International Journal of Engineering & Technology, 7 (4) (2018) 5489-5493

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET
doi: 10.14419/ijet.v7i4.27489
Research paper



An IoT based system for vehicle allocation and unlocking using android application with RTDM for smart transportation

Aswathi A. R [1] *, S. R. Umamageswari [1], K. Sambath [1]

[1] Department of Electronics and Communication Systems, Sri Krishna Arts and Science College, Coimbatore, Tamil Nadu, India.
**Corresponding author E-mail: angelashz.ar@gmail.com*

Abstract

An Internet of Things (IoT) technology based smart vehicle management system using android application is used for allocating, unlocking and real time data monitoring (RTDM) mode. This system delivers the information about availability, allocation, and unlocking of vehicles. IoT technology provides a path between user and server for selecting vehicle through mobile app and to unlock the vehicle. Also, between admin and front-end module to monitor the vehicles through website. Special Android app (*Trackit*) is designed for an easy access of user in their smart phone. Company App have facility to list out the availability of vehicles and can allocate vehicle as per the request from driver. Unlocking of vehicle from parking slot is from Android app according to the command from server after authentication of the driver is another highlight of the system. Administrator can track the details of on-running vehicles from company website with the help of front-end controller affixed in vehicle. The status of company vehicles is stored in database and it can be retrieved by administrator as per the requirement. In future, this system is a best solution for commercial transportation which directly benefits transportation arms of logistics, fleet management and supply chain system.

Keywords: *Android Application; Arduino UNO; Commercial Transportation; RTDM (Real-Time Data Monitoring); Wi-Fi Module.*

1. Introduction

The progress of IoT (Internet of Things) is very influential on human activities. For an embedded developer the definition of a “Thing” in the Internet of Things can be defined as an embedded computing device or an embedded system itself that transmit and receives information over a network. IoT will not be seen as individual systems, but as a critical, integrated infrastructure upon which many applications and services can run. Some applications will be personalized such as digitizing daily life activities, others will be city-wide such as efficient, delay-free transportation, and others will be world-wide such as global delivery systems [1]. IoT is based on multiple integration of communication solutions, technology identification and tracking, sensor networks and actuators, and sharing of other information distribution [2]. The more sensors combined and with the increase in data collection time, the data will become larger and known as the "Big Data". Big Data was introduced by Gartner Report in 2001 and has three dimensions covering 3Vs: Volume, Velocity, and Variety. This definition has been rewritten and reasserted by others to include the fourth V: Veracity [3]. In short, IoT provides a means of data collection, detection and monitoring of an event, an algorithm for acting on an activity, storage of data and a considerable analysis.
IoT broadens utilisation of Internet giving the correspondence, and this way between system of the gadgets and physical articles, or ‘Things’ [4]. It gives a dream where things wind up plainly keen and act alive through detecting, processing and conveying by installed little gadgets which communicate with remote things or people through network [5]. Newer advancement in making low-cost, low-power embedded systems are helping engineers to build new application for Internet of Things [6]. This devised system uses IoT technology in commercial transportation field. Such benefits extend to business and manufacturing by reducing the transport arm of organizations. With the better analytics and control such as monitoring vehicle conditions and travel time between points eliminates problems due to logistics and fleet management.
Developments in science and technology are fundamentally changing the way the people live, connect, communicate and transact, with a great impact on economic development. In the field of vehicle transportation, technological development is very important for every nation. As the changes in technological growth proportionally increase the standard of living of a nation too. Transportation system plays an important role in day to day life of all people. So, it is a huge responsibility to provide safe and reliable vehicle for transportation. The logistic system and the corresponding supporting facilities can realize the real-time tracking of transport vehicles and goods, and improve the safety of the transport goods. At the same time, it improves the reliability of the transportation, thus improving the service quality and the service level for the customers, so as to achieve great economic and social benefits [7]. This work is useful for ever increasing accidents and theft cases. This proposed system is designed mainly to allocate vehicles to driver from a pool of vehicles over internet booking facility, unlocking vehicle using IoT and monitors data on a real-time basis in a server.

2. Related works

Many researchers have studied and made research on various technologies to implement vehicle locking, tracking and monitor-

Copyright © 2018 Aswathi A. R et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ing system. There are different techniques for tracking the vehicle and to provide solutions for theft and accidents. Some of the previous work which has been done in this field is abstracted here.

