

# CHAPTER 10

## CHIP NUMBER VEHICLE APPLICATIONS AS PART OF INTERNET OF THINGS (IoT)

### 10.1 INTRODUCTION

Currently the number of motor vehicles is increasing in Indonesia. Based on BPS data 2014 Number of motor vehicles in 2014 as many as 114,209,266 vehicles consisting of passenger cars 12,599,138 units, 2,398,846 units of bus, car goods 6,235,136 units and the most dominant motorcycle 92,976,240 units. The city of Jakarta as the capital of the Republic of Indonesia in 2015 the number of motor vehicles as many as 17,523,967 units dominated by two-wheeled vehicles with the amount of 13,084,372 units. It was followed by private cars with 3,226,009 units, 673,661 units of freight cars, 362,066 units of buses and 137,859 units of special vehicles, while the road growth was only 0.01 percent so it was not comparable with the number of vehicles. One way to break down congestion in Jakarta is the reduction in the number of motor vehicles such as three in one for four-wheeled vehicles, the implementation of electronic road pricing (ERP), and the reduction in the number of motorcycles. The reduction in the number of motorcycles aims to reduce traffic density while reducing the number of traffic accidents. Guntoro Barovich, [1], The level of traffic accidents each year is increasing. This is due to the lack of awareness, discipline, tolerance and emotional high riders who have an impact on motorist negligence. Police korlantas data in zebra operations in 2015 there was a 5% increase or approximately 684,973 letters of infringement cases compared to 2014. In addition, another problem is the crime of motor vehicle theft. This is not independent of the behavior of vehicle users in driving a motor vehicle [2]. This accident or crime handling solution can be done in a way to control the number of vehicles in an integrated manner. The Internet Of Things (IoT) can be used as a vehicle detection control tool through the use of number plate chips

### 10.2. LITERATURE REVIEW

#### 10.2.1 Internet Of Things

Internet of Things (IoT) is a concept / scenario where an object has the ability to transfer data over the network without requiring human-to-human or human-to-computer interaction. IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS), and the Internet. A Things on the Internet of Things can be defined as subjects suppose people with implanted heart monitors, farm animals with biochip transponders, a car that has built-in sensors to alert the driver when tire pressure is low. So far, IoT is most closely related to machine-to-machine (M2M) communications in manufacturing and electricity, petroleum, and gas. Products built with M2M communication capabilities are often called smart or "smart" systems. (Eg smart label, smart meter, smart grid sensor). Although this concept was less popular until 1999, but IoT has been developed for decades. The first Internet tool, for example, was a Coke machine at Carnegie Melon University in the early 1980s. The programmers can connect to the machine via the Internet, check the status of the machine and determine whether or not there is a cold drink waiting for them, without having to go to the machine. The term IoT (Internet of Things) came to prominence in 1999 when it was first mentioned in a presentation by Kevin Ashton, cofounder and executive director of the Auto-ID Center at MIT.

### 10.2.2 City Smart Transportation System

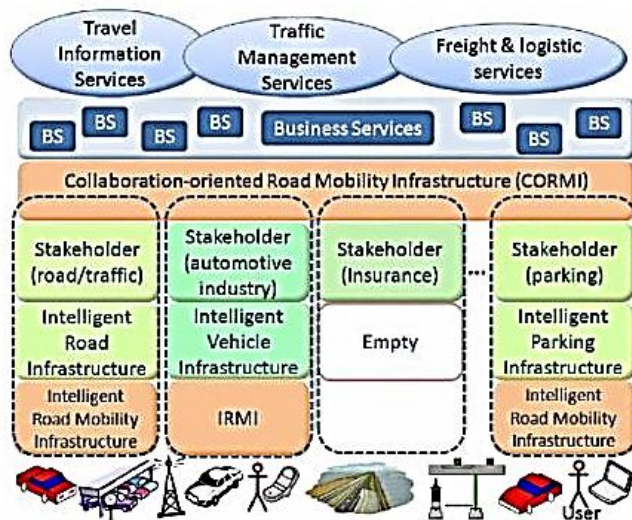


Figure 10.1: A Strategy to address mobility intelligent infrastructures [2]

### 10.2.3. Vehicle registration number

Every motor vehicle in the world has license plate as vehicle identity. The numbering system itself is governed by each State. Motor Vehicle Number Signs are made of aluminum plate with two lines of writing.

