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Automatic Floor Cleaning Machine

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Abstract - *Households of today are becoming smarter and more automated. Home automation delivers convenience and creates more time for people. Domestic machines are entering the homes and people's daily lives, but it is yet a relatively new and immature market. However, a growth is predicted and the adoption of domestic machines is evolving. Several machine automatic cleaners are available on the market but only few ones implement wet cleaning of floors. The purpose of this project is to design and implement Automatic Machine and Manual via Phone Application. Automatic Cleaner Machine is designed to make cleaning process become easier rather than by using manual vacuum. The main objective of this project is to design and implement automatic machine prototype by using Arduino UNO, Motor Driver L293D, Geared Motor, Ultrasonic Sensor, and Bluetooth module and to achieve the goal of this project. Automatic Floor Cleaner Machine will have several criteria that are user-friendly.*

Key Words – Arduino UNO, Motor Driver L293d, Geared Motor, Ultrasonic Sensor, Bluetooth Module

1. INTRODUCTION

Cleaning is the essential need of the current generation. Basically in household floors the floor has to be cleaned regularly. Different techniques are used to clean the different types of surfaces. This is a automatic and a Manual Phone Application control prototype cleansing machine These robots operate semi- or fully automatic to perform services useful to the well-being of humans and equipment. With the aim of keeping our robot as simple as possible, while able to perform the initial goals, i.e. an automatic vacuum cleaner robot able to randomly navigate through a room or a house with the minimum human assistance, the following specifications were found:

- Obstacle detection and avoidance
- Dirt suction from floor
- Wet and dry mopping
- Automatic cleaning

The aim of this project work is to develop and modernized process for cleaning the floor with wet and dry and also Obstacle detection. It is very useful for cleaning the floors. It can be used wet and dry; hence it is widely used in houses, hospitals, auditorium, shops, computer centers, etc.

1.1 OVERVIEW

The modern robotics is a science of intelligent control and connection between perception and action. Sensors are used to obtain information about vision, forces acting, etc. The micro-controller or robot computer is used to perform programming, planning and control. Currently, the research is concentrated on designing and developing robots to address the challenges of human life in their everyday activities. The work is focused on developing a new generation of robots that can live together with humans by providing assistance and services to humans at their home, workspace, and public spaces. Automated cleaning machine, as the name indicates it is used for autonomous cleaning of the house, work or public spaces. They find their applications in-floor cleaning. They are characterized by the capability to perform their function autonomously over a substantial time in the presence of obstacles. These are categorized under service robots or domestic robots. In this project, the emphasis is laid on the floor cleaning its working environment. However, the literature on floor cleaning machine was very limited. Hence, a study on floor cleaning was done to draw ideas for developing methodologies for the design of floor cleaning machine.

1.2 LITERATURE SURVEY

This machine operates in automatic as well as in

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manual mode. This machine is specially made on the basis of modern technology. Cleaner has all the features which are required for a vacuum cleaner. It can work automatically and manually. Cleaner has many competitors who are selling same product in high prices. The floor cleaning using automatic and manual modes. They have used bluetooth modules for wireless communication between phone and machine. In the automatic mode, machine controls all operations itself and changes the lane in case of hurdle detection and moves back. In the manual mode keypad is used to perform the expected task and to operate the machine. **2. BLOCK DIAGRAM**

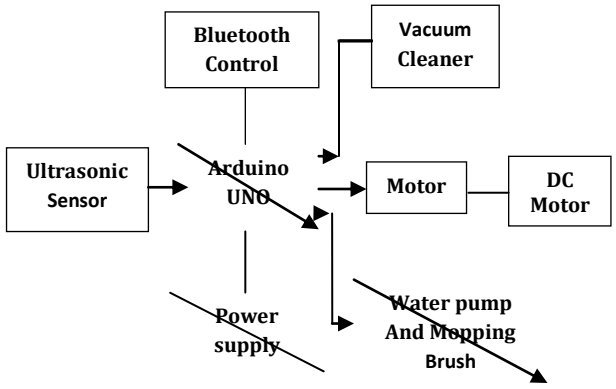

Fig.1. Block Diagram of Floor Cleaning Machine

1.1 ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to serial converter. This board is very simple and can be easily used, everything you need to support the microcontroller is in this board, just plug it in a computer via USB cable and power using an AC-to-DC adapter or battery to get started.

2.2 MOTOR DRIVER IC L293D

A very easy and safe is to use popular L293D chip. It is a 16- pin chip. The pin configuration of a L293D along with the behavior of motor for different input conditions is given in fig. 4. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. When an enable input is high, the associated drivers are enabled. Also their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

2.3 ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with ultrasonic transmitter and receiver module. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work: Using IO trigger for at least 10us high level signal The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time ×velocity of sound (340M/S) / 2.

2.4 BLUETOOTH MODULE

For the communication of the machine with the cell phone or a mobile we are using the Bluetooth device. 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 port 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 device. Bluetooth gives the connectivity between two devices using their MAC address.

2.6 DC MOTOR

A DC motor is a type of rotary electric machines that converts electric energy into mechanical energy. To periodically change the direction of current waft in part of

the motor, some internal mechanisms either electromechanical or digital are included in most of DC motors. Maximum kinds produce rotary motion; a linear motor immediately produces pressure and motion in a directly line.

2.7 VACUUM CLEANER

This is the process to clean the dust particles from the surface so that the load will be lessen for the purpose of other operation. If we remove this part there will be unnecessary load on scrubbing and wet sucking. This process is achieved by using a 12v DC vacuum pump. The inlet is divided into a number of holes so that dust all over the width can be sucked. The outlet is connected to a chamber that collects dry debris for disposal on a later case.

3. WORKING

In the modern era, the Automatic 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. In the paper, main focus is to build and program it in such a way, that it can move around freely and clean a specific area by the vacuuming process. Brushes are attached at its side in order to collect the dust while moving. It uses Ultrasonic sensors to detect the obstacles and hence change its direction while moving

Microcontroller (AT mega 328p) is used which is provided with clock signal (quartz crystal operating at 16 MHz frequency). DC motors attached to motor drivers to provide high current and most importantly it is installed with a sensors and suction unit to perform vacuum operation effectively. For Power Supply two separate batteries are used. One is used to turn on the cleaning unit and other is used to provide power to the suction unit.

4. RESULT

The machine that was manufactured facilitates both mopping and vacuuming mechanism. It works in both manual and automatic modes. The entire project started after approximating weight of the robot. Based on the weight, the torque required for the robot to move was estimated and the market survey was done to get to the final motor which was high Torque Metal Geared DC motor had been used in the robot. The shape and size of the robot were decided to keep in mind the ease of navigation and programming. With the motor in hand the power supply to the robot is to be selected, keeping in mind the voltage supply and the current capacity the market availability was narrowed down and the Lead Acid Batteries were chosen to reduce the cost of the robot. The IR Sensors which were in use by most of the existing Cleaning robots were replaced by the Ultrasonic sensors which were more accurate. Many challenges had to be addressed during every stage of the development of the robot.

Fig.2. Automatic Floor Cleaning Machine

5. CONCLUSION

The main objective of this thesis work was to design a proof-of-concept for an autonomous floor-cleaning machine. An extensive literature study was done to understand and compare the state of art technologies of these systems. However, the studies concentrating on the methodology of these systems were quite limited. The preliminary design and component selection of the vacuum cleaner system was based on the vacuum and airflow equations along with assumptions. The basis of these assumptions were the analytical skills of understanding, reasoning and comparing the existing models of vacuum cleaners.

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