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Engineering Fire Alarms using IoT-based Equipment the Same as Building Applications

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Abstract:- This research applies an IoT-based fire alarm system. Where the design or design is integrated into the internet network, from the detector to the announcement equipment on the fire alarm system, the plan will also be tested for its working system by the work system required for the building's fire alarm system. The results of this research are the design and testing of an IoT-based fire alarm system.

Keyword:- *IoT, Fire Alarm.*

I. INTRODUCTION

This research started with a customer's request to design a fire alarm system that does not use cables to connect to fire alarm monitoring. Because of this demand, researchers seek a product that can meet customer demand. The application will also be by the fire alarm system in general buildings.

And from this customer request, the equipment is obtained from the online web in the network. It turns out that the development of IoT has been relatively rapid in Indonesia, and several providers are producing detectors that work wirelessly and are based on IoT. [1] [2] Based on the equipment obtained, the design of this IoT-based fire alarm system can be developed with several engineering tools. This is so that the equipment can be designed according to the fire alarm construction in buildings and can work according to the general fire alarm system in buildings. Preliminary on detector integration with fire alarm announcements.[2] [3] [4] [5] [6] [7]

II. METHOD

A. FIRE ALARM DESIGN

The design plan for this system is based on the building's division of the alarm system. In fire alarms, the equipment is generally divided into two functions, namely:

- Detectors: Smoke/Heat Detectors, Break glass
- Announcement device: Bell, Indicator Light

And the general scheme of the fire alarm can be seen in Figure 1.

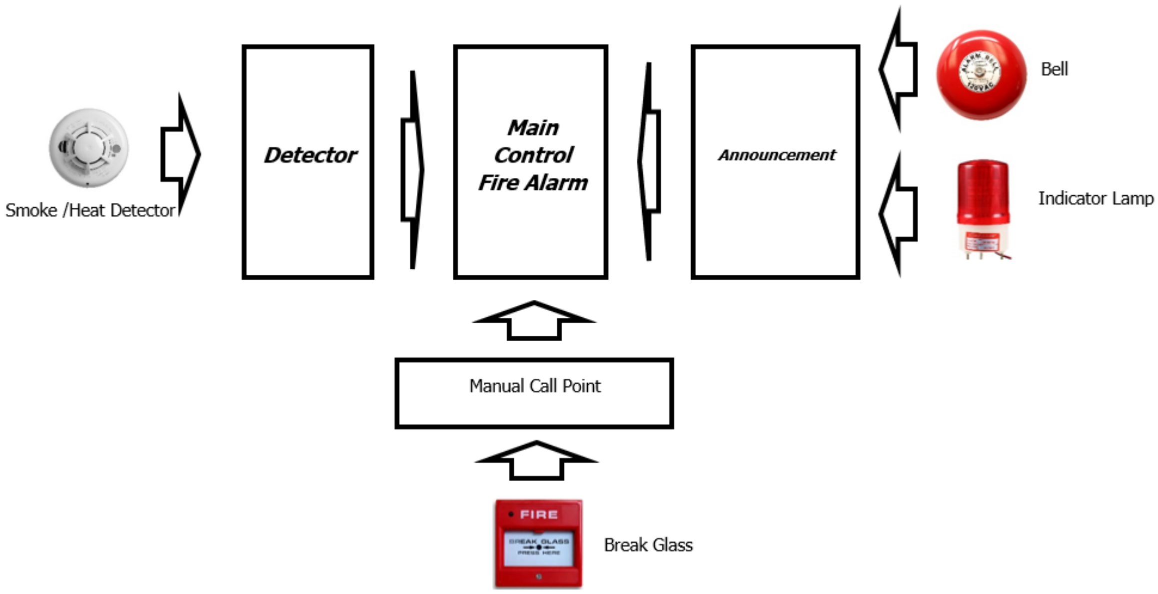

Fig. 1: Schema fire alarm system

As seen in the picture above, several fire alarm system equipment are in the building. Fire alarm equipment in the building consists of a detector, announcement, manual call point central control fire alarm. Fire alarm systems in buildings in general. And as for some of the equipment used, among others:

- Detector consists of a Smoke or Heat Detector
- Announcement consists of an Indicator lamp and Bell
- Manual Call Point consists of Break glass
- Main Control Fire Alarm: Control and monitoring panel

On the planning and application of an IoT-based fire alarm system. IoT equipment engineering to support this fire alarm application, consisting of:

- IoT-based Smoke Detector
- IoT-based Smart Breaker
- IoT-based DIY Switch
- Smartphones
- Wireless Routers

Some of the above equipment is needed to apply this IoT-based building fire alarm system, where the schematic can be seen in Figure 2 below.

