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# An Innovative Solar Based Robotic Floor Cleaner

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**Abstract:- Conventional floor cleaning equipment is most commonly found in airports, train platforms, hospitals, bus stops, shopping malls, and a variety of other commercial settings. These devices require electrical energy to operate and are not user-friendly. Around India, particularly during the summer, there is a power outage, and most floor cleaning machines are ineffective as a result, particularly around bus stops. As a result, there is a need to design low-cost, user-friendly floor cleaning machines. In this project, we will create solar-powered mobile floor cleaning equipment that may be used as an alternative to traditional floor cleaning machines. Because of the high cost of manpower, time, effort, and affordability, automated floor cleaning devices have been widely employed in developing countries for many years. This abstract is based on our creative concept to design, develop, and manufacture a semi-automatic solar-powered mobile floor cleaning machine that will run on solar energy, mobile communication, battery power, or electricity. A semi-automatic floor cleaning machine will be created with basic considerations for less energy consumption, machine and operating cost reduction, reduction of human effort, environmental friendliness, and ease of use in mind. The project's foundation is the utilisation of renewable energy, which is abundant in most nations, has a low environmental impact, and is simple to build on a commercial scale in the future.**

***Keywords**:- Sensors, controllers, solar energy, and a floor cleaning mechanism.*

## I. INTRODUCTION

Conventional floor cleaning equipment is most commonly found in airports, train platforms, hospitals, bus stops, shopping malls, and a variety of other commercial settings. These devices require electrical energy to operate and are not user-friendly[1]. Around India, particularly during the summer, there is a power outage, and most floor cleaning machines are ineffective as a result, particularly around bus stops. As a result, there is a need to design low-cost, user-friendly floor cleaning machines. In this project, we will create solar-powered mobile floor cleaning equipment that may be used as an alternative to traditional floor cleaning machines. Because of the high cost of manpower, time, effort, and affordability, automated floor cleaning devices have been widely employed in developing countries for many years.

Cleaning may appear to be a simple task, but having a clean, clutter-free living area has been linked to numerous favourable outcomes, such as being free of disease and allergies. Cleaning is a necessary task in almost every location. This is sometimes easy and sometimes challenging because certain sites have big floor surfaces that require more than one person to clean, so we needed some way to compensate for this problem.[2] Robotic cleaners have received significant attention in robotics research in recent years because of their usefulness in assisting humans in floor cleaning applications at homes, hotels, restaurants, workplaces, hospitals, workshops, warehouses, and universities, among other places. Essentially, robotic cleaners are defined by their cleaning abilities, such as floor mopping, dry vacuum cleaning, and so on. Some devices rely on simple obstacle avoidance using infrared sensors, whereas others rely on laser mapping. Each cleaning and operation mechanism in robotic floor cleaners has its own set of benefits and drawbacks.[3] Fully automatic and semi-automatic machines are both expensive and heavyweights on the market. As a result of focusing on both weight and cost, they are out of reach for many people, including the organising committees of hotels, hospitals, and hostels. As a result, there is a need to design and build a floor cleaning machine that is both simple to use and cost-effective. This machine is simple to use, and not only does it save time and money when cleaning, The cost of maintenance is likewise relatively low.[3]

## II. LITERATURE SURVEY

A solar-powered floor cleaning machine, "AKASH NAGTODE (2017). He has created a solar-powered cleaning system. He employed a photovoltaic panel to transform energy particles (photons) into electricity. He powers his cleaning machine with this clean energy."[4] According to M. Ranjit Kumar (2016), "regular floor cleaning machines are most commonly used as a part of aeroplane terminal stages, railway stages, healing centres, transportation stands, and shopping centres, as well as in numerous other business places." These devices require an electrical current to function and are difficult to use. In India, particularly during the summer, there is a control emergency, and the vast majority of floor cleaning machines are not used effectively as a result, particularly in transit stands. The floor cleaning machine was demonstrated and investigated in this study using proper, financially accessible programming. We can see from the restricted component analysis that the emotion of worry in the physically performed floor cleaning machine is as far within as possible." SANDEEP, Design and Development of Tricycle Operated Street Cleaning Machine," J. MESHRAM et al. He invented the tricycle-powered street cleaning machine. In this research paper. He designed a concept specifically for rural areas. He concluded that street cleaning is less effective." MOHSEN AZADBAKHT ETAL [2014]: "Design and fabrication of a tractor-powered leaf collector machine equipped with a suction-blower system." - "The authors explained the fabrication of a tractor-powered blower leaf collector machine." He built the machine with a chassis, pump, blower, gearbox, and hydraulic jack. They concluded that the overall power usage of that machine is roughly 14634 W, with a range of up to 20m."[5] MANREET KAUR [2014]: "Design and fabrication of manual and automatic floor cleaner robots." The author created a robot that can clean the floor in both automated and manual modes. His robot was outfitted with IR sensors to identify obstacles, four motors, and a water pump. He finished by mentioning the "convenience of dual-mode operation for easy floor cleaning."[6]

