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A REVIEW ON AUTOMATIC ELECTRIC VEHICLE CHARGING STATION WITH BILLING SYSTEM

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ABSTRACT- The market for electric vehicles has grown with each year, and EVs are considered to be a proper solution for the reduction of pollution. So far, not much attention has been given to the use of electric vehicles for public transportation, such as taxis and buses. However, a big introduction of electric taxis and electric buses could generate issues in the area. The challenges are different from those of private electric vehicles, as their required load is significantly greater. Recent years have seen the start of research on these issues.
Electric vehicle technology offers numerous benefits, but it also has several drawbacks, including issues with battery charging, increased electric charge accessibility at charging stations, and battery life evaluation. In this research, a smart switching mechanism for electric vehicles is suggested. An ultrasonic sensor is used to detect vehicles at the charging station. The charging system is discussed in the part that follows the detection of the vehicle battery voltage. The suggested system offers a highly efficient, cheaper, and environment-friendly solution for charging electric vehicles. In order to meet the need of an ever growing demand for electric vehicle charging infrastructure, a software based electric vehicle charging system has been built. It has the ability to optimally schedule charging in order to safely maximize the use of available resources for charging electric vehicle and thereby maximizing the number of electric vehicles that can be connected to the pantograph while enhancing pantograph stability

I. INTRODUCTION

Because of its clever, costeffective, and environmentally beneficial services, electric vehicles have gained the at tention of users. Due to the extraordinary wonder of the steady growth in urban populations, it is now crucial at the metropolitan area provide trustworthy solutions. [1] One of the contributors to this ecological instability is the transportation industry alone, which accounts for nearly a quarter of global greenhouse gas emissions. There is reason to accept that for the time being, there will be a period of development after a very long time where the conventional internal combustion engine has been the dominant automotive solution. However, signs of a shift towards completely electric alternatives are becoming more and more evident.

and a ascent of the EV industry[2][3]. Decreasing the emission of harmful substances (both CO2 AND NOx) is one of the key reasons, yet different additional factors like economic benefits, more noteworthy energy

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autonomy and a shift towards a less oil- concentrated vehicle area play a role in the overall development of Electric vehicles sector. Customer interest industry innovation advancements, as well as government initiatives and guidelines are the three primary forces that drive the reception of EV technology.[5] As these forces acquire strength, the EV portion of the overall industry will extend. By 2030, EVs are expected to represent up to 60% of new vehicle deals. If shoppers buy EVs at the normal rates throughout the following five to ten years, an absence of charging stations could turn into a hurdle to EV adoption. A developing EV charging station foundation appears to be inescapable to accomplish the future difficulties of versatility. The vehicle and battery industries have gained significant technological growth with different solutions to overcome significant obstacles for mass-market sales, such as an upgraded charging framework organization.[8][9] In any case, the deployment of EVs is still at a beginning phase and there is a long way to go. The establishment and business exploitation at the necessary scale of a public charging framework, or a public charging station (CS) organization, is a critical component to work with mass EV adoption since it improves accessibility and availability, diminishes range anxiety and empowers the utilization of EVs for significant distance travel.

II. BLOCK DIAGRAM

A. The Block Diagram

Charging Station Unit: charging station unit contains various sensors, microcontroller and other Components which includes Arduino Mega, IR/ Ultrasonic Sensor, RFID tag reader, Switches, Relay driver circuit, Pantograph motor, LCD display, Buzzer etc.

When System starts initializing, the ultrasonic sensor starts, to detect presence of vehicle. when vehicle is detected. pantograph (supply) motor get's connected to vehicle charging point.

Arduino Senses Battery voltage after connection, voltage and bill readings are shown on LCD display. when battery is fully charged or it disconnects Switch press pantograph points automatically gets disconnected. controller ask to scan RFID tag reader. It also sends SMS about deduction of charging bill amount to respective customer.

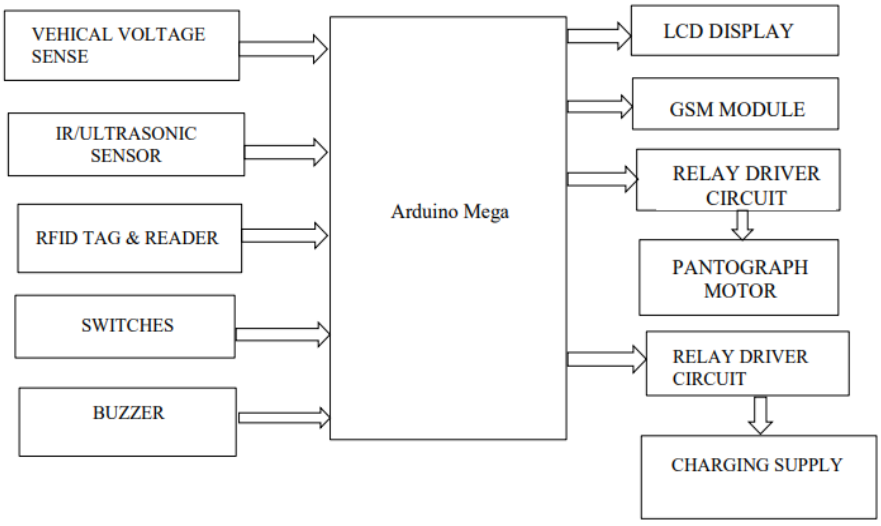

Fig. 1. Block Diagram Of Charging Station Unit.

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2.Vehical Unit:

Vehicle unit contains microcontroller and various components Such as Arduino UNO, Relay driver circuit, Battery voltage sense, Switches, Battery Bank , Buzzer, LCD display etc.

When the initialization starts after the system starts, battery voltage is sense by Arduino. Battery voltage is display on LCD display Continuously. Buzzer indicates charging by beeping.

