All Purpose Robot for Floor Cleaning and Mopping with Metal Detector

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Abstract: *Robots are being extensively used in various fields of work. They have taken over dangerous, boring, and monotonous jobs. While cleaning is still done with the help of maids and janitors in institutes and big building complexes which strains and tires them? Hence the need for an autonomous floor cleaning robot. The existing floor cleaning robots are bulky and are not very user-friendly. They tend to be on the expensive end. Automatic floor cleaner is a compact robotics system which provides floor cleaning service at big industrial floor , co-operate offices , sports stadium, bus stands, railway platform and educational institute for reducing human efforts. A robot which is capable of efficient dust cleaning and mopping of the floor of a given room is the main aim of the robot. Robots are being developed that will be useful for colleges, offices, and industries in order to be economically feasible. This helps to keep the workspace clean without physical labour. Also, the device will clean the room with a single switch of a button.*

Keywords: Floor Cleaning, Smart Robot, Floor Mopping, Metal Detection, NodeMCU.

I. INTRODUCTION

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 iRobot. Many related appliances from various companies have been followed. 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. From the very beginning of human era, cleaning was one of the tedious tasks. There were many methods for cleaning the premises. But those methods were tedious and needed high effort. It has become difficult for the working population to find time for room cleaning. Because of the difficulties, the existed system was not considered as an efficient method. As the technology has advanced, with the help of automation, cleaning task was made much more efficient. The burden of cleaning can drastically be reduced by means of using an automatic floor cleaner capable of accepting user commands via mobile. Main objective of this project is to design and implement a robot by using Node-MCU, Metal detector Sensor, LCD display, etc. and thereby controlling the robot through user commands by means of GSM.Among various vacuum cleaning robots present in the world only some robots can be used especially for doing the household chores of man. Among those robots, one special kind of robot that is very useful for everyone

is cleaning and mopping robot. A simple automatic robot that uses some prefixed algorithms and programs to clean the specified area is called a cleaning robot. The main use of this robot is to reduce the human interaction in the cleaning process which can be a time taking process. These robots can be used anywhere i.e., in offices, houses, industries etc. These robots can be activated with the press of a single button or can be pre-set to activate at a particular time.n recent years, robotic cleaners have taken major attention in robotics research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops, warehouses and universities etc. Basically, robotic cleaners are distinguished on their cleaning expertise like floor mopping, dry vacuum cleaning etc. Some products are based on simple obstacle avoidance using infrared sensors while some utilize laser mapping technique. Each cleaning and operating mechanism of robotic floor cleaners has its own advantages and disadvantages. For example, robots utilizing laser mapping are relatively faster, less time consuming and energy efficient but costly, while obstacle avoidance based robots are relatively time consuming and less energy efficient due to random cleaning but less costly. Countries like Pakistan are way back in manufacturing robotic cleaners. Importing them from abroad

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increases their costs. The main objective of this work is to provide a substantial solution to the problem of manufacturing robotic cleaner utilizing local resources while keeping it low costs.

II. LITERATURE SURVEY

Floor cleaning robot may be a trending concept in these recent days. By reviewing different paperwork and techniques of used several cleaning robots, we've started acting on our design of floor cleaning robot which is predicated on Raspberry Pi 3 model. The papers surveyed for literature review are as follows:

AishwaryaPardeshiet. al, [1] This paper presents the look, developed and fabricated model of programmed cleaner robot. this type of robot performs automated function with extra features like choose and place mechanism and dirt container with air vacuum mechanism. this type of labour is straightforward and helpful in betterment of life variety of a mankind.

Ajith Thomas et. al, [2] proposed an autonomous robotic for floor cleaning program. it's able to perform sucking and cleaning, detection of obstacles, and water spraying. Furthermore, it's also able to add manual method. All hardware and software functions are manipulated by Raspberry pi3 model.

Vaibhavi Rewatkar and Sachin T. Bagde [3] provided a comprehensive overview of the technological advantages helped within the real world for the convenience of just about all of the people that are extremely busy. Consequently, this has led to arriving up with a goal of constructing an automatic home appliance. The review includes computerized cleaner having components to DC motor operated wheels, the dustbin, cleansing brush, mop cleansing and obstruction avoiding sensor. A 12V battery is employed for supplying power. Special technique of ULTRAVIOLET germicidal cleaning technology. The study has been done keeping in mind economical expense of product.

