# LITERATURE REVIEW : SMART HOME BASED ON IOT FOR SECURITY SYSTEM

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**Abstract**

***Security is an important aspect that must be considered from a house, building, and environment. The purpose is to avoid various types of crime such as theft and robbery that can cause loss. In various regions in Indonesia, the rate of theft and robbery is still high, so a good security system is needed so that cases of theft and robbery can be avoided as early as possible. In the era of technology that is developing so rapidly nowadays, there are many breakthroughs in security systems for homes, buildings, and environments that utilize technology, one of which is a security system based on IoT (Internet of Things). In this paper will focus on reviewing the concepts applied by several previous papers relating to security systems for homes, buildings and the environment. Then the results of the review can obtain appropriate and relevant concepts to be applied for home security systems with minimal internet network conditions.***

**Keywords:** Smart Home, IoT, Security System, Sensors, Microcontroller

## 1. Introduction

Security is everywhere an important part and is a major concern for everyone in various parts of the country especially in Indonesia. So everyone wants a home, an industrial place, a bank, etc. to be safer [1]. Where the safe conditions will provide a sense of comfort so that it will have a good impact in facilitating various activities and daily activities of a person or group of people wherever they are. In Indonesia alone we can see in the news and in the newspapers there are still many cases of theft and robbery that occur in various regions. Based on 2017 national statistical data from Badan Pusat Statistik (BPS) there were 12,095 cases of theft with violence and 111,450 cases of theft in 2016 [2]. From these data show that the crime rate with cases of theft and robbery is still high. This happens because there is still a lack of awareness about security and the security system that is owned is still ineffective in overcoming the problem.

Security system by utilizing technology is a system built to be able to monitor the security of a house, building, and environment in real time, so that security systems with technology can provide a breakthrough to overcome these cases, one of which is a security system based on IoT.

This security system based on IoT has a concept that combines several devices such as controllers, sensors, smartphones and internet networks. This paper will review several papers relating to IoT-based security systems for homes, buildings and the environment, then classify these papers into several appropriate and inappropriate concepts to be applied to regions with geographical conditions that lack internet access.

## 2. Current Studies

In this section, we will discuss the hardware components used in previous papers to build an IoT-based smart home security system. There are three main components used in building an IoT-based smart home security system including :

### 2.1 Communication Module

In building a security system based on IoT for homes, buildings and the environment there are several technological concepts proposed by previous papers. Where each concept has a difference in determining the communication module used. This communication module is commonly used to build automation systems and IoT-

based systems. Among them, there is a Bluetooth Module that has the ability to transmit data and sound simultaneously [3] with a fairly small power consumption only ranging from 3.6 to 6 volts [4] so it is suitable for building low-cost security systems [5]. The second module is a GSM module, which has a working system by giving orders and receiving information via SMS [6] [7] and through calls [8] by utilizing GSM frequencies [9] connected to network operators which are around [10] making it more efficient and flexible [11]. And the third module is a Wifi module that has many other features to be used in WSN beyond its network capabilities [12]. Only with a supply control of 3.3 volts [13] and can be programmed directly [14]. This wifi module has strong and sophisticated connectivity [15] so that it can quickly send data generated from the microcontroller to the cloud

### 2.2 Microcontroller for Management System

In order for the security system to be built more manageable, it requires a microcontroller to control and manage all devices connected to the system. From the previous papers there were several microcontrollers that were used including using Arduino Uno which was most widely used for research [16] because it was open-source [17] so the programming language that was run was very easy to modify [18] and supports many [19] libraries that can facilitate users in building systems based on IoT with microcontrollers. Next is the NodeMCU microcontroller which is also open-source [20] and the program can be written in the Arduino IDE programming language [21]. The NodeMCU is also supported with Wi-Fi connectivity [22] which allows sending and receiving data from the mobile application via internet server [23]. The last is a Raspberry Pi microcontroller that has functions such as a mini computer [24] with a Linux-based operating system [25] that is optimized with ARM and becomes the core of home automation [26]. With this microcontroller, the entire system can work properly and produce output that is in accordance with the user's own needs.

### 2.3 Sensors in Security System

Another important part of the security system based on IoT is the sensor, whose function is to detect and convert physical information into digital form. There are several types of sensors used in previous papers which are Motion Sensor [22] which is mostly used to detect the presence of thieves, Infrared Sensor [24], Ultrasonic Sensor [28]. The three sensors are more directed at the security of homes and buildings from criminal cases. While other papers utilize several sensors such as gas sensors [27], fire sensors and temperature sensors [6] [29] for security from fire and gas leakage.

From the results of the review papers related to security system based on IoT, it can be concluded that there are three parts of hardware that cannot be separated in developing security system based on IoT including Module, Controller and Sensor.

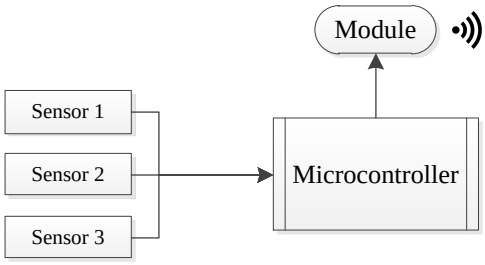


**Figure 1**. Hardware Circuit

Figure.1 is a circuit of all three hardware components in building a security system. The hardware circuit includes sensors which will be connected to a microcontroller. Then the microcontroller will send the results of data that has been processed from the sensor to the module to be forwarded to the user as information.

