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Alexa Controlled Smart Ev System

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Abstract

Electric vehicles (EVs) are becoming more prevalent on the road and in the grid of power plants in the design of EVs, the energy system and management are crucial components. Fully battery electric vehicles (FBEVs) and hybrid electric vehicles are the two main forms of EVs. Alexa Controlled Electric Vehicle is a new concept that integrates Amazon's Alexa voice assistant into an electric two-wheeler. This innovative combination has the potential to revolutionize the way we ride bicycles, offering a safer, more convenient, and more enjoyable experience. Riders of the Alexa Controlled Electric Vehicle could control various aspects of their ride using voice commands. For example, they could: Turn the vehicle on or off through their phone, Adjust the vehicle's speed and lighting, Lock and unlock the vehicle and Control the vehicle's horn. These features would not only enhance convenience but also improve safety. The Lock and Unlock feature eliminates the need for keys, while controlling the vehicle's horn and lights introduces a new way to locate the vehicle in parking areas and utilize the headlights as emergency lights in forested areas. The Alexa Controlled Electric Vehicle (2 wheeler) is still in the early stages of development, but it has the potential to change the way we think about transportation. This innovative concept could make riding bikes safer, more convenient, and more enjoyable for everyone.

Introduction

In cities it is seen that many person drives vehicle carelessly so that many problems can arise, such as accidents, key got stolen, etc. so to overcome this problem and for controlling it an intelligent and improved system for bikes is required. The bike's crank speed and crank position are sensed via a micro controller, torque sensor, gyro and accelerator disposed on the bike's crank. External power and control signals can be passed to and from the crank micro controller and the e-bike controller through a throttle connector of the e-bike controller via slip rings around the crank hub with and with pogo pin connectors connected to the respective slip rings. Throttle data can also be provided to the e-bike controller wirelessly via a wireless dongle coupled to the throttle connector of bike controller.

The battery management system (BMS) is crucial in electric vehicles (EV). BMS is a comprehensive system that includes configurations and techniques for assessing overall performance for different types of Energy Storage Device (ESD), overall health, charging and discharging processes, battery tracking, data collection,

thermal control, device management, duration, and thermal management for cell protection. In ESD, an unbalanced cell voltage during the charge or discharge period as a result of an electrochemical process. One of the primary areas of development in the BMS is to enhance the voltage balancing systems. Researchers are creating cell balancing systems to increase the longevity of the cell, safeguard it against explosion, and enhance the voltage balance systems.

Various research studies examined energy management techniques linked to different energy storage system. The BMS for plug-in hybrid electric vehicles (HEVs) and hybrid electric vehicles (HEVs) is explored in [1] by summarizing offline, real-time, and learning-based algorithms. But in [2] another evaluation of the BMS for HEVs through 2012 is provided and contrasted. [3] While looking at the typical BMS of hybrid electric and fuel cell vehicles, a general overview of ESSs, power converters, and charging systems is provided. Authors in [4] identify the control tactics used in fuel cell hybrid vehicles, and compare the benefits and drawbacks of each. A more thorough segmentation of optimization-based tactics in HEVs is established and has been mentioned in [5]. This paper explains many types of energy storage technologies that are now available and different ways of energy management system.

III. BATTERY MANAGEMENT SYSTEM

Electric mobility is moving towards global penetration day by day and it is the responsibility of the manufacturers to provide a safe and comfortable driving experience to the customers. It is inevitable to ensure safety and security of the passenger and the vehicle. BMS plays a crucial role to monitor the battery. BMS is the essential part in almost every high-end electronic device including smart phones, laptops, electric vehicle and so on. The purpose of Battery Management system includes (i) Data acquisition (ii) Cell Equalization (iii) Provide Over/Under charge control (iv) Thermal management (v) Battery Stage Determination (vi) Safety and security. Even though the battery breakaways and damages cannot be eliminated, however, the safety functions in the BMS provides a better and safer environment for the batteries to reduce the likelihood of undergoing unstable situations.