Vinod J Thomas et. al, [4] designed a cleaner robot for domestic application. The robotic contains a cleaning module which may be used for cleaning. The Robot was created in order that it may well be capable of reach almost every space and corner of any room that it must be as compact as possible. The working robot is handled using an Android phone using Wireless Bluetooth Technology. The robot was created with an Arduino microcontroller at its core. The microcontroller is complemented with communications modules like Wireless Bluetooth motors and dirt Suction System to work accordingly. Manya Jain et. al, [5] discussed the event of Automatic Floor Cleaner. The project is often used for domestic and professional purpose to scrub the surface automatically and manually. When it's turned ON, it gulps within the dust particles by moving everywhere the surface (floor or the other area) because it moves over it. the driving force control mechanism are often wont to drive the motors where robot having the ability to manoeuvre and also the also few sensors are accustomed detect and avoid the obstacles. this can be often useful in making the approach to life better for humankind.

AbhishekPandeyet. al, [6] reviewed the requirement of a residence Cleaning Automatic robot. For keeping time there's a requirement of programmed system that cleans alone without person interventions. Also, they considered how precisely to help those that have physical disabilities. Because that they had to induce this done, they needed a cleaning system that may add accordance from what we are saying, thus supporting a physically someone.

Karthick.Tet. al, [7] is intended to create up an autonomous automatic robot which will move itself without constant human instruction. The autonomous cleanser robot involves low power consuming electric components and it can operate at very low power. Electric parts are the controller board At mega 2560, Ultrasonic detectors, transformer IC and motor driver circuit. Mechanized part is motor unit with gearbox founded. Ultrasonic detectors will identify obstructions in line with the program being executed. A 12V, 4.5Ah rechargeable lead acid electrical device is that the energy source for this proposed cleaning automatic robot.

ManreetKaur and Preeti Abrol, [8] came up with the working of automatic robot Floor cleaning. This automatic robot can add any of two methods. All hardware and software functions are handled by AT89S52 microcontroller. This automatic robot is in a position to perform sweeping and mopping job. RF modules are getting used for cordless communication between remote (manual method) and automatic robot has range of 50m. This robot is given with IR sensor for obstacle recognition and automates water sprayer pump. Four motors are being employed, two for cleaning purpose, one for pump and one for tires. Dual relay circuit is employed to work the motors one for the pump and another for the cleaner. In previous works, there's no use of automated water sprayer and works only in programmed mode. With the automated mode automatic robot controls all the functions itself and alters the road if just in case there's

hurdle detection and moves back again. With the manual method, the keypad will be accustomed execute the expected job and operate automatic robot. In manual method, RF component is employed to transfer the knowledge between remote and automatic robot and display the data associated with the hurdle detection on LCD. the entire circuitry is associated with 12V electrical device pack.

Zelun L, Zhicheng Huang, [9] designed a cleaning automatic robot predicated on the ultrasonic basics. With the sole chip microcomputer AT89C52 and ultrasonic detectors the robotic can do the characteristic of practical impediment avoidance, programmed manage and programmed sweeping. Within the cleaning automatic robot, a revolving cylindrical brush is used before the automated robot and it sweeps garbage in to the dustbin along the way of motion, and a mop is used behind the automated robot, and it can sweep the ground when the automated robot is functioning.

RupinderKaur [10] designed a swabbing automatic robot which is extremely good for cleaning jobs especially in homes, Office buildings, Industries where sanitation could be a significant matter. Many research organizations are active in locating the most effective results through the unreal intelligence. Certainly, artificial intellect could be a branch of technology which makes computers sounds like mind. This product will sweep, and mop the bottom area with clean and other wiping components; and yes it collects the dust particles and other small parts in it. Mapping is wont to instruct this small device.

These devices is just too simple to use, very affordable and cleans every nook of the region. Being autonomous, it could add one's absence.
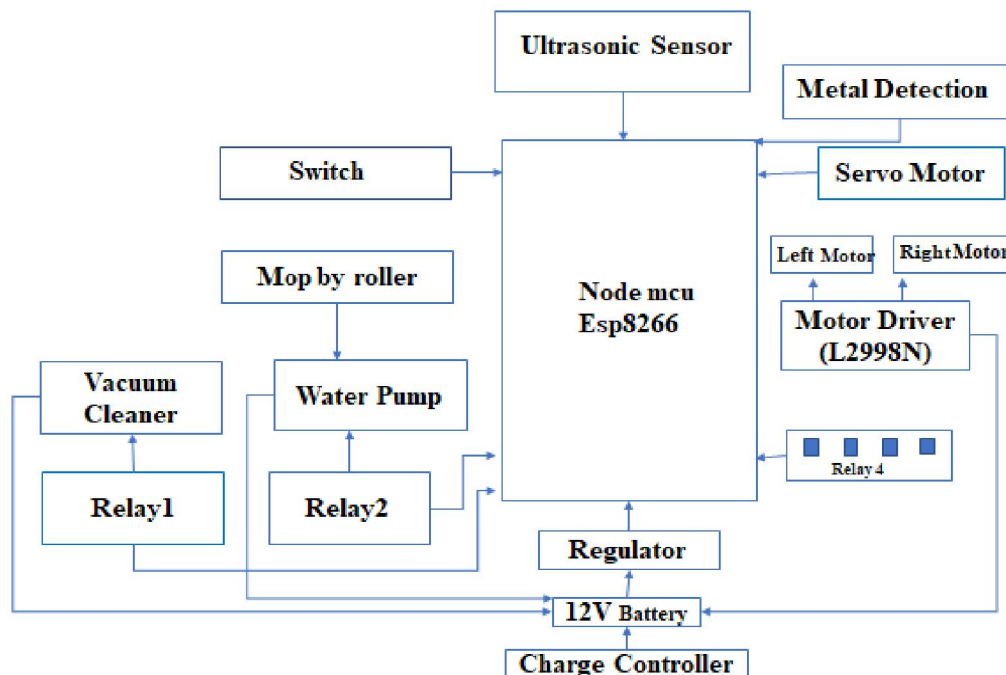
III. PROPOSED SYSTEM