Authors in [8] demonstrates system in ARM7 for vehicle data monitoring system which records various parameters of the vehicle. Various parameters are obtained through sensory network and also uses GPS and GSM modules to identify the position of the vehicle and to send various information of the vehicle to control station respectively. Authors in [9] developed a system for which vehicle can be tracked through a specially designed application in the smartphone and can lock/unlock vehicle remotely. Also, with the help of GPS, the exact location of the vehicle is sent to the mobile unit as SMS.

In [10] authors implemented a system to track multiple vehicles of a different kind in the large environment using GPS and GSM. The special feature of this system includes remote locking and opening system for the vehicle along with a network of sensors for the security of the vehicle. In [11] authors designed a special system for school vehicles to monitor the route travelling by the vehicle and senses temperature and gas leakage. This system is based on Embedded Linux Board and Android application. In [12] authors implemented a vehicle black box system to record the data detected and secondly how to present recorded data in a simple way.

Previous works provide some insights about prevailing transportation systems but none of them demonstrated a complete system. Through this work, we intend to propose a new IoT system for commercial transportation systems. In the following sections, we will discuss about our system architecture and components to realise this efficient system.

3. System architecture

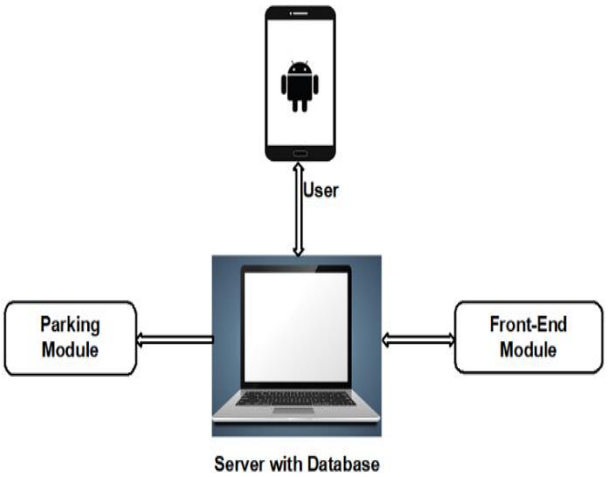


Fig. 1: Schematic Representation of the System.

An IoT based system for vehicle allocation and unlocking using Android application with RTDM (Real-time data monitoring) for smart transportation have four main blocks as represented in Fig. 1. The important blocks of this system are Android Application in Smart phone for driver, Server for Administrator, Vehicle detection in parking Module, and Front-end module attached in vehicles. This work presents a solution for commercial transportation system in companies. Driver of the company can book the vehicle from an Android Smart phone according to the availability of vehicle in parking slot. For authentication driver's User ID and Password is necessary to open the application. If all vehicles are booked, server will give excuse message to driver in phone. Server stores all information about drivers and vehicle details of the company. To unlock vehicle from the parking slot, driver enter User ID and OTP (will be provided at booking time) and after verifying these details server pass command to front-end module to unlock the door. Once the booked vehicle starts running, values of sensory network in front-end module can be monitored by the administrator from company website whenever required. This work is very helpful to maintain transportation system of a company in a better manner.

In parking module, IR (Infrared) sensor is used to detect the vehicle on each slot. Status of each parking slot whether the vehicle is available or not is stored in database of server using ESP8266 Node MCU. As Node MCU is a combination of a processor and Wi-Fi, it collects data from IR sensor and the processed data is transmitted to the server through Wi-Fi. Availability of the vehicle is continuously updated to the database.

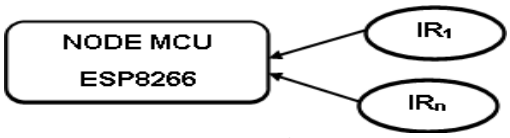


Fig. 2: Block Diagram of Parking Module.

