DEVELOPMENT OF ACCESS CONTROL INFORMATION SYSTEM MODULE

DEGREE: BACHELOR

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Introduction

Relevance of this, the work topic is to introduce innovative practices with extension of the system functional. It is customization and creation of industry solutions.

Team of authors under leadership of Pochinok N.B.(2016), provided researches on similar topics as a useful effectiveness teleology in different areas of the economy.

The integrated a new custom technology in routine is the main purpose of the researches. The case of the research object is access system.

To attain the established purpose, require:

- Hardware was chosen,
- Statement of work that has been prepared and ordered,
- The electrical connections that has been developed,
- Algorithm was developed,
- Device was tested,
- Socio-economic justification of importance efficiency (Pochinok, N.B. (2016).

Practical testing of research by topic useful effectiveness in different field of the economy provided under leadership authors Shmakova E.G., Veretekhina S.V., Mnatsakanyan O.L.

In case of this thesis, let us thanks to God Allah SWT. and all prices to Him. The Lord of the world, The Creator of everything until this research finally finish completely. Secondly, peace be upon to our Prophet Muhammad SAW. who has move our soul from the bad character to the good one. Thirdly, never forget to thank to all of my supervisors and authors in helping finishing this thesis. The special thanks for :

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Chapter 1. Analysis of the Subject Area

1.1. Analyst of Internet of Things

Acknowledge, based on Gartner Community, the Internet of Things (IoT) capability to increase the above 26 billion users between 2020 and 2025 with annual application of smartphone, personal computer, tablets, and other devices. The high amount of annual application on devices takes large value on its market. Considering a Mckinsey Global Institute Prediction, IoT has the potential to generate $4T to $11T of economic value by 2025. This enlargement the IoT amount considering the new idea of people to pursue the human handled on computer.

Technology nowadays utilize the microcontroller to command its program and filtrate a debug on program. As Somayya Madakam said on his research (2015) “The Internet of Things is a novel paradigm shift in IT arena.” Means the technology was rely the internet connection to be the main part of its peripheral. Possibility to connect and control each devices in one smartphone in everywhere and anywhere.

As the explanation before, the implementation of IoT has considerable amount devices. There are so many provider offering the similar service of the technology could be find. One of the various bridge is called as an Arduino. The Arduino offers several IoT technology of their company.

1.2. Review Problem of Internet of Things

Technological developments now are things that continue to occur at the time of this millennium. Technological developments now are things continue to occur at the time of this millennium. Current technological developments occur very rapidly. The treatment of society towards technology is increasingly aggressive. Some substantial companies carry out various developments and innovations in technology. Especially with the era of industry which almost reached point 5, became the main focus of the community in flocking to develop. As written by Peter Waher (2015) “To be able to stand out as a superior player,

companies invent new buzz words in an attempt to highlight their superior knowledge. In this battle of gaining the reader's attention, the world is now seeing a plethora of new definitions, one better than the other, such as "Internet of Everything," "Web of Things," "Internet of People and Things," and so on. To pour gasoline on fire, there is a constant overlap and confusion of ideas from related terms, such as "Big Data," "Machine-to-Machine," and "Cyber-Physical Systems" to mention a few".

Competition in the technological era is acrimonious and can make all circles involved in it. Even now, children aged 5 years already understand how to use smartphone which is one of the technological developments. This indicates that technology has really become a habit inherent in society. Technology is a helper of many human jobs. Facilitate a variety of complicated jobs. Current technology revolves around a device that can be controlled remotely and easily.

For example, many companies have provided tools that can be turned on or off remotely using the internet. Even smart house have been created where a house can be controlled remotely. The concept of how it works is to embed internet-based programs in devices such as lights, water heaters, air conditioners, and others where the program has an address that is connected to the device on the controller or smartphone that will control the device. This is an effective way in the use of items in the house. If people want to get home with a cool air from the air conditioner without waiting, just turn on the air conditioner from the smartphone. If people want to turn on the balcony light at night, they can turn it on via mobile. Human work will be made easy with this technology.

However, what if there is a mistake in the house that can causing the fatal mistakes? This will certainly be a problem for the program itself. In this study, the used problem is when fire is detected through a sensor temperature. The system will send the information to mobile phones wherever and whenever. This research is the development of the use of Arduino UNO boards and flame sensors that detect temperatures between 80-85 degrees Celsius which is the average temperature of a fire. The tools used will be based on IoT which currently has been widely circulated in technology development. Also mobile phones that meet

the capacity for the use of IoT itself, such as smartphones with the operating system series 6.0 and higher devices. This will support the success of these tools and programs in detecting fire and detecting the shortcomings of the program itself so that further development can be done.

With the development of IoT condition on fire detection, it will be easier to user on getting information of not visited places. Even if the person is in a different city, this information still be conveyed and take action from the situation. The system can automatically sprinkle the fire in the right place or other means. However, this research only develops how the sensors detect fire and sends alarm notifications to smartphone that are installed or connected to the detection program and device.

1.3. Research Questions

How the notification pop up when the fire detected by fire sensor?

1.4. Research Objective

This research was conducted to find out how to connect Arduino with fire sensor until the notification shown up in smartphone.

1.5. Research Methodology

As explain by Ali KHumaidi (2018) that the design of a program has several stages. In addition to determining the problem, below are the stages mentioned in the article.

1.6.1. Data Collection

The first thing that needs to be done is to collect all the data about the problems of the IoT on Arduino, fire sensor, and the device that sustain the development. This will be a reference to the result of the study.

1.6.2. Device Analyst

Find the basic device ingredients to arrange the internet-based program. In addition, researchers could find the advantage and disadvantage of program to develop it.

1.6.3. System Design

The design of this system includes communication between devices instead what devices are connected to the mainboard, thus monitoring of the connected device can be done.

1.6.4. Communication Design

The concept of IoT is the use of the internet on each device interconnected. The internet network or Wi-Fi connection use the IP address as the main connection.

