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ADVANCED SOLAR POWERED FLOOR CLEANING ROBOTIC

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ABSTRACT:

Proper cleaning and sanitisation promote human health, which has a direct impact on our surrounds and our houses. Cleanliness has been linked to improved health in recent years. In order to help this cause, we have studied the topic and created a working model and design for a robotic automated floor cleaner. Our goal is to make cleaning any indoor space easier and faster while using less human labour. Because there are two sides to every story, the fuel-powered machines are expensive and have an adverse effect on the environment, while the manually operated ones are exceedingly time-consuming and tedious. Thus, we have come up with a substitute that may be used to render the previous restrictions void. Any home, hospital, hotel room, dorm room, school, college, etc. has a serious health danger from dust. The voluntary reduction of human labour costs by automated machine cleaners saves both time and money, making them essential for contemporary life. The majority of these cleaners are made specifically to meet the unique needs of the users. The project uses systems and devices from the mechanical, electrical, and electronic domains in partnership. It is made up of a number of structural parts, including a chassis, a few motors, and several electromechanical components. Our goal is to demonstrate a functioning cleaning machine model that can be utilised in a home while using the fewest resources possible.

I. INTRODUCTION

A clean environment is essential to everyday living. It is the process of maintaining a disease-free, dust-free environment for our mental and social well-being. In recent years, a variety of cleaning solutions have been available to keep your home dust-free. For the benefit of humanity, MACHINE-CONTROLLED FLOOR CLEANERS were created. One of the greatest and most useful appliances for homeowners to maintain clean floors is the hoover. Every one of these vacuums that are accessible has advantages and disadvantages. To keep a home clean, housekeeping tasks like sweeping and dusting need to be done repeatedly each day. We've suggested a robotic automated floor cleaner since, in the recent past, cleanliness has been linked to improved personal health. As a robot, it essentially removes human mistake and performs cleaning tasks more effectively. The basic obstacle avoidance method used by this robotic device makes use of ultrasonic sensors. We are making it cost-effective by using local resources to cut down on electricity use. Here, we are avoiding obstacles and achieving the required motion with the use of image processing techniques. In order to simplify things, we designed this device to be a short-range wireless communication device that runs at the 2.4GHz ISM band and is Bluetooth capable. We created a motor driver integrated circuit (IC), which is utilised to operate motors in autonomous robots, to ensure the device's dependable mobility. For hardware projects, it serves as an interface between Arduino and motors. When you want objects to react to

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manual input and different sensor readings, Arduino is fantastic. If the machine's owner misplaces the remote control, they may manually operate it by connecting a wireless Bluetooth application to an Android application.

PROBLEM STATEMENT

Daily housekeeping tasks like dusting and sweeping must be done often in order to preserve cleanliness. However, cleaning may sometimes be a dangerous physical exercise. In order to combat such issues, a number of machines have been developed with human comfort of use in mind, simplifying difficult and time-consuming tasks. However, moving and cleaning these complicated, large and heavy hoover cleaners is a laborious task. The hundreds to thousands of watts of power used by hoover cleaners on the market drives up electricity bills. The hoover motor burns out when the running electric motor becomes too hot. When dusting, there are some particles that, when breathed, might create respiratory system difficulties in that individual, which can lead to other health concerns. To guarantee a clean home, a number of devices on the market utilise certain mechanical and electrical systems. There are vacuums that don't come with reusable rubbish bags. Because one has to be personally present for the machine to move, these devices make life more difficult and cleaning tasks more challenging. In order to lessen the amount of work required for cleaning, our project aims to develop a low-cost, locally available device that can be used to dust and sweep areas that are far from dusty environments. It does this by using Bluetooth, DC motors, Android applications, ultrasonic sensors, and remote controls in place of manual labour.

EXISTING SYSTEM

Traditionally, a dry or wet mop is used to clean floors, while the hand may also be used as an instrument. On the surface, they must brush thoroughly. This involves cleaning a variety of surfaces, primarily marble, highly polished wood, and cement floors. The rough surface flooring, such cement floors, which are mostly found in semi-urban regions, are the ones coated with a lot of dust. The robot's body is made up of several tiny parts. It contains sensors, microcontrollers, actuators, and other parts, much like any other robot.