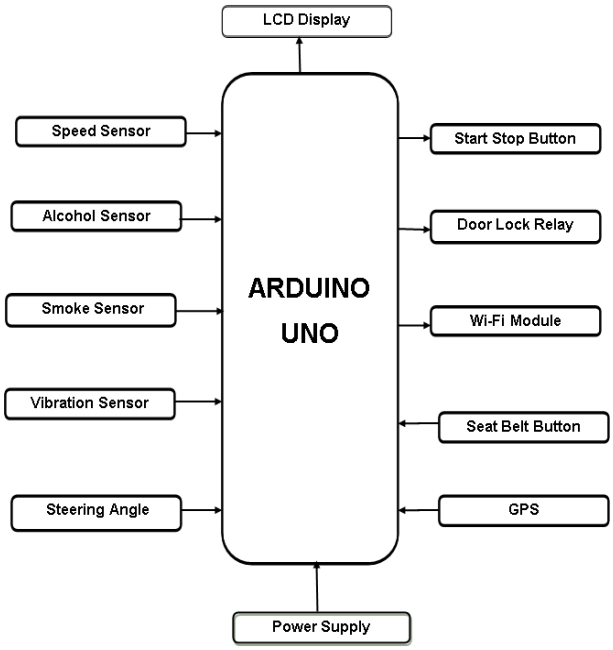


Fig. 3: Block Diagram of Front-End Module.

Front-end module of this implemented system is shown in Fig. 3. Arduino UNO is the back bone of this implemented system, to collect various data and to process it. Door lock relay is used to unlock the vehicle based on the command from server. Sensory network helps to monitor the parameters like alcohol detection, smoke detection, speed of the vehicle, steering angle, whether seat belt is used or not and also accident detection. GPS receiver in this front-end module gives the location of on-running vehicle and Wi-Fi module helps to send the processed data to server for monitoring the on-running vehicles.

4. System component

4.1. Hardware tools

Arduino UNO board is used in front-end section is a microcontroller based on Atmega328. It collects data from array of sensors, is processed and output is transmitted to server and LCD. In Arduino board two pins are dedicated to serial communication to transmit and receive data. In this proposed system these pins are connected to Wi-Fi module. Beside these pins a virtual Rx and Tx serial lines are also used for GPS communication. ESP-01 is the beginning version of ESP8266 is used as Wi-Fi module. The data is received and processed in Arduino board is transmitted to wide range of communication by using ESP8266 Wi-Fi module. It is a complete package of SoC and microcontroller unit with 8 pin GPIO.

GPS receiver module in front end section receive information from GPS satellite and helps to find exact position of the vehicle.

Arduino receives a data line from GPS module and it contains Greenwich Mean Time, latitude and longitude. Then Arduino extracts required information from GPS and combine with Google map link so that it helps to view location just in single click on the link. MQ-3 sensor is used for alcohol detection, which is based on a sensitive material SnO2. As the alcohol gas content increases the conductivity of sensor increases. MQ-2 smoke sensor module consists of sensitive MQ-2 element, a protection resistor and an adjustable resistor. This sensor can detect above mentioned gas leakages. These outputs are fed to Arduino and through Arduino the details are updated to server.

This proposed work utilises vibration sensor to detect weather any accident occurs or not. If any accident occurs to vehicle it will give immediate response to the server used by admin. Steering angle can be calculated by connecting a pot to steering shaft. Variation in the pot is fed to Arduino and is converted to an ADC value. This ADC value is processed and shown as degree on website. Liquid Crystal Display (LCD) is used to display status of sensors on front end section itself. The relay is connected to door lock of the vehicle to unlock the door according to the instruction from server. Also, a push button is connected to engine start and for seat belt sensing. When seat belt is used by driver button get pressed. Thus it works for sensing seat belt.

Node MCU is the core part of parking slot section. Availability of vehicles in each parking slot is sensed through IR proximity sensor and collected at Node MCU. This is based on matured ESP8266 technology. This module is a self-contained Wi-Fi networking solution offers a bridge from existing Microcontroller and Wi-Fi with 13 pin GPIO. The status of each vehicle in parking slot is updated to a table in database with the help of ESP8266 Node MCU module. IR sensor is abbreviated form of Infrared sensor, which consists of an IR LED as IR transmitter and a photodiode as IR receiver and this package is known as Opto-coupler. IR sensor is used in vehicle and parking slot section. In front end section proximity sensor is used to calculate RPM (Rotation per Minute) of the wheel so that the speed of the vehicle can be calculated. IR sensor in parking slot detects vehicle and the status is automatically updated to database.

4.2. Software tools

Server station is controlled by administrator of the company. Administrator is the only person who can access website which shows all database related to employers and vehicles of the company. Administrator can monitor real time data from running vehicles. Also, on running vehicles, booked vehicles and available vehicle list can be accessed from the database to website. Adobe Dream Weaver IDE is used to develop the company website using HTML, CSS coding and in Bootstrap framework. Database is created in SQL using WampServer software.

