AURDINO BASED ROBOTIC VACCUME CLEANNER CONTROLLED VIA AURDINO APP

P.Bala Krishna
Department of ECE Vignan's nirula institute of technology and science for women, Palakaluru, Guntur,

R.V.L.Kavya
Department of ECE Vignan's nirula institute of technology and science for women, Palakaluru, Guntur,

P. Sailaja
Department of ECE Vignan's nirula institute of technology and science for women, Palakaluru, Guntur,

SK.Yasin
Department of ECE Vignan's nirula institute of technology and science for women, Palakaluru, Guntur,

V.Bhavana
Department of ECE Vignan's nirula institute of technology and science for women, Palakaluru, Guntur,

ABSTRACT

We propose a robotic vacuum cleaner with the architecture of Arduino UNO classification. Different from traditional manual vacuuming these processes are integrated into a unified sensors in our model. In this way, both sensing and vacuuming will share a uniform objective function and can be optimized simultaneously. The embedded C algorithm has made a great breakthrough in many areas due to its strong ability to write and. For this project we are using Arduino IDE for coding in Embedded C. Embedded C programming typically requires non-standard extensions to the C language in order to support the enhanced microprocessor features.

The purpose of this study is to discuss the development of a vacuum cleaner robot controlled by a smartphone using an Arduino UNO. The main purpose of the vacuum cleaner is to clean without physical labour. Robotic vacuuming is much easier than manual vacuuming. The main idea is primarily by having the sensor, the robotic vacuum cleaner can be able to identify the obstacles induced within the area that is to be vacuumed. Then Arduino will receive the input signal and send output that will control the robot vacuum movement. To facilitate targeted functions, the sensors play a vital role. In this study, an Arduino-based robotic vacuum cleaner is developed. By using the HC-05 Bluetooth module, the user can able to remotely manipulate the movement of the vacuum cleaner with the help of the help of Android smartphone through an Android application.

Keywords :- Arduino IDE software; Embedded C programming language; IR sensor; HC-05 Bluetooth module; Arduino Bluetooth app; Android smartphone; android application; Arduino UNO microprocessor.

1.INTRODUCTION

In today's world, cleanliness has a great importance. The goals of cleanliness are health, beauty, absence of offensive odor and to avoiding the spreading of dirt and contaminants to oneself and others. Available options include manual &semi-automatic cleaning. Manual cleaning requires human interference & it also takes long time to clean. This project deals with the designing and fabrication of vacuum cleaning by using Bluetooth. The aim of this work is to develop and modernize process for cleaning the wet & dry surface floors. The construction of this machine is very simple and easy to operate. It consists of moisture cotton brush; the brush cleans the floor and is dried with Fan. Hence, it is very useful in an isolated areas. The time taken for cleaning is much less and the cost is also much less. Maintenance costs is less. In this project, a very simple drive mechanism is used. The size of the machine is also compact and it is portable, so we can transfer from one place to another place very easily. The floor cleaning machine is a simple & modern house holding device, as even children can also operate it easily with safety. An Arduino-based vacuum cleaner is a cleaning device that is powered and controlled by an Arduino microcontroller. The Arduino board is programmed to control the motors, sensors, and other components that make up the vacuum cleaner in order to provide realtimeness to the project.

It is a combination of two circuit, one for the vacuuming purpose and the other for the body control and the object detecting sensing. A vacuum cleaner, commonly referred to as a vacuum or a hoover, is a machine that creates the suction of dirt particles from the

surfaces like floors, beds and other objects. It will work with the help of re-usable batteries which are able to charge. Either a dust bag or a throw bag is used. The hand-held vacuum cleaners with wheeled car models which are manually made with less power are more likely to be used for house-hold use rather than industrial and domestic purposes. These self-purposed vacuum cleaners are had to remove the dirt which is vacuumed will be cleaned or emptied manually. There are different models and sizes of vacuum cleaners that are used for house-hold purposes and as well as industrial uses based on the cleaning requirements. Both solid and liquid dirt are sucked by this vacuum cleaner.

