

INTERNET-BASED MONITORING THINGS SYSTEM AS A MEANS OF PREVENTING AMMO STORE FIRE IN INDONESIAN NAVAL SHIP

Priyadi Hartoko¹, Estu Setia Widodo², Anton Nugroho³

^{1,2,3} Indonesian Naval Technology College, Bumimoro-Morokrembangan, Surabaya 60187, Indonesia
priyadi.hartoko@tnial.mil.id

ABSTRACT

In order to carry out the main tasks of the Indonesian Navy, namely maintaining the national defense and law enforcement at sea, it is necessary to have trained personnel and adequate weaponry, which is often known as the Integrated Fleet Weapon System (SSAT). One of the examples of an old Indonesian Naval Ship which is still active in operation is the Indonesian Naval Ship Striking class. It is necessary to have ammunition storage with a maximum temperature is 32° Celsius and maximum humidity is 80%. In order to reduce the possibility of fire, it is necessary to have a monitoring system that is accurate, quick, and flexible. With the existence of the tools has made that is a Monitoring System Based on the Internet of Things, it is hoped that monitoring of the ammunition warehouse can be faster, more flexible, remote, and mobile, and ensure that ammunition storage fits its standard. The device made is able to produce an alarm if the temperature is higher than 32° Celsius, the humidity is more than 80%, also if there is smoke in the store. The monitoring System is built using V1, temperature and humidity sensor SHT 30, and smoke sensor MQ-135. humidity more than 80% also if there is smoke in the store. With the existence of alarms as early warning and automation systems for temperature and humidity and smoke in the storage, the risk of fire can be minimized and the loss of personnel and materials can be avoided.

Keywords: Indonesian Naval Ship, Ammunition Storage, Monitoring, Internet of Things.

1. INTRODUCTION

In carrying out the duties of national defense and law enforcement at sea, the Indonesian Navy requires 2 (two) very vital components, namely trained personnel and adequate weapons. It is common knowledge that the need for weapons systems is a very important part and affects the performance of the Indonesian Navy. The weapon system in question is often referred to as the Integrated Fleet Weapon System (SSAT).

SSAT consists of 4 main components, namely Indonesian Naval Ship, Aircraft, Marines, and Bases. One of these components is the Indonesian Naval Ship, which is the spearhead of national defense and law enforcement at sea. The Indonesian Naval Ships themselves are quite numerous and varied, spread over 3 RI Fleets, namely First Fleet, Second Fleet, and Third Fleet. The existing Indonesian Naval Ship is divided into various Ship Units, namely Escorta Ship Unit, Submarine Unit, Amphibious Ship Unit, Fast Ship Unit, Mine Ship Unit, Patrol Boat Unit, and Auxiliary Ship Unit.

The existing Indonesian Naval Ship, the age or year of manufacture of Indonesian Naval Ship also varies. Of all the Indonesian Naval ships that are still operating, many of them are quite old ships. It should be remembered that every Indonesian Naval Ship carrying out operations always carries weapons and ammunition. The ammunition itself is stored in one of the ship's rooms, namely the ammunition depot.

There is a saying, Indonesian Naval Ship's crew members sleep on piles of fuel and explosives and are surrounded by power lines. This phrase illustrates how dangerous it is to live on board the Indonesian Naval Ship. The position of the ammunition depot itself is generally in the bow, on the lower deck. On old ships, ammunition depots generally do not have adequate monitoring and security systems.

Some Indonesian Naval Ship classes already have a monitoring system that is integrated with the Integrated Platform Management System (IPMS), which can be accessed from the bridge and the Machinery Control Room (MCR). In the ammunition depot on other types of ships, generally, only a simple thermometer is installed as an indicator of the temperature of the ammunition depot. As for the monitoring itself, it must be carried out directly in the warehouse. This is of course a problem in itself, considering the location of the ammunition depot is located in a location that is quite separate from the troop cabin and other operational rooms. While the security of the ammunition depot is also a priority for the safety of all personnel on board.