A. FUNCTIONS OF BMS

Energy storage systems used in EVs includes Electrochemical, Electro mechanical and Electrical Batteries. Most electrochemical batteries are prone to overheat. Moreover, Lithium based batteries tend to explode while thermally unstable. To maintain the battery temperature, BMS plays as essential role. On any event of fault, the temperature of the battery pack or the system can tremendously rise which leads to abnormal heat generation, external heat transfer and poor heat dissipation. Major reasons of thermal shoot up include external short circuit, current sensor fault, overcharging, battery connection fault, cooling system failure, mechanical shocks such as collision and many more. The thermal runaway can cause battery swelling, battery permanent damage, fire, explosion and smoke. During thermal runaway, it checks for options to turn on cooling system and helps to provide a better the cell environment. Moreover, it can shut down other cells to protect from severe damages during emergencies. BMS monitors the battery health and acquire the information regarding SOH, SOL, State of Power (SOP) and SOC and ensure the life and safety of the batteries well in advance. SOH utilizes and captures the age of battery as capacity fade and internal resistance [17]. A capacity decay of 20% and / or an internal resistance rise of 100% are generally considered as the End-of-Life (EOL) of a battery in automotive application. There are various techniques available to estimate the battery properties such as state-of-charge, state-of-health, state-of-power as mentioned in [18]. Moreover, the status of the battery can be obtained using various algorithms. Many researches are progressing towards obtaining the said battery parameters with ultimate accuracy. Main challenges and advancements in the field of state estimation is showcased in [19].

Cell equalization is a very vital feature of the Battery Management System. The vehicle battery is made of combination of many cells in series/parallel.It is extremely common to have unequal charging rates between each cell in the battery pack. To ensure that each cell reaches full charge at the same time, there are various cell equalization methodologies existing. Cell equalization techniques include (i) Active cell balancing and (ii) Passive cell balancing methods.[20]-[21]. In passive cell balancing, which is also called as resistor bleed method dissipated the charge as heat across the resistor. In active balancing, it utilizes an inductor or capacitor to transfer the charge effectively from high charged cell to low charged cell thus supporting balancing in a much effective manner.

An active balancing technique for Lithium-ion battery is presented in [22] based on inductor balancing method. The paper presents equalization of eight series connected cells in reduced time. Conventional issues

in inductor-based methods such as longer time and lesser accuracy is eliminated here. Intense communication is inevitable which helps in proper decision making. Interaction with the motor controller as well as upper vehicle controller must be carried out correctly for the vehicles to operate as intended. A data link is utilized by a BMS's communication function to monitor performance, log data, issue diagnostics, or set control variables. The two most widely used protocols by BMS to interact inside the vehicle are CAN (standard communication) and RS232 and RS485 communications through the data bus. In [23], a new battery fault diagnosis algorithm is proposed with better battery safety by utilizing charge duration, charging current and capacity of the storage element.

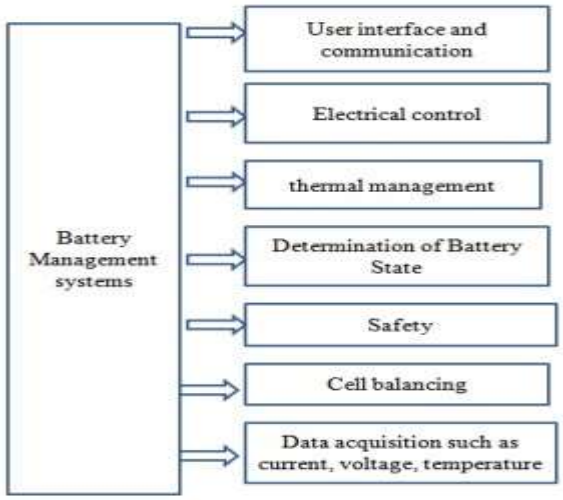


Figure 1 components of **BMS**

SOC, SOH calculations are implemented and initial error is reduced using Coulomb counting method (CCM). A further subject area that necessitates BMS monitoring is charging control. Two stages are involved in charging. Constant Current (CC), during which the charger provides constant current. The secondary stage, known as Constant Voltage (CV), is where the battery receives a fixed voltage level while only receiving little current. The BMS makes sure that all these processes go smoothly.

