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CAMPUS CLEANER BOT

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ABSTRACT

This study examines the many cleaner bot types used in schools, such as self-contained vacuums, robotic litter collectors, and waste segregators driven by artificial intelligence.

cleaners. It looks at the underlying technologies, such as computer vision, machine learning, and sensor integration, that allow these bots to operate in a range of contexts and carry out cleaning duties.

This survey also covers the effects of cleaner bots on university campuses and how they can lower operational expenses, improve hygienic standards, and encourage eco-friendly behavior. It also examines the difficulties these bots encounter, including user acceptability, energy efficiency, and environmental adaptation.

The report also offers suggestions for future lines of inquiry, highlighting the necessity of developments in artificial intelligence algorithms, robot interaction to The acceptability and potential of Campus Cleaner Bot.

This paper's primary goal is to close the knowledge gap between theory and widely available components and real-world application. The robot construction cost was chosen to be lower by using the adaptive manufacturing method.

I. INTRODUCTION

Cleaning has been a tedious chore from the beginning of human society. There were multiple approaches for maintaining order in the space.

But these approaches were laborious and time-consuming. People who work are finding it more and more difficult to find time to clean their rooms. The difficulties meant that the existing system was not considered an automation.

The cleaning procedure was far more

successful.

The workload associated with cleaning can be substantially decreased by using a robot floor sweeper that responds to user commands on a mobile device. This project's main objective is to design and construct a robot that can be operated by an Arduino Mega, a display with an LCD, an ultrasonic sensor, and additional parts.

Since it is equipped with sophisticated obstacle identification and avoidance technology, the campus cleaner bot can easily go through intricate terrain. Even in places with heavy traffic, its embedded AI algorithms allow it to adjust to changing conditions and ensure broad cleaning. Utilizing sustainable energy sources like solar panels or rechargeable batteries, the robot minimizes its environmental impact by running silently and producing no pollutants. Its intelligent monitoring features enable it to give data on cleanliness levels in real time, enabling resource management and focused cleaning operations. The bot's modular architecture also makes maintenance and updates simple, extending its useful life and enabling it to maintain our campus sustainable and clean for many years to come.

II. LITERATURE SURVEY

1. Manya Jain, Pankaj Singh Rawat, Assist.Prof. Jyoti Morbale "AutomaticFloor Cleaner"International Research Journal of Engineering and Technology Volume: 04 Apr 2023.

In the field of robotics, there appear several autonomous as well as the manual based cleaning robots. They include many unique features which are subjected to make user friendly. According to the survey [1-5] automatic cleaning robots are more convenient than manual based machines. The autonomous cleaning robots are intelligently programmed that serves the basic function of cleaning i.e., dry as well as wet cleaning. Some of the cleaning robot products are available with a brush around sharp edges and corner while other includes wet mopping and Ultra Violet (UV) sterilization.

2. Uman Khalid , Muhammad Faizan Baloch , Haseeb Haider , Muhammad Usman Sardar Muhammad Faisal Khan, Abdul Basit Zia1 and Tahseen Amin Khan Qasuria Faculty ofElectronic Engineering, Ghulam Ishaq Khan "Smart Floor Cleaning Robot (CLEAR)" Institute of Engineering Sciences and Technology, Pakistan Hamdard Institute of Engineering & Technology, Hamdard University, Karachi, Pakistan 2023.

Robotic Vacuum Cleaner The paper addresses about the robot which is controlled by the android application through Bluetooth module. The application sends the information to microcontroller to have control over robot. The distance of the obstacles is detected using the ultrasonic sensors and the distance is displayed on LCD and as well as on application. Here man controls the overall operation indirectly.

3. Manreet Kaur, Preeti Abrol "Design and Development of Floor Cleaner Robot(Automatic and Manual) "International Journal of Computer

Applications (0975 – 8887)Volume 97– No.19, July 2023.

