Internet of Things in Monitoring and Notification of Industrial Security Systems

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Abstract. One of the factors that influence the course of industry is the security factor, which is represented by security devices and security guards on the internal security system. Information technology changes the security system to be more complicated. The purpose of this study is to monitor and protect security systems using information technology. The method used in this study is the Monte Carlo Algorithm. This research provides a solution to the problem of mathematical data and decisions. The results of this study are automated testing in real-time communication, both on mobile devices and websites. The accuracy of the first data test was 98% and the second data test was 98%. This research is very appropriate to be applied in the application of industrial security systems.

1. Introduction

Technological developments in the industrial world have reached the 4th generation or the so-called Industry 4.0 starting from the first generation occurred at the end of the 18th century. In the Industrial Age 4.0 this emphasizes the digitalization of information technology [1]. One important factor that influences the course of industry is the security system that is a mandatory requirement, always a priority that needs attention. Includes external and internal security represented by the security device and security guard [2].

Current information technology in security systems is made more complex, developing and more modern [3]. the main characteristic of progress is the interaction between machines and machines that combine automation technology [4]. Industry 4.0 is an industrial era where technologies such as artificial intelligence, automation, and the internet affect each other's lives [5]. all entities within an industry can communicate in real time based on the use of internet technology. Technically integrated from Cyber Physical System (CPS) and Internet of Things (IoT) into the industry [6]. CPS itself is a technology to combine the real world with cyberspace and the Internet of Things (IoT) is a technology where objects around us are connected to the internet and some devices can transmit data via the internet [7].

Internet of Things (IoT) is a concept where several devices can send their data over the internet without human assistance [8]. At the moment it is becoming a new technology that is developing in Indonesia, and various types of industries in the world are now beginning to utilize this technology. The concept of internet of things (IoT) includes 3 main elements, namely: physical or real objects that have been integrated in the sensor module, internet connection, and data center on the server to store data or information from the application [9]. Internet of things (IoT) that can do a data / information transmission through a network with machine communication with a machine without human intervention known as the Smart System [10].

The main problem is that it is not usually possible for the system to know what threats will occur in the future in industrial security systems, in anticipation of adding a prediction method that is using the Montecarlo algorithm. This method proved to be efficient in solving differential equations, field radians integrals, and was generally carried out using computers and using computer simulation techniques [11]. Monte Carlo Algorithm is a special approach computational algorithm that is very useful for simulating various behaviors in physics and mathematical systems [12]. Monte Carlo algorithms are often used to analyze decisions in situations that involve the risk of several parameters to be considered.

2. Method

The industrial security system uses internet Foo Things (IoT) technology as monitoring data and information notification data, designed using several sensors. Monitoring data is obtained from inputting DHT11 sensors, while Notification data is obtained from inputting MQ-2 Sensors, PIR Sensors and Flame Sensors. Some sensors can send information as monitoring data, and notification data, obtained from ESP8266 processing, can be seen in Figure 1.