The Indonesian Naval Ship Ammunition Warehouse contains one type of large caliber ammunition, namely the 120 mm caliber. besides that, there is also 40 mm caliber ammunition, as well as ammunition for Anti Submarine, namely ASROC Nelly and Erica. This of course has a very big risk and requires an adequate monitoring system, as well

as equipment to prevent fires from occurring in the ammunition depot. Although this type of ship has undergone several modifications, including maintenance and repairs at the Depo level up to Mid-Life Modernization (MLM), the condition of the ammunition depot still needs more attention.

With the development of technology and the changing era into a digital world, as well as demands for the security of ammunition depots, it is necessary to have tools that can be used for more modern monitoring. The current role of the Internet of Things (IoT) also has a significant impact on us. By utilizing the presence of IoT, it is hoped that the implementation of monitoring of ammunition warehouses can be carried out more quickly, flexibly, remotely, and mobile, without having to carry out direct observation or monitoring in the ammunition warehouse, especially when supported by a fire prevention system in the ammunition warehouse so that the security of the ammunition warehouse itself more secure.

2. MATERIALS AND METHOD

2.1. Internet of Things and Local Hosts

Internet of Things (IoT) is becoming an increasingly hot topic of conversation in the era of the industrial revolution 4.0 because of its concept which not only has the potential to influence our lifestyle but also how we work. The Internet of Things (IoT) is a computing concept about everyday objects connected to the internet and able to identify themselves to other devices. According to the RFID (Radio Frequency Identification) identification method, the term IoT belongs to a communication method, although IoT can also include other sensor technologies, wireless technology, or QR (Quick Response) codes.

Some of the benefits of IoT may not be obvious, but that doesn't mean you can't feel them. The three main benefits directly obtained from IoT are connectivity, efficiency, and convenience. Local host or local web is a designation for a local server that is on our computer, basically, a computer can function as a server, so when we create a web-based application, we have to put it on a web server, so that it can be accessed. Local host is not just a term, but also a domain name, so of course a local host must have an address or it can be called an Internet Protocol Address. The local host function is very important because localhost allows us to know whether our website can function or not.

2.2. Microcontroller

Microcontroller is a chip that functions as a processing system, controller, and control of all systems that will be used. This microcontroller functions as the main brain, better than a

microprocessor, because the microcontroller does not require additional memory devices and external I/O, as long as the microcontroller chip is able to accommodate data.

The microcontroller chip has several very important features, including:

- a. Other serial communication interfaces such as a s IC, a serial peripheral interface, and controller are a network for system connection.
- b. *Central processing unit* from simple 4-bit processors to high-performance 64-bit processors.
- c. *Inputs/output network* interface such as serial port (UART).
- d. There are Timer and Watchdog features.
- e. RAM to store data.
- f. ROM, EPROM, EEPROM, or flash memory to store programs on the computer.

2.3. Esp 8266 / Esp 32 MCU nodes

MCU nodes is an open-source controller chip from the IOT platform as well as a development kit that uses the C++ programming language with the Arduino IDE compiler.

In the development of the Nedelcu Esp 8266 and Esp 32 modules, the difference is only in the analog port. The Esp 8266 has one analog pin, whereas the Esp 32, has 8 analog pins. Both of these modules integrate the GPIO Port, PWM, I2C, 1-Wire, and ADC.

MCU nodes Esp 32 Specifications:

- a. This board is based on the Esp 32 serial Wi Fi SoC (Single on Chip) with USB to TTL onboard. The wireless used is IEE 802.11b/g/n.
- b. Using voltage, average 3.3volt.
- c. There are 9 GPIOs on the Esp 32, of which there are 3 pwm, adc and rx/tx pins.
- d. There are Mosi and Miso pins, built 32 bit.
- e. There is a SCLK pin from master to slave which functions as a slave.

2.4. Temperature-Humidity Sensor

Temperature humidity sensor is a temperature and humidity sensor that is intelligent and capable of measuring the temperature and relative humidity of the air around the sensor with a certain output. This sensor uses a capacitive component and a thermistor to measure the surrounding temperature.

Temperature is a quantity that shows the degree of heat of an object, objects that have heat will show a higher temperature than cold objects by touching them with the human senses, to find out the temperature, a thermometer is used.