II. LITERATURE SURVEY

A.] Automated floor cleaner journal automation and control [4] Traditionally, a dry or wet mop is used to clean floors, while the hand may also be used as an instrument. On the surface, they must brush thoroughly. This involves cleaning a variety of surfaces, primarily marble, highly polished wood, and cement floors. The rough surface flooring, such cement floors, which are mostly found in semi-urban regions, are the ones coated with a lot of dust. The robot's body is made up of several tiny parts. It contains sensors, microcontrollers, actuators, and other parts, much like any other robot.

B.] A Robust Obstacle Detection Method for Robotic Vacuum Cleaners' authors are Mun-Cheon Kang, Kwang-Shik Kim, Dong-Ki Noh, Jong-Woo Han, and Sung-Jea Ko. [1] When robotic hoover cleaners (RVCs) clean the floor in intricate conditions, including underneath tables or chairs with tiny legs, they sometimes have trouble recognising impediments because they use ultrasonic or infrared (IR) sensors. a reliable triangulation-based obstacle detection (OD) technique for RVCs functioning in different housing conditions. Using the RVC's

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IR emitter, the suggested approach projects a horizontal IR beam towards the ground. Then, the RVC's wide-angle vision camera takes a picture of the floor or an obstruction's reflected IR line. The image coordinates of the pixels in the acquired picture that correspond to the IR line are used to identify obstacles.

C.] Tahseen Amin Khan, Abdul Basit Zia, and Muhammad Faisal Khan, the authors of the Smart Floor Cleaning Robot (CLEAR) [2] As technology advances, scientists are paying increasing attention to robots in an effort to improve human well-being. This article describes how the IEEE Standard 1621 (IEEE Standard for User Interface Elements in Power Control of Electronic Devices used in Office/Consumer Environments) was used in the design, development, and construction of the prototype Smart Floor Cleaning Robot (CLEAR). Along with other characteristics like scheduling for a specified period and a bag-less trash container with an auto-soil disposal mechanism, the subject robot may function both autonomously and manually. This work has the potential to significantly improve humankind's way of life.

D.] Manreet Kaur's publication, International Journal of Design and Development of Floor Cleaner Robot (Automatic and Manual), [7] It was this technology that first suggested using robots to clean floors. There are two modes of operation for this floor cleaning robot: "Automatic and Manual." The AT89S52 microprocessor manages all hardware and software functions. This robot is capable of mopping and sweeping. Robots and remotes (manual mode) can communicate wirelessly over a 50-meter range thanks to RF modules. This robot has an infrared sensor built in for obstacle detection.

III. DESIGN OF HARDWARE

This chapter provides a quick explanation of the hardware. It goes into great depth about each module's circuit diagram.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

• 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilise the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.

• A more robust RESET circuit.

• The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the

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Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

Fig: ARDUINO UNO

POWER SUPPLY:

The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c. power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

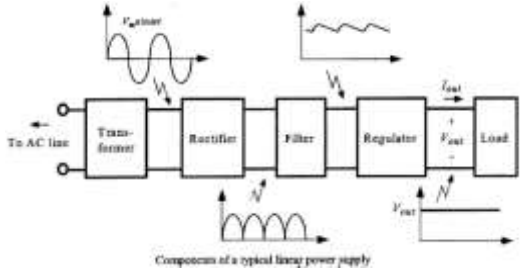


Fig: Block Diagram of Power Supply

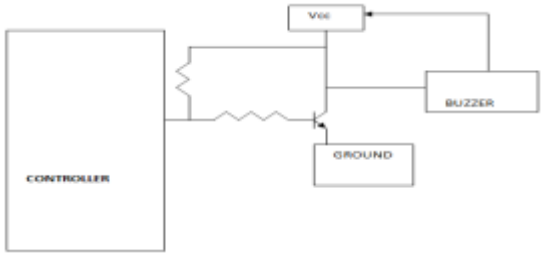
LCD DISPLAY

The model shown here is the one that is most often utilised in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

Fig: LCD

BUZZER

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



L293D:

Half-H drivers with triple high-current include the L293 and L293D. With voltages ranging from 4.5 V to 36 V, the L293 is intended to provide bidirectional driving currents of up to 1 A. Up to 600 mA of bidirectional driving current may be achieved with the L293D at voltages ranging from 4.5 V

