Kingdom of Saudi Arabia
Ministry of Higher Education
Jazan University

College of Computer Science & Information Technology

APPROVAL FOR BINDING OF GRADUATION PROJECT REPORT

GRADUATION PROJECT (495CNET-3)

GROUP : 5369

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To be filled in by student

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Project title	:	Overheating servers monitoring based on IoT

To be filled in by supervisor*

This is to certify that the project submitted and presented by the above mentioned student(s) is

☒ COMPLETE & ACCEPTED **☐ INCOMPLETE** **☐ NOT ACCEPTED**

and the draft of graduation project report has been corrected from all content flaws, typing errors and language mistakes.

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بسم الله الرحمن الرحيم

Graduation Projects Committee (GPC)

Gradution Project Thesis

Overheating servers monitoring based on IoT

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College of

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I'd want to begin by praising and thanking Allah, the Almighty, who provided me with a lot of chances, education, and benefits that allowed .me to finish my thesis

secondly Without the constant help of my supervisor, Mr. Ibrahim .Ahmed Aqeel, this research would not have been successful

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and Mr.Ibrahim Hassn Alshourbaji

Finally, I would always thank of financial and moral support from our parents. I beseech God to care after those who remained and to show mercy to those who left. Ameen

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Chapter 1: INTRODUCTION

1.1 PROJECT Introduction

- ### Introduction

Servers are critical components of any business' infrastructure, but they can also be one of the demanding to operate.

Overheating a server may result in data loss and downtime, which can be a major concern for any organization.

Data loss is one of the dangers of server overheating.

Servers that overheat can malfunction and shut down, resulting in data loss.

Other concern is harm to the server's physical parts, which might reduce its longevity.

Overheating can also cause performance concerns since heated servers may not be able to run at maximum level.

Users and companies who rely on the server for important applications may experience interruptions as a result. One of the most common causes of server overheating is a lack of adequate airflow.

When servers are put in a confined space, the air around them may quickly get stale and stagnant.

As a result, the server components may overheat since they are unable to adequately dissipate heat.

Another reason of server overheating is dust collection.

Dust collection on server components may act as an insulator, preventing effective heat dissipation.

Dust build-up is usually caused by poor server cleaning or maintenance.

Insufficient cooling systems may result in server overheating.

1.2 Problem Background

The nodes of a server generate a lot of heat

Data centre administrators employ modern ventilation systems in novel ways to dissipate heat away from servers.

If the nodes surrounding the CPU reach temperatures of 85-90°F and remain there for an extended period of time, you risk blowing the CPU.

Meltdown.

There might be a problem for numerous reasons, such as a colling system that is no longer functional or a cyber assault on that system that is requiring the CPU to perform a lot of processing.

The project's goal is to offer an alternate cooling system for the server in the event that it overheats or requires backup cooling in the event that the cooling system loses power.

- Reasons of server overheating include:

1. Heat shortens the life of your hardware.

According to some research, even slight rising temperatures can reduce the lifespan of a hard disk by up to two years.

Indeed, heat may degrade the parts of your server's motherboard, CPU, and other parts over time, leading to premature failure.

One approach to consider heat in your server is the difference between your server operating at 75% versus 100% capacity 24 hours a day, 7 days a week owing to the added load created by heat.

It's hardly unexpected if a server that is continually overheating crashes.

2. High temperature Decreases Performance

Heat can result in longer reaction times and writes mistakes in hard drives and other parts, eventually leading to losing data and general stability.

While this may not result in the type of "downtime" often associated with a server shutting down or components malfunctioning, it is unquestionably a decrease in productivity.

When there is a lag in system performance, hard disk instability can raise customer discontent and lead to worse problems down the line.

3. Heat Increases Operational Costs

Another important thing to keep in mind is that if your hardware breaks because of heat, you need not only have to replace the damaged equipment, but you will also have to recover and install the data that was on the disk.

You must also budget for the time and expense of IT specialists, HVAC crews, and any other experts required to get you back up and running. Furthermore, as a result of this downtime, you may need to convince your consumer base that you are still capable of providing the service you have promised them.

The cost of lost production due to downtime is a physical expense, just as real as the cost of replacing broken equipment, and it shouldn't be ignored.

4. High temperature Is Highly dangerous

Overheating hardware can cause much more simply harm; parts might eventually fail, causing extensive damage across the equipment or even increasing the danger of fire.

1.3 Problem Solutions:

1. Maintain adequate ventilation in the server room.

This may be accomplished by ensuring that no objects are obstructing air vents and that the room temperature is not excessively hot.

Utilize server racks with integrated fans.

This will aid in the circulation of air around the servers, keeping them cool.

Make use of server cabinets with doors.

Cabinet doors assist to keep the server room cooler by preventing hot air from moving around the space.

Make use of server cooling solutions.

Air conditioners, evaporative coolers, and chilled water systems are examples of cooling technologies that may be used to keep servers cool.

2. Keep the room cool by using air conditioning.

One of the greatest ways to keep your servers from overheating is to utilize air conditioning to keep the room temperature cool.

You can assist avoid your servers from working too hard and overheating by keeping the temperature low.

Moreover, ensure that your servers have adequate airflow to keep cool and avoid overheating.

3. Utilize server racks with built-in cooling fans.

If your servers are overheating, using server racks with built-in cooling fans is one of the best strategies to avoid additional damage.

By employing fan-equipped racks, you can ensure that your servers are consistently cooled and do not overheat.

If necessary, you may easily install more fans to your server racks.

4. Regularly monitor the temperature of the servers and take action if they begin to overheat.

It is critical to periodically monitor the temperature of your servers if you have them.

If they begin to overheat, they may be damaged and must be replaced.

Take action as soon as you detect the temperature increasing to avoid this.

You may either relocate the servers to a cooler area or use fans or air conditioning to keep them cool.

1.4 R Project Goals and Objectives:

A. Cooling System will work automatically in case of any need of extra cooling

B. keep monitor room temperature state from anywhere using cloud services

C. The efficiency of the system to help protect against cyber attacks that aim to raise the temperature of the processor to increase the load on it

- **Benefits:**

1. Extend the life of the server
2. Boost Server Performance
3. Lower Operating Costs
4. a secure working environment

1.5 Project Scope:

In any field of work that requires the presence of rooms for servers, such as the information technology department, cloud services, or many other fields

of work that use Internet technology and have a risk that servers will be damaged through cyber-attacks or breakdowns in the main cooling equipment

Chapter 2: System Analysis

2.1Developmet Methodology

- **Determining the requirements of the project:**

After packing the matter and choosing an idea from the appropriate number of projects, we have to determine the appropriate numbers that achieve the idea of the project.

This is achieved through several things:

1- First, that the equipment is available and easy to access, and it will be replaced at any time

2- The equipment should be cheap and at the same time the equipment should be appropriate and able to convey the same idea that can be achieved by using expensive, efficient and high-quality equipment.

3- There should be equipment that increases security during the implementation of the project for those in charge of the project, in addition to the parts themselves

- **Analyzing :**

Before starting the project, we have to think about several things and thinking about the problems that may face the project and make sure that it can perform the job perfectly by answering some questions:

1-How can the server be kept from overheating?

2- What are the dangers of a server overheating?

3-what is the ways to avoid overheating servers?

4- How to construct a server room that doesn't get too hot ?

- **Design selection:**

After selecting the suitable pieces and researching the extent of the novelty of the project, we will start searching for a suitable design so that the equipment can work in the most appropriate way possible and with high efficiency.

- **implementation:**

  After defining the requirements, determining the feasibility of the project, and choosing the appropriate design for the project, the stage begins now in which it begins to implement the project on the ground by assembling the pieces together and writing the necessary codes to implement our project.

- **Testing:**

  selecting the project and ensuring its efficiency on the ground and achieving the desired goal

2.2 User and System Requirements

2.2.1 Hardware Requirements

• DHT11:

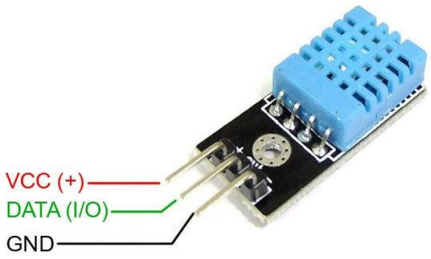


FIGURE DHT11 PHOTO

The widely used DHT11 temperature and humidity sensor includes an exclusive NTC for temperature measurement and an 8-bit microcontroller to output the temperature and humidity values as serial data.

You can buy the DHT11 sensor as a sensor or as a module.

In either case, the sensor's performance is unchanged.

The module will have three pins , whereas the sensor will come in a 4-pin package of which only three pins will be used.

The only distinction between the sensor and module is that the module will come with an internal pull-up resistor and filtering capacitor, whereas the sensor requires you to use them externally if necessary. The sensor has an accuracy of 1°C and 1% and can measure

temperature from 0°C to 50°C and humidity from 20% to 90%.Therefore, if you want to measure in this range, this sensor might be the best option.

- **Specifications for DHT11**

1- Voltage Range: 3.5 to 5.5V
2- 0.3 mA is the operating current (measuring)
3- 60uA (standby) (standby)
4- Serial data are output.
5- Range of temperatures: 0°C to 50°C
6- Range of Humidity: 20% to 90%
7- Resolution: Both temperature and humidity are 16-bit values.
8- Precision: ±1°C and ±1%

- **ESP32:**

FIGURE ESP32

The ESP32 is a low-cost, low-power microcontroller that includes Bluetooth and Wi-Fi.

It is the replacement for the ESP8266, a low-cost Wi-Fi microchip with extremely restricted functionality. It includes a power amplifier, low-noise amplifiers, filters, and a power management module in addition to an integrated antenna and RF balun.

