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Framework Investigation of Security Monitoring System for Production Line on IR 4.0

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Abstract: This paper presents an Investigative Framework for Security Monitoring Systems for Production Lines at IR 4.0. The framework consists of Raspberry Pi 3 as the main IoT processing module, four sensor there are RFID sensors, PIR Sensor, MQ2 Sensor, and Magnetic Door Sensor. RFID is used to collect data that is being used in the area, PIR sensors to determine the state of the production floor where this sensor will measure the movement of the radius sensors, MQ2 sensors to determine the level of dangerous gas as quickly as cigarettes, methane gas that can cause fire on the production floor, Magnetic door sensor to determine the condition of the door on the production floor. This paper is for the framework of the cost and completeness of the system needs.

Keywords: Security monitoring system, production line, IR 4.0, Raspberry Pi 3, RFID, PIR sensor, MQ2 gas sensor, magnetic door sensor, framework.

1. Introduction

As the use of the production floor increases in manufacturing activities, a system that can provide information about security monitoring is needed. This system must be integrated with a communication network that can be controlled and monitored remotely. Thus, security staff can control and monitor the state of the production floor comfortably [1]. Internet of things (IoT) connects all objects that are in the human environment such as washing machines, televisions, security systems and others; by using the internet. It makes it easy for users to access all the information wherever they are [2]. There are various applications that use this technology. It facilitates the management of human life. For example, in fire control in the jungle that uses the detector network to monitor the temperature to prevent sudden forest fires [3].

The problem formulation that must be solved is what hardware will be used in implementing this security monitoring system, and how the system works. Based on the formulation mentioned above, the purpose of this paper is to create a framework, assemble and test the system. In this paper, the proposed framework will be chosen based on the cost and completeness of the system. The benefits of the framework in this study as a guide before implementing the assembly system. Raspberry Pi 3 is a single-board computer with wireless LAN and Bluetooth connectivity, and it is the earliest model of the third-generation Raspberry Pi [4]. The specification of the Raspberry Pi 3 are Quad Core 1.2GHz Broadcom BCM2837 64bit CPU, 1GB RAM, BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board, 100 Base Ethernet, 40-pin extended GPIO, 4 USB 2 ports, 4 Pole stereo output and compo-site video port, full size HDMI, CSI camera port for connecting a Raspberry Pi camera, DSI display port for connecting a Raspberry Pi touchscreen display, Micro SD port for loading your operating system and storing data, upgraded switched Micro USB power source up to 2.5A.

Passive infrared sensors (PIR sensors) are electronic sensors that measure infrared radiation (IR) emitted from objects in their field of view. When the sensor is idle, both slots detect the same amount of IR, that is, the amount that

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radiates from around the room or wall or outside the room. When warm body temperatures such as humans or animals pass by, it will first cut off half of the PIR sensor, which causes a positive differential change between the two parts [5].

Gas Sensor Module (MQ2) is useful for detecting gas leaks that occur in the home or industry. This sensor is very suitable for detecting gases, such as H2, LPG, CH4, CO, alcohol, smoke or propane. Because of its high sensitivity and fast response time, measurements can be made as soon as possible. Sensor sensitivity can be adjusted with a potentiometer. Since this sensor has an analog output, it needs to be connected to one of the analog sockets in Grove Base Shield. It is also possible to connect the Grove module to Arduino directly by using a jumper cable. The output voltage of the sensor will increase when the gas concentration increases.

The best preheat time for the door sensor is above 24 hours. This sensor is basically a reed switch, encased in an ABS plastic shell. Usually the reed is 'open' (there is no connection between the two cables). The other half is a magnet. When magnets are less than 13mm (0.5 ") away, the reed switch closes. These sensors are often used to detect when a door or drawer is open, which is why they have mounting tabs and screws. Some double-sided foam tape can be used to mount this sensor without need to screw [6]. The RFID systems consist of three components, namely transponders (tags), interrogators (readers) and computers that contain databases. The interrogator reads the tag data and sends it to the computer for authentication. The information provided is processed, and then after verification, access will be granted. This system offers frequency bands ranging from low frequencies to microwave frequencies [7], namely Low Frequency: 125-134 KHz, High Frequency: 13.56 MHz, Ultra High Frequency: 902-928 MHz, and Microwave Frequency: 2, 4 GHz. Depending on the source of electrical energy used, the RFID tags are classified as active or passive. The active tags use batteries to power the tags' circuits and send task information at the request of the reader. However, this tag is very expensive and rarely used. On the other hand, the passive tags get electrical energy from readers to power their circuits. This tag is very cost effective and hence most applications use it. In this work, the passive RFID tags have been used to transmit information to the reader when he comes around the electromagnetic field produced by the reader.

