FRAMEWORK INVESTIGATION OF HEALTHY MONITORING SYSTEM FOR PRODUCTION LINE ON IR 4.0

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Abstract

Each production line is required to comply with occupational health regulations. But in reality many companies do not comply with these regulations because there are no tools available at the market at low prices. This paper presents an investigation of the health monitoring system framework for production lines on IR 4.0, and proposes a cost-based and system-wide framework. The framework of the paper consists of raspberry pi 3 as the main module of IoT processing, and there are 3 sensors such as DHT11, MQ5, and MQ9. The DHT11 sensor is used to detect temperature and humidity, the MQ5 sensor is used to detect Liquified Petroleum Gas (LPG), and the MQ9 Sensor is used to detect carbon monoxide (CO). The method used in this paper is to look for literature studies, then collect component data, then select components based on literature studies. Then form components into several frameworks, which are then selected as the best framework. Finally, arrange, run and test the system.

***Keywords**: detecting, framework, healthy, IoT, monitoring.*

Abstrak

Setiap lini produksi diwajibkan memenuhi peraturan kesehatan kerja. Namun dalam kenyataanya banyak perusahaan yang tidak memenuhi peraturan tersebut karena tidak ada peralatan yang tersedia dipasaran dengan harga murah. Makalah ini mempresentasikan penyelidikan kerangka kerja sistem pemantauan kesehatan untuk lini produksi pada IR 4.0, serta mengusulkan kerangka kerja berdasarkan biaya dan kelengkapan sistem. Kerangka kerja pada makalah terdiri dari raspberry pi 3 sebagai modul utama pemrosesan IoT, dan terdapat 3 sensor seperti DHT11, MQ5, dan MQ9. Sensor DHT11 digunakan untuk mendeteksi suhu dan kelembaban, sensor MQ5 digunakan untuk mendeteksi Liquified Petroleum Gas (LPG), dan Sensor MQ9 digunakan untuk mendeteksi karbon monoksida (CO). Metode yang digunakan dalam paper ini adalah dengan mencari studi literatur, kemudian mengumpulkan data komponen, lalu memilih komponen berdasarkan studi literatur. Selanjutnya membentuk komponen kedalam beberapa framework, yang kemudian dipiilih satu framework yang terbaik. Terakhir, merangkai system, menjalankan dan mengetest system.

***Kata kunci**: IoT, kerangka, kesehatan, mendeteksi, pemantauan.*

1. INTRODUCTION

Health is a healthy condition, both physically, mentally, spiritually and socially, which enables everyone to live productively socially and economically (Government, 2009). Health will usually have an impact on the quality of one's work. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization leads to release of lot of gaseous pollutants. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma (Kaur, 2016).

Air quality is one of the main factors that determine health in the room and outdoors. Air quality parameters can be in the form of air and humidity temperatures, Carbon Monoxide (CO), and Liquefied Petroleum Gas (LPG). The relationship between temperature and humidity is very related, so if the temperature changes, the air humidity also changes. High relative humidity will accelerate the increase in expenditure of body fluids through sweat (Sandi, 2017). CO is odorless, colorless, tasteless and highly poisonous gas. After combining with the hemoglobin of blood, it forms carboxyhemoglobin (HbCo) which leads to reduction in oxygen carrying capacity of blood thus causes hypoxia (Kaur, 2016). LPG gas is propane gas and butane gas that liquified. in large

concentrations, LPG can cause shortness of breath, increased heart rate, headache, nausea, vomiting, and disorientation (K, 2012).

There are many people still confused how to know the level of air quality in a room. Monitoring process can be one of solution to determine the air quality in production line whether healthy or not. Usually people know the condition of air quality still using manual methods. For example, People go to the place, then measure the temperature and humidity using hygrometer. Therefore, to make easier, it is needed a tool that can monitor the level of air quality in the production line automatically.

Healthy monitoring system is a tool that aims to monitor the level of air quality in a room automatically. Healthy monitoring system is equipped with three sensors to detect temperature and humidity, carbon monoxide, and LPG. Healthy monitoring system also equipped with one processing module to process the program.

Meanwhile, the formulation of the problems in this research is how to create healthy monitoring system. Based on the formulation of the problem, the purpose of this paper is to create a framework, assemble the system, and test the system. In this paper only presents the proposed framework selected based on the cost and completeness of the system. The benefits of the framework in this research as a guide before assembling the system. The research boundaries are using raspberry pi 3 and MQ 2, MQ 9, DHT11 sensors, and research was carried out in manufacturing buildings Telkom University. The benefit of this research is easier to know the air quality condition in the production line.