Sensors with digital output are good for monitoring applications in ammunition warehouses, sensor data is sent serially to the microcontroller and has a very good level of stability and accurate calibration, calibration coefficients are stored automatically in internal memory, so when the sensor detects something, the module includes the coefficients in the calculations.

Sensor system used to measure temperature and humidity with a 5 Volt voltage source and 2-wire bidirectional communication. This sensor system has 1 data line that is used for addressing commands and data reading. Data collection for each measurement is carried out by giving addressing commands by the microcontroller. The sensor provides humidity and temperature data output on the Data pin alternately according to the clock given by the microcontroller so that the sensor can work. The sensor has an ADC (Analog to Digital Converter) in it so that the data output has been converted into digital data and does not require an external ADC in processing data on the microcontroller. An example of a temperature-humidity sensor is the SHT 30.

2.5. Smoke Sensors

Smoke Sensors in Indonesia often referred to as smoke detector is a kind of sensor that can detect the presence of smoke content. This detector is useful for homes, offices, schools, and industries to detect the presence of smoke originating from electrical, machine, or fire malfunctions so as to prevent fires from occurring.

Based on the principle of detection, smoke detectors are divided into several types:

- a. *Photoelectric smoke detectors*
This sensor, this type of detector uses light to detect the presence of a plume of smoke.
- b. *Ionization Smoke Detector*
Active radio ionizing in the air in a chamber that is open to ambient air will experience ionization entering the chamber so that the current decreases.
- c. *Aspirated Smoke Detector*
This type of smoke detector is sensitive to Nephelometer and works dynamically to detect whether or not there is additional air contamination through the chamber pipe in a room.

The main material of this sensor is SnO₂ with low conductivity in clean air. If there is a gas leak, the sensor conductivity will be higher. With each increase in gas concentration, sensor conductivity also increases. This gas and smoke sensor detects the concentration of flammable gas in the air and smoke, then the output reads it as an analog voltage.

2.6 Blynk

Blynk is a Platform for Mobile OS applications (IOS and Android) that aims to control Arduino, Raspberry Pi, ESP 8266 / Esp 32, Wemos D1, and similar modules via the internet.

There are three main components in this platform, namely:

- a. *Blynk App*
To create interface applications for projects that are made, namely by activating or using various widgets provided by the platform.
- b. *Blynk Server*
Responsible for all communication between smartphones and hardware.
- c. *Library or Blynk Library*
All hardware platforms allow communicating with servers and processing all incoming and outgoing commands.

3. RESEARCH METHODS

3.1 Research Design

There are two parts in the research design, namely the hardware design (*hardware*) and software design (*software*). The plan will be implemented through several stages. The first stage begins with designing the system design. The second stage is to select the required sensors and devices. The third stage, testing each part according to its function. The next stage is assembling the devices that have been tested according to the system design. Finally, test the system functions.

3.2 Hardware Design

The design of the hardware in this monitoring system begins with preparing the materials to be used, then setting up and installing them. The following is a system design chart and flowchart that has been made.

The design of this study is to make a tool that can be used to monitor the condition of the ammunition warehouse, both temperature, humidity, and sensors for smoke detection. This tool uses the ESP 32 Microcontroller as its processing unit, as well as a controller for actions to be carried out if a parameter changes. Monitoring can be carried out from the LCD display located on the equipment panel, and can also be accessed from mobile devices, such as cell phones, tablet PCs, laptops, and so on. In this study, the researchers chose to use a mobile phone based on the Android Operating System. The application installed on the cellphone is BlynkMonitoring using access to the wifi on the ship

as a means of connecting. The design is divided into two, namely hardware design and software design.

