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Regenerative Charging Technique for Electrical Vehicles

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Abstract: ***Various sources of power generation techniques are in use in recent days. Automated vehicles have a tremendous future. Road transportation is majorly used transportation. Usage of car is drastically increased and the need for the petrol and diesel are increased. Now days due to these electric vehicles are started to implement in our country. Even government is started to encourage the electric vehicle developers. At a public parking facility, only electric vehicles (EVs) that are parked at dedicated parking spaces with charging points can enjoy charging services. Installing a charging point at each parking slot is very expensive. As an alternative, this project proposes the novel idea in a public transport facility, only electric vehicles (EVs) that can drive at dedicated with wireless charging path which can enjoy charging services. Installing a Wireless Charging Path (WCP) as Electric Vehicle Service Road (EVSR). Like service roads will be easy for charging the EVs wirelessly while traveling. Charging mechanism of vehicles is done via a wireless which reduces the requirement of cables, reduce the waiting time for charging and also has generating system based on solar energy. It is also based on ais artificial intelligence system.***

Keywords: ***Automated Vehicles, Regenerative Charging, Electrical Vehicles, Artificial Intelligence, Machine Learning.***

I. INTRODUCTION

Charging in a hybrid or electric vehicle, the electric motor switches to generator mode. The wheels transfer kinetic energy via the drivetrain to the generator. The generator turns in a similar way to a bicycle light generator transforming part of the kinetic energy into electrical energy, which is then stored in a high-voltage battery. At the same time, generator resistance produced from the electricity created, slows the vehicle. When more braking torque is required than the generator alone can provide, additional braking is accomplished by friction brakes [1].

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The development of latest technologies such as Internet of things (IoT) [2]-[3], Wireless communication, Solar development, Embedded systems created a way for smart EV [4] development. In many situations the generator s braking power is sufficient to slow the vehicle as desired by the driver. As a result, the friction brake is used less often, for example, in instances of very rapid deceleration, at very low speeds and when stationary. If a vehicle is broken by a conventional braking system, the use of a friction brake creates brake dust. The amount of brake dust emission depends, among others, on the individual driving behaviour, the braking system and the power train configuration. Vacuum-independent regenerative braking systems in electrified vehicles can decrease brake dust emission by even more than 95%. The reason: regenerative braking systems allow the recovery of kinetic energy and initiate an emission-free generator braking. Deceleration from the regenerative braking system suffices in most cases to slow the vehicle as wanted Friction brake is seldom fully used, e.g., for very rapid deceleration, at low speeds and when stationary Noticeable increase in range (electric vehicles) Reduced fuel consumption and CO2 emissions particularly in urban traffic situations involving frequent braking and acceleration (hybrid vehicles) [9][10][11][12][13][14][15]

Smart EV Charging

Smart EV charging delivers reliable, safe, renewable, and cost-effective energy to EVs while meeting the needs of drivers and local grids. It depends on sophisticated back-end software that captures data from EVs, networked chargers, and the grid. That data is used to optimize charging of EVs, integrate power from storage and renewable sources, and minimize impact on the grid. For buildings and fleets, site-level energy needs are also factored in. Advanced algorithms balance all these elements to dynamically distribute the lowest-cost energy when and where its needed without compromising either local energy needs or EV charging. Self-Healing Algorithms for EV Charging EV drivers are challenging EV charge point operators and e-mobility service providers to do a better job of managing charger availability and stability and deliver a seamless charging experience. Self-healing algorithms built into an EV charging management platform can fix up to 80% of the software-related operational issues that render EV chargers unusable by drivers. Real-time issue discovery and automated self-repair maximize charger uptime and optimize EV owners charging experience.

Vehicle-to-X (V2X)

The idea of using the energy stored in EV batteries for other purposes started with vehicle-to-grid (V2G).

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V2G envisions using smart EV charging to control a two-way flow of energy between EVs and the grid. Instead of generating more power during peak times, utilities would purchase stored energy from EV owners and distribute it over the grid. During non-peak times, the EVs would draw energy for recharging. V2X extends the idea to include different use cases and destinations for power drawn from EVs, such as vehicle-to-home (V2H), vehicle-to-building (V2B), vehicle-to-farm (V2F) and vehicle-to-load (V2L). Smart Battery Management EV batteries consist of thousands of cells, which are grouped into modules, which are connected so they act as one battery. When enough cells degrade to the point where the battery is no longer useful for powering electric vehicles, smart battery management technology can give those batteries a second life. They can be racked and stacked so that multiple EV batteries can act as one very large battery that can be used for local storage of energy from the grid or from renewable sources. The technology that makes these possible combines software, sensors, and hardware to correct for non-functioning cells, optimize charging, and communicate with smart EV charging and energy management software. In this way, energy from renewables can be captured when conditions are good, stored, and integrated back into the local grid or the local EV charging infrastructure.[16],[17].

