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SMART ENERGY MANAGEMENT AND NAVIGATION FRAMEWORK FOR AUTONOMOUS ELECTRIC VEHICLES IN COMPLEX ENVIRONMENTS

Dr.M.Sangeetha [1], M.Ruba [2], R . Arunkumar [3] , G.Purushothaman[4] , Viji .M [5], R.Shanthi [6] , Ramesh V [7]

1. Professor, EEE, sangee2maya@ gmail.com, M.A.M.SCHOOL OF ENGINEERING, Siruganur, Trichy-621105.
2. Assistant Professor , CSE , K.RAMAKRISHNAN COLLEGE OF ENGINEERING , Trichy.
3. Assistant Professor, MECH, MRKIT, Kattumannar koil ,Tamilnadu ,India.
4. Assistant Professor , EEE, M.A.M.SCHOOL OF ENGINEERING, Siruganur,Trichy-621105.
5. PG Student, EEE, M.A.M.SCHOOL OF ENGINEERING, Siruganur,Trichy-621105.
6. PG Student, EEE, M.A.M.SCHOOL OF ENGINEERING, Siruganur,Trichy-621105.
7. PG Student, EEE, M.A.M.SCHOOL OF ENGINEERING , Siruganur,Trichy-621105.

ABSTRACT

Autonomous Electric Vehicles (AEVs) are revolutionizing the world of smart city transportation duet other lower source consumption, improved traffic efficiency, zero carbon emissions, and improved road safety. To ensure the safe passage of vehicles through a complex environment, it is essential to plan for safe and smart navigation and energy management for AEVs. This demands an effective model for locating the optimal Electric Charging Stations (ECS) for scheduling and recharging the AEVs when they run on low battery. Many research works, however, do not focus on navigation and scheduling policies for A EV charging that would occur in extreme events in complex environments. The electric vehicles are convenient technologies to reduce fuel cost and environmental emissions. The gas online price always comprises fluctuations but the electricity price is much more stable. The electricity price is also less expensive than gasoline. As a result, electric vehicles are conveniencetechnologiestoreducefuelcost.Theelectricitycostsandenvironmentalpollutionareth eother targets that can be minimized by optimal charging-discharging of electric vehicles. The number of Electrical Vehicle (EV) charging stations is steadily increasing everyday as electric vehicles become more popular. With the proliferation of electric vehicles and their predicted sales growth in the near future, battery recharging will pose many challenges. In this paper we will introduce a smart power meter to recharge the electric vehicle. IOT technology is implemented to handle the electric vehicle (EV) recharging process. The proposed EV charging station draws current from the utility grid at low total harmonic distortion (THD).The optimal charging discharging pattern of electric vehicles reduces the economic cost of the unit commitment problem.

