Smart Wireless Power Transmission System For Autonomous EV Charging

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Abstract- *In today's world wireless technology has a widespread application which includes industrial and household applications. In this project we have reviewed on wireless power transfer (WPT) using renewable source i.e. solar energy. According to the day-ahead electricity market, we propose a two-stage optimal charging scheme, to find the optimal reserved wholesale electricity of each group day-ahead and the charging scheduling schemes of WCECs in each slot. To ensure optimal charging, our approach involves measurement of the transfer efficiency of individual transmission coil to determine the most efficient one to be used. This not only improves the charging performance, but also minimizes energy losses by autonomously activating only the coils with the highest transfer efficiencies. The results show that with the proposed system it is possible to detect the coil with maximum transmitting efficiency without the use of actual power transmission and comparison of the measured efficiency. This also proves that with the proposed charger set-up, the position of the receiver coil can be detected almost instantly, which indeed saves energy and boosts the charging time. In this system we create RFID for wireless chargers based on the intrinsic non-linear distortion effects of the underlying charging circuit. Using such RFID, we design the WirelessID system to detect potential short-range malicious wireless charging attacks. WirelessID collects signals in the standby state of the charging process and sends them to a trusted server, which can extract the RFID and then identify the charger.*

Keywords- WPT; RFID; Arduino Uno.

I. INTRODUCTION

As one of the most important technological changes in recent years, the Internet of Things (IoT) has stimulated market demand for smart home, intelligent vehicle, wearable device, smart city and other scenarios. A wide range of IoT devices have been deployed in these applications, where many of them are supplied through wireless power. This makes wireless charging technology and wireless charging devices an important component of IoT system. Infrastructure based on wireless charging will have a huge market share in the hardware of IoT. Wireless charging uses an electromagnetic field to transfer energy between two objects through electromagnetic induction. This is usually done with a charging station. Energy is sent through an inductive coupling to an electrical device, which can then use that energy to charge batteries or run the device. Induction chargers use an induction coil to create an alternating electromagnetic field from within a charging base, and a second induction coil in the portable device takes power from the electromagnetic field and converts it back into electric current to charge the battery. The two induction coils in proximity combine to form an electrical transformer. Greater distances between sender and receiver coils can be achieved when the inductive charging system uses resonant inductive coupling. Recent improvements to this resonant system include using a movable transmission coil (i.e., mounted on an elevating platform or arm) and the use of other materials for the receiver coil made of silver plated copper or sometimes aluminium to minimize weight and decrease resistance due to the skin effect.

II. PROBLEM STATEMENT

Current technologies only allow electric vehicles to be charged through plug-in cable. However, the problem occurs when the user need to find the charging point and the charging cable is lost or damaged. This project is about designing a wireless power transfer for electric vehicles. The concept of this project is suitable for any electric vehicles such as bus, car and light train. It will prepare a new convenient way to recharge the battery of the electric vehicles rather than using the traditional plug-in cable. With the implementation of wireless power transfer WPT in order to charge the electric vehicle, there is no physical connection or contact between the vehicles and the power supply. The process is fully automated, whereby no human handling works are required to perform the charging process. Even though wireless power transfer concept is well developed and has been applied in industrial application, but its applications in the transport sector are still emerging. Furthermore, another serious problem occurred with current plug in cable for electric vehicles is people tend to get an electrical shock if the cable system is damaged. With wireless charging approach for electric vehicle can prevent this incident happen because no wire or cable is required and

it's transfer in electromagnetic form, so that, people will not get electrical shock in this kind of energy transfer.

III. LITERATURE SURVEY

Albert Y. S. Lam et. Al [2014] To enhance environmental sustainability, many countries will electrify their transportation systems in their future smart city plans, so the number of electric vehicles (EVs) running in a city will grow significantly. There are many ways to recharge EVs' batteries and charging stations will be considered as the main source of energy. The locations of charging stations are critical; they should not only be pervasive enough such that an EV anywhere can easily access a charging station within its driving range, but also widely spread so that EVs can cruise around the whole city upon being recharged. Based on these new perspectives, we formulate the EV charging station placement problem (EVCSPP) in this paper. We prove that the problem is nondeterministic polynomial-time hard. We also propose four solution methods to tackle EVCSPP, and evaluate their performance on various artificial and practical cases. As verified by the simulation results, the methods have their own characteristics and they are suitable for different situations depending on the requirements for solution quality, algorithmic efficiency, problem size, nature of the algorithm, and existence of system prerequisite.

