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IOT Based Wireless Charging Center

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ABSTRACT :

Wireless power transmission is the way to transfer power without using wire. The abstract describes how wireless power transmission can send electricity without needing wires, making it easier to provide power in areas without traditional power sources. It highlights how this technology can benefit everyone by providing clean energy. Specifically, it talks about how wireless charging can be used for electric vehicles, making it easier and more convenient to charge them. The abstract also mentions ongoing efforts to standardize wireless charging systems across different vehicle makers and locations. Overall, it discusses successful experiments in wireless power transmission and its potential future use in electric vehicles.

Keywords – Wireless Power Transmission, Electric Vehicles, Standardization.

Introduction

Electric cars are becoming really popular because they're seen as a smart choice for transportation. One issue with them is that they need to be charged often because their battery range is limited. As more people drive electric cars, there's more traffic, and we're also worried about running out of fuel for traditional cars.

Electric cars need charging stations just like gas cars need gas stations .There are two main ways to charge electric car batteries wirelessly: static charging, where the car is parked and charges, and dynamic charging, where it charges while driving. Cars that charge when parked are called battery electric cars (BEVs), while ones that charge while moving are called online electric vehicles (OLEVs). You can charge a BEV at home or work, but the downside is that the batteries need to be big and heavy to store enough power. OLEVs have coils in the road that charge them as they drive.

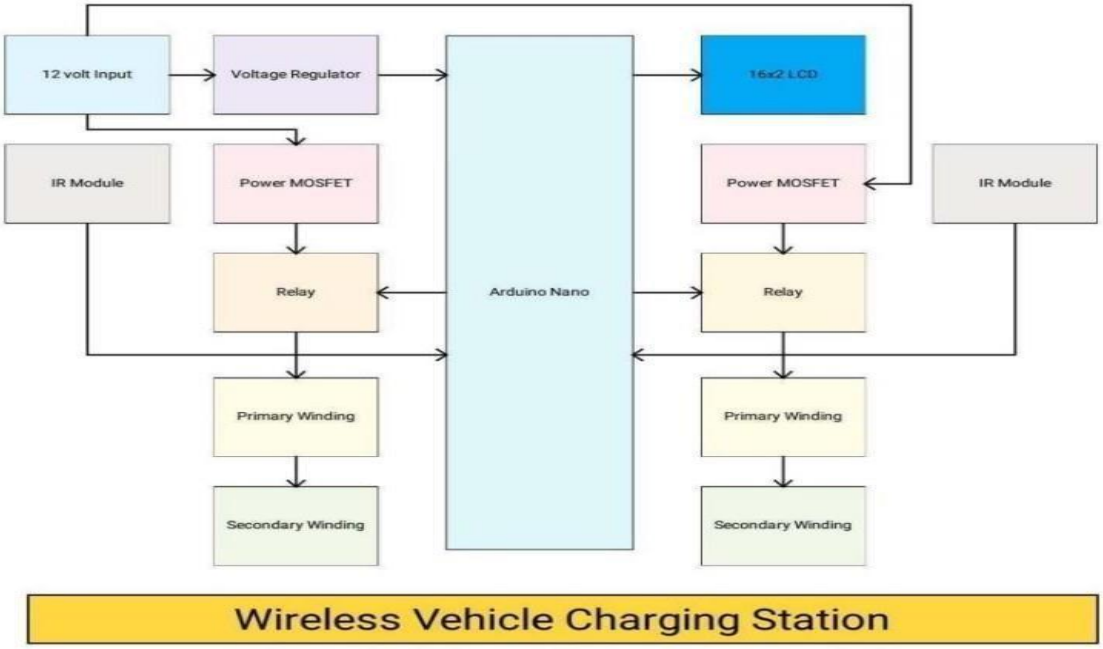
Charging an electric car when it's parked is cheaper and more convenient, so it's a good idea to combine parking spots with charging stations, especially with the help of smart technology like the Internet of Things (IOT).