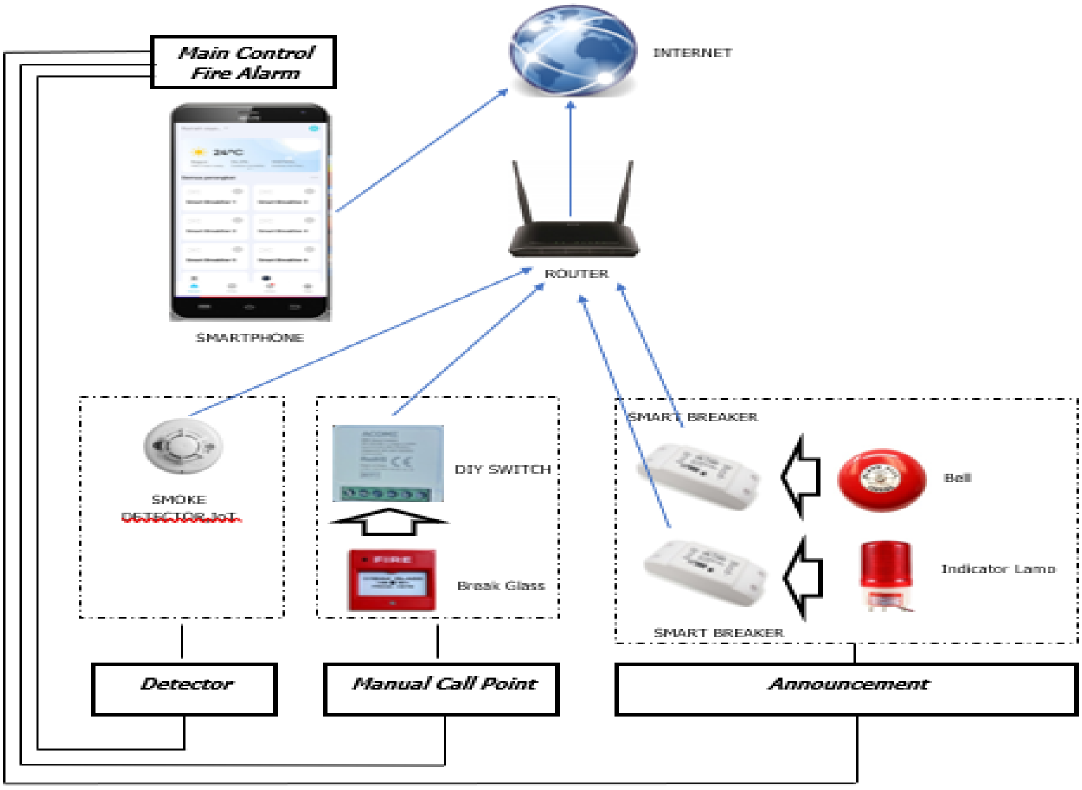

Fig. 2: Scheme For Fire Alarm Based On IoT

In the IoT-based fire alarm system scheme,[8] the equipment all leads to one network in the router, which is connected to the internet network. To communicate with remote monitoring and control attached to the smartphone. As for the functional conditions of fixed equipment, such as fire alarm systems in buildings, there are only a few pieces of equipment engineering. So that the fire alarm system can work based on IoT (Internet of Things), the sections on the IoT-based fire alarm are as follows:

- Main Control Fire Alarm: Smartphone monitors and controls fire alarm equipment. Both detectors, announcements, and manual call points.
- Detector: Smoke & Heat IoT; this detector has a microcontroller and radio frequency embedded in it. This is to facilitate communication and secure a non-wired network.
- Announcement: Smart breaker is used for communication media, and IoT switches on the power source for announcement equipment. The embedded equipment has a microcontroller and radio frequency. This is to facilitate communication and secure a non-wired network.
- Manual Call Point: DIY Switch is used as an IoT communication medium for input to break glass, which functions as a manual call point. The embedded equipment has a microcontroller and radio frequency. This is to facilitate communication and secure a non-wired network.
- Additional equipment: Router, as communication between equipment and connecting network equipment in a wide area outside the local area.