Xiao Lu et. Al [2015] Wireless charging is a technique of transmitting power through an air gap to an electrical device for the purpose of energy replenishment. Recently, wireless charging technology has significantly advanced in terms of efficiency and functionality. This article first presents an overview and fundamentals of wireless charging. We then provide the review of standards, that is, Qi and the Alliance for Wireless Power, and highlight their communication protocols. Next, we propose a novel concept of wireless charger networking that allows chargers to be connected to facilitate information collection and control. The application of the wireless charger network in user-charger assignment, which clearly shows the benefit in terms of reduced costs for users to identify the best chargers to replenish energy for their mobile devices.

Robert C. Green et. Al [2010] Plug-in hybrid electric vehicles (PHEVs) are the next big thing in the electric transportation market. While much work has been done to detail what economic costs and benefits PHEVs will have on consumers and producers alike, it seems that the more important question is "what impact will PHEVs have on distribution networks nationwide?". This paper finds that the impact of PHEVs on the distribution network can be determined using the following aspects of PHEVs: driving patterns, charging characteristics, charge timing, and vehicle penetration. The impacts that these aspects of PHEVs will have on distribution networks have been measured and calculated by multiple authors in different locations using many different tools that range from analytical techniques to simulations and beyond. While much work has already been completed in this area, there is still much to do. Areas left for improvement and future work will include adding more stochasticity into models as well as computing and analyzing reliability indices with respect to distribution networks.

Siqi Li et. Al [2015] Wireless power transfer (WPT) using magnetic resonance is the technology which could set human free from the annoying wires. In fact, the WPT adopts the same basic theory which has already been developed for at least 30 years with the term inductive power transfer. WPT technology is developing rapidly in recent years. At kilowatts power level, the transfer distance increases from several millimeters to several hundred millimeters with a grid to load efficiency above 90%. The advances make the WPT very attractive to the electric vehicle (EV) charging applications in both stationary and dynamic charging scenarios. This paper reviewed the technologies in the WPT area applicable to EV wireless charging. By introducing WPT in EVs, the obstacles of charging time, range, and cost can be easily mitigated. Battery technology is no longer relevant in the mass market penetration of EVs. It is hoped that researchers could be encouraged by the state-of-the-art achievements, and push forward the further development of WPT as well as the expansion of EV.

Binsy Joseph et. Al [IEEE 2019] Wireless Power Transfer Techniques are gaining popularity in Electric Vehicle charging applications due to its safety and convenience. Wireless Electric Vehicle charging system can be a potential alternative technology to charge EVs without any plug-in problems. The fundamental challenge for implementing Wireless Power Transfer for Vehicle application is the coupling variation between the primary and secondary coils due to misalignment and air-gap between coils. Compensation circuits are necessary for the Wireless Inductive Power Transfer system, to have maximum power transfer from the primary coil to secondary coils. This paper describes the design and simulation of the Inductive Wireless Power Transfer System using PLECS software. FEM simulation is carried out to verify the effect of coupling variation between primary charging pads and secondary coil mounted on the vehicle due to air gap distance between them.

IV. PROPOSED SYSTEM

Wireless power transfer (WPT) is the technology that forces the power to transmit electromagnetic field to an

electrical load through an air gap without interconnecting wires. Implemented through Inductive Power Transfer, the wireless charging for car drivers is convenient as far as safety and comfort are concerned: the user should not be worried about handling power cords, thus avoiding the electrocution risk. The battery is charged while the EV is used. In the dynamic charging a track is present inside the road, consisting of multiple transmitting coils, thus allowing the power transfer towards the receiving coil that is inside the car, whenever the receiving coil is aligned, during the motion, to any of the road coils. Web services can also provide information about EV charging to consumers and help them to plan their journey. All sensing , controlling and indicating task are taken by microcontroller. All data are dumped to the Blynk application for indication purpose.

