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Automatic Floor Cleaner

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Abstract- The world today is governed by automation. When complex operations are made automated to simplify tasks, the benefits of automation can also be tapped to perform simple household tasks. One such task is cleaning. Cleaning, though undermined by its nature of work, is extremely vital. Cleanliness begets a healthy life. However, in the hustle and bustle in today's world cleanliness has been neglected. The research paper details the development of Automatic Floor Cleaner. The project is used for domestic and industrial purpose to clean the surface automatically. When it is turned ON, it sucks in the dust by moving all around the surface (floor or any other area) as it passes over it and also do the mopping work at the same time. The controller is used to drive the motors, the suction unit and also couple of sensors to avoid the obstacles. This can be useful in improving the lifestyle of mankind**.**

Keywords — Motor Driver, Ultrasonic Sensor, Suction Unit, Vacuum Unit, Mopping Unit.

1.INTRODUCTION

Cleaning is essential and often overlooked task. In today's world where time is money cleaning has been viewed as time-consuming task. However, cleanliness and hence health cannot be compromised. Many initiatives were taken towards building of automatic floor cleaners.

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 and mopping process.

Vacuum cleaner is at the middle of structure and mopping unit is at back of the device so that it can perform both of the work at the same time i.e. dusting and mopping. It uses Ultrasonic sensors to detect the obstacles and hence change its direction while moving and also preventing the cleaner to fall from height.

I. ARCHITECTURE

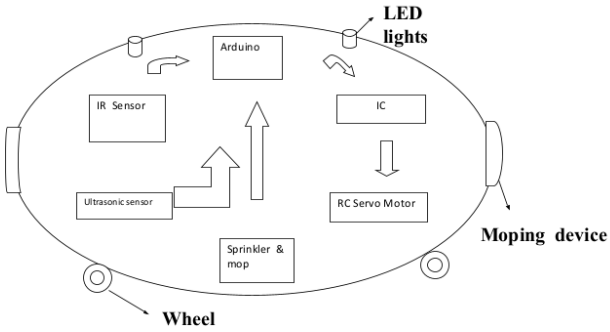


Fig. Block diagram of Automatic Floor Cleaner

The above figure shows the architecture of Automatic Floor Cleaner. Microcontroller (Arduino) is used which is provided with DC Servo motors attached to motor drivers to provide high current and most importantly it is installed with a sensors, suction and moping unit to perform dry and wet cleaning operations effectively. For Power Supply chargeable batteries are used which will also drive the cleaning unit and other requird units.

A. Hardware used:

a. Arduino
b. Ultrasonicsensor (SC-H04)
c. Motor driver (L293D)
d. Suction unit (Vacuum)

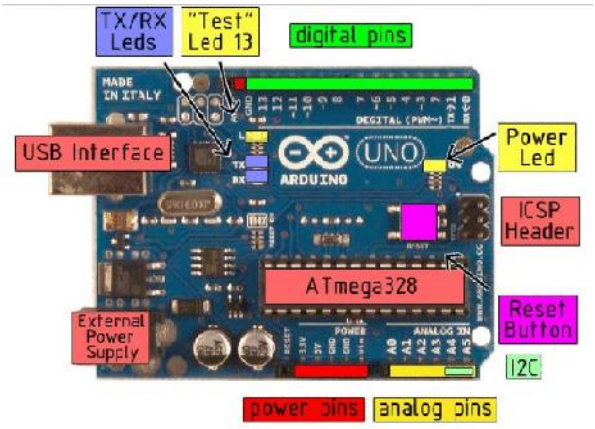


Fig -2: Arduino pin description

ATmega328/ Arduino: ATMega328p is the ATMEL Microcontroller on which Arduino board is based. The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB 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, internal and external interrupts, serial programmable USART, a byteoriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between1.8-5.5volts. The device achieves through put approaching 1 MIPS per MHz Serial data to the MCU is clocked on the rising edge and data from the MCU is clocked on the falling edge. Power is applied to VCC while RESET and SCK are set to zero. ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, lowcost microcontroller is needed.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz 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 an AC-toDC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USBto-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Fig -3: Ultrasonic Module