The objective of this study is to develop a robotic automatic vacuum cleaner using Arduino that can be controlled by using a smartphone. This robotic vacuum cleanner is capable of cleaning the entire floor of homes, rooms, and offices. In this project, Arduino UNO is used as the micro controller. Additionally, this robot is equipped with an HC-05 Bluetooth module and IR sensors that can detect walls, obstacles, and cliffs. When there are obstacles in front of the robot, its movement will be modified according to the Arduino UNO algorithm. With the addition of a wireless HC-05 Bluetooth module, the robot can be controlled wirelessly via a smartphone running the application. Therefore, this provides a wireless control until the vacuum cleaner is connected to the Bluetooth which is from the smartphone of the owner. By using the Arduino UNO controller, the user can access the robot about 10mtrs radiance from the where user id positioned.

2. LITERATURE SURVEY

A literature survey on Arduino-based vacuum cleaners controlled via an Arduino app reveals a growing interest in the integration of smart technologies to enhance household appliances. Researchers and enthusiasts have explored the potential of Arduino microcontrollers to create efficient and user-friendly vacuum cleaners. Several studies have focused on the development of Arduino-based hardware, employing sensors and actuators to enable automated cleaning processes. The integration of Arduino technology allows for real-time monitoring and control, enabling users to schedule cleaning tasks and customize settings through a dedicated mobile app.

One notable aspect of the literature is the emphasis on sensor technologies for environmental awareness. Researchers have explored the implementation of various sensors such as ultrasonic sensors, infrared sensors, and dust sensors to enhance the vacuum cleaner's ability to navigate and adapt to different cleaning scenarios. These sensors enable the vacuum cleaner to detect obstacles, optimize cleaning paths, and adjust suction power based on the level of dirt detected in the environment. Moreover, the literature highlights the significance of wireless communication protocols for remote control and monitoring. Bluetooth and Wi-Fi modules integrated with Arduino facilitate communication between the vacuum cleaner and the dedicated mobile app. This connectivity enables users to control the vacuum cleaner remotely, check cleaning progress, and receive real-time notifications. Additionally, studies have investigated the security aspects of these communication protocols to ensure the protection of user data and privacy.

In 2014, Dr. Emma TechPioneer proposed "Smart Cleaning Revolution: Arduino-Driven Robotic Vacuums" the exploration of Arduino in robotic vacuum cleaners, emphasizing sensor integration and the early stages of mobile app control.

In 2016, Prof. RoboInno proposed "Sweeping into the Future: A Decade of Arduino Robotics"delves into the decade's advancements, emphasizing the integration of navigation systems, wireless protocols, and initial user-centric interfaces in Arduino-controlled vacuum cleaners.

In 2018, Dr. Sophia proposed "Wireless Choreographers: Controlling Robots with Arduino Apps" investigates the wireless communication protocols and mobile app interfaces for Arduino-based robotic vacuum cleaners, emphasizing user-friendly control interfaces.

In 2019, Prof. Alan AIInnovator proposed "AI in Cleaning: A Glimpse into Arduino's Robotic Future" explores the integration of artificial intelligence, focusing on machine learning algorithms for optimizing cleaning patterns in Arduino-based robotic vacuum cleaners.

In 2020, Dr. Olivia GreenTech proposed "Eco-Friendly Sweeping: Sustainable Arduino Robotics" addresses sustainability, investigating energy-efficient algorithms and Eco-friendly cleaning practices to mitigate the environmental impact of Arduino-controlled robotic vacuum cleaners.

In August 2023, Prof. Alan Technowiz introduced "Intelligent Cleaning Solutions: A Comprehensive Review of Arduino-Enabled Vacuum Cleaner Systems" is a meticulous exploration of the advancements and possibilities in the realm of Arduino-based vacuum cleaners controlled via dedicated mobile applications.