The interrogator coil translates the received signal and passes it on to the computer for further processing. Many researchers have used this RFID technology to develop access control systems. This system consists of RFID terminals, cameras, servers and warning devices. After detecting the transponder, the terminal takes photos and sends data including UIDs and photos to the server via a TCP / IP connection. The server searches the database and sends the results back to the terminal to allow or deny access [8]. This RFID system can monitor illegal actions that occur, for example, someone tries to enter when the door is open without the completion of the authentication process, then the alert device will turn on in the web service. The system performance has been tested by installing an RFID kit with an antenna that covers a range of 10 cm and the results obtained are very satisfying. This RFID-based security authentication system is embedded with a new face recognition structure. This system consists of two phases, namely registration and recognition. In the registration phase, ten images of user faces with different emotions are collected and Eigen information is obtained by extraction algorithms. This information together with the UID is written on the RFID tag [9].

In the recognition phase, a face tracking camera and extraction algorithm returns facial eigen information in the image. This information is then matched with information already stored in the tag to be moved. The entire process carried out on the ARM11 processor can replace the terminal / server computer which results in a faster response time, around 57ms with an increased accuracy of up to 86.5%. The RFID-based access control systems utilizing facial recognition based on neural networks have been described by [10]. This system can recognize the face of the person holding an RFID card and deny access if the person is not recognized. The function of the radial base nerve network (RBFNN) has been used to study the faces of people who are recognized. Principal component analysis (PCA) has been used to extract features from images and linear discriminant analysis (LDA) to enhance this feature. Networks are trained with local generalization error models (L-GEM) to improve generalization capabilities [11].

The RFID has been used by [12] to help people overcome the problem of bad memory to carry or store important items in bags before traveling or going to work. Raspberry Pi as a microcontroller has been used by [13] to develop single phase inverters which are used to understand the concept of inverter voltage output control, and by [14] used to design CSK-CDMA Transceiver Based Indoor Visible Light Communication.

2. Methodological Research

The picture above shows how a security monitoring system will be created, where a laptop is used to create a program code that will be entered into raspberry pi 3, then raspberry pi 3 will execute the program and use input parameters from the PIR sensor, magnetic sensor, mq2 sensor and RFID. The results of the program execution will be sent to a cloud and can be accessed through the webpage service on laptops or smartphones connected to the internet. Flowchart of work part A is containing the step of work from begin until buy the hardware component, the first step is searching the study literature that has related with the system that will be create. Second, collect the data of hardware and software that have been used in previous literature. Third, making alternative of framework for the hardware of system. Fourth, choose the best framework based on the ability to fulfill the purpose of system and the cost. Finally buy the hardware based on the selected frame-work.

Flow of work part b is containing the step of after receiving the component until assembly the hardware and make the webpage. The first step is checking the condition and the function of component. Second, prepare the component that already check before assembly. Third, connect the sensors to main module process by the open port of raspberry pi **3.** Fourth, create and upload the pro-gram of system to the raspberry pi 3. Finally make the webpage for receive the data from raspberry pi 3. Flowchart of work part c is containing the step of run until test the system. The first step is turn on the raspberry pi 3. Second, hosting the webpage to the cloud. Third, connect the raspberry pi 3 to internet for send the result of processing program to the cloud. Fourth, check the result in the webpage that already hosting. Finally run the system for 30 minutes to test the system before system is implemented. Flowchart of work part D is containing the step of implement the system to the place that has been choose. The first step is bringing the system to the place of implement. Second, install the system. Third, run the system. Finally check the result of the system on webpage that has been hosting.

