

DESIGN AND IMPLEMENTATION OF FLOOR CLEANING ROBOT USING IOT**Prof. Heena B. Kachhela***Computer science Engineering, Tulsiramji gaikwad patil college of engineering technology Nagpur, India, Polytechnic
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manavkamble@781gmail.com***Abstract**

In today's world, robots play an important role in all fields of work. The robot made human work much easier and saved energy and time. This article describes a floor-cleaning robot that allows both dry and wet cleaning by commanding the robot with an Android device. This robot made cleaning easy and efficient thanks to the wireless system. This system consists of two vacuum compressors placed in front of the robot for dry cleaning and a cleaning pad with a supported water tank behind the robot for wet cleaning. The proposed robot is controlled by an Android mobile application or Blink which acts as a transmitter and gives commands to the receiver node MCU which has 11 I/O pins and 1 analogy pin. The Node MCU receives the instructions from the Wi-Fi receiver through the Android application, decodes the instructions, and guides the robot to the right path and direction. Ambient Assistive Living has been the focus of both studies and commercial life due to the aging of the rapidly growing population and related health and social problems. High on the government's agenda is the need to control, if not reduce, healthcare costs while improving service quality. While technology has a significant impact on achieving these goals, all solutions must be designed, implemented, and validated with the right domain expertise. To avoid these difficulties, real-time remote monitoring of human health can be used to detect disease recurrence and enable early intervention. Thus, the research in this paper focuses on building an intelligent health monitoring system that can remotely monitor the elderly. The technology discussed in this article focuses on the ability to monitor a person's physiological data to identify diseases that can help with early intervention. This is achieved by properly processing and interpreting the sensory information received and communicating the diagnosis of the disease to the correct specialist. The conclusion shows that the proposed approach can improve clinical decision support while promoting early intervention practices. Our extensive simulation results show that the proposed system performs better than expected with minimal packet loss (2.2% of all packets are dropped) and low latency (96% of packets are received in less than 1 millisecond). This makes the system work well and cheaply for data collection and editing.

I. Introduction

Evolutes on of robots brings advancement in the process of floor cleaning. Floor cleaning is a regular task carried out by number of people every day, it needs lot of human energy and time. Naturally, the high cost of this simple task has motivated alternative solutions and that is Automatic Floor Cleaner.

Robot is an intelligent device having its own brain fed with computer logic so that it can do the work according to the algorithm designed. On regular

basis, peoples lead a sophisticated and time-consuming lifestyle. Sometimes peoples are always thinks to reduce long taking time. For reduce time consumption, robots have taken to reduce the manual works. Autonomous smart floor cleaning system using IOT will reduce long time taken manual working procedure. In our project model, this robot has cleaning expertise like mopping, wet floor cleaning, picking up the waste, dry vacuum cleaning etc.

Automatic is a great solution of this problem. So, we make an autonomous floor cleaning robot that operated by internet of things and Arduino Nano programming. Ultrasonic sensor is the most important for autonomous floor cleaning robot because ultrasonic sensor works as eyes of robot. Ultrasonic sensor useful for turning of robot by sense by obstacle or wall. Sensing distance range of robot set by Arduino Nano programming. In this range robot sense the obstacle and turn back.

These day's humans lead a sophisticated life. People within the cities don't have regular and have long working times. In such a situation someone will choose time saving methods. Thus, robots have taken the manual works. For career oriented and job going women it becomes hectic to handle home and office together. Traditionally floor is cleaned with the assistance of mop or wet mop using the hand as a possible tool. they need to clean hard on the surface. The cleaning includes cleaning of varied surfaces basically cement floors, highly polished wooden or marble floors. Among these floors the rough surface floor like cement floor, mostly present in semi urban areas are covered with such a lot of dust which needs longer for cleaning.