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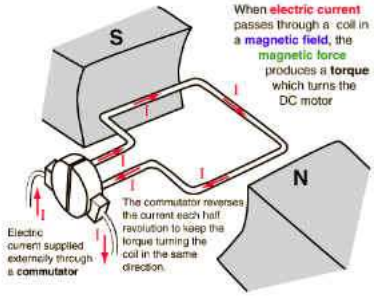
to 36 V. In positive-supply applications, these devices are intended to drive inductive loads such solenoids, relays, dc, and bipolar stepping motors, in addition to other high-current/high-voltage loads. Every input is compatible with TTL. With a pseudo-Darlington source and a Darlington transistor sink, each output is a full totem-pole driving circuit. Drivers 1 and 2 are enabled by 1,2EN, while drivers 3 and 4 are enabled by 3,4EN. Drivers are enabled in pairs. The corresponding drivers are activated and their outputs are active and in phase with their inputs when an enable input is high. These drivers are disabled and their outputs are turned off and in the high-impedance condition when the enable input is low. Each pair of drivers creates a full-H (or bridge) reversible drive appropriate for solenoid or motor applications when the right data inputs are provided.

DC MOTOR

A DC motor is intended to operate with DC electricity. Michael Faraday's homopolar motor, which is rare, and the ball bearin motor, which is a recent invention, are two instances of pure DC designs. The two most popular forms of DC motors are brushed and brushless, which are not strictly speaking DC machines since they require internal and external commutation, respectively, to produce an oscillating AC current from the DC source.



Solar panel :

A solar panel may be any of three types: a solar hot water panel, a photovoltaic (PV) module, or a group of solar PV modules installed on a supporting structure and electrically linked. A PV module is a solar cell assembly that is linked and packed. For both commercial and residential use, solar panels may be utilised as a part of a larger photovoltaic system to create and deliver power. Each module is assigned a rating based on its DC output power, which normally falls between 100 and 320 watts under conventional test settings. Given the same rated output, a module's efficiency dictates its size; for example, a 230-watt module with an efficiency of 8% would have double the area of a module with an efficiency of 16%. A small number of solar panels are on the market with efficiency levels higher than 19%. Most solar setups consist of many modules since a single module can only provide a certain amount of electricity. An inverter, a panel or array of solar modules, a battery, a sun tracker, and connecting wire are the standard components of a photovoltaic system.

Through the process of photovoltaic effect, solar modules employ light energy, or photons, from the sun to create electricity. The vast majority of modules employ thin-film or wafer-based crystalline silicon or cadmium telluride cells. Either the top layer or the rear layer of a module might be the structural (load-bearing) element. Additionally, cells need to be shielded from moisture and mechanical harm. The majority of solar modules are inflexible, while those that are based on thin-film cells are semi-flexible. 1958 saw the first usage of these primitive solar panels in orbit.

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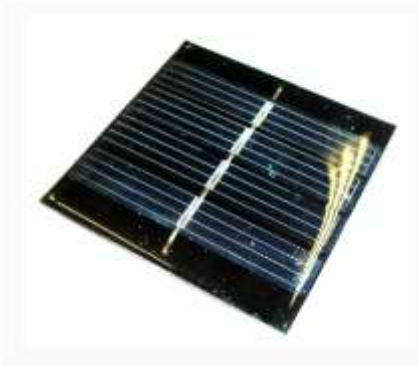
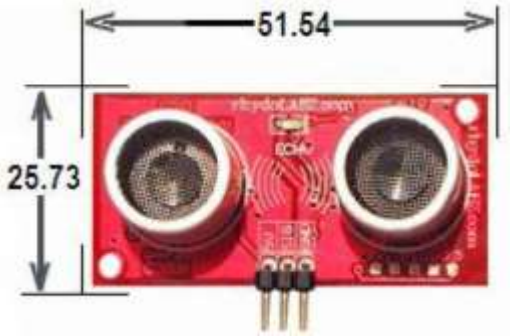
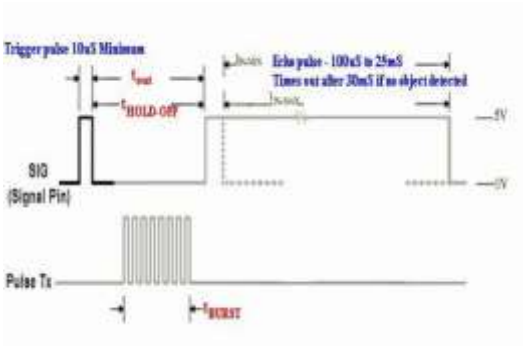