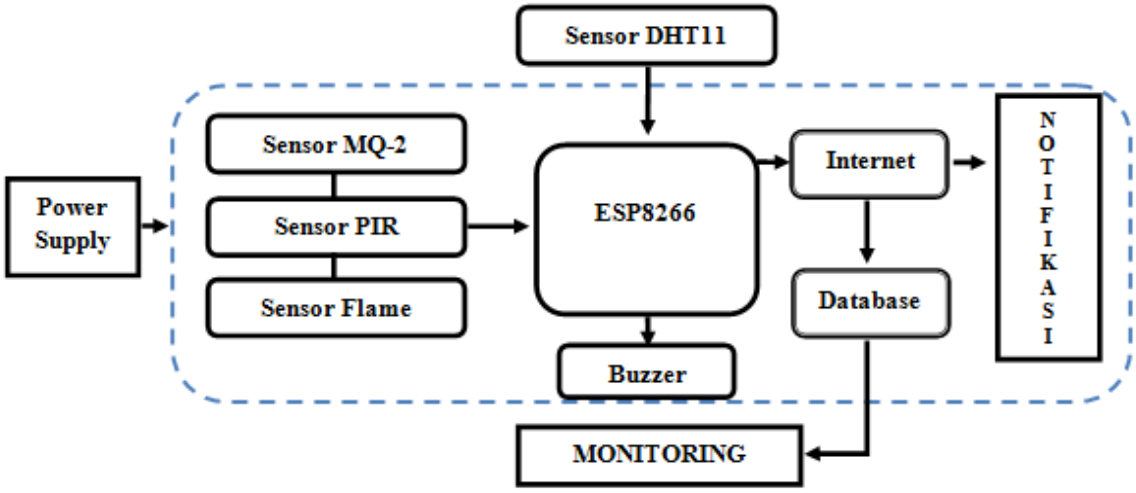

Figure 1. System Scenario Diagram

The PIR sensor and Flame Sensor when detecting an object are worth 1 or High, and the MQ-2 Sensor when detecting smoke indicates an air change exceeds the threshold level, then ESP8266 will process and send Notification information to the smartphone. Sensor DHT11 input data into the MySQL database as a data medium that will be accessed through the website and mobile application as monitoring data.

2.1 Detection and Monitoring

Temperature input data and humidity input data come from outside the system, which comes from a series of devices sent and processed using ESP8266 using Internet of things (IoT) technology by means of the get_data method which will be stored in the MySQL database.

2.2 Monte Carlo Algorithm

The data used is the past data or previous data from the average sensor data stored in the database. Testing is done to predict in the next 1 hour. Moisture data is used because, air humidity has the potential to be the main cause of easy fire when it is in the condition of 30 percent which means that the water content in the air is very dry [13] [14]. In this test using 1 hour recapitulation data is divided into 6 parts so that 1 data is an average of data per 10 minutes.

2.3 Determining Probability

The probability value is obtained from the number of moisture calculation values, namely by means of the average value of the humidity listed divided by the total number, where:

$$\text{Probability} = \left[\frac{average\_humidity}{Total} \right] \quad (1)$$

2.4 Determine Cumulative Probability

To determine the calculation value of cumulative probability distribution by inputting the initial data based on data on probability. Then in the second step add the previously inputted data with the second probability data. The next step is done in the same way so that in the last data there is a cumulative probability value of 1.00.

2.5 Determining Random Numbers

To determine the random value using the Linear Conruential Method (LCM) method by generating random numbers using the equation:

$$Z_n = (a.Z_i + c) \bmod m. \quad (2)$$

For the last step is to make predictive simulations of a series of experiments using random numbers by taking predetermined random numbers (Generating random numbers) based on the interval and the average humidity previously processed and calculate the probability distribution and cumulative distribution.

3. Result

The data sent to the MySQL database is then displayed on the website as a system Monitoring the sensor data display. In the graph image the temperature data obtained from the DHT11 sensor is shown in blue linechart color, while the red linechart is the data obtained from the moisture data. Sensor data is sent directly in real time and stored in the database.

Sensor data stored in the database is obtained per 1 hour period to be calculated data. Predicted data using 1 hour recapitulation data is divided into 6 parts so that 1 data has an average of data per 10 minutes, seen in Table 1.

Table 1. Table of Average Humidity

Minutes to	**Average data on humidity**		
	Data 1	**Data 2**	**Data 3**
1 s/d 10	70	70	71
11 s/d 20	70	70	71
21 s/d 30	70	71	72
31 s/d 40	69	71	72
41 s/d 50	69	71	72
51 s/d 60	68	70	72
Total	416	423	430

The lower the air humidity, the air will dry the amount of water in the air decreases too. in this study will make predictions on the humidity for the next 1 hour. To do a prediction simulation the first is done to determine the probability value.

To determine the interval value starting from the first probability value and the smallest value, ie 00 to 17 until the final value reaches 100 the calculation results are shown in Table 2.

Table 2. Interval Data Tables

Minutes to	Average Humidity	Probability	Probability Cumulative	Interval		
1 s/d 10	70	0.17	0.17	0	s/d	17
11 s/d 20	70	0.17	0.34	18	s/d	34
21 s/d 30	70	0.17	0.51	35	s/d	51
31 s/d 40	69	0.17	0.67	52	s/d	67
41 s/d 50	69	0.17	0.84	68	s/d	84
51 s/d 60	68	0.16	1.00	85	s/d	100
Total	416					

A random value is a number that cannot be predicted. To determine this random value using the *Linear Constructive Method* (LCM) method by generating random values. Based on the calculations that have been described using the *Linear Conventional Method* (LCM) method shown in Table 3

Table 3. Random Figures Table

i	**Zi**	**(a.Zi + c)**	**Zi + 1 = (a.Zi + c) mod m**	**Interval**
0	56	983	63	63
1	63	1102	90	90
2	90	1561	89	89
3	89	1544	72	72
4	72	1255	59	59
5	59	1034	22	22

Random numbers that will be used in the calculation of the experimental circuit simulation are 63, 90, 89, 72, 59 and 22.

