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Review Paper on Design & Development of Autonomous Floor Cleaning Machine

Mr. Shivam. S. Pandgale[1], Mr. Prajwal. S. Mane[2], Mr. Siddhesh. S. Ghadge[3], Mr. Shlok. V. Ashtekar[4], Mr. Arun. M. Meshra[5]

[1, 2, 3, 4, 5]Department Of Mechanical Engineering, JSPM'S RSCOE IInd Shift Polytechnic, Tathawade, Pune-33

Abstract: In this era of automation, new automatic machines which are already present there in market are getting more attention of researchers, automatic lower surface of room cleaning machines are one of these. As we see there are lot of advanced lower surface of room cleaning machines already exists in markets but there are some issues due to which this machines are limitedly popular only up to economically great countries like because of their high cost, complicated designs, lack of awareness about cleaning. In this paper a automatic as well as manual (bluetooth module controlled) lower surface of room cleaning machine is introduced, which will be fabricated by considering the point of views – To make it affordable for every class of society, customer satisfaction, to spread awareness about cleaning, environment friendly, efficient cleaning and both to improve & simplify the work of mankind by reducing efforts and utilizing less energy.

It will consist components like vacuum dust collector (for collecting minute dirt particles from lower surface of room), first and only on of kind water lower surface of room cleaning arrangement (which is not present in other lower surface of room cleaning machines out there now), IR sensors operated, arduino controlled.

Keywords: Automatic & manual (bluetooth module controlled), affordable, environment friendly, reduction in efforts, water cleaning arrangement, IR sensors, arduino controlled.

I. INTRODUCTION

In the present era a lot of new technologies are on the path of innovation and the lower surface of room cleaning topic is one of them but if we look history of some past years there was time when the society had been cleaning lower surface of rooms traditionally by using different handmade equipment's. Initially it was being cleaned by different reed brushes. The brushes did not have long handles which would have rendered their use less irksome and required bending low when employing them.

For the ease of human beings different designs of brushes are evolved. As the time passed new technological period starts a lot of new techniques are used to clean the lower surface of room. The initial among those was the reciprocating motion of brush actuated by muscular force. In this present time, people lead a much occupied life. People in cities have uncertain and long working times. In such a condition a person will always discover ways to optimize time. Thus automatic work is taken over by machines nowadays. Autonomous robots for lower surface of room cleaning machines are available in the markets. It is able to perform sucking and mopping tasks, barrier detection, and automatic water sprinkle. Moreover it is also able to work in manual mode.

This lower surface of room cleaning machine cleans your house's lower surface of room with the rotating mops.

There's also water pump and water reservoir which can be switched on according to need to spread water uniformly on mops to make it wet proper cleaning. The machine uses bluetooth communication via HC-05 bluetooth module to send the commands the most commonly used microcontroller- Ardiuno UNO. The machine is powered on lead acid batteries which give ideal voltage required for all motors in it. The mops are rotated by the pairs of driver motors. To make this autonomous cleaning happen there may be numbers of features are to be added.

II. LITERATURE REVIEW

In old times lower surface of room is cleaned by hand using different homemade equipment's. Initially it was being washed by different stick brushes. According to Egyptian houses were built of sundried mud bricks at times white-washed and the lower surface of rooms were stamped earth. The lower surface of room of the outdoor kitchen too was simply the ground baked stone hard by the sun. Except it was raining, which happened only infrequently, this lower surface of rooms was easy to keep clean by sweeping. Like most primitive Egyptian equipment's, these brushes did not have lengthy handles which would have provided their use less annoying, and required bending low when using them. For the ease of human beings different designs of brushes are evolved. Again while the ages of sovereign carpets of different designs are utilized to cover the lower surface of room to keep it clean. As the time passed new technological period begins a lot of new techniques are used to clean the lower surface of room. The first among those was the reciprocating motion of brush actuated by muscular force. The brush design is replaced time to time

depending upon the lower surface of room structure and ease of washing personnel. As the electricity came into part vacuum cleaner are invented to clean a dry surface. Moving forward different lower surface of room cleaning machines are being invented to clean the lower surface of room with minimum usage of muscular power. Then came the idea of mobile robot. Mobile robots have the ability to move around in their surrounding and are not fixed steady to one physical location. By contrast, industrial robotic machines are basically more-or-less steady, containing of a jointed arm and gripper assembly, attached to a fixed surface.

