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Wireless Ev Charging Station with Real Time Energy Monitoring and Management Using IOT

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Abstract -- The increasing adoption of electric vehicles (EVs) has led to a growing demand for accessible, efficient, and intelligent EV charging infrastructure. However, users often face challenges such as difficulty locating available charging stations, lack of real-time slot availability, and unclear billing systems. To overcome these issues, this project proposes an Android-based mobile application that allows users to find and book slots at the nearest EV charging stations. By integrating IoT technology with charging hardware, the system provides real-time monitoring and control of the charging process. Charging sessions are measured based on time and electricity consumption, enabling transparent, units consumed, and total cost. This smart system ensures optimal use of charging infrastructure by preventing overcrowding, reducing wait times, and offering a seamless user experience. Additionally, the IoT-based setup enhances operational efficiency by automating data collection and improving station management. The application aims to promote EV adoption by making the charging process more accessible, user-friendly, and technologically advanced. This project bridges the gap between EV users and efficient energy management, contributing to a more sustainable transportation ecosystem.

I.INTRODUCTION

Electric Vehicle (EV) charging stations are a crucial part of the evolving electric mobility ecosystem. As the world moves towards sustainable energy and reduced carbon emissions, the adoption of EVs is growing at a rapid pace. However, the widespread use of electric vehicles depends heavily on the development of a reliable, accessible, and efficient charging infrastructure. EV charging stations serve as the backbone of thistransformation, providing the necessary energy supply to keep electric vehicles operational across both urban and rural areas. EV charging stations are categorized based on their charging speed and power output. areas. The fastest form, known as DC fast charging. Additionally, new technologies such as ultra-fast charging and wireless charging are being developed to further enhance user convenience and system performan

An EV charging station typically consists of several key components. These include the power supply system, charging connectors and cables, user interface units, and

communication systems that connect to central servers or cloud platforms. Safety mechanisms such as circuit breakers, surge protectors, and fault detectors ensure the protection of both the vehicle and the userINTERNET OF THINGS (IoT)

The internet of things (IoT) has sparked a revolution in various industries, and healthcare stands at the forefront of this transformation. IoT in healthcare refers to the integration of smart devices and technology into the medical landscape, allowing for a more efficient, accurate, and personalized approach to patient care. This essay explores the profound impact of IoT on healthcare, highlighting its benefits, challenges, and future prospects.

1.1 IoT in Healthcare

IoT in healthcare revolutionizes patient care by enabling remote monitoring, enhancing diagnostic capabilities, and optimizing operational efficiency. Despite challenges related to security and interoperability, the potential for improving healthcare outcomes and accessibility is immense. With continued innovation and concerted efforts to address challenges, IoT will continue to shape the future of healthcare, offering a more connected, efficient, and patient-centric approach to wellness and medical treatment.

1.2 ELECTRIC VEHICLE (EV) STATION

New industries are emerging, like Electric Vehicles (EVs). In India, Electric vehicles Sales are increasing. As mentioned in a below chart As of now electric charging stations are limited in India and people cannot find the right charging station which will save them time and money. The problem is not only finding the charging station but also charging it quickly because of the time required to charge the EVs. This leads to the inconvenience of EV users as requires a lot of time, so slot booking is required to charge EVs. As the electric vehicle industry is growing in India and fewer charging stations are available in India and new registrations of the charging station are growing so there is no availability of this growing charging station on virtual Maps.

1.3 ANROID APPLICTION

An Android application is a software program designed to run on devices powered by the Android operating system. Android, developed by Google, is one of the most widely used mobile platforms globally, supporting millions of applications across various domains such as communication, entertainment, education, finance, healthcare, and more. Android applications are built using programming languages like Java, Kotlin, and XML, and are compiled and packaged into APK (Android Package) files that can be installed on Android smartphones and tablets. The open-source nature of Android allows developers to create highly customizable and feature-rich apps that can be distributed through the Google Play Store or other third-party platforms.

II. LITERATURE REVIEW

2.1 Integration of Green Renewable DG based EV Charging Stations Planning in Unbalanced Distribution Network

Authors: Abhinav Kumar Year:2023

Description:

The deployment of renewable energy sources and the proliferation of electric vehicles are crucial steps towards reaching a more sustainable energy future. The idea behind integrating green renewable distributed generation (GRDG)-based EV charging stations into unbalanced distribution networks is to use locally generated renewable energy to power electric vehicles. The dynamics of uneven distribution networks, the erratic nature of renewable energy sources, and the fluctuating energy requirements of EV charging stations make integration an intrinsically complex process. The imbalanced nature of distribution networks, which can result in voltage fluctuations, power imbalances, and other operational concerns, is one of the main challenges in this context. Sustaining the stability and dependability of the distribution network as a whole primarily depends on the deployment of intelligent grid management algorithms.

2.2 The Reliability and Economic Evaluation Approach for Various Configurations of EV Charging Stations

Author : K. Vaishali Year:2022 Description

Electric vehicles (EVs) become more popular as a form of transportation and companies that make useful things are focusing on building charging stations for customers. It is hard to keep charging ports reliable for EVs that are being charged in between, even though charging station companies are building stations according to the distribution system's requirements. To make the charging station of the distribution system more reliable, the 36-ported design has been proposed with the combination of uniform and non-uniform port arrangement. The configurations have been functioned with 50–350 kW distribution system. The failure rate estimation has been implemented with the standards of the MILHDBK217F book.