1.6.5. The Design of the Internet of Things

The design of the IoT aims to connect the Arduino and fire sensor to the smartphone that can be carried places and can be control anytime by internet connection. The design incorporates hardware: Arduino, fire sensor, Wi-fi connection.

1.6.6. Design of Work System

The cultivation of the Arduino, fire sensor, and the Wi-Fi are connected to push the notification on smartphone. When there is fire detected in place with the sensor in it, the notification will show itself on smartphone.

1.6.7. Testing

Testing on the device that have been made, could be find the untruth in the device and the program. It can be followed up with the development of the system.

1.6.8. Writing the Report

After going through all the stages, the final stage is to write the report. By writing down all the result of the research, the report of the research on IoT fire detection can be proven. The result of actionable research will become a product.

Chapter 2. Development of an Information System

2.1. Hardware Development

Software development created in developing system is summarized in several tools. The supporting tools for making fire detection which can be read by sensors and sending information to the smartphone are collected in several kinds of tools and materials.

Not merely to detect things, these tools can be used in several IoT(Internet of Things) projects that have not been or have been developed and created. Likewise, there are substantial innovations created from some of the materials provided in this study.

2.1.1. Arduino UNO

The most popular product today which still used as a source tool still owned by small rectangular device with a size of approximately 6 * 5 cm which has various jumper ports and the pcb line with a shape like an urban miniature. This tool has many advantages in IoT control providers. With that advantage, this tool will be really useful for this research in making the expected module development.

Arduino UNO is an open-source microcontroller based on microchip ATmega 328p microcontroller and developed by Arduino CC. The board is equipped with sets of digital and analog input/output(I/O) pins that may interfaces to various expansion boards(shield) and other circuit. Arduino UNO has everything to convenient operation with microcontroller. The main control include:

- 14 digital I/O (6 could be use as PWM output)
- 6 analog inputs
- 16 MHz crystal oscillator
- USB connector
- Power connector
- In-circuit programming connector (ICSP)

- Reset button

The capacity of the available features above is sufficient in making or developing IoT systems and innovations. With the example image below:

Figure 2.1. Arduino Uno Board

The figure above proves that Arduino has 14 digital I / O consisting of: GRN, VER, V3, V5, Port 3, 4, 5, 6, 7, 8, and etcetera. The board can turned on by connecting the connector adapter to the computer that will run the program. Then, the system is easy to develop. This convenience is provided by Arduino CC in developing technology that increasingly sophisticated over time. Therefore, the Arduino system development in fire detection is also needed.

2.1.2. Fire Detector

The sense of touch in humans has a very quick response to exposed the fire. The same condition with fire detector designed to respond the fire around them. The fire sensor detect the presence of fire with various signs such as an alarm, activation of the fire extinguishing system or other tools installed in the system. The basis of this system itself has several detection sources, such as: ultraviolet detectors, IR detectors, infrared, thermal cameras, etcetera.

However, the research employs the flame sensor module for Arduino which has sensitive radiation on flame. It also can detect ordinary light source in the range of a wavelength 760nm-1100 nm. The distance of detection is up to 100 cm.

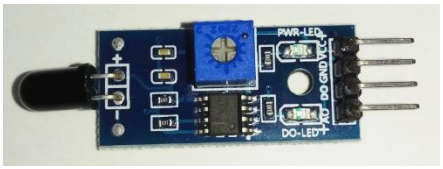

Figure 2.2. Front of Flame Sensor Module

Figure 2.3. Back of Flame Sensor Module

The figures above are the physics of flame sensor module for Arduino. 4 Pins IR in the sensor smart sense for Detecting Fire Source and Receiving Infrared. The usage of the pins are below based on the product explanation on its website.

- VCC, counting for 3.3V-5V voltage on power supply,
- GND, as ground,
- DO, as digital board output interface (0 and 1),
- AO, analog board output interface,

However, the module is available on online market or offline market. The tools are easy to get. Some of the module has no AO pin, which concluding the uses of breadboard in additional conditions.

2.1.3. Relay 5V 1 Channel

Relays are most commonly used switching device in electronics. Lern to use on in the circuits based on the requirement of the project. A rely is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, however other operating principles are also used, such as solid-state-relays. Relays are used where it is necessary to control a circuit by separate low-power signal, or where the several circuits must be controlled by one signal.

The high voltage to be in this one device relay around 3-5 Volt. Compressing and balancing the electricity power to other devices. 1 channel of the relay is conduct to how many device can be compressed. 1 channel means 1 Arduino board can relate the channel, and there is only one output pin of GND, CC, and VER3. Some of another relay might be 2, 4, and 8 channel in one board and has so many output pins.

Figure 2.4. One channel relay module

The relay module has blue color to claim that the device is safe to use with only 5V high voltage of electricity and one output to process. It has ability to output the driver such as: 250VAC-10A, 125VAC-10A, 30VDC-10A, 28VDC-10A. Compatible and simple to use in any output group devices.

2.1.4. Wi-Fi Module

The Wi-Fi module on this research use the ESP8266 serial port Wi-Fi module NodeMcu Lua V3 of IoT development board CH-340. The module is an open-source firmware and development kit with Lua language program on Arduino. NodeMcu is a prototyping Wi-Fi module that has USB port in serial chip, thus can be control through the computer to program. The module use the stabilize ESP88266 chip, and use the ESP-12 module that has GPIO, PWM, ADC, 12C, and 1-WIRE interface.