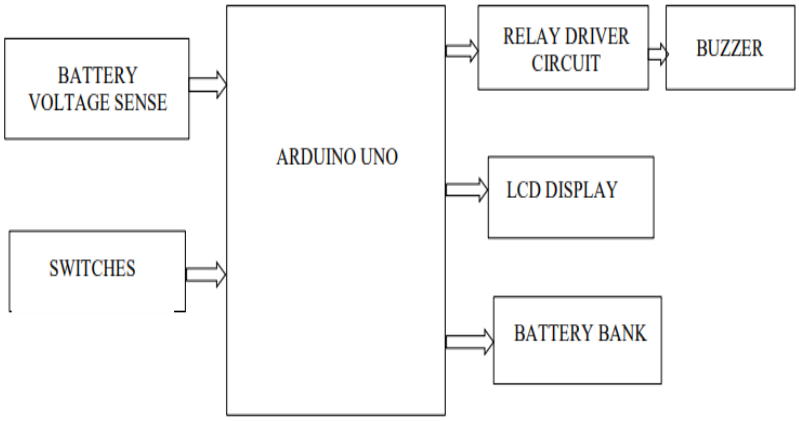

Fig.2.Block Diagram Of Vehicle Unit

B. Hardware Implementation

It includes several types of sensors, and microcontroller shows the block diagram of the Mine Unit operation which consists of the fire sensor, water sensor, gas sensor, and temperature sensor.

1) Pantograph:

In electronic locomotives, pantograph acts as mobile current carrying equipment which is mounted on the roof. It collects power from the overhead equipment under both static and dynamic conditions and transfer it to locomotive. Pantograph is a word derived from Greek language, which means every write. It's a Structure with mechanical linkage therefore it works by forming a parallelogram. The Modern Pantograph principle is derived from a linked support structure called "Scissors mechanism ".The system is used to make contact with or cable overhead

Features:

- Product family is Wayside Monitoring System
- Technology used in optical , No-contact
- Pantograph 3D Measure

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- Measuring speed is 0÷320 km/hr (0÷200 mph)
- Grayscale images of the pantograph

2) *Arduino Mega:*

The Arduino ATmega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila. Arduino Mega is based on ATmega2560 Microcontroller, an 8-bit AVR Architecture based MCU from ATMEL. It is available in a 100-pin Quad package. It is designed and developed to provide more number of IO lines(both Digital and Analog), more flash memory and more RAM when compared to UNO.

Features :

- Operating Voltage is 5V
- Input Voltage is 7-12
- Input Voltage (limit) is 6-20V
- Digital I/O Pins are 54
- Analog Input Pins are 16
- DC Current per I/O Pin are 20 mA

3) *Arduino Uno:*

The Arduino Uno is an open source microcontroller board based on the Microchip ATmega328p microcontroller and developed by Arduino.cc and initially released in 2010. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website.

Features:

- Operating Voltage is 5V
- Input Voltage (limit) is 6-20V
- Digital I/O Pins are 14

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- PWM Digital I/O Pins are 6
- Analog Input Pins are 6
- Flash Memory is 32 KB

4) *16*2LCD Display:*

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD.

Features:

- Operating Voltage is 4.7V to5.3V
- Current consumption is 1mAwithout Backlight
- Alphanumeric LCD display module meaning can display alphabets and number.
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters

5) *Ultrasonic Sensor:*

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). This is the HC-SR04 ultrasonic distance sensor. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit. There are only four pins that you need to worry about on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground).
Features:

- Input Voltage is5V.
- Current Draw is20mA (Max)
- Digital Output is 5V.

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- Digital Output is 0V (Low)
- Working Temperature is 15°Cto 70°C.
- Ultrasonic Frequency is 40kHz.

6) *IR Sensor :*

IR transmitting infrared light and when any object comes near, it is detected by the sensor by monitoring the reflected light from the object. It can be used in robots for obstacle avoidance, for automatic doors, for parking aid devices or for security alarm systems, or contact less tachometer by measuring RPM of rotation objects like fan blades. Sensor are used to detect objects and obstacles in front of sensor.

Features:

- Main chip include in IR sensor is LM393
- Operating voltage is 3.3-5 VDC
- Distance measuring range is 2-30cm
- Dimensions are 48*14*8mm
- Weight of the sensor is 15 gms

7) *RFID Tag And Reader:*

Radio Frequency Identification (RFID) refers to a wireless system comprised of two components: tags and readers. The reader is a device that has one or more antennas that emit radio waves and receive signals back from the RFID tag. Tags, which use radio waves to communicate their identity and other information to nearby readers, can be passive or active. Passive RFID tags are powered by the reader and do not have a battery. Active RFID tags are powered by batteries. RFID tags can store a range of information from one serial number to several pages of data. Readers can be mobile so that they can be carried by hand, or they can be mounted on a post or overhead. Reader systems can also be built into the architecture of a cabinet, room, or building.

Features:

- Frequency range is 13.56 MHz ISM band.
- Operating supply voltage is 2.5V to 3.3V.
- Max. operating current is 13 to 26 mA.
- Min. current (power down) is 10 microA.
- Read range is 5 cm.

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III. CONCLUSIONS

In the coming ten years, it's anticipated that EV adoption will rise dramatically because to improvements in EV technology, charging infrastructure, and grid integration facilities.
In this situation, the suggested method makes use of Pantograph technology to boost charging efficiency. Because it doesn't emit dangerous gases, the system with upgraded facilities performs better in terms of the environment. The system's automation also makes it possible for more precise technologies to be used with less labour. Thus, the suggested technique is the costeffective and environmentally friendly method of charging EVs .

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