Purpose / Need

• Making affordable and advanced keyless technology for the use of middle-class people.
• Finding vehicles in a parking area is a very tedious process, by using our project we can identify the vehicle location easily
• Smart security system enables maximum protection of the vehicle.

Solution

• Introducing an affordable and flexible voice assistant with a user-friendly environment.
• Using our human senses to identify the location of the vehicle.
• By introducing robust security to vehicles we can maximize the protection of the vehicles.

Unique Value Proposition

• Using key less technology for two-wheelers.
• Easy identification of electric bikes in crowded areas like parking and at night times or in dark places.
• Theft protection integrated with a braking system for further security of vehicles.

Existing Alternatives

• In some brands the vehicles can turn on automatically while the mobile phone is closer to the vehicle.
• In some brands there is assistance for parking the vehicle but there are no options or facilities to find the vehicle in the parking.
• There is an option for sending notifications to the owner when vehicle is moved.

Beneficiaries

• Vehicles are one of the most important things for middle-class families but in EVs, the facilities and features cannot be afforded by middle-class families so they are switching to non-facilitated EVs.
• By introducing our project we can facilitate the vehicle owned by middle-class people at an affordable price.

literature survey

Title	Author	Year
• A SmartBike: IoT crowd sensing platform for monitoring the rider safety	• Mohammad Saqib , Naadiya Khuda Bux , Syed Azeem Inam , Suleman , Saajid Hussain , Sheeba Memon	2022
• Battery Management System Algorithm for Energy Storage Systems Considering Battery Efficiency	• Jeong Lee , Jun-Mo Kim , Junsin Yi and Chung-Yuen Won	2021
• State-of-the-art review of fuel cell hybrid electric vehicle energy management systems	• Samson Obu Showers and Atanda Kamoru Raji	2022
• A Comparative Review on Energy Storage Systems and Their Application in Deregulated Systems	• Mitul Ranjan Chakraborty , Subhojit Dawn , Pradip Kumar Saha , Jayanta Bhusan Basu and Taha Selim Ustun	2022
• Energy management and storage systems on electric vehicles: A comprehensive review	• Dimitrios Rimpas a , Stavros D. Kaminaris a , Izzat Aldarraji b , Dimitrios Piromalis c , Panagiotis G. Papageorgas a	2021

Existing System

• Key used for start and stop functions.
• Auto Start functions while phone is connected to the vehicle.
• Can't Find the vehicle Unlike cars unlocking using Keys.
• Finding the Vehicle is not easy in the big parking areas.

Problem definition

• No reliable and cost efficient method for turn on/off the vehicle remotely.
• More time is required to find the vehicle in the areas like parking and Dark streets.
• There is no robust system for tow thefting of the vehicle.
• Cost of acquiring like these features in companies like ola and ather, ola are keeping their prices high like nearly 2 lakhs.

Proposed system

• Introducing an affordable and flexible voice assistant with a user-friendly environment.
• Using our human senses to identify the location of the vehicle.
• By introducing robust security to vehicles we can maximize the protection of the vehicles.

