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Battery Monitoring System for Electric bike

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Abstract— With the increase in demand for smart intelligent devices, integration of smart systems in automobiles has gained large attention in recent times. To develop the intelligent smart systems, installing vehicle sensors and processing data from them is the key fundamental step. Due to the limited range and long charging time for electric vehicles, proper utilization of the stored battery energy is crucial. To address the challenge of range anxiety we have developed a system that focuses on how an E-bike's remaining range can be accurately predicted. This system is designed to capture certain critical data from vehicle sensors and process the data which can later be processed for intelligent system development and to display the relevant information for the rider. With IOT application data can be transmitted at real time and this is an entirely new era in the transportation sector which leads to intelligent connected transportation systems.

Keywords— IOT, electric vehicle, range prediction, intelligent system.

I. INTRODUCTION

Electric vehicles are more environment friendly in transportation as there is no inflicting air pollution or noise pollution.There are certain automobile sector they converts old petroleum bike into electric bike. In these electric bikes electrical motor that is BLDC motor is used instead of combustion engine because BLDC motor delivers effective torque and speed as compared to IC engine. This bikes utilizes chemical energy stored in rechargeable battery packs. Lithium ion battery pack is used as it is smaller to be compared with lead acid.. These converted electric bikes does not have the feature of displaying the battery percentage, speed, voltage and other certain parameters as that of recent E-bikes .

However range anxiety can be a significant barrier to the adoption of electric vehicles. This is an important problem because range anxiety i.e. the fear of running out of battery with no place to recharge it before reaching the destination is the major barrier to the adoption of electric vehicles. The another issue faced is the current automobile industry is struggling with the issue of lack of information about the performance of product and during its usage. This paper presents an effort on how we can combine sensor's data and cloud connectivity technologies to resolve the issue of range prediction and displays the useful information for the user and the manufacturer.

Thingspeak is an open IOT platform that permits to collect, analyze and act on collected data. A user anywhere on the planet looking at this information will get to know how many Km bike can be travelled and voltage of battery pack. The local unit (UNO/ESP-01) will capture data from sensors and send this data to the internet writing on a specific thingspeak.com status channel.

II. LITERATURE REVIEW

The paper presents an effort on how we can combine automobile, data processing and cloud connectivity technologies which are fundamental in establishing a connected vehicle system demonstrated by Ramesh Babu in "informatics and infotainment system for smart E-bike using raspberry pi".

The paper on battery monitoring system consists of master control unit utilizes the message to estimate the batteries SOC and SOH .The data exchange between the smart phone and lower machine can be achieved via Wi-Fi. Accordingly a Wi-Fi sending and receiving module is added to the system as follows: the battery status information is sent to mobile phones via Wi-Fi and lower machine could obtain the commands sent by mobile phones. Information displayed on the mobile phone: cell voltage, equalization status, battery pack voltage, temperature and SOC.

The paper on Range prediction for EVs was cast as a multi-objective problem with conflicting objectives. Two approaches were considered: one assuming constant battery voltage and the other allowing battery voltage to be a function of SOC demonstrated by Warren Vaz, Arup.K.R.Nandi.

III. OBJECTIVE

The prime objective of this project is to develop a module which can collect data from vehicle sensors like speed,distance covered,battery percentage and expected range. The information collected is used to display ride metrics information onto a display dashboard on the vehicle.

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This riding information is concurrently logged onto a remote web server using Wi-Fi connectivity which will store the information permanently and can be used to analyze the riding information for future development of applications.

IV.PROPOSED WORK

This project is designed to capture certain critical data from vehicle sensors and process the data which can later be processed for intelligent system development and to display the current speed, distance covered, battery percentage and range prediction information for the rider. There are various existing system on smart E-bike monitoring where mobile phone is used as a dashboard to display the relevant information for the rider and webpage application.HTML webpage application is developed using HTML, CSS and Java script functionality which will receive data from sensor in user friendly format.

The LCD is used to display the ride metrics and an IOT application for displaying the data on webpage i.e. Thingspeak. With IOT, data can be transmitted at real time and this paves way for an entirely new era in the transportation sector leading to intelligent connected transportation systems.

A. Theory

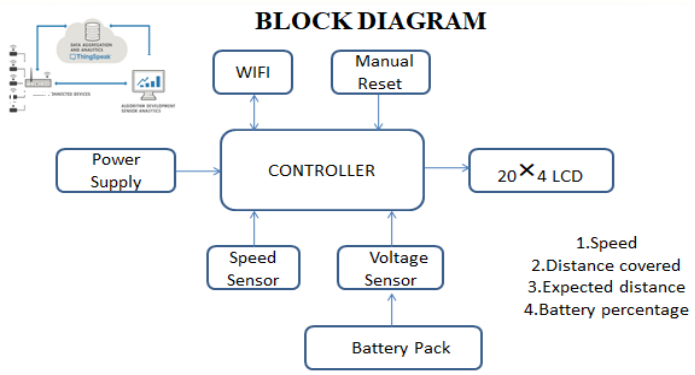
This project is designed using ATMEGA328 microcontroller and the interfacing components are voltage sensor, speed sensor, Wi-Fi module and LCD display. Voltage sensor is used to sense the voltage of battery pack. Speed sensor is used for displaying the current speed on LCD display. Voltage sensor and speed sensor both plays equal role in range prediction.

