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VOLTAGE MONITORING AND OBSTACLE DETECTION IN A SMART ELECTRIC VEHICLE USING ARDUINO

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ABSTRACT:

The goal of this project is to develop a gadget that can charge electrical cars using a solar-powered influence framework and enable online payments for flexibility. The project aims to resolve the concerns raised by the charging of electric vehicle transportation divisions. One of the foci of this work is incorrect anticipation via remote payments. A few observation points exist, such as Tesla charging stations, etc. We open up our charging stations to real-time IoT access. Similar to how we notify clients about battery status, we also notify clients about car charging, allowing us to keep informing clients on the state of their vehicles. Along with providing the owners of the vehicle with security options and guaranteeing the security of the appropriate installations, it also provides the office with the living area of the car, meticulously designed charging station locations, and all other pertinent information. This maintains the client charge log and prior payments in addition to handling concerns such as cheating in the accusation stations of the owners. Similar to this, this method may be used in parking lots of IT organisations or workplaces.

I. INTRODUCTION OF PROJECT

India is the third-largest producer and user of power globally. Since 2000, the amount of energy used has doubled, and fossil fuels like coal, oil, and solid biomass still account for 80% of the demand. Renewable energy makes up around 20% of the total. India's need for energy is predicted to double by 2040 and its need for electricity to perhaps quadruple due to a rise in the country's use of electric cars, according to NITI Aayog's energy policy study. Future power consumption will be heavily burdened by the growing number of electric cars. Infrastructure for electric car charging should be developed; these vehicles should run on renewable energy. The best solution is to use solar charging stations. First, electrification will shift the way that the world consumes energy, moving away from the requirement for on-site fuels like petrol, oil, and natural gas and towards the demand for electricity. This implies that although the total need for power in our nation will rise, the demand for fossil fuels will decline. In India, solar power production has a significant impact. The nation's geographic position makes it advantageous to produce solar energy. The cause is that India is a tropical nation that experiences 3,000 hours of sunlight a year due to almost constant solar radiation. Utilising solar energy may help us become less reliant on fossil fuels to generate electricity.

In the modern world, disruption and security concerns are becoming more prevalent. A few charging terminals are available for observation; for example, charging is available at some bunks. In any case, with today's innovative fuel technology, we may even now find more explorers on their own cars, regardless of where the customer is travelling. In many aspects of our current state, such as hourly charging installments, power-based installments, etc., a force charging system is essential. The majority of charging station frameworks are excessively costly for working class organisations to establish. The typical gatherings use Internet of

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Things (IoT) based little expenditure billing structures to assist them in verifying their payment and eligibility for their benefit, among other things.

As we become more aware of how the world is changing with every new advancement and how much room there is for advancement in the area of electric vehicle innovation. Due to the increasing complexity of human culture and association, there are a great deal of charging concerns and different arrangements in our structures, necessitating the need for security in installments. As a result, security operations are fundamentally noteworthy to all of an association's customers. By then, the client has supported the structure if the system has exceptional security. Our structure uses security and visibility as the pillars of its governance. Our structure provides security by monitoring past performance, granting IoT access to the car for both customers and charging station associations, preventing unauthorised areas, and providing unparalleled support in the event of an emergency.

PROBLEM DEFINITION

Checking the drivers' erroneous justifications for the time delay to get at the destination on time is one of the primary tasks that our system will comprehend. to see if someone tries to enter the car without permission. must prioritise the safety of the students while also resolving other concerns, such as the location of the car. Furthermore, if any unauthorised card is flagged as an alert, our system will sound an alarm. In addition to screening their children, guardians may wish to confirm that everything was safe throughout the transfer and find out whether their kids arrived safely on time. Our system will provide the area as well as the specifics of the login and logout processes. The guardians will get a warning about the condition of the car, ensuring their safety and providing them with regular updates on the location.

II. LITERATURE SURVEY

Numerous documents linked to the security framework have been found. Differentiated security models applied to different scenarios.

[1]. With the use of super capacitors (SC) as energy storage, this study offers the Wireless Power Transfer (WPT) architecture based on Inductive Power Transfer (IPT). The suggested architecture is appropriate for dynamic charging electric vehicles (EVs), where energy oscillations need to be generated without unduly taxing the EV battery or utility grid.

