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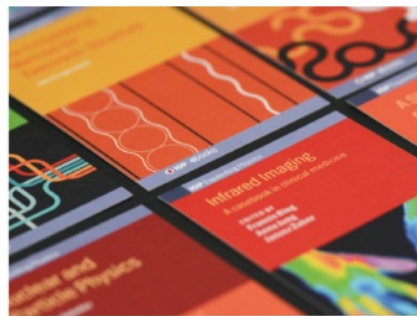
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## Progressive Parking Smart System in Surabaya's Open Area Based on IoT

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**Abstract.** Nowadays, progressive parking systems still have disadvantages. It only serves to notify total parking rates to motorized vehicle users when they are still in the parking area. Besides, the payment uses cash. Meanwhile, some users want to pay parking fees using tokens or virtual money. It has dual functions. They are a total parking tariff notification online and to reduce the leakage of parking rates because parking users are not given tickets by park officials. Moreover, it can find out the position of the vehicle in the parking area. By using the GPS Module, it will send data to Arduino Uno if the vehicle is in the parking area. Furthermore, it will activate the initial parking time with the Wemos D1 Mini controller. Later, it will provide notifications on the user's smartphone using the *Blynk* application. Users can find out the total parking rates that will be paid through notifications on the smartphone and directly cut the balance in the parking user account progressively. The trial of an opened area progressive parking system based on the Internet of Things (IoT) produces a tool that is able to provide modern notifications using wireless or hotspot connections.

**Keywords :** Progressive Parking, Open Area, Smart System, IoT

### 1. Introduction

Each city must have parking infrastructure. It arranges the vehicle according to its place temporarily. Meanwhile, it is also one of the main problems that arises because the traffic increases as well as the impact of the development of transportation facilities which continues to increase [1]. There are several things that must be considered in parking problems. They are parking lots, parking rates, convenience and parking services [2] [3]. Parking customers often complain that parking costs are too expensive because some parking lots impose fines if they park over time. Progressive parking costs for motorcycle IDR. 2000 for the first 2 hour and for car IDR 5000. If they park for more than one hour, they must pay an extra fee of IDR. 500/hour for motorcycle and for car IDR 1000. Based on customers' complaints, the writers start to conduct a research by creating a progressive parking system

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based on IoT. With this IoT-based progressive parking system, it can minimize customer complaints if they get parking fee fines, namely by sending notifications to customers' smartphones, to find out the total parking rates obtained. Therefore, there is a Wemos D1 Mini microcontroller on each vehicle. It serves to connect vehicle data to the customer parking smartphone.

Some researches about car parking that have been carried out include, based on smart parking and IoT-based parking. Begins by researchers Idris et.al, namely reviewing several papers from various papers, all of which are paper-based smart parking, some are parking management, e-parking, hardware-based parking (microcontroller, RFID and other sensors) [4], Research conducted by Hilmani, namely designing and developing smart parking systems using wireless sensor networks (WSN) technology with adaptable controls and hybrid self-organization algorithms [5], but the weakness of this system is that sensors must be installed everywhere. Research conducted by Shaikh, et.al. almost the same as research conducted by Hilmani using WSN technology [6], but this research is more complete by providing information on empty parking lots and several other features. The management architecture design uses intelligence is distributed and the decisions are decentralized [7]. The proposed architecture is scalable due to the addition of additional new peripheral subsystems supported by the introduction of gateways that do not require re-engineering of the communication infrastructure, research conducted by Alam, et al. [3].

Other IoT-based studies, including Kanha, et al., Present an IoT-based cloud-based smart parking system [8]. The proposed Smart Parking System consists of an IoT module which is used to monitor and indicate the condition of the availability of each parking space in parallel. A mobile application is also provided that allows users to check the availability of parking spaces and book a suitable parking space. Then research on other IoT, information about the nearest car park from the user's position and information on traffic jams by Alsafery [9]. The study by Thanh et al., Is almost the same as other studies with cloud-based from the IoT architecture [10], by offering easy parking for its users. The research related to IoT, with implementation outside parking, is automatic smart home security, using a Microcontroller Launchpad TI-CC3200 board equipped with an embedded microcontroller and integrated Wi-Fi shield [11].