Scrubbing mechanism As discussed earlier scrubbing of surface is necessary for proper cleaning. For different type of floors different types of scrubbers are to be used. For stone flooring soft cloths, for cement floors hard plastics are used. In our case the scrubber is given a rotational motion to scrub the surface. The rotational motion is achieved by a 12v DC motor having 600rpm. The scrubber is as shown in fig5. One side of the scrubber is fixed with the dc motor which again clamped to the chassis by C-clamp and screw. The other part of the scrubber is connected to a ball bearing which is again clamped to the chassis via C-clamp. The connection of bearing is done by a hub. The hub is a metallic object of cylindrical shape. On one side of the hub a hole is made and the scrubber is fixed. The bearing is fitted by transition fit to the ball bearing. Transition fit is the type of fit when the diameter of the shaft and the hole are same and hence the shaft is fixed by applying continuous force.

4. Jens-Steffen Gutmann, Kristen Culp, Mario E. Munich and Paolo Pirjanian. The SocialImpact of a Systematic Floor Cleaner. In IEEE international workshop on advance robotics and its social impacts, Technische University munchen, Germany May 21-23, 2022.

Modelling the spiral path

The spiral path is the initial phase of coverage path planning. Therefore, at the beginning of the spiral path, the robot is at the origin of the frame. An imaginary X axis and Y axis is drawn which meet on the initial position of robot. The spiral is either clockwise with increasing radius and decreasing theta or the spiral is anti-clockwise with increasing radius with increasing theta.

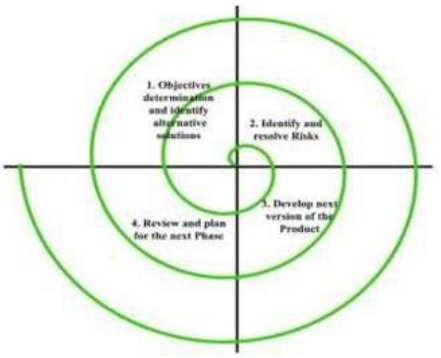


Fig 5.Spiral path

5. **Mr.Chavan Swaroop Chandrakant, Mr.Parulekar Sharvarish Shashikan, Mr. Gavali Omkar Raju, Mr. Gokhale Shantanu Bhalchandra, Mr. Shinde Vaibhav Tanaji " Semi-Automatic Floor Cleaner with Obstacle Avoidance for Indoor Applications"**

Robot vacuum cleaners perform cleaning autonomously, i.e. without human intervention. The cleaning algorithm determines the pattern in which the robot moves across the floor and varies from brand to brand and model to model. The pattern can be random or mapped following Aa zig-zag, crisscross, or spiralling pattern, or it can be controlled by simultaneous localisation and mapping (SLAM) 38 . The top-three robot models in a recent German consumer test reveal a hard floor cleaning performance almost as good as that of an average (150-200 Euro) cylinder vacuum cleaner, while carpet cleaning performance is only half as good in comparison.

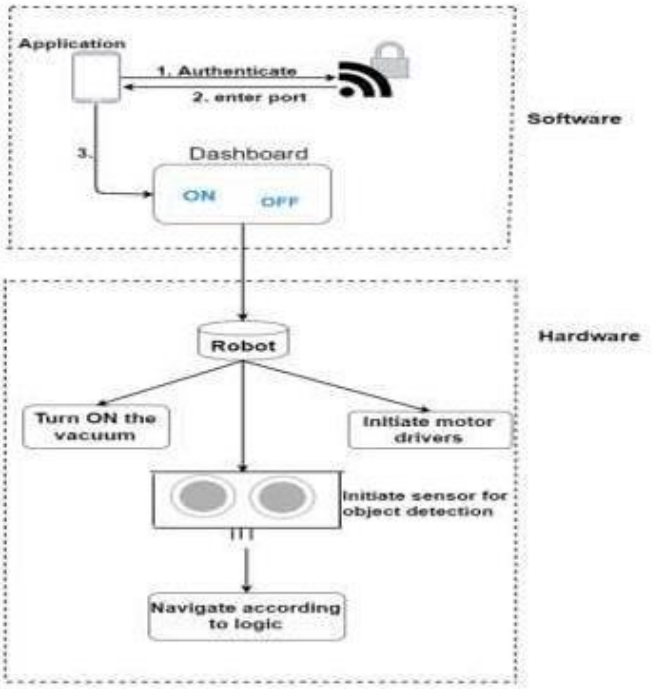
6. Vaibhavi Rewatkar, Sachin T. Bagde," Design of Automated Floor Cleaning System" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 23218169 Volume: Issue: 2

- cleaners Are assumed to follow the same use pattern as mains-operated vacuums.