Ultrasonic sensor (SC-H04): 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: (1) Using IO trigger for at least 10us high level signal. (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. (3) 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

Fig -4: Motor driver shield

Motor driver (L293D):

a) Four H-Bridges: Two L293D Motor driver chips

b) L293D is rated at 0.65A per bridge (1.20A peak) with thermal shutdown protection, Motor Voltages from 4.5VDC to 16VDC. (up to 36V if C6 and C7 are upgraded)

c) Up to 4 bi-directional DC 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) Separate Logic and Motor power connections

g) Terminal block connectors for motors and power

h) 2 connections for 5V 'hobby' servos

Suction unit (vacuum):

The suction unit in the project have 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 rotating purpose (i.e. wheels).The propeller is made up of steel and it has the diameter is of 5 cm which is divided into 8 equal plates, each rotated at angle of 22 degrees. It requires the current of 0.4 amperes. It has a narrow nozzle which is 1 cm wide. The vacuum assembly is enclosed in the rigid plastic chamber, in order to prevent dust enter this section. It is made waterproof against splash water. It rotates and suck in the dust and which can further removed by detaching the unit.

B. Software Description

To program the Arduino the Arduino IDE is used which is free software that enables programming in the language that the Arduino understands. In the case of the Arduino, the language is based on C/C++ and can even be extended through C++ libraries. The IDE enables writing a computer program which is a set of step-by-step instructions that is then uploaded to the Arduino. Arduino will then carryout those instructions and interact with whatever it has been connected to it. In the Arduino world, programs are known as “sketches”.

1.2 WORKING

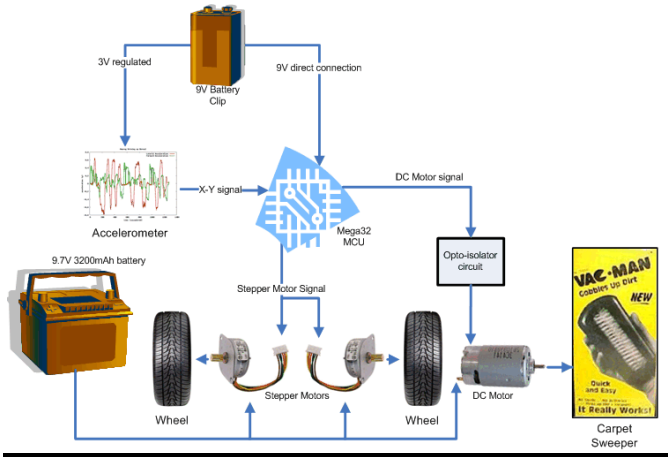


Fig -5: Working Diagram

The automatic floor cleaner is intelligently programmed to clean a specific area through a vacuum cleaning assembly. The cleaner is cost effective, convenient, environment friendly that saves the valuable time of any person. The vacuum cleaner is made on a circular piece of board that has wheel beneath it and brushes attached at its side in order to collect the dirt as it passes over the surface. DC motor is used to change direction of wheels which is connected to the platform. If the enough current is produced then DC motors can be operated directly otherwise a motor driver is required so as to provide it a high current i.e. upto 0.7 to 1.2 ampere. Driver Used is named as L293D with H-Bridge Configuration. The cleaner is handy and can spin anywhere in any direction. Sensors are basically used to set up a communication link between the outside world and the digital device and to fulfil the purpose use two Ultrasonic Sensors (HC-SR04) are incorporated in the project. One of it is used to detect the obstacles or hurdles in front of the cleaner so it moves back and change its path or lane and the other is used to detect the height in order to prevent the cleaner from falling down. A self-build suction unit is attached to the brushless DC motor rotating at a very high speed. It suck in the dirt as soon as it is turned on. It can be detached and the dirt can be removed from it.

