WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Integrating IOT in Autonomous EV Charging Stations

Dr K Gaayathry[1], Darwin I[2], Raghuram M[3], Sundharadevan S[4], Thaneshwaran S[5].

[1,2,3,4,5]Instrumentation and Control Engineering, Saranathan College of Engineering, Tamilnadu

ABSTRACT

Today's growing use of electric vehicles (EVs) that are connected to the power grid creates difficulties in managing operating costs and coordinating EV charging. With time-varying prices and users who prefer varied charging times, an EV Charging Station (EVCS) offers difficulties for scheduling all demands, information recording and sharing for network management, as well as data privacy and security. For all charging needs, we should use EVSEs with at least minimal control and management capabilities. In our study, we managed electric vehicle (EV) charging in common areas using the Internet of Things (IoT) concept. In order to start the electric vehicle charging process, the user identification mechanism is managed by the mobile application. A sensor is used to measure the current and voltage based on the microcontroller, and the device then communicates data with the mobile application. To see this process in action, a user interface has been created that displays the various sensor data to the user and also sends alert messages. After charging, the user can check the state of their phone's charging. Since the data will be stored in the cloud, it will remain safe and secure.

Keywords: *E-vehicles, IOT, GSM Module.*

INTRODUCTION

Whether you currently drive an electric vehicle (EV) or are thinking about purchasing one, charging is an essential component of operating an EV.With the widespread adoption of electric vehicles rapidly approaching, the relevance of excellent electric vehicle charging will become crucial for the network administrators of charging stations as well as the public power grid.The charging infrastructure presents one of the biggest challenges when trying to break into the electric vehicle (EV) industry, with the main problems being related to the lack of an acceptable framework in private buildings (high rises) due to their unpreparedness for this new reality. The loft doesn't meet the requirements for EV owners because of a widespread power problem.

Frameworks may be able to create new solutions to these problems in light of recent developments in the Internet of Things (IoT), as well as related sensors and correspondence stages. Rental accommodations and the potential need for assistance with electric vehicle charging are another aspect of this difficulty. Sadly, there is a general reluctance in condos to install EV charging stations, even though a few owners may use them. There is also a problem with the security of the electrical systems because they are not designed to support EV charging stations, and changing the electrical foundation of the loft requires the consent of the majority of owners, which can be difficult, however they can be difficult to obtain from government building health specialists. This is a barrier to reception because the majority of private buildings have typical areas with shared electrical infrastructure and are not prepared for the installation of new EV charging frameworks. Four major problem areas were identified by a review: sharing electric vehicle charging arrangement structures, charging framework inaccessibility, building restrictions, administrative challenges, and parking garage accessibility.

LITERATURE REVIEW

- This work addresses the concern of higher refueling time in Electric Vehicles (EVs) which limits their wide-spread use for transportation. Efficient charge scheduling is crucial for optimal use of limited charging infrastructure and minimizing waiting queues at Charging Stations (CSs). Previous works on this topic are mainly theoretical and assume global availability of EV and CS data. This work aims to provide a practical solution through efficient EV-CS coordination.
- The growth and usage of the electric vehicle is on the rise over the past few years. Demerits of conventional IC engine vehicles like depletion of fossil fuel, increase in fuel price and negative impacts on the environment made us to shift to electric vehicles. The fuel for electric vehicle is electrical energy which is extracted from the power grid through charging station. In the power grid, the energy share from conventional energy sources are high, that too coal, which again leads to the same negative impacts as like IC engine vehicles.
- The use of non-renewable resources in transportation has contributed significantly to pollution and global warming. To address this issue, there is a growing need for a shift towards renewable energy-based transportation infrastructure. The increasing adoption of Electric Vehicles (EVs) has further highlighted the need for sustainable energy sources to power them. This research paper proposes a solution to address the challenge of charging EVs through the utilization of renewable energy sources.

