International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 02 | Feb -2017 www.irjet.net p-ISSN: 2395-0072

Informatics and infotainment system for Smart E-Bike using Raspberry Pi

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Abstract – *With the increase in demand for smart intelligent devices, integration of smart systems in automobildes is inevitable and certainly 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. This paper provides overview of how to capture certain critical vehicle data from various sensors and process the data which can later be processed for intelligent systems development and to display the relevant information for the rider.*

Key Words: Informatics, Infotainment, Smart Vehicle, GPS, Odometer, Speedometer, Data Logging, Dashboard.

1.INTRODUCTION

The current automobile industry is struggling with the issue of lack of information about the performance of product and its sub systems during its usage, which can later be used for future product development or improving the current product or sub systems. This is mainly due to the fact that the collection of data from sub systems of gasoline vehicles is hectic and processing such large chunks of data is not possible[1]. But with the advent of electric vehicles and owing to its simplistic design and lesser number of parts one can collect large amounts of data from the vehicle and use it for further research. With cloud connectivity, this 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 [2]. Automotive grade Linux OS platform is an upcoming product whose development is completely open sourced and many automobile giants are already adopting this OS which can be used as base to develop informatics and infotainment systems and other applications based on the data. This 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. Fundamental sensors like Speedometer, GPS and Accelerometer and gyro are used to develop the module using Raspberry Pi, the data from which is logged onto a database file and this information is transmitted via Wi-Fi and further GUI is developed to display ride metrics information onto a dashboard as shown in Fig-1.

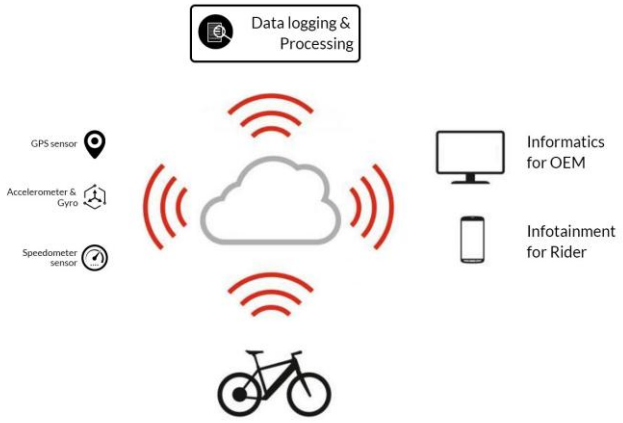

Fig-1: Connected E-Bike system

2. LITERATURE REVIEW

Developing a community of software developers for enabling Automotive industry to utilize Linux and open source technologies for product development is the prime focus of Automotive grade Linux team and the same was demonstrated by Matt Jones and Magnus Feuer in Collaboration summit, 2013 at San Francisco, California [3].

The paper on Implementing the connected e-bike: challenges and requirements of an IoT application for urban transportation by Kristina Flüchter [4] demonstrates how connecting physical systems like E-bike to virtual world is creating interest among users and the challenges and technological restrictions concerning the completeness of collected data from vehicle sensors which are to be addressed.

A blog article by Ather energy, a smart EV startup aimed at developing a next generation intelligent connected scooter mentioned it its blog [5] about the how the digital revolution is transforming various products and how the need to connect with a machine in its physical environment and gather data without any help from humans has been the premise of smarter, connected products.

3. OBJECTIVE

The prime objective of this project is to develop a module which can collect data from vehicle sensors like speed, GPS information and motion tracking using accelerometer and gyro sensor and log the data onto a database file. The information collected is used to display ride metrics information onto a display dashboard on the vehicle.

A rider can access the digital dashboard on the vehicle which will display the current speed, trip distance, travel time, GPS location status and lean angles of the vehicle. This riding information is concurrently logged onto a remote web server [6] using Wi-Fi connectivity which will store the information permanently and can be used to analyze the riding information for future development of applications. The dash board UI interface can be changed as per the requirement as it is developed on HTML5 platform and the can be accessible remotely by anyone who has the required credentials to the web server. Once the ride is finished, the rider can visualize the riding information by gaining access to the web server which will display variations of speed vs time, paths travelled and can also track his motion.

