DEVELOPMENT THE PROTOTYPE OF WARNING MONITORNG GAS VIA ANDROID BASED RASPBERRY PI IN A WAREHOUSE CHEMICAL PT. NAMASINDO PLAS

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ABSTRACK

Safety and Health Management System (SMK3) today received a very important concern because of the high number of accidents. SMK3 aimed at creating a system of occupational safety and health in the workplace by involving members of management, labor, working conditions and environment are integrated in order to prevent and reduce accidents and occupational diseases. One of the causes of workplace accidents that should be of concern is the danger that may be posed by LPG gas in case of leakage. The hazard can cause an explosion to fire that can endanger workers in a company. Based on these dangers we need a tool that can detect leaks as well as warning signs of leakage and fitted with handling. To get the system to work automatically, it would require an android app and Raspberry pi as a controller of the apparatus. The system is designed by using a sensor that works MQ2 detection of gas leaks in gas installations connected to the machine industry. The system is designed to provide information in the form of a warning so that prevention can be directly dealt with immediately. With the construction of the security system on the installation of gas via android-based Raspberry pi is in accordance with the expected goals that facilitate the control and monitoring of gas leaks in linggkunan work

Keyword : *SMK3, Raspberry pi, MQ2, LPG*

INTRODUCTION

To meet the demands set by the government and its customers. PT. ABC has participated in the first audit refers to the standard OHSAS 18001: 2007, ILO-OSH: 2001 and Permenaker No 5, 1996 [1] about Safety and Health Management System (SMK3). At the time of the first audit, there are several findings, one of them in chemical warehouse in which there are gas engines that are installed into production. The findings reported by the auditor to the team K3 PT. ABC is, the weakness of the security system gas installations in the warehouse, because if there is a leak in the gas installation, it can be risky as contamination of the product, the danger of gas inhaled by employees and the most dangerous is the explosion. For now security systems is not maximized and can effectively control the danger of gas leaks. The security system which runs today still use the emergency button to be pressed by someone who knows when there has been a leak in the gas installation in chemical warehouse, this could create a risk to the safety of employees and the production process in PT. A B C.

Along with the development of increasingly sophisticated technology from time to time, the security system must be improved in order to monitor leaks in gas installations can be more effective and efficient [2]. By because they were monitoring an object becomes more practical. To observe an object does not need to be carried out continuously, but enough to put a sensor that lead to the desired object and then watched through andoid smartphone. For the tool to be used as a controller and a conduit of information in the warehouse of chemical gas leak will use Android smartphone. In one of the journals of the International Journal of Computing and Technology titled Android Base Home Automation Using Raspberry Pi writes that it is possible to create a system to control and monitor the use the raspberry pi through the application [3] android that run on smartphones that use the system opersi android [4].

Based on the above background, the thought of making a leak detection on gas installations based raspberry pi is connected to an android application [4] so that the K3 team can monitor the condition of the warehouse without having to repeatedly come to the site. The number

of employees in particular K3 team is using android smartphone can be used as a solution for monitoring and controlling leaks in gas installations in the chemical warehouse melaluai android smartphone they use. It is expected with the construction of this system can increase and decrease the risk for accidents caused by LPG gas.

1. LITERATURE

1.1 Internet Of Things

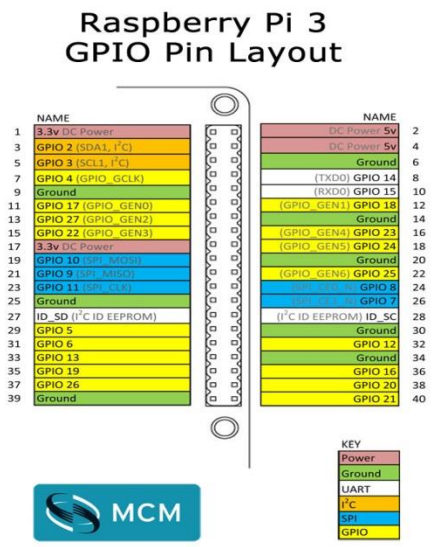
Internet of Things (IOT) is a concept that describes the future of computing in which every physical object can be connected to the Internet and can identify themselves from other devices [5]. The term Internet of Things came to prominence in 1999 when it was first mentioned in a presentation by Kevin Ashton, confounder and executive director of the Auto-ID Center at MIT (Massachusetts Institute of Technology)

1.2 Androiandroid operating system

Android is a software stack for mobile devices that includes the operating system middleware, and core applications released by Google. Android is an operating system (mobile operating system), which adopted the Linux operating system, but has been modified. Android was taken over by Google in 2005 from Android, Inc. as part of a strategy to fill the mobile operating system market. Google took over the entire work team that developed the android including Android [6].