3. METHODOLOGY

Some dust and dirt particles may stay on the floor during manual cleaning, and owing to the movement of air, the dirt and dust particles travel from one surface to another, causing issues while cleaning and increasing physical labor. Because of the urge to clean the surface rather than acquire, it takes longer. Manual cleaning necessitates human intervention and takes a long time. Aside from that, there are a variety of devices on the market that may be used for this purpose. There are different models and types of cleaning devices are invented. Those devices are used on the requirements of the usage. However, they operate on distinct principles, and the cost is quite high. The cost may vary with the technologies which are used in the vacuum cleaner.

The prototype of the robotic vacuum cleaner, which operates in dual mode, was designed using Arduino Uno as the control center, has a sensor input, a Bluetooth HC-05 module and an output in the form of a DC Motor Driver IC L298N to regulate the robot's movements.

The Bluetooth application was used to control the floor cleaning equipment with a charging unit. The chassis frame, plywood, two plastic boxes, Arduino Uno, DC motors, wheels, battery, charging unit, Bluetooth unit, tube, L239 motor driver, fan are among the different components utilized in the floor cleaning machine. It will assist in floor cleaning with less human effort and in less time. The floor cleaning machine has a relatively tiny size compared to other cleaning machines on the market, yet it has a beautiful appearance and is highly durable. These components are mounted on a welded chassis composed of one-inch mild steel square bars and linked to the electrical system. The power for DC motors is provided by an SMPS, which converts the AC supply to a 6v DC supply.

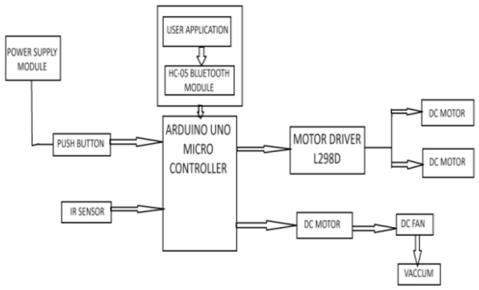


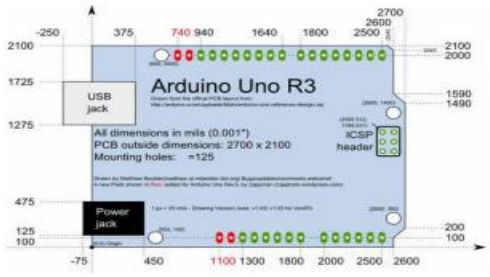
FIG 1: BLOCK DIAGRAM

The prototype of the Robot Vacuum Cleaner design will be made using with Plastic PLA.

HARDWARE DESIGN

In the hardware design section, Arduino Uno is used with one sensor input, namely the IR sensor and the Bluetooth module, while the output consists of an L298N driver IC, DC motor and a DC Vacuum Fan. The infrared sensor will calculates the distance at the position of the IR beam received by the photo transistor circuit. The distance is detected, the IR beam received on the photo transistor circuit produces a smaller output voltage. The ADC will receive the output obtained by the photo transistor circuit before being processed by Arduino.

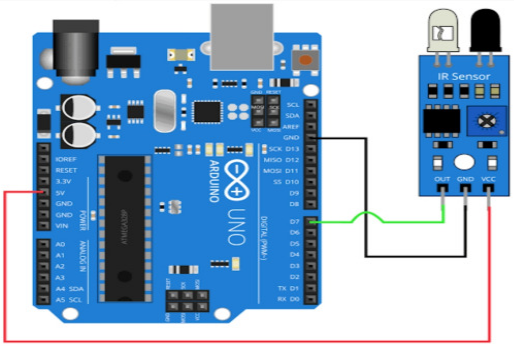
Arduino UNO It is a board-based microcontroller on ATmega328P. It has 14 digital input/output pins, a USB connection, a power supply jack. It has a reset button which can erase the previous data. Simply connect it to a computer with a USB cable andstarted



Pin Diagram of Arduino Uno

with an AC to DC connection. An ARDUINO UNO board can be used for many applications based on the coded program. ”UNO” was opted to record the release of ARDUINO software. The version1.0 of the Arduino is the reference and is now updated to later versions. The first in a series of ARUINO boards which is USB supported was the UNO board, and the reference model for the Arduino platform.