Key Words: AEVs, ECS, EV, THD

INTRODUCTION

Autonomous Vehicles

(AVs) have attracted a lot to fat tension as a technologically advanced and completely automated mode of transportation due to the significant advancements in computing technology and the automotive industry [1]–[3]. It is believed to be the next generation of smart transportation, with maximized safety and efficiency for smart energy management. AVs are rapidly being developed and transformed with electroniccontrolsandhavereplaced.Traditionaloperatingmechanisms, paving the way to a versatile framework for autonomous technologies. With the advent of sustainable energy developments, Electric Vehicles (EVs) are enhancing AVs in numerous ways that boost progression and development, are eco-friendly, and provide high efficiency. Due to its apparent advantages, such as low exhaustible petroleum resource usage, high efficiency, and low cost of ownership, the entire EV market has been increasing over recent years [4], [5]. With the integration of alternate renewable and clean energy sources, the emission of greenhouse gases can be minimized by using electric AVs. With the introduction of 6G, communication technology can leverage new speeds to decrease latency and improve throughput. This can address the various limitations in optimization problems that utilize comparatively slower network models [6]. AVs integrated with EVs, known as Autonomous Electric Vehicles (AEVs), could provide many advantages, from smart technology integration feasibility to cost efficiency and environmental friendliness. They make use of modern computational developments in technology and highly enhanced batteries to enable smart transportation solutions for passengers [7]. After a specific amount of time, the battery of the AEV starts to drain. The battery drainage rate depends upon several factors, such as the passenger and cargo load, the weight of the AEV, and the external temperature. To ensure that the AEVs reach their Destination with a sufficient battery, AEVs need to be recharged at Electric Charging Stations (ECS). Multiple ECSs are located in different locations and have different charging capabilities. Due to the restricted cruising range of vehicles, they need to make frequent stops for recharge during long journeys. Furthermore, AEVs need to find convenient charging stations and facilities for their optimal journey, a sin [8], with quick authentication to speed up the charging process [9]. An uncertain and complex environment, such as that of a disaster site, makes the transportation and navigation of vehicles strenuous and demanding due to dynamic obstacles. In such scenarios, blocked roads, fall entrees, traffic congestion, and other hindrances make finding convenient ECS a major concern. So far, existing literature has proposed solutions to optimizer outing and charge scheduling challenges for an urban environment with well-established infrastructure and simplified scenarios [10]. Considering these mobility characteristics, in particular, few studies have focused on realistic scenarios that involve the spatiotemporal dynamics of obstacles in motion and complex terrain. Moreover, recently Deep Reinforcement Learning (DRL) has been employed to make decisions in uncertain scenarios since an optimal strategy for the agents can be learned directly from experience data and does not require modeling the random distribution. However, very few models would help in planning for a fleet of vehicles, considering uncertain obstacles, traffic congestion in the road network, and the efficient total coverage of all charging stations. In this paper, we present a Collaborative Optimal Navigation and Charge Planning (CONCP) framework for a fleet of AEVs in a complex environment to overcome the aforementioned challenges. We envision the fleet of AEVs navigating through a disaster site during evacuation and performing scheduling algorithms for optimal charging of AEVs. For this purpose, a Multi-Agent Deep Deterministic Policy Gradient (MADDPG) algorithm based on Multi-Agent DRL(MADRL) has been formulated. The proposed CONCP model can effectively perform AEV navigation and charge scheduling despite as to chiastic environment. This is because the model can acquire observations from agents in the environment and [9] formulate an optimal model based on the information about the agent's states and actions. The model is well-suited to a scenario in which many AEVs interact with their environment collaboratively to minimize the time taken for the journey and perform optimal navigation. The main contributions of this work are as follows: 1) Formulate an optimal routing model for a fleet of AEVs that offers a smart routing and energy management system while considering the peculiarities of the available charging station infrastructure, charging times, energy consumption, and optimization. 2) ADRL technique, namely the MADDPG algorithm, obtains the optimal scheduling strategy for a fleet of AEVs in a complex environment. 3) The collaborative model performs cooperative AEV navigation and charge planning ensuring guaranteed transportation for a fleet of vehicles. The rest of this paper is structured as follows. An overview of the literature study is presented in Section II. Section III describes the system model and the electric vehicle control dynamic so fanAEV.SectionIVputsforththeproposedCONCPframework.Thesimulationsetupandperformancecomparisonsofthe MADDPGto other existing cutting-edge algorithms.

EXISTINGSYSTEM

Electric vehicle charging station with charging port that charges electric vehicles and the charged voltage is displayed on LCD. In this system the bill pay mentis manual and in formation's are not stored .EV can be slowly charged using a common 230 V / 16 A socket (single phase), it is not a desired approach as charging time will be too large, even for a whole night. According to Tesla, that connection only provides power but that will depend on the car use of a driver according to certain [8] variables such as distance to work and the type of driving activity. This can be scaled depending on many factors such as cost.