Each piece of equipment can be contained in an electrical wiring diagram from the described IoT-based fire alarm system scheme. This condition is because several inputs and outputs on the IoT equipment are obtained at 220 V, while the working power of the fire alarm equipment, especially the announcement, is at 24 V., And this is done so that during the design process, it can run well and as desired with limited equipment specifications required. The wiring diagram can be seen in Figure 3 below. Where additional equipment is needed in the form of:

- 220 Volt Relays
- And Power Supply 220 Volt – 24 VAC

From the addition of several supporting components, equipment such as bells and indicator lamps can work.[9] [10] [11] [12] [13] [14]

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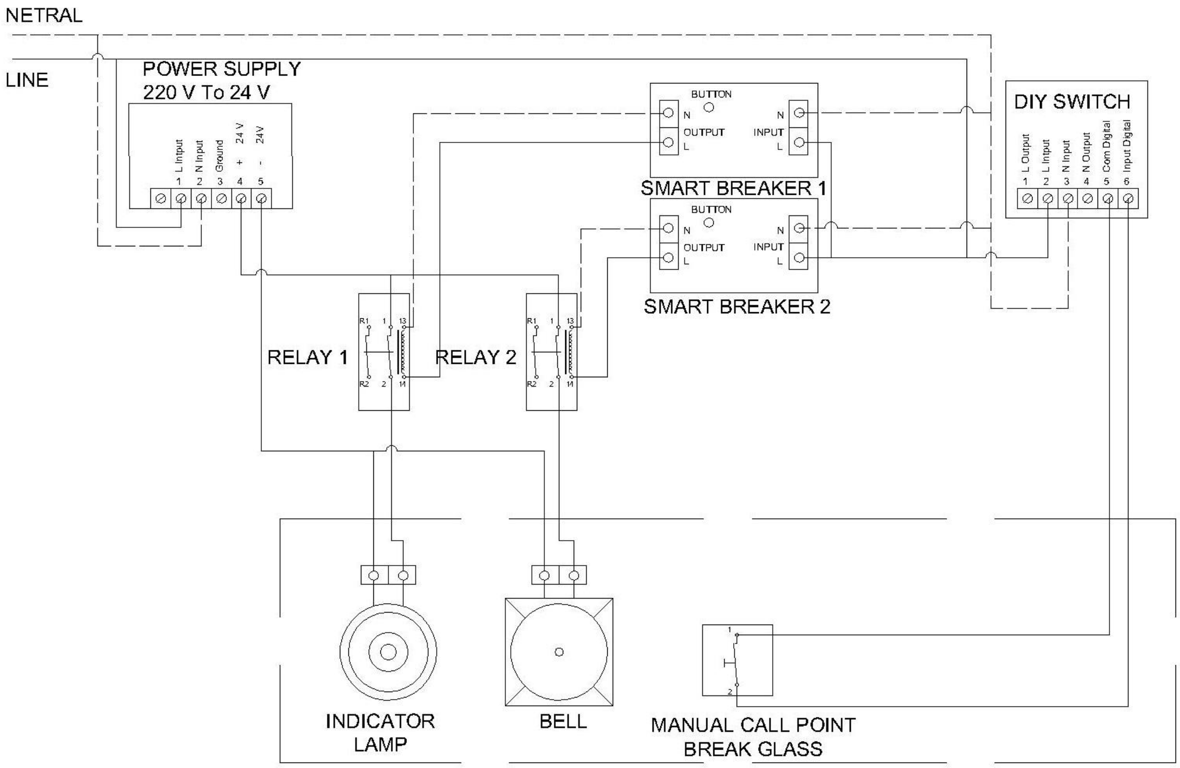

Fig. 3: Electrical Wiring Diagram

B. WORK PRINCIPLE

This equipment has the general working principle of a fire alarm system in buildings. Fire alarm equipment will provide fire information when a detector indicates smoke or heat in a room. Simultaneously, the information is received by the central control fire alarm and forwarded in the form of a low output for the indicator lamp and bell. Thus, the indicator lamp and bell will light up; this is a sign of a fire in the area inside the building. The call point works as a direct call without any readings from the sensor by pressing the broken glass inward. At the same time, the contact on the broken glass is connected and enters as input to the central control fire alarm and is forwarded the same as the detector in the form of a low output for the indicator lamp and bell. Thus, the indicator lamp and bell will light up; this is a sign of a fire in the area inside the building. An illustration of the process can be seen in Figure 4.

