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Real-time Parking Information System with Cloud Computing Open Architecture Approach

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ABSTRACT

Technology nowadays is evolving quite fast and human themself try to transform everything into digital to make things easier and reachable without space and time limitation. For instance a cloud server that make possible for a person or a company to have a server without have any real physical server. It can reduce cost and easy to maintain. In current parking system there are local server that serving a ticketing and billing, few of them are displaying the park lot status in a front gate for to notify the users. In this paper we provides a concept to make the information of park lot go directly onto users hand with smartphones assistance so decision time will be reduce.

Key words : Cloud computing, smart monitoring, parking system, service oriented architecture

1. INTRODUCTION

A parking lot for a shopping center or hotel usually using a parking system management from a third party that provides a ticketing and billing service for the users. In a modern city a VMS (variable message sign) place on parking area and the displayed message control by an operator [1]. If the parking are full then there is no other way than looking for another park lot even in outside of the current park lot and of course it will be a waste of time for doing that. There is another thinking for using a spatial information to deliver exact location of available parking lot [2]. This system is using a 4S technology: GIS (geographical information system), GNSS (global navigation satellite system), ITS (intelligent transport system) and SIIS (spatial imagery information system). This method make users easier to get a park lot with PDA (personal digital assistant). That information are provide for positioning. Another design is to monitoring system with Internet of Things (IoT) paradigm which is provides displaying information on a smartphones [3]. These technology are meant to solve a parking problem, today economic evolving are very fast in a city and parking lot

became a social issue and from a driver perspective while selecting a parking lot, information about parking lot is really important[4]. With idea of transferring information directly to driver, we intend to solve a problem with parking area management.

2. SCOPE AND PURPOSE

Numbers of people buying a vehicle are increasing and that was one of many factors of traffic cause nowadays alongside with car parking problem contributing as major problem worldwide scale [5], indirectly a parking lot which is serving users include in those vehicle are increasing as well. While in other case that the users wasting time looking for a park lot outside of the building as an alternative place for parking or move to next mall and still hoping there still a parking lot available for them. Most cities face a problem for finding a parking space and the drivers used to finding it within 7.8 min average [6]. This uncertain event absolutely time consuming. With that in mind how if we can deliver that parking information to a driver in a real time so time will surely reduced. With assistance of smartphone and a fusion of several technology that idea can be realise and that the point of this paper. Like Gubbi *et al* stated there will be 9 billion interconnects devices and forecasted 24 billion in 2020 [7]. While the city goes to smart city context those number of interconnected devices are real deal and will became chaos if the system and infrastructure don't support it. Later on we
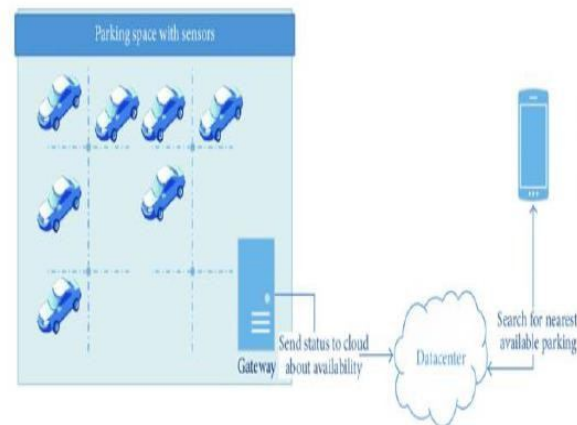

