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An Interacting Control and Monitoring Battery based Electric Vehicle Model

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ABSTRACT

Peoples have shifted from fossil fuel-powered vehicles to electrical vehicles recently. it's environmentally friendly and additionally saves additional energy. electrical scooter has 2 main elements that area unit BLDC motor as a first-rate mover and battery as energy storage. Therefore, style of watching and diagnosis instruments is required to take care of battery performance. style of the instrument essentially organized to optimize the battery usage, monitor and establish a disruption or injury on battery utilized in electrical scooter. Parameters utilized in style area unit voltage, current, temperature, and battery capability. moreover, in optimizing the battery usage, all of the parameters area unit processed by a Controller space Network (CAN) protocol. The parameters are going to be displayed on smartphone to produce the performance and provides associate alert if the interruption or battery status; fault is occurred like over temperature and unbalanced cell. additionally here introduced the reverse chagrining technique with further battery for additional life performance in vehicle. supported the experiment results, it's shown that most voltage to minimum.

Keywords: —EV ,Controller Area Network , BMS

INTRODUCTION

The major parts of an electrical vehicle system square measure the motor, controller, power provide, charger and drive train. Fig. one demonstrates a system model for an electrical vehicle. Controller is that the heart of an electrical vehicle, associated it's the key for the conclusion of a superior electrical vehicle with an optimum balance of most speed, acceleration performance, and traveling vary per charge. management of electrical Vehicle (EV) isn't an easy task in this operation of associate heat unit is basically time-variant (e.g., the operation parameters of heat unit and also the road condition square measure invariably varying). Therefore, the controller ought to be designed to form the system sturdy and accommodative, rising the system on each dynamic and steady state performances. Another issue creating the management of heat unit distinctive is that EV's square measure extremely "energy-management" machines. From moveable physical science to electrical vehicles (EVs), batteries square measure wide used as a main energy supply in several applications. Interest in batteries for heat units are often copied back to the mid-19th century once the primary EV came into existence [1]. Today, since EVs will scale back gasolene consumption up to seventy fifth [2], heat unit batteries have gained revived attention within the vehicle market. Hub of the Universe Consulting cluster [3] has reported that, by 2020, the worldwide marketplace for advanced batteries for electrical vehicles is predicted to achieve United States of America $25 billion, that is thrice the dimensions of today's entire lithium-ion battery marketplace for client physical science. The U.S. Council for Automotive analysis (USCAR) and also the U.S. Advanced Battery syndicate (USABC) have set minimum goals for battery characteristics for the long commercialisation of advanced batteries in EVs and hybrid electrical vehicles (HEVs) [4]. To enlarge the market share of EVs and HEVs, safety and responsibleness square measure the highest issues of users. However, each of them square measure subject to not solely the battery technology however conjointly the management system for the battery. Therefore, battery management system (BMS), because the connective between the battery and also the vehicle, plays a significant role in rising battery performance and optimizing vehicle operation during a safe and reliable manner. though battery technology is flourishing, lithium-ion batteries stay the foremost common in heat unit and HEV applications because of their high energy and power densities, and long life time. beside the expansion of battery technology, the performance of battery management system (BMS) is critically necessary to confirm safety, responsibleness, and potency of the battery pack [2]. A comprehensive review of various energy management strategies has been given in [3] for heat unit and HEV applications. Modifications to model parameters are often performed by totally different techniques like parameter estimation and model choice [9], [2]. Parameter estimation techniques take out there measurements of battery to estimate model parameters over time as given in [1]–[3]. However, adaptation supported the measurements suffer from the matter of observability and typically entails optimisation. Adaptation on its own is so not adequate to ensure adaptation stability and avoid overparameterization [2]. A model choice and change strategy would be conjointly needed to change between predefined models typically contained at intervals a library of models with parameters that square measure accessible through a look-up table. These models are often optimized to capture the ever-changing dynamics of the battery whereas aging or in operation at totally different regions. This methodology ofmodel choice not solely guarantees stability, however conjointly provides info on the so at the same time with SoC. A post-processing methodology is given in [9] to estimate parameter values of a reduced order physics-based model for various states of battery life.