## III. PROPOSED SCHEME USE OF COMPONENTS

### *A. ULTRASONIC SENSOR:*

Ultrasonic sensors are used to detect obstacles and alter direction while travelling. This sensor is controlled by an Arduino controller and also drives DC motors via driving circuitry. The HC-SR04 ultrasonic sensor, like bats, uses sonar to estimate distance to an object. It provides outstanding non-contact range detection in an easy-to-use design, with high accuracy and reliable results. Its operation is unaffected by sunshine or dark materials, as Sharp rangefinders are (but acoustically soft materials such as fabric can be difficult to detect). It has an ultrasonic transmitter and receiver module.[7]


Fig: 3.1 HC-SR04 Ultrasonic Sensor

The ultrasonic ranging module HC-SSR04 has a non-contact measurement range of 10 to cm -400cm with a ranging precision of 3mm. Ultrasonic transmitters, receivers, and control circuits are included in the modules. Using an IO trigger for a high-level signal of at least 10us. The module automatically delivers eight 40 kHz pulses and detects whether a pulse signal is returned. If the signal is returned via high level, the period of high output IO duration is the time between sending ultrasonic and returning. Distance to be tested = high-level time velocity of sound (340 M/S) / 2.[8]

### *B. ARDUINO UNO:*

The ATmega328P-based Arduino Uno is a microcontroller board. It contains 14 digital I/O pins (six of which are PWM outputs), 6 analogue inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It comes with everything you need to support the microcontroller; simply connect it to a computer through USB or power it using an AC-to-DC adapter or battery to get started. The Uno differs from the previous boards in that it does not include the FTDI USB-to-Serial driver chip. Instead, the Atmega8U2 is coded as a USB-to-serial converter. This board is very basic and easy to use; it contains all you need to support the microcontroller.[9]Simply connect it to a computer via USB connection and power it with an AC-to-DC adapter or battery to get started.[10]

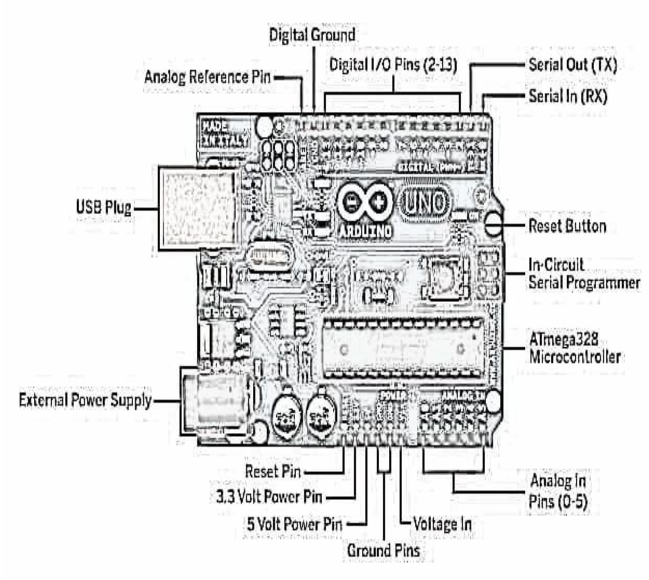


Fig: 3.2 Arduino Board

### *C. BATTERY:*


Fig: 3.3 Battery

BATTERY : 12V-1.3Ah: Rated voltage: 12V; capacity: 1.3 Ah; AGM technology Maintenance: free rechargeable batteries Body dimensions: 97x43x52mm; storage time: 6–9 years; leads: 4,8mm connectors; weight: 0.58kg; rechargeable batteries; application alarm systems; and power backup systems.[11]

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*D. LCD:*


Fig: 3.4 Liquid Crystal Display

LCD is an abbreviation for liquid crystal display. It is a type of electronic display module that is used in a wide range of applications, such as various circuits and devices such as mobile phones, calculators, computers, TV sets, and so on.[12]

**The features of this LCD mainly include the following.**

The operating voltage of this LCD is 4.7V–5.3V.

It has two rows, each of which can produce 16 characters.

The current consumption is 1 mA with no backlight. • Each letter may be made with a 588-pixel box.

