

DESIGN AND FABRICATION OF WET AND DRY FLOOR CLEANER WITH IOT BASED CONTROL

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ABSTRACT:

Cleaning is essential in our daily life. We may not realize that many products used around the houses, colleges and workshops may cause harmful effects. In house hold products there also contains so many of the harmful components that can cause dizziness and respiratory tract irritation. This project is applicable to clean the floors which are wet and dry. Current project work targets to use floor cleaner machine to clean household purpose and office floors. Cleaning is specially carried out by continuous relative motion between scrubber and floor for wet floors and for dry floors vacuum cleaner is used to suck the dry dust. These floor cleaner saves huge cost of labour in future. It reduces the cleaning time and cost effective. It cleans more accurate. This floor cleaner can be modernized by connecting electric and mechanical motors.

KEY WORDS: IOT module, LCD module, Micro controller, Vacuum cleaner, Water pump.

1. INTRODUCTION:

Swachh Bharat Abhiyan or Swachh Bharat mission is nation wide campaign in india for the period 2014 to 2019 that aims to clean up the streets, roads and infrastructure of India cities, towns, urban and rural areas. Small and medium enterprises engaged in manufacturing of cleaning equipment such as rubbers, wipers, twist mops and street brooms have been an up stick of up to 30 percent in business, when Swachh Bharat Mission launched. Business in these sector are upbeat as the mission has given them an breather aim an increasingly stiff competition put up by modern day retail outlets. There is huge demand for cleaning machines for purpose of road, floor cleaning.

Robot is an electromechanical machine and used for various purposes in industrial and domestic applications. Robot appliances are entering in the consumer market, since the introduction of Robot's. Initially the main focus was on having a cleaning device. As the time pass on many improvements were made and more efficient appliances were developed. In early 2010, a new automatic floor cleaner robot "Mint" was developed by Jen Steffen. Detachable clothes were attached for sweeping and mopping purposes. For tracking mint used the GPS-like indoor localization system. In recent years, robotic cleaners have taken major attention in robotic research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops etc. Basically, robotic cleaner are distinguished on their cleaning expertise like floor mapping, dry vacuum cleaning etc. Each cleaning and operating mechanism of robotic floor cleaners has its own advantages and disadvantages. Floor cleaner is a compact robotics system which provides floor cleaning service in room and big offices reducing human labour. Basically as a robot it eliminates human error and provides cleaning activity with much more efficiency. If we clean the floor manually then there is a possibility that the operator will leave some portion of the floor. Also due to manual labour involved this is time consuming and irritating to clean the floor. Also in big offices floor area is very huge and the people involved there for cleaning purpose cannot clean it much more efficiently. This is where the robot comes as an advantage. Also the robot is small and compact in size. So we can carry it and place it wherever we can on the house. Also in

industries the robot is very cost effective as compared to manual labor involved. The flexibility, time saving and efficiency make the robot a clean choice for cleaning the floor.

In the modern era, the IoT Floor Cleaner is required. Thus, the cleaner is designed in such a way that it is capable of cleaning the area reducing the human effort just by starting the cleaning unit. This Project is designed to build and program it in such a way, that it can move around freely and clean a specific area by the vacuuming process. With the advancement of technology, robots are getting more attention of researches to make life of mankind comfortable. This projects presents the design, development and fabrication of prototype IoT based Dry and Wet floor cleaner Robot. This robot operates using Internet based Wireless control system. It contains additional features like dirt container with air vacuum mechanism. This work is very useful in improving life style of mankind.

2. LITERATURE REVIEW:

H. Asada, et.al [1].This paper presents a design and implementation of a motion control system for a cleaning robot based on infrared sensors. An infrared sensor system has been developed for complete coverage navigation of a floor cleaning robot. As the robot adopts a complete coverage cleaning strategy and executes back and forth cleaning task the infrared sensors can help robot align with walls and keep the robot stay in the planned path. Moreover a landmark has been designed for navigation control using multi directional infrared signals. Each of them has a unique digital code to facilitate the robot memorize a cleaned area. Thus the robot can complete the cleaning task efficiently in an environment with unexpected 'Static Obstacles'.