System Design & implementation

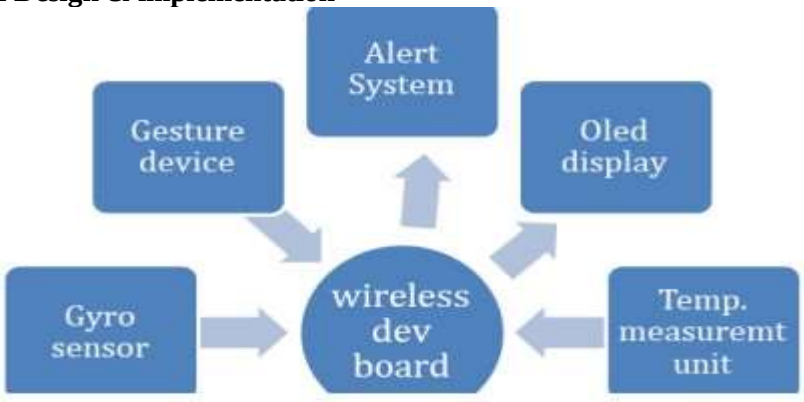
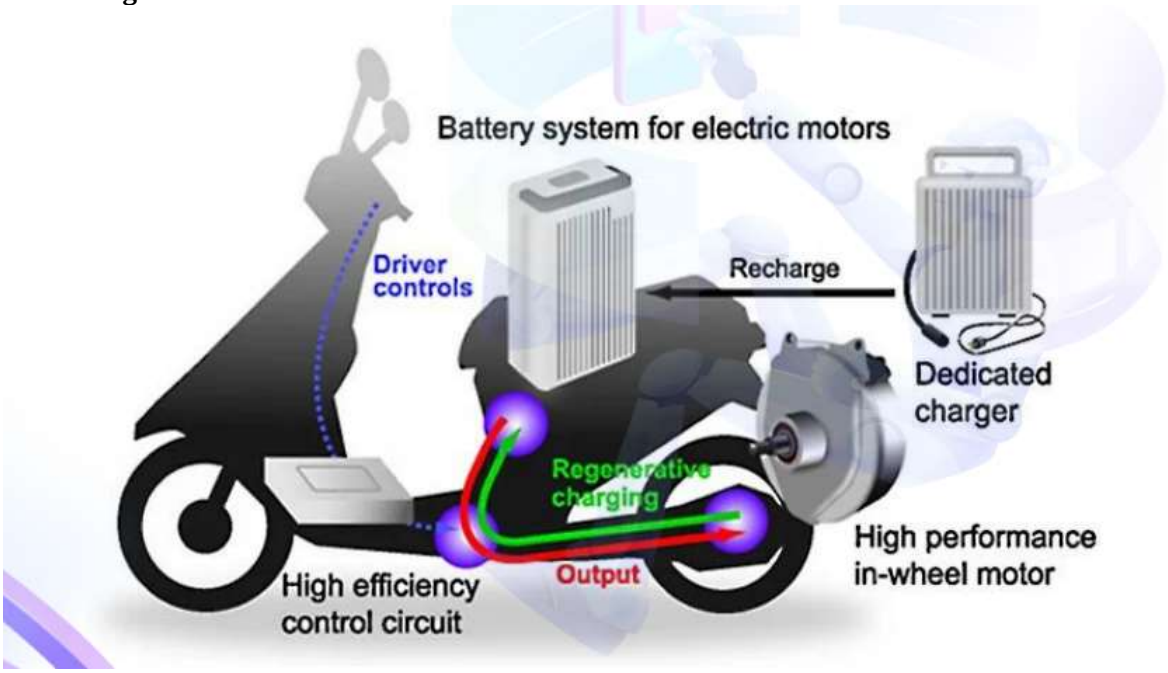
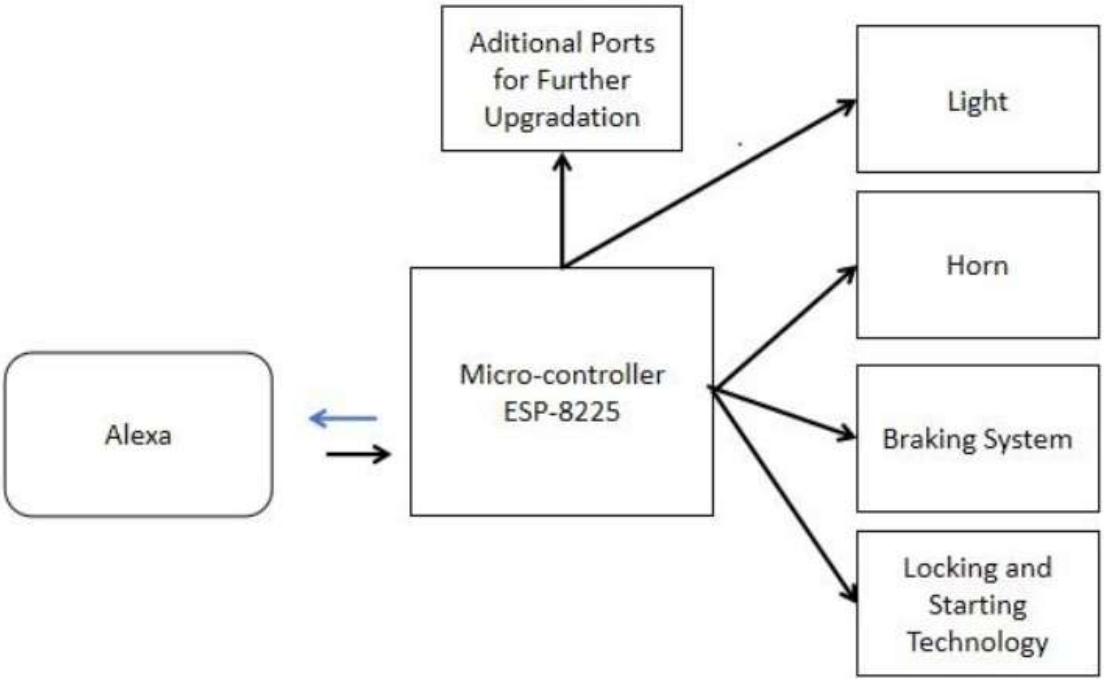


