



Development & Implementation of Custom Connectivity Protocol for Identification and Tracking of Public Transit Vehicles Using Portable and Station Nodes

Erabathini Chetan Laxmirajam, Dr. Prof. R. S. Kawitkar

M.E. Student, Dept. of Electronics, Sinhgad College of Engineering, Pune, India

Professor, Dept. of Electronics, Sinhgad College of Engineering, Pune, India

ABSTRACT: Now a day's tracking of mobile vehicles in a large area outdoor environment based on the Global positioning system (GPS) and Global system for mobile communication (GSM). Focusing on current traffic situation in city area and user requirements, we are trying to implement custom protocol based vehicle tracking system which can help user as well as traffic management. RFID can be useful, but it has some limitation, hence we are making custom, short range protocol in portable as well as station node which can be installed in buses and bus stop. Considering today's fast moving life requirements we are implementing this solution with efficient lightweight MQTT protocol with required Quality of service and AWS services.

KEYWORDS: Custom RFID, vehicle tracking system MQTT, Quality of services, Commercial AWS Services, Web Services.

I. INTRODUCTION

In today's communication technology, GPS tracking System is a common approach used, to get the positions of vehicles in real time for fleet-planning. [1] proposed a GPS tracking system called as Vehicle-Race-Tracking application. This system is composed of commodity hardware's, open-source software's and easy-to-manage user interface with the Google-map. It is a basic lap-counting method, for use in sports/motorsports which are held on fixed circuits or courses and can be used in events held at different coasts. There are different types of tracking devices available in market these days.

The purpose of this paper are going to make simple and very effective traffic management system using the custom protocol having a wide range RFID which we will implement in the buses and differences with talk to each other through our own custom protocol. When will think about the traffic we come across tracking of vehicles

In this paper we will be implementing transmitter and receiver's module in vehicles. So that when was passed from each other they will explain its on state to other vehicle and hence the complete data of each vehicle will be updated in the server. When we come across in this situation we have to think about the speed and effectiveness of the solution.

In current scenario there are different technologies such as Wi-Fi, Bluetooth, Zigbee but these protocols has its own disabilities so we cannot use them. In turn we are going to make our own protocol.

In this paper we will discuss our own antenna and its relation and demodulation process for identification and location transfer amongst vehicle. Vehicles which state it's on location as well as will have information of passing vehicle. Server will maintain all the data and will be shown to each user through application or website that means if user will have access to it real time traffic density is and will take proper decision according to requirement.

This paper divided into seven main sections: section II addresses the existing issues, section III gives the block diagram of the implemented system, hardware and software requirements are described in section IV, the obtained results are detailed in section V, and section VI concludes the entire project.

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirccce.com

Vol. 5, Issue 5, May 2017

II. PROBLEM OF IDENTIFICATION

The current problem in the major cities is that public transport bus system due to heavy traffic. So it is difficult to have actual arrival and departure time of the buses. There are two technologies available first GPS system with this technology we can only detect the location of the vehicle but not the vehicle details, and second is Black box system. with this we can only store the information but not share. To address these issues we have designed and implemented this system which will share as well as update the location.

III. BLOCK DIAGRAM

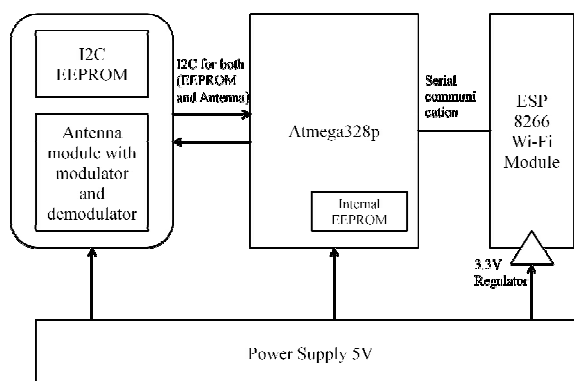


Fig 1. Block Diagram of main device

The above block diagram explain the working of the system which can be designed from this paper in which ATmega328/P processor is used for automation and controlling of the other devices like Antenna module with modulator and demodulator, ESP 8266 Wi-Fi module and other devices[7]. This paper gives the practical model of a transport vehicle current location and vehicle details to manage traffic system. Actually it consist of two parts, first hardware with moving vehicles to exchange the frame of vehicle details and previous vehicle node location and second is AWS server to update real-time vehicle details in the SQL data base to share with users.