The module has lot of pins to bridge the devices. There are 9 digital board pins to output the interface, 5 ground pins, and 3 power supply pins. The equipment of the Wi-Fi module are:

- Connector,
- Reset button,
- Flash button,
- 5 pins of GND,
- 9 pins of digital output interface,
- 3 pins of V3 voltage on power supply,
- Analog board pin,

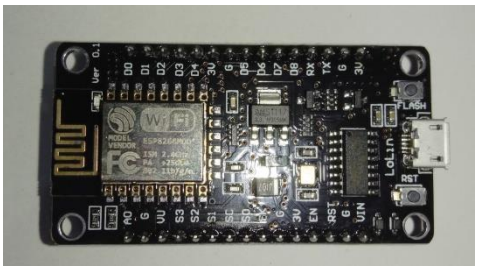

Figure 2.5. Front of Wi-Fi module

Figure 2.6. Back of Wi-Fi module

The figure above is the physic of Wi-Fi module that stands on itself. The pins are conduct to be connected by female jumper cable. Some cases use the breadboard to be the bridge of connected.

2.1.5. Jumper Cable Male-Female

This cable with I/O port is use to connecting each devices depends on different sides Input and Output.

Figure 2.7. Rainbow jumper cable male-female

The figure above is rainbow cables jumper type male-female with the configuration as: 20cm long, 1p-1p, 2.54mm pin header. This cable used to connect the Arduino board, sensor, relay, and another electronic module based on its necessary.

2.1.6. Smartphone

Smartphones are used for receiving notifications of detected fire information from the designed Arduino system. For its uses there several capability of the cellphone to be suitable to used by a system that has been designed, such as:

- Oreo operating system in minimum for Android or IOS 7 for Apple,
- RAM 2 GB at minimum,
- Internal storage around 16-23GB.

The smartphone used in this study was the ACE 3 developed by Samsung with criteria that match those mentioned above.

2.2. Software Development

In this research, module development is one of the concerns. Therefore, the use of software is really needed to help build programs that have been designed. It has intention the development of the module in this research runs successfully and the fire detection device runs as planned.

There are also some software needed are:

2.2.1. Fritzing

Fritzing is an open-source initiative to develop amateur or hobby CAD software for the design of electronics hardware. This application support designers and artists to move from experimenting with prototype to build more permanent circuit. In this case, the application helps user to create schemes and design them in detail and carefully before physical form installation.

Figure 2.8. The logo of Fritzing

It is the simulation app to build the circuit board of Arduino and another module that conclude in it.

2.2.2. Arduino IDE

Based on the description, the Arduino IDE (Integrated Development Environment) is a cross-platform application for Windows, macOS, Linux, and etcetera, was wrote in Java programming language. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, and other vendor development boards. The Arduino IDE supports the language C and C++ using special rules of code structuring.

Figure 2.9. The logo of Arduino IDE

2.2.3. Blynk

Blynk is a platform for Mobile OS applications (iOS and Android) that aims to control the Arduino, Raspberry Pi, ESP8266, WEMOS D1, and similar modules via the Internet. This application is a place for creativity to create a graphical interface for projects that will be implemented only by the drag and drop widget method.

Figure 2.10. The logo of Blynk

Its use is very easy to set everything up and can be done in less than 5 minutes. Blynk is not attached to any particular board or module. From this application platform can control anything remotely, wherever we are and at any time. With a note connected to the internet with a stable connection and this is what is called the Internet of Things (IoT) system.

2.2.4. Language Need

The languages used in this development process are C, C ++, Lua, and Java which are combined use in the Arduino IDE application which supports the use of several programming languages.

2.3. Statement Development

There are some statements on this system processing the IoT devices include some explanation about each process. In this discussion, there are several statements that will be described also explained. The explanation contained on the stages of system design planning on fire detection and push the notification to the smartphone. The planning including the connection between Arduino, fire sensor, and smartphone.

Unified modeling language is a modeling method that will be used in designing systems on this network. This description takes the form of use case diagram and activity diagram. The diagram below is a use case of the proposed system design.

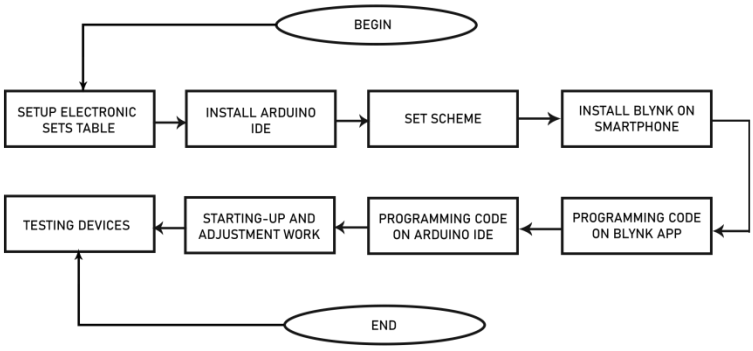

Figure 2.11. The structure of the main statement

Contain the development method which include the scheme statement of design. In the scheme above, explaining the detail and comprehensive collection of equipment in the Russian State Social University(RSSU) TechnoPark area. After complete the equipment, scheming process based on Arduino UNO conclude with the design of international standardization of Arduino to maintenance the devices in some statement after. The programming fragment code is programming the devices for be connectable to each other. In this process, the researcher use Arduino IDE which is the official tools from Arduino to maintenance the devices and program it.

The installation is done after setting up the tools using the Arduino IDE application which uses the Java language in its programming. The java language itself has been combined with C, made a bit complicated in programming it. The process above connect the Arduino device with smartphone using the internet.

The noticed case afterwards is the installation of blynk on a smartphone. Blynk can be installed independently and free of charge on all devices with limited connection type. Any further usage will be subject to a subscription fee. However, free usage is sufficient to create the system needed in this study. Blynk has convenient installation, because it has a fairly successful user interaction, likewise of the usage.

The used activities in Blynk are intermediaries hardware and smartphones. Therefore, the connection of the smartphone must be qualified and have the right network to communicate with Arduino straight. In this study, the author used the

NodeMCU (Wi-Fi) network that available in Blynk to equalize the network provided by the fire detector. The choice of this network needs to be noticed because it will greatly affect to the connection of smartphones and tools that have been assembled.

