REVIEW PAPER ON SMART VACUUM CLEANER

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Abstract

In our survey, we found that cleaning is very important at home and workplace, from ancient times we come to know that cleaning is done by women. Also, women are upgraded by time, it seems that women play a crucial role in society, so they can't handle both home and work at the same time because it consumes time and energy. Later a vacuum cleaner is invented by Hubert Cecil Booth in year 1901. Which required a human to operate. In our survey, we also found that it is difficult for disabled and old people to clean houses on their own. Smart Vacuum Cleaner is introduced, which is helpful to people for cleaning houses. The smart vacuum cleaner has features like automatic control, remote control, and cliff-off edge. this smart vacuum cleaner is very helpful in saving time and energy. the size is small which is easy for Carrie and compared to another vacuum cleaner it has less cost.

I. Introduction

In the present era, the use of technology has increased, which makes human life easier in day-to-day life. Smart vacuum cleaners are also one of those technologies developed by humans to make human life easier in cleaning houses and industrial areas. The devices and technologies used to develop the smart vacuum cleaner are Arduino uno, Bluetooth, servo motor, and ultrasonic sensor. the design of a smart vacuum cleaner looks like a car, which has a vacuum cleaner on it and is attached to a long nozzle from which dust can suck. using Bluetooth technology. We can have different modes of connectivity to operate the smart vacuum cleaner, rechargeable batteries are used for power sources and additional features can be added to a smart vacuum cleaner, based on where it is being used like if the smart vacuum cleaner is being used outdoors, we can put solar panels for reaching purpose. The size is also small and saves energy and time, very cost-effective

II. Literature survey

The paper presents the plan and execution of a smart autonomous floor cleaning and wiping robot controlled via an Android application. The robot can operate autonomously or be controlled remotely through the Android app via Bluetooth connectivity. The system consists of components like rechargeable batteries, motors, vacuum fans, water pumps, and sensors including ultrasonic, infrared, and cliff sensors. The Android app features a user login system for secure access and provides controls for directing the robot's motion for cleaning tasks. Testing confirms the robot's functionality, including obstacle detection, autonomous navigation, vacuuming, and mopping.[1].

The study presents the design and development of a smart vacuum cleaner capable of operating in both remote control and automatic modes. In the remote-control mode, users can control the vacuum cleaner using an Android smartphone, adjusting motor speed and direction as well as activating the suction motor. This mode also includes features such as monitoring battery voltage and sending SMS alerts to users when the battery is low, preventing sudden shutdowns and extending battery life. In the automatic mode, users can schedule cleaning times via text message, and the vacuum cleaner operates autonomously, notifying the user upon completion. The system is equipped with various components including Arduino Pro Mini, motor driver, HC-06 Bluetooth module, Sim800L module, LM2596 DC/DC converter, and rotary encoder module.[2].

The paper presents the development of an automatic floor cleaning robot utilizing Arduino Uno microcontroller, Ultrasonic Sensor, Motor Shield L298, Servo, and DC Motor. The robot operates by detecting obstacles with the ultrasonic sensor, and when an obstruction is detected, it navigates in a direction free of obstacles. The testing of the

ultrasonic sensor revealed different conditions based on distance readings, where the robot stops when the distance is less than 15 cm. [3]

The paper discusses the increasing significance of photovoltaic (PV) energy in the renewable energy sector and the challenges posed by dust accumulation on solar panels, leading to decreased efficiency. Various strategies for solar panel cleaning, including automated cleaning robots, are explored. The improvement of a sunlight powered charger cleaning robot utilizing Arduino. Which incorporates a microcontroller-based dust cleaning framework, ultrasonic sensor for distance measurement, water pump, and brushes for cleaning. The effectiveness of the robot is demonstrated through experiments showing significant improvements in power output after cleaning.[4]