1.3 Raspberry Pi

Raspberry Pi mini computer is a device about the size of a credit card. Raspberry Pi has a system Broadcom BCM2835 chip (SoC), which includes ARM1176JZF-S 700 MHz processor (firmware included a number of modes "Turbo") so that users can try overclocking, up to 1 GHz, tanp, VideoCore IV GPU, and initially shipped with 256 megabytes RAM, then upgrade to 512MB. Includes built-in hard disk or solid-state drive, but using an SD card to boot and long-term storage. The operating system is planted on an SD Flash Card, which makes it very easy to be replaced and exchanged. The potential is incredible, from the already or not yet been explored, but it has been tested as a multimedia player with good skills [7]. Raspberry pi has GPIO (general purpose input output). Is a generic GPIO pins on a chip that can be controlled and programmed via software both in pin configuration as input or output pin.

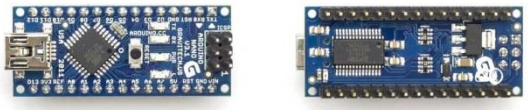


Sumber gambar : https://www.raspberrypi.org

Gambar 2.1 Raspberry pi GPIO

1.4 Arduino Nano

Arduino adalah kit elektronik atau papan rangkaian elektronik *Open source* yang di dalamnya terdapat komponen utama, yaitu sebuah chip mikrokontroler dengan jenis *Advanced Versatile* RISC (AVR) dari perusahaan Atmel. Mikrokontroler itu sendiri adalah chip atau *intergrated circuit* (IC) yang bisa di program menggunakan komputer. Tujuan menanamakan program pada mikrokontroler adalah agar rangkaian elektronik dapat membaca input, memproses input tersebut dan kemudian menghasilkan output sesuai dengan yang di inginkan. Jadi mikrokontroler sebagai "otak" input, output dan proses pada sebuah rangkaian elektronik.



Sumber Gambar : https://www.arduino.com

Gambar 2.1 Board Arduino Nano

1.5 Sensor MQ2

This sensor functions like a potentiometer, the sensor resistance will change proportional to the gas concentration detection. Changes in resistance value of the sensor will then be transferred to the Port ADC1 microcontroller for conversion to PPM value. (Part Per Milion) MQ-2 gas sensor has an output resistance value changes, so that in use with

ADC microcontroller load resistor needs to be added so that the results can be worth the voltage sensor readings. Changes in the value of the voltage is then converted into PPM (Parts Per Milion).

1.6 Web Service

Web Service is a software system designed to support interaction and interoperability between systems on a network. Web service is used as a facility that provides services (in the form of information or data) to other systems, so that it can interact with the system through the services provided. Web service stores information data in JSON or XML format, so that this data can be accessed by other systems, although different platforms, operating systems, and programming languages [8].

2. CONTENTS OF RESEARCH

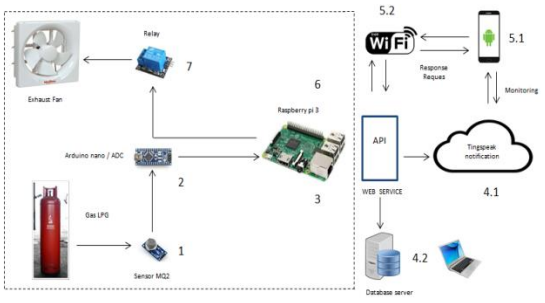
2.1 Trouble Analisis

Some of the problems that often occur when the gas leak checking activity are:

1. Weak security system on gas installations in chemical warehouse, because the security system which runs today use the emergency button is operated manually in the event of a gas leak.
2. The inefficient time when monitoring at gas installations in the chemical warehouse, because the K3 team should check the condition of the warehouse at any time during business hours.

2.2 Analysis System Design Architecture

The system will be built to have several stages, input data obtained from MQ2 sensors, processing the input data by raspberry pi 3 tapil warning information on android smartphone applications.