Based on Parihar (2019), NodeMCU is an open source LUA based firmware developed for Espressif's ESP8266 wifi chip. NodeMCU firmware comes with ESP8266 Development board/kit and require 2.5V to 3.6V Operating Voltage, On-board 3.3V- 600mA regulator, 80mA Operating Current, 20 µA Current during Sleep Mode. NodeMCU has 30 pins, 1 micro USB connector, and 1 reset button. The 30 pins are; 9 digital pins, 3 pins of 3.3V, 5 Ground pins, 12 pins of PWM, Analog pin, VIN pin, and VU pin.

After installing the Blynk correctly, the connection between the Blynk and the Arduino device will occur. This connection utilized a modified C language with several java languages. Programming is carried out through the Arduino IDE which previously installed on the computer where the Arduino device is located. Writing details in a programming language are needed to prevent failure in the program. Therefore, writing must be done carefully and with proper calculations. If the system was built successfully, a test could be done.

2.3.1. Devices Structure

In this case, the installations are twice. The first is for hardware installation, and the second is for software installation. The available hardware development arrange into a tool that connected to each other.

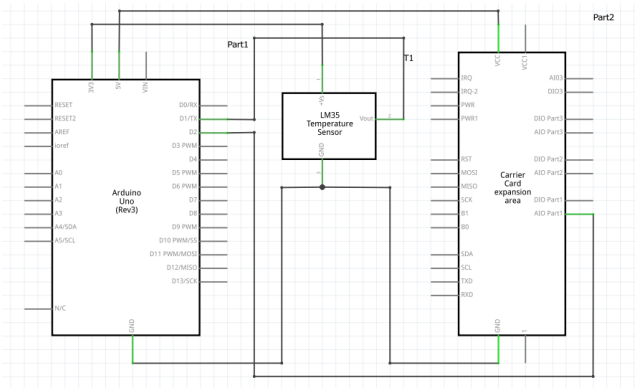

Figure 2.12. The devices structure

The picture above is series of developments that will be installed on the hardware in this study. The installation is carried out by connecting three devices, including the Arduino board, the fire sensor, and the Wi-Fi module. This connection uses a rainbow jumper cable which is commonly used to connect various Arduino devices. The cable used is standard copper cable that has a delivery capacity of 0.25Hz per second which can send electricity quickly. The series of connections itself through the ports have their respective roles. The picture above shows a series between the Arduino board and the Flame sensor, namely: GND-GND, VCC-V5, D0-D1. Where GND(ground) functions to connect the two devices so that all their functions are connected to each other. VCC is a port that functions to infuse power to other devices, where the fire sensor has a power source on port V5. D0 functions to place a port on the Arduino board that can be managed by the program and connected to the D1 port on the fire sensor so it can fill the port that was originally empty.

The Wi-Fi module device installed via GND-GND, VCC-V5, DIO1-D2 ports. The ports available on the Wi-Fi module and connected to the Arduino board that have not much different between the functions each port. GND(ground) which has a function to connect the two devices, VCC which functions to distribute power, and DIO1-D2 as a port that compresses the tool so that can be managed by the program through the default of Arduino application itself, namely the Arduino IDE.

The use of the Arduino IDE will greatly facilitate the continuation of the second installation and software installation. In this software installation, the Arduino IDE application has to be available with the installed port and complete library settings. In some case, the library and the port is not available yet, download from the legal Arduino site to complete the installation. Once it done, the tool runs well and the installation has complete.

2.4. Algorithm Development

The detection of the flame heat measure the temperature between 80-85 celcius degree. Recognition of heat temperature is carried out by sensors that have some series of heat detectors in a room or certain objects that are several centimeters in front of it. This heat setting has its own ability to detect the heat.

When fire burns it emits a small amount of Infra-red light, this light will be received by the Photodiode (IR receiver) on the sensor module. Then we use an Op-Amp to check for change in voltage across the IR Receiver, so that if a fire is detected the output pin (DO) will give 0V(LOW) and if the is no fire the output pin will be 5V(HIGH). In this project we are using an IR based flame sensor. It is based on the YG1006 sensor which is a high speed and high sensitive NPN silicon phototransistor. It can detect infrared light with a wavelength ranging from 700nm to 1000nm and its detection angle is about 60°. Flame sensor module consists of a photodiode (IR receiver), resistor, capacitor, potentiometer, and LM393 comparator in an integrated circuit. The sensitivity can be adjusted by varying the on board potentiometer. Working voltage is between 3.3v and 5v DC, with a digital output. Logic high on the output indicates presence of flame or fire. Logic low on output indicates absence of flame or fire.

2.4.1. Flowchart

Below is a flowchart design of the heat analysis system and sending alerts via smartphone. The structure below will make the program easier to run.

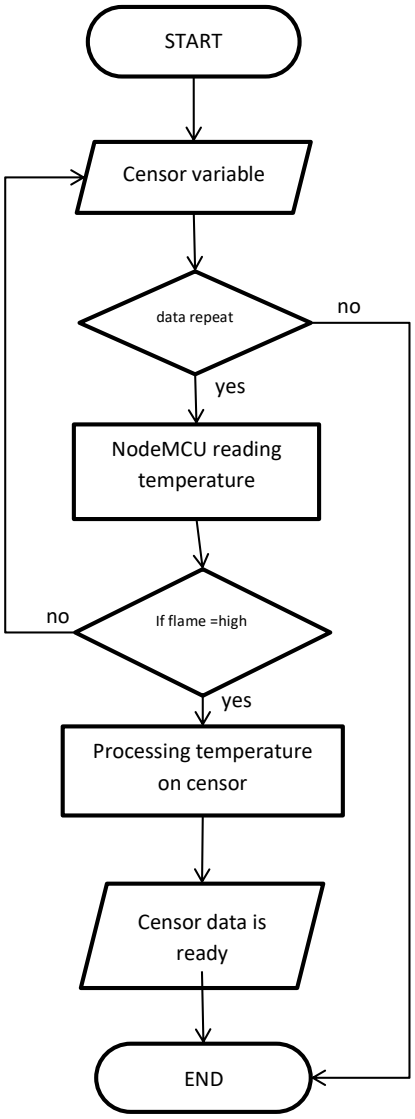

Figure 2.13. The flowchart of the system

The flowchart above starts with “start” and ends with “end”. At the “start”, the system will get a variable sensor from the device itself. After that, the system will enter a loop which make the system work continuously and monitored the activities that occur around. If it does not work, the system will end immediately. If so, then the NodeMCU will detect the recorded temperature. In this recording, NodeMCU will start working to detect the temperature to be fire or not fire with its own system. If the detected temperature is high, then flame = high. If the temperature is detected high, the program will return to the variable censor. If flame = high, then the fire has been

detected and the system is finished running. If the fire detection system is finished, the Arduino will work to send a signal to the smartphone via the Wi-Fi Modul installed in it.