- In the proposed approach, The Installation of a Wireless Charging Path (WCP) as Electric Vehicle Service Road (EVSR). Like service roads will be easy for charging the Electric vehicles (EVs) wirelessly while travel.
- the proposed system reveals an automated mobile charger for EVs. When an EV which is traveling in EVSR, requests for charging, the signal is sent from the slot to charger path road through Wireless Sensor Network (WSN).
- After receiving the signal by the charger via WSN it will check before initiating the charging process, it is necessary to check the vehicle information and the payment details.
- If the payment is done properly, it will start charging if not it wont charge, the charger begins to charge EVs battery. At the same time, EV checks the capacity of battery using voltage sensor

The rest of the paper is formulated as making detailed literature study in Section II. The system tool selection, problem identifications are discussed in Section III. The system architecture, detailed system design steps are discussed in Section IV. The rest of the paper is concluded with future enhancement.

II. BACKGROUND STUDY

K. Nishikawa et al., (2013) In the conventional resonator coupled WPT system, coil resonators made of copper wire are usually used. So, unloaded Q of coil resonator is a few hundred to one thousand due to metal conductivity. There is a limit for transmission distance due to the loss caused by low unloaded Q of the coil resonator. In this study, the authors propose a novel WPT system using ceramic dielectric resonators. Unloaded Q of dielectric resonator is several tens of thousands depending on the material. Thus, we can expect much longer transmission distance by using ceramic resonator [5].

M. Böttigheimer et al., (2018) the author presented a new designed test bench for an entire EV with an integrated inductive charging system is presented. Especially the testing of misalignment and the consideration of the vehicles underfloor can be realized very easy. With the aid of the new test bench, an 11kW prototype which was designed in a former paper will be measured and parameters will be compared with the designed parameters. The progress in testing infrastructure will lead to a faster and easier development of new prototypes [6].

Y. -H. Wu et al., (2019) the author discussed quasi-dynamic charging scenario to present the charging system, including an IoT structure and wireless charging, for an Arduino smart car. Our communication system is based on ESP 8266 NodeMCU which is a cost-efficient WiFi Microcontroller. The whole system is verified in experiment. The result shows that the system can provide good performance in a realistic situation, and a good basis for our next step-dynamic wireless charging [7].

S.F. Hui et al., (2017) The present paper is to discuss the project for the sea water solar power generation. The configuration of the solar power system for sea water is examined. The solar cells design, connection power distribution, protection, environment impact and shore side power management are discussed. The power delivery using V2X is proposed. Solar power installed in sea water has advantages as compared to installed on lands such as good and unshaded solar source by buildings or plants, better cooling, good utilization of surface than lands, but it also suffers from other scenario such as the sea water corrosion, wave and tidal disturbance [8].

III. SYSTEM DESIGN

The system model is developed using embedded platform with high level embedded C programming. The system design is explained in Section IV. Various hardware blocks are utilized in the presented system.

ESP32

ESP32 is a low-cost System on Chip (SoC) Microcontroller from Espressif Systems, the developers of the famous ESP8266 SoC. It is a successor to ESP8266 SoC and comes in both single-core and dual-core variations of the Tensilicas 32-bit Xtensa LX6 Microprocessor with integrated Wi-Fi and Bluetooth.
The good thing about ESP32, like ESP8266 is its integrated RF components like Power Amplifier, Low-Noise Receive Amplifier, Antenna Switch, Filters and RF Balun. This makes designing hardware around ESP32 very easy as you require very few external components.

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Voltage Sensor

Fig. 1. Voltage Sensor

DC Voltage Sensors are used to measure the potential difference between the ends of an electrical component. This can be used to measure the DC voltage in the circuits. The sensor is mechanically fixed by soldering the secondary circuit pins to the PCB. The primary connection can also be integrated in the sensor. Pulsating voltage with a galvanic insulation between primary and secondary circuits. The voltage detector indicates the presence of a voltage higher than a limit. The Voltage Sensors are equipped with a micro controller that greatly improves the sensor accuracy, precision, and consistency of the readings. They are supplied calibrated, and the stored calibration (in Volts) is automatically loaded when the Voltage Sensor is connected.