Gambar 3.1 Arsitektur Perancangan Sistem

The following data flow analysis and a stage to explain the process of working on the architectural design of the system above:

1. MQ2 sensor will detect hydrocarbon gas levels in the air around the installation of LPG gas cylinders, then MQ2 sensor will send an analog signal to a microcontroller arduino nano based on levels of gas are detected by sensors MQ2. The gas to be detected is a type of LPG gas consisting of two gas mixture that is 30% propane and 70% butane. To distinguish the LPG gas and other gas type it in there MQ2 sensor datasheet that will determine the type of gas to be detected, the following datasheet for the sensor differentiates the type of gas:
   - Propana 200-500 ppm
   - Butana 300-5000 ppm
   - Metana 5000-20.000 ppm
   - Etanol / alkohol 100-2000 ppm

   Hydrocarbon gases are captured by the sensor MQ2 will affect the analog resistance value that can be converted into a voltage. The results of sensor readings can be read by a pin ADC (analog to digital coverter) on the microcontroller arduino nano.
2. Arduino nano works as ADC (Analog to digital converter). ADC is used as an analog to digital converter so that the signal can be read by the raspberry pi. For example, if the reference voltage is 5 volts, the input voltage is 3 volts, the ratio of input to the reference is 60%. So, if you use 8-bit ADC with a maximum scale of 255, will obtain a digital signal by 60% x 255 = 153 in decimal form and will be converted into a binary form that is 10,011,001

   Signal=(sample/max_value)* reference_voltage
   = (153/255) * 5
   = 3 Volts
3. Raspberry pi will receive the value imputan of Arduino nano that has been converted digital kesinyal. Raspberry pi programmed by using the language python to process imputan value into information that will be sent to the android smartphone, if the value of gas that have been defined already mecapai predetermined maximum limit, exhaust fan automatically turns on the child. Simultaneously with raspberry exhaust fan fire up the command will send that information of value to the tingspeak.com server and PT. A B C. server

4. The value delivered by the raspberry pi will be stored on the tingspeak server and PT. A B C the server.
    1. Data that is sent to the server tingspeak.com by raspberry pi is the data for notification when the value of the field = 1 means there has been leakage following and if the value of the field = 0 means no leaks.
    2. Data that is sent to the server PT. ABC is the data from sensor readings from MQ2 periodically, the result is stored on a server PT. ABC and can be seen on the web application in the form of line charts and tables.
5. The same practice on android smartphone will work in two stages, namely:
    1. Applications on Smartphones andorid willmemaca tingspeak.com value on the server periodically if the value of the field = 0 means no leaks in the gas installation, if the value of the field = 1 means there has been a leak in the gas installations. An application on android smartphone will provide notification if the value read on the field = 1.
    2. An application on android smartphone cancontrol the GPIO on raspberry pi which serves to control the switch relay.
6. Rasberry pi received orders from android smartphone to run a program that serves to deactivate the relay switch that has previously been active to turn on the exhaust fan in triger by sensors MQ2. GPIO to the raspberry will control relay.
7. The switch relay will receive the signal in the form of voltage supplied by the GPIO to the raspberry pi what if the value of the prograp raspberry HIGH then the relay will be active and if the value of the program LOW then the switch is off.

2.3 Web Service

In the construction of this web service based Restfull API with JSON-based data exchange, web development service built into 2 parts webservice for android devices and web services for web applications, both web service will be connected on a single database. Webservice that will be accessed by the web application and the android app and then meretrun back on devices with JSON format.

2.4 Hardware Requirements Analysis

Hardware analysis is an analytical process more emphasis on aspects of the utilization of the hardware needed for research Prototype Warning Via Android-Based Gas Monitoring raspberry pi in Chemical Warehouse PT. A B C

2.4.1 *Smartphone* Android

Analysis of the hardware used on android for implementing this application can be seen in the table below

Tabel 3.1 Spesifikasi Perangkat Keras Pengguna

No	Perangkat Keras	Spesifikasi
1	Sistem Operasi	*Lollipop*
2	RAM	1 GB
3	Memory Internal	8 GB
4	Processor	1.3 GHz

Tabel 3.2 Minimal Spesifikasi Perangkat Keras

No	Perangkat Keras	Spesifikasi
1	Sistem Operasi	*Ice Cream Sandwich*
2	RAM	512 MB
3	Memory Internal	1 GB
4	Processor	800 MHz

Based on the comparison of the existing hardware, it can be concluded that the specifications of the hardware to the user is already above the minimum specifications of the system and can run diperangkat user owns.