T. Palleja, et.al [2].This research work describes the key features of the latest available resource constrained hardware platforms for slot applications. Based on these features specific production are recommended for each platform to utilize their hardware capabilities efficiently. Structure, architecture and operational features of recommended are described that make efficient use of hardware architectural potentials of devices employed in slot applications. Therefore a comparative study is presented on features of hardware architectures particularly focused on resource constrained devices. While enabling these necessary features in architecture associated challenges that may arise and should be taken into account are also articulated in this paper. Thus, the study opens doors for future work since following the proposed recommendations, more robust algorithms can be implemented to better utilize the specific hardware architectural features of devices in slot applications. Moreover, this research can be taken as initiating guidelines for developers to design an efficient to meet the demand of futuristic IOT and slot applications.

Jens-Steffen Gutmann, et.al [3].This paper presents efficient floor cleaning with sweeping and mopping operations. This robot works in two modes automatic and manual for user convenience. This proposed work provides the hurdle detection in case of any obstacle that comes in its way. This proposed work provides the hurdle detection range is 1ft. RF modules provide wireless communication between remote and robot and their range is 50m. If there is hurdle in the way of robot, it sends the information to the remote which gets displayed on the LCD. An automatic water sprayer is attached which sprays water for mopping purpose for the convenience of the user. User can also operate this robot manually with the help of remote. It reduces the labour cost and saves time also 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.

3. INTERNET OF THINGS

The Internet of things (IOT) is the inter-networking of physical devices, vehicles buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IOT-GSI) defined the IOT as "the infrastructure of the information society." The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of

the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IOT will consist of almost 50 billion objects by 2020.