From some previous studies, whether the smart parking research based on IoT or without IoT, is basically the same, which makes it easy for user automation to find available parking spaces quickly and efficiently. In terms of hardware usage, on average, it uses various sensors and several types of microcontrollers and is still in prototype form. Whereas in the research that has been done is to make and develop tools to detect, if motorized vehicles are parked in a predetermined parking area that is automatically installed significantly in every parking lot in Surabaya, East Java, Indonesia. And is equipped with an application to connect the parking device with the user's smartphone, find out how much the total parking fee charged. But in this paper the discussion is limited to the System that is made to work, if connected to Wifi or Hotspot because it uses the Android Application, then the user is required to have an Android-based smartphone. However, parking rates are based on simulations and Wemos D1 Mini as a microcontroller to connect the Server and User.

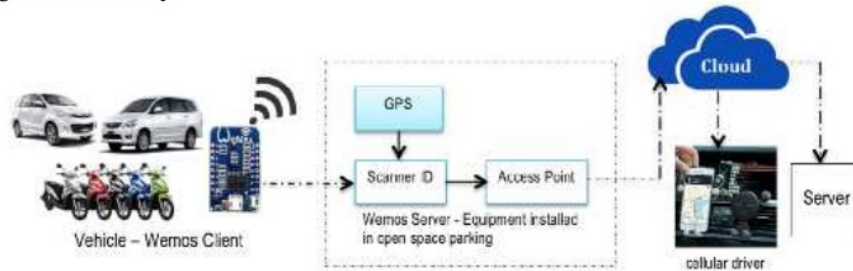
## 2. Methods

The methodology is an essential thing as a way of conducting research. It includes literature review, problem analysis, hardware design, program writing, test results and documentation.

The functional requirements of this progressive parking system are a system capable of detecting the presence of a vehicle or car [12], a system capable of making parking reservations and a system capable of monitoring parking [13]. Progressive parking location system used in this study is to implement a system design that has been built. Test data used for implementation are data on the number of vehicles parked and parking locations in open spaces in Surabaya, East Java, Indonesia. The system architecture is shown in Figure 1. The design of the system is done by stating the functional specifications of the system, starting from data acquisition to the output results obtained by the user. Systematically, the flow of the system functions starting from the vehicle to be parked is assumed to have chips installed on each vehicle, when the vehicle is parked in an open space (progressive parking), the wemos claim signal that is on the vehicle chip will be captured by the wemos server signal and access point in the parking lot, so that the data using IoT cloud will be



communicated with the server and to the user's mobile to make payments, so that it will reduce parking losses manually.



**Figure 1.** Block diagram of Progressive Parking.

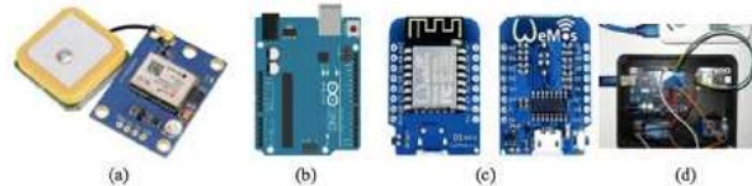
### 2.1. Existing Progressive Parking Conditions

Progressive parking is a levy payment system that is calculated based on the length of parking time. The longer the vehicle is parked, the greater the fees that must be paid. In this study a progressive parking system was created, which was only implemented in two locations, namely in Bungkul Park and Surabaya City Hall.

In principle, progressive parking on a system that is made, if the vehicle stops at a designated parking area and is detected by the bus and access points for 300 seconds, then the vehicle is declared to be progressive parking.

### 2.2. Hardware Design

The progressive parking identification is built, the initial work is the D1 Mini wemos installed in the vehicle, will emit a signal to the equipment installed in the open parking area, then the information obtained is forwarded to the Wemos D1 Mini and data processing is performed. The Wemos D1 Mini will transmit parking status information and will be received by the access point and forwarded to a web-based parking management server. Information data on the cloud will be uploaded with special application software in the driver's gadget, so that the driver can immediately get information about progressive parking and will deduct the balance in the driver / user's cell. Figure 2. shows the design of the supporting hardware needed to build or design a progressive parking system based on IoT.