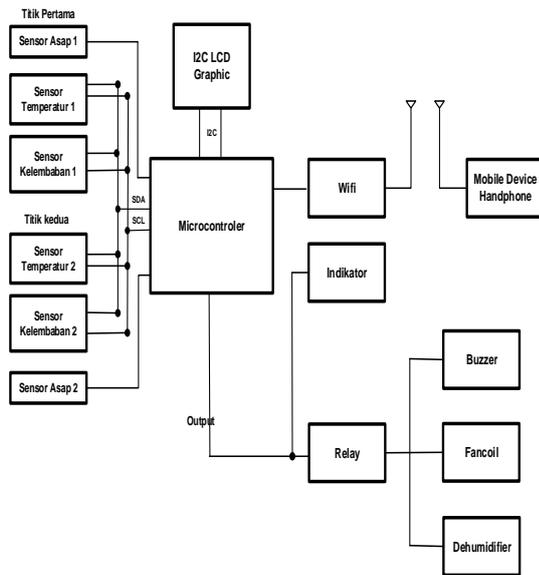


Figure 1. Monitoring System Block Diagram

3.3 Draft Software

The software design is implemented after the completion of the hardware design. Software design is closely related to applications and programming languages. The software that will be used in this system is ISIS Proteus, Arduino IDE, and Blynk.

4. Result and Discussion

4.1 Design

The monitoring system that has been created will be used to facilitate ship members in carrying out guard duty, especially those in charge of the Indonesian Naval Ship ammunition warehouse. The ammunition warehouse monitoring system consists of two systems, namely local monitoring using a graphic LCD display and remote monitoring using an Android mobile phone that has the Blynk application installed.

The sensors used in this study use analog sensors and digital I2C sensors. The sensors used, namely the SHT 30 are used to measure or read temperature and humidity, while the analog sensors use the MQ-135 to detect the presence of smoke, all of which are controlled by the NodeMcu ESP 32 Devkit V1 Microcontroller.

Remote monitoring is equipped with an indicator, and room condition data from the sensor is sent by the ESP 32 Devkit V1 Microcontroller to the internet network via wifi to send it to the Blynk application, where the indicator display on the

Android cellphone will be exactly the same as that on local monitoring. For local monitoring, the ammunition warehouse is equipped with an LED indicator and also equipped with a buzzer.

4.2 Implementation

Several steps have been taken so that the implementation of the monitoring system creation process can be carried out properly. The steps taken include assembling hardware, creating program scripts on Arduino, creating new projects on the Blynk application, and uploading Arduino programs to the microcontroller. After the tool is finished, it will be installed on the ship with integration into the existing system on the ship. For alarms, it is integrated with the ship broadcast system or the Public Address System on the fire alarm sub-system or Fire Alarm.

Local monitoring will be installed in the ammunition depot. Fancoil and dehumidifier will be integrated with local monitoring. If there is a change in temperature exceeding the limit of 32°C, an alarm will sound, the indicator light will turn on and the fan coil will turn on. If the humidity exceeds 80% then the alarm will sound, the indicator light is on, and the dehumidifier will run at higher power to reduce humidity levels more quickly. If smoke is detected in the ammunition depot, the alarm will sound and the indicator light will light up. Remote monitoring on mobile phones will later be brought by the Officer in Charge of Ammunition or Pasen. If an alarm occurs, the sound will be heard throughout the ship's room, while on the cellphone there will be a notification in the form of a sound.

In the integration process on the ship, the main requirement that must be met is that the ship provides an internet network via wifi so that the microcontroller on local monitoring can connect to the Blynk Server and the Blynk App on mobile phones. The use of remote monitoring is emphasized when the ship is docked at the base, where after working hours the members leave the ship and only members of the guard division remain. Conditions during working hours and holidays are considered to have a higher level of vulnerability due to the limited number of personnel on board. With remote monitoring with the Blynk App on a mobile phone, it is hoped that it can help minimize the risk of fires by providing early warning of indications of a fire occurring.