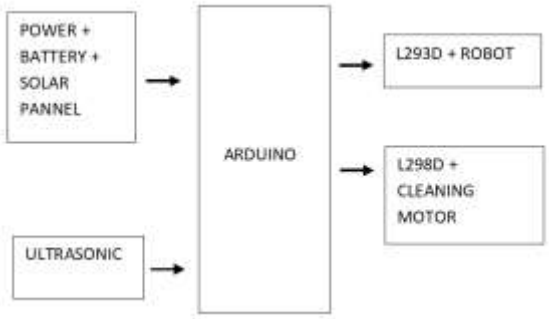
ULTRA SONIC SENSOR:

The "ECHO" Ultrasonic Distance Sensor by Rhydolabz is a fantastic device that offers detection and ranging from very close (2CM) to far away (4M). The sensor offers highly accurate non-contact distance measurements ranging from 2 cm to 4 meters that are precise and reliable. It is a useful sensor for mapping and measuring distance because of its small size, longer range, and simplicity of use. One I/O pin may be used for both triggering and measurement when the board is interfaced with microcontrollers. The ultrasonic wave is sent by the sensor, which then generates an output pulse in response to the time it takes for the burst echo to return to the sensor. It is simple to compute the distance to the target by measuring the echo pulse width.



IV. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

4.1. BLOCK DIAGRAM:



WORKING: The Advanced Solar Powered Floor Cleaning Robot uses solar energy to power itself while cleaning floors on its own. The system employs motors for movement, brushes for cleaning, and ultrasonic sensors for obstacle detection and navigation. It is all managed by an Arduino UNO. The operation of the robot is described below:

1. System Initialization

- The Arduino UNO initialises the attached parts, such as the ultrasonic sensor, DC motors, brush motors for cleaning, and solar power management system, when the robot is switched on.
- Sunlight energy is gathered by the solar panel and stored in a battery. The robot uses this energy to move and perform cleaning tasks.

2. Solar Power Supply

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- Sunlight is converted into electrical energy by the solar panel, which powers the onboard battery. The robot's power source is the battery, which enables it to function even in low light by using stored energy.
- A power management circuit makes sure that the Arduino, motors, and sensors are powered by a steady voltage and current from the battery.

3. Obstacle Detection Using Ultrasonic Sensor

- The robot has one or more ultrasonic sensors installed for navigation and obstacle detection. High-frequency sound waves are emitted by the ultrasonic sensor, and these waves reverberate when they encounter an obstruction.
- The robot's distance from the item is determined by the Arduino UNO by processing the time it takes for the sound waves to return.
- When an impediment is detected by the ultrasonic sensor within a certain range (10–20 cm, for example), the robot modifies its trajectory or stops in order to avoid it.

4. Movement Control with Motors

- The robot moves its wheels with the help of servo or DC motors. An H-bridge motor driver circuit is used by the Arduino to control these motors.
- Usually, the robot advances straight forward until it detects an obstruction. The Arduino instructs the motors to either stop, reverse, or turn in order to avoid the obstruction when the ultrasonic sensor detects one.
- The robot can traverse the whole floor area without assistance from a person thanks to the movement control algorithm, guaranteeing thorough cleaning of every region.

5. Cleaning Mechanism

- The floor cleaning mechanism is usually composed of a revolving brush or a set of brushes that gather and move dust and debris into a collecting container.A another motor, also controlled by the Arduino, powers the cleaning brushes. The robot glides around the floor, sweeping trash with its rotating brushes.
- To collect finer dust particles, a hoover pump may be included into certain designs.

V. CONCLUSION

The authors designed this hardware type of smart house cleaning device in response to the growing need for sophisticated, less time-consuming automated machinery. An analytical analysis shows that the simulated outcomes agree sufficiently with the machine's hardware operations in real time. Furthermore, the sophistication represents the pinnacle of the art. The model is special since it doesn't need the user to have any technical knowledge to use it. Therefore, according to the authors, the developed model is financially feasible.

FUTURE SCOPE:

The current technology may be further modified, perhaps combining dry and wet cleaning. Numerous other systems exist that might replace the Arduino, but doing so would raise the system's total cost.

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