2.4.2. Program Writing

The program written by C language in additional conditions. In the case, the installation done in Arduino IDE which the original provider to assembly the program with the tools.

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <Blynk.h>
#include <BlynkSimpleEsp8266.h>
```

Figure 2.14. The code

The code above to call the Blynk command in the next attribute of the codes to include. The command that made by the code will make easier to the author for coding another Blynk commands in the next writing. Besides, it is useful to declare that the commands above are the use of Blynk application.

```
char auth[] = "OR80CX-o79rrEnSja_5-8avvGsGI7mqF";
char ssid[] = "admin";
char pass[] = "admin";
```

Figure 2.15. The code

The auth code above is obtained from the verification code given by the Blynk application on the cellphone to connect the two devices. The code can be obtained from email or via the Blynk application directly. The SSID and the password is the internet connection that available in the area. If there is no internet connection, then the program will not successful.

```
int isButtonPressed = digitalRead(D1);
if (isButtonPressed == 1 && flag == 0)
{
  Serial.println("FIRE!!! FIRE!!! FIRE!!!");
  Blynk.notify("Alert: FIRE!!! FIRE!!! FIRE!!!");
  flag = 1;
}
```

The code above declare that the notification will display the words as follows. The code written using the Arduino IDE means that the program is being designed and run on the Arduino UNO which assembled and connected to fire detector and Wi-Fi Module.

Chapter 3. Socio-Economic Explanation of the Development

3.1. The Creating in Different Countries

In this statement the researcher uses a comparison of two countries between Indonesia and Russia. To looking for the differences in capital prices, selling prices, and profits from tools that have been made, and comparing the majority of uses of the tools to be marketed. The price attracts buyers make the needs of each country being different, especially Indonesia and Russia.

However, the cause of price attraction needs for the product itself, such as the needs of the community in fighting fires. Behind, the statistics for fire incidence in Indonesia can be seen below.

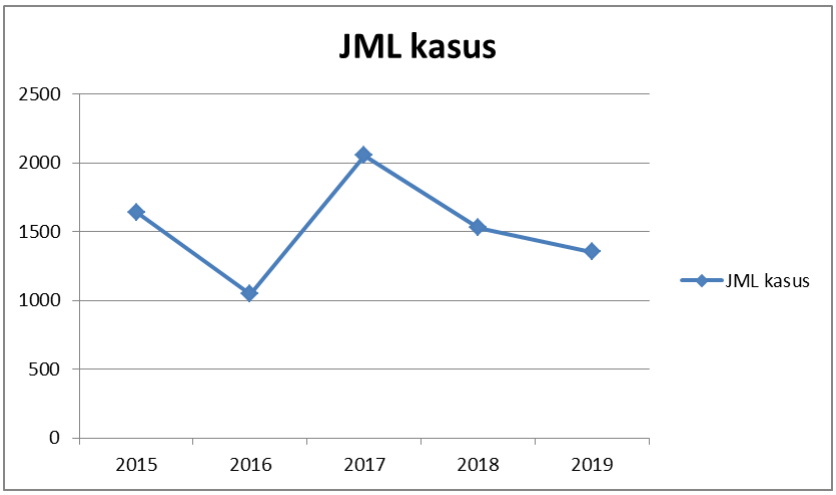

Figure 3.1. Data statistic of fire incidence in Indonesia

The data in the graph above is obtained from the official website for fire management in Indonesia. Fire cases in Indonesia occur every year with a different number of cases. Where 2019 is the highest cases of fires and 2016 is the lowest year of fire cases. With an Indonesian population of 268,074,600 people since its determination in 2019 and an area of 1,919,440 km^2, the percentage of fire incidents is less than 2% each year.

Furthermore, below is a fire case in the Russian Federation.

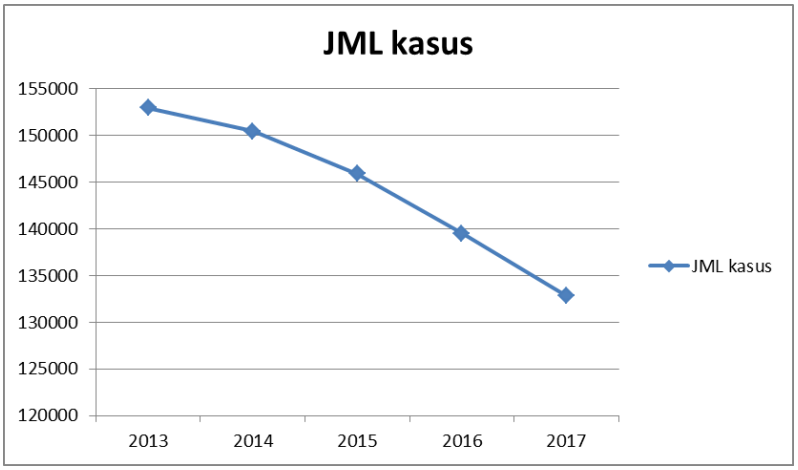

Figure 3.2. Data statistic of fire incidence in Russia

The graph above shows the number of fire incidents throughout Russia based on calculations by the Russian Federation government. In this country, the incidence of fire decreases every year for last 5 years. The condition explains that fire readiness and responsiveness is increasing. With a population in Russia of 146,793,744 people based on the 2019 CIA count and an area of 17,075,200 km^2, the percentage of fire incidents is not more than 5% each year which is decreasing in 5 years.

With the different situation above, the awareness of each country in the emergency situation is different. Indonesia has a smaller percentage of the need for firefighters than Russia. Indonesia does not have a sustainable decline, means Indonesians awareness of the importance of the fire hazards is low. That has the number of fires that fluctuate every year. Other case in Russia, where the incidence of fires has decreased every year in five years, which means the awareness of the population about the dangers of fires is increasing. Likewise, with the advancement of technology. Russia has a lot of technology that other countries may not have. This case make Russia is furiously to the development of technology. The technological developments that occur in Russia are very crucial. This is what makes Indonesia have to try harder in developing the technology.

The explanation above explains that the product will be easier to sell in Russia than Indonesia. However, the need for this product is more pro-Indonesia, because Indonesians awareness of the dangers of fire is more dominant and needs