Photovoltaic system

Fig. 2. Photovoltic system

A photovoltaic system typically includes a panel or an array of solar modules, a solar inverter, and sometimes a battery and/or solar tracker and interconnection wiring.
A single solar module can produce only a limited amount of power, most installations contain multiple modules. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. Cells must also be protected from mechanical damage and moisture. Most solar modules are rigid, but semi-flexible ones are available, based on thin-film cells. Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability.

Relay Mechanism

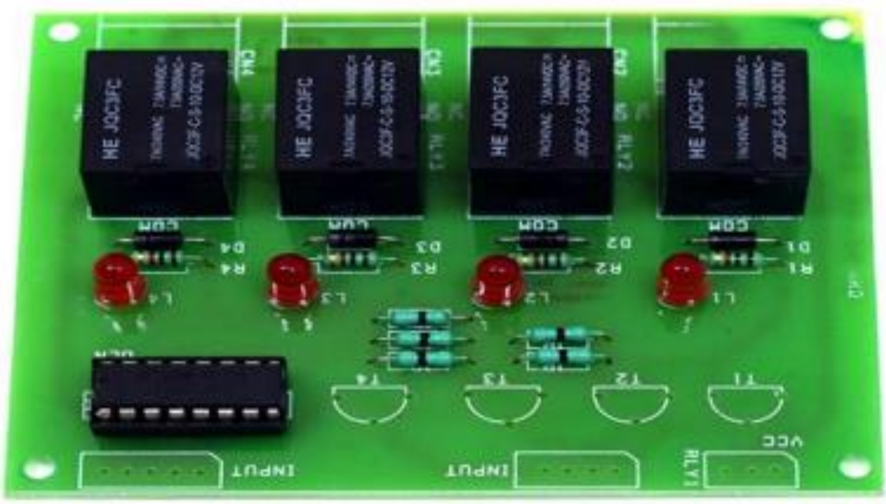

Fig. 3. Relay mechanism

A relay is an electromechanical switch which is activated by an electric current. A four-relay board arrangement contains driver circuit, power supply circuit and isolation circuit. A relay is assembled with that circuit. The driver circuit contains transistors for switching operations. The transistor is use for switching the relay. An isolation circuit prevents reverse voltage from the relay which protects the controller and transistor from damage. The input pulse for switching the transistor is given from the microcontroller unit. It is used for switching of a four device [18][19][20][21].