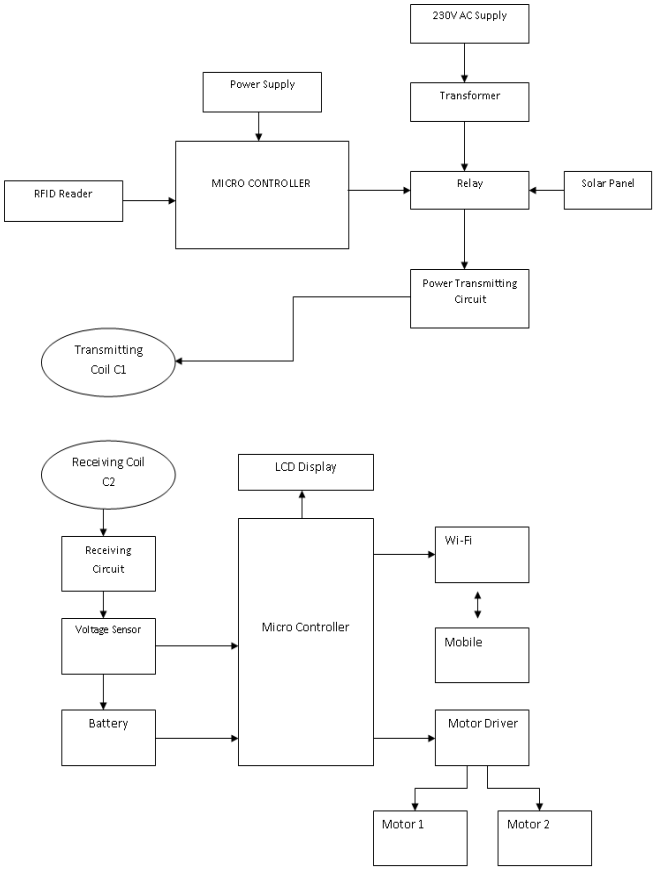


Fig 1 Block Diagram

Software

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

V. HARDWARE DESCRIPTION

POWER S UPPLY UNIT

Power supply is a very important part of electronic circuit. This circuit requires fixed +5 V supply so to fix this voltage we need voltage regulator. In this work we used IC7805 as voltage regulator. A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. There are two types of voltage regulators: linear and switching. Here we make use of a linear regulator employs an active pass device (series or shunt) controlled by a high gain differential amplifier. It compares the output voltage with a passive reference voltage with a precise reference voltage and adjusts the pass device to maintain a constant output voltage.

LCD DISPLAY

Liquid Crystal Display (LCD) is an Alphabetic Display it means that it can display Alphabets, Numbers as well as special symbols thus LCD is a user friendly Display device which can be used for displaying various messages unlike seven segment display which can display only numbers and some of the alphabets. The only disadvantage of LCD over seven segment display is that seven segment is robust display and can be visualized from a longer distance as compared to LCD. Here we have used 16 x 2 alphanumeric displays.

RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-trans mitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power

required to directly control an electric motor or other loads is called a contractor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), 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.

EM-18 RFID

It is used to read unique ID from RFID tags. Whenever RFID tags comes in range, RFID reader reads its unique ID and transmits it serially to the microcontroller or PC. RFID reader has transceiver and an antenna mounted on it. It is mostly fixed in stationary position. RFID Reader has transceiver which generates a radio signal and transmits it through antenna. This signal itself is in the form of energy which is used to activate and power the tag.

VOLTAGE SENSOR

A voltage sensor is a sensor used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine the AC voltage or DC voltage level. The input of this sensor is the voltage, whereas the output is the switches, analog voltage signal, a current signal, or an audible signal.

ESP8266-01

The ESP8266 ESP-01 is a Wi-Fi module that allows microcontrollers access to a Wi-Fi network. This module is a self-contained SOC (System On a Chip) that doesn't necessarily need a microcontroller to manipulate inputs and outputs as you would normally do with an Arduino, for example, because the ESP-01 acts as a small computer. Depending on the version of the ESP8266, it is possible to have up to 9 GPIOs (General Purpose Input Output). Thus, we can give a microcontroller internet access like the Wi-Fi shield does to the Arduino, or we can simply program the ESP8266 to not only have access to a Wi-Fi network, but to act as a microcontroller as well.

Motor driver IC

L293D is a motor driver IC that can control two DC motors at a time .Input 00 and 11 stop the motors whereas logic 01 and 10 starts the rotation of the motors in clockwise and anticlockwise directions, respectively

Solar Panel

A solar cell panel, solar electric panel, photo-voltaic (PV) module or just solar panel is an assembly of photo-voltaic cells mounted in a framework for installation. Solar panels use sunlight as a source of energy to generate direct current electricity. A collection of PV modules is called a PV panel, and a system of PV panels is called an array. Arrays of a photovoltaic system supply solar electricity to electrical equipment.

VI. HARDWARE CONNECTION

The first part of the proposed system is wireless power transfer which contains windings and charging circuit. The second part of the proposed wireless power transfer system design was the choosing of a suitable micro-controller. The requirements for the micro-controller are Arduino.