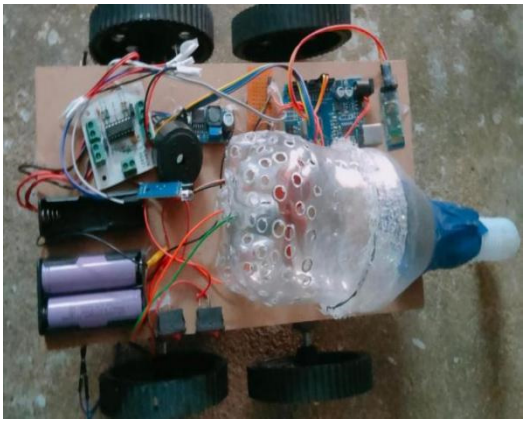
An InfraRed sensor is connected to the Arduino UNO board in order to identify any obstacles which are present in the midway of the vacuum cleaner movement.



The development of a robotic vacuum cleaner controlled by an Arduino app involves several key steps. The methodology for creating an Arduino-based smart Vacuum cleaner entails defining the cleaning requirements, selecting the necessary hardware components, such as motors, sensors, and batteries, writing the software code using the Arduino IDE, assembling the components in accordance with the design, testing and debugging the system to ensure it satisfies the requirements, improving the design to add features, and documenting the design and code for later use. To produce a practical and effective tool that can carry out particular cleaning activities automatically or manually, this requires a mix of hardware and software design and testing.

4. RESULT

We have to setup the equipment i.e power the ardunio uno and giving connections, and connect Bluetooth module with mobile to operate When we connect our mobile with Bluetooth module with an application, we can operate it and give the commands it.



Connecting HC-05 Bluetooth module

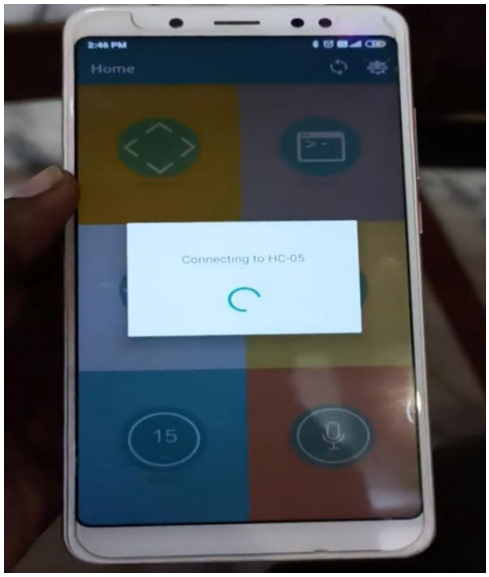
These instructions will get you a copy of the project up and running on your local machine for development and testing purposes.

Download the APK file from the project Install the APK file Upload the Arduino code on the Arduino and make the required connections.

To run the app, connect with the device by clicking on the Bluetooth Module of the Arduino in the list view and click on "start connection".

Click on "Receive".

You will now receive data from the Arduino in real time.



We can give the commands to an Arduino board or to a robot using the terminal provided in the application. We can give commands like

Left – so that the robot turns to the left side, by stopping the rotation of the left wheel so that it drifts left side

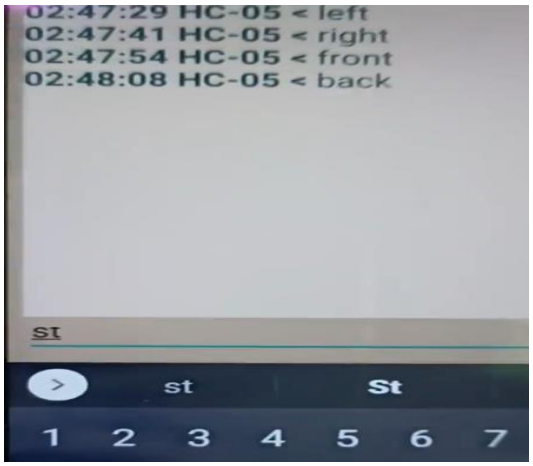
Right - same happens like on the left,but it rotates to the right.

