INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 3, Issue 6)
Available online at www.ijariit.com

A Proposed Framework for Realtime Monitoring of Speed and Location of a Vehicle

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Abstract: The working man commutes to work and other destinations on a daily basis by various means of transport. One such popular means is by the use of cabs. In cities, several companies enable such commuters to avail the services of daily vehicle hiring from one location to another. Safety of the passenger being the most important criteria, it is important for the fleet management company to be able to monitor the vehicle in which the passenger in seat, in real-time. Our research proposes a simulated system using a speed sensor and a GPS module and a microcontroller to fetch the data and view the vehicle's speed and location coordinates on a smartphone.

Keywords: Android, IOT, GPS module, speed sensor, MSP microcontroller, Wi-Fi module.

I. INTRODUCTION

In the existing systems, companies have the facility of monitoring where the vehicle is located at any given point in time. Besides location, they, however, have no idea of what is happening inside the vehicle. So, although the company can ensure that a customer has reached the destination on time, there is no way to know and thus guarantee if the passenger has reached safely. There is also no way to notify the driver of the vehicle to correct any errors on his part and make him aware that he is being monitored.

In our proposed framework we have created the simulation of a vehicle, with a system to track the speed and location of the vehicle in real-time. This data is then transferred to a smartphone with a notification sound every time the speed exceeds a limit.

II. SYSTEM ARCHITECTURE

A. System Overview

To build the simulated vehicle, we have used DC motors fitted to the rear of the rover. An LM393 speed sensor is used to capture the speed of an electric motor. This Infrared speed sensor module uses a pin that goes from Low to High detecting the gap in an encoder disc, thus allowing you to know how fast the vehicle tyre is moving. In a real life-sized vehicle, the speed is captured from the car's speedometer.

For the location of the vehicle, we have used a GPS module with an external antenna. The module has an SMA connector that mates with the antenna. The module uses the concept of Differential GPS by which the quality of location data gathered is enhanced using the GPS receivers. The module receiver calculates its position based on satellite signals and compares this location to the known location. The difference is applied to the GPS data recorded by the moving GPS receiver module in the vehicle.

We have used an MSP430F149 mixed signal microcontroller which captures the speed and location and sends it over a wireless network to an IP address. An ESP8266 Wi-Fi module is used for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection and generating a network for the rover.

B. System Design

Fig.1 shows a block diagram of the proposed system. The vehicle's gearbox is connected to the speed sensor so that the sensor can detect the current running speed of the vehicle. The mixed signal microcontroller is also connected to the Wi-Fi module which generates a wireless network. The GPS module detects the exact latitudinal and longitudinal coordinates of the moving vehicle and sends this data to the microcontroller. The speed along with the location is sent via the generated wireless network to an IP address. The data is then received on an Android application installed on a smartphone so that the driver may receive a beeping notification every time he exceeds a certain set limit.

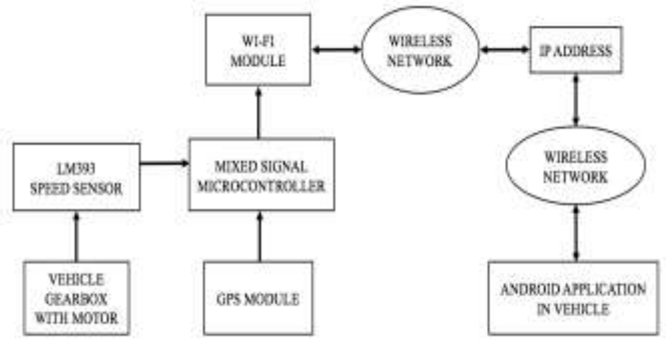

Fig. 1: Block Diagram of Proposed System

C. Detailed Design of the Rover

As shown in Fig. 2, the rover was built in order to simulate the functioning of a real life-sized vehicle. A DC motor is connected to the tyres of the vehicle in order to make it move. We make use of a D-to-A converter and a Darlington Pair in order to amplify the current supplied to the vehicle. The speed sensor is connected to the DC motor in order to capture the rpm speed of the motor and transfer it to the microcontroller.

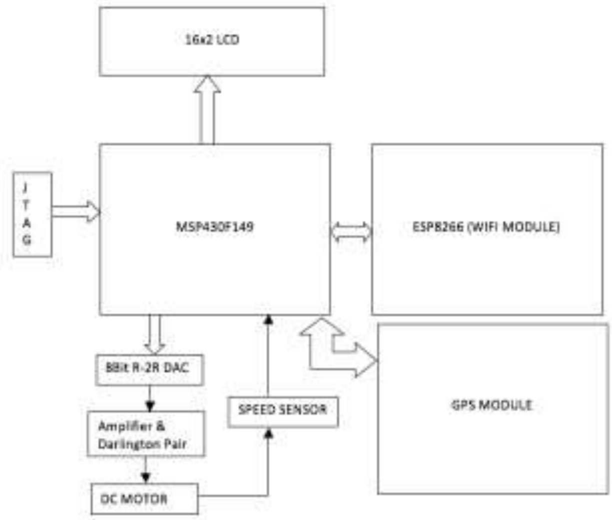

Fig. 2: Design of the Rover

The GPS module consists of an antenna and receiver set which is also connected to the microcontroller. The Wi-Fi module is linked only to the microcontroller to receive the data. We have connected an LCD screen to view the speed set on the rover.

