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Tracking of Vehicle's Location Using Probe Request

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Abstract - *The objective is to monitor traffic density and implement real time tracking of vehicles in smart cities using probe requests caching with device information.Though there are multiple existing systems with these features, they are not implemented due to several shortcomings, mainly such as being cost ineffective or being too complex for implementation. However, this system can be simple and efficiently implemented with minimal cost. Another huge benefit of using this system is that it can be used in all kind of vehicles, and not just on the modern smart vehicles.*

The Existing System requires an active internet/gsm connection to transmit data in near real-time. But in this model, the vehicles doesn't require any type of connections.

Key Words: Probe Request, Tracking, Vehicle, Safety

1. INTRODUCTION

The proposed system consist of a Wi-Fi module fixed in the vehicle. Unlike the existing system the vehicle does not require any kind of active connection. Therefore even when the vehicle goes to a place with weak mobile network .the vehicle can be tracked. The Wi-Fi hotspots are placed on significant spots in the road so as to monitor the vehicles. Initially, the Tracking System is set in the post or lamp. The Wi-Fi modules will be fixed in the vehicles by the respective manufacturers. Each of these manufacturers have their unique MAC addresses. A probe request is sent by the Wi-Fi module to the nearest Wi-Fi access point and the requests are logged and then traffic analysis is done. The result is then logged to firebase database. The user can view the data using a webpage.

2. MODULE DESCRIPTION

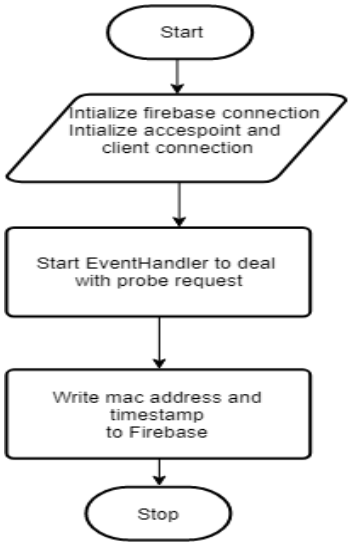
2.1 Wi-Fi module in vehicle

The Wi-Fi module fixed in the vehicles doesn't require any programming. A power supply to the module is enough. The Wi-Fi module by default works in client mode (Connects to access point).

2.2 Tracking Device

Wi-Fi module are placed on significant spots in the road so as to monitor the vehicles. The probe request from the vehicles are cached in this device. All of the Tracking devices are connected to a centralized server to store the data. In this System we used Firebase as a database. Firebase provides a realtime database and backend as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud. The Wi-Fi module is programmed in Arduino ide. Arduino IDE is an open-source software program that allows users to write and upload code to development boards.

The connection to the firebase is initialized using project name and key. The Wi-Fi module mode is set to Client and Access point mode. It connects to internet in client mode and serves as hotspots in access point mode. An Event Handler is initialized to deal with the incoming probe request. Whenever a probe request arrives the mentioned function will be called. The Mac address is extracted from the request object .The Wi-Fi module will get timestamp from ntp server (Network Time Protocol). Then the dataset contain the mac address, Device Name, Time stamp is updated in the Firebase database.



3. HARDWARE AND SOFWARE USED

3.1 NodeMCU

- NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.
- Less than $2 WI-FI MCU ESP8266 integrated and easy to prototyping development kit.
- The ESP8266 needs up to 300mA to work. Adapter provides up to 1000mA, so you even have a lot of spare current for powering anything you plan to connect to your board, like, say, a display.
- USB – micro USB port for power, programming and debugging
- Headers – 2x 2.54mm 15-pin header with access to GPIOs, SPI, UART, ADC, and power pins
- Power – 5V via micro USB port
- Dimensions – 49 x 24.5 x 13mm

3.2 Firebase

- Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014.
- Firebase provides a realtime database and backend as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud.
- Data is stored as JSON and synchronized in realtime to every connected client.

4. CONCLUSIONS

We developed and tested a vehicle tracking system to track the location of a moving or stationary vehicle in real-time. This system has described the design and implementation of our vehicle tracking system. An in-vehicle device, a tracking device and a webpage are used for the vehicle tracking system.

In this work, the in-vehicle device is composed of a Wi-Fi module which is ready to connect. On the other end, the tracking device is in hotspot mode, looking for clients. The in-vehicle device sends request to the tracking device. The web interface written in HTML&JS is implemented to directly connect to a database. A vehicle's unique ID (MAC id) obtained from an in-vehicle device are recorded in a database table. The system was able to experimentally demonstrate its effective performance to track a vehicle's location anytime from anywhere. Furthermore, our implementation is low-cost that is based on easily accessible off-the-shelf electronic modules. The system can be further more improved by adding safety features like average speed between two points warning for over speeding.

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