In the future, when we have driverless electric vehicles (EVs) that need to charge automatically without human help, we can use Wireless Charging Systems (WCS). These systems are designed to charge EVs without needing to plug them in. They're really handy because they're simple, reliable, and easy to use. However, they only work when the car is parked or not moving, like when it's in a parking lot, garage, or waiting at traffic lights.

But there are some challenges with these stationary WCS. They can have problems with electromagnetic compatibility, which means they might interfere with other electronic devices. They also might not be able to transfer a lot of power, they can be bulky, and they might not work over long distances as well as traditional plug-in chargers. Plus, they might not be as efficient. Most EVs use lithium-ion batteries, which are smaller and have longer life cycles compared to older lead-acid batteries.

But even though lithium-ion batteries are better, they still need to be monitored carefully to prevent problems. If a lithium-ion battery gets overcharged, it can cause serious safety issues like fires. So, it's important to have a battery monitoring system in EVs that can tell the driver about the battery's condition to avoid these problems. In the past, battery monitoring systems only told the driver if the battery was low, but now they're becoming more advanced to help prevent safety issues like overcharging.

Proposed System



The challenge of integrating electric vehicle (EV) charging infrastructure into residential buildings, particularly apartments, is significant. Many buildings lack the necessary electrical infrastructure to support EV charging, which poses a barrier for potential EV owners living in these spaces. Shared electricity in apartment buildings often doesn't meet the demands of EV charging, making it difficult for residents to charge their vehicles conveniently.New advancements in the Internet of Things (IoT) offer potential solutions to this problem. By leveraging IoT technologies, such as sensors and communication platforms, innovative systems can be developed to address the challenges of EV charging in residential buildings. These systems can enable smarter and more efficient management of electricity usage, facilitating the integration of EV charging infrastructure into existing buildings.

However, there are additional hurdles to overcome, especially in rental housing and condominiums. In rental properties, tenants may require assistance in installing EV charging solutions, while in condominiums, there may be resistance from owners to invest in EV charging stations that only benefit a few residents. Moreover, safety concerns regarding the electrical systems in these buildings further complicate the process, as adjustments may require consensus among owners and approval from building safety authorities.

Overall, the lack of preparedness of residential buildings for EV charging presents a significant barrier to the widespread adoption of electric vehicles. Addressing these challenges will require innovative solutions that leverage IoT technologies, while also navigating issues related to ownership, safety, and regulatory approval.

Literature Review

We review many different review materials so we can learn about others' work on different kinds in the working of wireless power transfer. We found some of the information listed below to be very useful.

Manshadi, S.D., Khodayar, M.E., Abdelghany, K. and Uster, H. (2018) Wireless Charging of Electric Vehicles in Electricity and Transportation Networks. IEEE Transactions on Smart Grid, 9, 4503-4512.

This paper is about a wireless charging station (WCS) that charges electric vehicles (EVs) while they're moving. It looks at how the WCS affects both the electricity network and the transportation network.In the transportation network, the total cost of traveling includes both the time it takes to travel and the cost of the electricity used along the way. Each EV chooses the path that costs it the least in total.In the electricity network, changes in how many EVs use the WCS because of changes in traffic flow affect the price of electricity. This, in turn, changes how the EVs decide to charge and where they go, which affects traffic flow.By coordinating between the electricity and transportation networks, we can reduce congestion in the electricity network by routing traffic better in the transportation network[1].

Subudhi, P.S. and Krithiga, S. (2020) Wireless Power Transfer Topologies Used for Static and Dynamic Charging of EV Battery: A Review. International Journal of Emerging Electric Power Systems, 21, Article ID: 20190151

This paper reviews different ways to wirelessly charge electric vehicle (EV) batteries, which are seen as a great option compared to traditional gasoline cars. Among the various methods, wireless charging is becoming popular.There are two main types of wireless charging: static and dynamic.Static charging uses methods like inductive and capacitive charging to transfer power to the EV battery without any physical connection.Dynamic charging involves charging the EV battery while it's on the move, which is more complex[2].

