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SOLAR BASED WIRELESS EV CHARGING

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Abstract : This project describes the development and construction of an electric vehicle charging system that uses solar power to offset the costs associated with fuel and reduce pollution. The number of nations using electric cars on their roads is continuously increasing. Electric vehicles not only benefit the environment but also reduce transportation expenses by using considerably less expensive power instead of costly fuel. Here, by developing an infrastructure for charging electric vehicles, we provide a fresh and practical solution to this issue. Since the EV can charge while traveling and the system is fueled by solar energy, there is no need for a second power source. The solar panel, battery, IR sensor, regulator circuits, copper coils, relay, pico controller, and LCD display are all used in the system's construction. So, technology validates the feasibility of an EV wireless charging system that is embedded into the road and powered by solar energy.

Keywords— Wireless Charging, Raspberry Pico, Solar energy.

I. Introduction

Within the transportation domain, electric vehicles (EVs) are a new idea. It's expected that electric cars, or EVs, will soon dominate the auto industry. In this case, regulation of the electric vehicle (EV) charging process is necessary to maintain the integrity of the power networks. Despite this, as the number of electric cars (EVs) increases, a sizable amount of energy will be retained in the batteries, enabling the opposite effect. In the future, electric vehicle (EV) interaction will play a significant role in smart grid technologies, enhancing the grid's independence. As fossil fuel prices rise and carbon dioxide emissions decline, electric vehicles are now more competitively priced than vehicles with traditional internal combustion engines.

Despite these disadvantages, the expensive cost of EVs prevented them from being widely embraced by consumers. Both all-electric cars and fast-charging facilities are hard to come across. Electric vehicles can be classified into two categories: fully electric vehicles and partially electric vehicles. Electric vehicles not only have little environmental impact and cheap operating costs, but they also use very little or no fossil fuels. In order to improve the efficiency of charging stations, electric vehicles will be the main form of transportation in the future [1]. The most frequent justification offered for not purchasing an electric vehicle is the lack of infrastructure for charging them.

By using renewable energy to shorten the charging time, the portable EV charger was tested. In this project, a hybrid power system is used to offer long-distance electric vehicle drivers a special service. There are no locations for these drivers to refill their cars with power in between major roadways. If you wish to charge your electric car using electricity, the wireless EV charger is a fantastic option [3]. As the price of fossil fuels rises and CO2 emissions decrease, electric vehicles are becoming more affordable than conventional seen as an ongoing vehicle. Restrictions like high car expenses prevented the widespread adoption of electric vehicles [3].

Both all-electric cars and fast-charging facilities are hard to come across. Electricity can be used to power EVs either fully or partially. Electric automobiles have cheaper running costs than their gasoline-powered counterparts because they have fewer moving components and have a smaller environmental effect [10]. The components of our project system include an LCD display, a solar panel, a battery, a transformer, regulator circuits, copper coils, an AC to DC converter, and an AC controller. With this technology, charging electric vehicles while driving is not necessary; they can be done while moving. The battery and solar panel are connected by a charge controller. The battery is storing direct current electricity. Now, the DC power needs to be converted in order to be sent.

II. Literature Survey

A solar charging station for electric cars using a solar panel array and a power conditioning device to convert solar energy into electrical energy was proposed by Bugatha Ram Vara Prasad et al. in 2021. An energy management system built into the system maximizes the usage of renewable energy sources and controls the charging process. A feasibility study using bipolar pads for wireless power chargers was carried out by T.D. Nguyen et al. in 2020. The study assessed bipolar pads' functionality and effectiveness for wireless charging, emphasizing the technology's potential advantages in lessening the need for physical connections. A bidirectional battery charger for electric vehicles was created by Bugatha Ram Vara Prasad and K. Aswini (2021) to allow for effective charging and discharging of the vehicle's battery. A battery management system built within the system controls charging and guarantees peak performance.

A real-time coordination system for electric vehicles was proposed by M. Singh et al. (2019) to support the grid at the distribution substation level. The system optimizes the use of renewable energy sources and minimizes dependency on the power grid by managing the charging and discharging of the vehicles through the use of clever algorithms and a communication network.