3.1. Making Prediction Simulation

Predictive simulation of a series of experiments using Generating random numbers based on the Interval and the average humidity previously processed and calculating the probability distribution and cumulative distribution. seen in table 4

Table 4. Data Prediction Table 2

No	**Data 1**	**Random Number**	**Prediction**	**Data 2**	**Accuraci %**
1	70	63	**69**	70	99
2	70	90	68	70	97
3	70	89	68	71	96
4	69	72	69	71	97
5	69	59	69	71	97
6	68	22	70	70	100

In the calculation results there are two data that become comparisons. the first is in data 1, that is, the data sought to determine the predictive value of the next data, then data 2 is the real data that occurs. Predictive data obtained compared to the real that is in data 2 to see what percentage of data prediction calculations will occur.

3.2. Simulation of the Website Application

The final results display displays probabilities and cumulative probabilities and interval data as an assessment based on random values used as prediction data shown in Figure 3.

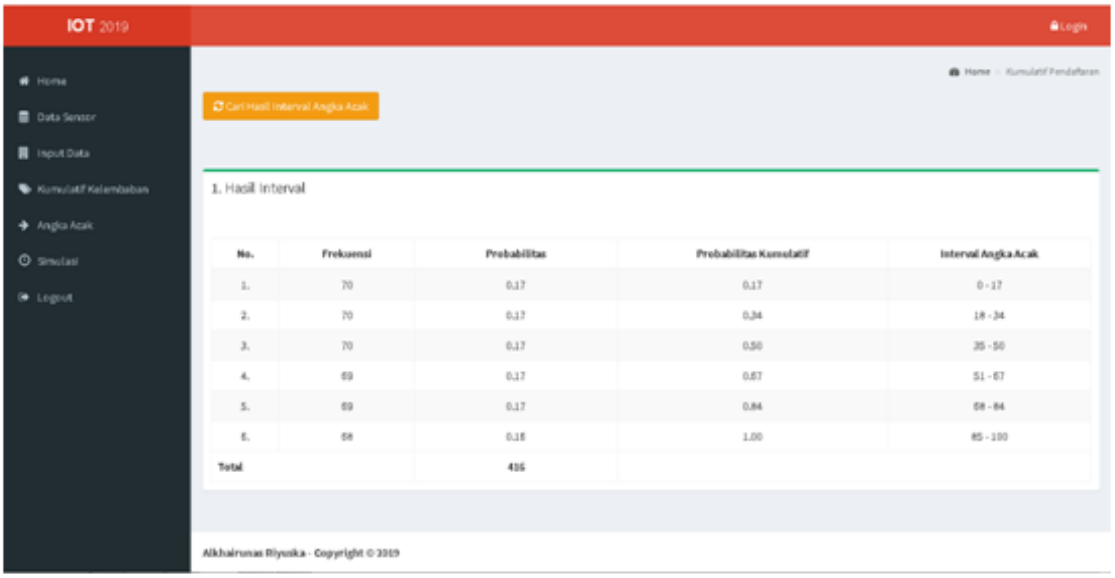

Figure 2. Website Interval Display

Generating random numbers consists of a, Zo, c, and m. It is known that a = 17, c = 31, Zo = 56 and m = 92 and displays the number of generating numbers 6 times the number of generators.
In the simulation view, displaying predictive data and accuracy based on comparisons of real data. In this view, determine the simulation value based on the random value between the interval ranges. The percentage comparison based on the value of the simulation data is divided by the real data value. shown in figure 4.