[2]. —Electric vehicles (EVs) may now be charged in both directions thanks to vehicle-to-layer (V2L) technology, which also speeds up power layer auxiliary support. However, with time, the battery package in an electric vehicle may progress in cell dynamic changes. This is because of the battery pack's electrochemical orderings and formative complexity. Three potential causes of these diversifications in V2L systems are: (1) external wrecks; (2) lengthy unfoldings to high temperatures; and (3) early, extra charging and discharging successions to power layer. Defective sensors are a meticulous reference for these diversifications. Therefore, it may be argued that the battery packs in electric vehicles (EVs) are heavily dependent on the tracking of these in-cell changes and the resultant spread of each implicated component. This paper proposes a prognostication based technique to demonstrate the condition of variation triggered sensors. In order to forecast the in-cell mutations of a battery pack, a propagation model is first improved by intelligently using covariance and a median-based expectation. Second, each variant is divided and distinguished using a surmise model. For the calculations, this is accomplished by developing a conditional probability-based

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density function. Experimental measurements from lithium-ion battery packs in electric vehicles are used to assess the suggested monitoring architecture.

[3]. The online assessment of the infallible state of charge (SoC) is a useful tool for determining the driving range of electric cars (EVs). For lithium-ion batteries, the link between open circuit voltage (OCV) and SoC is crucial to SoC estimate. This research proposes a unique OCV test that combines the IO test and the LO test (CIL) in order to compare it with the conventional incremental OCV (IO) inspection and the low current OCV (LO) test. Two SoC estimating techniques are connected on the accuracy, robustness, and concurrence speed for the full SoC area, based on the unimpeachable parameters online identification of the dual polarisation (DP) battery model. In the meanwhile, there is disagreement over the SoC online estimation under different temperatures in the correlative analysis of the three OCVSoC relationships fitted by the related OCV tests.

[4]. The widespread use of plug-in electric vehicles (PEVs) presents several cybersecurity risks in addition to reassuring benefits including energy security, economic stability, and environmental benefits. PEV cybersecurity is far less studied than power grid security. Cyberattacks against PEVs, however, have the potential to have detrimental outcomes, such as overcharging that damages battery packs or Denial-of-Charging (DOC) that renders EVs inoperable. In this study, we reconnoitre control-oriented routes for PEV cybersecurity in an effort to tackle this problem. As a signal, we concentrate on developing algorithms to identify cyberattacks that could have an impact on PEV battery packs while they are being charged. Two algorithms are discussed: There are two types of detectors: (i) Static, which uses just variables that are measured, and (ii) Dynamic, which uses measurements in addition to the conversance of system dynamics. Additionally, we want to construct the Dynamic Detector using a filter-based technique that examines a number of multi-objective criteria, such as attack sensitivity, resilience, and stability.

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.

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

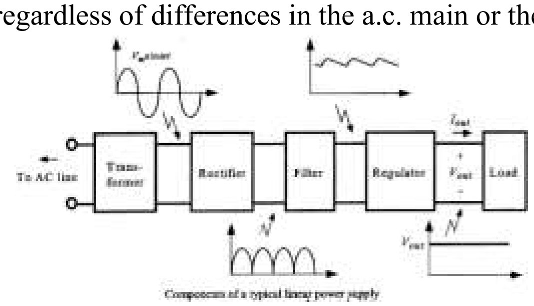


Fig: Block Diagram of Power Supply

LCD DISPLAY

The most popular model in practice is the one detailed here because of its cheap price and wide possibilities. It uses the Hitachi HD44780 microprocessor and has a 16-character message display capability on each of its two lines. It shows every letter of the alphabet, every Greek letter, every punctuation mark, every mathematical symbol, and more. Additionally, user-generated symbols may be shown. Among the most helpful features are those that automatically change the display's message (left and right shift), pointer appearance, lighting, and so on.

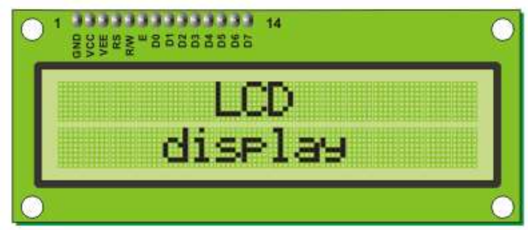
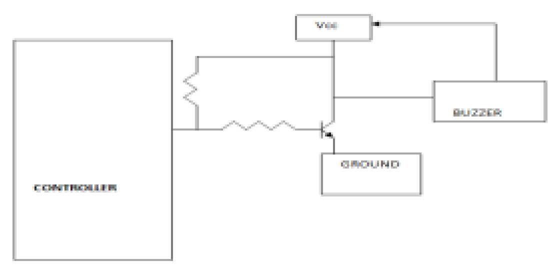


Fig: LCD

BUZZER

Not enough current is flowing via digital systems and microcontroller pins to power the circuits (buzzer circuits, relay circuits, etc.). Although these circuits have a current need of around 10 milliamps, the pin on the microcontroller can only provide 1-2 milliamps. This is why the microcontroller and buzzer circuit are separated by a driver, such a power transistor.