Fig. 4: Fire alarm system duty cycle

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From the principle of the fire alarm system and the picture of the fire alarm system cycle, the working principles of the IoT-based fire alarm system are compared. What is slightly different in focus is that information is managed by an application system installed on a smartphone instead of MCFA through internet facilities as a liaison between the smartphone and the detector, manual call point, bell, and indicator lamp.[15] [3]

C. Application Board Plan

The simulation overview plan is made with an example of a small room with multilevel conditions, one different room, and one combination box. And can be seen in the application board plan drawing in Figure 5

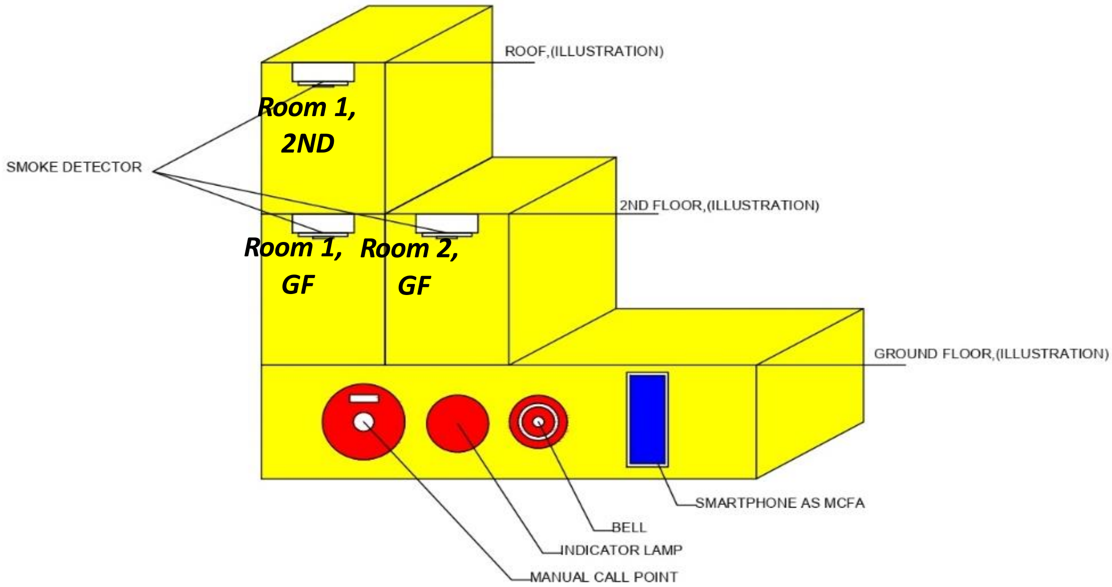

Fig. 5: Application Board Plan

D. Step for installation of device

During the application process, several steps must be carried out. Among others :

- The process of installing and initializing each device on IoT equipment.