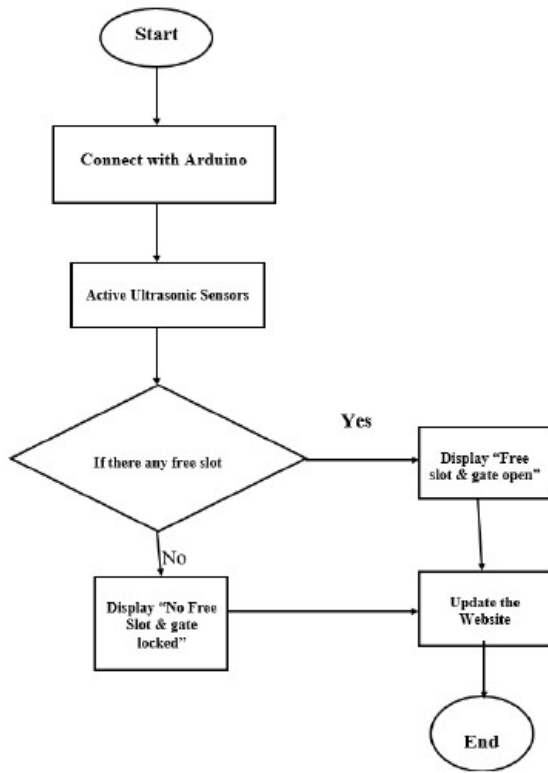**Figure 1:** Parking System Using IoT

Figure 2: Flowchart Parking Information

will focusing on it design concept. In this paper we limited the scope in a one of Indonesia large city in this case was Medan city, North Sumatera which is will be an example for concepting in this paper.

3. LITERATURE REVIEW

Basically parking system aims to provide information about the availability of parking that will be used to manage parking spaces at a place and provide information to users regarding the availability of parking spaces. There have been several previous studies regarding parking systems including integrating IoT-based parking systems with cloud (Figure 1) [8], in his research proposed a smart parking system that was used to monitor every available parking space and provide a mobile application to see the availability of parking and order the desired parking space. Mainetti et al., n.d. using a RFID to detect available space for parking then transmit it through IEEE 802.15.4 Network to Smart Gateway so the data can be forward to central server via GPRS [9] a research aims to reduce congestion rates in urban areas because of the large number of vehicles seeking parking, IOT-based smart parking systems are applied, in its application using arduino (as the whole brain system) and sensors in each parking area to determine parking availability, which the conclusion is the benefits of reducing time and fuel because the smart parking system developed provides information about the availability of parking spaces, Figure 3 show flow chart and circuit diagram of automated Car parking. Similar to IoT applied to transportation system [10]
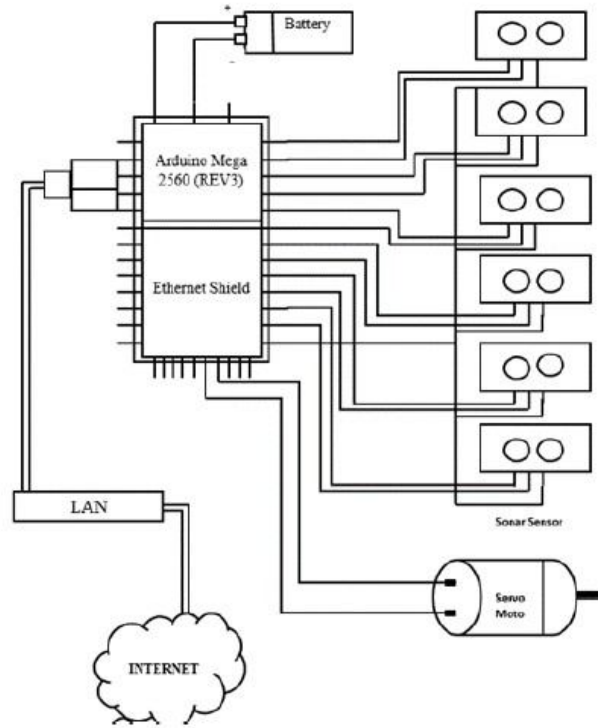

Figure 3: Circuit Diagram Automated Parking

In other words SOA (service oriented architecture) helping those parking system management to talk to each other without knowing what operating system they use. Like clearly illustrate in Figure 4 [11]. Many of parking management system are third party which is processing this kind of stuff. Different system and method are exact fact for the service provider.