The solution uses the least amount of space on the printed circuit board as a whole. This board uses TSMC 40nm low power 2.4 GHz dual-mode Wi-Fi and Bluetooth chips, which have the best power and RF properties and are secure, dependable, and expandable to a range of applications. The ESP32 supports three types of I/O modes with each GPIO Pin: Digital, Analog and Internal Sensors

- **Specifications of ESP32:**

1- A single- or dual-core 32-bit LX6 processor with a clock speed of up to 240 MHz.

2- A ROM of 448 KB, 520 KB of SRAM, and 16 KB of RTC SRAM.

3- Supports 802.11 b/g/n Wi-Fi connectivity at rates of up to 150 Mbps.

4- Support for Bluetooth v4.2 Classic and BLE standards.

5- programmable GPIOs.

6- Two 8-bit DAC channels and up to 18 12-bit SAR ADC channels

7- There are six serial ports: four SPI, two I2C, two I2S, and three UART.

8- Ethernet MAC communication for physical LAN (requires external PHY).

9- A SDIO/SPI slave controller and an SD/SDIO/MMC host controller

10- A maximum of 16 channels for motor and LED PWM.

11- Secure Boot and Flash Encryption.

12- Hardware acceleration for RSA, AES, Hash (SHA-2), ECC, and RNG.

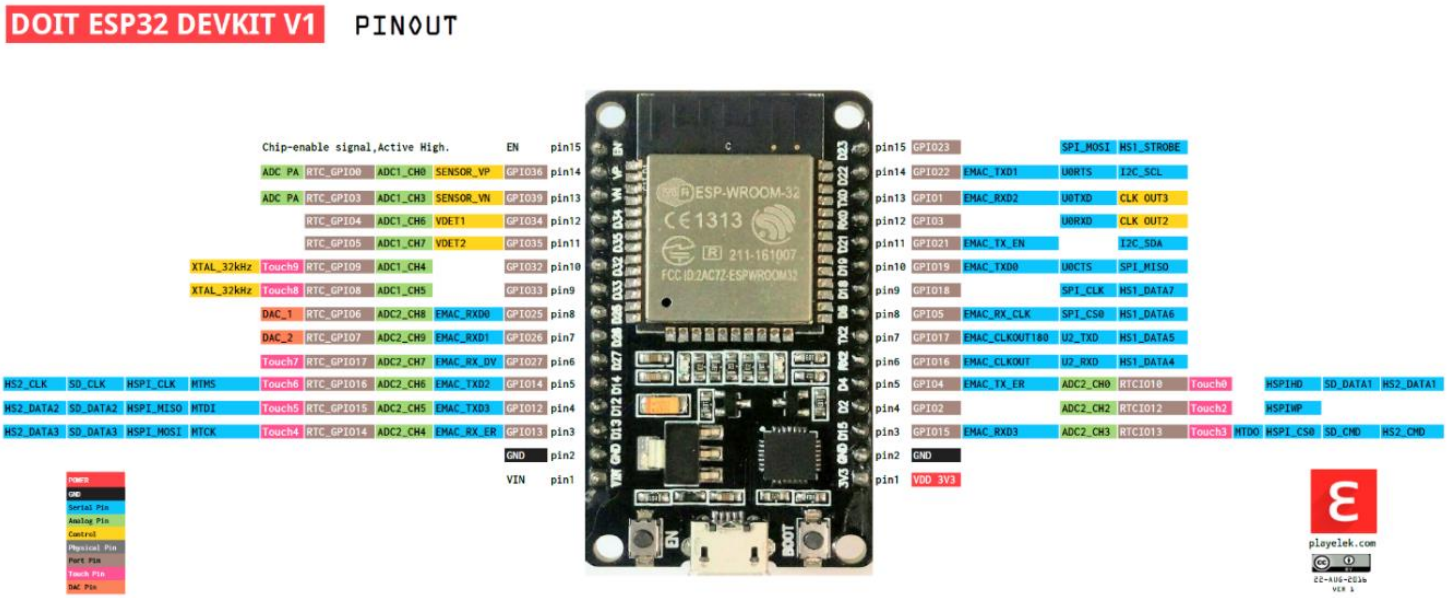


FIGURE ESP32 PINS

- **Electrical Pins:**

1. VIN: A pin used to connect an external power source ranging from 5 to 14 volts.
2. 3V3: Voltage regulator output pin having a 3.3 volt output and a maximum current of 1 amp.
3. The ESP32-WROOM module is powered by the regulator.
4. GND stands for ground outputs.

- **IN/Out Ports:**

1. Digital I/O: pins 1–5, 12–19, 21–23, 25–27, 32–33.

I/O pins that can be used for anything.

The pins can be set to be input or output.

The logic level of one is 3.3 V, whereas the logic level of zero is 0 V.

The maximum output current is 12 milliamperes.

2. Digital inputs: are available on pins 34-36 and 39.

Contacts for general-purpose input.

It can be set to accept only input.

3. PWM: is used on all I/O pins.

Allows the output of analog values as a 16-bit PWM signal.

The maximum number of channels available is 16.

4. ADC: there is 15 ports which its (2, 4, 12-15, 25-27, 32-36, and 39).

Allows analog voltage to be digitally represented in 12-bit increments.

5. DAC: Pins 25 (DAC1) and 26 (DAC2).

An analog output of a digital-to-analog converter that can generate 8-bit voltage values. The pins can be utilized to output audio.

Allows analog voltage to be digitally represented in 12-bit increments.

- **Interfaces:**

1. Each platform I/O pin supports hardware interfaces.
2. I2C : A serial "I2C" interface is used to communicate with peripherals.
3. SPI : A serial "SPI" interface is used to communicate with peripherals.
4. UART/Serial :Use the "UART" interface to communicate with peripherals.
5. I²S :A protocol for sending and receiving audio interface with other audio equipment.

- **1 Channel 5V Relay Module**

A 5v relay is a type of automatic switch that is typically used in an automatic control circuit to control a high-current signal with a low-current signal.
The relay signal's input voltage varies from 0 to 5V.

FIGURE 5V RELAY

Applications for Single-Channel Relay Modules:

1. Mains power switching
2. Switching at a high current
3. Isolated power supply
4. Automation in the home

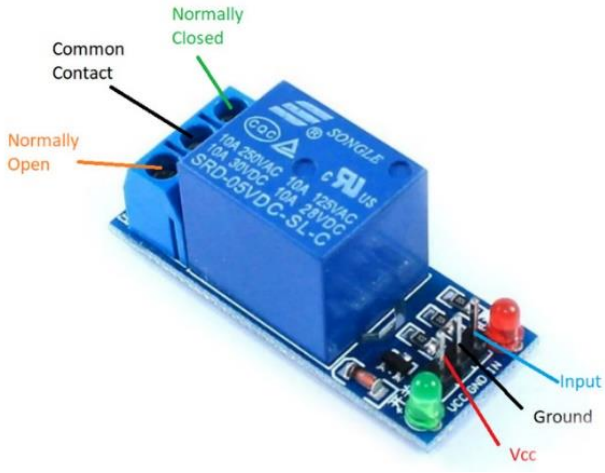


FIGURE RELY PINS

Single-Channel Relay Module Pin Description

Pin Number	Name	Description
1.	Relay Trigger	Input used to turn on the relay

2.	G	0V as reference
3.	VCC	Power supply input for the relay
4.	NP	The relay's normally open terminal
5.	Common	The relay's common terminal
6.	NC	The relay's normally closed contact

Single-Channel Relay Module Specifications

• Voltage range: 3.75V to 6V.

• The idle current is 2mA.

• When the relay is turned on, the current is 70mA.

• Maximum contact voltage of the relay is 250VAC or 30VDC.

• Maximum relay current is 10A.

- **Raspberry Pi:**

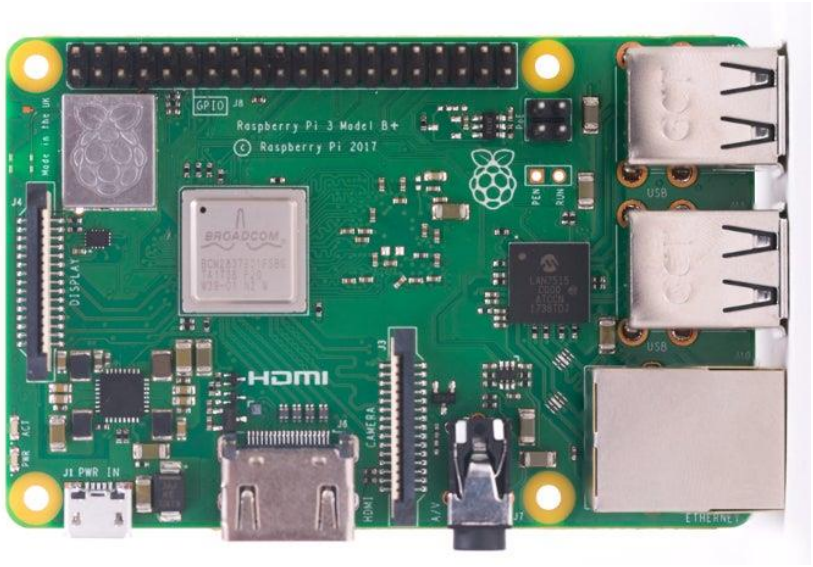


FIGURE RASPBERRY PI

The Raspberry Pi is characterized as a credit card-sized minicomputer that can communicate with any input and output hardware device such as a monitor, television, mouse, or keyboard, thereby converting the setup into a full-fledged PC at a low cost.