4.2.1 MQ-135 Sensor Circuit

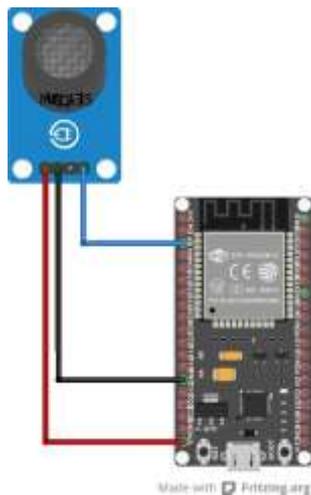


Figure 2. The Esp 32 Devkit V1 circuit with the MQ-135 sensor

There are two types of output data from the MQ-135 sensor, namely analog and digital data. In this study, analog data output was used as input to Esp 32 Devkit V1, because apart from being able to detect the presence of smoke, analog data also provides data on the concentration of smoke in the air in parts per million (ppm) units. The ppm value will increase when the sensor is given a stimulus in the form of smoke. Apart from being able to detect the possibility of a fire occurring, this sensor can also indicate the level of air health based on the smoke concentration value in the displayed air. The pins used are pin 36 for MQ-135 at point one and pin 39 for MQ-135 at point two, where these pins are analog inputs to Esp 32 Devkit V1. An example of a data input line connected to the analog input pin (36) on the MQ-135 can be seen in Figure 2.

Wiring procedure:

- Pin A0 on MQ-135 is connected to pin 36 on Esp 32.
- The VCC pin on the MQ-135 is connected to the 5V pin on the Esp 32.
- The GND pin on the MQ-135 is connected to the GND pin on Esp 32

4.2.2 SHT 30 Sensor Circuit

The output of the SHT 30 is in the form of a digital signal based on UART or I2C where this sensor consists of a calibrated temperature and humidity sensor with the capability of a temperature and humidity sensor. Temperature and humidity data are sent using I2C SCL and SDA communication. The pin used is pin 22 on Esp 32 Devkit V1 to connect SCL SHT 30 and pin 21 to connect SDA

SHT 30. Figure 4.2 describes the wiring scheme between Esp 32 Devkit V1 and SHT 30 sensor.

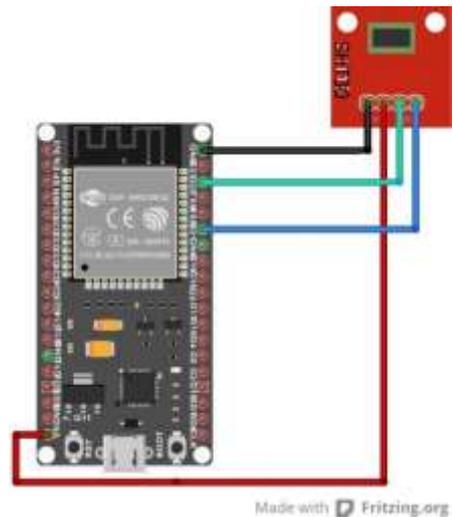


Figure 3. The Esp 32 Devkit V1 circuit with the SHT 30 sensor

Wiring procedure:

- SCL SHT 30 pin is connected to pin 22 on Esp 32.
- SDA SHT pin 30 is connected to pin 21 on Esp 32.
- The (+) pin on SHT 30 is connected to the 5V pin on Esp 32 Vin.
- The (-) pin on SHT 30 is connected to the GND pin on Esp 32.

4.2.3 Data Display On LCD

Data from sensors at each point is sent to Esp 32, then data from each sensor is displayed on local monitoring in the ammunition depot. The display used for local monitoring is a 20x4 LCD.

LCD 20x4 connected first with I2C (*Integrated Circuit*) before connecting to Esp 32 Devkit V1. The two pins used are pin 22 which is connected to the SCL (Serial Clock) pin and pin 21 which is connected to SDA (Serial Data). The other two pins are the 5V pin and the GND pin.

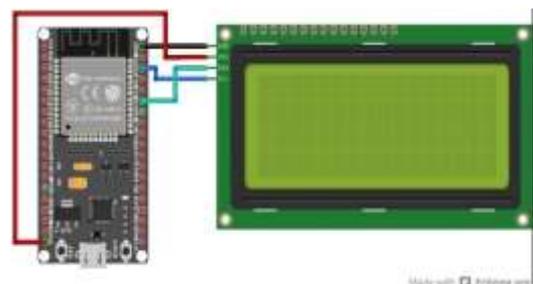


Figure 4. Esp 32 circuit with I2C LCD 20x4

Wiring procedure:

- The SCL pin on I2C LCD is connected to pin 2 on Esp 32.
- The SDA pin on the LCD I2C is connected to pin 21 on Esp 32.
- The VCC pin on the LCD I2C is connected to the 5V pin on Esp 32.
- GND pin on I2C LCD Connect to GND pin on Esp 32.