What will we do with SOA is using it method combine with Cloud Computing Open Architecture (CCOA). Though it was cloud computing that contain a service of this entire system so outside attack to cloud infrastructure should be consider as well [12]. As shown in Figure 5 about cloud computing play as a center of the system gravity. Cloud platform need to suitable with purpose and system architecture, there is a several cloud
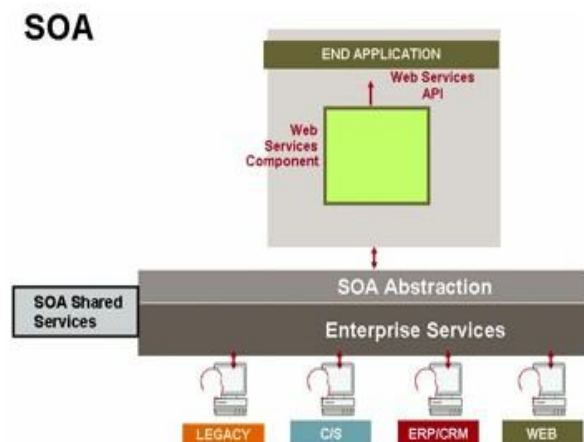

Figure 4: Service Oriented Architecture

Figure 5: Cloud Computing

platform who offer a different architecture, application and characteristics [13]. And Zhang and Zhou develop a combine architecture contain SOA and Cloud Computing that will be used as an approach method in this paper. CCOA use the power of SOA and virtualization context of Cloud Computing ecosystem with its reusable and customizable seven architectural principles of CCOA [13].

3.1. Integrated Ecosystem Management for Cloud
In this first principle, it is expected that the integration of all parties involved in cloud computing ecosystems. Integration that is expected to help, manage and support all the needs of both vendors, partnets and users of cloud computing services.

3.2. Virtualization for Cloud Infrastructure
In this second principle , it is expected that virtualization in the cloud infrastructure will enable users to manage cloud computing both regarding hardware and software in the form of interfaces. The interface can later be used to manage hardware requirements such as plug-and-play mode, handling storage related to performance and remove actions, on the software architecture side it is expected to manage software including operating systems, code, logic changes and can be assembled and executed dynamically based on reusable code element composition and just-in-time compilation technology.

3.3. Service-Orientation for Common Reusable Services
In this third principle, it is expected that the public services available in cloud computing can be reused which
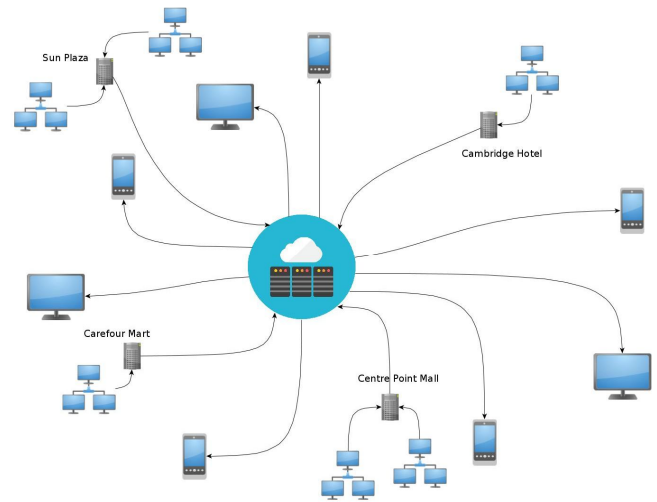

Figure 6: CCOA Framework

Figure 7: Proposed Designed System

include various services that hide the complexity of middleware, databases and tools used as provision, utilization, monitoring, billing tools such as Customer Relationship Management and Enterprise Resource Planning (ERP), the service is called (Cloud Horizontal Business Services). And other services, namely Cloud Vertical Business Services include, for example, shipping and payment services.

3.4. Extensible Provisioning and Subscription for Cloud
In this fourth principle, it is expected that cloud computing will make it easy for users to expand their use of cloud computing services according to their needs and subscribe to the cloud.

3.5. Configurable Enablement for Cloud Offerings
In this fifth principle, cloud computing is expected to be able to provide services that can provide convenience for users in configuring the cloud services used. The service is in the form of an interface through a web browser to be used in interacting with the parties involved in cloud services. In addition, the service is expected to be able to manage configuration changes in the software and can be tested to find out whether the changes made are good before being published to end users.