The Raspberry Pi is a small, low-cost single-board computer the size of a credit card that enables people of various backgrounds and levels of competence to experiment with and learn to compute.

It is an improved motherboard developed in the United Kingdom by the Raspberry Pi foundation, which is now generally regarded as a developing component of computer technology.

Other peripheral hardware devices, such as a keyboard, mouse, and monitor, can be connected to the minicomputer.

- **Work with the Raspberry Pi:**

  The Raspberry Pi is a computer that can be programmed.

  It has all of the core properties of a standard computer motherboard, but no peripherals or internal storage.

  To set up the Raspberry computer, an SD card must be plugged into the designated slot.

  The operating system must be installed on the SD card in order for the computer to boot. Raspberry Pi computers are powered by the Linux operating system. This reduces the amount of memory needed and promotes a diversified environment.

  The Raspberry Pi can be linked to output devices such as computer monitors or a High-Definition Multimedia Interface (HDMI) television after the operating system has been installed.

  Input devices like mice and keyboards must also be linked.

- **Aspects of the Raspberry Pi:**

  1. CPU

  A Central Processing Unit is found in every computer, including the Raspberry Pi.

  It acts as the computer's brain, executing commands via logical and mathematical operations.

  Raspberry Pi boards employ the ARM11 CPU family.

  2. HDMI connection

  The Raspberry Pi board includes an HDMI port, which allows the device to display video selections from the computer's output.

  The Raspberry Pi is linked to an HDTV using an HDMI cable.

Versions 1.3 and 1.3 are compatible.

It also includes an RCA input for additional display options.

3. GPGPU

The GPU, or Graphic Processing Unit, is another component of the Raspberry Pi board.

Its primary role is to speed up image calculations.

4. RAM

RAM (Random Access Memory) is an important component of a computer's processing engine.

It stores real-time data for convenient access.

The original Raspberry Pi has 256MB of RAM. Over time, developers steadily and substantially increased the size.

The capabilities of different Raspberry Pi models vary. Raspberry Pi 4 with 8GB RAM is currently the most powerful.

5. Ethernet link

The Ethernet connector is a connectivity hardware feature included on Raspberry Pi B models.

The Ethernet connector allows the minicomputer to connect to the internet through a wired connection. Without it, the Raspberry Pi would be unable to do software updates, web surfing, and other operations.

The Ethernet port in Raspberry computers uses the RJ45 Ethernet connector. This component allows Raspberry Pi to communicate with routers and other devices.

6. SD card reader

The Raspberry Pi, like many other standard PCs, requires some sort of storage device.

However, unlike standard PCs, it does not have a hard drive or memory card.

The Raspberry Pi board has a Secure Digital card or SD card slot, into which SD cards must be placed in order for the computer to function.

The SD card functions similarly to a hard drive since it contains the operating system necessary to turn on the machine. It can also be used as a data storage device.

7. GPIO Pins

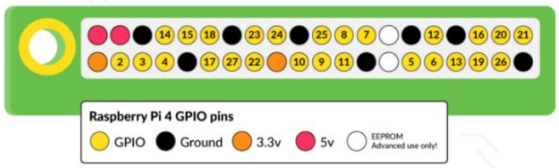


FIGURE GPIO PINS

On one side of the board, there is a cluster of upwardly extending pins.
The original Raspberry Pi had 26 GPIO pins, but most variations now have 40.
These pins are rather fragile and should be handled with caution.
They are important components of the Raspberry Pi device because they broaden its variety of applications. GPIO pins enable communication with other electrical circuits.

They can read and alter electric signals from other boards or devices based on how the user programs them.

8. LEDs

This module contains five light-emitting diodes. They show the user the current condition of the Raspberry Pi gadget. Their tasks include the following:

a) PWR (Red): This simply displays the power status.

When the gadget is switched on, it emits a red light that is only shut off or removed from the power supply.

b) ACT (Green): This light flashes to indicate that there is SD card activity.

c) LNK (Orange): The LNK LED becomes orange when active Ethernet connectivity is enabled.

d) 100 (Orange): When the data rate on an Ethernet connection reaches 100Mbps, this light glows.

f) FDX (Orange): During the Ethernet connection, the FDX light illuminates.

It denotes that the link is full-duplex.

9. USB connections

Connectors are an essential part of the Raspberry Pi.

They allow the computer to connect with external devices such as a keyboard, mouse, and hard drives.

The original Raspberry Pi gadget had only two USB 2.0 ports.

In later editions, this number was increased to four.

The Raspberry Pi 4 and Pi 400, which are newer devices, include a mix of USB 2.0 and USB 3.0 ports.

10. Power supply

A power connector of the Raspberry Pi accepts a 5V micro USB power connection.

A Raspberry Pi's power consumption is determined by its operation and the amount of peripheral hardware devices installed.

- Specification

Processor: Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz (Broadcom BCM2711).

2-Memory: LPDDR4 1GB, 2GB, or 4GB (depending on model)

3-Connectivity: IEEE 802.11b/g/n/ac wireless LAN at 2.4 and 5.0 GHz, Bluetooth 5.0, and BLE Gigabit Ethernet

2 × USB

3.0 ports

There are two USB 2.0 ports.

4-Video and audio: 2 tiny HDMI ports (up to 4Kp60 supported)

MIPI DSI display port with two lanes

MIPI CSI camera port with two lanes

4-pole stereo audio and a composite video connector are included.

5-Multimedia: H.265 (4Kp60 decode, 1080p30 encode); H.264 (1080p60 decode, 1080p30 encode); OpenGL ES 3.0 graphics SD card compatibility: H.265 (4Kp60 decode, 1080p30 encode); H.264 (1080p60 decode, 1080p30

Micro SD card slot for installing software and storing data

5V DC input through USB-C connector (minimum 3A1)

Input of 5V DC through GPIO header (minimum 3A1)

PoE (Power over Ethernet) support (requires separate PoE HAT)

6-Environment: 0-50ºC working temperature

- **12v fan**

  This fan will be used as a cooling gas for the project, there is no specific thing that should be used as a cooling gas, but we chose this fan for its cheapness and efficiency

FIGURE 12V FAN

- **BreadBoard:**

  A breadboard (sometimes known as a plugblock) is a device for creating temporary circuits.
  It is advantageous to designers since it allows components to be easily removed and replaced.
  It is useful for someone who wants to create a circuit to demonstrate its functionality before reusing the components in another circuit.

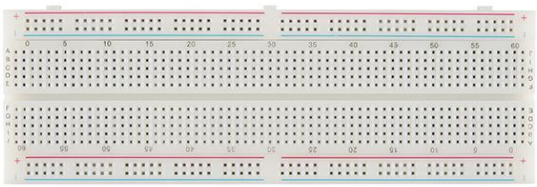


FIGURE BREADBOARD PHOTO

- **Jumper wires :**

  Jumper wires are basic cables containing connector pins at either end, one end, or no end that allow them to connect two points without soldering. Jumper wires are frequently used in conjunction with breadboards and other prototyping tools to enable for rapid circuit adjustments as needed.

FIGURE JUMPER WIRES PHOT

- **mb102**

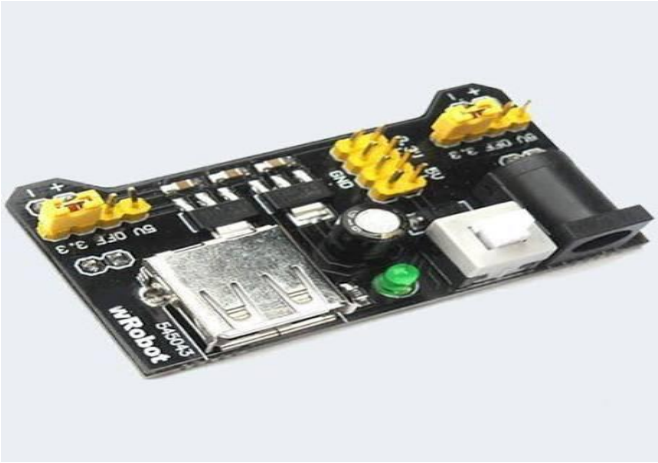


FIGURE MB102 PHOTO

The MB102 Breadboard Power Supply module is an essential and low-cost component in electronics labs.

It provides power to the circuits and is also used for testing.

The small, compact module uses little power and may be operated by input voltages ranging from 6.5 to 12 volts.

The module has two voltage regulators that output 3.3 and 5 volts, respectively. Mb-102 also has a capacitor for noise reduction and voltage smoothing.

When connected to a power supply, the module contains a switch that allows it to be turned on and off manually.

It contains an additional USB connector as well as berg headers that may be carefully adjusted. The component is ideal for prototypes and small breadboard circuits.

- **The contents of the mb102:**

  1-Power Port & USB Port: A DC power port and a USB-A connector power the module.

  2-Power Switch & LED: A switch is included to provide for extra control, as well as an LED to indicate module activation.

  Three jumpers: The mb102 breadboard supply module may supply 3.3 or 5 volts to breadboard rails.

  They may each be run individually.

  4-Berg Headers: Berg headers may be used to power other devices as well.