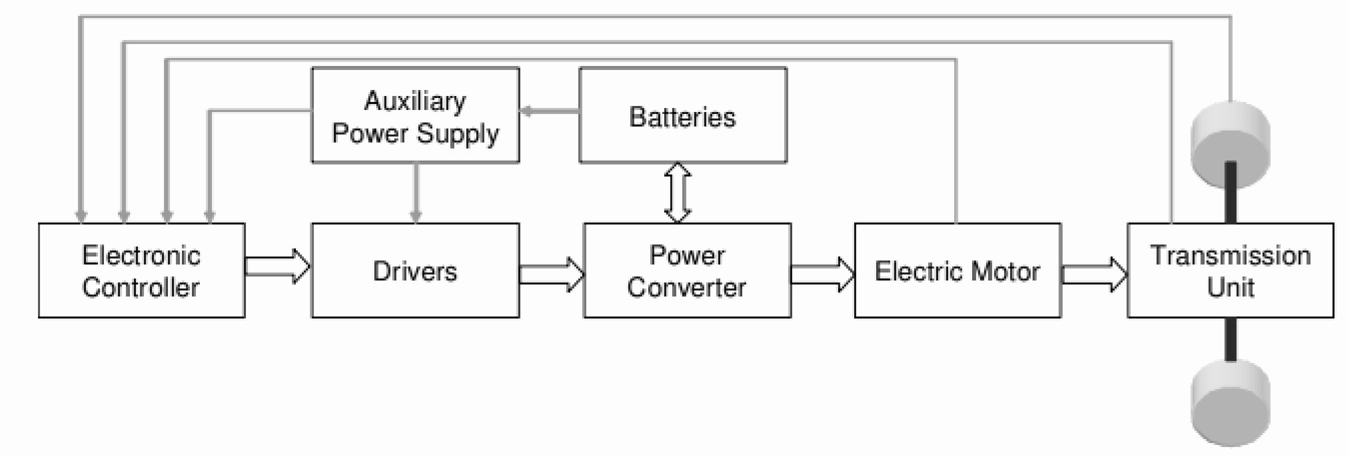

FIG.1.COMPONENTS OF EV

RELATED WORK

Zhipeng Liu, Fushuan Wen "OPTIMAL PLANNINGOFELECTRIC-VEHICLE CHARGING STATIONS INDISTRIBUTIONSYSTEMS" - 2013 With the progressive exhaustion of fossil energy and the enhanced awareness of environmental protection, more attention is being paid to electric vehicles (EVs). Inappropriate sitting and sizing of EV charging stations could have negative effects on the development of EVs, the layout of the city traffic network, and the convenience of EVs' drivers, and lead to an increase in network losses and a degradation in voltage profiles at some nodes. Given this background, the optimal sites of EV charging stations are first identified by a two-step screening method with environmental factors and service radius of EV charging stations considered. Then, a mathematical model for the optimal sizing of EV charging stations is developed with the minimization of total cost associated with EV charging stations to be planned as the objective function and solved by a modified primal-dual interior point algorithm (MPDIPA). Finally, simulation results of the IEEE123-nodetestfeeder have demonstrated that the developed model and method cannot only attain the reasonable planning scheme of EV charging stations, but also reduce the network loss and improve the voltage profile. Guibin Wang, Zhao Xu "TRAFFIC-CONSTRAINED MULTIOBJECTIVE PLANNING OF ELECTRIC-VEHICLE CHARGING STATIONS" – 2013 Smart-grid development calls for effective solutions, such as electric vehicles (EVs), to meet the energy and environmental challenges. To facilitate large-scale EV applications, optimal locating and sizing of charging stations in smart grids have become essential. This paper proposes a multi objective EV charging station planning method which can ensure charging service while reducing power losses and voltage deviations of distribution systems. A battery capacity-constrained EV flow capturing location model is proposed to maximize the EV traffic flow that can be charged given a candidate construction plan of EV charging stations. The data-envelopment analysis method is employed to obtain the final optimal solution. Subsequently, the well-established cross-entropy method is utilized to solve the planning problem. Weifeng Yao, Junhua Zhao "A MULTI-OBJECTIVE COLLABORATIVE PLANNING STRATEGY FOR INTEGRATED POWER DISTRIBUTION AND ELECTRIC VEHICLE CHARGING SYSTEMS" – 2014 An elaborately designed integrated power distribution and electric vehicle (EV) charging system will not only reduce the investment and operation cost of the system concerned, but also promotes the popularization of environmentally friendly EVs. In this context, a multi-objective collaborative planning strategy is presented to deal with the optimal planning issue in integrated power distribution and EV charging systems. In the developed model, the overall annual cost of investment and energy losses is minimized simultaneously with the maximization of the annual traffic flow captured by fast charging stations (FCSs). Additionally, the user equilibrium based traffic assignment model (UETAM) is integrated to address the maximal traffic flow capturing problem. Subsequently, a decomposition based multi-objective evolutionary algorithm (MOEA/D) is employed to seek the non-dominated solutions, i.e., the Pareto frontier. Finally, collaborative planning results of two coupled distribution and transportation systems are presented to illustrate the performance of the proposed model and solution method Nick Machiels, Niels Leemput "DESIGN CRITERIA FOR ELECTRIC VEHICLE FAST CHARGE INFRASTRUCTURE BASED ON FLEMISH MOBILITY BEHAVIOR" – 2014 This paper studies the technical design criteria for fast charge infrastructure, covering the mobility needs. The infrastructure supplements the residential and public slow charging infrastructure. Two models are designed. The first determines the charging demand, based on current mobility behaviour in Flanders. The second model simulates a charge infrastructure that meets the resulting fast charge demand. The energy management is performed by a rule-based control algorithm that directs the power flows between the fast chargers, the energy storage system, the grid connection, and the photovoltaic installation. There is a clear trade-off between the size of the energy storage system and the power rating of the grid connection. Finally, the simulations indicate that 99.7% of the vehicles visiting the fast charge infrastructure can start charging within 10 minutes with a configuration limited to 5 charging spots, instead of 9 spots when drivers are not willing to wait.Hongcai Zhang, Zechun Hu "AN INTEGRATED PLANNING FRAMEWORK FOR DIFFERENT TYPES OF