For the ease of human beings the first floor cleaner was produced during 1980s. In that equipment the aim was to wash the lower surface of room with less power utilization.

There sweeping technique of mop is actuated by a timing motor which was associated by the dc circuit. Here water is sprayed on the mop and hence the wet mop is utilized to clean the debris from the lower surface of room. But the problem here was it can't use any chemical solvent or disinfectant.

Again for soaking motive only hot air is utilized. Again for displacing the machine a worker has to be engaged. To overcome this disagreement current study was done to allow the cleaner move automatically throughout any type of room. The moping mechanism is also modified to lower the cost. In current study the mop is continuously rotating around an axis perpendicular to the motion of the cleaner which also helps in aiming water on the lower surface of room backward. Rather than using a wet mop a sprinkle mechanism is utilized to make the lower surface of room wet which is scrubbed by the mop.

A vacuum cleaner was used to soak dirty water from the lower surface of room surface and side by side cleaning the surface. For automatic action of the cleaner mobile robotics are used.

Mobile robots are a main attention of present research and almost every major university has one or more than one labs that focus on mobile robot research.

Mobile robots are also found in military, industrial and security settings. Household robots are consumer products, including entertainment robots and those that do certain household tasks such as gardening or vacuuming. From then on more advanced robot is designed for household instruments for automating the tasks including micro woven, washing machine. After that only the revolution of mobile robotics came to domestic usages.

The problems with current automatic lower surface of room cleaning machines are they are only used in households for only dry and wet cleaning but not as infection remover. So it is only used in households and not in hospitals or small areas in public. The automatic mops used to clean floor like hydrobot are big and they also require great power and are used for commercial motive. But we think this will solve all in one go… We will basically aim on a smart and smaller and better designed robot which can be utilized in many areas like educational areas and healthcare (which are of course small areas) and also for domestic use. So it will be both for aboriginal cleaning like medicals and indoor floor cleaning. In future we will aim on indoor air cleaning service as an extra advantage to this machine.

III. AIM OF PRESENT WORK

A. Main aim

This present work is aimed at working of an automated motion operated machine that could clean the lower surface of room of usual Indian house-hold. Once the machine will put in ON mode it will run all over the surface without including any bit of floor space. The machine should avoid the barriers on its way.

Better cleaning is obtained by motion of the mop which is relatively rotational in type. The cleaning process is perform by making the lower surface of room wet and mopping it and again making the floor dry. The floor should be dry after the procedure is completed because wet lower surface of room leads to different sort of issues as mentioned above. For this motive vacuum pumps are to be utilized.

The cleaning also face challenges like which type of dirt it will meet. So dry cleaning mechanism is installed. This leads to better cleaning when heavier particles are there as dirt particle, Thus leading to better cleaning of the floor. There might be oily surfaces in some situations. To avoid these situations necessary disinfectants should be used. Four wheel drive mechanism is to be used for proper operation of the machine.

For controlling all the motors and vacuum pumps usually micro controller like Aurdino is used. For completing the motion all over the floor spiral mechanism and particle swarm optimization technique is being utilized. Image sensing techniques for avoiding obstacles are to be used. Optimization techniques are utilized for improving efficiency of movement data. It checks no repeatability of the motion over a particular space. Generally we are to design a portable machine that could move automatically all over the lower surface of room avoiding barriers and cleaning the floor

B. Other Objectives

Some of our another objectives are given below in the table

Table I other objectives

Mission Statement: Automatic Lower Surface of Room Cleaning Machine	
Product Description	• Omni directional, cleans efficiently, uses infrared sensors, Automatic as well as manual, Bluetooth controlled.
Key Business Goals	• Environmentally friendly. • Capture maximum cleaning machine sales. • Increase efficiency. • Customer satisfaction & provide better customer service. • Make cleaning machine affordable for every class of society than the expensive existing machines out there.
Primary Markets	• New Automatic Lower surface of room Cleaning. Machine Users. • Middle – Class Families (Rs 1,800,000 – Rs 7,200,000). • Average size homes (2300 sq. ft.).
Secondary Markets	• Professional cleaning services. • Businesses. • Upper class families (Rs 7,200,000– unsp.).
Assumptions and Constraints	• New product platform. • Infrared System. • Wireless System. • Lower surface of room Water Cleaning is new idea with combination of vacuum and mops.
Stakeholders	• Purchasers and users • Manufacturing operations

