of sensors to detect obstacles and navigate through different environments, ensuring thorough and efficient cleaning. The system also includes a set of DC motors for movement and a motor-driven cleaning mechanism that can adjust its speed and operate a fan for drying the floor.

Existing autonomous floor-cleaning robots typically utilize conventional control interfaces or limited wireless options, which may not fully meet the evolving demands of users for intuitive and flexible control mechanisms. This poses challenges in terms of user experience, convenience, and adaptability to modern smart home environments. Consequently, there is a need for innovative solutions that leverage wireless technologies to enhance user interaction with autonomous robots, particularly in the context of floor cleaning.

Main objective of develop a robot equipped with smart sensors and cleaning features to effectively clean different types of floors. Incorporate Bluetooth technology so you can control the robot from your smartphone, making it more convenient and accessible. Create a simple and intuitive mobile app interface for controlling the robot, scheduling cleaning sessions, and checking its status. Evaluate how well the robot works and how satisfied users are with it. Use feedback to make any necessary improvements for a better experience. In this project we also use Arduino UNO microcontroller. By this project, we tried to reduce the cost of mopping robot as compare with other mopping robots.

II. LITERATURE SURVEY

Traditionally, floor cleaning required significant manual effort, using hands or handmade tools. With the advent of electricity, vacuum cleaners revolutionized cleaning by requiring minimal physical exertion. However, as technology advanced further, the introduction of mobile robots reshaped the cleaning landscape. [1] These robots are programmed to autonomously navigate their environment, offering a hands-free cleaning experience. Today, numerous companies dominate the market with a variety of robotic floor cleaners, each tailored to specific cleaning needs, whether dry or wet. Major players include Dyson, iRobot, and Neato Robotics, among others. [2] However, despite their efficiency in routine cleaning tasks, current floor cleaners face limitations when it comes to removing infections. While existing floor cleaners excel at routine dry or wet cleaning tasks, they fall short in effectively

removing infections. This poses a significant challenge, particularly in environments where hygiene and sanitation are paramount, such as healthcare facilities or homes with vulnerable occupants. [3] This research work presents the development of a novel tetris inspired reconfigurable floor cleaning robot - hTetro, utilizing the hinged dissection theory of polyominoes. The developed robot platform is capable of transforming between any of the seven set of one- sided tetromino morphologies according to the perceived environment with an objective of maximizing the coverage area. [4] A new sliding-mode trajectory-tracking wheeled mobile robots (WMR) control is proposed. Dynamic model with uncertainties parameters (unknown or time varying mass and moment of inertia) of the WMR is considered. Robust stability depending on upper bound uncertainties, is guaranteed. A mobile platform, PatrolBot, with two driving wheels and two rear wheels is used in order to check proposed sliding-mode control. [5] Results obtained in a reduced scenario show that floor-cleaning coverage is complete in all cases if the path-planning exploration algorithm has some random dependence. [6] One microcontroller with 4 ultrasonic sensors is attached to it. This has 2 bread boards for circuit connection which ultimately can be replaced after welding. 6 For scrubbing we are using the brushes instead of cloths. The scrubber rotates at very high speed which performs very good mopping action. [7] Navigation system of the robot is basically dependent on the sensors and microcontroller and algorithm fed to it. Basically, the data acquisition system (here sensor) first collects the data from the environment and feeds to microcontroller. The microcontroller uses 2 algorithms. [8] Basically, after sensing the obstacle distance from outside environment, if the robot has sufficient space on its 4 sides it will move in spiral path at first half of its running. [9] The spiral path can be anti-clockwise and clockwise. The spiral path can be generated by the decreasing ratio of left motor encoder and right motor encoder. Basically, random straight path searches from one node to another by the help of natural heuristic search. [10] After the spiral motion the robot if detects a collision then it follows the edge of the wall until it gets enough free space for spiral motion again. After some moment if it doesn't get any specific clear area for spiral motion then it will move in random path for some time and the obstacle detection and avoidance system will be carried out by the help of ultrasonic sensors. After that robots stop rotating if the timer is over. [12] In this process we can divide a particular area in the floor as grids and move accordingly so that it will have very confine control over the robot. So, it will have grid based search over the floor for movement. Finally, we implemented computer vision by the help of ultrasonic imaging and analyzing the image for the dust particles by the help of supervised learning and clustering the data. [13] We have implemented here a search algorithm for motion planning. Automatic floor cleaner is a compact robotics system which provides floor cleaning service in room and big offices reducing human labor. Basically, as a robot it eliminates human error and provide cleaning activity with much more efficiency. [14] If we clean the floor manually then there is a possibility that the operator will leave some portion of the floor. Also due to manual labor involved this is time consuming and irritating to clean the floor. Also, in big offices floor area is very huge and the people involved there for cleaning purpose cannot clean it much more efficiently. [15] This is where the robot comes as an advantage. Also, the robot is small and compact in size. So we can carry it and place it wherever we can on the house.