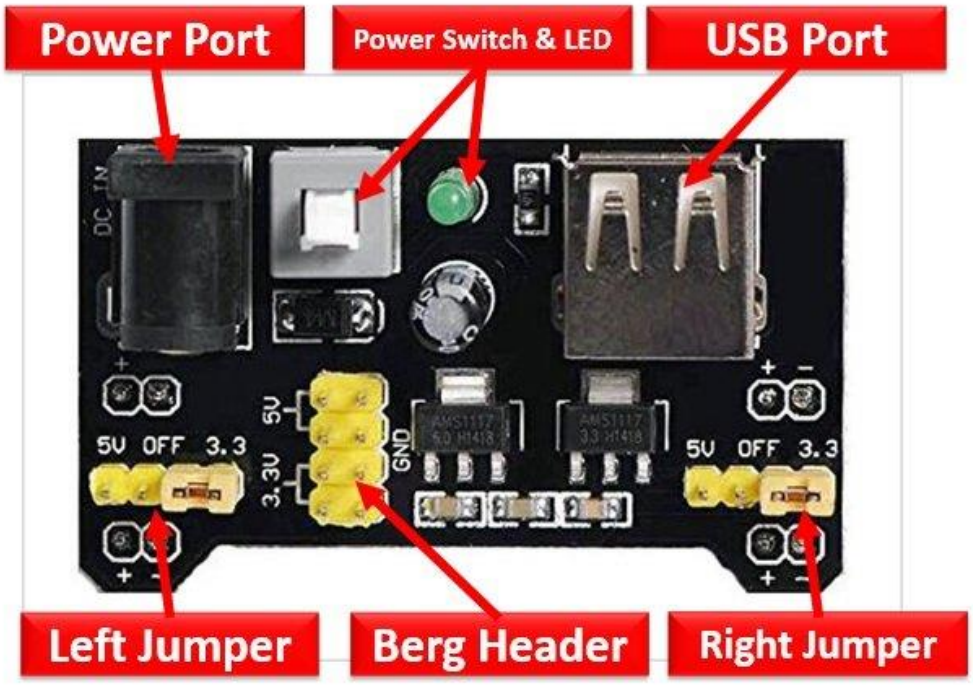


FIGURE 1 CONTENTS OF MB102

- **Specifications and Characteristics**

1. Operating
2. The voltage range is 6.5 to 12 volts.
3. Output voltage: 3.3 or 5 volts
4. The maximum output current is 700 mA.
5. Module dimensions: 5.3cm x 3.5cm
6. An on/off switch on the module controls the external input switch.
7. The Breadboard module includes a USB connector as well as a DC port.
8. The USB port provides power to the circuits via the module.
9. The module features customizable power lines that may be controlled independently.
10. The module has the ability to switch between 3.3V and 5V output voltages.
11. Connect the BBPS module directly to the breadboard.
12. For added convenience, the BBPS module features two pairs of onboard 3.3V and 5V DC output berg connections.

2.2.2 Software Requirements

- **arduino software (IDE)**

The arduino software (IDE) is an open source software used to program Arduino boards. It is an integrated development platform created by arduino.cc.

Allows for the writing and uploading of code to Arduino boards.

It also included a number of libraries as well as a collection of mini-project examples.

The Arduino software (IDE) is compatible with many operating systems (Windows, Linux, and Mac OS X) and programming languages (C/C++). As a result, the Arduino software is a tool for developing new things.

and develop new electrical projects.

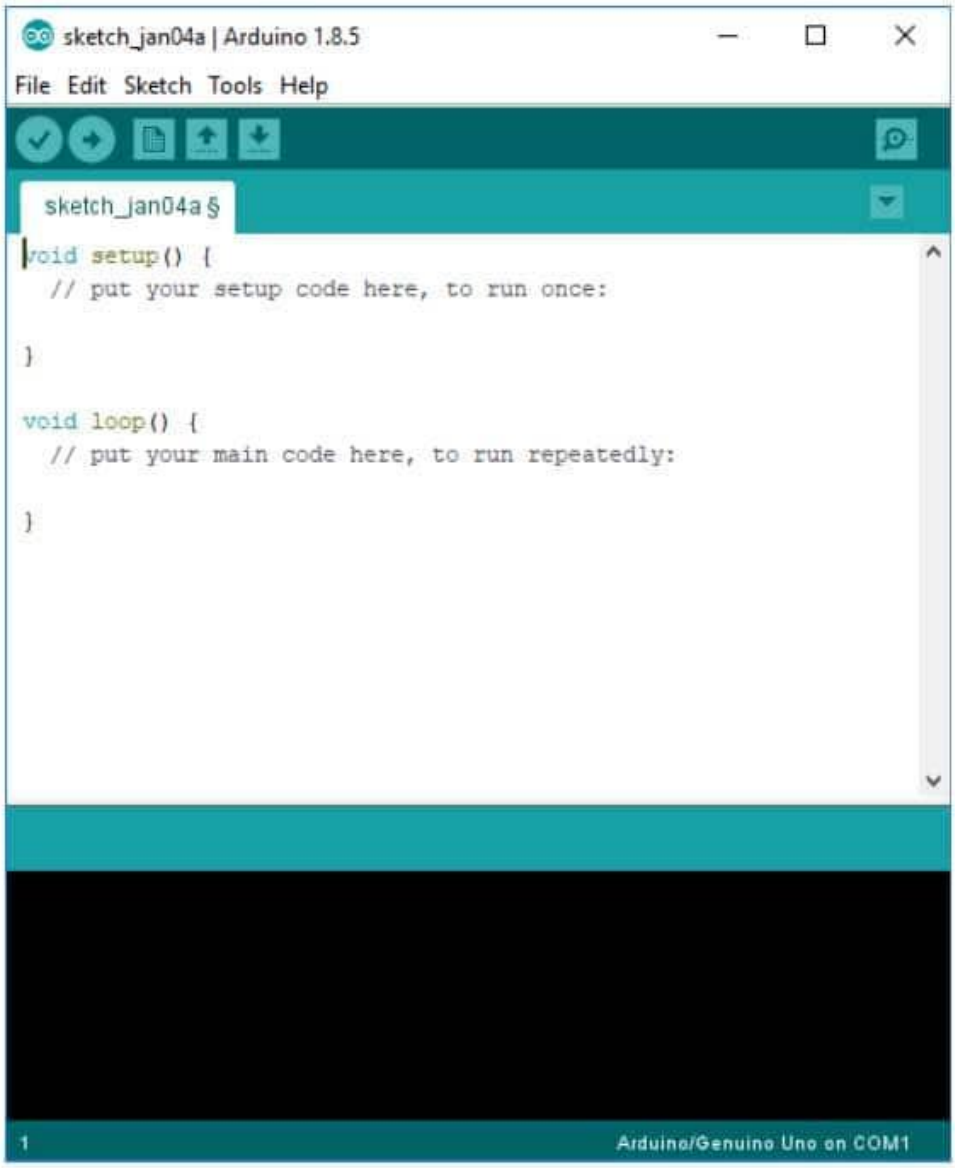


FIGURE ARDUINO SOFTWARE INTERFACE

- **Blynk**

Blynk is an IoT software platform that allows you to connect devices to the cloud, create mobile apps to control and monitor them remotely, and manage thousands of users and deployed products.

It is a PaaS (Platform-as-a-Service) that allows businesses and individuals to seamlessly go from a prototype of a connected product to commercial launch and growth.

In addition to typical IoT technologies, all Blynk choices include native mobile apps.

Customers may connect any device to the Internet and use a set of software packages that support over 400 hardware varieties to run commercial initiatives.

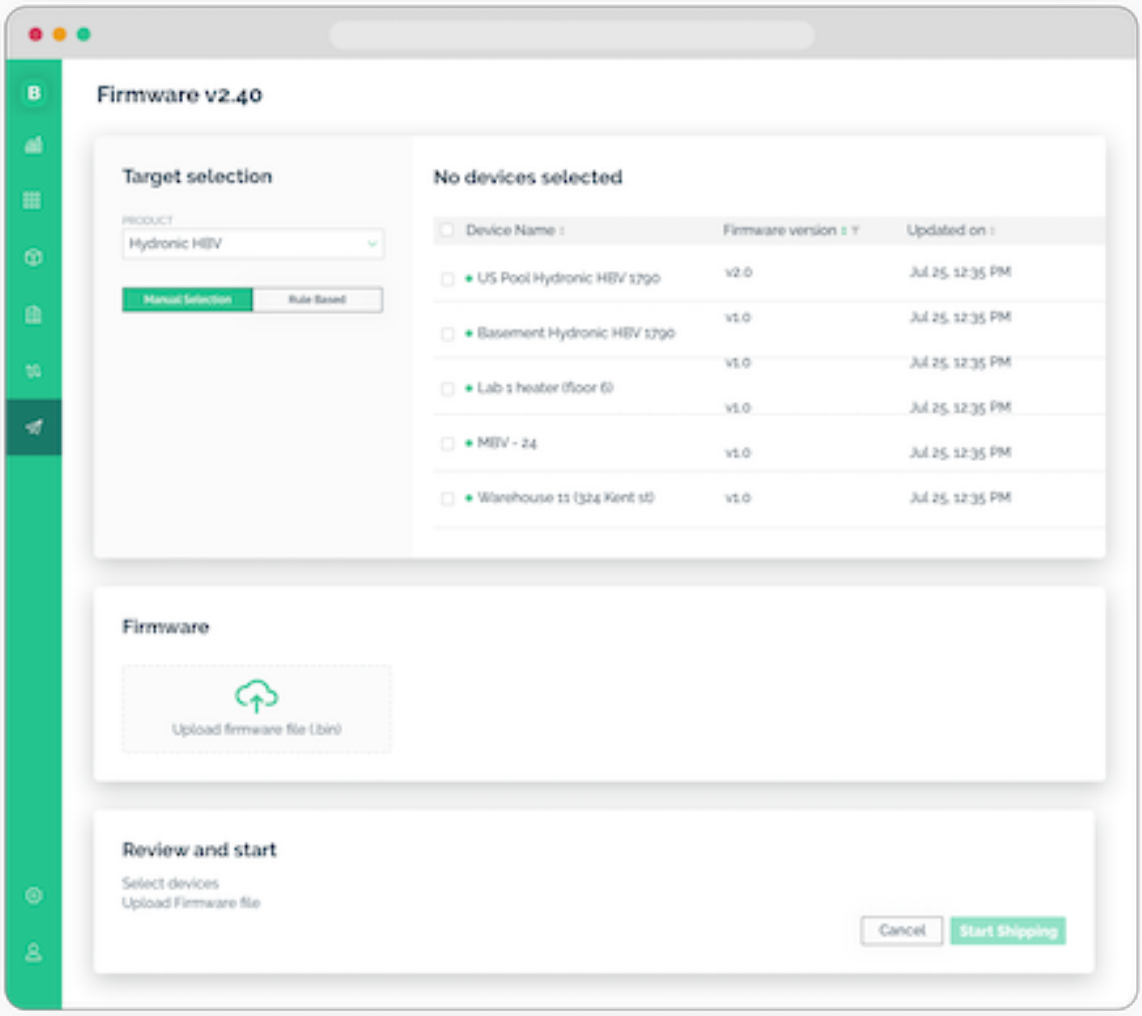


FIGURE BLYNK INTERFACE

- **VNC Viewer:**

VNC Viewer collects your input (mouse, keyboard, or touch) and delivers it to VNC Server for injection and remote control.