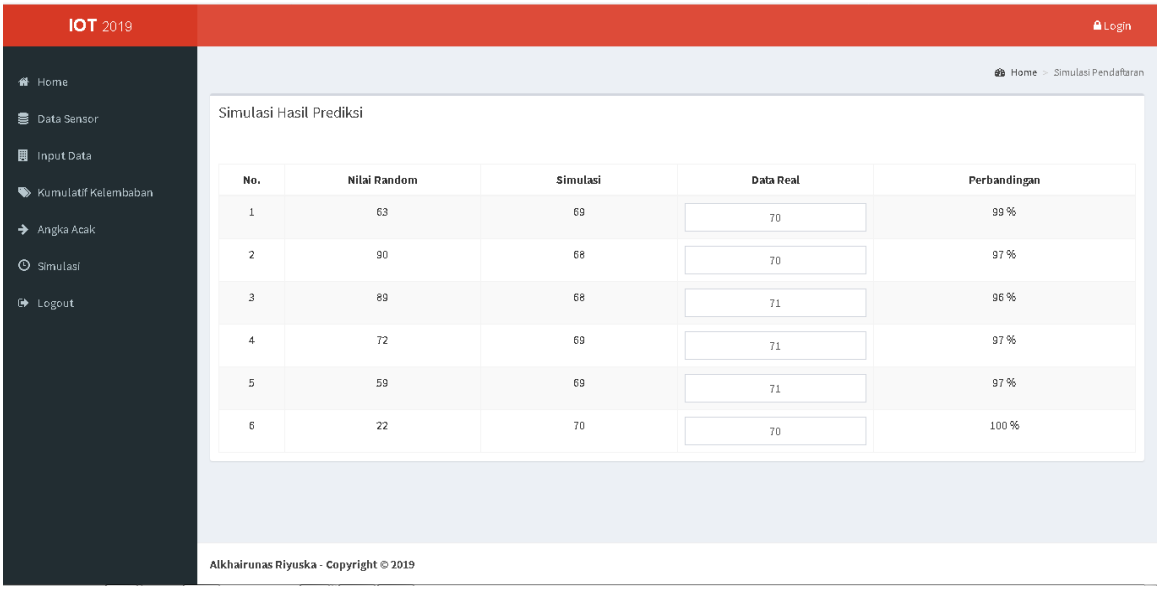

Figure 3. Display of Website Simulation

Notification Sensor sends information data when the MQ-2 sensor detects a change in air content from smoke. When the sensor detects smoke, the device system immediately detects and provides information in the form of notifications.

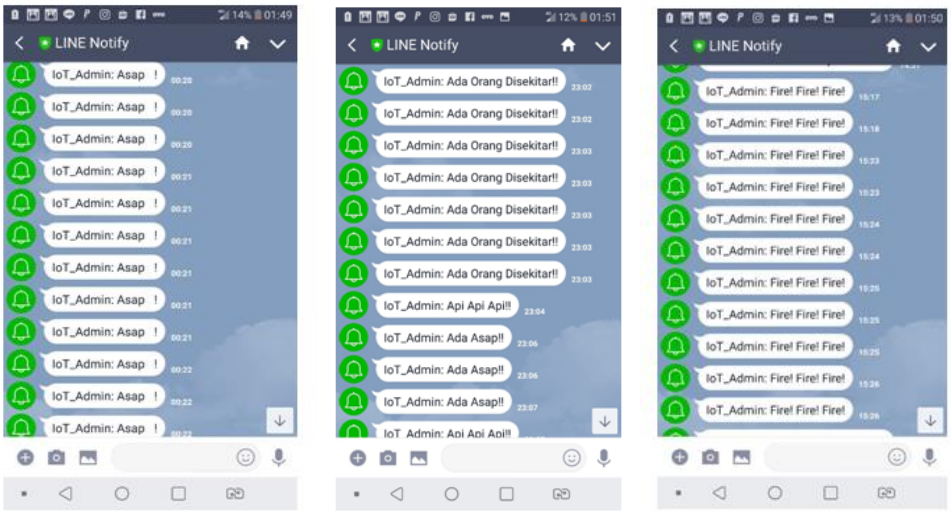

Figure 4. Security System Notifications

When the PIR sensor detects a movement disturbance that is detected it is indicated by the notification information data sent to the line application. Flame sensor works to provide notification information when the sensor detects the presence of fire in the room and how the Flame or Fire Sensor sensors work which will be processed and send warning notifications to the Line application.

4. Conclusion

Monitoring and notification of industrial security systems using Monte Carlo Algorithms can provide predictions of moisture data that will occur in the next 1 hour with the accuracy of testing the first data by 98% and testing the second data by 98%. Internet of Things (IoT) technology can provide Notification information via smartphone on the Line application.

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