IV. INTRODUCTION TO ARDIUNO 2560

A. Ardiuno UNO mega 2560 Microcontroller

Arduino MEGA 2560 board is just like a brother of Arduino UNO board. It is way more powerful than Arduino UNO and also twice as long from it. This board is the successor of Arduino MEGA. It can be named as ATMega2560. As compared to other microcontrollers it can have more memory space. Arduino MEGA 2560 is different from all other boards of Arduino that came before as they don't use the FTDI USB-to-serial driver chip. Instead it uses ATmega16U2 programmed as a USB-to-serial converter. It is programmed in Arduino IDE software like all other boards in terms of coding. We don't need to attach extra components or devices to make this board in running condition to use. As per our requirements we can just plug and play with this board as everything is built in that makes it readily available.

Microcontroller like Arduino Mega 2560 is an amazing for the projects that need huge amount of input-output pins or if high processing power is needed. It is designed for more complex projects because as for simple projects large amount of input output pins are useless and a board with less memory fails to achieve our requirements. It can be used as a stand-alone project or in combination with other boards. Mostly it is used for creating a stand-alone project.
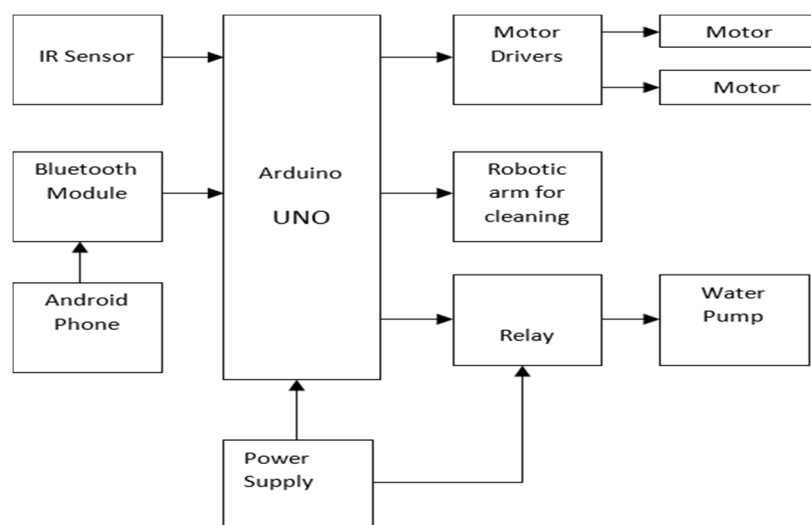
Figure.1 Arduino UNO circuit connection block diagram [5]

B. Pins of Ardiuno mega 2560 Board and Uses
1) In digital side 54 pins for I/O (input output pins)
2) 15 pins out of this are useful for PWM (pulse width modulation)
3) In analog side 16 input pins
4) Ground pins : 5
5) One pin for 3.3 volts
6) One reset button
7) USART pins : 4 (These are hardware serial ports which produces maximum speed to set up communication)
8) ISP programming pins : 6
9) Crystal oscillator is added on the board having frequency of 16 MHz
10) USB cable port (It is used to transfer and connect code from computer the board)
11) ICSP header (Used to program the board and to upload code from computer. Indeed a remarkable addition in Arduino MEGA 2560)
12) Power Jack
13) Resettable Polyfuse: (to provide extra layer of protection. It prevents USB port of the computer from overheating in case of high current flowing through microcontroller board)
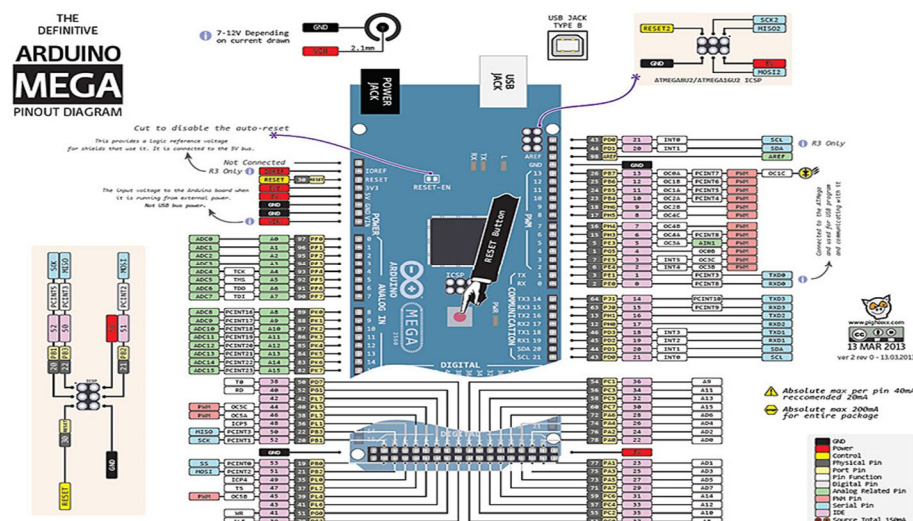