You'll need a VNC Server for the distant computer and a VNC Viewer for the computer or mobile device you want to manage.

This will be used to control and show the Raspberry pi system from any device.

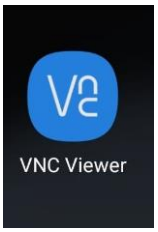
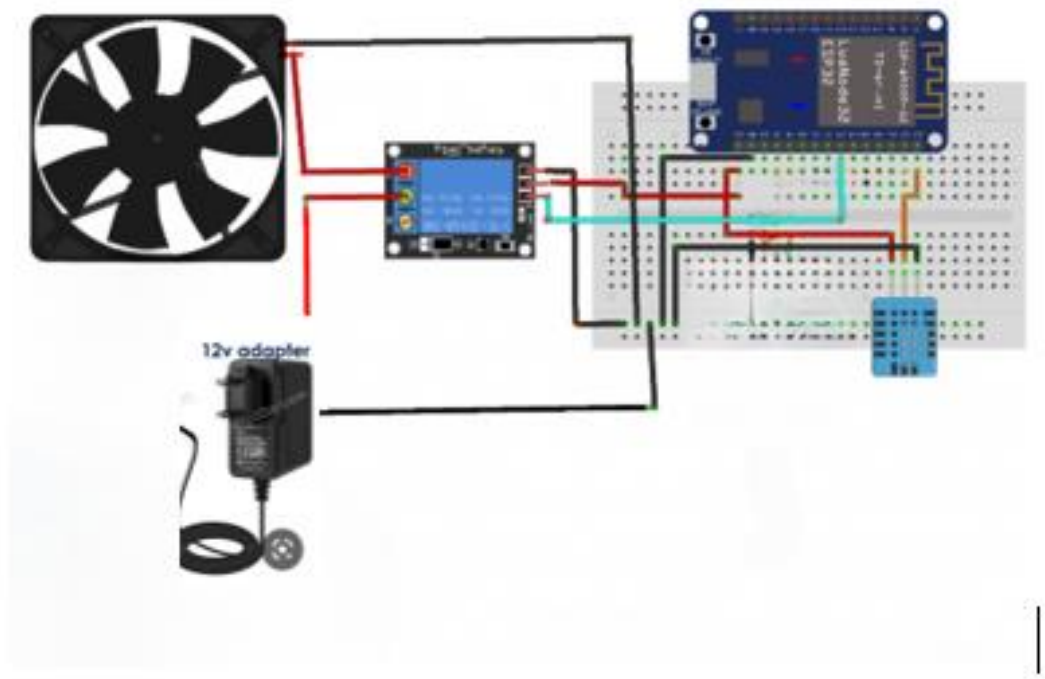


FIGURE VNC VIEWER APP

Chapter 3: Project Design

3.1 System Architecture:



- **Esp32:**

It will be used to control the system using written codes, also to send data blynk to keep monitor temperature as addition feature

- **Dht11:**

temperature and humidity as serial data.

It will be used to send temperature data to the esp32

Relay:

it will be used to accept instruction from esp32 and use it to control the cooling device

- **MB102:**

Breadboard Power Supply module is one of the essential and low-cost components in the electronics labs. It powers the circuits and is also used for testing purposes. The small compact module is power efficient and can be operated using an input voltage range of 6.5 Volts to 12 Volts.

- **Raspberry pi:**

It will use to test our cooling system agency cyber attack

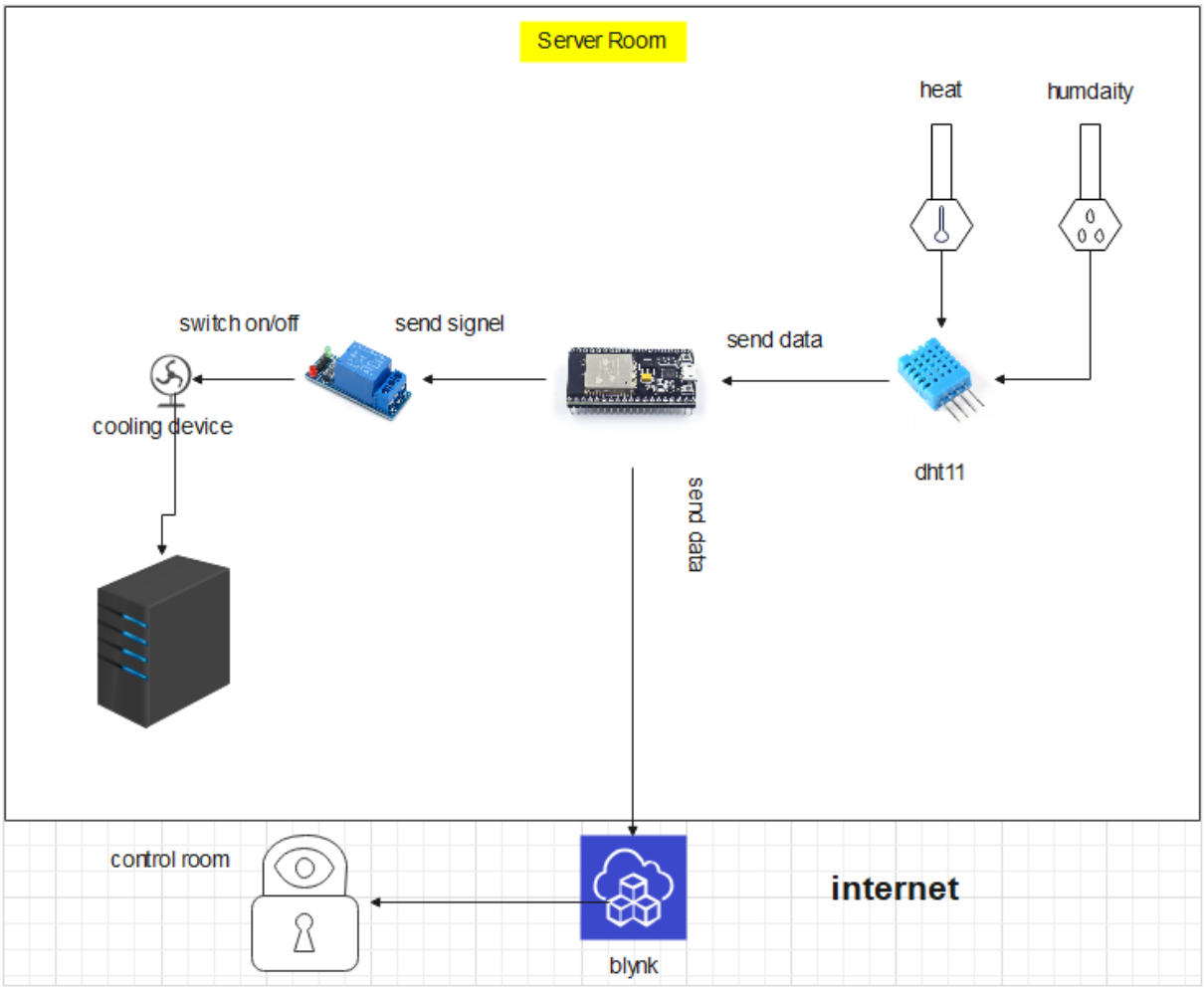
Breadboard:

is used for building temporary circuits.

- **Jump cables:**

wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering.

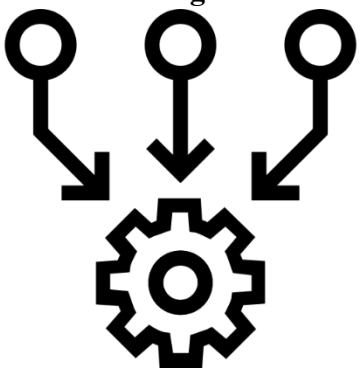
3.2 Data Flow Diagram:



Chapter 4: PROJECT IMPLEMENTATION AND RESULT

4.1 Project Implementation:

- **Data collecting:**



Before the DHT11 sensor can read sensor data, the start signal must be delivered to it.

To do this, the DHT11's DATA pin must be configured to a digital output.

The DATA pin must receive an 18-millisecond digital pulse followed by a rising edge.

The esp32 pin must then be set to a digital input via an internal pull-up.

Now, at the Arduino pin, read the DHT11 response signal.

DHT11 has successfully broadcast a return pulse if a falling edge is seen within 90 microseconds.