A website is developed to monitor on-running vehicles and to view entire details of the company. Planning phase is the first stage to Plan about the requirement and gathered information. A new document is created for coding in code view. CSS is used to style the appearance and after testing the coding, it is published. Wamp or WampServer is a software which helps to use computer as a local server and can host designed websites. WAMP is named as a stack of software Windows, Apache, MYSQL, and PHP. This software helps in proposed system to check the back-end aspects like database SQL. In this proposed system database named 'manage' is created and it consists of four tables to store booking information, details of drivers and vehicles. When a vehicle is booked from Android application details of booking is stored like vehicle ID, driver ID, time of booking, allotted OTP, start and end time, date, status, whether vehicle is in parking slot or not, unlock time so on. Company drivers list is separately stored in database and it stores data like driver name, mobile number, license number, address, joining date so on. List of company vehicle is stored in database to store all details of vehicle like vehicle type, number, brand, status so on.

An Android Application is specially developed for this system and named it as 'Trackit'. This application helps the driver to send request for vehicle booking. Driver can view list of vehicles which is available for booking. After booking a vehicle driver can unlock it when using vehicle. For that secure locking system is provided using IoT Technology. While booking a vehicle, driver will receive an OTP and at the time of vehicle requirement, it is unlocked by entering an OTP and User ID. After the verification and authentication as per the instruction from the server door will be unlocked. Also, engine starts only after this above-mentioned procedure. Android Developer tool is used to build Android apps which provides a first-class environment. It set up the environment as the latest Android platform. So, user can immediately build apps and run them on emulator. This ADT is connected to Eclipse the IDE used in this work help to develop easily. It is a java-based platform.

Arduino Software is known as Arduino IDE and it mainly consist of a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It helps to connect the hardware board to upload program and to communicate with Arduino hardware. Sketches written on Text Editor and save with file extension ".ino". After saving and exporting the sketch feedbacks, if error occurs error information displays on bottom area. Also, Toolbar button provides various icons like verify and upload programs, create, open, and save sketches, and open the serial monitor. Additional components can be obtained from Menu bar. Arduino IDE software is used to code and burn program for both Arduino UNO and Node MCU.

5. Result

A system prototype for an IoT based system for vehicle allocation and unlocking using Android application with RTDM for smart transportation is implemented and functionality of different system module are tested. Driver can easily book the required vehicle, unlocking as per the command and RTDM (Real Time Data Monitoring) is possible using IoT platform. Android section, server section, hardware section depicted below.

Select Vehicles from home page after login and driver can see list of company vehicles. According to the requirement of vehicle, driver can choose a vehicle and reserve that vehicle through booking process and click on Generate OTP button. To unlock vehicle door, user uses this OTP and user ID.

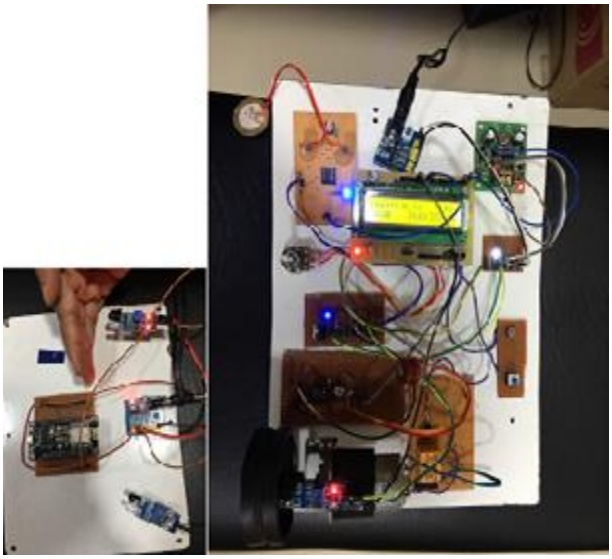
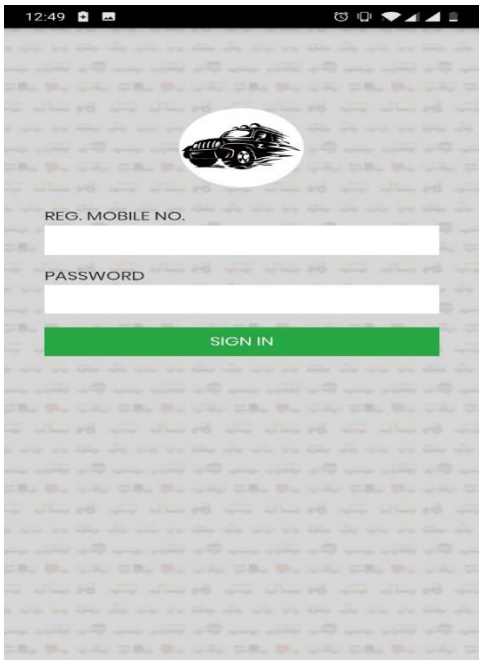


