DESIGN AND DEVELOPMENT OF AN AUTONOMOUS SANITIZATION ROBOT WITH VOICE INTERACTION

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Abstract:

The simplicity and potency of the concept behind this wireless, Bluetooth-controlled floor-cleaning device will surprise you. It is mostly made up of DC motors wired together in a wheeled plastic container with a cleaning solution on top and a scrub attachment at the bottom via one of the motors. The brush cleans and dries the floor with the assistance of the CPU fan. Anyone can run this gadget. As a result, it is especially useful in homes, hospitals, and other similar settings. The Bluetooth module is used to control the entire system with the help of a remote control or a mobile device. A mobile application is available to facilitate Bluetooth communications between the system and the smartphone. The system may be controlled and rotated. It works well and can be controlled manually for the user's convenience. Cleaning is made easier and more enjoyable, and everyone can build something rather than buy it. Interior design is becoming increasingly significant in our daily lives. Floor cleaning is vital for our health and minimizes the amount of manpower required. As a result, our project is quite beneficial in our daily lives.

Keywords: Automatic; floor cleaning machine; Bluetooth; prototype

1. Introduction:

The design and construction of a floor-cleaning machine are the topics of this essay. The purpose of this study is to create a more contemporary method for wet and dry floor cleaning. For washing the floors, it is quite helpful. It is usable both wet and dry. A floor cleaning system is particularly helpful for cleaning floors in hospitals, homes, auditoriums, stores, and computer centers, among other places; it is also quite straightforward to design and use. This machine is simple enough for anyone to use. It consists of a damp cotton brush that cleans the floor and is dried using a small blower. Therefore, it is highly beneficial in homes, hospitals, etc. Cleaning only requires a very small amount of time and money. The expense of maintenance is less.

2. Concept Description:

Here's a highly inventive and clever build that can replace the task of washing the floor using only items you can easily find at home. You'll be astounded by the concept's simplicity and usefulness—it's a Bluetooth-controlled cordless floor-cleaning device. Essentially, it is a wheeled plastic container with DC motors wired inside of it. A cleaning solution is placed on top, and the scrub is connected to one of the motors from the bottom. The system looks like a robot assistant at work and operates flawlessly. enables anyone to build something rather than buy it, which undoubtedly makes cleaning easier and more enjoyable.

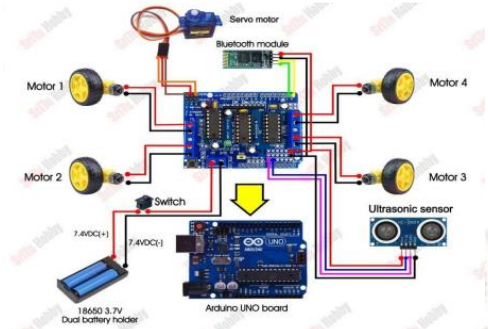
Many innovative enterprises and activities have used wireless and radio technologies as their foundation. The modern consumer wants items that are convenient, small, and usable anytime and anywhere. The use of wireless technology may be the answer to society's demands or desires. The topic of this research will be cutting-edge wireless technology like Bluetooth. This project provides an in-depth look at how various technologies are currently being employed. By doing this, the project will go over how Bluetooth technology functions, its history, context, and use.

3. Block Diagram

The cleaning solution is properly diluted before being poured into the reservoir through the top opening. The cleaning agent is placed in the tanks until they are full. The valve is opened by pulling the lever. The tank's cleaning solution leaks onto the ground. The lever is released, and the machine is turned on after the required amount has been supplied. Through pulleys and belts, the motor drives the brush. When the adjuster rod is unscrewed and the handle

is moved in the necessary direction to clean a large enough area, the brush applies pressure to the floor. Once more, the lever is pulled to dispense cleaning solution as needed. The floor is thoroughly cleansed as this procedure is repeated.

CIRCUIT DIAGRAM



The cotton brush provides a clean surface finish and shines while preventing harm to marble and mosaic floors. For cleaning purposes, this project is completely unified. It has the elements required for floor cleaning, including a water supply, scrubber, and fan. It is a mechanical device with wheels and a control for movement. This floor-cleaning equipment is made up of several DC motors that power the wheels and revolving brushes. The motor wiring is carefully constructed, taking into account how the wheels are configured and how two dual two-way switches are used for control.

A pushbutton is also used to turn the revolving objects, known as scrubs, on and off. Additionally, perforations and a gat valve are incorporated into the plastic tubing to control how much cleaning solution is released into the floor. After the scrapes, it features two CPU fans for drying the scrubbed floor area. The machine is wired via LAN cables that are attached to its controller, and the controller is connected to a 12-volt power source.