4.2.4 Local Monitoring

The local monitoring circuit is a combination of several sensors, namely two temperature sensors, two humidity sensors, and two smoke sensors. Apart from these sensors, an LED indicator and a buzzer for the alarm are also added as well as two fans for the fan coil and dehumidifier. The power supply for local monitoring uses a 12 Volt DC adapter and the voltage is lowered using a 5 Volt USB Step Down.

Local monitoring is installed in the ammunition depot so that room conditions are monitored locally via a 20x4 LCD monitor. Local monitoring makes it easier for members to check the ammunition warehouse they are responsible for. Figure 4.4 shows an example of the display on local monitoring.

The wiring or cabling for each sensor used is still the same as in the previous discussion. Local monitoring combines all four sensors using I2C communication and with an additional 2 analog pins for the smoke sensor. The Esp 32 output uses a led indicator, buzzer, fan coil, and dehumidifier.

A microcontroller equipped with a wifi module is installed on a local monitoring board for serial data communication using a local network or wifi. Esp 32 Devkit V1 is a microcontroller that is equipped with a wifi module so that it can communicate with other electronic devices, where the control system uses an application or control software called Blynk, which is installed on an Android cellphone, after which the control parameters are programmed in it. Agar MicrocontrollerEsp 32 can communicate with Blynk, so it is necessary to install the Blynk Library into the Arduino IDE Program.

The working voltage that can be used for local monitoring boards is 5 volts, so a voltage step down from 12 volts to 5 volts is needed. The 5 VDC voltage is used to supply sensor voltage, LCD, relay modules, and also indicators.



Figure 5. Local Monitoring

4.2.5 Remote Monitoring

Remote Monitoring using a mobile phone with Android OS. The application used is the Blynk App. This application can be downloaded on the Android Play Store as a remote monitoring system that is used by displaying reading data generated by the sensor. In this display, there are several gauge indicators for reading sensor values and led indicators as alarm indicators. The Blynk App also contains notifications when an alarm occurs, so users can find out if there is an alarm even if they are not opening their cellphone. Figure 4.5 is an example of the display layer on an Android mobile phone that has installed the Blynk App and a new project has been created with the name AMMO warehouse.



Figure 6. Blynk App Monitoring

Temperature, humidity, and smoke content readings are displayed in Blynk where the reading

values will follow online based on conditions in the ammunition depot or in this case local monitoring. The sensor reading value is sent using the internet via a local wifi network and then sent to Blynk on an Android cellphone.

4.2.6 Wiring Diagrams Local Monitoring Network

Figure 7 shows the overall Wiring Diagram. This study describes in detail the wiring diagram of the system used to build an ammunition warehouse monitoring system. At the input, two analog sensors and two I2C sensors are used for temperature and humidity.

The part that becomes the data processor or microcontroller is Esp 32 Devkit V1. Serial communication occurs between the microcontroller and the Blynk App, so remote communication using the internet network can be implemented.

The output indicators used are Led and Buzzer. The temperature and humidity control actuators in the ammunition depot are using a fan coil and a dehumidifier. All sensor readings can be monitored from the 20x4 LCD located on the local monitoring in the ammunition depot.