The probability function of the ports has been evaluated in terms of failure rate and reliability as per the standards of the MILHBK-338B book. As per the failure rate of each port, the evaluation process has been introduced to find the success rate of the charging station. The failure rate of the port arrangement of the proposed 36-ported charging station has been evaluated by using the binomial distribution method. Moreover, the cost estimation process has been implemented for the proposed 36-ported charging system in terms of the failure rate and success rate of the individual port maintenance.

2.3 Surrogate-Assisted Combinatorial Optimization of EV Fast Charging Stations

Author: Jyun Year:2022 Descriptions :

In this work, an artificial neural network (ANN) surrogate model-based method is proposed to assist the optimal design of the modular electric vehicle (EV) fast dc charging station. This is a typical combinatorial optimization problem, which is hard to solve analytically as the key design parameters are discrete, e.g., the numbers of charging poles, power electronic converter modules, and switching contactors. In the first part of the article, the details on how to generate the expected charging power demand of the charging station are presented, where characteristic EV charging curves are considered. The charging station is designed to operate under a modified first-

come-first-serve (FCFS) policy to maximize the quality of service (QoS) to the customers. The system time ratio, energy efficiency, and capital expenditure (CAPEX) are then taken as the performance indicators to evaluate different designs in correlation to expected charging demand. By varying the design parameters, we generate a group of datasets from an adjustable charging station simulation model, which is then used for supervised training of an ANN. As a surrogate model of the charging station, the trained neural network is finally used to quickly map the design parameters into the performance indicators, where optimal design parameters are found by evaluating the proposed cost function.

III. PROPOSED DESIGN

The increasing adoption of electric vehicles (EVs) has significantly transformed the transportation landscape, leading to a surge in demand for accessible, efficient, and intelligent EV charging infrastructure. Despite the growing number of charging stations, users continue to face several challenges, including difficulty in locating available stations, uncertainty around real-time slot availability, and confusion over billing systems. These issues often result in a frustrating experience for EV owners, hindering the widespread adoption of electric vehicles. To address these challenges, this project proposes the development of an Android-based mobile application that empowers users to find, book, and manage charging slots at nearby EV charging stations with ease. By integrating Internet of Things (IoT) technology with the charging infrastructure, the system facilitates real-time monitoring of charging sessions, allowing users to view the status and availability of stations instantly. The app offers transparent billing by tracking both the time spent charging and the electricity consumed, providing users with a detailed breakdown of the total cost. This intelligent system not only enhances the user experience by preventing overcrowding and reducing waiting times, but also optimizes the use of charging stations, ensuring that resources are allocated efficiently. Moreover, the IoT-based setup automates data collection, improving station management and operational efficiency.

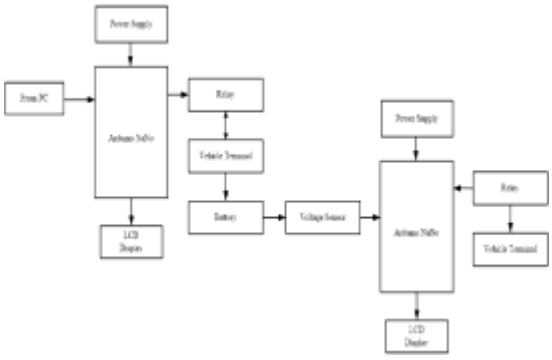

Fig: Block Diagram

IV. REQUIREMENTS

HARDWARE REQUIREMENT

1. Power supply
2. LCD
3. Relay
4. Battery
5. Voltage sensor
6. Arduino NANO
7. Drive
8. motor

SOFTWARE REQUIREMENT

1. Arduino IDE
2. Android studio
3. Python
4. Fire base

V. METHODOLOGY

The internet of things (IoT) has sparked a revolution in various industries, and healthcare stands at the forefront of this transformation. IoT in healthcare refers to the integration of smart devices and technology into the medical landscape, allowing for a more efficient, accurate, and personalized approach to patient care. This essay explores the profound impact of IoT on healthcare, highlighting its benefits, challenges, and future prospects.

One of the primary advantages of IoT in healthcare is its ability to enhance patient monitoring and management. IoT devices such as wearable sensors, smart watches, and implanted devices collect real-time data on vital signs, activity levels, and other health metrics. This continuous stream of information enables healthcare professionals to track patient health remotely, intervene promptly in case of anomalies, and provide personalized treatment plans. For instance, patients with chronic conditions like diabetes or heart disease can benefit from continuous monitoring, leading to early detection of complications and timely interventions.

VI. CONCLUSION

The proposed IoT-based smart EV charging system offers an innovative solution to common challenges in electric vehicle infrastructure. It enables users to easily locate, book, and monitor charging slots in real time through a dedicated Android application. The integration of IoT allows for accurate tracking of electricity usage and charging time, resulting in transparent billing. Relay and sensor components ensure automated control and enhance safety during operation. The simulation validated all core functionalities, confirming the system's reliability and responsiveness. Real-time updates improve the user experience by minimizing delays and managing charging loads efficiently. The mobile interface is intuitive and supports seamless interaction. This system is scalable and adaptable, making it suitable for future advancements in smart transportation. It also reduces manual management, streamlining operations for service providers. Overall, the project supports the shift toward sustainable and intelligent mobility solutions.

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