Automation of occupational safety and health (K3) electricity based on internet of things (IoT)

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Abstract. The use of computers in the future can dominate human work and defeat human computing capabilities such as controlling electronic equipment remotely using internet media, IOT (Internet of Things) allows users to manage and optimize electronics and electrical equipment that uses the internet for Automation of Work Safety and Health (K3) Internet Based Electricity of Things (IoT). Design of Automation Occupational Safety and Health (K3) Electricity Based on the Internet of Things (IoT), which is used to test the installation of research instrument equipment. This needs to be done to ensure that the installation and research instruments function properly at the actual time of the experiment. Devices that have been made by researchers can work well as expected, where the automation of the protection of Occupational Health and Safety (K3) Internet-Based Electricity of Things (IoT) so that it can provide initial assistance in the event of work accidents caused by gas leakage and fire monitored online by panel space operators.

Keywords: safety and health (K3), sensor, internet of things, Arduino, electricity

1. Introduction
In this globalization era, it is not only information and communication technology that is increasingly developing, but also technology in the health sector. The level of need for health in modern society is somewhat more complex. This is what influences health experts to provide more optimal services to meet the needs and demands of the community. One of the most sought after health services today is the hospital. The use of computers in the future can dominate human work and defeat human computing capabilities such as controlling electronic equipment remotely using internet media, IOT (Internet of Things) allows users to manage and optimize electronics and electrical equipment that uses the internet. This speculates that shortly communication between computers and electronic equipment is capable of exchanging information between them thereby reducing human interaction. This will also increase the number of internet users with various internet facilities and services.

Internet of things has become a separate field of research since the development of internet technology and other communication media, the more growing human needs about technology, the more research that will be present, the internet of things is one of the thoughts of researchers...
who are optimizing several tools such as media sensors, radio frequency identification (RFID), wireless sensor networks and other smart objects that allow humans to easily interact with all devices connected to the internet network.

Occupational safety and health is an inseparable part of the labour protection system and for construction service work can minimize and avoid the risk of moral or material loss, loss of working hours, as well as human safety and the surrounding environment which can later support improved performance effective and efficient in the development process [1].

Work safety and health efforts must be organized to realize optimal work productivity in all workplaces, especially those that are at risk of health hazards and prone to disease. Therefore, hospitals are included in the workplace criteria with various potential hazards that can cause health impacts such as potential radiation hazards.

According to the Regulation of the Minister of Manpower of the Republic of Indonesia Number 12 Year 2015 Concerning Occupational Safety and Health Electricity in the Workplace The implementation of safety electricity to protect the safety and health of workers and others who are in the workplace environment from potential hazards electricity, creating safe, reliable electrical installations and providing the safety of buildings and their contents, and creating a safe and healthy workplace to encourage productivity. include, planning, installation, use, change, maintenance, inspection and testing [2,3].

Electrical properties that are not visible and cannot be touched. We know there is electricity after seeing the consequences, such as lights on, fans spinning, and the radio sounds. There are three dangers caused by electricity, namely electrocution, heat or fire, and explosion. In the installation of electrical installations, usually prone to accidents. Accidents can arise as a result of direct contact with current flowers or errors in the installation procedure. This research is expected to provide early protection and protection regarding Occupational Safety and Health (K3) Electricity Based on Internet of Things (IoT) in Electrical Installation of Brawijaya University Malang Hospital and the factors that influence it so that later recommendations can be given to reduce the risk of being exposed to electrical hazards at Brawijaya University Malang Hospital.

2. Research method
To ensure the safety and health take place properly, it is necessary to pay attention to the standard facilities that support activities can run safely. PPE standards such as project helmets, protective shoes, eye protection, masks and ear protectors. In addition to the protective clothing, the installation of warning boards, traffic signs, rules or regulations on the use of equipment under their functions and the provisions that make the location of activities safe and supported by personnel who handle each operational activity will guarantee work safety and health can go well. [4].

| Table 1. Electricity unit table |
|--------------------------------|
| Electric Voltage (Volt)        | Volt (v)       |
| Electric Current (Current)     | Ampere (A)     |
| Frequency                      | Hertz (Hz)     |
| Electrical power               | Watt (W)       |
| Electrical energy              | Watt – Hour (Wh) |

Michael Faraday, a British scientist, is the "Father of Electricity" because it is thanks to his pioneering findings that electricity is now a technology of many uses. Other names that are also considered electric figures are de Coulomb, Alessandro Volta, Hans C. Crested and Andre Marie Ampere. Simply stated, electricity is a property of matter which arises from the presence of an
electric charge which is a condition of electron particles and protons. Electricity is something that is not visible to the naked eye, the most common electrical phenomenon that occurs is lightning where the electron jumps from electric particles. The most common units of electricity used daily are:

This research was conducted by experimental research methods. The purpose of this study, namely to get an explanation of the problems examined in the explanation in the form of a causal relationship between the dependent variable and the independent variables that affect the problem occurs.

Pre-experimental design that is used for testing the installation of research instrument equipment. This needs to be done to ensure that the installation and research instruments function properly at the actual time of the experiment. Examining the causal relationship between variables of a process, by imitating the actual process. Designing Electrical Based Internet Of Things (IoT) Electrical Safety and Monitoring System (OHS) Monitoring System in Electrical Installation of Universitas Brawijaya Malang Hospital[5].

This study uses two types of data, namely primary data about the results of the product in the form of Automation of Occupational Safety and Health Electricity Based on Internet of Things (IoT) in Electrical Installation of Universitas Brawijaya Hospital Malang.