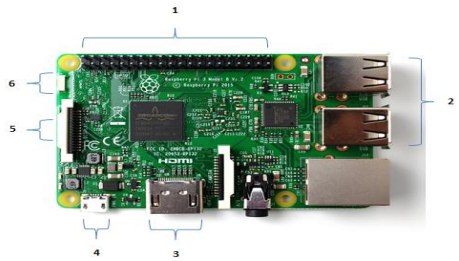
2.4.2 Analisis *Mini PC Raspberry Pi 3*

As a replacement for the PC in this study used sebuath mini PC that is raspberry pi 3. Raspberry pi or often abbreviated Raspi, is a single-board computer SBC (single-board circuit) which is about the size of a credit card degan. Raspberry pi has a processor, RAM and hardware port that the computer can be connected to a monitor, your keyboard and mouse. Besides raspberry pi also dilengkapai with GPIO (General-Purpose Input / output) which serves to control a relay which works as a switch. Relay is one of the component parts of the system to be built. Rasberry pi is a good choice for use as web servers as a liaison between android smartphone devices and microcontrollers are suitable for the system to be built on research that is being done.

Tabel 3.3 Sfesifikasi Board Rasberry Pi 3

Sfesifikasi Board Rasberry Pi 3	
SoC	Broadcom BCM2837
CPU	4x ARM Cortex-A53, 1.2GHz
GPU	Broadcom VideoCore IV
RAM	1GB LPDDR2 (900 MHz)
Networking	10/100 Etherner, 2.4GHz 802. 11n wireless
Bluetooth	Bluetooth 4.1 Classic, Low Energy
Storage	MicroSD
GPIO	40-pin header, populated
Port	HDMI, 3.5mm analogue anudio-video jack, 4xUSB 2.0, Ethernet, Camera serial interface (CSI). Display Serial Interface (DSI)

Raspberry pi can be activated by using a micro USB cable with a voltage of 5V and a minimum current of 700 mA. With the current limit of 700 mA at micro USB and GPIO pin. Each digital pin either input / output logic high and logic low 3.3 VDC 0 VDC. If the tension was less than 3.3V on each pin wherever it may result in damage.



Gambar 3.1 Board raspberry pi 3

Here is an explanation of the instructions number on the picture 3:34:

1. 40 pin GPIO (General purposes input output)
2. Slot USB (universal serial bus)
3. Slot HDMI (High-Definition Multimedia Interface)
4. Micro USB slot for 5VDC voltage source
5. microSD slot on the bottom for storage media
6. Wifi

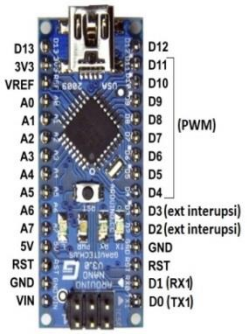
2.4.3 Analysis of Microcontroller Arduino Nano

Board microcontroller used in this penelitiaon is board arduino nano. Arduino is a microcontroller board based nano ATmega328P with a very small size. Arduino nano to be used as an ADC (analog to digiltal converter). ADC is working to convert the analog signals that send MQ2 sensor into digital signals that can be read by the raspberry pi. By using arduino nano will facilitate the process of assembling electronic circuits ATmega328 microcontroller compared assemble from scratch in breadboard.

Tabel 3.4 Sfesifikasi *Arduino Nano*

Sfesifikasi Arduino Nano	
Chip mikrokontroler	Atmega328p
Tegangan operasi	5V
Tegangan input	7V-12V
Digital I/O pin	14 buah, 6 diantaranya menyediakan PWM
Analog input pin	6 buah
Arus DC per pin I/O	40 Ma
Memori Flash	32 KB,0.5 KB digunakan untuk bootloader
SRAM	2KB
EEPROM	1KB
Clock speed	16 Mhz
Dimensi	45 mm x 18 mm
Berat	5 g

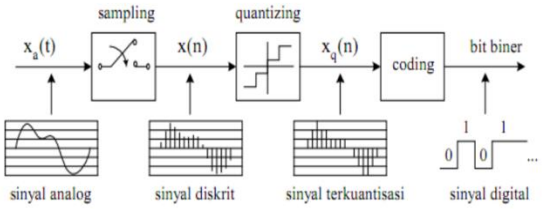
On board there are two types arduino nano ie pin pin pin analog and digital. All pins on the Arduino, both digital and analog pins pin, can be used as digital pins. Analog pins on the Arduino Nano can be used for input and digital output. Just pin analog has the feature to be able to change the incoming analog signal into a digital value which is easily measured. Digital pin can only recognize the signal as a value of 0 volt and 5 volt as LOW HIGH value. While the analog pins can recognize signals on the voltage value range. This is very useful when we want to measure something of a sensor and uses the input values for later.