The paper discusses the development of a fully automatic floor cleaner designed to address the limitations of traditional cleaning methods and expensive robotic cleaners. The proposed cleaner integrates wet and dry-cleaning capabilities along with UV sterilization for germ removal. It utilizes Arduino Uno microcontroller for control and coordination of various components including ultrasonic and IR sensors for obstacle detection, DC motors for motion, and a UV lamp for sterilization. The design aims to reduce costs while providing efficient and versatile cleaning functionality. The cleaner's operation involves autonomous navigation, sweeping, wet cleaning, and UV sterilization, enhancing its applicability in various settings including households, hospitals, and industries. The paper introduces the concept of a "Smart Floor Cleaning Robot" designed to automate the process of cleaning floors in homes and various institutions. The proposed robot expects to resolve this issue by giving an independent cleaning arrangement that can be controlled remotely through a Wi-Fi module. It incorporates a mini vacuum cleaner for dust removal and a motor-based mop for wet cleaning using water. Additionally, the robot utilizes ultrasonic sensors to detect obstacles and ensure safe navigation. The system's design involves Arduino Uno microcontroller and L293D motor shield for motor control. The hardware includes geared motors for movement, cleaning mop, vacuum cleaner, and ultrasonic sensors for obstacle detection. The proposed system is capable of autonomous cleaning while providing obstacle detection data through NodeMcu connected to Thing Speak. Calibration and coding for the ultrasonic sensor ensure accurate obstacle detection, and the experimental results demonstrate successful cleaning performance in a room environment.[6]

The introduction of Smart Vacuum Cleaners addresses the growing need for automated cleaning solutions in modern households and workplaces, especially for individuals with demanding schedules. These cleaners utilize advanced technology to autonomously navigate and clean floors, reducing the reliance on manual labor and increasing efficiency. With features such as obstacle detection and avoidance, battery level indication, and remote control via applications, they offer convenience and ease of use. And allowing for remote control and monitoring of vacuum cleaners through mobile applications. The methodology involves the integration of hardware components such as ultrasonic sensors, motor drivers, Wi-Fi modules, and vacuum cleaners, controlled by a microcontroller. [7]

The project introduces a dual-mode robotic vacuum cleaner designed to clean floors automatically or manually, catering to the busy lifestyles of modern times. In the automatic mode, the robot navigates the floor using ultrasonic sensors to detect and avoid obstacles, while in manual mode, it follows commands from an Android-based smartphone via Bluetooth control. This innovation aims to simplify cleaning tasks and address challenges in areas where human presence may be dangerous. The project utilizes Arduino Uno as the control center, along with components such as ultrasonic sensors, Bluetooth HC-05 module, and DC motor driver IC L293d to regulate the robot's movements. The software used for development is Arduino IDE, which supports programming languages C and C++.[8]

The project introduces an autonomous robotic vacuum cleaner designed to clean surfaces automatically or manually, offering three different modes of operation: manual, automatic, and timer mode. The system comprises three main units: obstacle detection and avoidance, cleaning, and control. The obstacle detection unit utilizes an ultrasonic sensor to detect obstacles and adjust the robot's direction accordingly. The cleaning unit includes both wet mopping and vacuum cleaning functionalities. The control unit facilitates communication between the user and the robot via a smartphone app, allowing for easy operation and mode selection. Hardware components such as Node MCU ESP8266, ultrasonic sensor, and L293D motor driver are used to implement the system. The Node MCU enables IoT capabilities, allowing the robot to be controlled remotely via the smartphone app. The software aspect involves the development of a smartphone application using the Blynk platform, providing users with intuitive controls for operating the robot in different modes and cleaning types.[9]

The project aims to develop an Arduino-based smart vacuum cleaner that operates autonomously, detecting obstacles and cleaning areas without human intervention. By integrating components like Arduino UNO, motor shield, ultrasonic sensor, and servo motor, the vacuum cleaner can navigate its environment and clean efficiently. The workflow involves measuring distances, detecting obstacles, and adjusting the robot's movement accordingly. Key components include wheels, motor shield, Arduino uno, ultrasonic sensor, servo motor, and batteries. The Arduino IDE is used for software development.[10]

III. Requirements

These are common parts used in all literature survey

Hardware

1) **Arduino uno:**
2) The Arduino Uno is a microcontroller based board in light of the ATmega328 (datasheet), consisting of 14 computerized input/output pins , 6 are analog pins and 6 can be utilized as PWM output, a 16 MHz earthenware resonator, a USB connection, a power jack, an ICSP header, and a reset button.

3) **Ultrasonic sensor:**
An ultrasonic sensor is a in tool that actions the equidistant to an article utilizing ultrasonic sound waves. A ultrasonic sensor utilizes a transducer to send and get ultrasonic beats that move back data about an item's vicinity.

4) **Bluetooth module:**
Bluetooth module is a essential circuit set of chips which coordinated Bluetooth capabilities and it can be utilized in remote organization carry . By and large, the Bluetooth module also isolated into the following: information transmission module, controller module.