BLOCK DIAGRAM

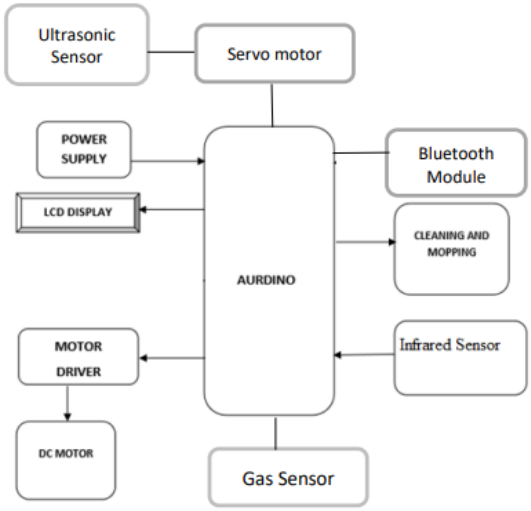


Fig 1. Block diagram of the proposed model

This document is useful for a variety of floor-cleaning tasks. Taking into account the size and accessibility of the floor that needs to be cleaned, this floor cleaning equipment can manage a large volume of cleaning work.

Fig 2. Hardware Prototype

a) DC gear motor

A geared DC motor is employed in this work. A "gear motor" may be an AC or DC motor paired with a gearbox; a DC motor is not the same as a "gear motor." When designing a motor for a specific use, a gear motor entails adding mechanical gears to the motor. This kind of addition typically works to enhance torque while decreasing speed. As an extension of DC motors, geared DC motors can be referred to. A gear assembly is connected to a DC motor in a geared motor.

Fig 3. B O Motors

RPM, which stands for revolutions per minute, is the unit used to measure motor speed. The gear assembly contributes to a reduction in speed and an increase in torque. The speed of a gear motor can be decreased to any desired value by using the right gearing. Gear reduction is the idea that a vehicle's speed can be decreased while its torque can be increased. This insight will go over all the important and little components that go into creating a gearhead and, ultimately, how a geared DC motor operates.

b) External Structure

An electric motor, gears, or a gearbox are all combined into a gear motor. The use of a gear motor makes it easier to integrate a motor and gear reducer system. To reduce the motor's speed while boosting its output torque, gears are used with motors. A coil of wire that can freely rotate between two magnetic poles that are in opposition to one another can be used to create a basic electric motor. The coil senses force and moves when an electric current travels through it. At first glance, a DC-geared motor appears to be a straightforward development of the simple DC ones. The motor's lateral view reveals the gearhead's outside protrusions. To attach the motor to the other components of the assembly, a nut is inserted close to the shaft.

Additionally, the shaft has an internally threaded hole that can be used to attach accessories or extensions, like wheels, to the motor.

4. Bluetooth Module

Bluetooth is a 2.4 GHz ISM-band open industry standard for short-range wireless communication that supports both speech and data transfer (up to 3 simultaneous voice connections using SCO links in a piconet or up to 723 kbps over an ACL link). The SEMCO-Bluetooth Modules, which include RF, baseband, and link management protocols in addition to Host Controller Interface (HCI) and HCI-UART capability built by Bluetooth standard version 1.1, are presented in this paper. SEMCO-Bluetooth Modules are created to be used as an all-purpose Bluetooth module that complies with Bluetooth version 1.1, The majority of us have become bogged down in the intricacies while attempting to determine which cable belongs where. In essence, Bluetooth seeks to resolve this issue. This technique is seen as a cable replacement.

a) Short Range Wireless

Between computing and communication equipment, there are several short-range digital connections; presently, most of those communications occur across cables. These connections connect to several devices utilizing a wide range of connectors with numerous permutations of shapes, sizes, and pin counts; the user may find the abundance of cables to be extremely onerous. Using radio waves to send and receive data, Bluetooth technology enables this technology to communicate wirelessly through a single air interface. As a result of its relatively low power consumption and specific design for short-range communications, Bluetooth wireless technology is ideally suited for use with small, portable personal devices that are normally powered by batteries.

b) Voice and Data

Voice appliances such as mobile telephones are also used for data applications such as information access or browsing. Through voice recognition, computers can be controlled by voice, and through voice synthesis, computers can produce audio output in addition to visual output. Some wireless communication technologies are designed to carry only voice while others handle only data traffic. Bluetooth wireless communication makes provisions for both voice and data and thus it is an ideal technology for unifying these worlds by enabling all sorts of devices to communicate using either or both of these content types Bluetooth is split into two sections: Bluetooth Specification and Bluetooth Profile. The Specification describes how the technology works (i.e. the Bluetooth protocol architecture). The Profiles describe how the technology is used (i.e. how different parts of the specification can be used to fulfill a desired function for a Bluetooth device).