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IV. METHODOLOGY

A. Architecture of proposed model

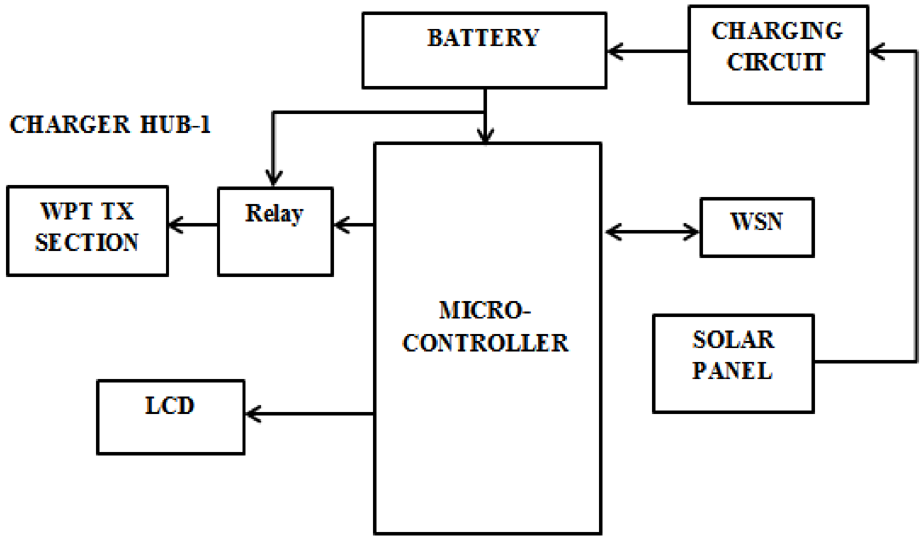

Fig 4. Charger Hub architecture

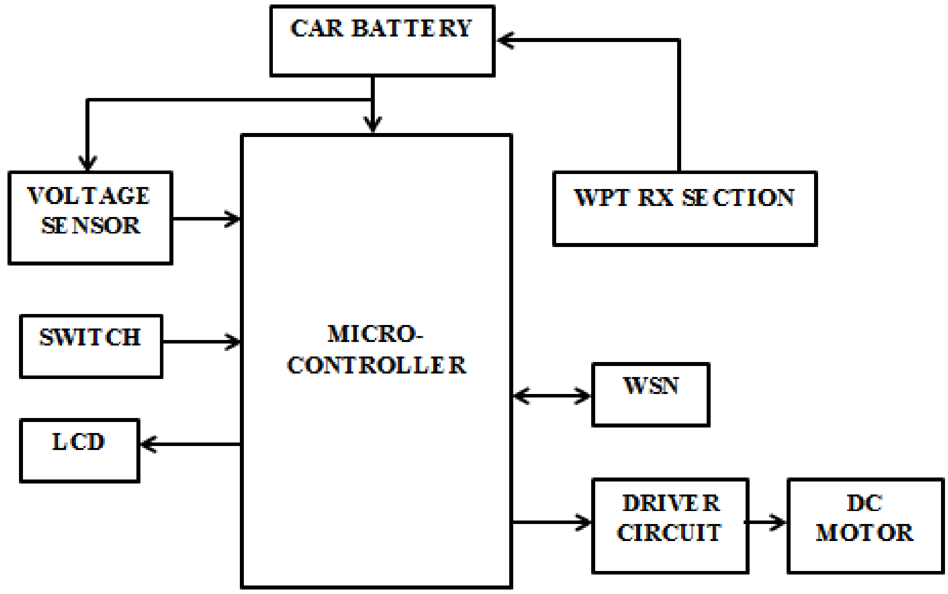

Fig. 5. System architecture of Proposed Phishing website detector

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone, or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP). The function of voltage sensor, Under-voltage, over-voltage, or voltage band models Powered from sensing input lines or from separate AC supply Available with time delays on pull-in and/or drop-out or with customized voltage-time trip curves.

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. Solar panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions. Solar modules use light energy from the sun to generate 5W power through the photovoltaic effect.

This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power supply.

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V. RESULTS AND DISCUSSIONS

A. Integrated Hardware

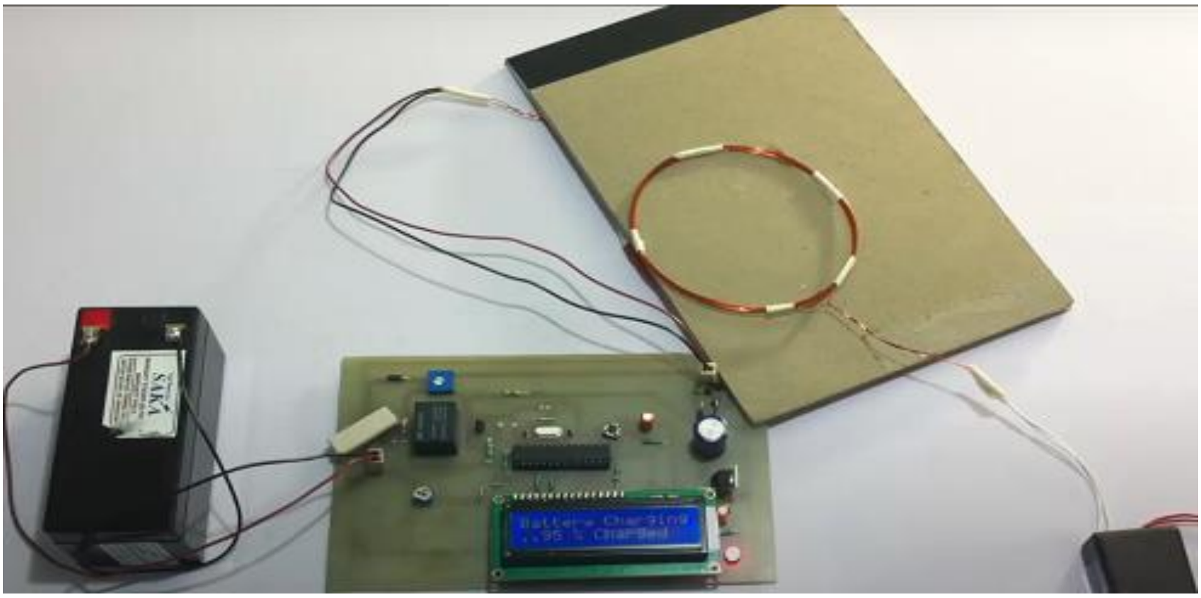

Fig 6. Integrated Wireless Power Transmission System

Fig 6. Shows the Wireless power transmisision system using microcontroller.