Gambar 3.2 Pin Arduino Nano

The working principle of the ADC is to convert analog signals into a form which is the magnitude of the ratio of the input signal and a reference voltage. For example, when a 5 volt reference voltage, the input voltage of 3 volts, the reference input ratio is 60%. So, if you use 8-bit ADC with a maximum scale of 255, will obtain a digital signal by 60% x 255 = 153 (decimal form) or 10,011,001 (binary form).signal =

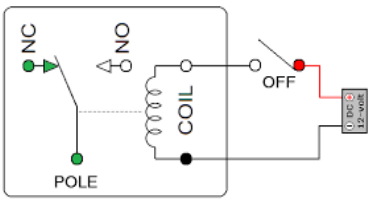
(sample/max_value)*reference_voltage
= (153/255) * 5
= 3 Volts



Gambar 3.3 Perubahan Sinyal Analog ke Digital

2.4.4 Analysis Relay Switches

To switch used in this study using a switch rellay. Relays are electromechanical components that act as switches which are operated using the power supply voltage. Relay consists of two parts, namely an electromagnetic coil and a set of switch contacts. Relay using Electromagnetic prinsif to move the switch contacts so that the electric current is small (low power) can conduct electricity with a higher voltage. For example, with the use of Electromagnetic Relay 5V and 50 mA are moving Armature Relay (which serves as a switch) to conduct electricity 220V



Gambar 3.4 Skema Saklar Relay

2.4.5 Analysis Sensor MQ2

LPG gas sensor used for sensor MQ2. MQ2 is an electronic component to detect levels of gas hydrocarbons such as iso-butane (C4H10 or isobutane), propane (C3H8 or propane), methane (CH4 or methane), ethanol (ethanol alcohol, CH3CH2OH), hydrogen (H2 or hydrogen), smoke (smoke), and LPG (liquid petroleum gas). Gas sensor can be used to detect gas leaks in homes and factories, in this study MQ2 LPG used for leak detection.

By using MQ2 Gas Hydrocarbon These sensors, researchers can detect hirdokarbon gas levels in the air by connecting the sensor to the microcontroller Arduino nano MQ2. Thus the researchers were able to create an electronic device to determine action based on the data that is read, such as sending a notification on android smartphone danger warning signs when a gas leak is detected.

Level sensor sensitivity MQ-2 varies for each type of hydrocarbon gas that can be detected according the following table:

- Propana : 200 - 500 ppm
- Butana : 300 - 5.000 ppm
- Metana : 5.000 - 20.000 ppm

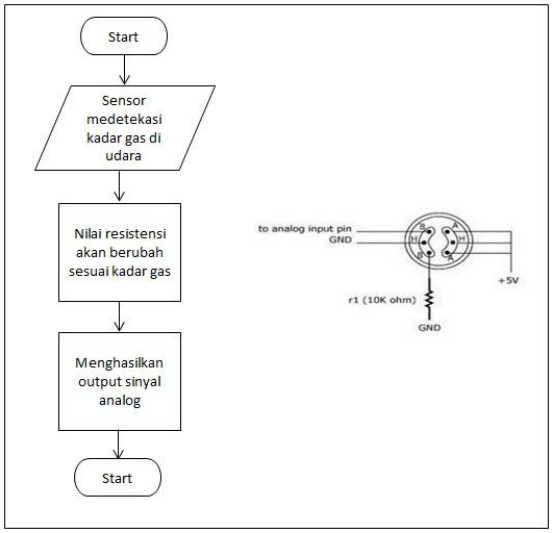
(For a sensor that is sensitive to methane, use the gas sensor MQ-4):

- etanol / alkohol: 100 - 2.000 ppm



Gambar 3.5 Sensor MQ2

The sensor output is in the form of analogue resistance which can easily be converted into a voltage by adding an ordinary resistor can also use a potentiometer so that the threshold of detection sensitivity can be adjusted as needed. By converting this impedance into a voltage, the results of sensor readings can be read by a pin ADC (analog to digital converter) on the microcontroller arduino nano. MQ2 gas sensor can be installed near the gas installations so that when there is leakage of LPG gas, this sensor will be easily detected.