3.6. Unified Information Representation and Exchange Framework
In this sixth principle, the results of managing information and exchanging data are used in cloud computing resources to allow collaboration and present effective features in accordance with the roles of each party involved. The results of information management are related to their respective roles to define their functions in the dynamics of the Cloud Computing ecosystem. potential resources to support collaboration between various business entities in the Cloud Computing environment are events, documents, transactions, business processes, reference links, annotations, and projects, assignments. Where existing message exchanges will form the patterns used again to support
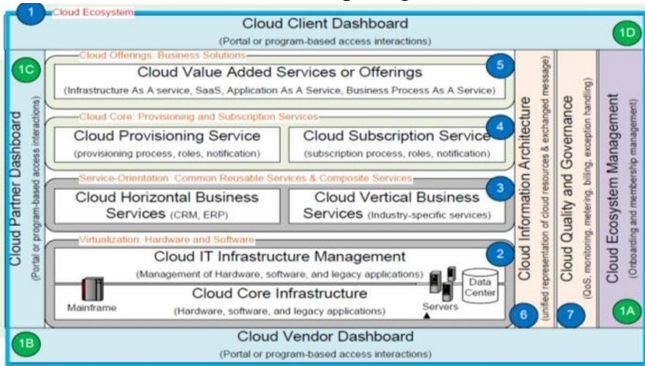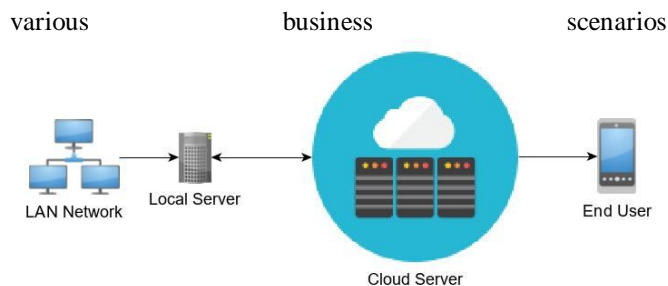
various business scenarios

Figure 8: Data Flow

which will then form the foundation for Architecture cloud information.

3.7. Cloud Quality and Governance

In this last principle, it is very important because cloud services must pay attention to two perspectives, namely quality service and governance. In the quality service point of view includes security, reliability, response time, and integrity (according to existing rules or compliance). Whereas from a governance point of view it includes coordination and communication in managing, operating the cloud properly.

4. SYSTEM DESIGN

4.1. SOA Integrated Cloud

Here we will try to visualize an integrated SOA and Cloud. With variety of system and service from each third party companies who responsible for parking management with their business partner. In this case we will be using a cloud service available in the market. While the SOA system do its role as middleware for these parking management system we will handle the data warehouse in the cloud and some of them will be collects and analize then display it on user smartphone with web view display. Another data will be for internal use of future improvement. User interface (UI) design also play important part of this system, while displaying a simple but useful UI will result a better efficiency.

4.2. Flow and Appearance

Figure 9: End User Main Menu UI

Figure 10: End User Sub-Menu UI

This system has a normal flow like others cloud based system infrastructure shown in Figure 7 but simple information flow are applied where a LAN Network with a input devices such as

a barcode scanner, RFID reader or a manual ticketing input which is role as first layer of data input collected into a local database and then transmit to cloud databases via API and the last is the end user retrieve the information via web view service on desktop or smartphone. As the appearance or the UI we do a simple but accurate design which is displaying a core information via mobile web view and will be more or less like shown in Figure 9 and Figure 10 which contain destination and parking lot status.

5. CONCLUSION

Technology exist to help people do their job easier, since first appearance of technology people keep developing and improving to get a better result. With this paper we hope to support people for use time more efficient and effective. We use several technology such as SOA, Cloud Computing, Web Service and much more. This system can be implemented in modern city with parking management available in each node of planned point. User can see parking status from many parking system management so decision can be made and no more wasting time for parking issue. We encourage you to develop more system or in bigger scale like smart city and its accompany with one purpose is to make life better.

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