Kanagachidambaresan, G.R., Anand, R., Balasubramanian, E. and Mahima, V., Eds. Internet of Things for Industry 4.0
This series of books discusses how technology, especially information technology, is changing our world in ways we might not fully understand yet. It covers a wide range of topics related to communication and computing engineering, such as wireless networks, mobile communication, gaming, healthcare technology, energy management, smart grids, and the Internet of Things (IoT). Essentially, it explores how technology is shaping our lives, from how we communicate to how we manage energy and live in cities[17].

Htwe, H.N., Mon, Z.Z., Mya, A. and Aung, M. (2019) Design and Implementation of IOT Based Vehicle Tracking System. International Journal of Science, Engineering and Technology Research, 8, 374-379.
This research focuses on vehicle security, which is important to prevent theft and accidents. They propose a system that tracks vehicles based on user needs. This system is affordable, provides accurate location information, and is easy for users to access. It uses GPS and GSM technology to track vehicles, and users can interact with the system using SMS on their mobile phones. In simpler terms, it's about creating a low-cost, user-friendly way to track vehicles using GPS and text messages[19].

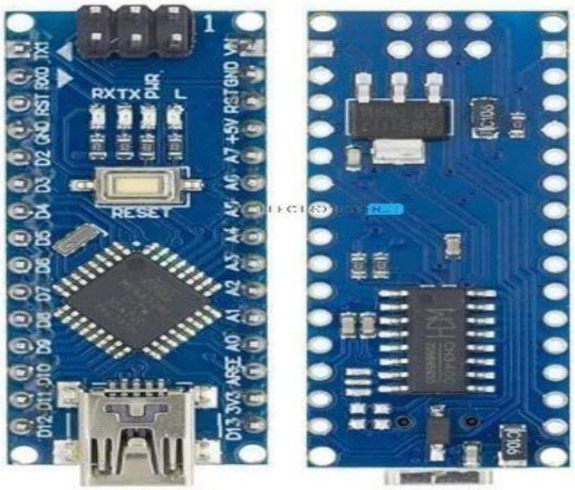
Sultanbek, A., Khassenov, A., Kanapyanov, Y., Kenzhegaliyeva, M. and Bagheri, M. (2017) Intelligent Wireless Charging Station for Electric Vehicles. 2017 International Siberian Conference on Control and Communications,
This study is about using Wireless Power Transfer (WPT) as a way to charge Electric Vehicles (EVs) without needing to plug them in. They discuss and simulate a WPT system designed specifically for EVs.What's unique about their system is that it's intelligent—it automatically aligns the transmitting coil (which sends the power) with the receiving coil (which receives the power) using a fingerprint method. This means the driver doesn't have to manually position the coils, saving time and reducing errors.Their system also has the capability to start charging the car during off-peak periods when energy costs are lower, which helps save energy and reduce electricity bills for EV owners. Overall, it's a smart and efficient way to charge EVs while also saving time and money[18].

Project Design

When an electric car parks on a spot with wireless charging technology, there are coils installed beneath the parking area that create a magnetic field. These coils in the car also generate electricity from this magnetic field. When the car parks over the charging spot, high-frequency electricity flows through the wireless charging station. This creates magnetic fields that induce electricity in the coils of the car. This electricity is then converted into direct current (DC) using a converter and used to charge the car's battery. So, essentially, the car charges wirelessly while parked over the charging spot.

Hardware Selection:

1.Arduino Nano:
Arduino circuit boards, programmed using the Arduino IDE, can read signals from sensors, control motors, and turn LEDs on or off. The Arduino Nano is a compact board that can perform all these functions. You send instructions to the main microcontroller, called the ATmega328, on the board using the Arduino IDE.The Arduino board has various components, including a USB port for power, a voltage regulator, a crystal oscillator, pins for different voltages (3.3V, 5V, ground, Vin), analog pins (A0 to A5), power LED indicator, Tx Rx LEDs for communication, digital input/output pins, Aref for reference voltage, and a reset button.The Arduino project began in 2003 as a program to create user-friendly microcontroller boards for hobbyists and professionals alike.