4. IMPLEMENTATION

This project is designed using a Raspberry PI single board computer used for embedded application. The Interfacing components used are Reed switch sensor, GPS Modem, Accelerometer and gyro sensor, Wi-Fi Dongle [7] as shown in Fig-2. USB mouse and key board can be used for user-friendly usage of the Board. The 32-bit ARM controller on the Raspberry Device supports the Functionality as the CPU Core

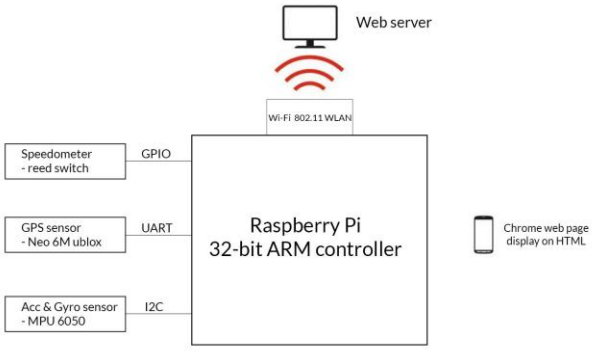

Fig-2: Block diagram of informatics and infotainment system for an E-Bike

The Linux OS is used as the Default operating system responsible for handling the tasks and peripheral on chip components. Python scripting is used for the programming the device and functionalities.

Reed switch is connected to raspberry pi GPIO pin, GPS module Neo 6M is connected via asynchronous UART communication, MPU 6050 Accelerometer and gyro sensor is connected via serial I2C interface as shown in Fig-3. The data from the sensors is processed and updated in a sqlite3 database file. The data is concurrently sent via sockets to a running web server through Wi-Fi module.

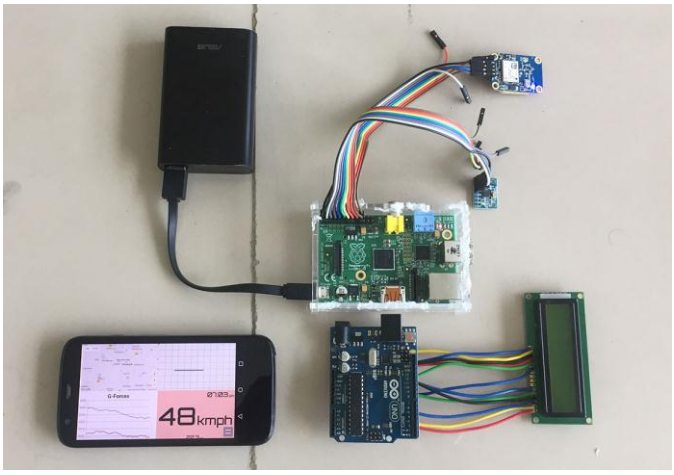

Fig-3: Raspberry pi connections with sensors

The module is fixed onto an E-bike. Raspberry pi is powered using a battery bank. The reed switch is fixed to the front wheel to measure the wheel rotations to measure speed and distance travelled. GPS and accelerometer and gyro are fixed to frame body of the vehicle as shown in Fig-4.

Fig-4: The ride monitoring module mounted to an E-Bike

An HTML web application is developed using HTML, CSS and JavaScript functionality which will receive data from server and will render the information in an user friendly format as shown in Fig-5 on any mobile connected to the web server.