- The first line indicates: area code (letter), police number (number), and final serial code / series (letter)
- The second line shows the month and year of expiration

The raw material of TNKB is aluminum with a thickness of 1 mm. The size of TNKB for 2 and 3 wheeled vehicles is 250 × 105 mm, while for motor vehicles of 4 or more wheels is 395 × 135 mm. There is a straight line border of 5 mm between the police number room and the number space of expiration. In the upper right corner and lower left corner there is a special mark (security mark) print of the Traffic Police symbol; While on the right side and the left side there is a special sign printed "Ditlantas Police" (Directorate of Traffic Police) which is the patent of making TNKB by Polri and TNI). Examples of colors and marks of black motor vehicles City Jakarta looks like the picture below:



**Figure 10.2** Typical Jakarta Vehicle Registration number

<http://www.dibacaonline.com/2016/07/begini-cara-baca-ganjil-genap-plat.html>

The police number is given in accordance with the order of registration of the motor vehicle. The serial number consists of 1-4 digits, and placed after the Registration Area Code. Number, Letters And Sort And The City Identity. The codes of each city are different

in Indonesia. The coding of this vehicle number will be part of charging chip which will be affixed to plate part number.

### 10.3. RESEARCH METHOD

#### 10.3.1. Methods and Production Stages

Preparation begins with the design of digital vehicle number plates for the size of motorcycles and cars, personalized number plates with black background and white writing, government number plate with red base and white writing, and common number plates with yellow base color and colored text Black using arduino module. Next do the programming to produce the design in accordance with the criteria of the traffic law of the Republic of Indonesia and simultaneously input the data of motor vehicle identity in a chip that will be implanted in a motor vehicle. Next make low-energy Bluetooth to support the process of data transfer from motor vehicle to the point of installation of data receiver by using frequency 433MHz. The next step is designing a digital vehicle registration system as an identity that is included to complement the identity of vehicles brought by motor vehicle users, in case of infringement of the digital vehicle registration is checked to be matched with the identity of the motor vehicle and the data residing on the police server. To complete the process of traffic violation is also made a digital ticket that will be stored on the server every time entering data traffic violation.

#### 10.3.2. Design of Hardware Digital Identity

The identification of vehicles built using an ESP8266 chip contains vehicle data and the owner is always transmitted constantly through the wifi signal.



**Figure 10.3:** System Block Diagram and Vehicle Identity Embedded to ESP8266

Every motor vehicle, either motorcycles or motorcycles, are all supplied with chips containing the identity of the vehicle as stated in the current STNK. Chip used to store motor vehicle identity using ESP8266. This chip will be given an identity (SSID) in the form of police numbers of each motor vehicle because it is unique (each motor vehicle is different).

After all the data is inserted next ESP8266 chip paired in a motor vehicle and serves as a client that emits data. If found access point then this chip will connect and give the SSID to access point then forwarded to the server to note the identification of vehicles in the data base. Each client will have an IP obtained from the configuration after it is connected to the wifi signal on the access point. The ESP8266 computer and chip must be connected to the same access point. Once the ESP8266 chip is filled with the identity of the next vehicle the chip is mounted on a motor vehicle in accordance with the police number.



**Figure 10.4:** Digital Vehicle Identification

#### 10.4. Software design

To realize the identification of this motor vehicle required two software namely Arduino IDE and PHP. The ESP8266 chip is programmed using the Arduino IDE and Server using PHP. Arduino Software for designing hardware client and router while PHP for the purpose of designing web service. For client hardware mounted on a motorcycle or car in the form of ESP8266 chip with a program filled in the form of a police number that is used as the SSID (Service Set Identifier) using the Arduino IDE and transmitted continuously by the wifi signal.