Existing idea

The station for electric vehicles uses both AC and DC current. While the majority of electricity is delivered from the power plants as alternating current (AC), batteries can only be charged using direct current. The E-vehicle charging stations now use a manually enabled and operated charging method. This style of billing necessitates unquestionable charges, and it is also the only style of charging that is time-based.Many charging stations employ a time-based billing system that bases prices on how long a customer's car is connected to the charging station in order to ensure accurate and equitable invoicing. Customers frequently initiate and terminate the charging process on their own in this way, whether through an app or by physically hitting a button on the charging station. By doing this, it is possible to prevent consumers from being charged for more than what they really use the charging station for, which is determined by the amount of energy transmitted.

BLOCK DIAGRAM

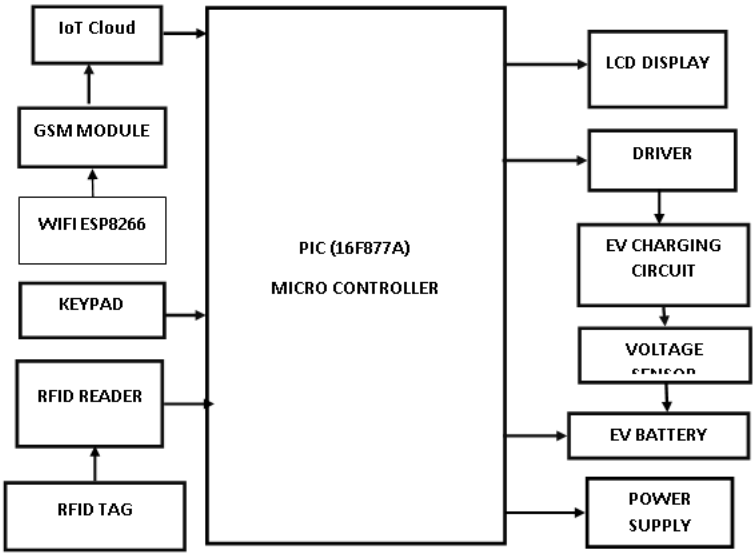

FIG 1: BLOCK DIAGRAM

HARDWARWE DESCRIPTION

PIC16F877A MICROCONTROLLER

In the creation of electrical, computer, robotic, and similar equipment, a peripheral interface controller (PIC) is a sort of microcontroller component. The Harvard Computing architecture, which the PIC is based on, places code and data in separate registers to maximise input/output (I/O) performance. The PIC was created by Microchip Technology.

The Microchip PIC16F877a is a 40-pin PIC microcontroller with RISC architecture that is utilised in embedded projects. It contains three timers, two of which are 8-bit timers and one of which is a 16-bit timer.

It supports many communication protocols like:

- Serial Protocol.
- Parallel Protocol.
- I2C Protocol.

Both hardware pin interrupts and timer interrupts are supported Because each PIC pin can carry out several functions, the pins of the microcontroller have multiple names.

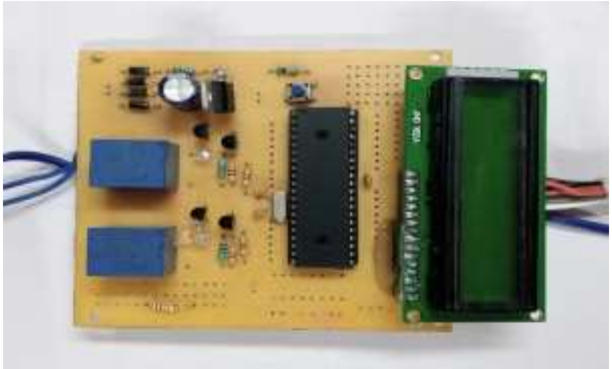

FIG 2: PIC MICROCONTROLLER

Check Pin # 25 from Fig. 3 as an illustration; it serves as both a digital Port C Pin # 6 (RC6) and a transmitter (TX) for serial communication. supplying the PIC Microcontroller with power; it operates at a +5V voltage. The frequency at which it will operate must also be provided. We utilise a crystal oscillator to supply frequency to the PIC Microcontroller, and for the PIC16F877a, you can use a crystal oscillator with a frequency range of 4MHz to 40MHz.