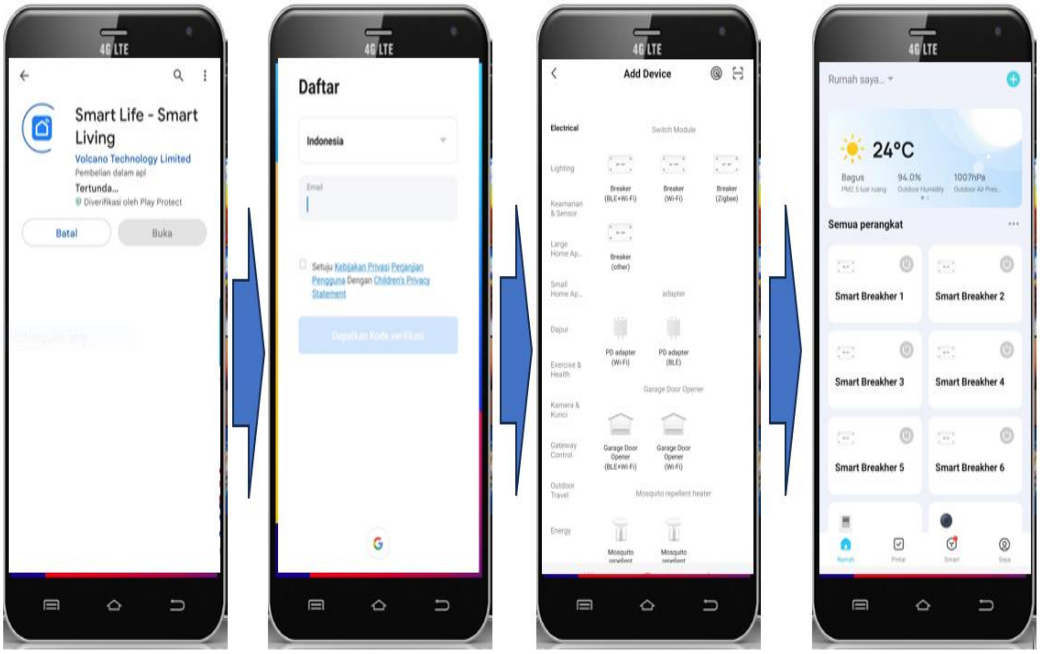

Fig. 6: Step For Device Installation

This process is to install the IoT provider application on a smartphone, record all IoT equipment used on the system, and include it in the application because it plays a role in every designed IoT equipment control.

- Creating an Engineering Scheme between IoT equipment, according to work principles.

Fig. 7: Create Scene

In this view, equipment engineering is arranged. How so that each piece of equipment can communicate with each other? On the fire alarm system used When the device status changes. And the parable of the alarm system used:

- If detector 1 (Smoke Alarm) or detector 2 (Smoke Alarm), or detector 3 (Smoke Alarm) breaks glass (On), then the bell and the lamp indicator are On. And vice versa for the bell condition and the lamp indicator is Off.
- Equipment Response Testing Process.Conduct smoke detector testing in each illustration room condition and test the call point.

III. APPLICATION & RESULT

A. *Application*

After the design and working principles are implemented, the application of this IoT-based fire alarm system can be applied. In the application process, the equipment is arranged in one application board. The detector is made in an illustration of a room in a building, while announcements and manual call points are on the same board as in general building applications. The visible display is only detectors, reports, and manual call points. Discrete IoT Appliances are closed on the application board. Can be seen in Figure 6.


Fig. 8: Actual Illustration Of Fire Alarm System

Tests were carried out in each room. The tests carried out follow the required working principles. As for some of the tests can be seen in the image of the fire alarm system equipment test. The space and equipment are as follows:

- *Room 1, ground floor. Smoke detector equipment.*

Fig. 9: Condition At Room 1-GF, Detector is On and Announcement On

- *Room 2, ground floor. Smoke detector equipment*

Fig. 10: Condition At Room 2-GF, Detector is On an Announcement On

- *Room 1, 2nd floor. Smoke detector equipment.*

Fig. 11: Condition At Room 1-2ND, Detector is On an Announcement On

- *And Manual Call Point*

Fig. 12: Manual Call Point Is On an Announcement On

B. Result

The application results are by the desired working principle when testing each room and equipment. All equipment can communicate adequately even though the conditions are via a wireless network for condition communication and response from IoT equipment. Can be seen in the table.

Table 1: Result Test 1 For Status & Condition Device

Device	Room	Status	Condition
Smoke Detector	Room 1-GF	On	Bell & Indicator Lamp On
Smoke Detector	Room 2-GF	On	Bell & Indicator Lamp On
Smoke Detector	Room 1-2ND	On	Bell & Indicator Lamp On
Manuall Call Point	Combination Box	On	Bell & Indicator Lamp On

Table 2: Result Test 2 For Status & Condition Device

Device	Room	Status	Condition
Smoke Detector	Room 1-GF	Off	Bell & Indicator Lamp Off
Smoke Detector	Room 2-GF	Off	Bell & Indicator Lamp Off
Smoke Detector	Room 1-2ND	Off	Bell & Indicator Lamp Off
Manuall Call Point	Combination Box	Off	Bell & Indicator Lamp Off

Thus, the test results above. And from the response speed when smoke and manual call points give orders, the response from announcements such as bells and indicator lamps is relatively fast. This is because a good network supports it.

IV. CONCLUSION

From the applications, IoT equipment can be developed in a fire alarm system in a building. For some IoT equipment applications, it is friendly. Because when using the application, it is easy to use and understand. This allows users of IoT equipment in the fire alarm system to find a problem and fix it independently.

In this application, the equipment is very dependent on internet network facilities because applications used on IoT equipment have independent storage space for their applications in a network.

And there are still a few more things that can be developed in this fire alarm system application if done in a large capacity. A network design will be designed for large-scale implementation because each piece of equipment uses radio frequency only from the provider.

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