2. LITERATURE RESEARCH

Monitoring is a process of measure, note, collect, processing, and communicate the information to help people in taking decision. Generally, monitoring is used in checking between performance and predetermined targets. Monitoring can provide information on the sustainability of the process to set steps towards continuous improvement. In its implementation, monitoring is carried out when a process is underway (Mudjahidin, 2012).

Sensor is a tool that use for detecting the environment changes. the following are sensor that use in this research: DHT11 is type of sensor used to detect temperature and humidity. It is use for measuring the temperature and humidity by using temperature & humidity sensing technology and digital-signal-acquisition technique with output in the form of calibrated digital signal. The sensor consists of NTC (Negative Temperature Coefficient) component for temperature measurement and resistive type component for measuring humidity (Kaur, 2016). MQ-9 sensor is a smoke sensor used in equipment to detect gas levels, one of it is carbon monoxide (CO). MQ9 Sensors are prepared by AL2O3 micro ceramic tubes, sensitive Tin Dioxide (SnO2) layers, measurement electrodes and heaters made of clean plastic and stainless steel. MQ-9 consists of 6 pins, 4 are used to pick up signals, and 2 others are used to provide heating currents (Yendri, 2017). MQ 9 sensor is sensitive for carbon monoxide and flammable gas (Splewak, 2015). MQ2 is type of sensor to detect Liquified Petroleum Gas (LPG). MQ2 sensor is use for various kinds of gases. MQ2 is for detect Methane, Butane, LPG, and smoke (Kaur, 2016).

Processing module is a tool that process the program. The following are used in this research: Raspberry pi 3 a credit-card-sized single-board computer powered by a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU and 512 megabytes of RAM. Raspberry Pi does not include a built-in storage device but uses an SD card for booting and storage. The performance and power consumption of raspberry pi 3 are suitable for processing various data and long-term usage without consuming a lot of power. Despite of the Raspberry Pi size, it has the capabilities to become a fully functioning computer that can run several programs at once (Sari, 2015).

Internet of Things (IoT) is a concept / scenario where an object can transfer data over a network without requiring human-to-human or human interaction to a computer (Mudjanarko, 2017). IoT is any activity that the culprit interacts using internet. In its use, the IoT is often found in various activities, for example: the number of online transportations, e-commerce, online ticket booking, live streaming, e-learning, etc. even IoT also assist in certain fields such as remote temperature sensors, GPS tracking, etc. that uses the internet or network as a medium to do so (Sulaiman, 2017).

I. SYSTEM DEVELOPMENT

The block diagram of healthy monitoring system as shown in Fig. 1.

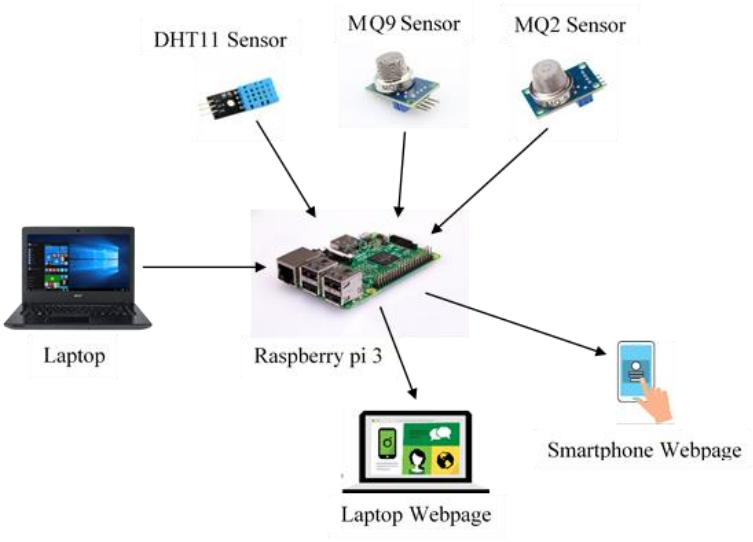

Figure 1. Block Diagram

The picture above shows how a healthy monitoring system will be created, where the laptop is used to create program code that will be entered raspberry pi 3, then raspberry pi 3 will execute the program and use input parameters from the DHT11 sensor, MQ9 sensor, and MQ 2 sensor. 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.