3. Result and discussion

Internet of Things or also known by the abbreviation IoT, is a concept that aims to expand the benefits of internet connectivity that is connected continuously. As for capabilities such as data sharing, remote control, and so on, including real objects. For example food, electronics, collections, any equipment, including living things that are all connected to local and global networks through embedded sensors and always active.

Another similar meaning, Internet of Things (IoT) is a concept / scenario where an object has the ability to transfer data through a network without requiring human-to-human or human-computer interaction. "A Things" on the Internet of Things can be defined as a subject, for example a person with a heart implant monitor, a farm animal with a biochip transponder, a car
that has a built-in sensor to warn the driver when tire pressure is low. So far, IoT is most closely related to machine-to-machine (M2M) communications in manufacturing and electricity, oil and gas. Products are built with M2M communication capabilities which are often referred to as "smart" systems. (example: smart label, smart meter, smart grid sensor).

The process of designing an Automation of Occupational Safety and Health (K3) Electricity Based on Internet of Things (IoT) in Electrical Installation UB Hospital Malang starting with making a design. After that, I prepared the materials and equipment needed to rank the Internet-Based Electricity of Things (IoT) Automation and Occupational Health and Safety. Several sizes will be made for automatic drying fabrics.

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**Figure 2.** Automation of occupational safety and health electricity based on internet of things (IoT)

**Figure 3.** Safety and health tools electricity based on the internet of things (IoT)
**Figure 2** is a series of Internet-Based Electricity of Things (IoT) Automation and Occupational Health and Safety Automation that will later be connected with several other components such as fire sensors, gas sensors and temperature sensors. As shown in Figure 2, each color cable has a placement that will be connected to the minimum Arduino system. Where in the test tool there is an output in the form of a siren that is functioning to give a notice to the people around that there is a work accident and esp module which is useful to notify the electrical panel operator to immediately come to the panel room that works online. Before installing the Internet-Based Electricity Of Things (IoT) Automation and Occupational Health and Safety Automation as seen in Figure 3, it is necessary to check whether the device is functioning properly and correctly in accordance with the research objectives.

The purpose of this tool is to be able to provide early protection to people around that workplace accidents occur with the sound of the siren to immediately maintain safety and protection online to the electrical panel operator to immediately take action to prevent rescue from greater accidents. In testing the device there are three sensors that are read out using internet-based monitoring of things:

a. **Gas sensor**
Gas Sensor (MQ2) is a sensor that is useful for detecting gas leaks both at home and industry. This sensor is very suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Because of its high sensitivity and fast response time, measurements can be made quickly. In the study of gas sensors function as a gas leak protection on the electric panel in Universitas Brawijaya Hospital.

![Gas sensor monitoring](image)

**Figure 4. Gas sensor monitoring**

In Figure 4. Notice that there is a gas leak This experiment was conducted by spraying gas around the gas sensor.

b. **Fire sensor**
Flame sensor or commonly called a fire sensor is a sensor that has a function as a flame detector where the fire has a wavelength between 760nm - 1100nm that can detect fire and convert it into
an analog scale representation. This sensor uses infrared as a transducer in sensing whether a fire is burning or not. In the study, gas sensors function as fire protection on electric panels in Universitas Brawijaya Hospital.

In the testing of the sensor shown in Figure 5. There is a notification that a hotspot of this experiment was carried out by spraying a fire around the sensor found on the electrical panel.

c. Temperature sensor
Temperature Sensors are components that can change the amount of heat into electrical quantities so that they can detect the symptoms of temperature changes in certain objects.
In figure 5 you can see the temperature graph which initially looks normal and then the temperature rises, meaning that there is a response to the temperature sensor after bringing something hot. Temperature sensors take measurements of the amount of heat/cold energy produced by an object so that it allows us to know or detect the symptoms of temperature changes in the form of Analog or Digital output. The Temperature Sensor is also from the Transducer family. In the study, gas sensors function as excessive heat protection due to shortages or leakage of gas on the electric panel in Universitas Brawijaya Hospital [1,6].

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5. Conclusion
Devices that have been made by researchers can work well as expected, where the automation of the protection of Occupational Health and Safety (K3) Internet-Based Electricity of Things (IoT) so that it can provide initial assistance in the event of work accidents caused by gas leakage and fire monitored online by panel space operators. Where:

a. The tool notifies that there is a gas leak online with the notification "Beware of Leaking Gas"
b. The tool informs you that there is a hotspot in preventing burns from using Android
c. Operators can monitor temperatures online if excessive heat occurs due to electrical short circuit.

6. References
[1] Sholihah Q, Kuncoro W, Sugiono, Tama I P and Novareza O 2020 Patient knowledge description of work safety and health (K3) in radiological Syst. Rev. Pharm.
[2] Reese C D and Eidson J V 2006 Handbook of OSHA Construction Safety and Health
[3] Reyes J P, San-José J T, Cuadrado J and Sancibrian R 2014 Health & Safety criteria for determining the sustainable value of construction projects Saf. Sci.
[4] Szycher M 2012 Health and safety Szychers Handbook of Polyurethanes, Second Edition
[5] Sholihah Q, Hanafi A S, Bachri A A and Fauzia R 2016 Ergonomics Awareness as Efforts to Increase Knowledge and Prevention of Musculoskeletal Disorders on Fishermen Aquat. Procedia
[6] Sholihah Q 2014 Relationship work fatigue related to work stress on circadian rythm night shift operator employee PT. Indonesia Bulk Terminal Kotabaru, South Kalimantan, Indonesia Eur. J. Soc. Behav. Sci.