Data from the DHT11 sensor may be obtained by polling the digital pulse's logical level while measuring the pulse width. The pulse width may be measured by measuring the amount of time that has passed from a certain point in time while polling for a logical HIGH or LOW.

The millis() and micros() functions keep track of how long it has been since Arduino booted.

Millis() returns the time since boot in milliseconds, whereas micros() returns the time since boot in microseconds.

This reserved information of dht11 it will going to be used in the esp32

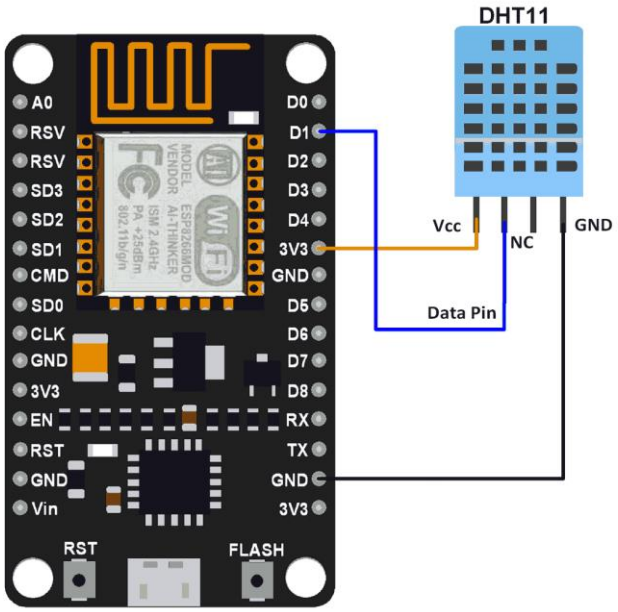
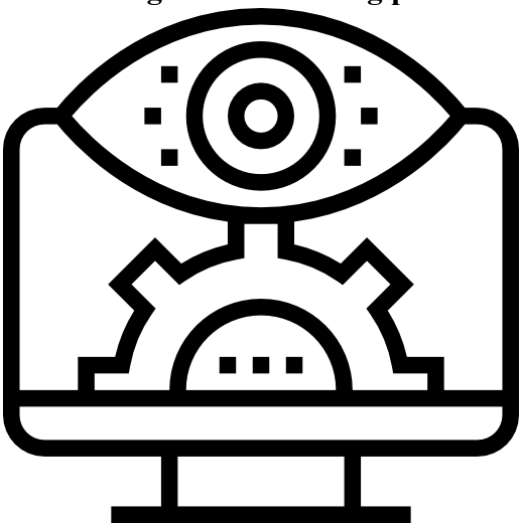


FIGURE DHT11 TO ESP32 CONNECTION

- **Controlling and monitoring process:**



The ESP32 supports TCP/IP, the entire 802.11 b/g/n/e/i WLAN MAC protocol, and the Wi-Fi Direct standard.

This means that the ESP 32 can connect with the great majority of WiFi routers on the market when used in station (client) mode.

It can also build an access point with full 802.11 b/g/n/e/i capability.

The ESP32 also supports Wi-Fi Direct.

Wifi-Direct is a superb peer-to-peer connectivity option that does not require an access point.

Wifi-Direct is simple to set up and provides significantly quicker data transmission speeds than Bluetooth.

This might be used to configure ESP32-based projects using a phone or tablet that supports WiFi direct.

and we will use this capability in our project to collect and send data to blynk service. The ESP32 will be used to control the relay module.

We will send commands to the ESP32 to toggle the relay module ON or OFF using the data obtained by the dht11.

This will be utilized to regulate the server's cooling device

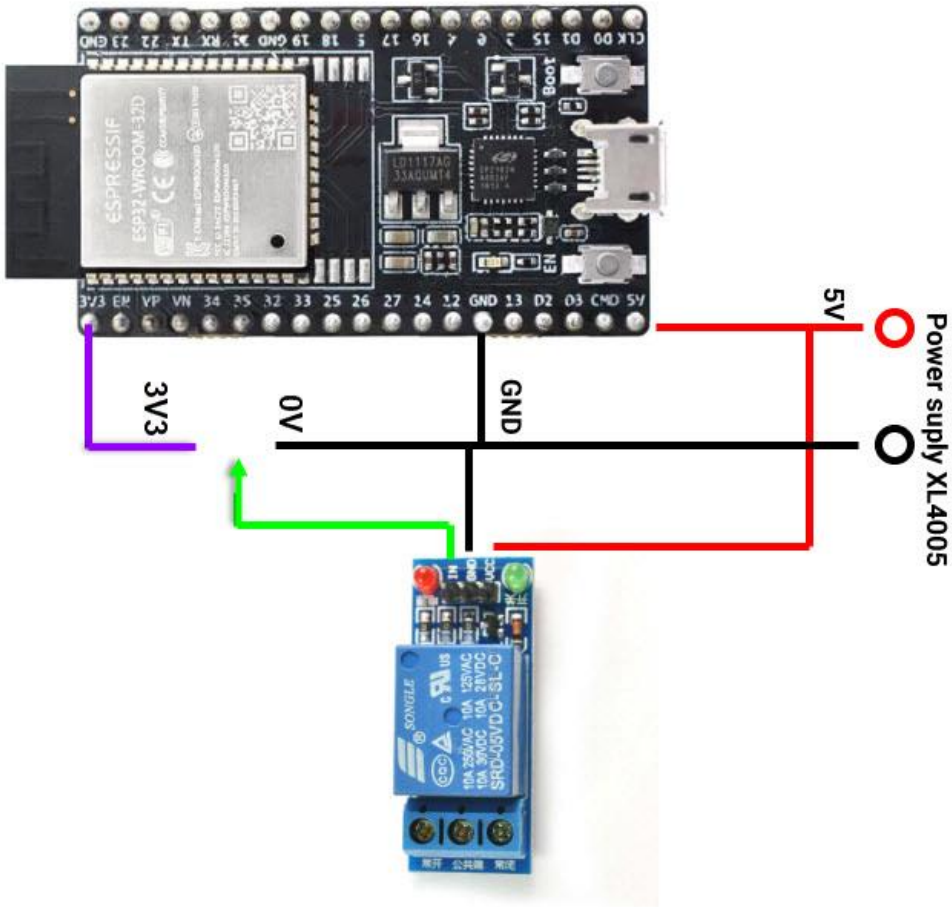


FIGURE RELAY TO ESP32 CONNECTION

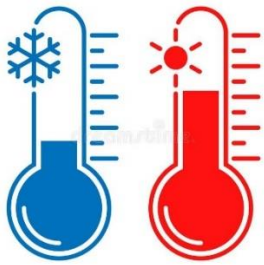
4.2 Project code:

```
#include <DHT.h>

#include <DHT_U.h>

#define BLYNK_TEMPLATE_ID "TMPL9pWIwJaz"

#define BLYNK_DEVICE_NAME "temperature and humidity
sensor"
#define BLYNK_AUTH_TOKEN "uyMnFgKeiJHTuodLbFo6XJiU-
eIPVNix"
#define BLYNK_PRINT Serial
#include <WiFi.h>
#include <BlynkSimpleEsp32.h>
#include <DHT.h>
char auth[] = BLYNK_AUTH_TOKEN;

char ssid[] = "####";  // type your wifi name

char pass[] = "#####";  // type your wifi password


BlynkTimer timer;
#define RELAY_FAN_PIN 17
#define DHT_SENSOR_TYPE DHT11
#define DHTPIN 33
#define TEMP_UPPER_THRESHOLD  35 // upper temperature
threshold
#define TEMP_LOWER_THRESHOLD  31 // lower temperature
threshold
```

```
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);
void sendSensor()
}
  float h = dht.readHumidity;()
  float t = dht.readTemperature(); // or dht.readTemperature(true) for
Fahrenheit

  if (isnan(h) || isnan(t))}
    Serial.println("Failed to read from DHT sensor!");
    return;

{
    Blynk.virtualWrite(V0, t);

    Blynk.virtualWrite(V1, h);

    Serial.print("Temperature : ");
    Serial.print(t);
    Serial.print("    Humidity : ");
    Serial.println(h);
}
void setup()
   }
Serial.begin(9600); // initialize serial

pinMode(RELAY_FAN_PIN, OUTPUT);

  Blynk.begin(auth, ssid, pass);

  dht.begin;()
  timer.setInterval(100L, sendSensor);
{
```

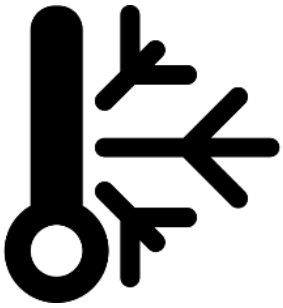
```
void loop()
}
  Blynk.run;()

  timer.run;()

  float temperature = dht.readTemperature();  // read temperature in
Celsius

  if (isnan(temperature))}
    Serial.println("Failed to read from DHT sensor!");
 {
else}

    if (temperature > TEMP_UPPER_THRESHOLD
)}

      Serial.println("Turn the fan on");

      digitalWrite(RELAY_FAN_PIN, HIGH); // turn on

 {    else if (temperature < TEMP_LOWER_THRESHOLD} (
      Serial.println("Turn the fan off");

      digitalWrite(RELAY_FAN_PIN, LOW); // turn off
{
{
 //  wait a 2 seconds between readings
  delay;(2000)
 }
```

4.3 Testing:



In this test, we used the Raspberry Pi as a server and exposed it to several specific temperatures to test the efficiency of the system.