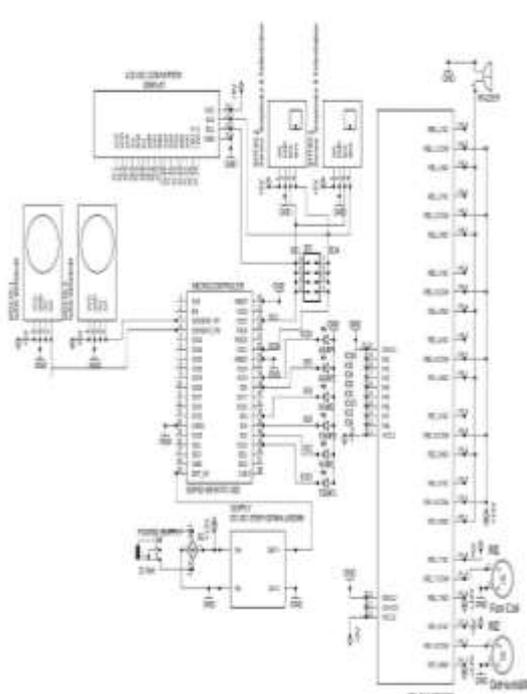


Figure 7. Local Monitoring Circuit Wiring Diagram

4.3 Test Results and Discussion

Based on testing the sensors that have been carried out by researchers, the following results are obtained below.

4.3.1 SHT 30 Temperature Sensor

Based on Table 4.1, it is known that the results of measuring temperature changes with three different simulated conditions obtained almost the same numbers between sensor 1, sensor 2, and the hygro thermometer as a comparison. This means that the SHT 30 temperature sensor is functioning properly with fairly accurate results. Temperature changes are read quickly by the sensor. The temperature readings between sensors 1 and 2 are not exactly the same because of the different sensor positions in the test room. The reading value is also different from the hygrometrometer because the hygrometrometer used as a comparison is equipment that is sold freely in the market and is not scientific standard equipment so it does not yet have a valid calibration certificate. However, it can be said that the sensor can respond well to temperature changes.

Table 1. Average SHT 30 Sensor Temperature Measurement Results

<i>Local Sensors</i>	Condition Simulation		
	Open (oC)	Hot (oC)	Cold (oC)
1	31.91	34.20	19.40
2	31.88	34.90	19.96
Hygro thermometer	28.80	34.50	23.59

4.3.2 Sensors SHT humidity 30

Table 2. Average SHT 30 Sensor Humidity Measurement Results

<i>Local Sensors</i>	Condition Simulation		
	Room (%)	Moderate humidity (%)	High Humidity (%)
1	74.92	76.77	82.34
2	74.95	76.23	81.74
Hygrothermometer	72.00	72.05	75.06

Based on Table 4.2, it is known that the results of measuring changes in humidity with three different simulated conditions obtained different numbers between sensor 1 and sensor 2. The difference in showing the percentage of humidity on sensor 1 from the simulation of room conditions to the simulation of moderate humidity conditions shows an increase. This shows that the humidity sensor on sensor 1 can still respond to changes in environmental conditions.

The display of the percentage of humidity on sensor 2 also responds from room conditions to moderate and high humidity conditions, indicating that the humidity measurement results of the SHT 30 sensor on sensor 2 are quite good.

4.3.3 Sensors MQ-135 smoke

Based on Table 4.14, it is known that the results of measuring the smoke level of the MQ-135 sensor with four different simulated conditions obtained different results between sensor 1 and sensor 2. In the experiments carried out, sensor 1 showed a higher number than sensor 2, namely 277 ppm in smokeless conditions, 421 ppm in low smoke conditions, 510 ppm in moderate smoke conditions, and 753 ppm in dense smoke conditions. This happened because the simulated smoke produced by the mosquito coils was not evenly distributed in the test room. Based on the data that has been obtained, the figure of 700 ppm has been set as the limit or input value indicating a fire. The input data threshold or value of 700 ppm is entered into the program code on Esp 32. If monitoring shows 700 ppm or more,

The data obtained on sensor 2 tends to have a smaller value than sensor 1. In normal conditions sensor 2 points to 320 ppm, in conditions with stimulation in the form of small smoke 380 ppm, in conditions with moderate smoke stimulation 335 ppm, and in conditions with strong smoke stimulation 601 ppm.

The average results of measuring changes in smoke levels in the air of the MQ-135 sensor can be seen in Table 3.

Table 3. Average Measurement Results of MQ-135 Sensor Smoke Levels

Local Sensors	Condition Simulation			
	No Smoke (ppm)	Small (ppm)	Current ly (ppm)	Conc entrat ed (ppm)
1	277	421	510	753
2	320	380	335	601

Based on Table 2, it is known that the results of measuring changes in humidity with three different simulated conditions obtained different numbers between slave 1, slave 2, and slave 3. The difference in showing the percentage of humidity in slave 1 from the simulation of room conditions to the simulation of moderate humidity conditions shows an increase. This shows that the humidity sensor on slave 1 can still respond to changes in environmental conditions.

