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Analysis and Implementation Wireless Sensor Network of Information Technology Systems

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ABSTRACT:- This paper, we propose a smart home system based on two approaches. The first approach is topologi architecture mesh and the second is the protocol of Wireless Sensor Network (WSN) are efficient. This system has two working environment, indoor and outdoor. Indoor environment using WSN system, while the external environment usingsystem. internet-cloudThis scheme is known as the Internet-of-Things (IOT). Indoor and outdoor environments connected to each other by means of a connecting bridge. WSN system formed from the components of WSN that uses a mesh topology. Each component of the WSN designed for implementing efficient data protocols are proposed. For outdoor environments, system-cloud Internet that there is a major infrastructure. Thus, the smart home system can be monitored and controlled from a smartphone, anytime and anywhere, as long as access to mobile data is available. For the evaluation of the system, several tests have been done to get the system profile.

Keywords:- Internet-of-Things, intelligent home systems, wireless sensor networks, mesh topologies

I. INTRODUCTION

Internet-based information system is a fundamental study of the concept of the Internet-of-Things (IOT). Various scenarios in the study of this topic have been published, ranging from the physical layer to the application layer. These conditions encourage the rapid development of the IOT concept to further the scheme, namely the Internet-ofEverything (IOE). IOE concept is not just talking about how to connect something just based on their function, but also establish a system that supports intelligent application (eg user status monitoring, user activity log, doctor's treatment plan, etc.). This is a scheme that is more complex than just basic communication Machine-to-Machine (M2M). The issue of the IOT generally revolve around the topic of power consumption, flexibility of systems, intelligent systems, selfconfigurable, and security issues. Regarding these issues, there are few studies conducted to try to find a solution. For example, the operating system (OS) light (light-weight) be a solution in facilitating the development of applications and implementation of the system [1]. The advantages of this OS is a level lower than the power requirements of complex OS and easy to configure. Therefore, the problem of the low power consumption and system flexibility can be partially solved with this technique. Several studies on the integration of light-weight OS in Wireless Sensor Network (WSN) has been widely publicized. For example, Harri Pensas et al propose Epis integration with TinyOS 2.0[2].

In 2012, Zhang et al filed Chunlong WSN integration with µC / OS-II [3]. In addition to light-weight approach based OS, multiple data protocols have been proposed to solve problems related IOT, which is an efficient power consumption, system configuration easy, and secure system. For example, Yuanbo Xu et. al. proposes WZ-LCP with authentication and key reforms as a solution to the security problems [4]. Another solution is a mesh network topology, especially for heterogeneous smart home applications. Mesh network topology has greater flexibility to disturbance and enable a variety of pathways to achieve the objectives [5]. Basically, the study area IOT not only focused on WSN, but the connection to the internetcloud are things that need to be examined as well.

A device that serves as a bridge between the outside environment (internet-cloud) and the environment in (WSN) has an important role. Because, this bridge has the responsibility to convert the data protocol and store important data. For example, the publication [6] proposes the use of the MySQL database engine for data storage. By using this database system, information management will be easy to do. Moreover, if we can choose a system that is low-cost database (opensource and light-weight), then it would be a better choice. In this publication, we try to complement the concept of smart home design by designing a platform that efficiently and easily configured for smart home system. It is based on the optimization of data protocols and the architecture of WSN. Efficiency is based on the optimization of existing WSN data protocols that have been proposed in our previous study [5]. Meanwhile, configurability is based on a mesh topology architecture design and embedded software program. Associated with WSN, we use three types of connections, ie ZigBee, Bluetooth, and WiFi. Each type of connection can be complementary to each other, so that the weaknesses of each connection can be eliminated. For databasing system, our system uses SQLite as a low-cost and lightweight to be implemented. In this databasing system, we save any important information about the status of connected devices. This publication is organized into several sections. The first part is an introduction to the background and some

related research. The second part is about the architecture of the proposed system. The third part is about evaluation and analysis of related experiments. Then, followed by the con-clusions and plan further research.