For saving the time the necessity was of House Cleaning Robot, which is an automatic system that works and cleans on its own without human control/intervention. Autonomous robot for floor cleaning application reduces much time in lifestyle. It performs sweeping and mopping tasks at a time, it also does obstacle detection, and has automatic water spray. Service robots are getting popular recently these robots operate semi- or fully automated to perform services helpful within the well-being of humans and equipment. Robots of types including medical robots, underwater robots, surveillance robots, demolition robots and other styles of robots those do a multiple job. they'll clean floors, mow lawns and guard homes and can also help in assisting old and disabled people, perform some surgeries, checking pipes and sites that are highly dangerous to people, fight fires and defuse bomb. The Internet of things (IoT) is a network of physical devices that are embedded with electronics, sensors, software and network connectivity to share the data. The IOT gives access to sense and control objects remotely in a network which gives direct integration of the physical world into computer-based systems. The robotics details with design, operations, construction and application of robots. It also details with computer system for the control, information processing and sensory feedback. The Internet of Things and Robotics have been hand-holding each other contributing to individual growth and development. In the modern era robots

are playing an important role in the life of mankind with their advanced technologies, making human life easier and more comfortable. The cleaning robots are effective in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops, warehouses and universities, etc. so they have taken more recognition in robotics research. Fundamentally, robot cleaners have been distinguished by their cleaning competence like dry vacuum cleaning, floor mopping, etc. Some existing products are built based on simple obstacle avoidance using infrared sensors or ultra-sonic sensors and some use laser mapping techniques. The operations and cleaning mechanism of each cleaning robot have its advantages and disadvantages. For example, some of the robots using

II. Literature Survey

By considering the distinctive explore papers, we have figured out the arrangement to actualize a computerized sun-situated floor cleaner. Considering all the decently existing ask almost works, we have chosen the same ask almost ranges after considering the composing diagram nearly the modified sun-fuelled floor cleaner. In [1], makers have collectively made a system with the organized Arduino with a Bluetooth Module and a servo motor to rotate mops and clean the floor. They utilized an L293D motor driver in their ask approximate works to run the wheels of their illustration. They have additionally included one ultrasonic sensor inside the examination work for earlier floor perception. The extreme diagram of their paper makes it conceivable for clients to drive the cleaner towards dust-filled zones by standing far off missing. They had a cleaning highlight inside the paper besides. It was most prominently foreseeing the Bluetooth course of the cleaner inside the conveyed paper. [2], makers have worked on Ultrasonic Sensor Assessment for Deterrent Avoidance in Quad copter-based Drift Systems. Since this work is more related to ultrasonic sensor utilization for keeping up a key removal from obstructions inside the meandering system, it shows disdain toward the truth that this work contains the headway of a drift system, it has so much unflinching quality with obstruction evading inside the way utilizing ultrasonic sensors. This paper talks about how ultrasonic sensors are tried and true for obstacle avoidance. Here they have finished adding up to the freedom of the meander utilizing ultrasonic sensors. It may be an arrangement reference, but it is associated with a cleaner utilizing Arduino-UNO, where this paper shows that the ultrasonic sensors related to Arduino are smaller than anticipated. In [3], the makers have

worked collectively to make an autonomous solar-powered cultivate cutter utilizing ultrasonic sensors. The paper is roughly making a mechanized grass cutter machine utilizing sun-based essentials and ultrasonic sensors to keep up a key removal from any obstacles. The creators have utilized the Arduino-UNO microcontroller to act as the centers component.

it with an AC-to-DC adapter or battery to get started.

Sr. no	Title Of Paper	Further Extension	Major Contribution
1.	“Automatic Floor Cleaner”	Pick & Place Mechanism	Brings Flexibility to do
2.	“Advance Mobile for Floor Cleaning”	Environmentally Friendly	Less Time Consuming
3.	“Floor Cleaning Robot”	Auto Disposal Mechanism	Helps Physically Disabled People
4.	“Automatic Floor Cleaner”	Work Automatically	Able to Cover a Large Area as
5.	“A Technological Survey on Autonomous Floor Cleaning Robots”	Dealing With Some Small Pieces Such as Paperclips, Paper, and Soil block	Saves time, helps Physically Disable people
6.	“Simple Autonomous Cleaner Robot”	Consume Less Power	Saves Time

III. Methods

AT Mega 328p/Arduino:

AT Mega 328p/Arduino is the ATMEL Microcontroller on which the Arduino board is based. The Atmel 8-bit AVR RISC-based microcontroller combines 32KB In-system programmable flash (ISP) memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes The Arduino Mega is a microcontroller board based on the ATmega1280 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It Switch Auto/ Manual Vacuum Ultrasonic Sensors IR Sensors LDR Sensors Battery & Power Regulator Left Motor Right Motor MOTOR: CHIP: Autonomous/Manual Robotic Vacuum Cleaner Micro Controller LCD Display Real Time Clock 9 contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power



Fig 1: AT Mega 328p/Arduino

Ultrasonic Sensor (SC- H04):

This economical sensor provides 2cm to 400cm of noncontact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HCSR04 module includes an ultrasonic transmitter, a receiver, and a control circuit. It can be used for avoiding obstacles as well as edge detection. In our project, we have tested both cases.

Sensor plays a very important role in every type of robot. Various types of sensors are present. A sensor is a transducer whose intention is to sense (that is, to distinguish) some normal for its environs. It identifies occasions or changes in amounts and gives a related yield, by and large as an electrical or optical sign; for instance, a thermocouple changes over temperature to a yield voltage. In any case, a mercury-in-glass thermometer is additionally a sensor; it changes over the deliberate temperature into the development and construction of a fluid that can be perused on an adjusted glass tube. Sensors are utilized as a part of ordinary questions, for example, touch-touchy lift catches (material sensors) and lights that diminish or light up by touching the base, other than endless utilizations of which the vast majority are never mindful. With advances in micromachinery and simple to-utilize microcontroller stages, the employments of sensors have extended past the more customary fields of temperature, weight, or stream measurement, for instance into MARG sensors. Besides, simple sensors, for example, potentiometers and power-detecting resistors are still generally utilized. Applications incorporate assembling and apparatus, planes and aviation, autos, solutions, and application autonomy.



Fig-2: Ultrasonic Sensor

Motor Driver (L293D):

- a) Four H-Bridges: Two L293D Motor driver chips.
- b) L293D is rated as 0.65A per bridge (1.20A peak) with thermal shutdown protection and motor Voltages from 4.5 VDC to 16VDC. (up to 36v if C6 and C7 are upgraded).
- c) Up to 4 bi-directional motors with individual 8-bit speed selection (256 speeds).
- d) Up to 2 stepper motors (unipolar or bipolar)
- e) Pull-down resistors keep motors disabled during power-up.
- f) Separated logical and Motors power connections.
- g) Terminal block connectors for motors and power
- h) 2 connections for 5V 'hobby' servos.



Fig-3: Motor driver shield

DC Geared Motor:

DC Geared Motor can be defining an extension of a DC motor. A geared DC has a gear assembly attached to the motor. The speed of the motor is counted in terms of rotations of the shaft per minute and is termed RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure.

Dual Battery Relay:

This relay is designed to isolate a second battery in a vehicle. The contact terminals are connected between the positive terminal of the starting battery and the positive terminal of the second battery. The negative terminals of both batteries attach to the vehicle chassis. One of the coil terminals is connected to the chassis ground and the other coil is connected to the ignition switch or fuse box. When the vehicle is running, both batteries are connected in parallel and both are being charged by the alternator. When the ignition switch is off, the contacts are open, disconnecting the second battery from the vehicle's electrical system.



Fig-4: Geared Motor

Suction Unit (Vacuum):

A suction unit in the project has a dirt bag attached and it sucks all the dirt into it, for this purpose it will also have a DC motor which will be synchronized with the DC motor used for a rotating purpose (i.e., wheels). The propeller is made up of steel and it has a diameter of 5cm which is divided into n8 equal plates, each rotated at an angle of 22 degrees. It requires a current of 0.4 amperes. It has a narrow nozzle which is 1 cm wide. The vacuum assembly is enclosed in a rigid plastic chamber, to prevent dust enter this section. It is made waterproof against splash water. It rotates and sucks in the dust and which can further remove by detaching the unit.