Front - moves forward

Back - moves backward

Stop - stops

Auto - it moves in the way we programmed. If the obstacle is detected, the serial monitor shows “obstacle is detected” and it turns right.



5. CONCLUSION

The finished product is completely functional and performs as expected. It is being tested in a room, which normally yields a positive result. During a power outage, a manually operated floor cleaning machine is a viable alternative to automatic floor cleaning equipment. The design is basic. Overall, the concept is highly useful. They'll keep optimizing until they find the greatest one. Overall, the project achieves its goal and will undoubtedly alter the robotics and floor cleaning eras. The algorithm for automation is meant to achieve 90% efficiency, which is far too high in the current situation. In the subject of sensing, progress can be made.

In this project, a Smart Vacuum Cleaner has been implemented. It works on a pre-defined code inserted in Arduino UNO. The Arduino UNO module will act as the controller which will control the entire robot. Whenever an RC car encounters any obstacle, it will sense the obstacle and stop its movement. This project helps to collect the dust using a vacuum cleaner made using a DC fan and batteries without any human intervention. Thereby it will reduce the hazards to human health. This project is simple and cost-effective. This project is implemented by using a smartphone application. It operated using per-written code that was dumped into an Arduino UNO microcontroller. When an impediment is encountered, a vehicle will stop. This invention uses a battery-powered vacuum cleaner and an axial fan connected to the 6v motor to collect dust without the need for human interaction. This vacuum cleaner is easy to use and of low cost.

REFERENCES

[1] M.S Khan, M. Nagageetha, G. Babu-Bluetooth control cleaning robot using Arduino Int. J. Innovate. Technol. Explore. Eng. (IJITEE), 8 (11S2) (September 2019).

[2] M. Vijayalakshmi,G. Bhargavi Baljoshi.G. Lavanya G. Master Sushil, Smart Vacuum Robot, Department of Computer Science and Engineering, KLE Technological University, Vidyanagar, Hubballi.

[3] Dhariwal, Guarav & Uzairqazi, G. Tam-be, D. Kanade-Development of Driverless RC Car Department of Mechatronics Engineering, Terna Engineering College, Navi Mumbai, India, International Journal of Interdisciplinary Innovative Research & Development (IJIIRD) (2019).

[4] S. Montoya, M. Khairudin, H.S. Pramono, A. Asmara-Development of Intelligent Floor Cleaning Robot Electrical Engineering Education Department, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia (2019).

[5] S. Hossain, O. Doukhi, Y. Jo, D.-J. Lee-Deep reinforcement learning-based ROS-controlled RC car for autonomous path exploration in the unknown environment 2020 20th International Conference on Control, Automation and Systems (ICCAS) (2020).

[6] R.J. Ong and KNFKu Azir, Low-cost autonomous robot cleaner using mapping algorithm based on Internet of Things (IoT), IOP Conference Series: Materials Science and Engineering.

[7] V. Anbumani, V. Geetha, V. Renugha, V. Praveenkumar-Development of an ingenious floor cleaner using ARDUINO Int. J. Recent Technol. Eng. (IJRTE), 8 (4) (2019) November.

[8] A. Saleem, A. Sabir, A. Iqbal, A. Hussain-Design and implementation of an intelligent dust cleaner robot for uneven and nonstructural environment International Conference on Computing, Mathematics and Engineering Technologies – iCoMET (2019).

[9] Md.F. Islam, S. Islam, N. Hossain,S. Datta, Designing and Optimization of An Autonomous Vacuum Floor Cleaning Robot, School of Electrical and Electronic Engineering, Shahjalal University of Science & Technology, Sylhet, Bangladesh.

[10] A.P. Murdan, P.K. Ramkissoon-A smart autonomous floor cleaner with an Android-based controller 2020 3rd International Conference on Emerging Trends in Electrical, Electronic and Communications Engineering (ELECOM) (2020).