to be increased. Therefore, this product will really help users to knowing the emergence of a fire from an inaccessible place. If the use of this product is used by many Indonesians, the percentage of fire cases in Indonesia could decrease every year. Indonesian society will be more aware of the dangers of fire, even though it is a small flame.

3.2. Practical Testing

The product is ready to be tried and used. The distribute is soon available in sometime after the research of marketing is done. Thus, researching of prices should be done in a certain time. Below is the result of the lowest price in the online market in Rubles.

Table 3.1. Table of Price in Russian Market

No.	Components	Price
1	Arduino UNO	1215,63 RUB/pcs
2	3-5 Volt Relay	177,20 RUB/pcs
3	Grove Cable Male-Female	388,30 RUB/40pcs
4	IR Flame Sensor Module	546,36 RUB/pcs
5	Wifi Module	336,10 RUB/pcs
Total		2663,59 RUB

Based on the price above, the components made a product with the 1543,74 RUB per product. From the accumulation, could build the own price with the commercial purpose. Comparing the Price is below from a different online market.

Figure 3.3. Price of Cable Jumper

The cable caught on Solarbotics.com sell for 6.95 USD which its 388,30 RUB per 40 layers of cable. The cable is thin metal covered by caoutchouc with two different port on its two corner. Regards on its quality, it can be increase to some rubles for commercials. Put it into 400,00 RUB per 40 layers of cable. The consument will not be mind for a little bit different.

Figure 3.4. Price of Arduino UNO

Amazon.com is one of the trusted market in the world, and it’s showing the price of Arduino UNO for 18,79 USD. It is an original brand from Arduino Uno. Based on the USD price it is 1216,02 RUB. Regards on its quality, it can be increase to some rubles for commercials. Put it into 1800,00 RUB/pcs. The consument will not be mind for a little bit different.

Figure 3.5. Price of Flame Sensor

The sensor of this project use the IR Flame Sensor Module. Could help to remoting device in certain distance. it is showing around 546,36 RUB/pcs. This component is officially from Amperka in Russia in limited sales area. Regards on its quality, it can be increase to some rubles for commercials. Put it into 750,00 RUB/pcs. The consument will not be mind for a little bit different.

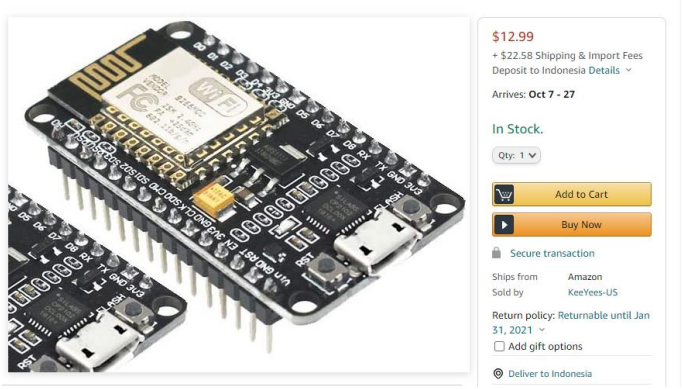

Figure 3.6. Price of Wi-Fi Module

The Wi-fi Module of this project one of the important device that has to be done. Could help to connecting device in certain distance. it is showing around 336,10 RUB/pcs. This component is officially from Amperka in Russia in limited sales area. Regards on its quality, it can be increase to some rubles for commercials. Put it into 550,00 RUB/pcs. The consument will not be mind for a little bit different.

Figure 3.7. Price of Relay Module

Relay Module 3V-5V is the importance item to compress the high voltage from main electricity. Not really high price for each item. some online market has hand with the provider of this product. Ebay.com is one of them. In this case, ebay has the biggest trustworthy consument that always use this market periodically. It is showing 1,66 GBP means 177,20 RUB/pcs. Regards on its quality, it can be increase to some rubles for commercials. Put it into 200,00 RUB/pcs. The consument will not be mind for a little bit different.

Table 3.2. Table of Price prediction

No.	Components	Price
1	Arduino UNO	1800,00 RUB/pcs
2	3-5 Volt Relay	200,00 RUB/pcs
3	Grove Cable Male-Female	400,00 RUB/40pcs
4	IR Flame Sensor Module	750,00 RUB/pcs
5	Wi-fi Module	550,00 RUB/pcs
Total		3700,00 RUB

The calculation of the profit

Table 3.3. Table of Profit

No.	Items	Market Price	Product Price	Profit
1	1	2663,59 RUB	3700,00 RUB	1036,41

Note:

Profit = Product Price - Market Price

= 2663,59 - 3700,00

= 1036,41

Profit = 1036,41

The calculation of profit in a week with 2 items a day is below.

- 2 items per day = 2 x 7 = 14
- 14 x 1036,41 RUB
- 14.509,74 RUB/week

The calculation of profit in a month with 2 items a day is below.

- 14 items per week = 14 x 4 = 56
- 56 x 1036,41 RUB
- 58.038,96 RUB/month

3.3. The Importance of Economic Rationale

The comparison of the price of product on its profit. Rationale is defined as an explanation of the basis or fundamental reasons for something. In economics, rationale are the reasons or thought processes that impact economic decisions. The interest rate is one of the primary influences on economic rationale.