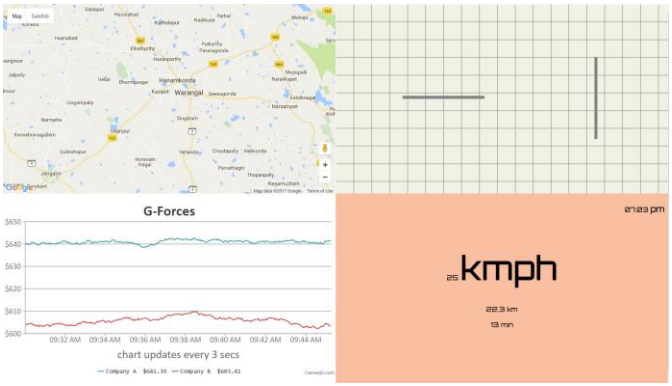

Fig-5: UI interface - Web page application

The web application displays speed, distance rode and time of travel which will get updated at real time. The script runs on JavaScript. GPS information is directly fed to a Google maps API which will locate the vehicle. The lean angles of the vehicle roll and pitch can be visualized through the web page. The G-Forces in three degrees are updated through a Google charts API on real time basis.

5. RESULT

With the monitoring system in place the vehicle is made to take some rides while the monitoring module is set to record and display concurrently the ride metrics information as shown in Fig-6.

Fig-6: Ride metrics dashboard

The collected data is later analyzed by accessing the data via webserver. As the data from all sensors are logged concurrently one can check how fast the vehicle is moving at what place and what how the vehicle is oriented at that instant at a place. The collective results of a ride are shown in Fig – 7.

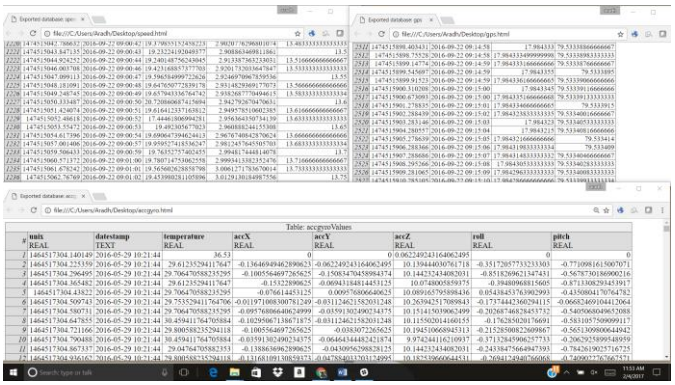

Fig-7: Collected data from vehicle

6. CONCLUSION & FUTURE SCOPE

In this paper we have proposed an Informatics system for an E-Bike which logs the riding data onto a web server and designed an Infotainment system which displays the riding information onto any device which can run a web page. Given that the data collection and information display are independent of each other one has the advantage of designing the webpage to display ride information in his own way. In future one connect battery information to the module to check for battery status and other vital sensors to the module and can interpret the data remotely. The Wi-Fi based communication can be replaced by the mobile internet from the service provider to maximize the network range.

ACKNOWLEDGEMENT

I am thankful to my friends Rahul reddy and Aradh who were involved in the designing and development of E-Bike upon which the module is developed. I would like to thank NIT, Warangal Incubation center for providing the necessary infrastructure and support.

REFERENCES

[1] von Watzdorf, S., and Michahelles, F. 2010. Accuracy of positioning data on smartphones. In LocWeb 2010 Proceedings (Tokyo, Japan, November 29, 2010).

[2] Gusikhin, O., Rychtyckyj, N. & Filev, D. Knowl Inf Syst (2007) 12: 147. doi:10.1007/s10115-006-0063-1.

[3] "The Linux Foundation" *YouTube*. YouTube, 29 April 2013. Web. 29 January 2017.

[4] Kristina, F., (2014), Implementing the connected e-bike: challenges and requirements of an IoT application for urban transportation,doi:10.4108/icst.urb-iot.2014.257191.

[5] "Why Connectedness Will Go beyond Mobile Devices & Apps?" Ather Energy. Ed. Tavleen. N.p., 19 May 2016. Web. 04 Feb. 2017.

[6] Shovic, John C. "Connecting an IOT Device to a Cloud Server - IOTPulse." Raspberry Pi IoT Projects (2016): 147-86. Web.

[7] Hu, Hui, and Lian Fang. "Design and Implementation of Vehicle Monitoring System Based on GPS/GSM/GIS." 2009 Third International Symposium on Intelligent Information Technology Application (2009): n. pag. Web.