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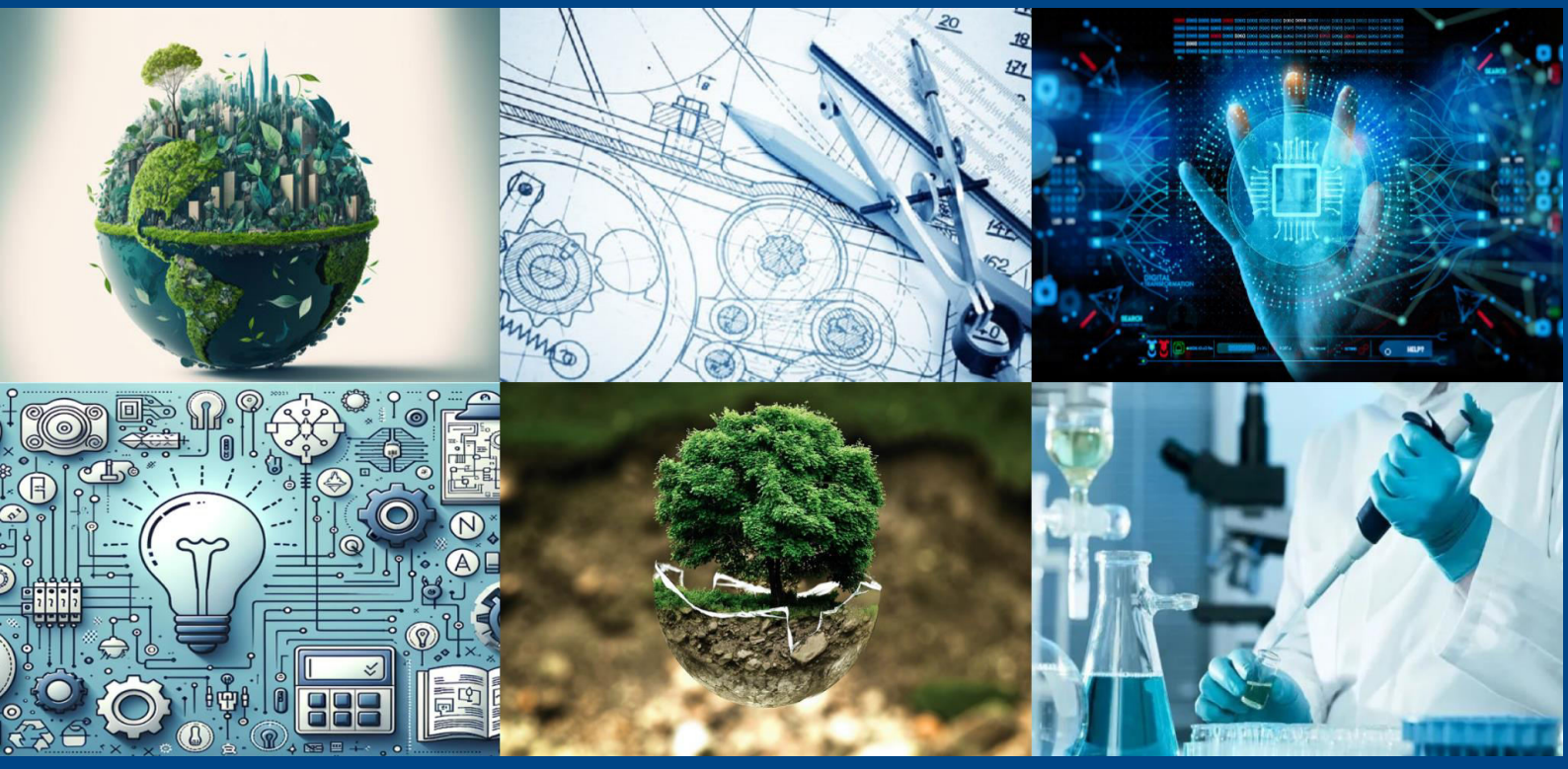

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EV Charging using Street Light a Dynamic Approach

Dr.G Amudha[1], Praveen Kumar R[2], Santhosh Pandiyan R[3], Siva Kumar M[4], Logesh B[5]

Professor, Department of Computer Science and Business System, RMD Engineering College, Chennai, Tamil Nadu, India[1]

Student, Department of Computer Science and Business System, RMD Engineering College, Chennai, Tamil Nadu, India[2-5]

ABSTRACT: Electric Vehicle(EV) charging is a critical component of the sustainable transportation ecosystem, enabling the operation and expansion of electric mobility. Charging infrastructure comprises various methods such as AC(Alternating current) charging, each wireless or inductive charging, each catering to different use cases. The technology involves energy transfer from the power grid to the EV's battery, with ongoing advancement aimed at improving efficiency, reducing charging times, and minimizing grid load. Integration with renewable energy sources and smart grids is enhancing the environmental benefits. The expansion of accessible charging stations and standardization of charging protocols are key to supporting the widespread adoption of EV's, ensuring convenience and reliability for users.AC charging is slower and suited for home uses, Expanding charging networks and standardizing technology will play a key role in mass EV adoption.