2. IR Sensor:

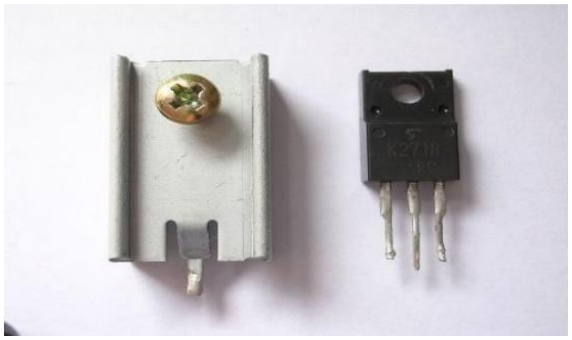
IR sensor is an electronic device that emits light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiation are invisible to our eyes, but infrared sensors can detect these radiations.

3.LCD

LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is a 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 for several reasons: LCDs are economical, easily programmable, and have no limitation on displaying special or 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 a 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. 16 Characters x 2 Lines Builtin HD44780 Equivalent LCD Controller works directly with ATMEGA, ARDUINO, PIC, and many other microcontroller/kits.

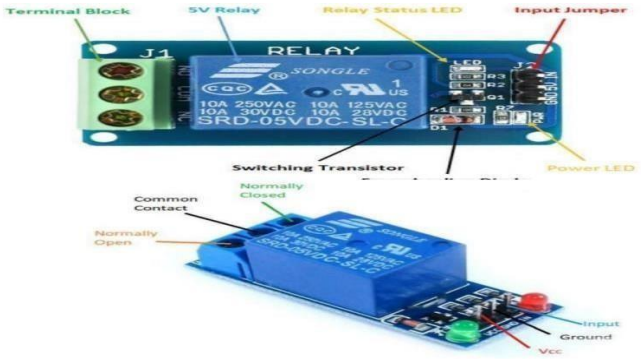
4.MOSFET

The metal-oxide-semiconductor field-effect transistor (MOSFET) is a type of transistor made from a semiconductor material like silicon. It has a special gate that controls the flow of electricity through it. By changing the voltage on this gate, we can control how much electricity flows through the transistor. This ability to control conductivity with voltage makes MOSFETs useful for amplifying or switching electronic signals.