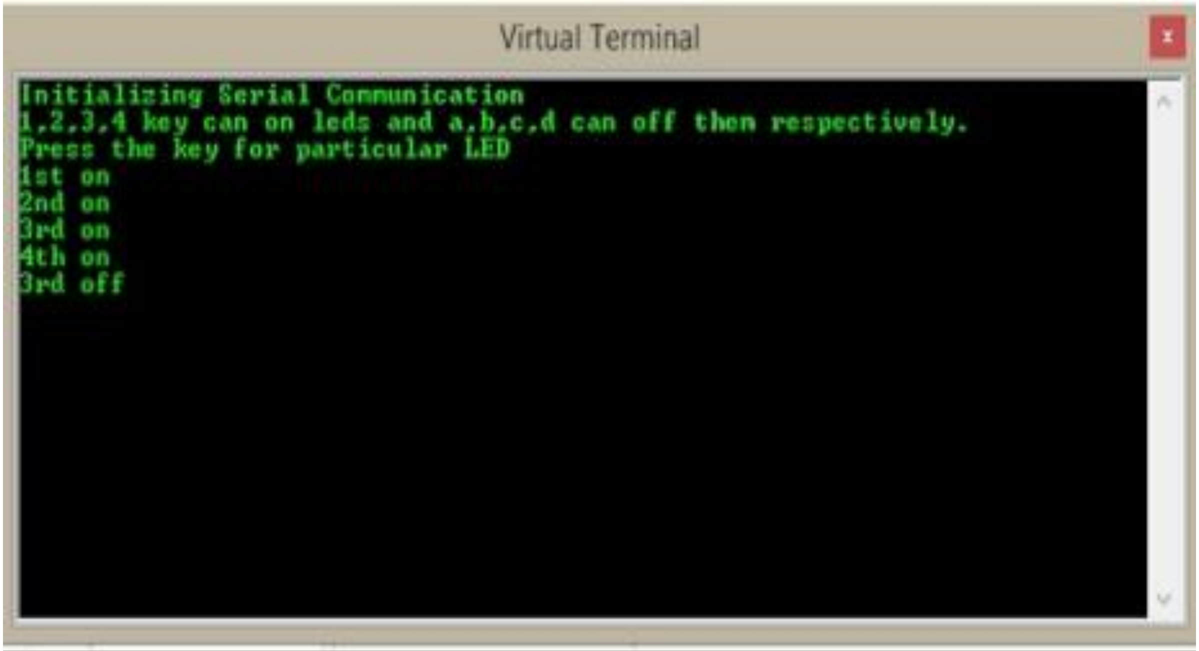

Fig 7. Terminal screen of Communication status

Fig 7. Shows the serial port terminal result showing the status of the serial port communication indicates the power transmission results. Output components such as Light emitting diodes, Motors get control after receiving the power.

VI. CONCLUSION

This project presented a novel quasi-dynamic wireless charging system that comprises a wireless charging system and a wireless communication system. The wireless communication system enables the system to function as the zigbee and provide energy without human intervention. The inverter, using a loosely coupled transformer, satisfies the ZVS condition, which provides the charging system with high efficiency at an optimum coupling coefficient through the design method. Therefore, we can utilize this method to calculate the maximum distance between two devices. This method ensures the feasibility of static charging and is an excellent start to the next step dynamic charging. In the future, we plan to use the quasi-dynamic charging system and put the class-E inverter into practice. Then, we will use the inverter in our dynamic charging system, which will be used more widely in daily life. For the communication systems, we should consider the communication range and the continuity between two ranges and the connection speed because of car motion.

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DECLARATION

Funding	Not funding.
Conflicts of Interest/ Competing Interests	Not conflicts of interest to the best of our knowledge.
Ethics Approval	Not relevant.
Consent to Participate	Not applicable.
Consent for Publication	I, give my consent for the publication of identifiable details, which can include photograph(s) and/or videos and/or case history and/or details within the text to be published in the above Journal and Article.
Availability of Data and Material	The datasets generated during and/or analysed during the current study are not publicly available. but are available from the corresponding author on reasonable request.
Authors Contributions	We all were responsible for the idea of the project and Gnanesh is responsible for the implementation of the idea to a real time project and Akash is responsible for building the block diagram and Teja is responsible for the hardware parts of the project.
Code Availability	Not applicable.

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