In this router also uses ESP8266 chip that filled the program to detect the presence of motor vehicles by capturing motor vehicle SSID emitted via wifi signal. This router must

first connect to the internet via the access point nearest. Domain name system or commonly abbreviated with DNS is a system that serves to translate IP address to domain name or vice versa, from domain name to IP address. Thus, the host computer sends queries in the form of computer names and domain name servers which are then mapped to IP addresses by DNS. After getting the IP then the next router will scan the wifi signal from the client (motor vehicle SSID) whether there is a motor vehicle located around the router, if there is a motor vehicle SSID then the router will send the SSID to the server (web service) then the web server will bring the SSID The.

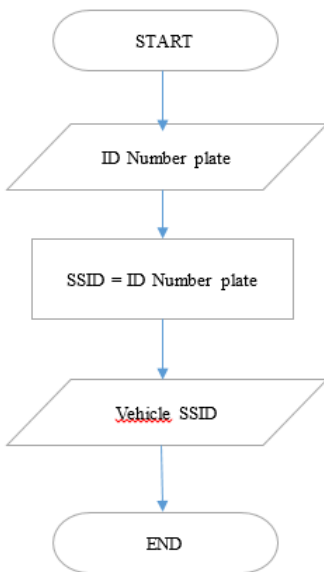


Figure 10.5: Flowchart Client

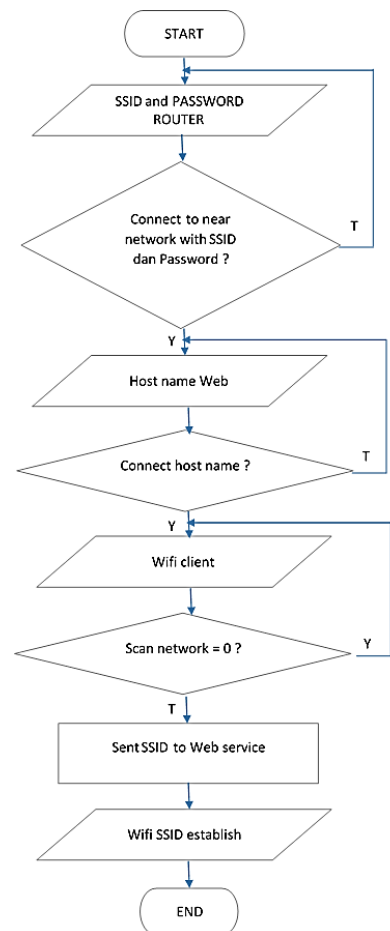
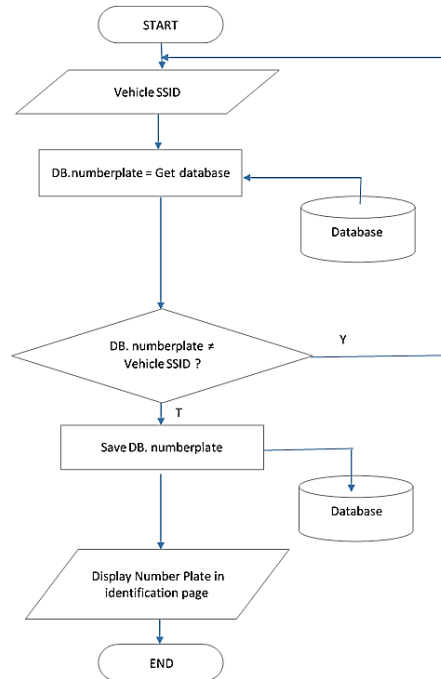


Figure 10.6: Flowchart Router



**Figure 10.7:** Flowchart Web Service

After the router sends the SSID of the motor vehicle to the next web service the system will check the database whether the SSID is already registered or not, if not then it will be displayed the police number of the vehicle only whereas if already registered web service will display complete data of motor vehicle beserta identity of vehicle owner motorized. The existence of the motor vehicle will be stored in the database and displayed in the monitor screen.