DISADVANTAGES

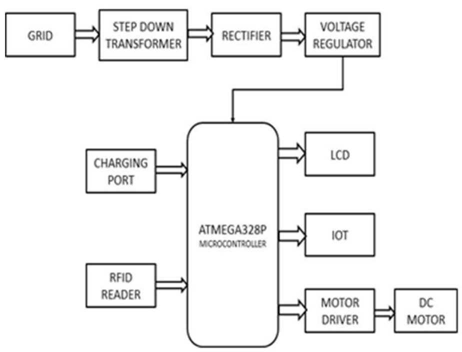
- Not efficient
- Requires human intervention
- Bill payment is manual

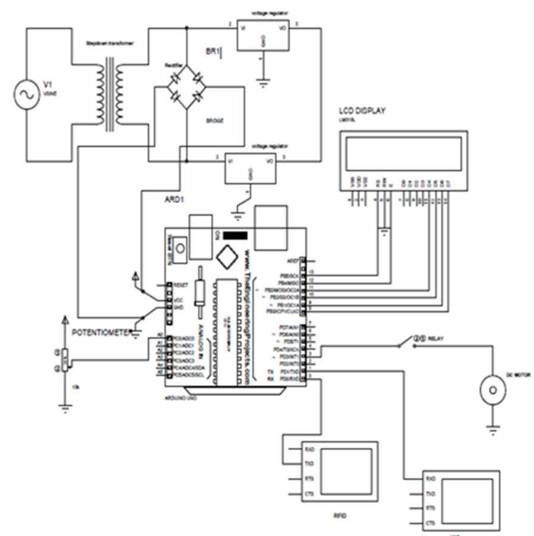
PROPOSED SYSTEM

Nowadays, fossil fuels are getting lesser and going to use up in future if continues consuming this high amount of fossil fuel. Other than that, environment is polluted because of green house gas emission from the burning of fossil fuel. Therefore, renewable energy is introduced and emphasized in many fields to reduce the usage of fossil fuel. Electrical vehicle technology is one of the important ways to reduce the usage of fossil fuel and very important in future when fossil fuel is used up. So, in future when there are more electrical vehicles is used, many petrol stations will change to EV charging stations. Hence this system proposes an IOT based smart power meter to recharge electric vehicle. In this system charging port [9] is used to charge the electric vehicle and measure the energy consumed by the vehicle during charging. RFID is used to make payment easy. The amount details are collected and bill payment is done by RFID tag assigned to the person. The vehicle motor starts only after the bill payment. This system removes the transients and harmonics caused by electric vehicle charging through grid. The measured charging voltage with charging cost is uploading to the web server with the help of IOT and also displayed in LCD.

ADVANTAGES

- It is eco-friendly and requires less components to design.
- RFID has used in this charging station to make easy payment there is no need to frequent maintenance.
- Low power losses.
- Possibility of high-speed charging
- No human intervention
- Low maintenance requirements





CIRCUIT DIAGRAM

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, mac OS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring.[4]The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a programs tub main() in to an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexa decimal encoding that is loaded into the Arduino board by a loader program in theboard'sfirmware.Arduinoisanopen-sourceelectronicsplatformbasedoneasy-to-usehardware and software. Arduino boards are able to read inputs-light on a sensor, a finger on a button, or a Twitter message - and turn it into an output -activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

PREPARING THE BOARD

Before loading any code to your Arduino board, you must first open the IDE. Double click the Arduino .exe file that you downloaded earlier. A blank program, or" sketch, "should open. The Blink example is the easiest way to test any Arduino board. Within the Arduino window, it can be found under File->Examples->Basics->Blink. Before the code can be uploaded [11] to your board, two important steps are required.

1. Select your Arduino from the list under Tools->Board. The standard board used in RBE 1001, 2001, and 2002 is the Arduino Mega 2560, so select the" Arduino Mega2560 or Mega ADK "option in the dropdown.
2. Select the communication port, or COM port, by going to Tools->Serial Port.

If you noted the COM port your Arduino board is using, it should be listed in the dropdown menu. If not, your board has not finished installing or needs to bere connected.

LOADING CODE

The upper left of the Arduino window has two buttons: A checkmark to Verify your code, and a right-facing arrow to Upload it. Press the right arrow but ton to compile and upload the Blink example to your Arduino board. The black bar at the bottom of the Arduino window is reserved forms sages indicating the success or failure of code uploading. A "Completed Successfully" message should appear once the code is done uploading to your board. If an error message appears instead, check that you selected the correct board and COM port in the Tools menu, and check your physical connections. If uploaded successfully, the LED on your board should blink on/off once very second .Most Arduino boards [15] have an LED pre wired to pin13.It is very important that you do not use pins 0 or 1 while loading code. It is recommended that you do not use those pin sever. Arduino code is loaded over a serial port to the controller. Older models use an FTDI chip which deals with all the USBspecifics.NewermodelshaveeitherasmallAVRthatmimicstheFTDIchiporabuilt-inUSB-to-serialportontheAVRmicro-controlleritself.