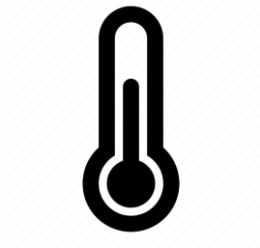
1- in cold atmosphere:



Here we tested the system in a room where the situation is at its best and the cooling in the room is at its highest efficiency, where the temperature was between 20-25 degrees Celsius in the air.

Result: The system did not show any interaction with the current situation, and this is expected because we set the system to work only when the processor temperature rises to a point where the system does not work efficiently (80 degrees Celsius or higher).

2- In a moderate room atmosphere

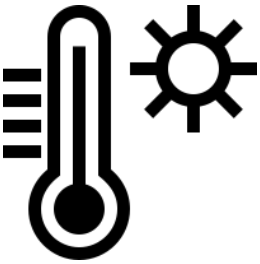


Here we tested the system in a room where the temperature was moderate, and the cooling in the room was moderate Efficiency depends on ceiling fans only, and the air temperature is between 25-30°C.

Result: The system started reacting to the current situation, where the system was keeping the processor at 40°C.

This is to be expected because we set the system to run only when the processor temperature rises to a point where the system is not working efficiently (80°C or higher).

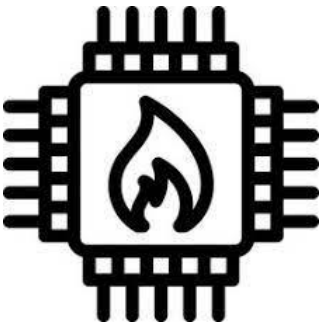
3- In a hot room atmosphere:



Here, we exposed the processor to the highest possible pressure, as we turned off any external cooling device.

Result: The system responded effectively to the current situation as the processor kept the processor temperature between 40 and 50degrees Celsius

4- Cyberattack:



we download a library on the system that forces the processor to work at 100%, in order to simulate cyber attacks.

Result: The system responded effectively to the current situation as the processor kept the processor temperature between 50 and 70 degrees Celsius.

4.4 Real screen shots of the working project:

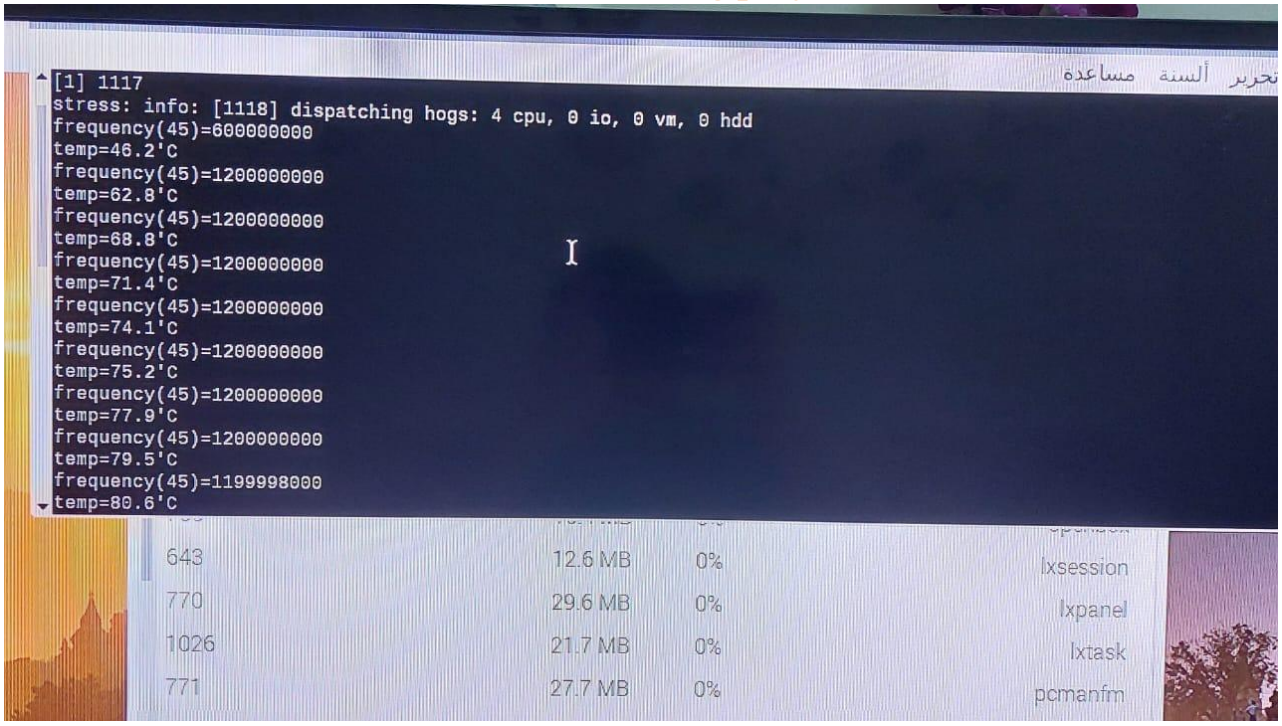


FIGURE CYBERATTACK ON SERVER

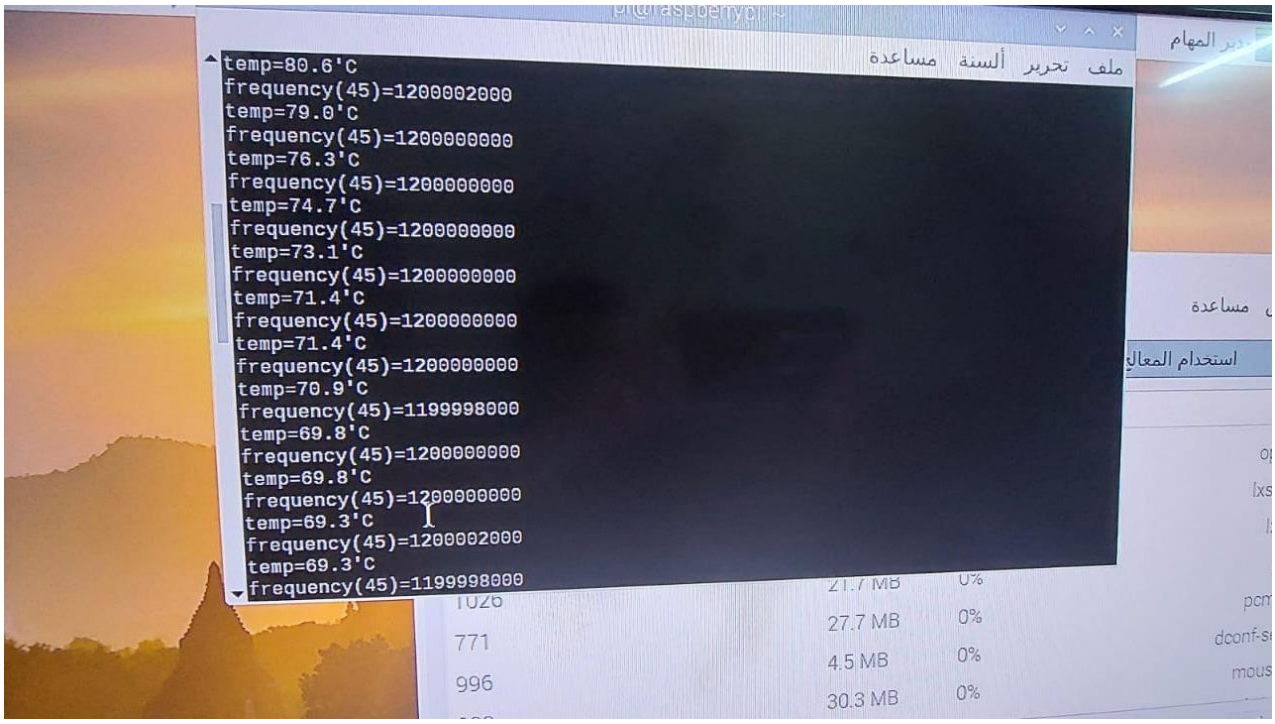
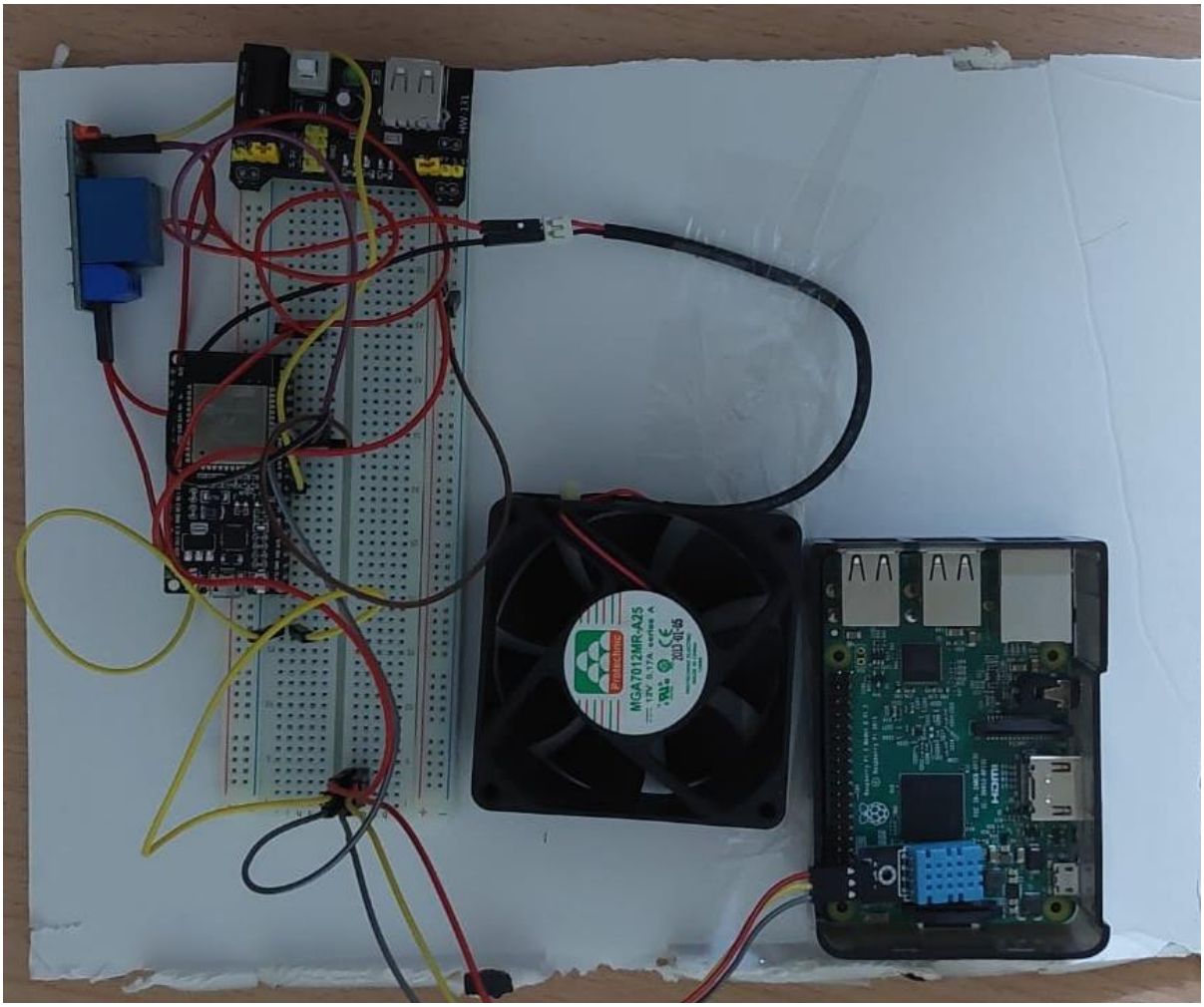