### 10.5. ANALYSIS AND DISCUSSION

After designing hardware client and router using wemos ESP8266 and server to accommodate database of motor vehicle identity. Routers are placed around the parking area of either motorcycle parking or car park due to the wifi signal range of about 10 meters. This router will capture the wifi client signal in the form of motor vehicle SSID set up in the form of police number (license plate). Then the router will forward the SSID to the data

server and then will be displayed on the monitor screen in the form of the identity of the motor vehicle



**Figure 10.8:** Router Installation (a) and Motorcycle Identification (b)

ESP8266 chip that functioned as a client filled by the identity of motor vehicles in the form of police numbers, then the chip will emit wifi signal continuously until found by a router. In this case the identity of motorized police license L 6125 QZ, this police number is used as the SSID name of the client. Each motor vehicle will have a different SSID because it uses the identity number issued by the authorized party that is the police and of course the police number of each motor vehicle will be different.

Like a motorcycle, the car was given ESP8266 chip that has been filled with the identity of the car. The identity of the complete vehicle and vehicle owners are stored in the database server. The test is done in the parking lot of Narotama University's campus area by installing a router to identify the motor vehicle located around the router. The router will always scan the wifi signals scattered around it, but only the number plate format will be captured by the router and forwarded to the server to display the identity of motor vehicles on the monitor screen. This router will automatically send data to the server when the wifi client signal has a format like the license plate of the vehicle. In this case use xenia car with police number L 1676 HB which is in the parker near the mosque of Narotama University Surabaya.





Figure 10.9: Vehicle identification

Routine motor vehicle user to the Narotama University campus of Surabaya must register their vehicle identity to the computer server to be recorded in the database of motor vehicle owners. The right to enter the motor vehicle identity data is the admin of this system. If already registered then the system will display the data of the owner of the motor vehicle, if it is aguest then it will display the police number only and the date and time to enter the campus.

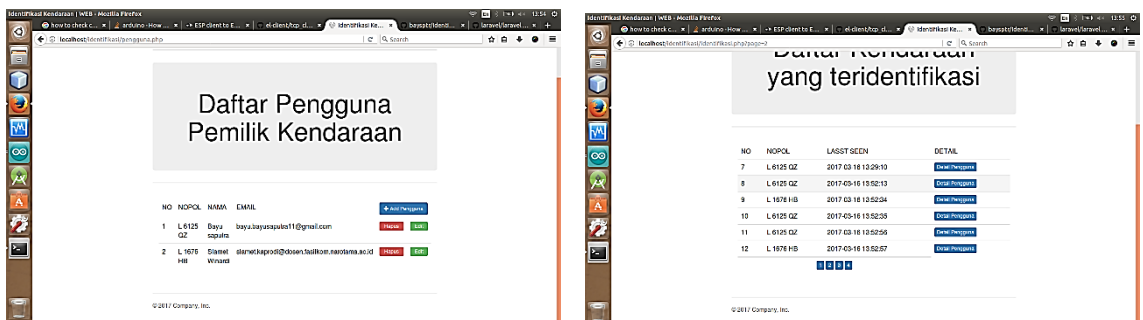


Figure 10.10: Owner database and vehicle identification

Data embedded in the ESP8266 chip will be recognised and can be reached by a router that has been installed in certain places. The signal emitted by the client will be captured by the router and then the SSID client will be forwarded to the data server to retrieve the database that has been input in a separate server. The data will be displayed in a monitor to detect motor vehicles that are around the router. At the current stage of the development, there are two data can be displayed which are the vehicle registration number

and the last time connection with the router. However, there are further data development for a complete system.

## **10.6 CONCLUSION**

After completing the design and test of the system, it can be concluded from overall system of motor vehicle identification with Wi-Fi technology obtained the following results:

1. The system is able to recognise the registration number according to the Republic of Indonesian Police force code.
2. The ability to reach 10 meters radius to detect the existence of vehicle with the help of signal emitted by it.
3. Facilitate the identification of vehicle in the event of problems that are crucial and can be used for the purposes of programs planned by the government in the form of odd numbered restriction, restrictions on the purchases of fuel and others

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