5) **Servo motor:**
A servomotor is a rotating actuator that considers exact control of precise , speed, then speed increase in a mechanical framework

6) **Batteries**
7) **DC gear motors / wheels**
8) **12v DC motor / vacuum cleaner**

Software

1) **Arduino IDE:**
Arduino Integrated Development Environment (IDE) which is open-source IDE which permits clients to compose code and transfer it to any Arduino board. Arduino IDE is written in Java and it viable with Windows, macOS and Linux (OS)

IV. Methodology

Figure 4.1 represents the block diagram of common prototype of smart vacuum cleaner. Power supply is directly connected to motor shield and 12v DC motor and Arduino uno, ultrasonic sensor, servo motor, 4 DC gear motor / wheels are connected to motor shield. Ultrasonic sensor, servo motor work is to avoid the obstacles, motor shield helps in navigation and direction of wheels, Arduino uno controls everything, according to the code that uploaded.

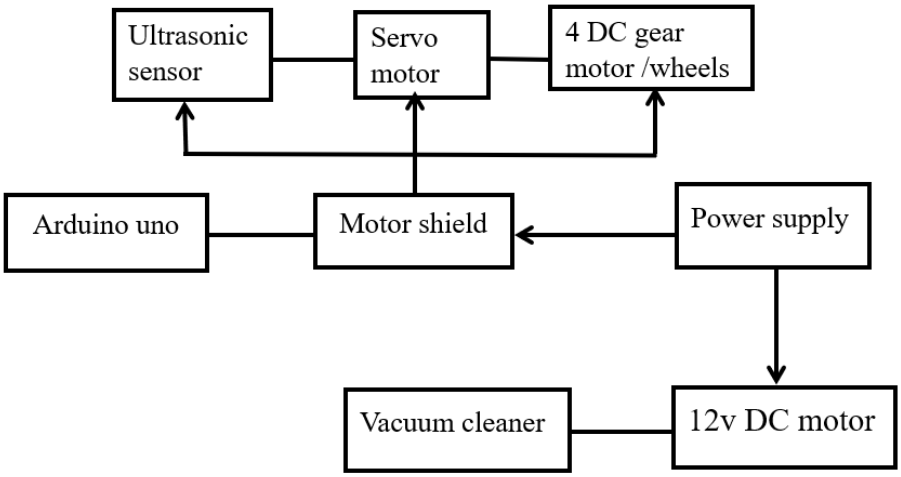

Fig 4.1 Block diagram

Algorithm

Randam walk algorithm is use. An random walk is known as an arbitrary cycle which depicts a way remembering a progression of random strides for the numerical space. It has progressively been well known in different trains like math and software engineering.

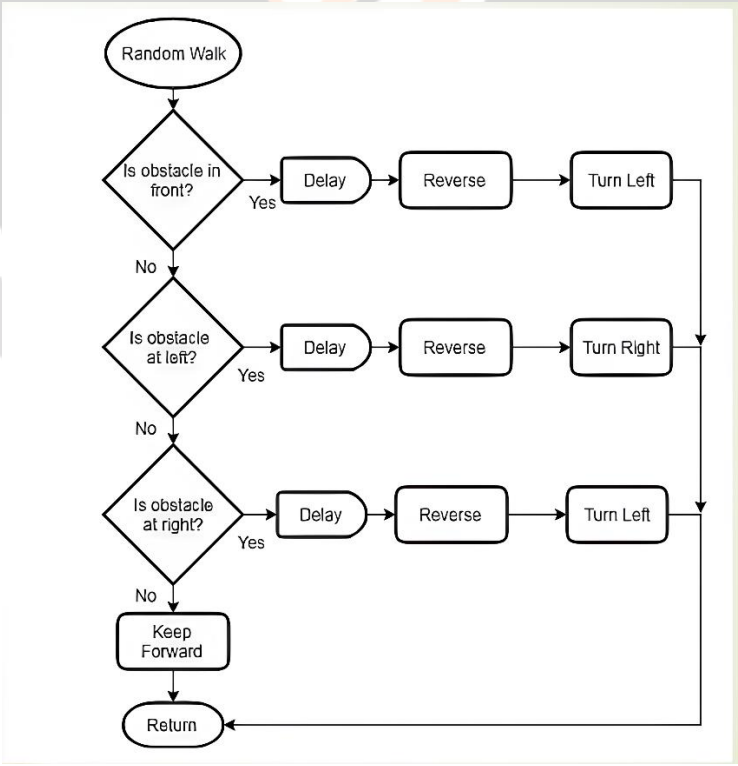

Fig 4.2 Random walk

Figure 4.2 is a flow chart of the Random walk algorithm, it detects the obstacle in front it turns left, the obstacle is in left it trun right, the obstacle is in right it turns left, there is no obstacle it keeps forwarding .this is how randam walk algorithm works