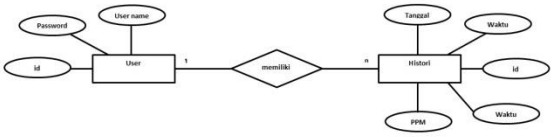


Gambar 3.6 Cara Kerja Sensor

2.4.6 Analysis Database.

The database is divided into two relation schema and table structure. Here is a relation schema and table structures are built.

Initial modeling based on data that is widely used is using ERD (Entity Relationship Diagram), ERD while the database system is as follows.



Gambar 3.7 Gambar Entity Relationship Diagram

1. User Table Structure User table is a table that contains data penggunaka of application data contained in it, among others, Id, Username, Password.

Tabel 3.5 Pengguna

No	Nama Field	Tipe Data	Ukuran	Key
1	Id	Int	5	Primary key
2	Namapengguna	Varchar	12	
3	Katasandi	Varchar	6	

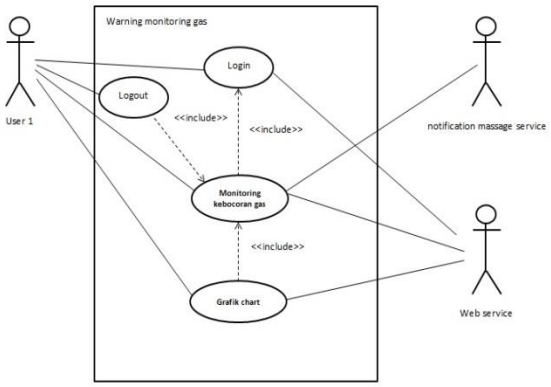
2. Historical Table StructureData Table beriksikan sensor is a data table that it happened that any leakage occurs then the data will be stored in the sensor data table.

Tabel 3.6 Historis

No	Nama Field	Tipe Data	Ukuran	Key
1	Id	Int	5	Foreign key
2	Tanggal	Date		
3	Waktu	Time		
4	Area	Int	3	
5	PPM	Double		

2.4.7 Use Case

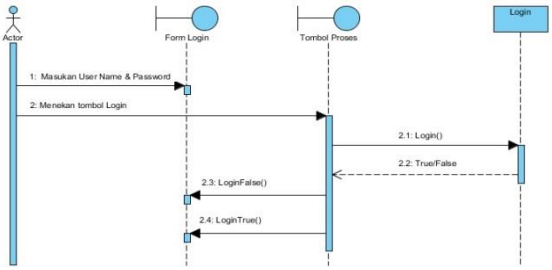
Use Case Diagram is a diagram that shows the functionality of a system or class and how these systems interact with the outside world and explain the system functionally apparent to users. From the identification of the actors involved on the Use Case Diagram can be described as follows.



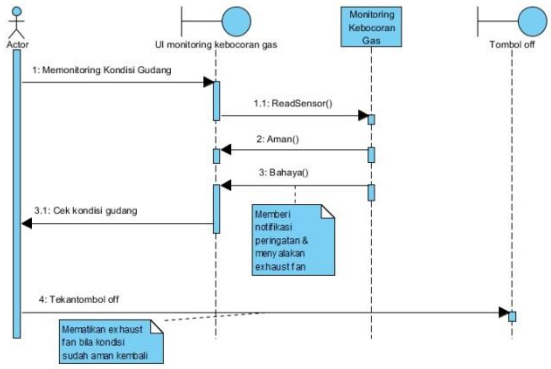
Gambar 3.8 Use Case Diagram

2.4.8 Sqeunce Diagram

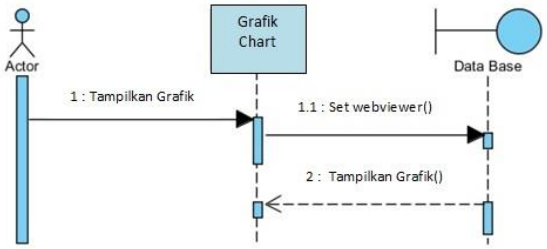
Sequence diagrams are used to describe the behavior of a scenario. This diagram shows some examples of objects and messages are placed between these objects in the Use Case. Therefore, to describe it must be known Sequence Diagram objects involved in a Use Case and its methods owned by the class diintalasi becomes the object.