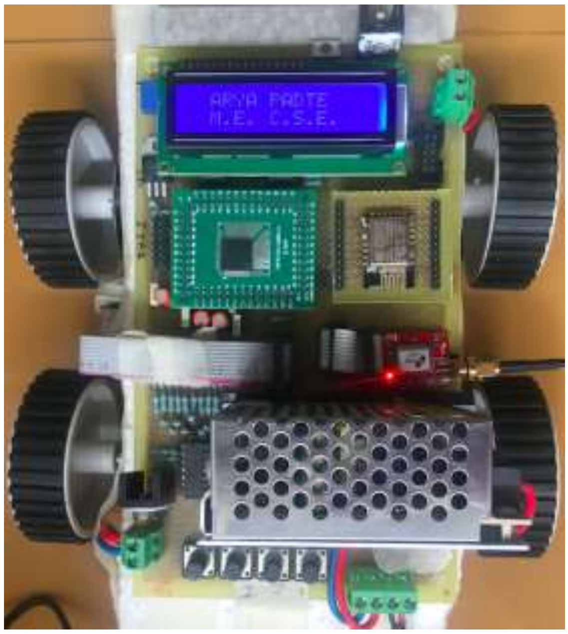

Fig. 3 Final Design of Rover

III. SOFTWARE IMPLEMENTATION

Fig. 4 indicated the software design flowchart to capture the speed and location of the vehicle and send it to the Android application. The system when turned on, needs to initialize components such as the Wi-Fi module and also the GPS module to establish a satellite connection.

To get the vehicle started, a speed is set onto it. When the vehicle starts running, a specific threshold speed is set. The speed and location data is continuously received on the Android smartphone is real-time during the time of the motion. At any point in time, if the speed exceeds the set threshold, the Android application sets off a beeping notification, until such a time that the vehicle is slowed down to below the specified limit.

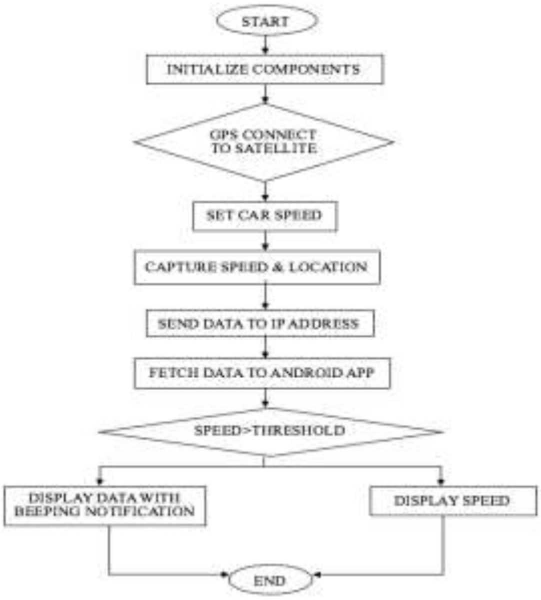

Fig. 4: Software Design Flow Chart

IV. Results

Fig. 5 shows the IP configuration of the network indicating that a wireless network has been successfully generated by the Wi-Fi module. We have set the default gateway to 192.168.4.1 with the port as 85. This is the IP address at which the data is received from the microcontroller.

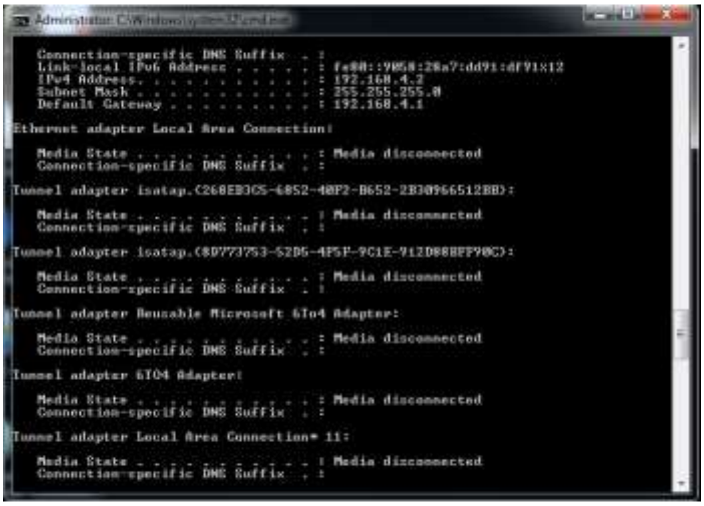

Fig. 5: IP Configuration on Generated Network

As seen in Fig.6, the speed is set on the vehicle. It displays the speed set by us and also the actual speed at which the motor is moving.

Fig. 6: Speed Set on the Rover

Fig. 7 shows a screenshot of the Android application. The top half of the application's screen displays the set speed of the vehicle, the actual speed, the current and the location coordinates of the vehicle. All this data is in received real-time. The lower half of the screen shows a continuous listing of those instances when the speed exceeds the set limit and with this makes a beeping sound to notify and alert the driver.

Fig. 7: Android Application Showing Real-time Data

V. CONCLUSION

Based on the achieved results, it is seen that the proposed system satisfies criteria to overcome limitations of the existing systems. By showing the location of the vehicle along with the speed, it increases the probability of safekeeping the passenger. Also, at a specific instant of time, the notification for speeding makes the driver aware of his wreck less driving and makes him rectify it, thereby increasing the passengers' safety all the more.

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