PEV CHARGING FACILITIES IN URBAN AREA"- 2015 To build a properly planned infrastructure for plugin electric vehicle (PEV), charging will bolster their market acceptance. Different types of PEV charging facilities for private PEVs, including public charging spots deployed in public parking lots (PLCSs) and roadside fast-charging stations (FCSs), are substitutes for each other. This paper proposes an integrated planning framework for them in an urban area from the perspective of a social planner. The planning objective is to minimize the social costs of the whole PEV charging system. The proposed framework decouples the planning for different types of charging facilities. The spatial and temporal charging demands for FCSs are generated by a charging demand forecasting method, when the quantities of different types of PLCSs are given. The optimal sitting and sizing problem of FCSs is solved by Voronoi diagram together with particle swarm optimization algorithm. By traversing the quantities of different types of PLCSs, the optimal planning results are obtained. The effectiveness of the proposed framework is verified via a case study of a real- urban area in China. The substitution effect between different types of charging facilities is studied. The impacts of the ambient temperature, the private charging spot possession rate, and the service level of PLCSs on the planning results are also assessed.

MODELING OF ELECTRIC VEHICLE

Generally, the modelling of an EV involves the balance among the forces working on a running vehicle. The forces area unit classified into road load and friction force. The road load consists of the gravitational attraction, hill-climbing force, rolling resistance of the tires and therefore the mechanics drag force. This resultant force F, can manufacture a antacid torsion to the driving motor, i.e., the friction force. For vibration study, the affiliation between the driving motor and therefore the tyre ought to be sculptured thoroughly. Presently, brushed DC motor, brushless DC motor, AC induction motor, magnet electric motor (PMSM) and switched reluctance motor (SRM) area unit the most varieties of motors used for electrical vehicle driving. the choice of motor for a selected electrical vehicle relies on several factors, like the intention of the electron volt, easy management, etc. up to speed of electrical vehicle, the management objective is that the torsion of the driving machine. The throttle position and therefore the break is that the input to the system. The system is needed to be quick responsive and low-ripple. electron volt needs that the driving electrical machine encompasses a big selection of speed regulation. so as to ensure the speed-up time, the electrical machine is needed to possess giant torsion output below low speed and high over-load capability. And so as to work at high speed, the driving motor is needed to possess sure power output at high-speed operation. during this chapter, the previous four varieties of motors that may be found in several applications are going to be mentioned thoroughly.