In order to promote sustainable and effective charging options for electric vehicles, the literature study emphasizes the significance of wireless charging technologies and renewable energy sources. The research highlights the necessity of sophisticated energy management systems and clever algorithms to control the charging procedure and maximize the utilization of renewable energy sources.

2.1 Need of Project

Since the middle of the 19th century, electric vehicle (EV) charging technology has been required. In the beginning, electric vehicles ran on disposable batteries, but "charging" technology ultimately took the role of the "dead" batteries. There was no market for any of these early electric vehicles because none of them were mass-produced. One big problem with charging outlets is that a lot of houses were constructed before the early 20th century. There was no electricity at the residence, therefore it was impossible to charge the car there. Homes needed to be electrified in order to increase the public's access to electric vehicles [2]. This would result in more people buying and utilizing electric vehicles, which is the intended outcome. About three-quarters of American automobiles were electrically propelled in the early 1900s [13]. These cars can be charged using one of two methods: either by using the batteries already installed in the vehicle, or by removing the battery and charging it somewhere else.

2.2 Objectives of proposed work

1. To build a solar charging system
2. To Increase fuel efficiency, decrease gas prices, and decrease pollution.
3. To store the charge in the Battery
4. To examine Electrical vehicle

III. Proposed Work

3.1 Block Diagram

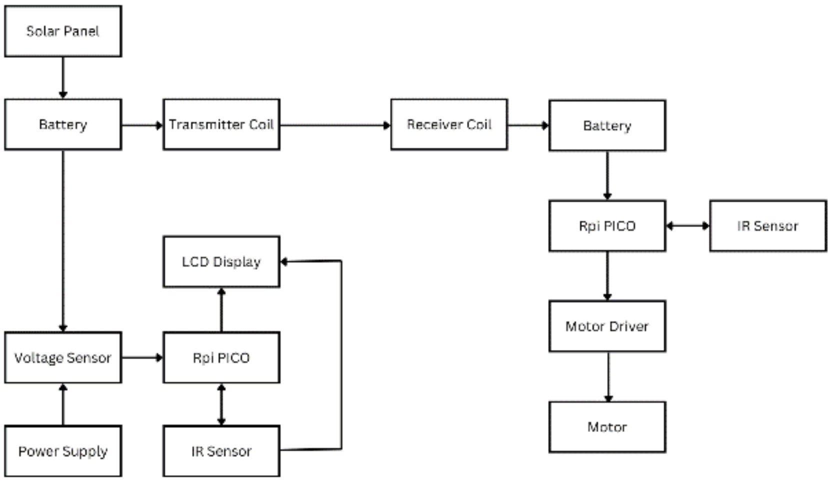

Fig 1 Block Diagram of Proposed System

3.1.1 Working of System

A solar panel charges the transmitter coils, which in turn charges the battery that is kept in reserve within the regulator. A transformer's primary and secondary coils are connected by a magnetic field that needs to be directed by the transformer's core in order to prevent energy waste. In response to oscillations in the net magnetic flux from the stimulated spin system, the receiver coil records an induced electric current. The receiver coil is wirelessly charged as a result. After the ac power has been converted, the DC power produced by the AC to DC converter powers the pico controller. An LCD panel that has been integrated into the system can show the initials of the car.

3.2 Hardware Specifications

3.2.1 Raspberry PICO

Raspberry Pi Foundation has launched a new Product named Raspberry Pi PICO which is very cheaper as compared to other Raspberry Pi Products. Almost one and half-year before Raspberry had launched a revolutionary update on their Single Board Computer (SBC) Pi 3 and become most popular Microcontroller board in the community which is known as a Raspberry pi 4. On the same timeline, the Raspberry pi foundation came with new astonishing SBC named as a Raspberry Pi PICO. The main highlighted thing about RPI PICO it is the Lowest cost and Smallest size development board from Raspberry pi Foundation ever. On the technical side, it is equipped with RP2040 Microcontroller chip developed by Raspberry Pi Foundation itself. RP400 is their first dual-core ARM Cortex M0+ processor-based latest small-sized, budget-friendly microcontroller. The RP2040 is supported with both c / c ++ and micro-python, meaning that if you're a beginner and want to learn any of these languages, the Raspberry Pico would be the best product-option to start with.