Figure.2 Arduino mega pin-out diagram [1]

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C. Applications of Arduino Mega 2560

As mentioned earlier, applications of Aurdino mega controller is pretty unusual due to large number of input-output pins. But it's massive for the projects mentioned below.

1) 8 bit computer
2) 3D printer
3) To control and handle more than one motor
4) Robot with many sensors
5) CNC router
6) Temperature detection and sensation
7) Detection of water level
8) Automation and security projects
9) Internet of things applications
10) Multitasking or parallel programming

D. Software for Programming Arduino Mega 2560

Just like other Arduino boards , Arduino MEGA 2560 also uses Arduino IDE. This IDE supports C programming so we have to write program in C language. We can type our program in it and then burn that code in our microcontroller and we can also change our code according to requirements. The code that we make on software is known as sketch and it is burned in software and then transferred to our microcontroller using USB cable.

V.   INFRARED IR SENSOR CIRCUIT DIAGRAM AND WORKING PRINCIPLE

An electronic device called as infrared sensor that emits in order to sense some features of the surroundings. An IR sensor capable of detecting motion of object as well as measuring its heat. These types of sensors available there only measures infrared radiations, rather than emitting are known as **Passive IR Sensors**. Generally, in infrared spectrum, all the objects radiate some kind of thermal radiation. These kinds of radiations are invisible to living eyes that can be detected by an IR sensor. The emitter is just an IR LED (**Light Emitting Diode**) and the detector is just an IR photodiode that is sensitive to infrared light of the equal wavelength as that emitted by the IR LED. When IR light strikes on the photodiode, the resistances and the output voltages will vary in proportion to the magnitude of the IR light undergone.
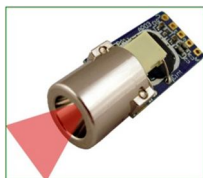

Figure.3 Infrared sensor [2]

VI.   INTRODUCTION TO L293D

L293D is basically a motor driver or controller. It has two built-in H-bridge circuits which are able to control two DC motors simultaneously in both clockwise and counter clockwise direction. It acts as an current high amplifier because it take low current signal at its input and provides higher current signal at the output in order to drives different load e.g. stepper motor & DC motors. Its features include large input voltage supply range, large output current high noise immunity input signals etc. Its normal real life usages contain stepping relay drivers, motor drivers, DC motor drivers etc. L-293D motor driver/controller is shown in the following figure.

Figure.4 L293D motor driver [3]

A. L293D Pins

1) L-293D has sixteen (16) pins, having different individual functions.

2) All of these sixteen pins along with their serial no, are given in the table shown below.

L293D Pins	
Pin. No	Pin Name
1	Enable 1,2
2	Input 1
3	Output 1
4	GND
5	GND
6	Output 2
7	Input 2
8	V_{CC2}
9	Enable 3,4
10	Input 3
11	Output 3
12	GND
13	GND
14	Output put 4
15	Input 4
16	V_{CC1}

Table II L293D pins [3]

B. L293D Pin Function

1) L 293D each pin has different tasks to perform when they are in working condition.

2) The tasks assigned to each pin are given in the table shown below.