Gambar 3.9 Squence Diagram Login



Gambar 3.10 Squence Diagram Monitoring

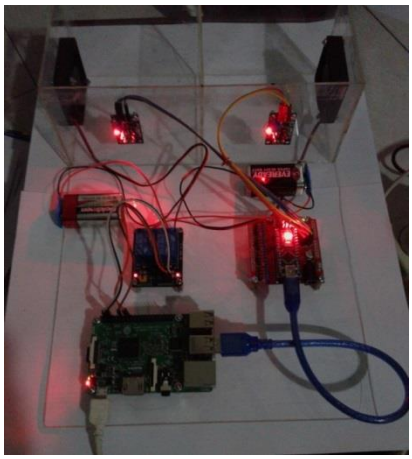


Gambar 3.11 Squence Diagram Grafik Chart

3. IMPLEMENTATION AND TESTING

3.1 Hardware Implementation

The hardware used to implement the system can be seen below.

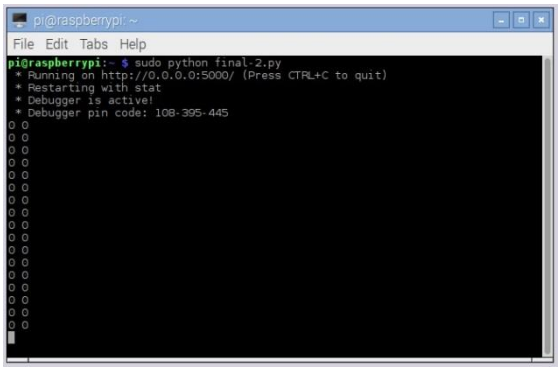


Gambar 4.12 Implementasi Perangkat Keras

3.1.1 Implementation Program In Raspberryi.

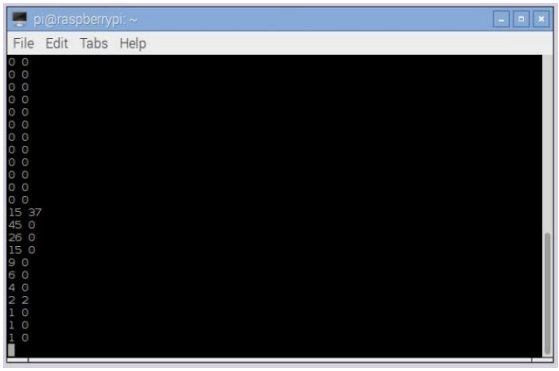
Raspberry pi can be seen on the value generated by the sensor sample results MQ2. Seen in the picture value will change in the event of a leak in the gas.

1. Results MQ2 sensors sample at the moment there are no leaks can be seen in the view below



Gambar 13 Nilai Sensor Tanpa Kebocoran Gas

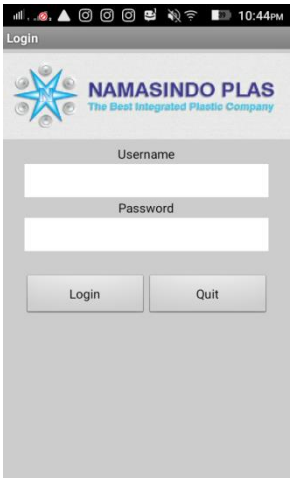
2. Results of sample MQ2 sensor in the event of a leak can be seen in the view below



Gambar 3.14 Nilai Sensor Pada Saat Gas Bocor

4.2 Implementasi Perangkat Lunak

1. User Login Username and Password fill in the login page to enter the application Warning Gas Monitoring



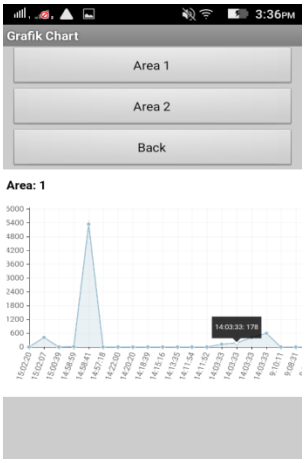
Gambar 4.15 Halaman Login

2. Monitoring On this page the user can view the status and condition of gas in case of leakage ate notification will appear in the form of a warning that the leak has occurred.



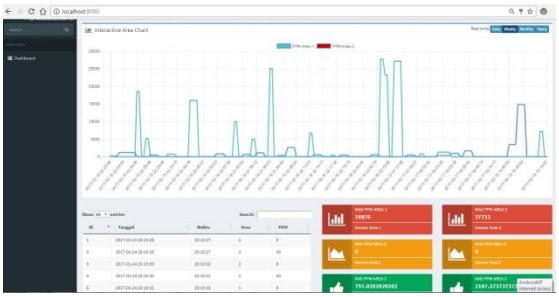
Gambar 4.16 Halaman Monitoring

3. Graph Chart On this page user can see the image Graphic Chart dar sensor readings result MQ2 the detection of gas leaks in the warehouse.