4. BLOCK DIAGRAM OF IOT BASED FLOOR CLEANER

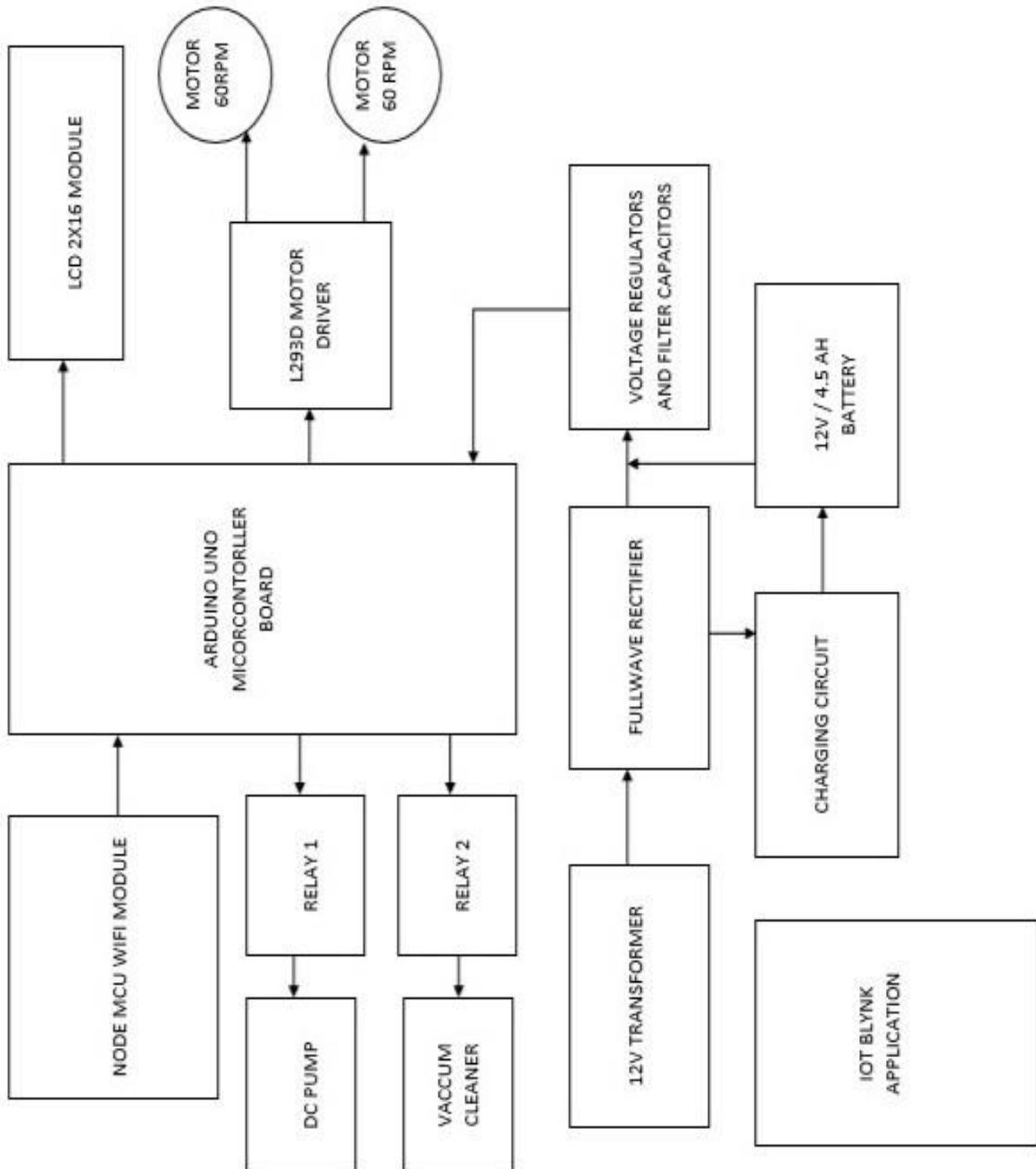


Fig 1: BLOCK DIAGRAM OF IOT BASED FLOOR CLEANER

5 MAJOR COMPONENTS AND THEIR DESCRIPTIONS:

ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program *argued* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

VACUUM CLEANER

A vacuum cleaner, also known simply as a vacuum, is a device that causes suction in order to remove debris from floors, upholstery, draperies and other surfaces. It is generally electrically driven.

The dirt is collected by either a dustbag or a cyclone for later disposal. Vacuum cleaners, which are used in homes as well as in industry, exist in a variety of sizes and models—small battery-powered hand-held devices, wheeled canister models for home use, domestic central vacuum cleaners, huge stationary industrial appliances that can handle several hundred litres of dust before being emptied, and self-propelled vacuum trucks for recovery of large spills or removal of contaminated soil. Specialized shop vacuums can be used to suck up both dust and liquids. Most vacuum cleaners are supplied with numerous specialized attachments, such as tools, brushes and extension wands, which allow them to reach otherwise inaccessible places or to be used for cleaning a variety of surface

DC PUMP

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the and natural gas or for operating cooling towers and other components of heating, ventilation and air conditioning systems. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis.



Fig 2: DC PUMP

LCD 2X16 MODULE

A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as DVD players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in nearly all applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.



Fig 3: LCD 2X16 MODULE

BLYNK APPLICATION

BLYNK application is used to control the robot by connecting it to TOT. It consists of control buttons they are forward, backward, left, right, vacuum cleaner ON/OFF.