However, most cordless vacuums often would not have sufficient run time, as most can run for 15-40 minutes while only a few can run for up to 60 minutes at the lowest power setting35 . Hence, the cleaning is assumed to be spread out over more cycles per week. Also, the capacity of a cordless is smaller than that of a normal vacuum cleaner, i.e. in the range of 0.2-0.8 litres compared with around 2-3 litres for an average sized standard vacuum cleaner according to Which?36. The same source also finds that, while a carpet dust pick-up of 79% is average for a cylinder vacuum cleaner the cordless handstick vacuum cleaner only reaches 47%. In other words, the average cordless would not meet the 2017 Ecodesign requirements for carpet cleaning (minimum dpuc 75%) and possibly could only enter as a hard-floor only model (minimum dpuhf 98%). Especially over the last 5 years there has been a lot of progress in performance, battery capacity and life for cordless vacuum cleaners. But there are also typical 'sweepers' and 'electric broom' types, i.e. a rotating brush without filtration and a 10 15 W suction power37 that is just enough to keep the dust from falling out of the small bin next to the brush. If their performance allows, they could be in scope of a revised regulation as hard-floor only.

7. **Ajaykumar,Madhura,Mahamunkar,Rose Merlin Jose Sahima Khan "Automated Operating Room Cleaning Robot".International Journal of Advanced Research in Electrical Electronics and Instrumentation Engineering. Vol-5,Issue 04,April 2021.**

This category includes mains-operated cylinder, upright and handstick vacuum cleaners, which are all covered by the current Ecodesign regulation and the previous, annulled Energy Labelling Regulation. Mains-operated household vacuum cleaner models were available in the highest energy label classes for energy efficiency (A+++) and performance classes (A) under the annulled Energy Labelling Regulation, but never for the same model, neither with active nor passive nozzles. This illustrates that there is a clear inverse relationship between carpet cleaning performance dpuc and energy efficiency. This cannot be said about the hard floor cleaning performance. Rather, every type of vacuum cleaner, even with very low suction power, can get a good hard floor cleaning rating with the current crevice test.



III. OBJECTIVES

- Customization and Adaptability
- Real-time implementation.
- Increased independency.
- Enhance communication.
- Low cost cleaning solution.

IV. WORKING

To sense the environment, the bot would be outfitted with cameras, LiDAR, ultrasonic, and infrared sensors. It could navigate the campus on its own using navigation algorithms, avoiding impediments and pinpointing areas in need of cleaning. The bot would map the campus either by using pre-loaded maps or by drawing maps on the fly as it went. It would be able to precisely pinpoint its location on the map in real time thanks to localization algorithms.

Different cleaning procedures may be employed by the bot depending on the surfaces it comes into contact with. This could involve mopping techniques, brushes, vacuums, and even specialty equipment for cleaning particular surfaces like tiles or carpets. The cleaning duties would be assigned to the bot automatically or by a centralized system that would identify places that needed attention. After that, it would plan and route itself to cover the entire campus as effectively as possible while using the least amount of time and energy possible.

With information from its sensors, the bot creates a real-time map of its surroundings. Simultaneous Localization and Mapping (SLAM) is the mechanism that enables the bot to recognize its location in relation to its surroundings and coordinate its motions accordingly.The map produced by SLAM is used by navigation algorithms to create effective routes for the robot to travel. These algorithms choose the optimal path for the bot to follow by considering obstructions, topography characteristics, and cleaning priority.The bot may use a variety of cleaning techniques, including brushes, suction systems, and mopping mechanisms, depending on its particular design. The bot's position and the kind of surface it comes into contact with determine which mechanisms are triggered.