**Figure 2.** Supporting Equipment for IoT-based Progressive Parking Systems, (a) GPS, (b) Arduino Uno, (c) Wemos D1 Mini, (d) Complete Circuit System

#### 2.2.1. Wifi Network

Wifi stands for wireless fidelity, a development of the term Hi-Fi, a wireless network technology that is used throughout the world. Wifi refers to a system that uses the 802.11 standard, which was developed by the Institute of Electrical and Electronics Engineers (IEEE) and was released in 1997 [14] [15]. Initially Wifi was intended for the use of wireless devices and Local Area Networks (LAN), but now more is used to access Internet. In short, the workings of wifi on a computer that is wireless LAN that has been configured so that it becomes wifi will receive data from computers in digital form. Then the data will be converted into radio signals and then sent to the router, sending these waves through the antenna on the adapter. And the signal from the router will send data that has been

processed from the internet to a computer that is connected to the WiFi adapter [16]. For internet use, wifi requires an access point commonly called a hotspot to connect and control between wifi users and the central internet network. A hotspot is generally equipped with a password that can minimize anyone who can use the facility.

### 2.2.2. Internet of Things (IoT)

Internet of Things (IoT) was first introduced by Kevin Ashton in 1999 [17] [18]. Although it was introduced 15 years ago, until now there has not been a global consensus on the definition of IoT. But in general the concept of IoT is defined as the ability to connect smart objects and enable them to interact with other objects, the environment and other intelligent computing equipment through the internet network [19]. IoT in its various forms has begun to be applied to many aspects of human life, this research is applied to the detection and payment of progressive online parking vehicles.

### 2.2.3. Supporting Hardware

Figure 2.a. Gps (Global Positioning System) module requires power or about 5V power that is connected to Arduino Uno. The Gps module itself functions to send latitude and longitude data (position) to Arduino Uno [20]. Arduino Uno microcontroller is also used as a power or conductor of 5V, and control of the Relay, and Wemos D1 Mini [21]. At pin 5V is used to supply the voltage to the GPS. Pin (D3) with Gps (TX) to send Gps signals to Arduino Uno which will later be translated as latitude and longitude. Pin (D4) with Gps (RX) to send Gps signals to Arduino Uno which will later be translated as latitude and longitude. Pin (D8) with Relay (IN) to give a high or low signal, shown in Figure 2.b. While Wemos D1 Mini is a process to connect a hotspot or wifi network contained in a parking area [22], Figure 2.c. Then send data to the server and then forwarded to the user's smartphone. And picture 2.d. is a circuit mounted on a progressive parking area.

### 2.3. Software Design

Realization of progressive parking identification requires three software namely Arduino Bootloader [23] to program wemos d1 mini as a client, server and router, PHP software to create a parking management application program on a server and Android Studio software to create an Android-based application program for gadgets (smartphones). The client hardware in this case is the client client filled with a program in the form of a vehicle ID number as SSID (service set identifier) and can receive signals sent from the server wemos and process them using Arduino Bootloader software and transmitted continuously by wifi signals. For hardware routers also used wemos d1 mini server which is programmed to be able to capture the wifi signal that is emitted by the hardware client wemos. This router must be connected to the internet network through the nearest access point and scan the SSID client then send it to the web service and the web server will display the status of the vehicle. For software design flowcharts can be seen in Figure 3. progressive parking system in an open space based on IoT.

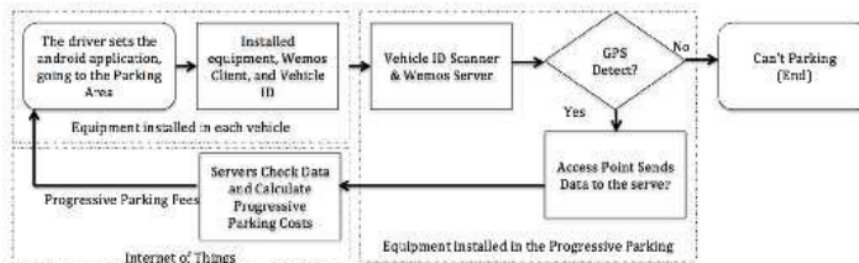


Figure 3. Flowchart of Progressive Parking System

### 3. Results

In accordance with Figure 2.d. and Figure 3, GPS sends data to the Arduino Uno microcontroller. If the vehicle is in a parking area that is equipped with wireless or hotspots, the Arduino Uno will

connect to the Relay to connect to the Mini D1 Wemos. In the admin display, there are 4 buttons, namely 1 button to return to the upper left and 3 buttons to the upper right. First, the project settings function to change or edit the name of the project, theme, and notification. Second, the widget box functions to add Step V tools. The last button works to run applications that have been created (IoT Parking). In the User's Blynk Appearance Display, the way to run it is that the user (driver) simply clicks on the application contained on his smartphone, then the display will appear as above. The application will determine the progressive parking rate or the total parking rate to be paid.