Bluetooth (HC - 06):

For the communication of the robot with the cell phone or a mobile we are using the Bluetooth device (HC - 06) is attached to the robot that receives the data from the mobile and also it can transmit the data. It is used for converting serial ports to Bluetooth. It has two modes: Master and Slave. Bluetooth is a wireless communication protocol running at the speed of 2.4 GHz with the architecture of client-server and which is suitable for forming personal area networks. It is designed for devices such as mobile phones (low power). Bluetooth protocol uses the MAC address of the devices. Bluetooth gives the connectivity between two devices using a MAC address.



Fig-5: Bluetooth Module

Servo Motor:

The Servo Motor consists of a DC motor, a Gear system, a position sensor, and a control circuit. The Gear and shaft assembly connected to the DC motors lower this speed into sufficient speed and higher torque. The position sensor senses the position of the shaft from its definite position and feeds the information to the control circuit. The control circuit accordingly decodes the signals from the position sensor and compares the actual position of the motors with the desired position and accordingly controls the direction of rotation of the DC motor to get the required position.



Fig-6: Servo Motor

Battery:

The size of the battery bank you'll need will depend on the storage capacity required, the maximum discharge rate, the maximum charge rate, and the minimum temperature at which the battery will be used. When designing a power system, all of these factors are looked at and the one requiring the largest capacity will dictate battery size. Temperature has a significant effect on how well lead-acid batteries will perform. At 400 F a battery in good condition will have 75% of its rated capacity, and at 00 F the capacity drops to 50%.



Fig 7: Battery

Voltage and Time Settings

In addition to minimum charge rates, there are charging voltage settings, which are specific to your 6-volt deep cycle battery bank. 'Bulk' Charge Voltage is the voltage at which the batteries will receive most of the charging.

When the battery has reached its bulk voltage level the charge current will slowly decrease as batteries become more charged. As a battery becomes more charged it presents more resistance to the flow of current than when discharged, hence the rate of amps declines during a charging cycle.

This part of the charging cycle is called the 'absorption' stage. We recommend 30 minutes of absorption time per 100-amp hours of battery bank-rated capacity (20-hour rate). All batteries will self-discharge over time, even if they are not used. In stand-by applications where utility power is available batteries are often finished charged at 'float' voltage.

This is the voltage level, which can be applied to the batteries to maintain their charged state and, at the same time, minimize loss of electrolyte. In generator cycle charging applications it is rare to "float" the batteries as it represents a costly and inefficient use of fuel.

Regular 'equalization' charging is required as part of a battery maintenance routine. Daily battery drain down will require a monthly equalization for optimal performance.

An equalization charge is an intentional overcharge, which causes rapid bubbling of the electrolyte, which in turn helps dislodge sulfation, which occurs naturally during normal charge/discharge cycling. Equalization charge settings involve both voltage and time specifications.

Sun-based panel's positive and negative wires are related to the battery's positive and negative terminals, independently, with a diode in between

to facilitate the right stream of imperatives from the board to the battery through charging. The charged 12v battery is utilized to convey supply voltage 5v to Arduino-UNO, L293D motor driver IC. The L293D motor driver interfacing the two-wheel motors kept for wheel improvements. In the intervals, the versatile vacuum cleaner is set up inside the cleaner besides doing its cleaning parcel [11-17]. In our ask-around, there are two modes of operation: the controlling mode of operation and the modified mode of operation. The controlling mode requires a Bluetooth module, whereas the modified mode doesn't require additional back. Obstruction evading is done actually by the cleaner itself. The adhere chart is shown in Fig.9 underneath the obstacle. The Fig.9 shows up the nitty-gritty stick affiliations taken after inside the circuit. The three ultrasonic sensors are put inside the same circular way with a canter microcontroller as Arduino-UNO. The associations from Arduino-UNO are drawn to all the other components like motor driver IC, wheel motors, Bluetooth module, and Voltage Controller conjointly to an IR sensor utilized inside the circuit for staircase disclosure. These sensors are all utilized to recognize hindrances inside the way to keep up a key remove from them and clean the floor.