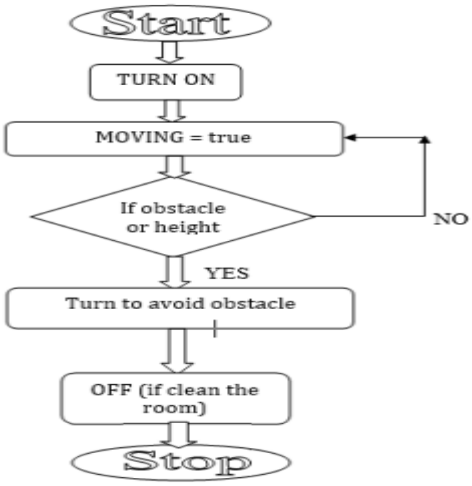


Fig -6: Flow Chart

2. FUTURE SCOPE

In today's era, 95 percent of the cost of cleaning a floor is labor. Naturally, the high cost of this simple task has inspired alternative solutions and that is Automatic Floor Cleaner .From industries to homes automatic floor cleaner is used and is becoming a very important part of life as it saves time, money and reduces human efforts to a great extent. Its approximate cost is 5000 INR. It is the future of cleaning in our fast moving life. It is no surprise that they would probably be more reliable than the manual sweeping.

The future scopes of the robots are as follows –

Using 2D mapping to generate a map of the surface

- to clean and clean it. Using disinfectants to kill bacteria using UV light.
- Using window cleaner
- Reducing the time and cost of runtime operation.
- Efforts to overcome most of the manual work
- needed to optimize the product. Improving the life of the product thus making it
- more durable. Adding features into the operation and product
- design topology standards

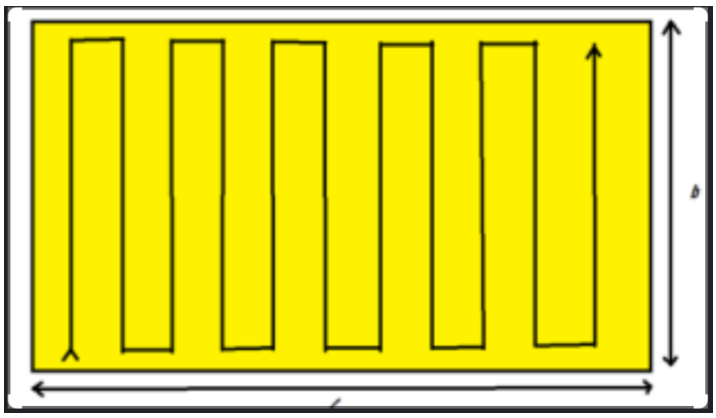
3. CONCLUSIONS

This research facilitates efficient floor cleaning. Since in project the floor cleaner is incorporated with different devices like DC motor(s), ultrasonic sensors etc., so it will be easy to handle it also saves time and will work automatically for cleaning purpose at homes and offices. With simple algorithm and program, the cleaner will be able to cover large floor areas as well as find 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 effective as it will not be picking up everything in as it is not in sight but using the automatic floor cleaner it can be done easily.

This proposed robot reduces the time and cost of labor. In the previous research papers like robot vacuum cleaner and automatic floor cleaner, robot had some drawbacks like colliding with objects in front of it and this vacuum cleaner couldn't reach to small areas and left those areas unclean and the automatic floor cleaner robot collects the dust but the drawback over

4. Implementation

As the Robot traces a Zig-Zag path we can calculate the area of the room by given parameters as length(l) and breadth(b). The more the area of the room the more the time taken by the robot to complete cleaning operation. As mentioned above, Area for Rectangular room = l*b. Similarly, for room of the other shapes, For Circle - A=(pi)r^2 For Square - A=(side)^2



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