The alphanumeric LCDs display alphabets and numbers.

It has two modes of operation: 4-bit and 8-bit; it has a blue and green backlight; and it shows a few user-made characters.[13]

*E. SOLAR PANEL:*

Fig. 3.5: Solar Panel

The sun is the source of solar energy. Solar panels (also known as "PV panels") are used to convert sunlight's light, which is made up of energy particles known as "photons," into electricity that may be used to power electrical loads. Solar panels have a wide range of applications, including remote power systems for cabins, telecommunications equipment, remote sensing, and, of course, electricity generation by residential and commercial solar electric systems.[14]

➢ *Software:*

- For programming, use "Aurdino IDE."
- Version 1.8.13
- For PCB design, Proteus Design Suite"
- Version 8.10

*F. 12V Gear DC Motor:*

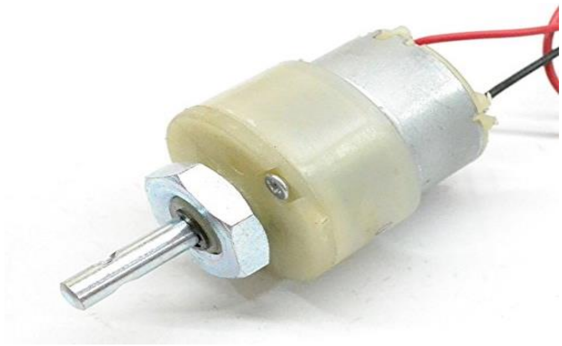

Fig. 3.6: 12V DC Motor

➢ *Features*

- 12V DC motors at 60 RPM with a gearbox
- The base motor spins at 3000 RPM. An internal hole in a shaft with a diameter of 6mm
- 125 gm weight; • a variable rpm motor of the same size; 0.5 kgcm torque the maximum no-load current is 60 mA, while the maximum load current is 300 mA.

*G. L293D Motor Driver Module:*

Fig: 3.7 L293D Motor Driver Circuit

The L293D is a 16-pin motor driver IC that can operate two DC motors in any direction at the same time. The L293D is capable of bidirectional drive currents of up to 600 mA (per channel) at voltages ranging from 4.5 V to 36 V (at pin 8!). It can be used to control small DC motors.[15]

➢ *Features: -*

- The same IC can be used to power two DC motors.
- Control over speed and direction is possible. Vcc2 (Vs) motor voltage: 4.5V to 36V
- Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600 mA • Vcc1 Supply Voltage (vss): 4.5 v to 7 v Switching time: 300 ns (at 5V and 24V)
- There is an option for automatic thermal shutdown. It comes in 16-pin DIP, TSSOP, and SOIC packages.

## IV. WORKING

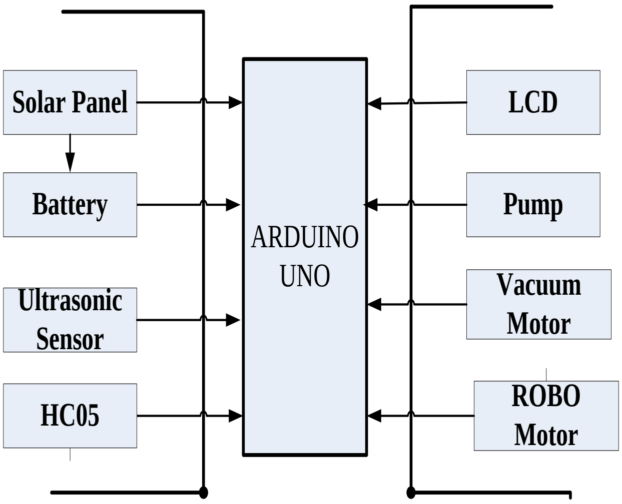


Fig: 3.7: Block Diagram

Fig. 3.8: Representation of vacuum cleaner functioning

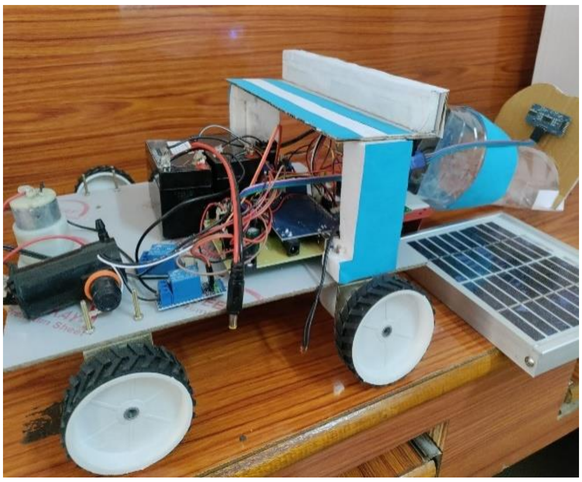

Fig. 3.9: Representation of water pump functioning

The robot is designed to assist and simplify daily cleaning activities. It combines dry and wet cleaning activities using a hoover cleaner and a wet cleaning brush.[16]

The robot is operated via a cell phone remote. The user uses the remote to deliver movement commander uses the remote to deliver movement commands. The robot receives movement commands and uses motors to accomplish the desired movement.