IV. Software

Express PCB:

Express PCB is a very easy-to-use Windows application for laying out printed circuit boards when not required.

Express PCB will guide you by highlighting the pins that should be connected software includes the Express PCB program to layout your board. If you link your schematic to Express PCB, the program will guide you through the wiring process by highlighting how the component should be connected.

When your layout is complete, you can determine the exact cost of having your board made with the compute board cost command.

We recommend that you begin your project by drawing a schematic using Express SCH. Drawing a schematic is not required, but it will save.

An overnight courier will deliver your PC boards in a few business days (typically 2 or 3).

The Display:

Take a few minutes to acquaint yourself with the Express PCB main windows, As shown below you will notice that there are two toolbars, one along the top and another on the left side. At the button of the display is a status bar.

Example PCB File:

The PCB file contains the application settings and data that are used by the software. The PCB file extension is also used for ACCEL or Protel printed circuit board files. P-CAD database files, PC-DOCTOR files. Broderbund print shop business card files and PCB layout check design rule template files.

PCB Design:

A print circuit board (PCB) mechanically supports and electrically connects electric or electronic components using conductive tracks, pads, and other features etched from one more sheet layers of copper laminated onto and between sheet layers of a non-conductive.

Substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

Alternatives to PCB include wire wrap and point-to-point construction, both once popular but now rarely used. PCBs require additional design effort to lay out the circuit.

Bluetooth RC Controller Application Model:

Technical data sheet describing the cost effective, high-performance u-bloc 6 based NEO-6 series of GPS modules that brings the high performance of the u-bloc 6 positioning. The application allows you to control an Arduino based RC robot over Bluetooth. This is done using a Bluetooth enabled Android phone. Visit this site for the Arduino code and control circuit. The app lets you control the Robot with either buttons or the phone's accelerometer. This application is designed to be used with a MODIFIED RC robot. You have to replace the robot's stock control circuit with a micro controller. This involves programming. The application will not work with a brand new, out of the box RC robot. Please visit the website before you download the application.

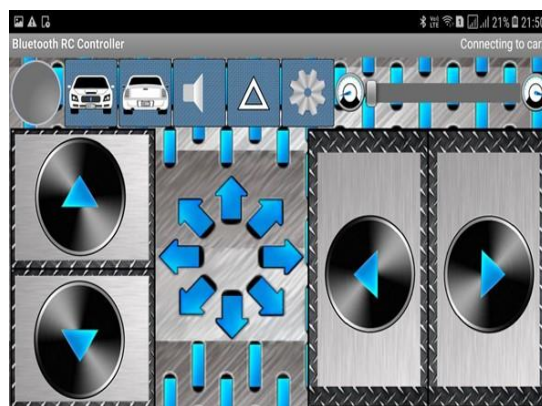


Fig 8. Bluetooth RC Controller Application

Bluetooth Before Connection Model:

Bluetooth is a short-range wireless technology standard used for exchanging data between it is mainly used as an alternative to wire connections, to exchange files between. Nonetheless, Bluetooth is useful when transferring information between two or more devices that are near each other in low-bandwidth situations. Bluetooth headphones and speakers can't connect with multiple devices at a time. Just think of Bluetooth pairing is a form of information registration for linking devices. Before you start the pairing operation, please confirm the following Refer to the operating instructions or help guide for model-specific information.

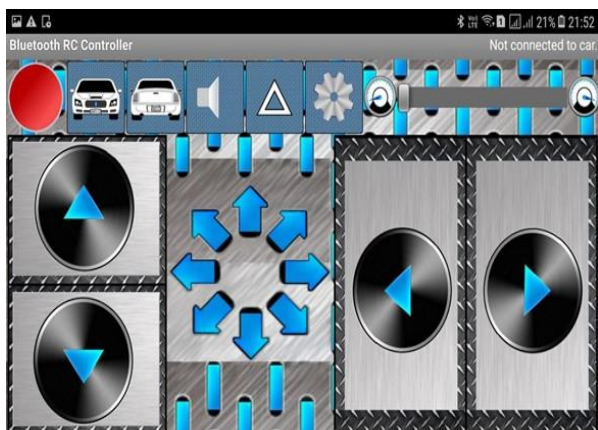


Fig 9: Bluetooth Before Connection Model

Bluetooth Selecting Connection Model:

Bluetooth pairing is a form of information registration for linking devices. By registering device information (pairing) between devices, they can connect to one another. In order to use a Bluetooth device, you must first pair it with another Bluetooth device. Pairing is a bit like exchanging phone numbers. Similar to how you must exchange phone numbers with a person you want to call, connecting Bluetooth devices requires you to first pair them to register the pairing information of each device. After pairing the devices the first time, there is no need to repeat this pairing process again. That is because each device has saved the necessary.



Fig 10: Bluetooth Selecting Connection Model

Bluetooth After Connection Model:

Bluetooth is a short-range wireless technology standard used for exchanging data between it is mainly used as an alternative to wire connections, to exchange files the development of the "short-link" radio technology, later named Bluetooth, it was the revised T39 model that actually made it to store shelves in 2001. Bluetooth networks (commonly referred to as Pico nets) use a master/slave. In this model, a single master device can be connected to up to seven. Will respond with its address, and possibly its name and other information. Connection -- After a device has completed the paging process, it enters the connection state.

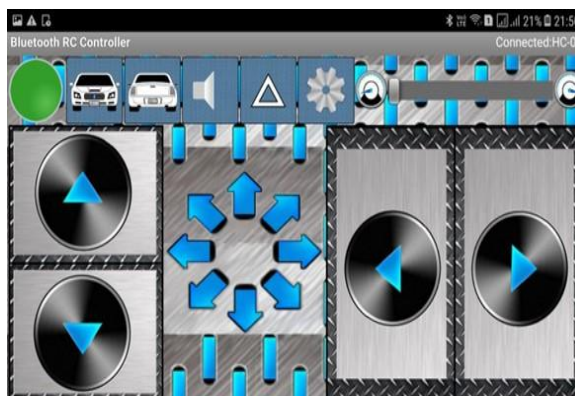


Fig 11: Bluetooth After Connection Model

V. Block Diagram

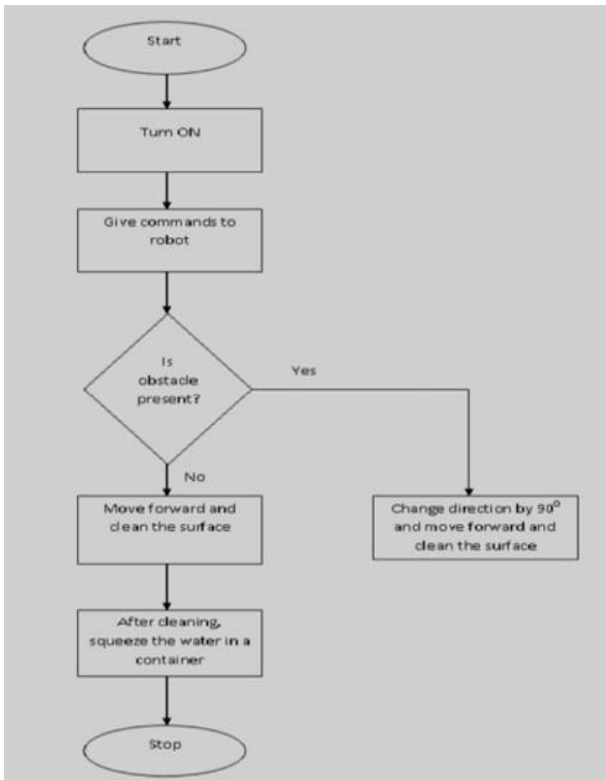


Fig 12: Flow Chart of Floor Cleaner

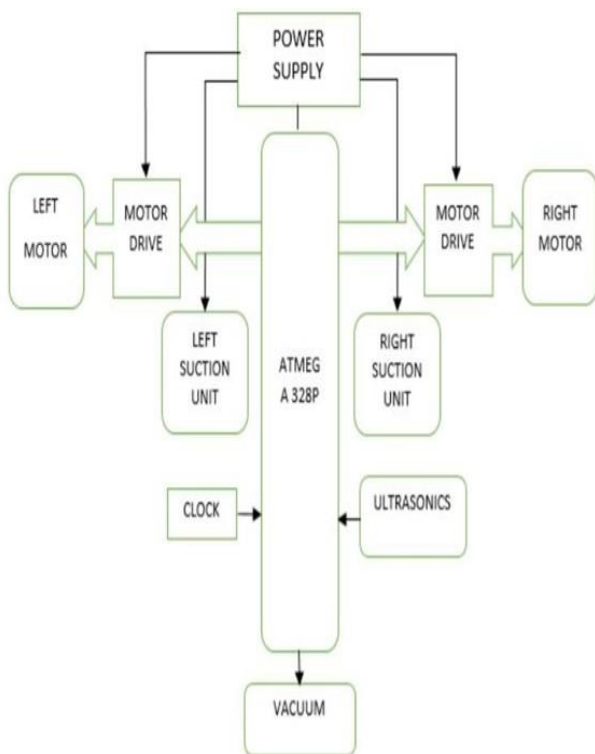


Fig 13: Architecture of Floor Cleaner

VI. Final Overview

In this project, we have checked the working of our project, we connected it with a battery whose cleaning and moving system is controlled by a DC gear motor and pump.

This technique is eco-friendly, and this work is an attempt to reduce accidents while in critical driving conditions. We have tested the working of the system by placing various objects ahead as obstacles. The system responded by reducing the speed of the vehicle when the obstacle is placed at various distances from it.

Also, the system properly performs the cleaning via a vacuum cleaner and wiper motor and this process is properly controlled by the Internet of Things. Controlling the system via the Blynk app is properly working.

The proposed model “Design and Implementation of Smart Floor Cleaning Robot using Android App” is shown in Fig. 1 for a better understanding of the proposed work. This block diagram consists of a 12v DC motor, L293D IC, IR Sensor, Bluetooth module, cleaning mechanism, and Arduino UNO. The power supply is given to the Arduino UNO as well as to the relay.