LEAD ACID BATTERY

One kind of rechargeable battery is the lead-acid battery. Two electrodes are immersed in an electrolyte of sulfuric acid to form the lead-acid battery. The negative electrode is connected to a grid of metallic lead, whereas the positive electrode is constructed of metallic lead oxide grains. Floated and valve-regulated lead-acid batteries are the two categories into which they fall. Depending on the battery's production process, sealed lead acid batteries can have a design life of anywhere from 3 to 5 years to 12 years or more.Lead, lead oxide, and sulfuric acid undergo a chemical process inside a lead-acid battery, a form of rechargeable battery, to store and release electrical energy.Each cell in the battery has lead plates that are submerged in an electrolyte solution of sulfuric acid. When the battery is charged, lead sulphate is converted back into lead and lead oxide, and sulfuric acid is also recycled. When a battery is discharged, lead, lead oxide, and sulfuric acid mix to form lead sulphate, which releases electrical energy. Lead-acid batteries are often used in cars, boats, and other forms of vehicles, as well as in backup power systems, uninterruptible power supplies (UPS), and other circumstances where a stable source of electrical power is required. They are powerful and reasonably affordable, but they are also bulky, have a short lifespan, and need constant maintenance to work properly. Lead and sulfuric acid in lead-acid batteries are both poisonous, which makes them vulnerable to environmental problems.

POWER SUPPLY

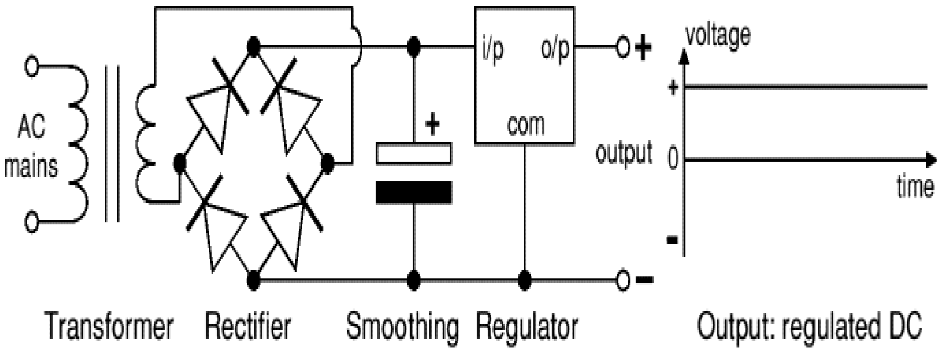

FIG 3: CIRCUIT DIAGRAM OF POWER SUPPLY

How voltage regulators, rectifiers, and filters work together to power supply circuits. An AC voltage is converted to a continuous DC voltage by rectifying it, filtering it to a DC level, and then regulating it to the required fixed DC value. Typically, an IC voltage regulator unit provides the regulation, which remains constant regardless of changes in the input DC voltage or the output load coupled to the DC voltage. a diode rectifier that generates a full-wave rectified voltage that is first filtered to create a DC voltage by a straightforward capacitor filter.

This DC inputs can be used by a regulated circuit to produce a DC voltage that not only has significantly reduced ripple voltage but also maintains its DC value even if the load attached to the output DC voltage changes or the input DC voltage varies somewhat. One of the several widely used voltage regulation IC units is typically used to provide this voltage regulation. In this circuit, the transformer's primary windings receive 230 volts of alternating current (AC), which are then step-down into a 12 volt supply. The bridge rectifier is then used to change the 12 volt AC supply to a 12 volt DC supply. Pure DC is created by converting the pulsing DC using a 1000 uF capacitor. The voltage Regulator-7805, which has three pins, provides a 5v dc output. Input 12 volts DC is applied to the first pin, ground supply is applied to the centre pin, and output 5 volts DC is obtained from the third pin.

VOLTAGE SENSOR

A device or piece of equipment called a voltage sensor is used to measure the current flow in an electrical system or circuit. The voltage signal is converted by a certain type of sensor into a quantifiable output that can be shown on a metre or recorded by a data logger. Voltage sensors are available in both contact and non-contact varieties. In contrast to contact sensors, non-contact sensors can detect voltage without making direct physical contact with the circuit or component being monitored. Two categories of non-contact voltage sensors are capacitive and electromagnetic. Voltage sensors are extensively used in power distribution systems, renewable energy systems, battery management systems, and electronic devices, to name just a few applications.