Each transport vehicle is passed with predefined memory to store information about own along with its location. This memory gets exchange through the passenger with other transport vehicle, here tracking is based on transport vehicle passage not on the GPS location.

ESP 8266 module is like Wi-Fi module, with the help of this transport vehicle data transmitted to AWS server to update information.

IV. HARDWARE AND SOFTWARE REQUIREMENT

A. Antenna Module:

Basic study and design of the rectangular micro strip chip less antenna equations are as follows:

Effective Dielectric constant can be given as follows:

$$E_{\text{reff}} = [(E_r + 1) / 2] + [(E_r - 1) / 2] [1 + 12(h / w)]^{-1/2}$$

Where,

- E_{reff} = Effective dielectric constant
- E_r = Dielectric constant of the substrate
- h = Height of the Dielectric substrate
- w = Width of the patch

Width(w):



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

$$w = (C_0 / 2fr) * [2/ (Er + 1)]^{1/2}$$

Length (L):

$$\Delta L = 0.42 h * \frac{[E_{eff}+0.3] [(\frac{w}{h})+0.264]}{[E_{eff}-0.258][(\frac{w}{h})+0.8]}$$

Now,

$$L = [C_0 / 2fr (E_{reff})^{1/2}] - 2\Delta L$$

By using this values implemented customized RFID card and passive tags to share data between transport vehicles with in specified time.

B. ESP8266

ESP8266 is a low cost Wi-Fi chip with full TCP/IP stack and micro controller unit (MCU), it is a set of high performance, high integration wireless network, designed for space and power constrained mobile platform designer. It provides unsurpassed ability to embed Wi-Fi capability within other system or to function as a standard application with lowest cost and minimal space required. Here ESP8266p and custom RF-ID is connected with AWS server and database.

Node MCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SOC from hardware which is based on the ESP-12 module. The term "Node MCU" by default refers to the firmware rather than dev kits.

ESP8266 is work on the base of IEEE 802.11b/g/n with integrated TCP/IP protocol stack and Wi-Fi 2.4 GHz, Some important parameter as given below:

Categories	Items	Values
Wi-Fi Parameter	Certificates	FCC/CE/TELEC/SRRC
	Wi-Fi Protocol	802.11 b/g/
	Frequency Range	2.4GHz – 2.5GHz
	Tx Power	802.11b: +20dBm
		802.11g: +17dBm
		802.11n: +14dBm
	Rx Power	802.11b: -91dBm
802.11g: -15dBm		
802.11n: -72dBm		
Type of Antenna	PCB Trace, External, IPEX Connector, Ceramic chip	
Hardware Parameters	Peripheral Bus	UART/IR Remote control
		GPIO/PWM
	Operating Voltage	3.0 – 3.6V
	Package Size	5 x 5 mm
External Interface	NA	
Software Parameters	Wi-Fi mode	Station/ Soft AP/ Soft AP+ station
	Security	WPA/WPA2
	Firmware Upgrade	UART Download/ OTA
	Software Development	Support Cloud server development / SDK for custom firmware development
	Network Protocol	IPv4, TCP/UDP?HTTP/FTP
	User Configuration	AT Instruction set, cloud server, Android/ ios App



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

The Custom RFID module is used as transceiver to get and send information to transport vehicle while moving, and by using ESP8266 is used to send that data to AWS SQL database which is connect to through a web page.

C. MQTT

Today IOT has become an good platform which is used in various areas be it in industrial automation or home automation or medical purpose, connecting various sensors for monitoring various device activities and monitoring those data from anywhere in the region so to provide more flexibility to the user[4][5]. For IOT to work efficiently. MQTT is the one of the most important application layer protocol for IOT.

MQTT is a machine to machine / IOT connectivity protocol. It was designed as an extremely lightweight publish/subscribe messaging protocol.

This paper requires fast communication with good QoS for connections with remote locations where a small messaging overhead is required and/or network bandwidth is at low. It is also ideal for mobile application because of its small size, low power usage, minimized data packets and efficient distribution of the information.

D. AWS

Amazon web services(AWS) provides on demand computing resources and services in the cloud, with pay as you go pricing. For example AWS server can run by log on to, configure, secure and launch EC2.

Amazon elastic compute cloud(EC2) provides scalable computing capacity in the AWS cloud. So its provides easy and faster communication. Virtual computing environment known as instances.