Table 1 describe progressive parking rates for motorcycles and cars. For motorcycles, it costs IDR 2000 for the first 2 hours. Next, it will get a progressive tariff of IDR 500. It means that a motorcycle that has more than two hours of parking will increase by IDR 500 and so on. For instances, Honda Vario motorbike, license plate K 2125 YQ, parks for 90 minutes (1.5 hours), it will get a basic rate of IDR 2,000, - On the other hand, Yamaha RG10, license plate L 2428 KX, parks for 240 minutes (4 hours), it will get a progressive tariff of IDR 3,000. For cars, it costs IDR 5.000 for the first two hours. Next, it will get a progressive tariff of 1.000. For instance, Daihatsu Xenia car, license plate L 1676 HB, parks for 110 minutes (1 hour 50 minutes), it will get a basic rate of 5.000. On the other hand, Honda Brio car, license plate L 1609 OC, parks for 215 minutes (3 hours 35 minutes), it will get a progressive tariff of 7.000.

**Table 1.** Database of Motorcycle & Car Parking

No	ID Vechile	Vechile Type	Start Parking	End Parking	Duration (Minute)	Parking Rate IDR
1	K 2125 YQ	Honda Vario	09:00	10:30	90	2000
2	L 4148 CA	Honda Supra	09:00	12:45	215	3000
3	K 2684 PQ	Honda Beat	10:00	11:00	60	2000
4	L 2428 KX	Yamaha RG 10	10:00	14:00	240	3000
5	L 5662 HF	Honda Supra X	10:22	13:18	176	2500
6	L 1676 HB	Daihatsu Xenia	08:00	09:50	110	5000
7	L 1809 OC	Honda Brio	09:10	12:45	215	7000
8	L 1277 HK	Kijang Innova	10:00	11:00	80	6000

#### 4. Conclusion

Gps Module Sensor Device for detecting parking vehicles in this research to cover existing shortcomings in the current Gps Module sensor. It is an IoT-based system. The conclusion is as follows: Progressive parking system in open space can run as desired by using the Android application. It aims to make it easier for vehicle users and find out the parking rates that must be paid. If the Gps Module sends data to Arduino Uno when the vehicle is in the parking area, it will activate the Relay to connect it to the Mini D1 Wemos. Then, it is continued to the user's smartphone via notification. With an online parking payment system, it can reduce parking budget leaks because it is directly connected with e-money balances and is directly connected to the server. Moreover, it can find out the number of vehicles parked in certain locations.

#### 5. References

- [1] Suthanaya P.A., (2017), *Development of Parking Demand Model for Private Hospital in Developing Country (Case Study of Denpasar City, Indonesia)*, Journal of Sustainable Development; Vol. 10, No. 5, pp. 52-60.
- [2] Sitesh K. S., (2014), *Study of Parking Patterns for Different Parking Facilities*, International Journal of Civil and Structural Engineering Research, Vol. 2, Issue 2, pp. 35-39.
- [3] Yulong H., Xiaoduan S., Lizhen D., Ruan J. and Subasish D., (2012), *Level of Service for Parking Facilities*, International IEEE Conference on Intelligent Transportation Systems Anchorage, Alaska, USA, pp. 1161-1165.
- [4] Idris M.Y.I., Leng Y.Y., Tamil E.M., Noor N.M. and Razak Z, (2006), *Car Park System: A Review of Smart Parking System and its Technology*, Information Technology Journal, Volume: 8 Issue: 2, pp. 101-113.