Fig. 4: Hardware Prototype of Parking Module and Front-End Module



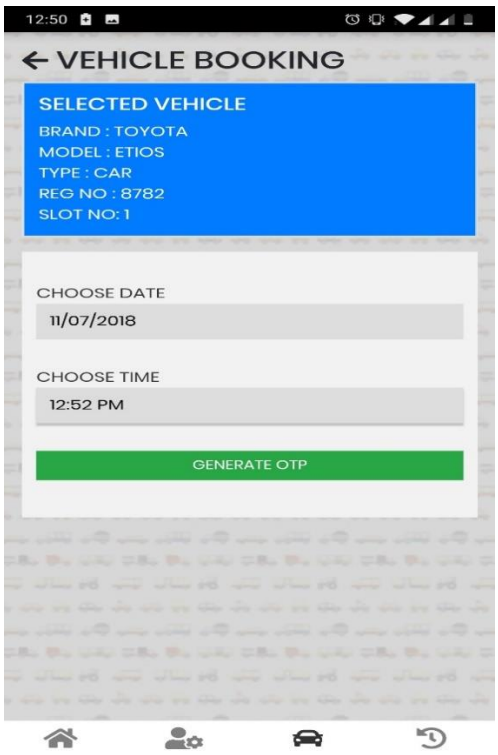


Fig. 5: Screenshot of Smart Phone App Login Page and Booking Page.

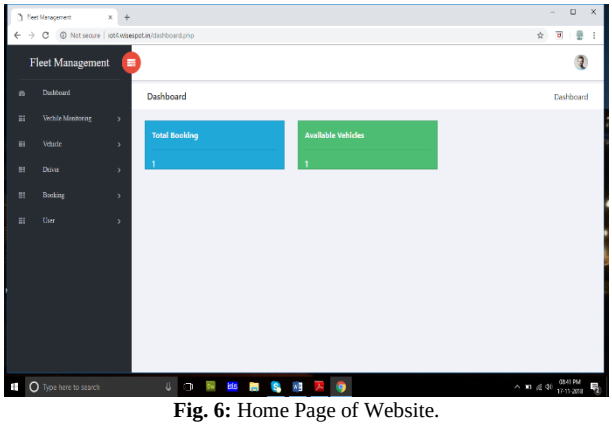


Fig. 6: Home Page of Website.

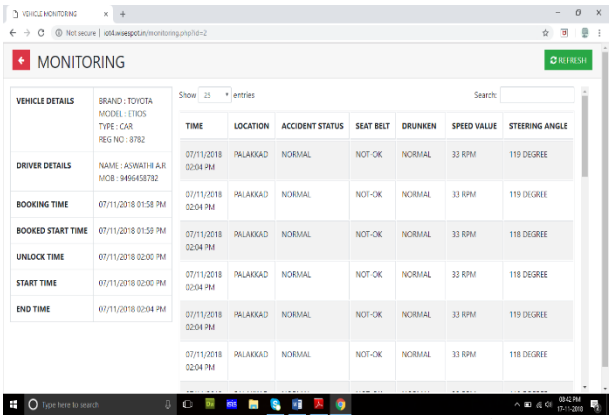


Fig. 7: RTDM (Real-Time Data Monitoring) Page of Website.

.

6. Conclusion

An IoT based System for Vehicle Allocation and Unlocking using Android Application with RTDM for Smart Transportation provides a good solution for commercial transportation management. User-Server, Server-Parking Section and Vehicle communication is established over IoT technology. Wi-Fi module used in the hardware module provides wide range of communication through that RTDM is made possible.