RFID READER

An RFID reader is a gadget that reads data from RFID tags wirelessly using radio waves. For contactless communication between a tag or transponder and a reader, a technique known as RFID, or radio frequency identification, is used. A control unit, a transceiver, and an antenna are the basic components of an RFID reader. The RFID tag is activated by radio waves emitted by the antenna, which also collects the data that is stored there. The tag's radio waves are reflected back to the transceiver, which transforms them into digital data that the control unit may use. The control unit controls communication with the tag and has the ability to connect to other gadgets like a computer or database.

FIG 4: RFID READER

RFID readers come in a variety of designs, including handheld, stationary, and mobile readers. While fixed readers are normally installed in a specified position and offer continuous monitoring, handheld readers are transportable devices that enable on-the-spot data collecting. Vehicles and other mobile applications employ mobile readers.

RFID TAG

An item of technology known as an RFID tag acts as the owner identification card for electric automobiles. For RFID-enabled devices, the LCD display shows the battery voltage data. It is feasible to process information uniquely for each tagged object by utilising RFID to distinguish between objects that each have a unique RF-tag. RFID consists of an RF-tag, an RF-tag reader, and management software.

FIG 5: RFID TAG

Because the RF-tag reader can identify the tag in less than 0.1 second, it is used in real-time applications. The recognition rate is more than 99.9% in an area of 05 m, allowing for full-duplex communication that can store up to 64 Kbyte of data. RFID tags have a wire circuit and antenna for transmitting data. The antenna receives the necessary power from the RFID reader. Additionally, it responds to the reader's asking cue. RFID tags come in a variety of sizes, from those smaller than a pin to those larger than a credit card.

DRIVER AND RELAY CIRCUIT

An electrical circuit called a driver relay circuit is used to control a relay's operation. Relays, which use low-power signals to switch high-power loads, are electromechanical devices. The driver circuit provides the relay coil with the appropriate voltage and current to ignite it while also isolating the control signal from the load being switched. Driver relay circuits are extensively used in a variety of applications, including as industrial control systems, automotive electronics, and home automation systems. They are an essential component of numerous electrical systems and are used to regulate loads such as motors, solenoids, valves, and lights.

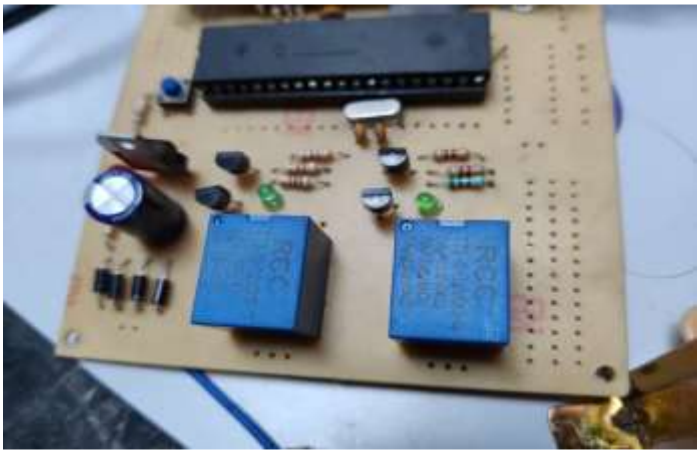

FIG 6: DRIVER AND RELAY CIRCUIT

A relay is an electro-magnetic switch that can be useful if you want to utilise a low voltage circuit to turn on and off a light bulb (or anything else connected to the 220v mains supply). Since most chips (op-amps, etc.) cannot supply the current needed to run the relay coil, a transistor is often needed. The driver relay circuit is coupled to the microcontroller's digital pins, and dc loads will be directly interfaced with the relay module. According to the pre-loaded code, the controller will send a signal (ON/OFF) to the driver/relay circuit. When the driver/relay circuit switches to the ON status, a 230 volt AC supply will be used to turn on the load.