Battery pack have multiple cell modules in which many numbers of cells are kept together to build a large battery pack. Basically a series of connection is used to compound the voltage whereas the parallel connection is for compound current capacity.

Speed sensor is fixed to the front wheel of electric bike to measure the wheel rotations to measure the speed and distance travelled. Optical encoder is used as speed sensor it consists of circular disc connected to shaft, containing one or more tracks of alternating transparent and opaque areas. A light source and an optical sensor are mounted on opposite sides of each track. Voltage sensor is connected across the terminals of battery pack. As controller cannot bear high voltage at its input and battery pack voltage is 48V so it is first regulated to certain voltage and then given to the controller for further operations. The 20*4 LCD is used for displaying the ride information that displays the current speed, distance covered,battery percentage and range prediction. The same information is displayed on webpage through IOT application i.e.thingspeak. ESP-01 Wi-Fi module is used for sending the data on webpage.

Thingspeak is an IOT platform.On thingspeak one can perform online analysis and processing of the data as it comes in. Thingspeak platform is user friendly and easy to access the information. Thus the ride information is displayed on the webpage that includes certain graphs like Speed Vs Time, Voltage Vs time etc. Thus electric bike manufacturers can read the detailed data about the battery usage and performance of bike.

B. Block Diagram



The rpm of front wheel is used for calculating the speed.The standard relation of speed,distance and time is used to calculate the distance covered by the electric bike.

Distance covered=Speed×Time

For range prediction of Electric bike distance covered is taken into consideration and capacity of bike is calculated including the motor specifications.

Range prediction=Battery full capacity(km)-Distance covered

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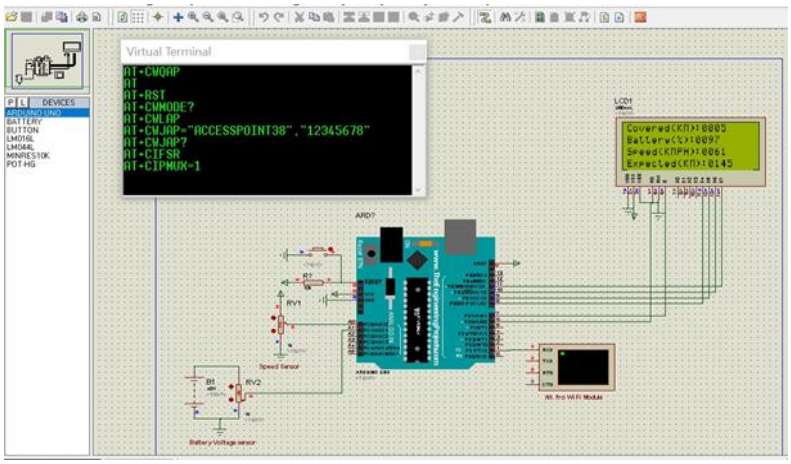
V. SOFTWARE SPECIFICATIONS

A. Arduino Software

Arduino IDE is used to program the Arduino UNO board. It is open source software used for writing and compiling the code into arduino module.

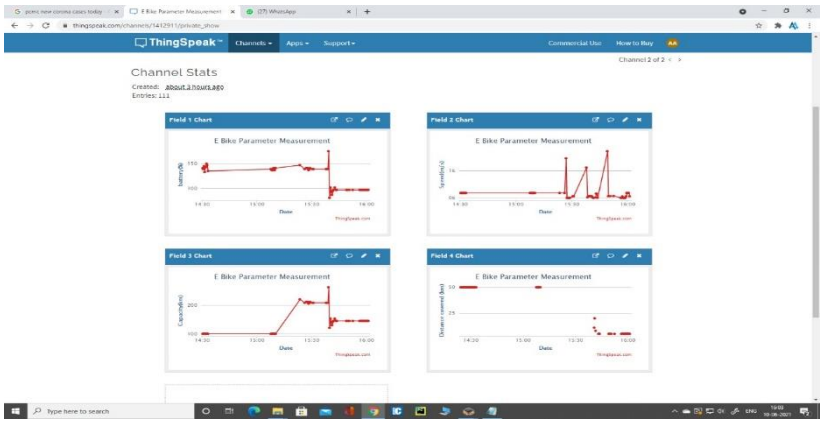
B. Proteus Software

The proteus Design Suite is a windows application for schematic capture, simulation and PCB layout design.



C. Thingspeak

ThingSpeak is IoT platform where you can send sensor data.On thingspeak one can perform online analysis and processing of the data as it comes in.Thus the ride information is displayed on the webpage that includes certain graphs like Speed Vs Time ,Voltage Vs time etc.Thus e-bike manufacturers can read the detailed data about the battery usage and performance of bike.



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CONCLUSIONS

In this paper we have proposed a system that captures certain critical data from vehicle sensors and process the data to display the current speed, battery percentage, distance covered and range prediction for the rider on LCD display and as well as graphical representation of data on Thingspeak platform and addresses the challenge of range anxiety.

ACKNOWLEDGMENT

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