6. WORKING OF FLOOR CLEANER

In this proposed system we have designed a IOT based Floor Cleaning Robot. This Robot is equipped with the DRY and WET cleaning Mechanism. This Robot has an advance controlling feature using IoT Technology. Floor Cleaning Robot can be controlled from anywhere in the World using IOT based Blynk Application. This entire system is developed using Arduino Microcontroller Board, LCD Module, Vacuum Cleaner, IOT Wifi Module Node MCU, DC Pump, Blynk Application and Battery as Major Components. User is provided with an IOT based Blynk Android Application. Mobile Phone and Robot has to be connected with Internet. User Interface / control panel of Blynk Application contains button such as (Forward, Backward, Left, Right, and Pump ON /Off, Vacuum On / off). User control command sends to Robotic vehicle from Blynk Application wirelessly using Internet Technology. Node MCU Receives command from Internet and send signal to Arduino Microcontroller. Microcontroller unit process the data and control DC Motors and Relay unit respectively. LCD Module is used for user notification such as Robotic Movements and Dry or Wet Cleaning Status.

Dry Floor Cleaning is done using DC Powered Vacuum cleaner and Wet Cleaning is done using Water Sprinkler with cylindrical Mopping roller. This entire System is powered using 12V / 4.5 Ah batteries. The power supply and Charging section of the system contains a step down transformer of 230/12V, used to step down the voltage to 12VAC. To convert it to DC, a bridge rectifier is used. Capacitive filter is used which makes use of 7805 voltage regulator to regulate it to +5V that will be needed for microcontroller and other components operation, in order to remove ripple. To Power Vacuum Cleaner Separate 12V / 3Amp Transformer based Power Supply system is used.

Advantages

- It gives accurate results and eliminates possibility of manual error.→
- It is very first and efficient and the control system used in industries are 100 times efficient than human work.

- In some part of the work areas it lessens the human efforts. Washing machine comes under this category.
- It also plays the great role in bringing entertainment in human life in different work.

Applications

- Industries
- Offices
- Schools

7. FUTURE SCOPE

In future enhancement of the project we can use different types of brushes for sweeping the floor based on the nature of the floor. The user has to change the brushes according to the floor manually. In manual mode user it can control the robot. The project can be extended to Municipality Corporation for cleaning rough surface by using IOT.

8. CONCLUSION

This floor cleaner facilitates efficient floor cleaning. User can operate this floor cleaner by using smart phone. It reduces labour cost and saves time also and provides efficient cleaning. In proposed technique we implemented microcontroller based floor cleaning robot to sweep the dust and unwanted waste in the floor. DC geared motor, motor driver, vacuum cleaner and DC pump are the main components of the floor cleaner. DC geared motor and other components are interface with Microcontroller board. Thus the system can be used in floor cleaning system in houses, hotels, workshops, hospitals and ware houses.

9. REFERENCES

- [1] H. Asada. Design and implementation of motion control system for a cleaning robot based on infrared sensors (1986).
- [2] J Frolizzi C. Disalvo. Service robots in the domestic environment. A study of vacuum in the home. In International Conference on human robot interaction HRI, March 2006.
- [3] G Tuangzhi Dai and Tiejun Chen. Design on measurement and control system of cleaning robot based on sensor array detection. In International conference on control automation. Guangzhou, China, 2007.
- [4] Xueshan Gao, Kejie Li, Wang, Guangliang Men, Dawei Zhou and Koki Kikuchi. A floor cleaner robot using Swedish wheels. In international conference on robotics and biometrics, China, 2001.
- [5] Youngka Ma. A study on development of the home mess cleaning robot McBot. In IEEE international conference on advanced mechatronics, Xian, China, 2008.
- [6] J-Y Sung, R.E. Grinter and H.I Christensen and L. Go. House wives domestic robot technology International Journal of social robotics, 2010.
- [7] J-S Gutmann, E. Eade, P. Fong and M.E. Munich, Vector field slam. In International Conference on Robotics and Automation (ICRA) 2010.
- [8] T. Palleja. Design of the floor cleaner with efficient needs for futuristic IoT applications, 2010.
- [9] Evolution Robotics Inc. Introducing Mint the evolution of floor care, 2011.
- [10] Jens- Steffen Gutmann. The social impact of the systematic floor cleaner. In IEEE International work shop on advance robotics and its social impacts, University Munchen, Germany, 2012.