II. SYSTEM DESIGN AND ARCITECTURE

In the proposed smart home concept, the system environment is divided into two (outdoor and indoor), namely the-cloud Internet-based systems and Wireless Sensor Network (WSN). Both of these environments are connected to each other by using a bridge access point, so the indoor-outdoor connection can be viewed as the concept of the Internet-of-Things (IOT). Basically, our vision for the smart home concept not only connect devices to the Internet but also to build intelligent environment. Indoor environment will be formed from the system Wireless Sensor Network (WSN) based on certain protocols which will be discussed later. Meanwhile, the external environment will use internet-cloud scheme there.

A. Working environment

Your paper must use a page size corresponding to A4 which is 210mm (8.27") wide and 297mm Indoor environment has four main sections by function: access point, host WSN, WSN nodes, and WSN endpoints. Access Point (AP) is responsible for connecting the system to the internet in the outdoor indoor WSN system. Therefore, the AP will distribute Internet Protocol (IP) for the device that should be connected to the internet (eg smartphones, WSN host). WSN host is responsible for the coordinator WSN. It is the control center WSN. So he should be able to understand all the protocols are connected. Moreover, WSN host should know all the information (identification number, status, configuration, etc.) from all connected devices (WSN WSN nodes and enddevices).

Instead, WSN nodes have the responsibility of the simplest in WSN system. He just needs to forward any received data without bothering to know where the final destination address. With this scenario, we can add nodes as much as we need without worrying about addressing.

For WSN device endpoint, this design associated with the application. They should be regularly monitored and updated into the database system on WSN host. Because of this database, users can access all the information and monitor the status of all devices. In WSN system, we use three communication protocols, namely ZigBee, Bluetooth, and IEEE 802.11b (WiFi). Each protocol has its own advantages and disadvantages. Combining all three together into a single system can eliminate the weaknesses. Comparison of three protocols can be seen in Table 1. ZigBee has positive points in the simplicity of the structure of data and range, but low data-rate. Therefore, ZigBee is suitable as a back-bone connection device and end-point nodes which only requires a data rate and low power consumption, but is used continuously. Meanwhile, the Bluetooth connection has strong points in the data-rate and compatibility to connect to the smartphone. Therefore, bluetooth suitable for smart-phone applications that require data-rate low or medium. Lastly, WiFi has its strong points at the level of communication with high data-rate and compatibility to connect to a smartphone. Therefore, it is suitable to use WiFi smartphone applications that need high data rate (eg video streaming). The WiFi connection can also build communication between WSN with internet-cloud. Therefore, WSN systems can obtain the IP address that will be managed by the access point bridge for control purposes outdoors (outdoor).

Table 1. Comparison of ZigBee, Bluetooth and WiFi [7]

Feature	*ZigBee*	Bluetooth	IEEE 802.11B
Complexity	Simple	Complex	Very Complex
Range	300 m	10 m	100 m
Data rate	250 Kbps	to 1 Mbps	11 Mbps

For connections main architectures in WSN, we choose a mesh topology, because it has the advantage of scalability. If we want to expand the WSN, we just need to add nodes or devices end-points in the area of affordable nodes or other end-points. In addition, the mesh topology has the best performance and reliability compared to a star topology or tree [8]. Excess use of technology mesh topology in WSN system are:

(1) its high flexibility, since by simply adding nodes, then he will find the nearest node or point and form an appropriate route;

(2) the system becomes robust, because if one node or point can not be used, then these alternatives will be immediately established;

(3) broadening the coverage area can be done by using devices whose placed between the existing track;
(4) every node or point will communicate with nodes or points near it, so as to minimize the interference of communication;
(5) the presence of alternative pathways will increase the utility of alternative devais, * with a different tree topology to be congested if the number of sub-nodes increases [9].

Outdoor environment designed for mobility purposes, so that the user can monitor any device in the home that is connected to the WSN system, anytime and anywhere. Therefore, the smart-phone or gadget needs to be connected to the internet-cloud. Access point bridge will manage every device on WSN system that should connect to the internet-cloud, with a particular IP address. With this scheme, the user can monitor and control any device in the intelligent home system that is connected to the system, anytime and anywhere. The proposed architectural illustration Detailed presented in Figure 1.