III. PROPOSED SYSTEM

This circuit is designed to control two DC motors and a fan using an Arduino UNO microcontroller. It includes a Bluetooth HC-06 module for wireless communication and two L298N DC motor drivers to handle the motor control. The circuit is powered through the Arduino UNO's Vin pin, which also supplies power to the motor drivers. Ground connections are shared across the components to complete the circuit. Microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. Wireless communication module. Used for Bluetooth serial communication. DC Motor (x2): Electric motor that runs on direct current electricity. L298N DC Motor Driver (x2): Dual H-bridge motor driver. Capable of driving two DC motors or one stepper motor. DC Motor (x2): Electric motor that runs on direct current electricity. Fan: Electronic device that creates airflow. Water Pump: Device used to move liquids.

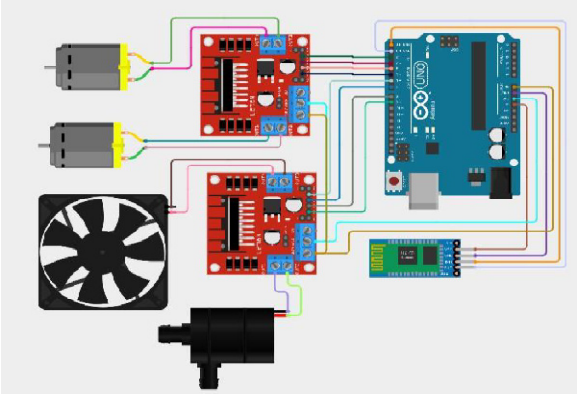

Fig.1: Schematic diagram of automatic floor cleaning

In figure.1, D2 connected to L298N DC motor driver IN4. D3 connected to L298N DC motor driver IN3. D4 connected to L298N DC motor driver IN2. D5 connected to L298N DC motor driver IN1. D6 connected to second L298N DC motor driver IN4. D7 connected to second L298N DC motor driver IN3. D8 connected to second L298N DC motor driver IN2. D9 connected to second L298N DC motor driver IN1. 5V connected to Bluetooth HC-06 VCC. GND connected to Bluetooth HC-06 GND, both L298N DC motor drivers GND. Vin connected to both L298N DC motor drivers 12V. D0 (RX) connected to Bluetooth HC-06 TXD. D1 (TX) connected to Bluetooth HC-06 RXD.

IV. CONCLUSIONS

In conclusion, this project has explored the design and implementation of an autonomous floor-cleaning robot controlled via Bluetooth technology. We aimed to bridge the gap between traditional robotic control interfaces and modern user expectations for wireless, smartphone-based control. Through the development of our robot, we have successfully integrated Bluetooth communication, allowing users to control and monitor the robot conveniently from their smartphones. This innovation enhances user experience, making floor cleaning more accessible and adaptable to modern smart home environments.

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