The robot relies on a battery, which a solar panel constantly recharges as the motors drain it. When the battery is exposed to sunlight, it lasts longer. A hoover with an ultrasonic sensor for obstacle detection is used in the system.

As a result, the robot does not collide with any obstacles. The robot includes a water tank that sprays water in front of it and is followed by a mop on the back side to clean the floor surface. As a result, we've created a remote-controlled robot floor cleaner.

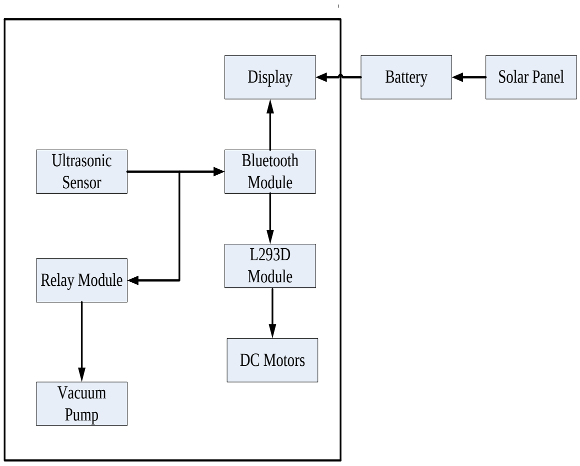


Fig: 3.10Modelling diagram

When a 10-watt solar panel is used and its energy is stored in a battery. The machine's electrical switchboard is powered by a 12-volt DC battery. The hoover cleaner receives power from the electrical board, and during operation, DC is provided to the hoover cleaner. The hoover is used to power the DC motors, which play an important role in the cleaning process. One of the three DC motors rotates the mop for cleaning. The mop's rotation is powered by a 12 V DC motor. The other two 12V DC motors are used to move the robot's wheels. The water supply is turned off during the dry cleaning process. The third motor moves the mop to provide thorough cleaning. A water spray pump is supplied at the bottom of the water tank to supply fresh water for effective cleaning. The supply of fresh water is controlled by a control valve. A number of holes are formed in the water-flowing tube for an equivalent amount of water. There is a hoover for cleaning dust particles that consists of an exhaust fan that is used to suction the dust, paper bits, and other particles.

The robot begins cleaning the floor by activating a simple switch. The floor-cleaning robot has a single switch that runs on battery power. The first step is to connect the power source to the pin. The robot starts moving in the direction the programming specifies by using the remote. The figure depicts a simplified flowchart of the robot's operation. When the bot is turned on, the suction and mopping mechanisms activate, and an ultrasonic.

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A simplified flowchart of the robot's operation is depicted in the picture. When the bot is turned on, the suction and mopping mechanisms kick in, and an ultrasonic sensor detects any head-on collisions. If there are any head-on collisions, it spins clockwise or anti-clockwise; if there are no collisions, it checks for bumper impact. If an impact is detected, the robot moves away from the impacted object; if no impact is detected, the robot moves forward and checks for potential head-on collisions, and the cycle repeats. The NIC sensor identifies any potential head-on collisions. If there are any head-on collisions, it spins clockwise or anti-clockwise; if there are no collisions, it checks for bumper impact. If an impact is detected, the robot moves away from the impacted object; if no impact is detected, the robot moves forward and checks for potential head-on collisions, and the cycle repeats.

## V. ADVANTAGES OF FLOOR CLEANER

- Quick and simple cleaning
- Vacuum cleaning to collect dust;
- Water tank and mopper for wet cleaning; and solar power source to extend battery life.
- Operation via Remote Control

## VI. CONCLUSION

This study makes effective floor cleaning with vacuuming and wet mopping possible. This robot works with remote control through a mobile device. This suggested work enables obstacle detection in the event that an obstacle is encountered. When a robot encounters a stumbling block, it adjusts course. It saves time and money while also providing efficient cleaning. The robot operates through Bluetooth in remote control mode. Operations such as adjusting the path in the event of a stumbling block are carried out automatically.[17]

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