Figure 2 Schematic diagram of **Proposed system**

Block diagram





Step by Step implementation

• Step 1: Drawing a rough circuit diagram

Drawing a circuit diagram help us to understand and plan the working of the device. Such diagram also prove to be very helpful while coding

• Step 2: Writing the code

Now, we have to write operational codes to take the inputs from various units and to perform operations on them.For example, on hand movement over bike's head, horn will blow and many more operations. We have used Arduino IDE for coding. The codes to perform various operations has

• Step 3 : Setting up accelerometer

This will help us to monitor the bike inclination. The variation in acceleration at a specific axis shows the inclination of bike. If the inclination limit is crossed then the buzzer starts.

• Step 4 : Setting up temperature sensor

The temperature sensor is placed on the engine to continuously measure its temperature to monitor its status.

• Step 5 : Setting up OLED screen

OLED screen is connected to the development board as shown in the circuit diagram. It shows temperature of the engine, inclination of bike from horizontal surface, and navigation from current position to destination.

• Step 6 : Adding navigation feature

We have performed this task by using a third party app - " Auto Notification ". This application takes notifications from your smart devices onto which it is installed. Thus, once the destination is set in the google map its notifications is used by auto notification mobile app and send data to tasker which send the data in IFTTT as a trigger and then by using " Web hooks " we can print navigation data in the OLED screen.

• Step 7 : Setting up voice command features

For this purpose we used IFTTT (cloud platform). In IFTTT commands are in form of IF "this" THEN "that" where, "this" is termed as trigger and "that" is a action triggered by "this". As soon as we click on "this" we are asked to select a trigger event app such as Gmail, Google Assistant, Blynk, etc. In our case we have selected Google Assistant. Once the trigger is selected then click on "that" and then you are asked to select another app to perform some operation triggered by "this". For example in our case we have selected "Webhooks". This will allow you to perform actions on the basis of different input values

. **• Step 8 : Uploading it to the development board**

After writing the code, it has to be uploaded on the development board. This can be easily done by just pressing upload button on Arduino IDE.

• Step 9 : Assembling components according to the circuit diagram

After completing the software part, we assembled all the components according to the circuit diagram using jumper wires. Temperature sensor, OLED, and Accelerometer are connected with one octabrix while ultrasonic and relay are assembled with another octabrix. Assembling the smart system with our bike After assembling the system with the bike, it becomes a smart bike.