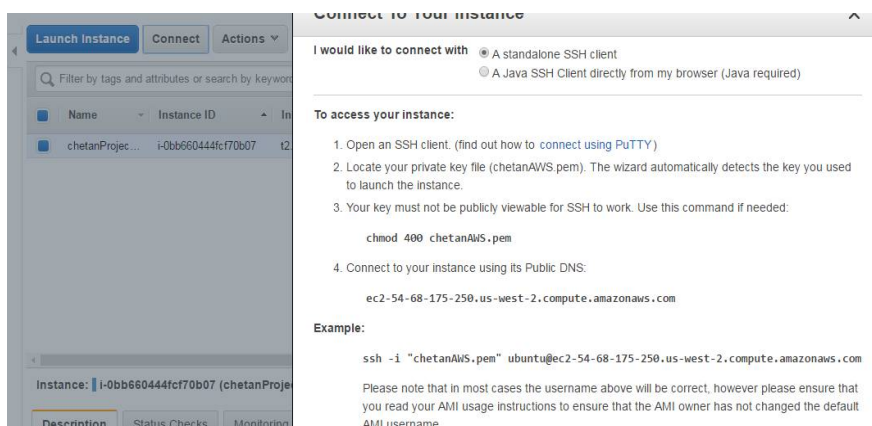


Fig 3. AWS .pem File

To launch the server first log on to the AWS console -> select EC2 then launch instant after that connect the server , then it provide .pem file to start server as shown in the above figure.

E. Eclipse Paho

Eclipse Paho is an MQTT broker, its main responsibility is to provide a communication channel between publishers and subscribers. If any publisher, using the Eclipse Paho MQTT client API can publish the messages to an MQTT Broker. It is the responsibility of the broker to deliver all the messages arriving on a topic to all interested clients.

Any client, who wants to publish or receive messages from MQTT broker[5], can use one of the following two classes of **org.eclipse.paho.client.mqttv3 package**.

The eclipse paho provides open source user implementations of MQTT messaging protocol aimed at new, existing and emerging applications for the Internet of Things.

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

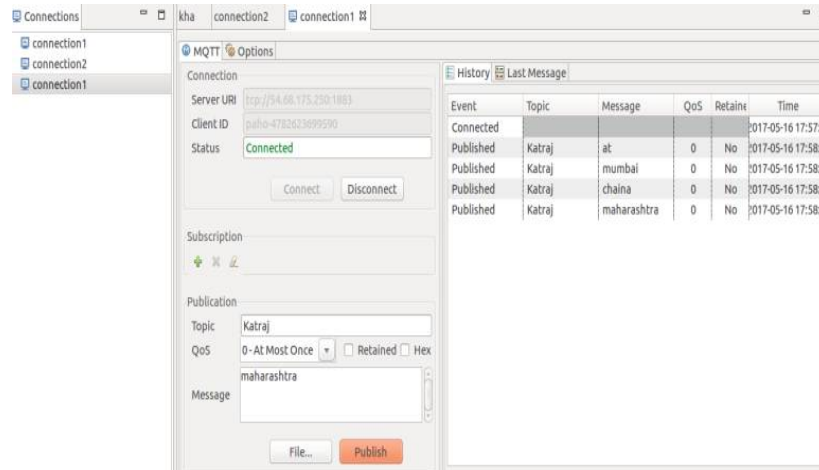


Fig 4: Paho testing of Publish and Subscribe

V. RESULTS

When two public transport vehicles passes through each other, the hardware device kept in the vehicle start synchronization with each other and exchange the data frames, and data will be stored in the external storage and this data will be send to server with the help of ESP8266 is connected through internet via hot spot and its sends the data to the AWS SQL database server with the help of MQTT.

The data will be storage in the form of first in first out and its update every few seconds.

User can access through the web or Android or ios device such as Application to get the present location of the vehicle and vehicle information. Some probable results are shown below.