L293D Pins Functions	
Pin Name	Pin Function
Enable 1,2	Enable pin for motor 1- active high
Input 1	Input 1 for motor 1
Output 1	Output 1 for motor 1
GND	Ground (0V)
GND	Ground (0V)
Output 2	Output 2 for motor 1
Input 2	Input 2 for motor 1
V_{CC2}	Supply voltage (12V)
Enable 3,4	Enable pin for motor 2- active high
Input 3	Input 1 for motor 2
Output 3	Output 1 for motor 2
GND	Ground (0V)
GND	Ground (0V)
Output put 4	Output 2 for motor 2
Input 4	Input 2 for motor 2
V_{CC1}	Supply voltage (5V)

Table III L293D pins function [3]

VII. INTRODUCTION TO 16×2 LCD MODULE

A. The liquid crystal display is normally used in different embedded projects due to its low cost, easy access and flexibility to get programmed.

B. Almost each and every electronic device we daily see it like in you mobile, calculator and some other devices.

C. There is a type of liquid display that has sixteen column and two rows so it is known as 16 x 2 LCD modules.

D. LCD also available in different arrangements like (8 x 1), (10 x 2), (16 x 1), but the 16 x 2 liquid crystal is normally used in embedded projects.

E. In this liquid crystal display, there are thirty-two characters and each of them consists of 5 x 8 pixels.

F. So we can say that character consists of forty pixels or dots and total pixels in this liquid crystal display can be fined as (32 x 40) or 1280 pixels.

G. During its interfacing with a microcontroller, it makes sure that liquid crystal display should be directed about the locations of pixels.
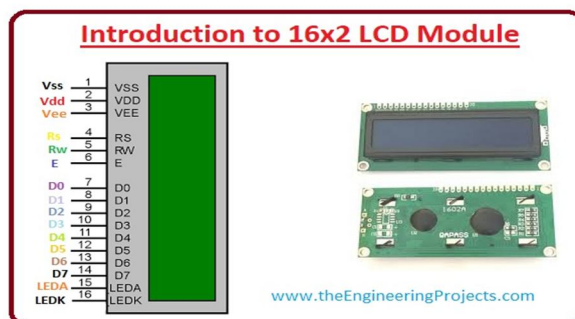
Figure.5 16×2 LCD Module *[4]*

VIII. OVERALL CIRCUIT CONNECTION DIAGRAM AND WORKING FLOW CHART
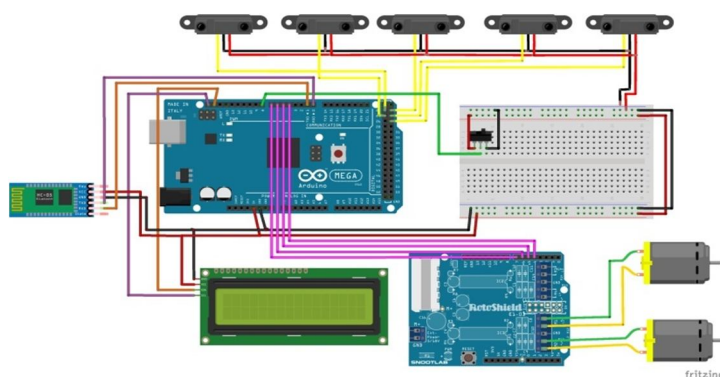
A. Circuit Connection
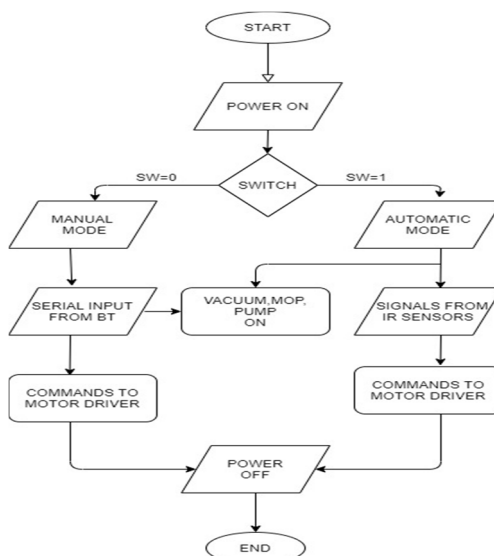

Figure.6 circuit connection

B. Flow Diagram

Figure.7 Overall working flow chart

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