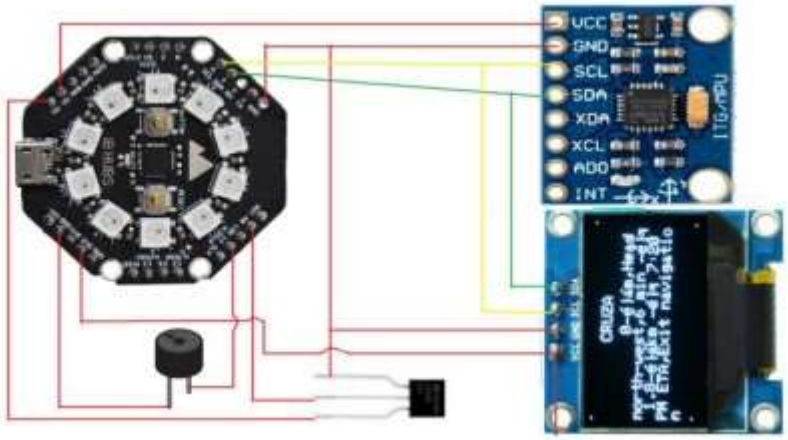


Figure 3 Hardware circuit diagram for octabrix 1

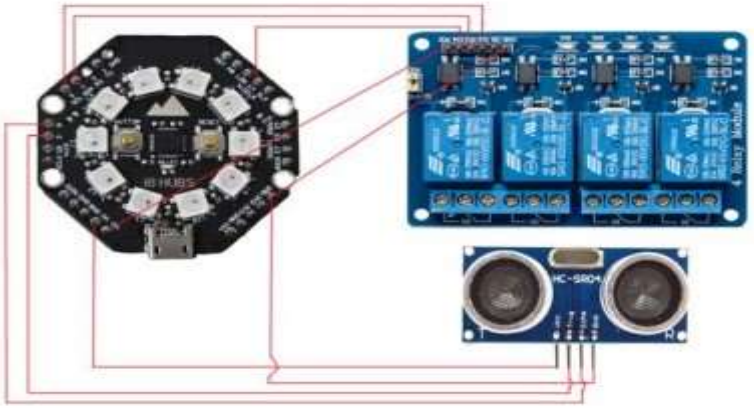


Figure 4 Hardware circuit diagram for octabrix 2

Figure 5 Alexa Controlled Smart EV System

In order that the manner in which the above-cited and other advantages and objects of the invention are obtained, a more particular description of the invention briefly described above will be referred, which are illustrated in the appended drawing. Understanding that these drawing depict only typical embodiment of the invention and therefore not to be considered limiting on its scope, the invention will be described with additional specificity and details through the use of the accompanying drawing.

Advantages

1. Protection from the unauthorized access to vehicles.
2. Easy to find and access the vehicles by the users.
3. Add many smart features to the vehicles without it.

Conclusions

Internet of Things based system for smart bike having features, monitor's the traffic, bike start with voice command, show the status of engine, show the inclination of bike, blow the horn without touching it, it has navigation features, gesture ignition and start with smart band, said system comprises of octabrix, ultrasonic sensor, temperature sensor, accelerometer, OLED screen and four channel relay, characterized in that;temperature sensor, OLED, and accelerometer are connected with one octabrix while ultrasonic and relay are assembled with another octabrix; Arduino IDE is used for coding which is required to perform various operations while driving the bike, accelerometer is used to monitor the bike inclination, variation in acceleration at a specific axis shows the inclination of bike, if the inclination limit is crossed, then the buzzer starts, and temperature sensor is placed on the engine to continuously measure its temperature and to monitor the status of engine OLED screen is connected to the development board, shows temperature of the engine, inclination of bike from horizontal surface, and navigation from current position to destination. Accordingly as claimed in claim wherein said system navigation of the bike performed by adapted configured system 'Auto Notification', this takes notifications from the smart devices onto which it is installed, thus, once the destination is set in the google map its notifications is used by auto notification app and send data tasker which send the data in IFTTT as a trigger and then by using "Webhooks" one can print navigation data in the OLED screen. Accordingly as claimed in claim wherein for setting up voice command features system implemented IFTTT (cloud platform),IFTTT commands are in form of IF "this" THEN "that" where, "this" is termed as trigger and "that" is an action triggered by "this", as soon as user clicks on "this" they are asked to select a trigger event app such as Gmail, Google Assistant, Blynk, etc, here in this system Google Assistant is selected; Once the trigger is selected then clicks on "that" and then it will ask to select another app to perform some operation triggered by "this". Energy storage system and battery management system are two important functions which need to be discussed in EVs. Researchers are finding a lot of challenges in these areas. This

paper discusses about the different types and challenges of ESS in EVs. It also gives a detailed explanation about the battery management system in EVs. A lot of research is still need in these areas to improve the performance of EV. Accordingly as claimed in claim wherein said system after writing the code, it has to be uploaded on the development board, performed by just pressing upload button on Arduino IDE. As we are moving towards the world of green energy, electric vehicles play a crucial role in it.

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