Gambar 4.17 Halaman Grafik Chart

4. Display the chart on the server can be seen through the web application. In this web application can be seen graphs, historical tables, and the time table of events.



Gambar 4.18 Tampilan Pada Aplikasi Web

3.2 Testing

These software testing using two stages, the first stage is the alpha testing that focuses on software functionality built with black box testing methods. The second stage of beta testing that focuses on the assessment of software that is built, the data collection methods such as interviews with the parties that will be involved in the system. Alpha testing is testing the functionality of the software built. Alpha testing is performed by the user who will use the software that had been established earlier and was accompanied by the builder. The builder noted errors and problems perceived by users. Alpha testing is divided into three stages, namely the test scenarios, case and test results, and the conclusion of testing.

1. Scenario Testing For further explanation of the application testing scenarios can be seen in the following table.

Tabel 4.7 Skenario Pengujian

No	Kelas Uji	Butir Uji	Jenis Pengujian
1	Login	Login sebagai User	Black box
2	Monitoring Kebocoran gas	Mengetahui stasus area (“aman” ,” waspada”)	Black box
		Menampilkan notifikasi apabila ada kebocoran	
		Button ON menyalakan Exhaust fan 1	

		Button OFF mematikan Exhaut fan 1	
		Button ON menyalakan Exhaust fan 2	
		Button OFF mematikan Exhaut fan 2	
3	Grafik chart	Menampilkan grafik chart hasil bacaan sensor	Black box

2. Login Testing

Tabel 4.8 Pengujian Data benar Pada Login

Kasus Uji	Skenario Uji	Hasil Yang Diharapkan	Hasil Pengujian
Login	User login dengan username dan pasword yang valid	Masuk kehalaman Monitoring dan login sebagai user	[√] Berhasil [ ] Tidak Berhasil

Tabel 4.9 Pengujian Data Salah Pada Login

Kasus Uji	Skenario Uji	Hasil Yang Diharapkan	Hasil Pengujian
Login	User login dengan username dan pasword yang salah	Menampilkan pesan error dan kembali ke halaman login.	[√] Berhasil [ ] Tidak Berhasil

Tabel 4.10 Pengujian Monitoring Kebocoran Gas

Kasus Uji	Skenario Uji	Hasil Yang Diharapkan	Hasil Pengujian
Monitoring kebocoran gas (status "aman","waspada") dan notifikasi	User mendapat informasi status ("aman","waspada")	Menampilkan staus ("aman","waspada")	[√] Berhasil [ ] Tidak Berhasil
	User	Menampil	[√]
	Mendapat notifikasi apabila terjadi kebocoran gas	kan notifikasi berupa Text dan getaran	Berhasil [ ] Tidak Berhasil
	User menekan tombol Button ON untuk menyalanak Exhaust Fan 1	Exhaust Fan 1 menyala	[√] Berhasil [ ] Tidak Berhasil
	User menekan tombol Button OFF untuk mematikan Exhaust Fan 1	Exhaust Fan 1 tidak aktif	[√] Berhasil [ ] Tidak Berhasil
	User menekan tombol Button ON untuk menyalanak Exhaust Fan 2	Exhaust Fan 2 menyala	[√] Berhasil [ ] Tidak Berhasil
	User menekan tombol Button OFF untuk mematikan Exhaust Fan 2	Exhaust Fan 2 tidak aktif	[√] Berhasil [ ] Tidak Berhasil

Tabel 4.11 Pengujian Grafik Chart

Kasus Uji	Skenario Uji	Hasil Yang Diharapkan	Hasil Pengujian
Menampilkan Grafik Chart	User menampilkan grafik chart	Menampilkan grafik chart hasi bacaan sensor	[√] Berhasil [ ] Tidak Berhasil

3.3 Conclusion Blackbox Testing

Based on the results of blackbox testing that has been done can be concluded that the process still allows an error occurred, but in the functionality of the system is to produce output, validation and error handling process is expected.

4. CONCLUSION

Based on the results obtained from studies conducted in the preparation of the final project refers to the purpose of research, it can be concluded.

1. The security system for leaks in the LPG gas installations in the chemical warehouse PT. ABC can be improved
2. Time for monitoring the condition of gas installations chemical warehouse PT. ABC becomes more efficient

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