The purpose of the review is to combine and classify papers relating for security systems based on IoT that are relevant and effective to be applied to certain regions that have minimal internet access. Where these areas still rely on 2G, 2.5G and 2.75G internet network technology which only have data transfer rates of 14.4Kbps to 236Kbps.

## 3. Method

The method used in writing this literature review is by choosing papers sourced from international journal websites such as IEEE Xplore, ResearchGate and others with the last five years published, starting from 2014 until 2018. The papers are chosen based on the titles that have relevance to smart home both from the security side system, as well as energy efficiency and others. After the paper is obtained the next step is to make a summary of each of these papers by taking important points that support the writing material in this literature review.

Figure.2 is the flow diagram or process of the paper selection method as a reference for writing literature review material. The first is Literature Search, which is looking for papers on the internet from web providers of international journals with papers that have titles in accordance with those discussed. After Literature Search is created a citation, where each paper that has been selected is summarized and included in the reference to be cited.

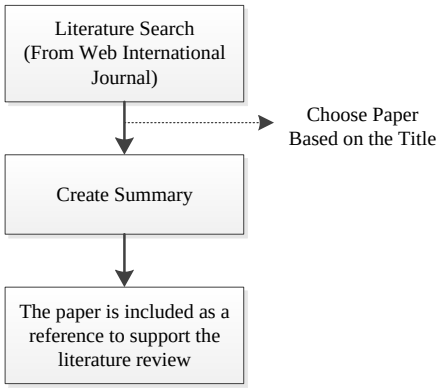


**Figure 2.** Flowchart of the paper selection method

## 4. Result

For the results of the paper collection, there are 21 candidate papers that relate directly to the security system for houses both for security from crime and the security of various unwanted events such as fires and gas leaks.

From the 21 papers, there are three concepts of communication technology that are implemented in the security system for the home. This communication technology is a technology that connects the security system that is built with the user's device as a system controller. The papers will be grouped based on the concept of communication technology owned. Table.1 is papers with the concept of technology that uses communication channels via Bluetooth, SMS and Wifi/Internet

**Table 1.** Concepts of Communication Technology

| No. | Concepts of Communication Technology | Papers |
|---|---|---|
| 1 | Bluetooth | [3] [9] [28] [29] |
| 2 | Short Message Service (SMS) | [3] [9] [6] [8] [7] [10] [16] [17] [18] [25] [28] |
| 3 | Wifi/Internet | [3] [6] [8] [12] [13] [14] [15] [16] [17] [20] [22] [25] [30] [24] [27] |

Table.2 is the range that can be accessed by the three modules. The Bluetooth module has a limited range of only 10 meters. While the range possessed by the GSM module is unlimited which can only be used domestically and for the wifi/internet module can be accessed from various places and anywhere in the world that provides internet network.

**Table 2.** Limitation Acces of Module

| No. | Concepts of Communication Technology | Papers |
|---|---|---|
| 1 | Bluetooth | Limited (10 meters) |
| 2 | Short Message Service (SMS) | Unlimited |
| 3 | Wifi/Internet | (domestic only) |

## 5. Analysis

Of the 21 papers that have been analyzed, there are three concepts of communication. The three concepts of communication technology have their advantages and disadvantages. Communication technology using wifi or the internet is the most widely used while under it there is GSM and Bluetooth. The use of wifi and internet technology

communication is more widely used because it can be reached from all parts of the world without identifiable restrictions. Where there is an internet network this technology can be used but with conditions in the area that have an internet network that is not good and even does not exist, this system cannot work. Whereas for GSM-based communication technology is technology that can only be done by utilizing telecommunication operator signals and must use prepay. And for Bluetooth it can only be accessed at close range according to the Bluetooth connection range itself if the owner is not at home then the system cannot inform the condition of the house.

## 6. Conclusion

Based on the available statistical data, it can be concluded that IoT-based security systems need to be built and implemented to protect homes, buildings, and environments in various regions of Indonesia from various crimes. In order for the IoT-based security system to work properly, it is necessary to select the concept of IoT-based system security technology that is appropriate to the conditions of each region. Because in some regions in Indonesia there are still many areas that lack internet access.

From the results of the analysis after reviewing several paper security systems for homes, it can be concluded that the concept of the security system technology that can be implemented for areas with minimal internet network is the technology concept of security systems that use GSM communication technology. Where papers that use GSM communication technology can be a reference or reference material in building IoT-based security systems for homes in areas with minimal internet network conditions. Some of these papers are like paper [1] which discusses security systems to find out the presence of someone who is not invited into the house and prevent fire accidents, paper [6] for monitoring security and safety, paper [7] automation bell if someone is detected in front of the house entrance, paper [8] which presents the concept of modern security systems or intelligent networks that are embedded, paper [9] the concept of low-cost security systems and flexible security, paper [10] security systems to avoid troublemakers, paper [16] more efficient home automation models , paper [17] the concept of IoT utilization for home appliances, paper [18] the concept of home security that uses fuzzy logic methods, paper [25] technology security systems for household security and family health, and paper [28] which discusses the use of IoT for monitoring various household appliances from anywhere and at any time.

For future work, it is expected that the use of IoT in areas with slow internet network conditions by combining the concepts of communication technology that exists in this research into one using fuzzy logic methods and others.

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