c) Technical Features

As seen in Figure 4 below, Bluetooth uses the unlicensed 2.4 GHz Industrial Scientific Medical (ISM) radio range. It operates between 2.402 GHz and 2.480 GHz on 79 channels. It consumes 1 mW of electricity to produce 100 mW of output, as reported in C.R. Balamurugan et al., International Journal of ChemTech Research, 2018, 11(04): 55–62. By raising the transmission power to 100 mW, the 10-meter maximum range can be increased to more than 100 meters. There is a 1 Mbps gross data rate. For transmission, Bluetooth combines circuit switching and packet switching methods.

d) Access Technology

There is a chance of interference because Bluetooth uses the same unlicensed ISM band as other devices such as 802.11 networks, baby monitors, garage door openers, microwave ovens, etc. (Helsinki University of Technology, 2000). The access method used by Bluetooth to prevent interference is known as FHSS or frequency hopping spread spectrum, There are 79 channels with a 1 MHz bandwidth each in the band where Bluetooth operates. Each channel has time slots that are 625 milliseconds long. Both devices set their radios to a different frequency after sending a packet on one frequency, thereby hopping at a pace of 1600 hops per second through several time slots. Bluetooth devices utilize the full ISM band in this manner, and a Retransmission will always be on a separate (ideally clear) channel if interference compromises transmission on one channel.

A Bluetooth network is made up of a Personal Area Network, or piconet, which typically has one master and up to seven slaves and can have from two to eight Bluetooth peer devices. The device that starts communication with other devices is referred to as a master. The communications are governed by the master device. connectivity and communication between it and the attached slave devices. The device that reacts to the master device is referred to as a slave device. The transmit/receive timing of slave devices must match the timing of the masters. Additionally, the master device controls the slave devices' broadcasts (i.e., the master device decides when a slave device may send). The Bluetooth device address (BD_ADDR) of the master device determines the frequency hopping pattern. The specific slave devices within the range of addresses are initially requested by the master device through a radio signal. In response, the slaves synchronize their hop frequency. along with keeping time with the master device. When a device joins more than one piconet actively, scatter networks are formed. In essence, the adjacent device distributes its time slots among the several piconets.

5. Arduino Uno

An ATmega328-based microcontroller board is the Arduino Uno. It contains six analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It also has 14 digital input and output pins, six of which can be used as PWM outputs. It comes with everything required to support the microcontroller; to get started, just use a USB cable to connect it to a computer or an AC-to-DC adapter or battery. The FTDI USB-to-serial driver chip is absent from the Uno, setting it apart from all previous boards. Instead, it has an Atmega16U2 (or Atmega8U2 up to version R2) that has been configured to function as a USB-to-serial converter.

The added SDA and SCL pins that are close to the AREF pin, as well as two more new pins—the IOREF—placed close to the RESET pin—allow the shields to adapt to the voltage supplied by the board. Shields will work with both the Arduino Due, which runs on 3.3V, and the board that uses the AVR, which runs on 5V.

Italian for "one," "Uno" was chosen to symbolize the imminent Arduino 1.0 release. Moving forward, the reference versions of Arduino will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and serves as the platform's reference model; you may compare it to earlier iterations by visiting the index of Arduino boards. ATmega328 microcontroller operating voltage (recommended)5V Input Voltage (limits): 7-12V Digital I/O Pins 14 are 6–20 volts, and six of them output PWM. Pins for analog input: 6 DC I/O Pin Current: 40 mA DC I/O Pin Current: 50 mA EEPROM is 1 KB (ATmega328), SRAM is 2 KB (ATmega328), and Flash Memory is 32 KB (ATmega328), of which 0.5 KB is used by the bootloader. Clock Rate 16 MHz.