The bot's cleaning schedule is managed by task scheduling algorithms, which optimize for variables like cleaning efficiency and energy usage while making sure the bot cleans every part of campus. The bot's navigation algorithms, actuators, and sensors are all coordinated by its control system. It gathers data from sensors, analyses it to determine how to move and clean the bot, and then orders the actuators on the bot to carry out its conclusions. Through a centralized dashboard or control interface, operators can remotely monitor the status and performance of the bot.

If needed they can step in to modify the bot's behaviour or offer manual support. The bot's control system incorporates safety features, such emergency stop buttons and collision detection, to guarantee safe operation in dynamic surroundings with human inhabitants. The bot collects, processes, and analyses data—such as sensor readings and cleaning performance metrics—in order to continually enhance the way it operates. It is possible to apply machine learning algorithms to find patterns in the data and adjust the bot's behaviour accordingly.

It's possible that the bot's design will function with the current campus utilities, like Wi-Fi networks for connectivity and battery-recharging stations.By virtue of its modular architecture, the bot is easily scalable to meet the needs of larger campuses or more frequent cleanings. It can also change with the seasons and surroundings, altering cleaning schedules and techniques as necessary. The campus cleaner bot offers real-time monitoring, efficiency, and safety while utilizing cutting-edge technology and clever algorithms to autonomously maintain cleaning around the campus.

V. COMPONENTS

ARDUINO UNO

Arduino Uno is a widely used microcontroller board known for its performance in electronics and DIY projects. It is powered by ATmega328P microcontroller and runs at 16 MHz clock speed. The Uno has 14 digital input/output pins (6 of which are PWM-capable), and 6 analog input pins and operates at 5V, providing flexibility for a variety of applications. This microcontroller provides 32KB flash memory for program storage, 2KB SRAM for variable storage, and 1KB EEPROM for data storage. The USB interface allows easy connection to a computer for programming and power supply. Programmed using the Arduino IDE and based on open source principles, Arduino Uno remains a popular choice among electronics enthusiasts and professionals, offering users a convenient and flexible environment for different tasks.

ULTRASONIC SENSOR

Ultrasonic sensors are a key component of the campus cleaner bot's sensory system, providing crucial information about its environment. These sensors emit high-frequency sound waves beyond the range of human hearing, which bounce off objects in the bot's surroundings. By measuring the time it takes for these sound waves to return after hitting an object, the sensor can calculate the distance to the object with high accuracy. This enables the bot to detect obstacles in its path and navigate around them effectively. Ultrasonic sensors are particularly useful in situations where visual sensors may be obstructed or ineffective, such as in low-light conditions or when cleaning surfaces with varying textures. Additionally, they play a vital role in ensuring the safety of the bot and those around it by helping to prevent collisions and navigate through crowded environments.

CHASSIS AND WHEELS

The chassis of a vehicle serves as its structural framework, providing support for various components such as the engine, suspension, and body. It determines the vehicle's overall strength, durability, and handling characteristics. Meanwhile, wheels are crucial components that facilitate movement, providing traction and stability. Together, the chassis and wheels

form the foundation of a vehicle, ensuring its ability to navigate different terrains and perform optimally.

IR SENSOR

Infrared (IR) sensors are pivotal components used in various applications, including automotive technology. These sensors detect infrared radiation emitted by objects and convert it into electrical signals. In vehicles, IR sensors are commonly employed in systems such as proximity detection, obstacle avoidance, and automatic headlights. For instance, they enable parking assistance systems by detecting objects near the vehicle, aiding drivers in maneuvering safely. Additionally, IR sensors contribute to adaptive lighting systems, adjusting headlight intensity based on ambient light conditions and the presence of other vehicles. Their versatility and reliability make IR sensors indispensable in enhancing both convenience and safety features in modern automobiles.