METHODOLOGIES FOR BATTERY EVALUATION IN BMSs

Based on the analysis higher than, it is seen that the analysis of battery standing is one among the weakest links in BMS and nevertheless it's an oversized impact on BMS performance. the highest concern for heat unit users is that the safety and reliableness of the facility system during a vehicle. the foremost vital question is whether or not they'll run out of battery power on the road. These problems talk to the estimation and prediction of SOC, SOH, and SOL of the heat unit battery. Thus, AN correct quantification of the battery standing has become one among the foremost essential tasks for BMSs. during this section, the most recent methodologies for battery state estimation and prediction are reviewed. SOC reflects the number of remaining charge that's obtainable to the battery. it's accustomed verify the driving distance remaining in EVs, whereas it indicates once the interior combustion engine ought to be switched on or off in HEVs [6]. because of the inherent chemical reactions of the battery and completely different external masses, the utmost capability of the battery step by step decreases over time. Uncertainty concerning these factors can cause non-linear, non-stationary battery degradation characteristics. the foremost easy approach for SOC estimation is Coulomb numeration, that characterizes the energy during a battery in Coulombs. This technique calculates the capability of electric battery by integration this flowing in and out of the battery over time. SOC is obtained by bearing on the activity purpose at full charge. However, this reference (i.e., the initial point) can amendment because of battery aging and coulombic potency. Thus, the reference should be remunerated once operative at follow conditions, and therefore the SOC estimation ought to be updated below completely different measured voltage. Building AN correct table between the discharge capability and electric circuit voltage (OCV) is important for achieving SOC. However, this method is long as a result of it needs an oversized quantity of coaching knowledge to ensure the accuracy of the table.

CONTROLLER DESIGN OF ELECTRIC VEHICLE DRIVEN BY DIFFERENT MOTORS

The vehicle is driven by a motor, that is equipped by the battery through a controlled power circuit. apart from circuit for management of the motor, there's quite ton of auxiliary management for automotive vehicle physical science. The management ways square measure enforced within the chip, like DSP (Digital Signal Processor). management of electrical vehicle is basically the management of motor. In solely the motor and its associated driving power circuit are replaced with completely different motors. With completely different motors, it's necessary to use completely different management ways. However, it's impracticable to incorporate all variety of motor and management ways in one book. Hence, during this chapter, just one typical management or control strategy are given. it's detected that typically PWM management is employed for DC motor, whereas variable-voltage variable-frequency (VVVF), FOC (field-oriented control) and DTC (direct force control) square measure used for induction motor. and a few ancient management algorithms, like inflammatory disease, cannot satisfy the wants of electrovolt management. several fashionable superior management technologies, like adaptative management, fuzzy management, artificial neuro network and skilled system square measure getting used in electron volt controllers.