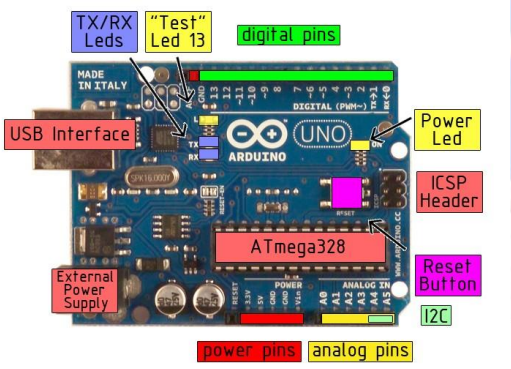


Fig 4. Arduino Uno Board Power Supply

Either an external power source or a USB connection can be used to power the Arduino Uno. The force source is automatically chosen. Either a battery or an AC-to-DC adapter (wall-wart) can provide external (non-USB) power. A 2.1mm center-positive plug can be used to connect the adapter by inserting it into the board's power connector. The 5V pin, however, may deliver less than five volts if supplied with less than seven volts, and the board may become unstable. The voltage regulator could overheat and harm the board if more than 12 volts are used. The suggested range is 7–12 volts.

The input voltage to the Arduino board, when it is powered by an external source (instead of 5 volts), is known as VIN from the USB port or another source of controlled power. This pin can be used to access voltage that has been supplied via the power jack or to feed voltage to it. The microprocessor and other components on the board are powered by a controlled 5V power source.
• 3V3, an internal regulator-generated 3.3 volt supply A 50 mA maximum current consumption is allowed.
• GND. drilled pins

6. Software For Interfacing Arduino And Bluetooth

Arduino IDE **The Android App**

7. Working and Methodology

The basic voice-controlled robotic vehicle's block diagram is shown. It consists of the smartphone, which understands voice commands and transmits them wirelessly to the Bluetooth module HC05. At that moment, the module switches the order of the content, and the string of characters is passed to the Arduino for further processing. The Arduino microcontroller decodes the received string and performs additional functions as a result. The motor receives the impulses and uses them to drive and power the other motors attached to it. Commands are given to the mobile application on the transmitter area through the microphone.

The Bluetooth module in this portable phone connects it to a moving vehicle. The portable program in use has been adjusted so that commands spoken into the handset are picked up by the microphone and converted from simple voice commands to complex word successions (A to D transformation). The Bluetooth transceiver module then sends the transceiver controller along with the previously stored sequences to the robotic vehicle. These signals are contrasted by the controller with the stored program orders before being converted into voice strings. The servo engines are then driven for the ideal duration of time using the voice strings. The engine driver functions better when the microcontroller's instructions are followed. The engine driver IC, which is powered by the Arduino, controls the particular engine. The system needs to be powered by a DC power supply. The DC energy source fuels the Bluetooth module and microcontroller.

A control system is put in place to guarantee the robot's autonomous movement. The robot was given an on-off control system based on an Arduino microcontroller, a motor controller, and infrared sensors. As a result, the robot halts just shy of the panel's edge. The obtained data from the infrared sensors were processed using the mode filter.

The Arduino Wireless Voice Controlled Robot comprises a transmitter and a beneficiary segment. The transmitter end comprises Smartphone Bluetooth and the Android application introduced on it. Thus, the Receiver area has an Arduino board as a processor, an HC-05 Bluetooth Module as a remote communication module, L293D for driving engines, and a couple of DC designed as a section for moving robots.

8. Result

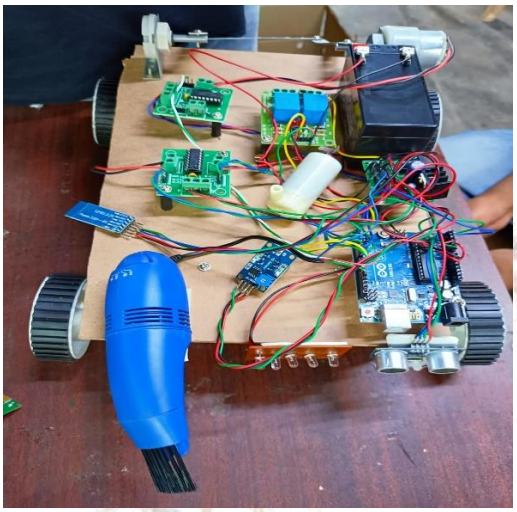


Fig 8. Setup of an autonomous sanitization robot with voice interaction.

9. Conclusion

The resulting product is fully functional and produces the necessary motion. It passes the test in the room where it is being tested. During a power outage, a manually operated floor cleaning machine provides an alternative to automatic floor cleaning equipment. To accomplish dry and wet tasks, the body is mechanically operated. Because cleaning and polishing may be done simultaneously, manual labor and time are reduced. Easy fabrication and very simple design. Overall, the idea is quite beneficial, and there is room for significant mechanical part growth. The optimization process won't stop until the best result is reached. Overall, the project is a success, accomplishing its goals, and it will undoubtedly alter the history of robotic floor cleaning. 91% efficiency is too high in the current environment for the automation section of the method. Sensing is a field where development is possible.

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