Fig. 1 Block Diagram

The project uses IR line Follower robot to the most commonly utilized microcontroller- Node-MCU. The robot is powered by a 12V lead acid battery, the ideal voltage for all the motors involved here. The driver motor pair are 300rpm ones while for the mops I've opted for 75rpm plastic ones. The most impressive part is that the mops used were homemade, from old CDs and rags and they clean just perfectly. This is a smaller version so might not be suitable for a large area. There can be tons of other features added, like making it completely autonomous, which I couldn't do due to a shortage of time.

In this system, the output signals from the ultrasonic sensor and infrared sensor are received by Node-MCU but the motors and the cleaning devices (vacuum cleaner and water pump) are not operated at the start of the system.

Once the countdown timer function is started, the floor is cleaned immediately.

Node MCU ESP8266

Nodemcu is a low-cost open source iot platform. It initially included firmware which runs on the esp8266 wi-fisoc from express if systems, and hardware which was based on the esp-12 module. later, support for the esp32 32-bit mcu was added. there are two available versions of nodemcu as version 0.9 & 1.0 where the version 0.9 contains esp-12 and version 1.0 contains esp12e where e stands for "enhanced" . The NodeMCU (*Node M*icro*C*ontroller *U*nit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

Fig. 2.Node MCU ESP8266

Ultrasonic sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is $D = \frac{1}{2} T \times C$ (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).

Fig. 3.UltrasonicSensor

Metal Detector

Metal detector non-contact metal induction detection module Availability: In stock SKU: 51860 Add to Wish list Operating voltage: 5V DC. Detector distance: 1CM. Adjust the potentiometer, let the modules work normally. Small and easy to use module. It comes with a Buzzer for metal detection indication.The metal detector generates a constant electromagnetic field using a coil of wire called the transmitter coil. When an electric current is passed through this coil, it creates a magnetic field around it. When the metal detector is swept over an area, if a metal object is present within the range of the magnetic field, it will induce eddy currents in the metal
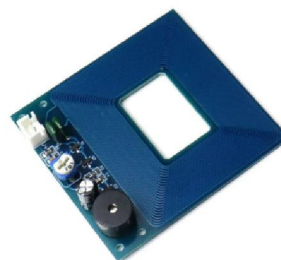

Fig. 4.Metal Detector

Relay

Arelayiselectricallyoperatedswitch.Manyrelaysusean electromagnet tooperate a switching mechanism mechanically, but other operating principles are alsoused. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or whereseveral circuits mustbecontrolledbyonesignal. A relay is an electrically operated switch. Current flowing through the coil of the relaycreates a magnetic field which attracts a lever and changes the switch contacts. Thecoil current can be on or off so relays have two switch positions and most have doublethrow(changeover) switchcontactsasshowninthediagram.

Fig. 5.Relay

Servo Motor

A **servo motor** is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a **servo mechanism.**

Fig.6 . Servo Motor

IV. CONCLUSION

In this Project, we are focused on developing the Robot that can perform the following functions: 1) Detect the straight path and avoid obstacles 2) Collect dust by Vacuum 3) Metal Detection 4) Mop the floor 5) Pore water by pump. The robot is specially built on the use of modernized technology. It has all the features that are required for a floor cleaning robot. It works automatically and manually. This could be locally manufactured with the help of local industries. This proposed robot reduces the cost and time of labour. The robot navigates with a front caster wheel and two rear wheels and detects obstacles using ultrasonic sensors. This project resulted in achieving the goals of developing an autonomous floor cleaning robot that can clean and maintain large floor spaces automatically and manually

V. ACKNOWLEDGMENT

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