With trade, competition increases and a rationalization of production often takes place as comparative advantages are being exploited. The outcome of trade

liberalization usually involves a specialization of production and the trade of surpluses between partners. Greater economies of scale achieved through specialization result in lower prices and higher profits. A situation of interdependency is thus created as each trading partner depends on the other for an array of goods. An absolute specialization of the production rarely takes place in reality but some sectors, such as this product and another IoT product have experienced a high level of specialization and geographical clustering.

Chapter 4. Result of Research

4.1. Result

With the various steps that have been taken, the process of writing the results of the program has arrived. The program and the resulting tools are successful fire detector with a temperature of 80 degrees Celsius. After the fire detected, the program will send a notification to the smartphone via internet. Then wherever the user is, a warning of the threat of fire can be known immediately.

The successful fire system device is captured below.

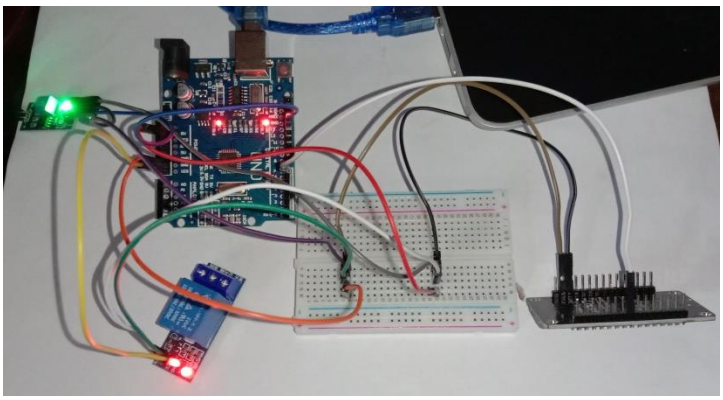

Figure 4.1. Device component

The picture above represents three components; Arduino UNO, Wi-Fi provider, fire detector, 1 channel relay, that well connected to one another through the breadboard that bridge several tools. There are two led lights on the fire detector to indicate the power and digital power on, as well as the 1 channel relay and the Arduino UNO.

The results of the program displayed on the notification in smartphone application are below

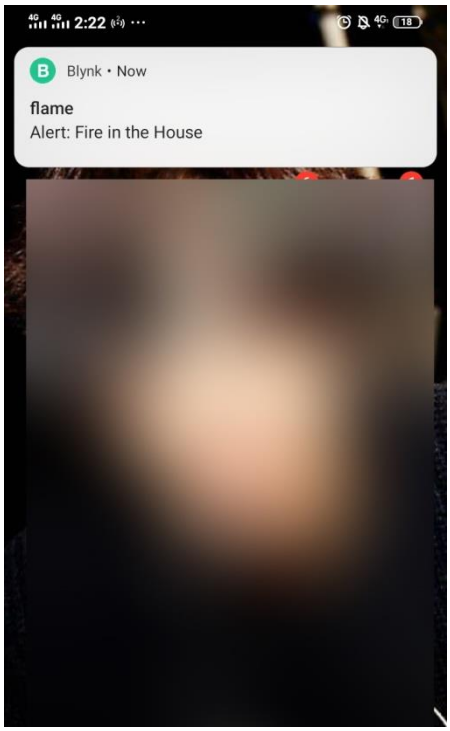

Figure 4.2. The notification

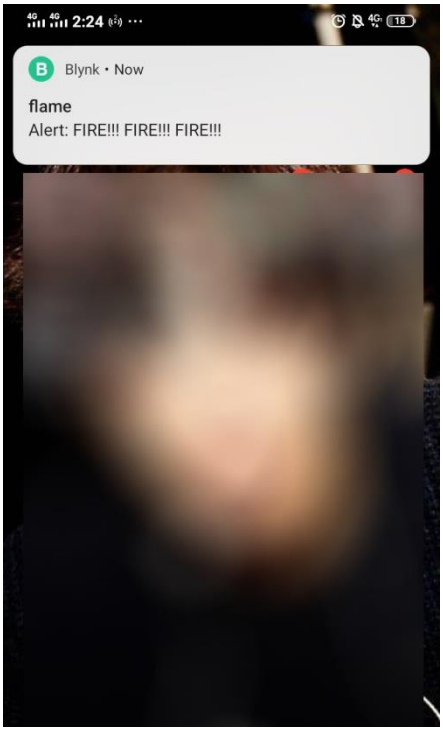

Figure 4.3. The notification

The figures above are the results of the notification that appears when fire is detected from the previous fire detector. This notification comes shortly after the fire is detected by the sensor, which will be very effective in using its safety. This notification shows the system that has been built is running properly and correctly.

4.2. Testing

The product is ready to be tried and used. The distribute is soon available in time after the research of marketing is done. Current problem is associated by Mnatsakayan O. L. [3] in his work. The practical testing is directly in the distributed place TecknoPark of Russian State Social University in additional tutor and survivor Federof Ruslan. Testing is done in the form of simulating a house that has an IoT devices in it with the installation of a temperature sensor that could detect fire. Applications that are already installed on the smartphone that placed next to the devices. With no cables connected, the system will prove internet usage in it.

The detection is carried out directly on the sensor which exposed to fire with a temperature of 80 degrees Celsius. In the first experiment, because the fire was

too far away by 30 cm, the sensor did not respond. This is because the distance is too far from the sensor, then make the sensor does not detect anything happen around.

The second detection was carried out at a distance of 5 cm with a fire of 80 degrees Celsius. The sensor reads the fire directly and the system sends a notification to the smartphone in the same time. This trial indicates the tests carried out on the system ran smoothly on the second try.

Chapter 5. Conclusion

5.1. Conclusion

This system is compact and can be seamlessly integrated. As daily activities progress, this tool can connect various devices to use. Users don’t have to bother to turn on the appliance in different place. Notification can be done in one device. Seamless integration comes from the internet that is directly connected to the controller. Therefore, user will feel truly in the industrial age 4.0 with this sophisticated tool.

The users will feel safe because of the notification about the fire alert which can be a warning to follow up on what actions will be taken next. With this, one of the users' concerns will be reduced because of the automatic fire system that has been created.

The system allows you to easily connect a fire alarm, security. The results can be showed up with Wi-Fi and internet controller.

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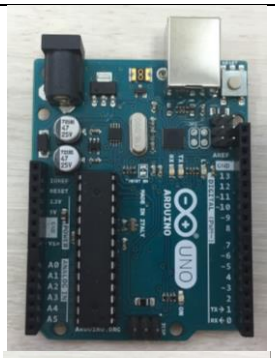
ATTACHMENT

Attachment A

1. Table of components.

No	Components	Figure
1	Arduino UNO/Geeduino	 
2	3-5 Volt Relay 1 Channel	
3	Grove Cable Male-Female	

4	Flame Sensor	
5	Wi-Fi Module	

Attachment B

Part 1