I. INTRODUCTION

Electric Vehicle(EV) charging is a fundamental aspect of electric mobility, enabling the use and widespread adoption of electric vehicles. It involves replenishing the battery of an EV through external power sources. As EVs have grown in popularity due to their environmental benefits and efficiency, the development of charging infrastructure has become critical to supporting this shift. The primary levels of EV charging are AC Fast charging requires a 240V power sources and delivers significantly faster charging, making it ideal for home installations, workplaces, and public charging stations. The expansion of charging infrastructure is vital for the successful adoption of EVs. While home charging remains the most convenient and cost-efficient option for most EV owners, public charging networks are essential for long trips and for those without access to home charging. Public stations are being installed at workplaces, shopping centers, parking lots, and along highways to alleviate range anxiety-the fear of running out of battery without access to a charging station .Moreover, smart charging systems are being developed to optimize energy use by charging during off-peak times, reducing the load on the electrical grid. As battery technologies improves, charging speeds will continue to increase, further enhancing the practicality of EVs. Overall, the evolution of EV charging infrastructure is essential to accelerating the global shift towards electric mobility.

II. IMPLEMENTED SYSTEM

The proposed system will use only electricity provided by the government to the street light to charge the vehicle. Solar power is used for operating the street lights.
No other power is used for these things, so we save more money.
This way, we help the environment and keep things simple.
During night times, the same street light provides lighting while also giving a place for EV's to charge.
This system works within a voltage range of 110V to 320V (AC), and provides Level 1 charging with a power output of less than 3.5 Kw. This is suitable for 2,3,4 wheelers . Charging is slow because of the lower power, and it can take several hours to fully charge a vehicle. The charging points are placed every 20 kilometers on highways or in cities to make it easier for people to find them while driving.
Users can check available charging points through an online booking system. This system allows users to book charging slots in advance. The charging prices depend on whether it is day or night. Charging is cheaper during daytime (₹3 per unit) because of sunlight, and costs more at night (₹4 per unit). The connectors used for charging are waterproof (IP68 rated), so they can work even in rain or tough weather.
The main goal of this system is to use existing streetlight infrastructure, which makes it easier to install in cities without using too much space. No much money is wasted in building up infrastructure.

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III. ADVANTAGES

Clean and Green Energy: By using solar power, the system supports clean energy, reducing the need for fossil fuels and cutting down harmful pollution. This helps in fighting climate change and keeping the air cleaner.
Low Maintenance: Solar systems need very little upkeep after installation, saving time and money on maintenance. There are fewer repairs compared to traditional electricity systems.
Easier Access: The charging points are placed regular intervals on highways , so it's easier for people to find a charging spot, especially for long-distance travel or in areas where charging stations are rare.
Dual Purpose: These street lights provide both lighting and EV charging, so they serve two purposes without taking up extra space or requiring new structures to be built.

Convenient for Users: The online booking system makes it easy for users to find available charging spots, book them in advance, and check their energy usage. This removes the worry of not finding a charging point when needed.
Easily Expandable: The system can be set up in many places without much difficulty, making it useful for cities, highways, and even rural areas where infrastructure is limited.

IV. DRAWBACK

High Installation Costs: Installing solar panels and batteries on street lights is expensive. While the costs will reduce over time, the initial setup may limit how fast the system can be rolled out in different places.
Slow Charging: The system only provides Level 1 charging, which is slow and may not be enough for larger vehicles like cars that need more power and faster charging.

Weather Dependent: Solar power works best when there is a lot of sunlight. On cloudy or rainy days, or at night, the system's ability to charge vehicles will be reduced, making it less reliable in some conditions.

Maintenance Needs: The system will require regular maintenance to keep the solar panels, batteries, and charging ports working properly. Bad weather or damage could cause problems and affect how well the system works.

Limited Locations: While the system works well on highways, it may be harder to set up in crowded cities with little sunlight or space. Some areas may not be suitable for solar-powered charging points

V. RESULT

While EV charging systems offer significant environmental and economic benefits—such as reduced air pollution, lower running costs, and the convenience of home charging—they face several challenges that need addressing. Limited charging infrastructure, slow charging times, high installation costs, and electricity grid demands are key areas of concern. Additionally, inconsistencies in charging standards and the environmental impact of battery production highlight the need for continued innovation and investment in infrastructure and technology. Despite these challenges, the ongoing advancements in EV technology and infrastructure development hold promise for a more sustainable and efficient future for electric vehicles.

VI. CONCLUSION

In conclusion, the development of robust and efficient electric vehicle (EV) charging infrastructure is fundamental to the success of sustainable transportation. By advancing technologies such as AC and wireless charging, integrating renewable energy sources, and optimizing smart grids, the EV ecosystem is set to achieve greater efficiency, reduced charging times, and minimized environmental impact. Expanding the network of accessible charging stations and standardizing charging protocols will ensure convenience and reliability for users, driving the mass adoption of EVs. Collectively, these efforts will pave the way for a cleaner, greener, and more sustainable future in transportation.

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