WIFI MODULE:

Chinese firm Espressif Systems makes the ESP8266, an affordable Wi-Fi microprocessor that can function as a microcontroller and has a complete TCP/IP stack.[1]

Ai-Thinker, a third-party producer, brought the chip to the attention of western OEMs in August 2014 with their ESP-01 module. With this little gadget, microcontrollers can establish basic TCP/IP connections using Hayes-style

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instructions and connect to a Wi-Fi network. Unfortunately, there was a severe lack of English-language information on the chip and the orders it could process back then.Many hackers were interested in the module, chip, and software on it, and they translated the Chinese documentation, because of the cheap pricing and the fact that there were very few external components on the module, which indicated that it may someday be extremely affordable in volume.the third

As an ESP8266 with 1 MiB of on-chip flash, the ESP8285 enables single-chip devices to establish Wi-Fi connections.[4]

The ESP32 is the chipset that will replace these microcontrollers.

LED:

One kind of semiconductor that can produce light is known as a light-emitting diode (LED). When turned on, this p-n junction diode produces light.[5] By applying an appropriate voltage to the leads, the device enables electrons to recombine with electron holes, resulting in the release of energy as photons.

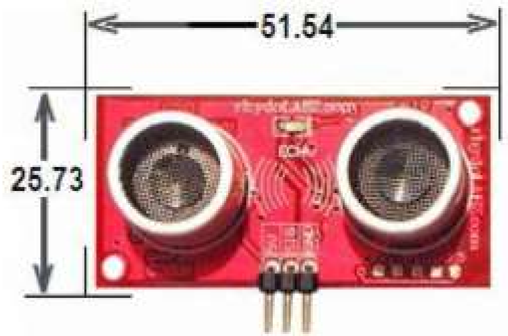
This phenomenon is known as electroluminescence, and the semiconductor's energy band gap dictates the light's colour, which is proportional to the photon's energy. LEDs often have tiny surfaces (less than 1 mm2) and may have optical components built in to control the beam's angle of incidence.

Early LEDs were often used as indicator lamps for electronic devices, replacing small incandescent bulbs. They were soon packaged into numeric readouts in the form of seven-segment displays and were commonly seen in digital clocks. Recent developments have produced LEDs suitable for environmental and task lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology.

LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. Light-emitting diodes are used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, and lighted wallpaper. They are also significantly more energy efficient and, arguably, have fewer environmental concerns linked to their disposal.

ULTRA SONIC SENSOR:

This "ECHO" Ultrasonic Distance Sensor from Rhydolabz is an amazing product that provides very short (2CM) to long-range (4M) detection and ranging. The sensor provides precise, stable non- contact distance measurements from 2cm to 4 meters with very high accuracy. Its compact size, higher range and easy usability make it a handy sensor for distance measurement and mapping. The board can easily be interfaced to microcontrollers where the triggering and measurement can be done using one I/O pin. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated.



BATTERY

A **Lithium-ion** or **Li-ion battery** is a type of rechargeable battery which uses the lithium ion energy storage by reversible reduction. It is the most common kind of battery for EVs and other small consumer gadgets. Applications in the aerospace and military industries, as well as grid-scale energy storage, are major markets for it. The memory effect, low self-discharge, and high energy densities of Li-ion batteries set them apart from other rechargeable battery technologies. On the other hand, a modest memory effect seen in LFP cells was likely due to poorly manufactured cells.[9]

There are many varieties of lithium-ion batteries, each with its own unique chemistry, performance, cost, and safety features. The active materials used by the majority of commercially available Li-ion cells are intercalation compounds. Graphite is the material most often used for the anode or negative electrode, but silicon-carbon is gaining popularity as well. Energy or power density may be made a priority during cell manufacturing.[10] The lithium polymer battery, which has a polymer gel electrolyte, a cathode material made of lithium cobalt oxide ($LiCoO2$), and an anode made of graphite is the standard for handheld devices because of the great energy density it provides.[11]Potentially more durable and capable of handling higher rates include lithium iron phosphate ($LiFePO4$), lithium manganese oxide ($LiMn2O4$ spinel or $Li2MnO3$-based lithium rich layered materials, LMR-NMC), and lithium nickel manganese cobalt oxide ($LiNiMnCoO$ 2 or NMC). The electrification of transportation, which makes use of NMC and its derivatives extensively, is a key technology for lowering vehicle-related greenhouse gas emissions, especially when coupled with renewable energy.in [13][14] The first rechargeable lithium-ion battery was developed by M. Stanley Whittingham in the 1970s using a titanium disulphide cathode and a lithium-aluminum anode. However, due to safety concerns, it was never commercialised.In 1980, John Goodenough used lithium cobalt oxide as a cathode to build on this work [15].[16] In 1985, Akira Yoshino created the initial model of the current Li-ion battery, which used a carbonaceous anode instead of lithium metal. In 1991, a team headed by Yoshio Nishi from Sony and Asahi Kasei brought it to market.