- [5] Hilmani A, M. Abderrahim and H. Larbi, (2018), *Designing and Managing a Smart Parking System Using Wireless Sensor Networks*, Journal Sensor Actuator Network, Vol 7, 24, pp. 1-20.
- [6] Shaikh I. F., Jadhav P. N., Bandarkar S.P., Kulkarni O.P. and Shardoor N.B., (2016), *Smart Parking System Based on Embedded System and Sensor Network*, International Journal of Computer Applications, Volume 140 – No.12, pp. 0975 – 8887.
- [7] Alam M., D. Moroni , G. Pieri , M. Tampucci, M. Gomes, J. Fonseca, J. Ferreira, and G. R. Leone, (2018), *Real-Time Smart Parking Systems Integration in Distributed ITS for Smart Cities*, Hindawi Journal of Advanced Transportation, Volume 2018, pp. 1-13
- [8] Khanna A and R. Anand, (2016), *IoT based Smart Parking System*, International Conference on Internet of Things and Applications (IOTA), IEEE, pp. 266-270.
- [9] Alsafery W., B. Alturki, K Jambi and S. Reiff-Marganiec, (2018), *Smart Car Parking System Solution for the Internet of Things in Smart Cities*, International Conference on Computer Applications & Information Security (ICCAIS), IEEE, pp. 1-5.
- [10] Thanh N. P., Ming-Fong T., Duc B. N., Chyi-Ren D., And Der-Jiunn D., (2015), *A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies*, IEEE Access Vol. 3, pp. 1581-1591
- [11] Ravi K. K., Vishal J., Suvadeep B. and Lakshmi B., (2016), *IoT Based Smart Security and Home Automation System*, International Conference on Computing, Communication and Automation (ICCCA), IEEE, pp. 1286- 1289.
- [12] Aalsalem M. Y., Wazir Z. K., Khalid M. D, (2015), *An Automated Vehicle Parking Monitoring and Management System Using ANPR Cameras*, International Conference on Advanced Communication Technology (ICACT), pp. 706-710
- [13] Todd Litman, (2019), *Parking Management Comprehensive Implementation Guide*, Victoria Transport Policy Institute.
- [14] Ramia B. M. A, Amin B. A. Mustafa, and Ashraf A. O, (2015), *A Comparison between IEEE 802.11a, b, g, n and ac*, Standards, IOSR Journal of Computer Engineering (IOSR-JCE) , Volume 17, Issue 5, Ver. III, pp. 26-29.
- [15] Der-Jiunn D., Shao-Yu L., Jordan L, And Kwang-Cheng C., (2016), *On Quality-of-Service Provisioning in IEEE 802.11ax WLANs*, IEEE Access, Vol. 4, pp. 6086-6104.
- [16] Homeland Security, *A Guide to Securing Networks for Wi-Fi (IEEE 802.11 Family)*, United States Department of Homeland Security (DHS) Cybersecurity Engineering
- [17] Alessandro B., Martin B., Martin F., Thorsten K., Rob van K., Sebastian L., and Stefan Meissner, (2013), *Enabling Things to Talk Designing IoT solutions with the IoT Architectural Reference Model*, Springer.
- [18] Pradyumna G., Omkar B. and Sagar B., (2018), *Introduction to IOT*, International Advanced Research Journal in Science, Engineering and Technology, Vol. 5, Issue 1, pp. 41-44.
- [19] Zainab H. Ali , Hesham A. Ali, and Mahmoud M. B., (2015), *Internet of Things (IoT): Definitions, Challenges and Recent Research Directions*, International Journal of Computer Applications (0975 – 8887) Volume 128, No.1, pp. 37-47.
- [20] Rui Liang, (2017), *The Design of GPS Information Display System Based on Arduino UNO R3*, International Conference on Mechatronics, Computer and Education Informationization (MCEI 2017), Advances in Computer Science Research, volume 75, pp. 590-594.
- [21] Anjari L. and Budi A. H. S., (2017), *The Development of Smart Parking System based on NodeMCU 1.0 using the Internet of Things*, International Symposium on Materials and Electrical Engineering (ISMEE), IOP Conf. Series: Materials Science and Engineering 384, pp. 1-8
- [22] Hettiarachchi L. H. A. D. U. S. and Sagara Sumathipala, (2018), *Smart Vehicle Parking Lots And Automated Lighting System for Parking Lot*, Systems Engineering Technologies.
- [23] Adil H., Abderrahim M. and Larbi H., (2018), *Designing and Managing a Smart Parking System Using Wireless Sensor Networks*, Journal of Sensor and Actuator Networks, Vol. 7 (24), pp. 25- 44.



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