4.3.4 Alarm

After testing the alarm, it has been proven that the alarm in the form of an indicator light and buzzer can respond quickly, instantly the temperature, humidity, and smoke content exceeds the specified limit. Alarm response less than 1 second after the parameter exceeds the limit. When the value returns to normal, the indicator light and buzzer will turn off. This shows that the alarm system on the equipment is functioning properly.

4.3.5 Fan Coils and Dehumidifiers

From the results of the tests that have been carried out, it can be said that the fan coil and dehumidifier have worked well. This can be seen when there is a temperature change exceeding 32° Celsius, the fan coil lights up. When the temperature has dropped below 32° Celsius, the fan coil turns off. Likewise, the dehumidifier is active when the humidity value reaches 80%, namely working with greater power, and returns to normal work when the humidity value has reached a value below 80%.

4.3.6 Blynk App On Mobile

From the results of the tests that have been carried out, it can be proven that the indicators displayed on the Blynk App on mobile phones have been able to show the same value as the value shown on the local monitoring, namely on the LCD. However, between local monitoring and remote monitoring on the Blynk App, there is a 1-second delay. This is because the setting on Blynk uses a 1-second delay for transmitting data from the microcontroller to Blynk Server via the internet.

However, this is not a problem because the Blynk App will continue to update online data continuously. The delay can occur for more than 1 second if the internet network used is unstable. The provider factor also determines network stability. The provider factor is one of the external factors that is not discussed in writing according to the boundaries of the problem that has been determined.

5. CONCLUSION

Based on the result and discussions, we can take some conclusions are:

a. Temperature and humidity sensors on the monitoring Internet of Things can be designed using SHT 30 as the sensor and Esp 32 Devkit V1 as the microcontroller. SHT 30 temperature and humidity sensors can generally work with a response of less than 1 second. The function of the tool made by the researcher is to monitor the ammunition warehouse for fire hazards. An extreme increase in temperature is one sign of a fire. The SHT 30 sensor can measure temperatures from -40° to 125°C , and with an accuracy of 0.5°C . Humidity that can be measured is 10% to 90% with an accuracy of 2%. In the event of a fire, it can be immediately identified by an increase in temperature as seen on the LCD monitor screen, buzzer sound, and by using the Blynk App on a mobile phone. The specified maximum value limit is 32°C for temperature and 80% for humidity,

b. Detection sensors smoke on monitoring the ammunition warehouse based on Esp 32 Devkit V1 using MQ-135 as the sensor. The MQ-135 smoke detection sensor installed in the monitoring module can detect the presence of smoke, with a range of 10 to 1000 ppm. The maximum limit of the specified value is 700 ppm to activate the alarm. The MQ-135 sensor takes about 5 minutes from the time it is first activated to read stably because inside there is a filament that needs to "warm up" first in order to achieve a stable reading.

c. The programming language used in the monitoring systemThe arsenal of ammunition is C language using the Arduino IDE compiler, both used for programming sensors, actuators, and serial communication with the Blynk App. The communication system between local monitoring and Blynk can run smoothly. If the system is running normally, then the Blynk App on the cellphone is turned off, then when the Blynk App is turned on again, the data will be updated quickly immediately. The time needed to update data is only 1 second after the Blynk App is turned on.

d. Monitoring SystemThis can be applied not only to ammunition depots on ships but also to onshore ammunition depots, with the main condition being an internet connection. Automation systems on fan coils and dehumidifiers can prevent a rapid rise in temperature and humidity in the warehouse. With an alarm that can be heard throughout the room and also notifications on your cellphone, this tool can help prevent fires in ammunition depots.

e. The hygro thermometer used is not standard laboratory equipment, so the validity of the results of temperature and humidity readings cannot be ascertained. However, the equipment has been able

to respond to any changes in temperature and humidity.

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