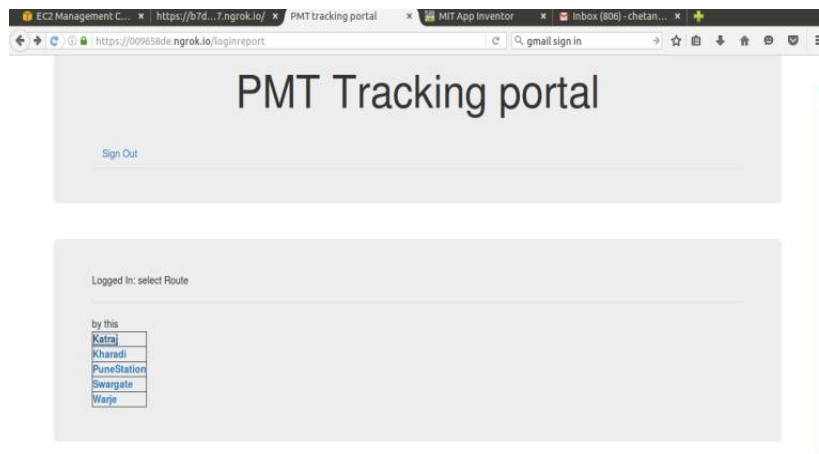


Fig6 : Result of Web Page index



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirccce.com

Vol. 5, Issue 5, May 2017

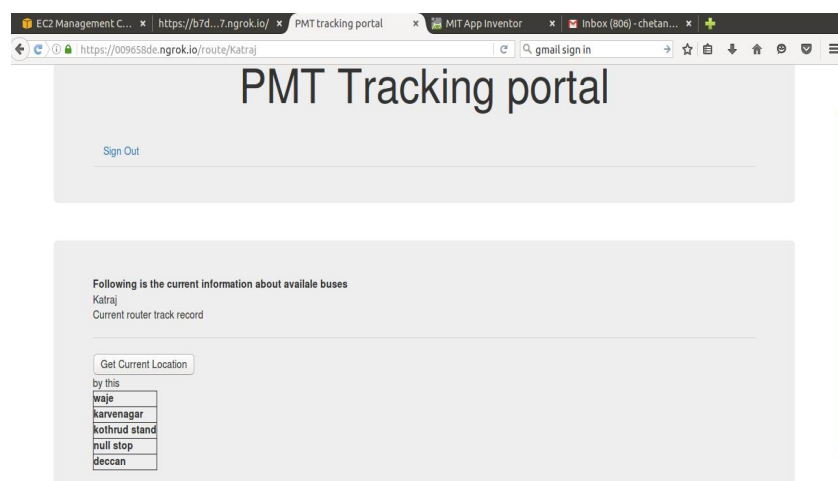


Fig 7: Web page of tracking of Katraj Station node

VI. CONCLUSION

In this paper, we have designed and implemented an efficient Vehicle Tracking System which overcomes the current uncertainty about the arrival of Public Transport Buses to the great extent traffic using customized RFID with MQTT, ESP & AWS services. The main advantage is that the designed system doesn't make use of classical systems such as GPS and GSM which have limitations related to certain environmental conditions. This paper also describes the vehicle details in simple manner, also it help to keep track of the vehicle in simplest way possible. In future it can also be used in vehicle security like theft actions ,illegal usage, and accident detection.

REFERNCES

1. Pham Hoang Dat, Micheal Driberg and Hguyen Chi Cuong (2015) IEEE Conference On open System "Development of Vehicle Tracking System Using GPS and GSM Modem" Pages: 89 – 94.
2. Rohit Dhall, Vijender Solanki (2016) Internanational Journal of Interactive Multimedia and Artificial Intelligence "AN IoT Based Predictive Connected Car Maintenance Approach" Pages: 16 – 23.
- 3 B.Sobhan Babu, T. Ramanjaneyulu, K. Srikanth, D. Hema Sindhu (2016) International Journal of Emerging Trends and technology in computer science(IJETTCS) "Smart Vehicle Management through IoT" Pages: 26 – 31.
4. Yuang Chen, Thomas Kunz (2016) 2016 International Conference on Selected Topics in mobile and wireless Networks (WoWNeT) "Performance Evaluation Of the IoT Protocols under a Constrained Wireless Access Network".
5. Vasileios Karagiannis, Periklis Chatzimisios, Francisco Vazquez-Gallego, Jesus Alonso-Zarate (2015)Transaction on Internet of Things(IoT) and Cloud Computing "A Survey on Application Layer Protocolsfor the Internet of Things" Pages: 1 – 9.
6. Sharvari Rautmare, Dr. D. M. Bhalerao (2016) IEEE International Conference on Advances in Computer Applications (ICACA) "MySQL and NoSQL database comparison for IoT application" Pages: 235 – 238.
7. Manan Mehta (2015) International Journal of Electronics and communication Engineering and Technology(IJECET) " ESP 8266 A breakthrough in wireless sensor network and internet of things" Pages: 7- 11.
8. Houda werfelli, Khaoula Tayari, Mondher Chaoui, Mongi Lahiani, Hamadi Ghariani (2016) International conference on Advanced Technologies for signal and Image Processing(ATsip) " Design of Rectangular Microstrip Patch Antenna" Pages: 798- 803.