The relay works as a switch so that it controls the water pump whenever the user receives the commands from the transmitter app. The robotic arm used here consists of three DC motors where one DC motor is used for moving the robotic arm up and down, the second DC motor is used to close and open the teeth of a robotic arm, and the last DC motor is used to rotate the arm completely. Here we use L239D drivers for driving DC motors to move in forward and backward directions. Bluetooth module is used to control the robot using a mobile phone application.



Fig 14: Final Overview of Project Work



Conclusion

This research facilitates efficient floor cleaning. Since in project the floor cleaner is incorporated with different device like DC motor(s), ultrasonic sensor etc. so it will be easy to handle it also saves time and will work automatically for cleaning purpose at home and offices.

With simple algorithm and program, the cleaner will be able to cover large floor areas as well a fond its way into and out of small corners. As the cleaner traverses the room the sweeper installed in it will manage to pick up a significant amount of dirt. Manual sweeping might not be that efficient as it will not be picking up everything in as it is not sight but using the automatic floor cleaner it can br done easily.

The robot is specially built on the use of modernized technology. It's all the features that are required for a floor cleaner. It works automatically and manually. It's auto drain feature. This could be locally manufactured smart floor cleaner robot. Meanwhile its scheduling feature which can be operated by computing only, android and windows app can make it little more A cheaper and user friendly vacuum cleaner robot can be development with two different mode of controlling (manual and autonomous mode) using an arduino board with more electronic functionality. Battery monitoring, self- charging, lighter body weight and to set alarm on/off time manually are the future scope of this project.

System is specially made on the basic of modernized technology. All feature are required for floor cleaning. It works automatically and manually too. So it will be easy to handle for everyday. Because of compact system, it to handle save time and will work automatically for cleaning purpose. Manual working is not that effective as it will not picking everything accurately bit smart floor cleaning system can give you accurate result.

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