The purpose of this proposed system is to provide an economical and reliable method to manage vehicles in a company and to provide secure unlocking method along with RTDM system for on-running vehicles. Vehicle driver book the vehicle through specially customised Android Application on smart phone. Availability of vehicle is automatically updated from parking section module from Node MCU. Next, unlocking of vehicle in this work is unique and safe method comparing to other previous works. Based on generated OTP and User ID server compares in booking list, if it is found in the list server gives command to Front-end Controller to unlock vehicle. Administrator of the company can monitor real-time data of on-running vehicles.

The main application of this work is for commercial transportation systems like fleet telematics and management solution, transport logistics applications, supply chain management solution, industrial transportation and so on. With the proper implementation of this work will enhances the safety of driver and vehicle, supply chain efficiencies, low cost to implement with latest technology and so on.

For future enhancement of this work, parameters of RTDM can be varied according to the application. In this system separate Front-end module is designed. Researcher can make studies to combine this front end module along with ECU (Engine Control Unit) also commonly known as ECM (Engine Control Module) and can be implemented in all vehicles as a black box system.

References

[1] John A. Stankovic, “Research Directions for the Internet of Things”, IEEE Internet of Things Journal, Vol. 1, No. 1, February 2014.

[2] S. Li, L. Da Xu, and S. Zhao, “The internet of things: a survey”, Inf. Syst. Front., vol. 17, no. 2, pp. 243–259, 2015. https://doi.org/10.1007/s10796-014-9492-7.

[3] D. Laney, “META Delta”, Appl. Deliv. Strateg. vol. 949, pp. 4, 2001.

[4] D. Giusto, A. Iera, G. Morabito and L. Atzori (Eds.), The Internet of Things, Springer, 2010. https://doi.org/10.1007/978-1-4419-1674-7.

[5] L. Atzori, A. Iera and D. Giusto, “The Internet of Things: A Survey”, Computer Networks – Science Direct, 2010.

[6] Florent Carlier and Val’erie, “IoT – An Embedded Agent for Smart Internet of Things Application on a Display Wall”, IEEE/WIC/ACM International Conference on Web Intelligence Workshop, 2016.

[7] Sun Jianli, "Design and Implementation of IoT -Based Logistics Management System", IEEE EEESYM, 2012.
[8] N. Dheerthi and G. Kiruthikamani, "Real Time Data Monitoring System with Intelligent Vehicle Tracking using ARM7", IEEE, 10.1109/GCCT.2015.7342677, April 2015.
[9] Gokulnath. M and Raagavi. G, "Advanced Vehicle Tracking and Security System using Android", IJETT, Vol 36, Number 7- June 2016.
[10] Nalina V, Sandesh A S, Royal Denzil Sequiera and Dr P Jayarekha, "Cloud Based Multiple Vehicle Tracking and Locking System", IEEE, July 2015.
[11] Prashant A. Shinde, Prof. Mr Y.B. Mane and Pandurang H. Tarange, "Real Time Vehicle Monitoring and tracking system based on Embedded Linux Board and Android Application", IEEE,, July 2015.
[12] Abdallah Kassem, Rabih Jabr, Ghady Salamouni and Ziad Khairallah Maalouf, "Vehicle Black Box System", IEEE, 10.1109/SYSTEMS.2008.4519050, May 2008.
[13] L. Jamjoom, A. Alshmarani, S. M. Qaisar and M. Akbar, "A Wireless Controlled Digital Car Lock for Smart Transportation", IEEE, 2018. https://doi.org/10.1109/LT.2018.8368510.
[14] Anitha Chepuru and Dr K.Venugopal Rao. (2015). A Survey on IoT Applications for Intelligent Transport Systems. IJCESR. Vol-2. Issue-8.
[15] E. K. Priya, P. Manju, V. Mythra, and S. Umamaheswari, "IoT Based Vehicle Tracking and Accident Detection System", pp. 4424–4430, 2017.
[16] Dina Fitria Murad, Meyliana, Achmad Nizar Hidayanto and Harjanto Prabowo, "IoT for Development of Smart Public Transportation System: A Systematic Literature Review", IJPAM. Volume 118, No. 18, 2018.
[1] B. Karakostas, "A DNS architecture for the internet of things: A case study in transport logistics", Procedia Comput. Sci. vol. 19. pp. 594–601, 2013. https://doi.org/10.1016/j.procs.2013.06.079.