Arduino is a readymade and open source evaluation Kit based on an 8-bit Atmel microcontroller. Arduino Microcontroller is the core of hardware interface module, which is WI-FI for exchanging data between controller from one side, and mobile from the other side. Vcc pin is connected to the 5V and GND pin is connected to ground. In the above circuit LCD is used to indicate the status of electrical loads.
Here LCD is interfaced to the Arduino microcontroller in 4 bit mode. If components are directly connected to hardware interface module, an isolating interface is needed to protect Arduino from interference.

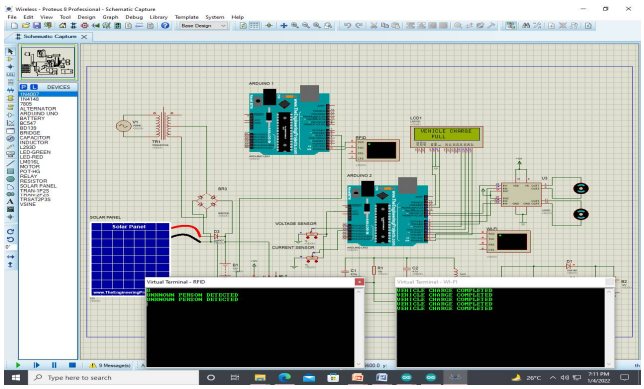
L293D is a popular motor driver. It is special by its high current and voltage rating. Each L293D can be used to control two motors. Each side controls each motor. 6 and 7 is the control pins for motor M1. Similarly 8 and 9 is the control pins for motor M2. Here, the circuit is demonstrated to control M1 only. Control pins are normally connected to Microcontrollers.

Basically, a 25V Voltage Sensor, like the one used here, has 5 pins in total. Two of them are on the two-pin screw terminal and three are male header pins. The Screw Terminal

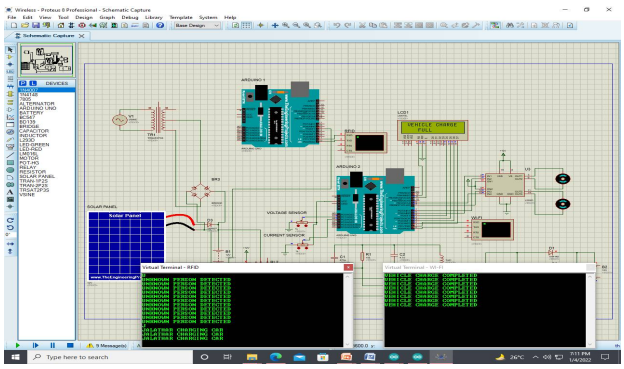
pins are marked as VCC and GND and they must be connected to the external source of voltage i.e. the voltage that needs to be measured. Coming to the three male headers, they are marked as S, + and –. The S pin is the "Sense" pin and it must be connected to the Analog Input of the Arduino. The "–" pin must be connected to the GND of the Arduino. The pin marked as "+" is not connected to anything (it is an N/C Pin).

VII. RESULT

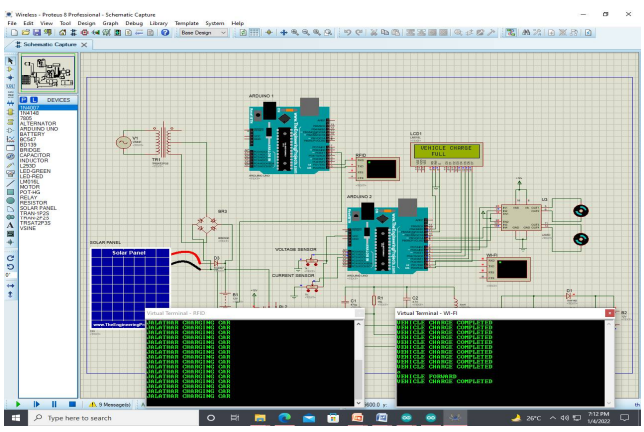
A. Detect Unknown person while charging



B. Charging Known person



C. Control EV through Wi-Fi



VIII. CONCLUSION

Today`s major challenge is to reduce the road accident that happens due to many reasons like not following the rules of traffic, driver mistakes etc, So to overcome these problems this proposed system will definitely helps and reduce the road accident. This system automatically controls the vehicle when any obstacles come in front of vehicles. System will automatically detect these obstacles of the traffic and control the vehicle. For obstacle avoidance ultrasonic is used that will give the obstacles coming in front of vehicle. Camera is used for the detection of the obstacle distance. Raspberry pi is used as controller for the system that will take input from the camera and ultrasonic sensor and generate output to control the car.

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