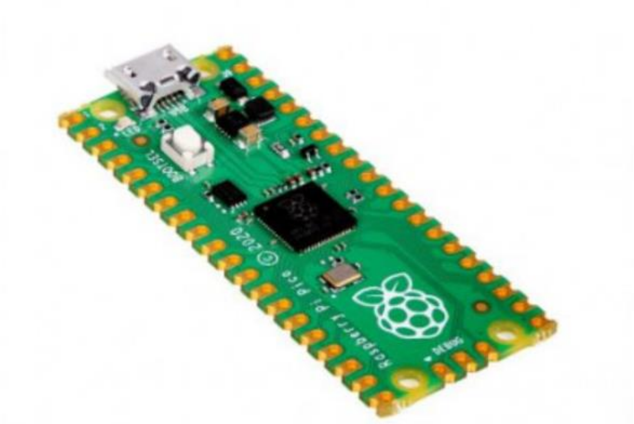

Fig 2 Raspberry Pico

3.2.2 Charging Transmitter and Receiver Coil

The 5V 2A Large Current Wireless Charger Module Transmitter Receiver Charging Coil Module is for a variety of small electronic products, wireless charging, power supply development, and design, with a small size, easy to use, high efficiency, low price characteristics. It is mainly used in mobile electronics products such as for charging the mobile phone wirelessly, game machines, tanks, MP3, MP4, adult products, digital cameras, electric shavers, machine learning, health care, etc. Due to the adoption of a Contactless charging power supply, to complete sealing of the products, waterproof and dustproof; increase product service life, use more convenient.

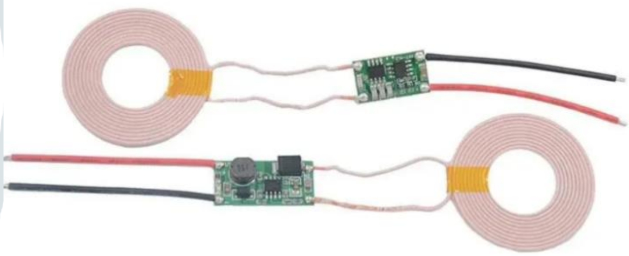

Fig 3 Transmitter and Receiver Coil

3.2.3 LCD Display

Characters and symbols that can be displayed on a 16x2 LCD include numerals, special characters, uppercase and lowercase letters, and the standard HD44780 controller. Because the display is frequently illuminated, it is simple to view in dimly lit areas. LCD screens are frequently utilized in many different applications, such as embedded systems, consumer electronics, and industrial control systems. They are a common option for information display in electronic projects since they are reasonably inexpensive, low-power, and simple to link with microcontrollers.

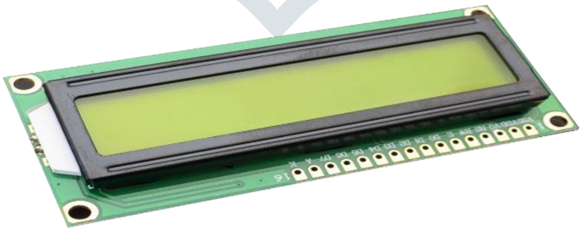

Fig 4 16x2 LCD Display

3.2.4 Solar Panel

The Poly Crystalline Panel RTM005P is an energy source that can provide reliable solar power, reduce electricity bills, and requires low or no maintenance. Polycrystalline solar panels, also known as multi-crystalline or many-crystal solar panels, are made from silicon fragments instead of a single pure ingot. They have an efficiency rating of 17% or less, and a higher temperature coefficient than monocrystalline solar panels. Polycrystalline panels typically have lower efficiency rates, typically in the 13-16% range, while monocrystalline panels have higher efficiencies in the range of 15-20%. Because of the lower efficiency rate, polycrystalline panels are not as space-efficient since they produce less power per square foot. On average, these panels last between 25-30 years, but they can last up to 35 years. These panels are integrated into the charging infrastructure, allowing electric vehicles to recharge their batteries wirelessly using the sun's energy.