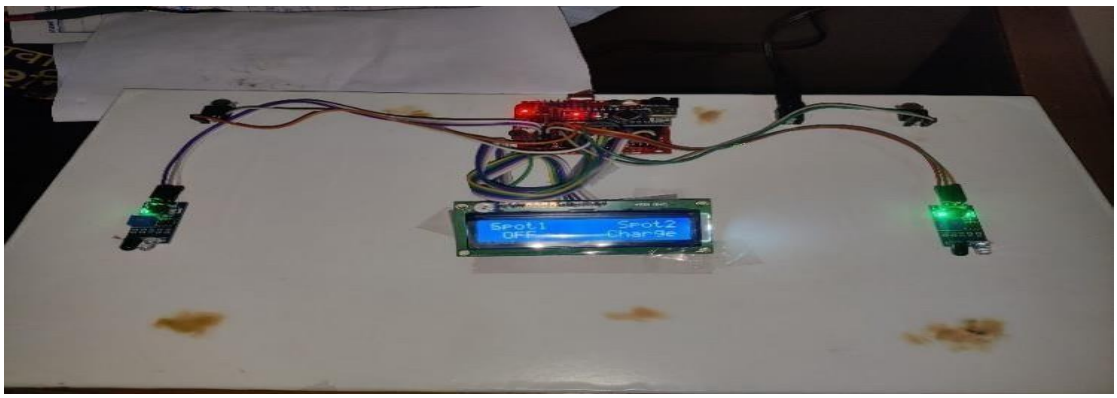


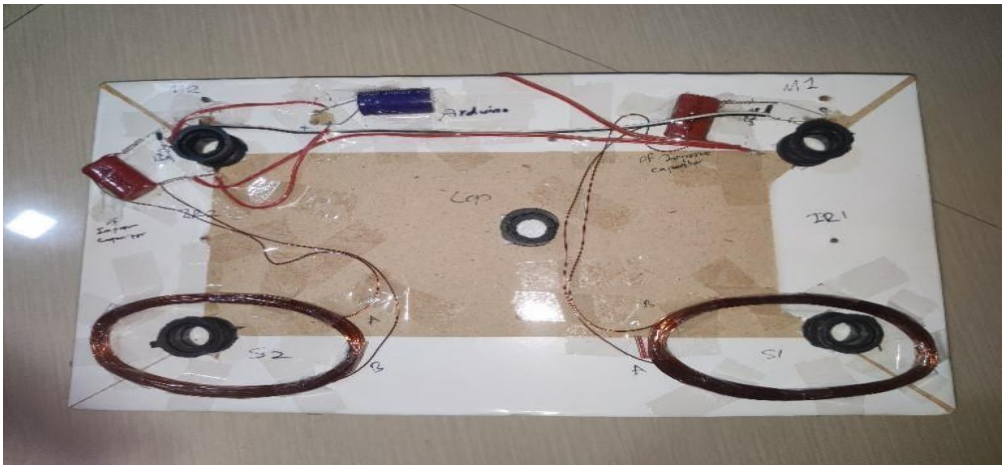
5.Relay Module:

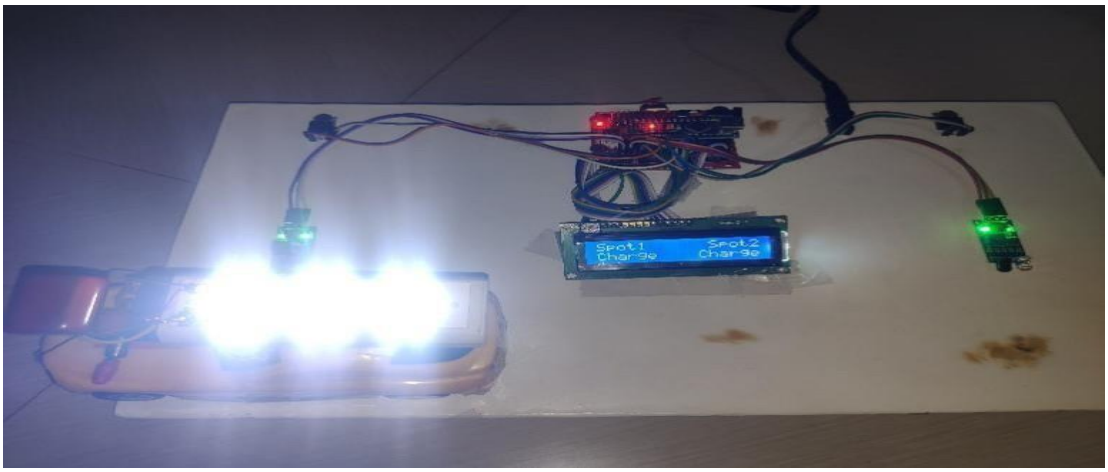
A relay is like a remote-controlled switch that can turn something on or off. It has input terminals for control signals and output terminals for switching the electrical circuit on or off. There can be different types of contacts: ones that make a connection, ones that break a connection, or a combination of both.Relays can be used to repeat signals over long distances, taking a signal from one circuit and sending it to another.The components on a 5V Single Channel Relay Module include a 5V relay, transistor, diode, LEDs, resistors, male header pins, and a screw-type terminal connector with three pins.



3.1 FINAL PROTOTYPE:







IV.OUTCOMES

Wireless charging is a convenient way to charge electric vehicles without needing to plug in a cable. Instead, the vehicle is charged by parking it over a wireless charger, which uses mutual induction to generate electricity in the vehicle's coil. This technology is advancing to allow for charging while driving. The paper discusses how this system works efficiently and how it could be implemented in future charging stations. It also mentions future technologies like payment through RFID tags and self-service entry and exit gates to reduce congestion at charging stations. Overall, the static wireless charging system is seen as a suitable and reliable technology for consumers

V. Acknowledgments

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