VOLTAGE SENSOR:

The red terminal's input voltage may be reduced by a factor of five thanks to this module, which operates on the concept of resistance points pressure.The maximum voltage that this module can accept as an analogue input from an Arduino is 5 V, which means that it cannot accept an input voltage higher than 25 V (5 V x 5 = 16.5 V if operating on a 3.3 V system).Due to the 10-bit AD on the Arduino AVR processor, the simulation resolution of this module is 0.00489 V (5 V / 1023), and the input voltage for this module should be more than 0.00489 V x 5, which equals 0.02445 V.

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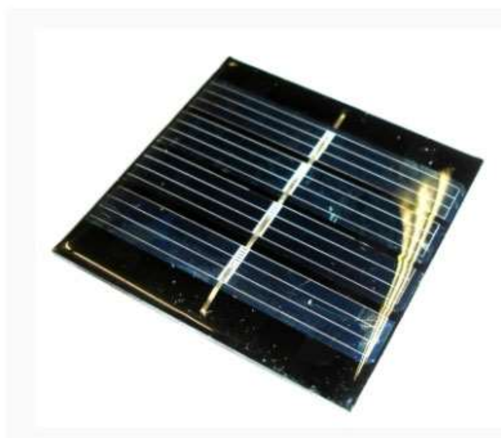
Solar panel :

Any one of many types of photovoltaic (PV) modules, solar hot water panels, or arrays of these modules installed on a supporting structure and linked electrically are collectively referred to as solar panels. Solar cells assembled in a packed form are called PV modules. Commercial and residential buildings alike may harness the sun's energy by installing solar panels as part of a bigger photovoltaic system. The DC output power under normal test settings is used to grade each module, and it usually falls anywhere between 100 and 320 watts. Given the same rated output, the size of a module is determined by its efficiency; for example, a 230 watt module with an efficiency of 8% would have double the area of a 230 watt module with an efficiency of 16%. Some solar panels are available with efficiencies higher than 19%. Due to their restricted power output, most solar systems use many modules rather than just one. Panels or arrays of solar modules, inverters, batteries, solar trackers, and connecting wires are the main components of a photovoltaic system.

The photovoltaic effect is a method by which solar modules convert the energy of the sun's rays into usable power. Crystalline silicon cells on a wafer or thin-film cells made of cadmium telluride or silicon make up the bulk of modules. A module's structural (load-bearing) element might be located on either the top or bottom layer. Mechanical damage and moisture should also be kept at bay from cells. Although most solar modules are inflexible, thin-film cell-based semi-flexible options do exist. It wasn't until 1958 that these first solar panels were sent into orbit.

When working with electricity, it is common practice to connect components in series to generate a certain voltage and in parallel to provide a specific current. The modules' current-carrying wires might be made of silver, copper, or another transition metal that isn't magnetic. There has to be an electrical connection between the cells and the rest of the system. The MC3 (older) or MC4 connectors allow for simple weatherproof connections to the rest of the system, and they are often used by popular photovoltaic modules for terrestrial operation.

In the event that any of the modules are partially shaded, bypass diodes may be built in or utilised externally to boost the power output of the remaining lighted areas.



IV. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

4.1. BLOCK DIAGRAM:

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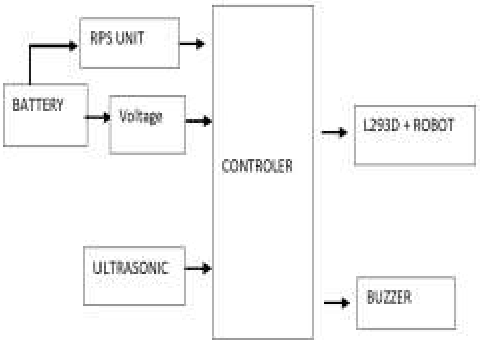

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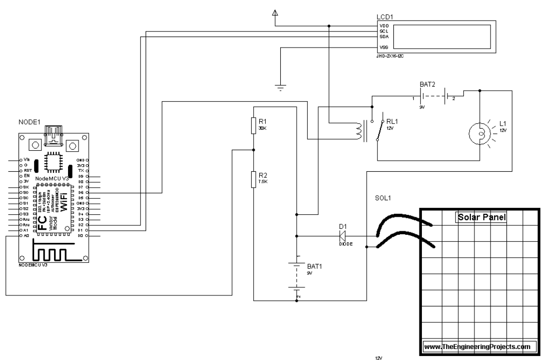

V. CONCLUSION

Utilising the Internet of Things for Electric Vehicle Charging A system is crucial for entry-level electric cars, and a web app makes it easy to keep tabs on customers' past actions. Computerised, semi-automated, and manual modes of operation are common for it to operate in.Easy to use and reasonably priced, it's perfect for regular authorities.

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