```
#include <IRremote.h>

int RECV_PIN = 11;

IRrecv irrecv(RECV_PIN);

decode_results results;

void setup() {

 Serial.begin(9600);

 irrecv.enableIRIn();

}

void loop() {

 if (irrecv.decode(&results)) {

   Serial.println(results.value, HEX);

   irrecv.resume();

 }

 delay(100);
```

Part 2

```
#include <IRremote.h>

int RECV_PIN = 11;

IRrecv irrecv(RECV_PIN);

decode_results results;
```

```
void setup() {

 Serial.begin(9600);

 irrecv.enableIRIn();
pinMode(8, OUTPUT);

}

void loop() {

 if (irrecv.decode(&results)) {
IF (RESULTS.VALUE == 16753245){
digitalWrite(8, HIGH);
Serial.printIn("success!");
delay (1000);
digitalWrite(8,LOW);
}
   Serial.println(results.value);

   irrecv.resume();

 }

 delay(100);

}
```

Part 3

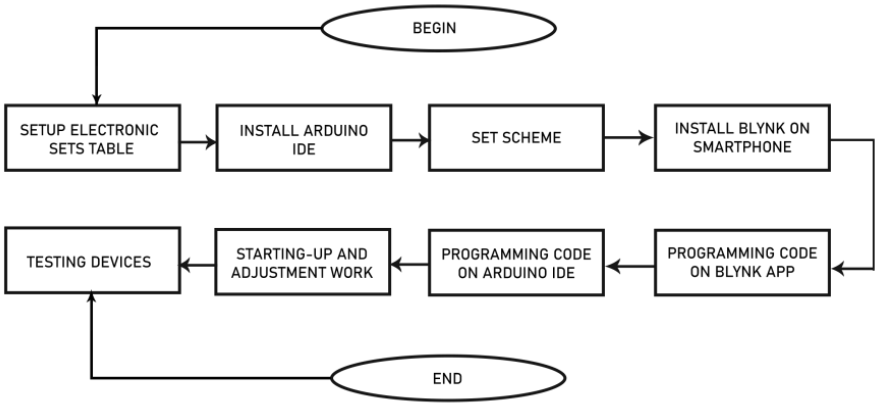
```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <Blynk.h>
#include <BlynkSimpleEsp8266.h>

BlynkTimer timer;
char auth[] = "OR80CX-o79rrEnSja_5-8avvGsGI7mqF";
char ssid[] = "admin";
char pass[] = "admin";
int flag=0;
```

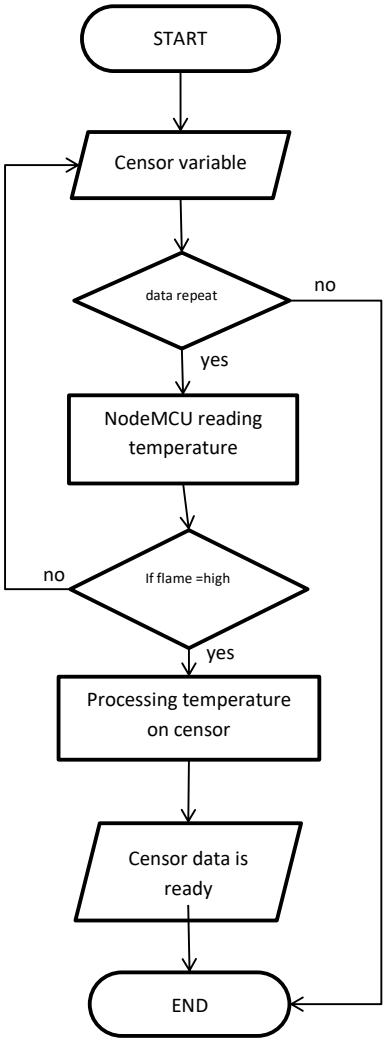
```
void notifyOnFire()
{
  int isButtonPressed = digitalRead(D1);
  if (isButtonPressed == 1 && flag == 0)
  {
    Serial.println("FIRE!!! FIRE!!! FIRE!!!");
    Blynk.notify("Alert: FIRE!!! FIRE!!! FIRE!!!");
    flag = 1;
  }
  else if (isButtonPressed == 0)
  {
    flag = 0;
  }
}
void setup()
{
Serial.begin(9600);
Blynk.begin(auth, ssid, pass);
pinMode(D1, INPUT_PULLUP);
timer.setInterval(1000L, notifyOnFire);
}
void loop()
{
  Blynk.run();
  timer.run();
}
```

Attachment C

1. The Developoment Structure



2. The Flowchart of the Program



3. The Device Structure