V. Conclusion

The evolution of cleaning technology, particularly the advent of smart vacuum cleaners, has significantly impacted household and industrial cleaning practices. This literature survey highlights the development and implementation of various smart vacuum cleaner designs, each utilizing a combination of hardware components such as Arduino Uno, ultrasonic sensors, Bluetooth modules, servo motors, and rechargeable batteries, along with software programming in Arduino IDE. The introduction of smart vacuum cleaners addresses the increasing demand for automated cleaning solutions in modern society, offering features such as autonomous navigation, obstacle detection, remote control via mobile applications, and scheduling capabilities. These advancements not only simplify cleaning tasks but also cater to individuals with busy schedules, disabilities, or old age who may struggle with manual cleaning. The methodology involves the use of a random walk algorithm for navigation, where the cleaner adjusts its direction based on obstacle detection. The significant advancement in cleaning technology, offering efficiency, convenience, and accessibility to users. With further research and development, incorporating additional features and enhancements, smart vacuum cleaners have the potential to revolutionize cleaning practices in both domestic and industrial settings, improving overall cleanliness and hygiene standards.

VI. References

[1] Anshu Prakash, Murdan Pawan, Kumar Ramkissoon, “A smart autonomous floor cleaner with an Android-based controller”, November 2020, DOI:10.1109/ELECOM49001.2020.9297006 Conference: 2020 3rd International Conference on Emerging Trends in Electrical, Electronic and Communications Engineering (ELECOM)

[2] Amir Talebi, Tahere Pourseif, Rozhina Esmaeil Nezhad, Mina Mohajeri ,“ Smart Vacuum Cleaner in Two Modes of Remote and Automatic”, July 2020 Research Journal of Engineering and Technology 07(07):5291-5298

[3] Yuda Irawan , Muhardi , Rian Ordila , Roni Diandra, “Automatic Floor Cleaning Robot Using Arduino and Ultrasonic Sensor”, Journal of Robotics and Control (JRC) Volume 2, Issue 4, July 2021ISSN: 2715-5072 DOI: 10.18196/jrc.2485 240.

[4] Faridah Hanim, Muhamad faizal Yaakub, Ili Najaa Aimi Mohd Nordin, Norain SahariDevelopment of solar panel cleaning robot using Arduino September 2020, Indonesian Journal of Electrical Engineering and Computer Science 19(3):1245, DOI:10.11591/ijeecs.v19.i3.pp1245-1250, License, CC BY-NC 4.0.

[5] Akanksha Vyas, Satyam Chourasia, Shubham Antapurkar, Raghvendra PrasadARDUINO BASED DRY & WET AUTOMATIC FLOOR CLEANER, April 2020, International Journal of Engineering Technologies and Management Research 5(2):14-18, DOI:10.29121/ijetmr.v5.i2.2018.607, License, CC BY 4.0

[6] Indronil Dey Niloy, Sayed Mohaiminul Hoque, Mashfiqul Hoque, Afif Bin ArfanSmart Floor Cleaning Robot, September 2023, DOI:10.1109/TENSYMP55890.2023.10223665, Conference: 2023 IEEE Region 10 Symposium (TENSYMP)

[7] M. Vijayalakshmi, Bhargavi Baljoshi, G. Lavanya, Gouri MasterSmart Vacuum Robot, May 2020, DOI:10.1201/9781003052098-10, In book: ICT for Competitive Strategies (pp.8190)

[8] Mrs.Y.Jyothi, P.Laxmi Prasanna, P.Vidya Sagar3, K.Uma4, P.Chandra Mahesh5, K.H.S.M.Sai , ROBOTIC VACCUM CLEANER, International Conference on Recent Trends in Engineering & Technology- 2023 (ICRTET-3), Orga Volume: 10 Special Issue: | Apr 2023 www.irjet.net p-ISSN: 2395-0072 , e-ISSN: 2395-0056

[9] Swati Patil, S R Yelmar, S R Yedekar, S S Mhatr, Autonomous Robotic Vacuum Cleaner, April 2021, DOI:10.47001/IRJIET/2021.504021

[10] Triveni., C Lalhmachhuana., R Lalrinsanga., Rebecca Lalrinzuali ,Vanlalrinchhana, Arduino Based Smart Vacuum CleanerJETIR July 2023, Volume 10, Issue 7 www.jetir.org (ISSN-2349-5162)