LCD DISPLAY

Liquid crystals are used to create images on a flat panel display known as an LCD (Liquid Crystal Display). The liquid crystals' orientation is controlled by an electric current, which also changes how much light passes through the polarising filters to create the image. Between two polarising filters and electrodes are liquid crystals. LCD screens are commonly used in a wide range of electronic devices, including televisions, computer monitors, cellphones, digital cameras, and more. They have several advantages over other display technologies, including low power consumption, high brightness, wide viewing angles, and the ability to display high-quality pictures and movies.

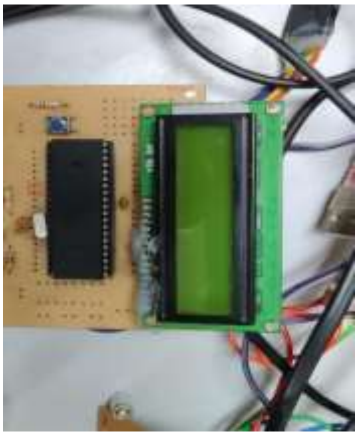

FIG 7: LCD DISPLAY

GSM MODULE

The functionality of the Global System for Mobile Communications (GSM) network is made possible through the utilization of a hardware component called a GSM module. This module enables devices to establish phone calls, send and receive SMS messages, and connect to the internet using cellular networks. The core of a GSM module is a printed circuit board (PCB) that incorporates a GSM chipset, a SIM card slot, and various other components related to communication. These modules are widely integrated into diverse devices, including GPS trackers, vending machines, and security systems.

GSM modules are designed to support different frequencies and work on various bands, depending on the specific geographical area of their usage. They also provide support for multiple communication protocols, including AT commands, which facilitate communication between devices and the module to control its operations. Due to their affordability and reliability in enabling wireless communication between devices, GSM modules have become an integral component in the development of numerous applications in the realms of Internet of things.

FIG 8: GSM MODULE

WIFI ESP8266

NETWORK MODULE A self-contained SOC with an integrated TCP/IP stack, the ESP8266 WI-FI module may grant a microcontroller access to the Wi-Fi. The ESP8266 module is a reasonably priced board with a sizable user base.

FIG 9: WIFI ESP826

RESULTS AND DISCUSSION

The battery's SoC value is displayed in Fig. 10. The data is also shown in the app. The Adafruit IO is a platform that allows users to quickly view their data as graphs, bar diagrams, and charts. The comparison of the data gathered over the course of a day is shown in Fig.11.Here, it is shown as a graph. Knowing the battery's condition would make it simple for the user to decide whether to feed power into the grid or draw it from it. The SoC status of an Android app is shown in Fig. 12. The app used for this is called MQTT dashboard.

FIG 10: BATTERY VALUE

FIG 11: COMPARISON DURING VARIOUS TIMEPERIODS

FIG 12: BATTERY STATUS

CONCLUSION

The state of batteries in smart grid systems is tracked by a smart grid that is Internet of Things (IoT) based. The IoT that is being developed here uses an Android app and a cloud platform for communication. The owner of a car may quickly assess the condition of its battery and decide whether to use the grid or sell electricity to it. The Adafruit IO's data storage is good for 30 days. In order to compare the status of various users, handling of numerous users may be introduced in future development.

References

1. Li, Wen, and Sami Kara. "Methodology" for Monitoring Manufacturing Environment by Using Wireless Sensor Networks (WSN) and the Internet of Things (IoT)." Procedia CIRP 61 (2017): 323-328.

2. Friansa, Koko, Irsyad Nashirul Haq, Bening Maria Santi, Deddy Kurniadi, Edi Leksono, and Brian Yuliarto. "Development" of Battery Monitoring System in Smart Microgrid Based on Internet of Things (IoT)." Procedia engineering 170 (2018): 482-487.

3. Shital khutwad, Shruti Gaur, "Wireless Charging System for Electric Vehicles", International conference on Signal Processing, Communication, Power and Embedded System (SCOPES), 2019.IEEE

4. Wu He F. (2019)Analysis of the mainstream charging pile of new energy vehicles and the construction problems of charging pile. J. Modern economic information,23: 325.

5. Wang B.(2020)Design and implementation of electric vehicle charging monitoring management system.D.Beijing Jiaotong University.