FIGURE TEMPERATURE DECREASE AFTER OUR COOLING SYSTEM STATRT WORKING



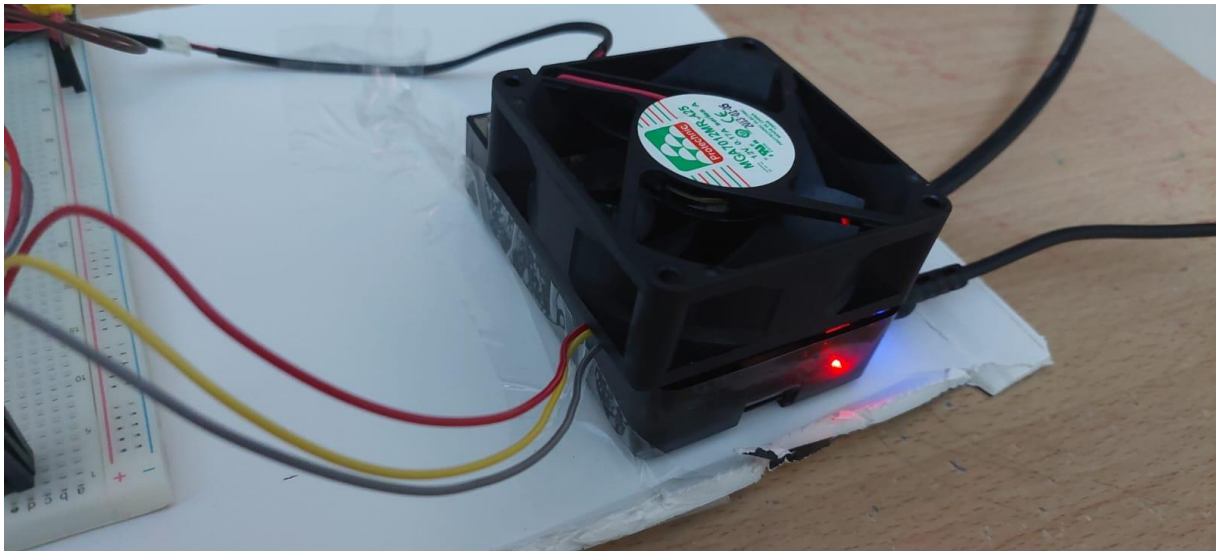


FIGURE PICTURES SHOWING HOW THE COOLING DEVICE WORKS

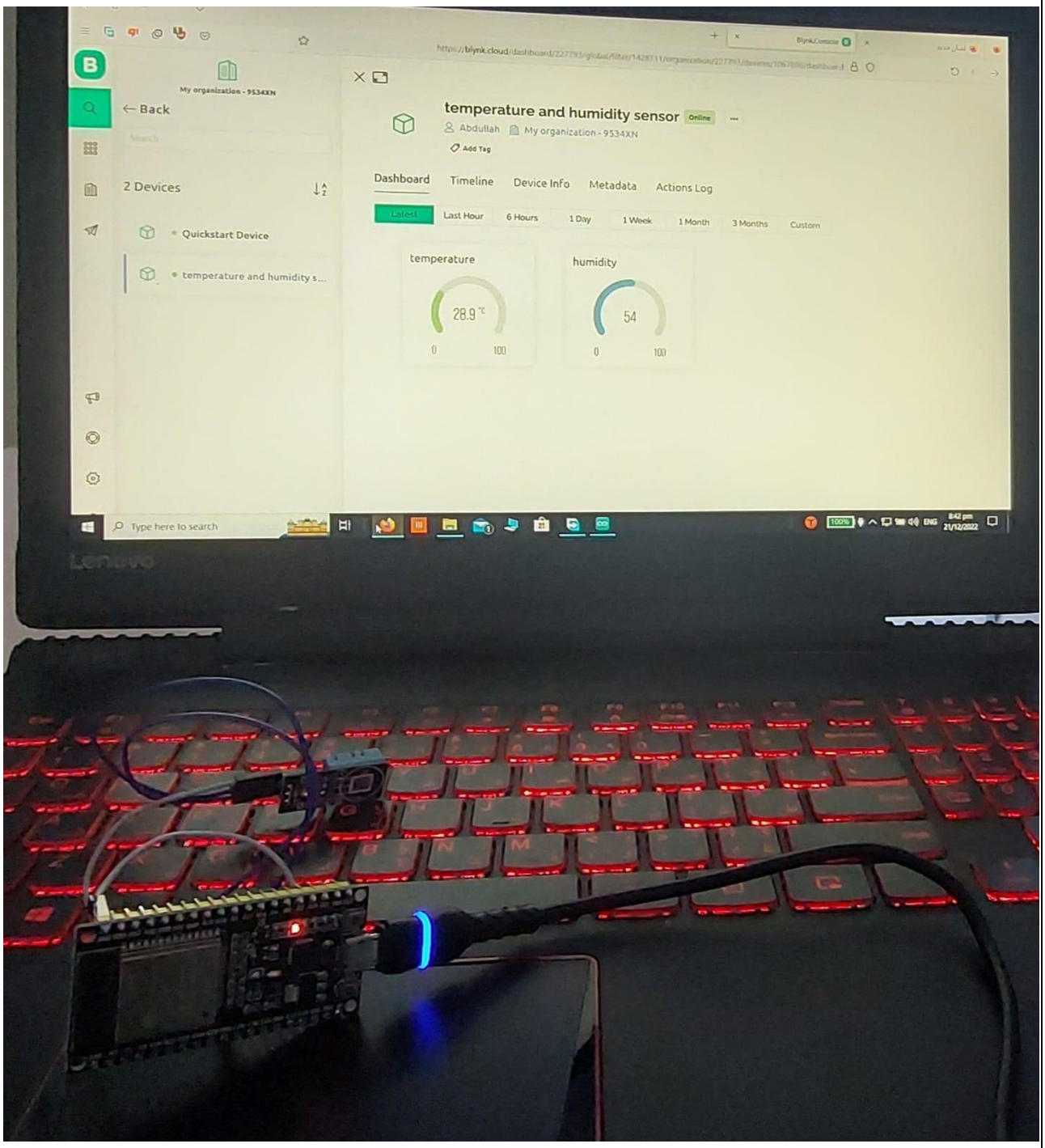


FIGURE PHOTO FROM BLYNK SITE

FIGURE PHOTO FROM ARDUINO IDE

Chapter 5: Conclusion

7.1 Summary

A server's nodes create heat. a great deal of heat

Administrators of data centres use current ventilation systems in unique ways to transfer heat away from servers.

You risk blowing the CPU if the nodes surrounding it reach temperatures of 85-90°F and stay there for a lengthy amount of time.

Meltdown.

There might be an issue for a variety of reasons, such as a colling system that is no longer operational or a cyber attack on that system that requires the CPU to undertake extensive processing. So that is where our project will come in handy.

The project's goal is to offer an alternate cooling system for the server in the event that it overheats or requires backup cooling in the event that the cooling system loses power.

- **How the system wok:**

  Dht11 will be used to send temperature data to the Esp32 ,then esp32 will use this information to the blynk cloud service and also it will going to control the relay to switch on/off the cooling system depend on the dht11 information

7.2 Limitations and Future Work

- **Future directions:**

1-add more security methods to this system

2- make this system work on separate power source to keep working even in the events of any electricity problems in the building

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https://ielectrony.com/

Useful YouTube channels:

https://youtu.be/Y_eyNLB1R1k

https://youtube.com/@ArabicDeveloper

https://www.youtube.com/@TechTrendsShameer