VACUUM OR SUCTION MECHANISM

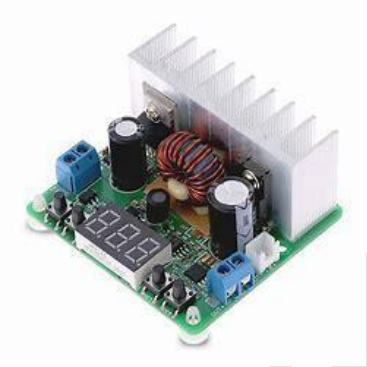
Vacuum or suction tubes are integral components in various systems, including automotive applications. In vehicles, they are commonly found in the braking system. In a vacuum brake system, for example, a vacuum tube creates negative pressure, which assists in the operation of the brake booster. When the driver presses the brake pedal, the vacuum created by the engine helps amplify the force applied, resulting in more effective braking. Additionally, vacuum tubes are utilized in other automotive systems such as HVAC (heating, ventilation, and air conditioning) controls and emissions control systems. Overall, vacuum or suction tubes play a crucial role in enhancing the functionality and performance of various automotive systems.

RELAY MODULE

A relay module is an electrical device that consists of one or more relays mounted on a single board with additional components such as transistors, diodes, and resistors. Relays are electromechanical switches that are used to control the flow of electricity in a circuit. The relay module provides a

convenient way to incorporate relays into electronic projects or systems. In automotive applications, relay modules are commonly used for controlling high-current devices or circuits. For example, they can be used to control the operation of headlights, horns, fuel pumps, cooling fans, and other electrical components in a vehicle. By using relays, lower power control signals from switches or sensors can be used to safely control these higher power devices without directly handling the high currents involved.

POWER MODULE



A power module is an electronic device that integrates multiple components, such as transistors, diodes, resistors, and capacitors, into a single package for the purpose of efficiently converting or regulating electrical power. These modules are designed to handle high power levels and are used in a variety of applications, including automotive systems.

WATER PUMP

A DC water pump is a device powered by direct current (DC) electricity that is used to move water from one place to another. These pumps are commonly used in various applications such as irrigation systems, aquariums, water fountains, and even in some residential plumbing systems where AC power may not be readily available or practical. They come in different sizes and capacities to suit different needs, and they offer advantages such as energy efficiency, quiet operation, and the ability to be powered by renewable energy sources like solar panels.

SPRINKLER AND WIPERS

Sprinklers are devices used for distributing water in a controlled manner over a designated area, commonly used for irrigation purposes in agriculture, landscaping, and gardens. They come in various types, including stationary, oscillating, and rotating, each suited for different coverage needs.

Wipers, on the other hand, typically refer to windshield wipers used in vehicles to clear rain, snow, or debris from the windshield for improved visibility while driving. They consist of a motorized arm with rubber blades that move back and forth across the windshield, often controlled by the vehicle's wiper system. Wipers are essential for safe driving in adverse weather conditions.

VI. CONCLUSION

The Product developed is definitely a very important product in robotics and floor cleaning area. 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 he hurdle detection in case of any obstacle that comes in its way. An automatic water sprayer is attached which sprays water for mopping purpose for the convenience of user. User can also operate this robot manually with the help of smartphone. It reduces the labor cost and saves time also and provides efficient cleaning. In automatic mode, the robot operates autonomously. The operations such as sweeping, mopping and changing the path in case of hurdle are performed automatically nevertheless, there are still new ideas to improve the developed system and to add new functionality to it.

The campus cleaning bot collected trash and debris on its own while successfully navigating pre-established paths throughout the campus. Its suction system successfully collected garbage into its storage chamber, and its sensors properly detected impediments and prevented collisions. The bot helped to create a more hygienic and clean campus environment by functioning dependably during both day and night shifts.

The viability and advantages of using autonomous robotic solutions for maintenance jobs at educational institutions were shown by the campus cleaner bot project. Campus workers saved time and resources as a result of the large reduction in the amount of physical effort needed for cleaning operations. Furthermore, the uniform operation of the bot enhanced the campus's general tidiness and aesthetic appeal, improving the wellbeing and contentment of students, staff, and guests. Optimizing route planning algorithms for more efficiency and adding new features, such the capacity to sort litter, could improve sustainability and lead to further advancements. In general, the campus cleaner bot has shown to be a useful tool for encouraging sustainability and tidiness on campus.

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