Fig 5 Solar Panel

3.2.5 IR Sensor

IR LEDs, or infrared light-emitting diodes, emit light in the infrared spectrum, which is invisible to the human eye. They are commonly used in various applications such as remote controls, security systems, and proximity sensors. IR LEDs work by passing a current through a semiconductor material, causing it to emit infrared radiation. These LEDs are efficient and durable, making them ideal for use in devices requiring invisible light transmission. They play a crucial role in enabling communication and sensing in applications where visible light is not suitable or desired.

Fig 6 IR Sensor

3.2.6 Relay

The 5V Single Channel Relay Module is a compact electronic device designed for controlling high-power electrical appliances with low-voltage signals, commonly used in automation projects and IoT applications. It operates on a 5V input signal and can switch a single circuit on or off. The module typically consists of a relay, which acts as a switch, and an optocoupler for isolation. It provides a simple interface for interfacing microcontrollers, such as Arduino, Raspberry Pi, or other digital control systems.

Fig 7 Relay

3.2.7 Rechargeable Battery

The 18650 Li-ion Rechargeable Battery with a capacity of 1500mAh provides reliable power for a variety of devices, including flashlights, laptops, and electric vehicles. Its compact size and high energy density make it a popular choice for portable electronics. With the ability to be recharged multiple times, it offers long-term cost savings and reduces environmental impact. The 18650 form factor ensures compatibility with a wide range of devices, while the lithium-ion chemistry provides stable performance and high discharge rates. Whether for everyday use or emergency backup, this battery delivers consistent power when needed.

Fig 8 Rechargeable Battery

3.2.8 Motor Driver

The L293 Motor Driver Module is a versatile electronic component used to control the speed and direction of DC motors or stepper motors. It features dual H-bridge circuits capable of driving two motors independently. Operating with a wide voltage range, typically from 4.5V to 36V, it's compatible with various motor types. The module offers built-in protection mechanisms such as thermal shutdown and overcurrent protection. With straightforward interfacing to microcontrollers like Arduino, Raspberry Pi, or other control systems.

Fig 9 Motor Driver

3.2.9 Motor

The Single Phase 12V DC Motor is a compact and efficient electrical device designed for a variety of applications, including robotics, small appliances, and automotive systems. Operating on a 12-volt direct current (DC) power supply, it offers reliable performance and precise speed control. With its single-phase design, it simplifies wiring and integration into electronic circuits. The motor typically features a brushed design for simplicity and cost-effectiveness.

Fig 10 Motor

IV. Result Discussion

4.1 Project Photo

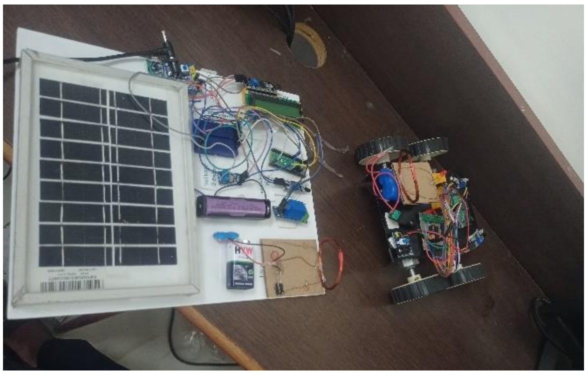

Fig 11 Project Photo

4.2 Advantages

1. Real Time solution
2. No Pollution
3. Required smaller battery size
4. Less human efforts

4.3 Applications

1. On highway
2. In mall or commercial places
3. Public Transportation

V. Conclusion

Given how drastically the environment has become worse, electric vehicles, or EVs, are becoming increasingly necessary. By 2030, the government intends to phase out diesel vehicles entirely. Rapid charging technology and charging stations are prerequisites for the broad adoption of electric vehicles (EVs), since waiting for an EV to charge is the largest barrier to EV adoption. A stable network of charging stations will be necessary for this transition to be successful. The widespread use of electric vehicles (EVs) has the potential to seriously impair the grid's dependability. At the core of the "solar-based wireless EV charging" proposal is a renewable energy infrastructure. A lead-acid battery is used to store solar electricity. The establishment of an entirely wireless charging infrastructure is made possible by the BMU.

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