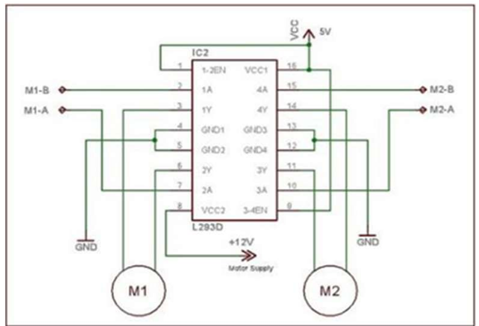
PRODUCT MODULES

The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB (Printed Circuit Board) layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller [14] simulation. All PCB Design products include an auto-router and basic mixed mode SPICE simulation capabilities. Alternate pairs of diodes conduct, changing over the connections so the alternating directions of AC are converted to the one direction of DC.

Output: full-wave varying DC: (using the entire AC wave):

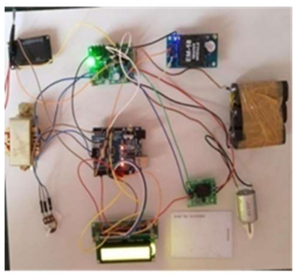
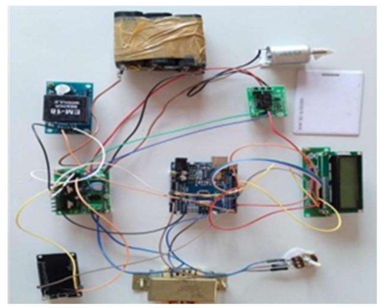
VOLTAGE REGULATOR

A voltage regulator is a circuit that creates and maintains a fixed output voltage, irrespective of changes to the input voltage or load conditions. Voltage regulators (VRs) keep the voltages from a power supply within a range that is compatible with the other electrical [12] components. While voltage regulators are most commonly used for DC/DC power conversion, some can perform AC/AC or AC/DC power conversion as well. This article will focus on DC/DC voltage regulators.



L293D based motor driver

TESTREPORT

ONCONDITION & OFF CONDITION

CONCLUSION

We have implemented a complete system to supervise the charging of EVs in car parks, using small and cheap microcontrollers connected to the Internet wirelessly. The proposed system allows a user to access the information associated with the charging process(cost, effective lapsed time, estimated time to full charge, etc.), and a supervisor to manage different aspects of the process such as billing of consumed energy, charging priorities, etc. This system aims to avoid power flow issues such as harmonics and losses. The use of an IOT connection dramatically reduces the wiring and the complexity of the installation, and simplifies the interaction with the users of the system.

FUTUREENHANCEMENT

Incorporating real-time weather data into the framework could enable the system to optimize the vehicle's energy management and navigation based on current weather conditions, such as rain, snow, or extreme temperatures. Theframeworkcouldbeenhancedtodynamicallyadjustthevehicle'srouteinresponse to changing traffic patterns, road closures, or accidents ,to ensure optimal energy management and timely arrival at the destination. The framework could be designed to monitor the vehicle's condition and performance in real-time, and use machine learning algorithms to predict when maintenance will be needed. This would enable the vehicle to be pro actively serviced to minimized own time and improve efficiency. Adding vehicle-to-vehicle communication capabilities to the framework could improve safety and energy efficiency. For example, vehicles could communicate with each other to avoid collisions, optimize traffic flow, and share information on available charging stations. The frame work could been handed to take advantage of renewable energy sources, such as solar or wind power, to recharge the vehicle's batteries. This would reduce the vehicle's carbon footprint and increase its range. The framework could be designed to improve the user experience by providing more natural and intuitive interaction between the vehicle and the user. This could include voice commands, gesture recognition, or augmented reality interfaces.

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