Fig. 1 - Block diagram

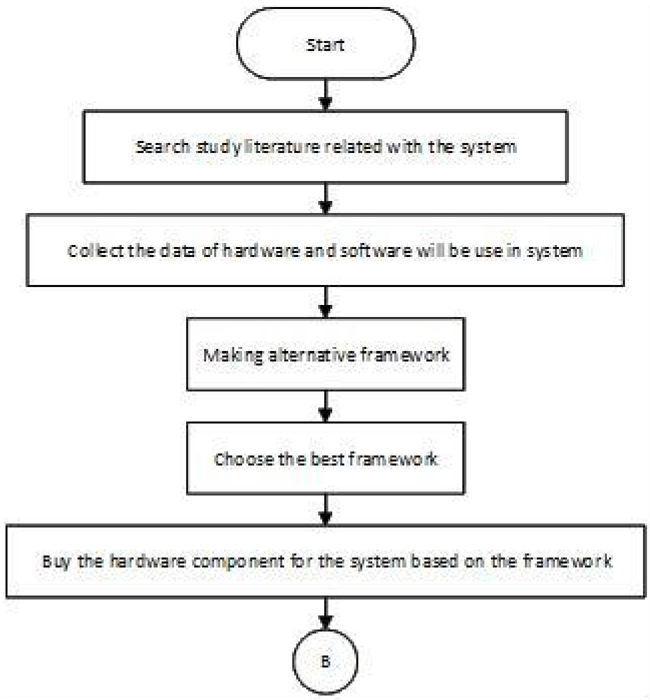

Fig. 2 - Flowchart of making system part A

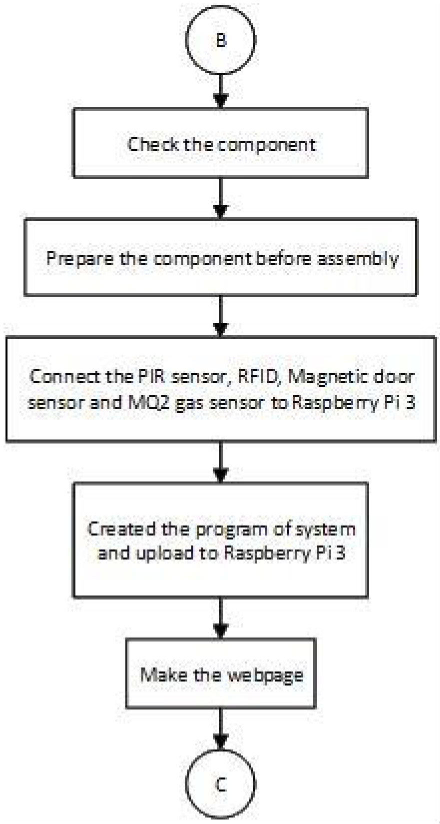

Fig. 3 - Flowchart of making system part B

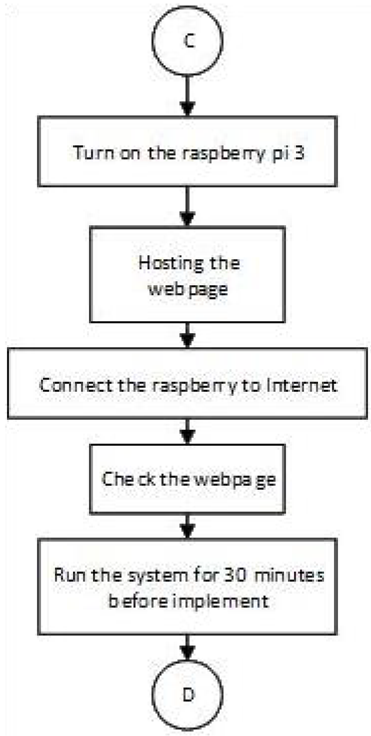

Fig. 3 - Flowchart of making system part C

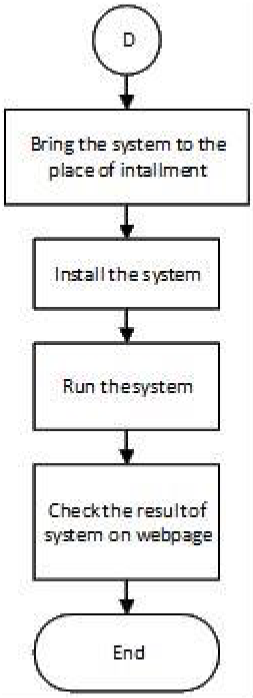

Fig. 4 - Flowchart of making system part D

3. Result

All authors are required to complete the Procedia exclusive license transfer agreement before the article can be published, which they can do online. This transfer agreement enables Elsevier to protect the copyrighted material for the authors, but does not relinquish the authors' proprietary rights. The copyright transfer covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microfilm or any other reproductions of similar nature and translations. Authors are responsible for obtaining from the copyright holder, the permission to reproduce any figures for which copyright exists. Package A is a package made based on the needs of the sys-tem with raspberry pi components, PIR Sensors, MQ2 Gas Sensors, RFID and Magnetic Switches. Based on the above components, the price to be issued is IDR 891,000 per pack-age system.