PROPOSED METHODOLOGY

Reliable battery management is critical for safety functions. There square measure many reasons that cause battery breakdown like deterioration of battery and style defects. Manual battery watching system is like traditional battery watching system which suggests that it doesn't save the information into the info. however solely show the information collected in real time. Therefore, it's essential to remotely monitor battery systems victimization wireless technology. There square measure numerous battery watching system victimization wireless communication that are developed for the business like uninterruptible power provide that is vital to make sure continuity of power provide for domestic and business throughout power interruption. The system consists of many devices like bluetooth that sends signals to the interface, wherever the operate of the interface itself is to show measured knowledge in order that the user will scan it. The check object of an electrical vehicle may be a battery pack. every battery pack consists of 12V/48V battery, with the arrangement of two or three parallel batteries. within the battery pack there square measure multi cells organized nonparallel. within the battery many sensors square measure put in like temperature sensors, current sensors, voltage sensors. within the BMS module, there square measure many sensors put in. In BMS there's a master board, slave board and auxiliary board for the will bus slot to USB. Figure depicts the summary of the planned system. so as for the system to figure, initially, the voltage device measures the lead acid battery’s voltage level. At identical time, a bluetooth interface primarily based mobile application reads the situation of the vehicle by victimization the mobile GPS operate. The battery’s voltage level readings and site of the vehicle square measure sent to associate Arduino NANO microcontroller for process. As shown within the figure, the processed knowledge square measure sent to battery watching program in an exceedingly laptop wirelessly victimization the mobile apk. Once knowledge transfer is sure-fire, the battery watching interface on the pc can show the updated knowledge of battery standing. once the battery made low voltage level, a notification email is shipped to send word the user. the net battery system not solely will live the voltage of the batteries however additionally communicate with the battery watching system to urge the parameter of batteries. The detail style of the system is delineated within the next sections. The master board is that the main controller of the BMS that functions to method knowledge, acquire knowledge and show the results of method to users. Besides that it additionally serves to watch and safety protection. This master board uses the ATMega328 primarily based Arduino NANO micro-controller. This micro-controller is provided with a data processing system which will be finished multi- tasking with a handing timer reaching sixteen megacycle per second within the master board, it consists of many module series includes controller Module, Current device Module, Temperature device Module, transformer Module, Communication Module, Voltage Sensing Module, Main Contactor management and control Module.Bluetooth may be a digital communication for exchanging knowledge while not a cable treater (wireless) at a distance of the scope of the radius not too remote. The bluetooth module used may be a HC-05 module, this bluetooth module may be a bluetooth module SPP (Serial Port Protocol) that's simply used for wireless serial communication that converts serial ports to bluetooth. Bluetooth HC-05 uses bluetooth V2.0 + EDR modulation (Enhanced knowledge Rate) the maximum amount as 3 Mbps by utilizing radio waves with a frequency of 2.3 GHz.

RESULTS AND DISCUSSION

The master board is that the main controller of the BMS that functions to method information, acquire information and show the results of method to users. Besides that it conjointly serves to observe and safety protection. This master board uses the ATMega328 based mostly Arduino NANO microcontroller. This microcontroller is provided with a data processing system which will be finished multi- tasking with a handing timer reaching sixteen megacycle per second within the master board, it consists of many module series includes controller Module, Current detector Module, Temperature detector Module, transformer Module, Communication Module, Voltage Sensing Module, Main Contactor management and control Module. Battery degradation models square measure supported specific materials, environmental conditions, and charge-discharge sport. Battery standing is calculable once discharging at constant current and constant temperature.

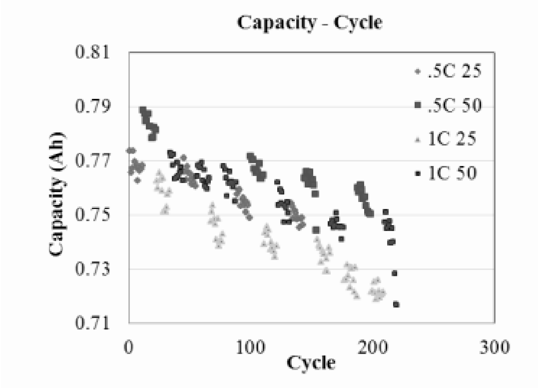

FIG.2. Discharge capacity alternating at the different discharge rates with different temperatures.

CHALLENGES

Generally, the estimation and prediction strategies have infeasible hardware needs, such as, ohmic resistance measure, that is dear and not sensible in several BMS applications these days. Meanwhile, the high machine complexness depends on expensive hardware, such as, the hardware. It may be seen that the trade-off between high performance and practicableness during a BMS is vital. moreover, most studies square measure performed during a laboratory surroundings and square measure conducted mistreatment full charge-discharge cycles. The performance of BMSs below in operation conditions, like vibration from jolting roads and temperature extremes from snow, rain or summer heat, has seldom been studied. These external masses are going to be mirrored within the battery's obtainable capability. Thus, it'll add un-modeled effects not taken into consideration in existing algorithms and models.

CONCLUSION

Monitoring System for battery pack already designed and ready to work well. leveling cell is an action to forestall injury to the battery pack caused by voltage totally different between cells. as a result of the distinction in cell voltage will build the lifespan of the battery decrease and break down quickly. conjointly done to boost the system by adding a lot of functions into the system. The system is employed in smartphones by developing smartphone application which will facilitate user to observe battery and as A battery degradation reminder. so as to boost the net communication, is accustomed get an improved net affiliation compared to existing GPRS and GSM technique.

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