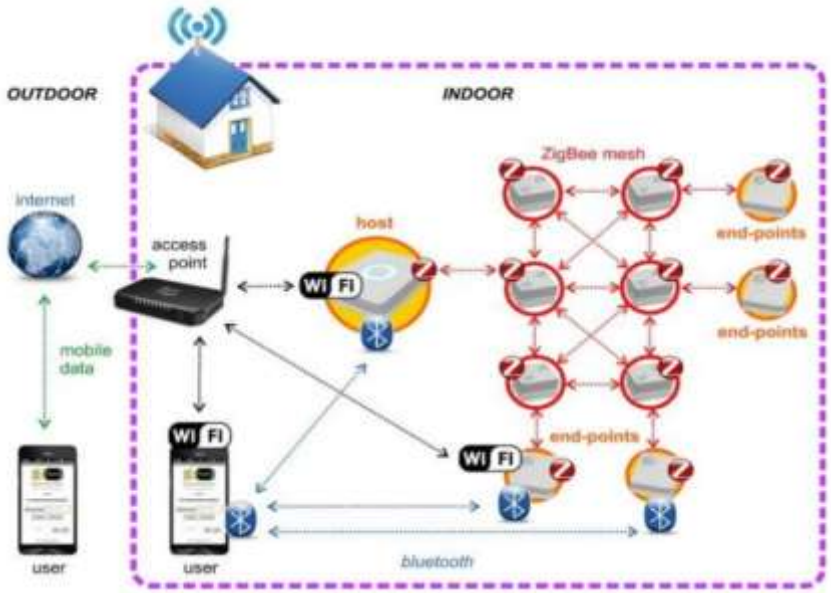

Figure1. The system architecture of the proposed

B. Protocol efficient data

In this WSN system, we use the data protocol design as shown in Table 2, as has been proposed in our previous study, the paper [5]. With this data protocols, we can design an efficient data packet for each application. Information available data such as the type of information, data continuity, until the length of the data payload included. Methods of packaging this information impact on power consumption. Large power usage efficiency relies on the use of character information that can be represented by 1-byte packet-init.

Table 2. Design data protocol

Header	*Address*	*Paket Init*	*Data Layout*	*Checksum*
3-byte	2-byte	1-byte	n-byte	1-byte

III. DATABASING SYSTEM

Databasing system is designed using SQLite system. SQLite been selected for a low-cost and easy to implement into an intelligent home system. To be able to implement the data to SQLite, we need to define the device address in the register SQLite. Addressing registers taking reference from our previous research work [5] to be applied in this study. Addressing the device registers are presented in Table 3 and is implemented in the system SQLite using Python programming. Examples of SQLite database system implementation is shown in Figure 2. The implementation of the system SQLite uses some information, which is the main number, identification number of the actual device, device status, and date of processing, and the processing time. By using this format, we just need to define the device name, identification, and definition status.

Table 3. Register addressing device

Categories	*End-Point*	Address	n-Byte
Monitor	Temperature Humidity Misc	0x01 0x02 ... - 0x03	2 2 ...
Control	Lamp Switch Curtains IrDA VLC Other	0x30 0x31 0x32 0x33 0x34 ... - 0xBF	1 1 2 78 32 ...
Combination	Keypad key other	0xC0 0xC1 ...- 0xFF	2 1 ...

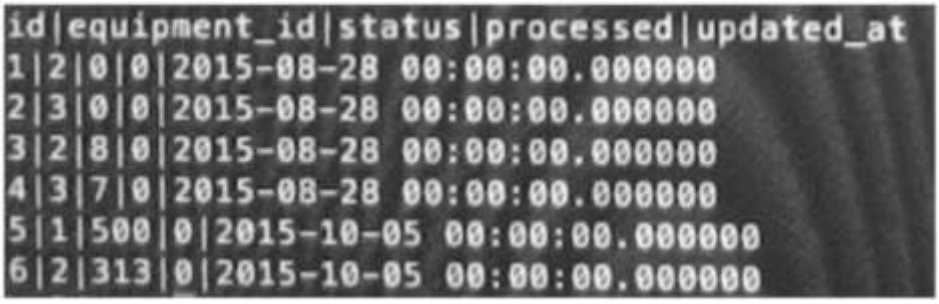

Figure 2. Examples of SQLite database structure format

IV. CONCLUSIONS

In this study, the protocol this data, we can design an efficient data packet for each application. The available information such as the type of information, data continuity, until the length of the data payload included. Methods in the information process, has an impact on power consumption. The amount of efficiency power usage relies on the use of character information that can be represented by 1-byte packet-init.

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