Table 1 - Price of Package A

	Price (IDR)
Raspberry Pi	750,000
PIR Sensor	18,000
MQ2 Gas sensor	20,000
RFID	59,000
Magnetic Switch	44,000

Table 2 - Price of Package B.

Component Name	Price (IDR)
Raspberry Pi	750,000
PIR Sensor	18,000
MQ2 Gas sensor	20,000
Magnetic Switch	44,000

Package B is a package made based on the needs of the system with raspberry pi components, PIR Sensors, MQ2 Gas Sensors and Magnetic Switches. Based on the above components, the price to be issued is IDR 832,000 per package system. Package C is a package made based on system requirements with components of raspberry pi, RFID, MQ2 Gas Sensor and Magnetic Switch. Based on the above components, the price to be issued is IDR 873,000 per package system. Package E is a package made based on system requirements with Arduino, ESP8266, RFID, MQ2 Gas Sensor and Magnetic Switch components. Based on the above components, the price to be issued is IDR 548,000 per package system. Package F is a package made based on system requirements with Arduino, ESP8266 components, RFID and MQ2 Gas Sensors. Based on the above components, the price that will be issued is IDR 504,000 per package system. Comparison of each package for framework.

Based on the comparison table above the ability to execute pro-grams can be done by all packages because it uses the processing module Raspberry Pi and Arduino. The ability to connect directly to the internet can only be done by packages a, b and c because it uses the raspberry pi module that has included Wi-Fi in the module. The ability to detect animal and human movements can only be done by packages a, b and d because the package uses a PIR sensor. The ability to detect flammable gases can only be carried out by packages a, b, c, d and e because it uses MQ2 gas sensors. The ability to collect visitor data can only be done by packages a, c, d, e and f because it uses RFID. The ability to detect the state of the door can be done by all packages because it uses a Magnetic door sensor. All paragraphs must be justified alignment. With justified alignment, both sides of the paragraph are straight.

Table 3 - Price of Package C

Component Name	Price (IDR)
Raspberry Pi	750,000
MQ2 Gas sensor	20,000
Magnetic Switch	44,000
RFID	59,000

Table 4 - Price of Package D

Component Name	Price (IDR)
Arduino	375,000
Esp8266	50,000
PIR Sensor	18,000
MQ2 Gas sensor	20,000
RFID	59,000
Magnetic Switch	44,000

Package D is a package made based on system requirements with Arduino, ESP8266 components, PIR Sensors, RFID, MQ2 Gas Sensors and Magnetic Switches. Based on the above components, the price to be issued is IDR 566,000 per package system.

Table 5 - Price of Package E

Component Name	Price (IDR)
Arduino	375,000
Esp8266	50,000
MQ2 Gas sensor	20,000
RFID	59,000
Magnetic Switch	44,000

Table 6 – Price of Package F

Component Name	Price (IDR)
Arduino	375,000
Esp8266	50,000
MQ2 Gas sensor	20,000
RFID	59,000

Table 7 - Comparation of each part in each package

Ability	A	B	C	D	E	F
Execute a program	x	x	x	x	x	x
Directly connect to internet	x	x	x			
Detect the motion of human and animal	x	x		x		
Detect the flammable gas	x	x	x	x	x	
Collect the data of visitor	x		x	x	x	x
Detect the condition of door	x	x	x	x	x	x

4. Conclusion

In this paper a framework has been proposed that will be used as a security system that meets the criteria of IR 4.0. Based on the results of the framework proposal package A has been chosen as the framework that will be used to carry out the next process. This package was chosen because it has the ability to adequately meet the criteria of the system to be made and the price spent for this package is still relatively affordable and for the components used in this package it is easy and quite a lot to be obtained on the market.

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