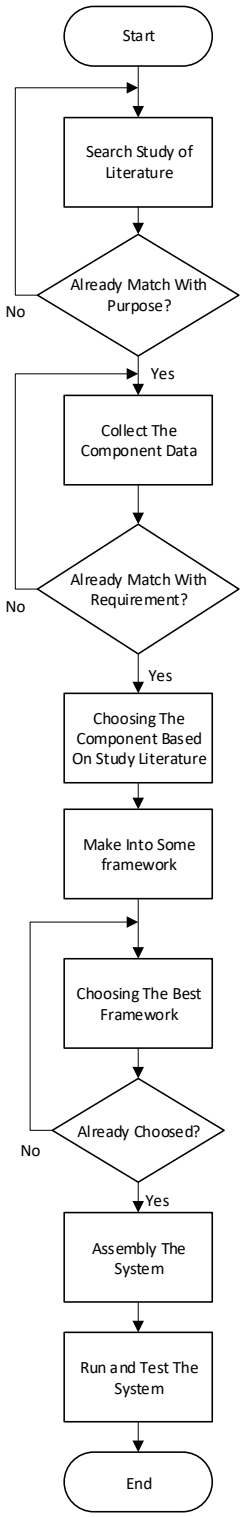

Figure 2. Flowchart for Creating Healthy Monitoring System

Fig. 2 shows a flowchart for creating monitoring system. Based on the flowchart picture above, the first step is look for literature studies related to the monitoring system. After searching the literature study, then collect all the components of the results of the literature study that was read. Third, choose components that are in accordance with the research that will be made. Then create a framework. then choose one of the best frameworks based on price and compatibility with the system. Then assemble the system. Once assembled, the last step is to run and test the system that has been assembled.

3. RESULT

In the research conducted, there were three packages made. The three packages are package A, package B, and package C. The three packages are shown in table 1, table 2, table 3, and table 4 as a comparison table of the three packages.

Table 1. Package A

Parameter Components	Components	Price (IDR)
Temperature and Humidity	DHT11	24500
CO	MQ9	30000
CO2	MG811	975000
LPG	MQ2	52000
Microcontroller	Arduino Uno R3	87000
Transmission Module	Zigbee	748000
Total		1916500

Package A is the most expensive package. In package A there are six component parameters which consist of three main parts, namely sensor, microcontroller, and transmission. In this package there are four sensors. The four sensors are temperature and humidity, CO, CO2, and LPG sensors. This package has a total price of IDR 1,916,500.

Table 2. Package B

Parameter Components	Components	Price (IDR)
Temperature and Humidity	DHT11	24500
LPG	MQ2	52000
CO	MQ9	30000
CO2	MG811	975000
Processing Module	Raspberry pi 3	700000
Total		1781500

Package B is the most complete package. In package B there are five component parameters which consist of two main parts, namely sensor and processing module. In this package there are four sensors and one module. The four sensors are temperature and humidity, CO, CO2, and LPG sensors. This package has a total price of IDR 178,1500.

Table 3. Package C

Parameter Components	Components	Price (IDR)
temperature and humidity	DHT11	22000
LPG and Smoke	MQ2	30000
Carbon Monoxide	MQ2	20000
Processing Module	Raspberry pi 3	700000
Total		772000

Package C is the cheapest package. In package C there are four component parameters which consist of two main parts, namely sensor and processing module. In this package there are three sensors and one module. The three sensors are temperature and humidity, CO, and LPG sensors. This package has a total price of IDR 772,000.

Table 4. Comparison of Three Packages

Parameters	Packages		
	A	**B**	**C**
Detecting Temperature and Humidity	v	v	v
Detecting Carbon Monoxide	v	v	v
Detecting Carbon Dioxide	v	v	
Detecting LPG	v	v	v
Connect to the Internet		v	v
Total Price (IDR)	1916500	1781500	804000

The table above is a comparison table of the three packages that have been made. From the table there are differences in each package. These differences include the ability and the total price of each package. In the capability parameter, package A is a package that cannot connect to the internet, then packet B is the package with the most complete capabilities, and package C which is unable to detect CO2. Then in terms of total price, package A is the most expensive package, then package B is the second most expensive, and package C is the cheapest package.

4. CONCLUSION

Based on the results of this paper, a framework has been proposed that will be used as a healthy monitoring system that meets the criteria of IR 4.0. Based on the results of the proposal, it has been chosen C because this package is in accordance with the needs and the cost that is owned. Package C can connect to the internet using raspberry pi 3. In package C does not really require CO2 sensors because on the production line there are many machines that emit CO and LPG gas, and require temperature sensors as a result of the heat produced by the machines.

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