VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana sangama", Belgavi-590 014.

INTERNSHIP TRAINING REPORT

ON

"Server Room Temperature Monitoring"

Internship training carried out at

IT Department Of Rotary Wing Research and

Design Centre Division, HAL Airport Area,

Bangalore, Karnataka - 560017

Hindustan Aeronautics Limited

Submitted in partial fulfillment of the requirement for the award of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

SUBMITTED BY

VARUN REDDY B

USN: 1GD20CS052

Department of Computer Science and Engineering

Gopalan College of Engineering and Management

Basavanagar,Seetharampalya - Hoodi Rd, Behind SAP Labs, Hoodi, Bengaluru, Karnataka 560048

2023 - 2024

GOPALAN COLLEGE OF ENGINEERING AND MANAGEMENT

Basavanagar, Seetharampalya - Hoodi Rd, Bengaluru, Karnataka 560048

Department of Computer Science and Engineering

GOPALAN COLLEGE OF ENGINEERING AND MANAGEMENT
ISO 9001:2015
Approved by AICTE and Affiliated to Visvesvaraya Technological University
Accredited with B+ Grade by NAAC

CERTIFICATE

This is to certify that the Internship entitled **"Server Room Temperature Monitoring"** is a bonafide work carried out by student bearing **USN:1GD20CS033** respectively in partial fulfillment for the award of the degree Bachelor of Engineering in Computer Science and Engineering of the Visvesvaraya Technological University, Belgavi, Karnataka during the academic year 2023-24. The internship report has been approved as it satisfies the academic requirement in respect to internship prescribed for the above said degree.

Signature of guide Signature of HOD Signature of Principal

DECLARATION

I, Varun Reddy B, student of Computer Science and Engineering bearing **USN:1GD20CS052** hereby declare that I own full responsibility for the information, results and conclusion provided in this report titled "**Server Room Temperature Monitoring "** submitted to Visvesvaraya Technological University, Belagavi.

To best of my knowledge, this internship work has been submitted in part or full in the organization for the award of degree. I have completely taken care in acknowledging my contribution in this academic work. I further declare that in case of any violation of intellectual property rights and particulars declared found at any stage. I will be responsible for the same.

Varun Reddy B– 1GD20CS052

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HAL/DC/RWRDC/HR/ Internship /218 /2024

30th April, 2024

CERTIFICATE

This is to certify that Mr. Varun Reddy B (USN: 1GD20CS052), student of B.E(Computer Science Engineering), Gopalan College of Engineering and Management, Bangalore has undergone Internship on No-pay-No-fee basis from 02.04.2024 to 30.04.2024 at Information Technology Department, Rotary Wing Research & Design Centre, Hindustan Aeronautics Limited, Bangalore.

2. His Behaviour, Punctuality, Conduct and Progress in Training was **'EXCELLENT'** as rated by the Department Head during his training period with us.

(U SUDHAKAR)
SENIOR MANAGER (HR)

Mr. Varun Reddy B
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ACKNOWLEDGEMENT

I would like to thank HAL RWR&DC Division for giving us the opportunity to learn and understand how a temperature monitoring system is vital in monitoring and maintaining the server rooms that contain the servers which is a massive store for large consolidated and sensitive data.

My sincere gratitude goes to Senior Manager (HR) , Mr. U Sudhakar for accepting my Internship request.

I have gained valuable insight into almost all the departments in RWR&DC Division in just a span of 1 month. I even had the chance to observe numerous aspects of the important tools used by Product Life Cycle Management (PLM) Team in the IT Department such as the advanced CAD systems, CAM softwares like- NXCAM and SolidWorks CAM , CAE softwares like-NXCAE as well as PDM tools like-TEAMCENTRE,WINDCHILL and ENOVIA and also got to see the upgrades being done on the LUH and ALH at the Final Assembly Hanger.

I would want to thank each and every staff and technician who were extremely welcoming , helpful, and kind enough to share their expertise and knowledge of the field and showing me practical demonstrations and being patient with me throughout the internship.

Last but not least I would like to thank Mrs.Priya Narayanan Nair for showing her concern and interest in helping us as well as for the time she spent reviewing our career goals , recommending strategies for achieving them and for the constant guidance throughout the entire Internship period.

ABSTRACT

This project focuses on the development of a **server room temperature monitoring system** using cost-effective and versatile components. We employ an Arduino Uno microcontroller connected to a DHT11 sensor module for precise measurement of temperature and humidity levels. Additionally, an SD card module is integrated for data storage. Through jumper wires and specified pin configurations, the components are interconnected, enabling seamless communication. Leveraging the Arduino IDE software and necessary libraries, including Adafruit DHT11 and Adafruit Unified Sensor, we establish a robust monitoring framework. Furthermore, we extend functionality by creating a **web interface** using PHP and MySQL via XAMPP software, facilitating remote data recording and analysis. This report highlights the importance of real-time monitoring for maintaining optimal server room conditions and showcases our integrated solution for effective temperature management.

TABLE OF CONTENTS

1.Introduction about HAL

- Hindustan Aeronautics Limited (HAL) is an Indian state-owned aerospace and defence company, headquartered in Bengaluru, India. Established on 23 December 1940, HAL is one of the oldest and largest aerospace and defence manufacturers in the world today. The history and growth of Hindustan Aeronautics Limited is synonymous with the growth of the Aeronautical industry in India for more than 79 years.
- The Company which had its origin as Hindustan Aircraft Limited was incorporated on 23 Dec 1940 at Bangalore by Shri Walchand Hirachand, a farsighted visionary, in association with the then Government of Mysore, with the aim of manufacturing aircraft in India. In March 1941, the Government of India became one of the shareholders in the Company and subsequently took over its management in 1942. In collaboration with the InterContinental Aircraft Company of USA, the Company commenced its business of manufacturing of Harlow Trainer, Curtiss Hawk Fighter, and Vultee Bomber Aircraft. In January 1951, Hindustan Aircraft Limited was placed under the administrative control of the Ministry of Defence, Government of India.
- HAL is currently involved in designing and manufacturing fighter jets, helicopters, jet engines, and marine gas turbine engines, avionics, software development, spare supply, overhauling, and upgrading of Indian military aircraft.

- HAL is actively engaged and is contributing to the space programs of the country. A separate Aerospace division was established in 1988. HAL is currently meeting the requirements of structures for aerospace launch vehicles and satellites of ISRO through the Division. Infrastructure has also been set up to undertake the complete assembly of the strap-on L-40 stage booster. Structures for GSLV Mk.III, Mars Mission, and Human crew module have beensupplied by HAL to ISRO. HAL is also setting up a dedicated facility for the manufacture of cryogenic engines.
- The manufacturing programs underway at HAL are the production of SU-30 MKI, LCA & DO-228 aircraft, and ALH-Dhruv, Chetak, Cheetal & LCH Helicopters. The Repair Overhaul (ROH) programs being carried out presently are Jaguar (with upgrade), Mirage (with upgrade), Kiran, HS-748, AN-32, MiG 21, Su-30 MKI, Hawk, Dornier Do-228, ALH, Cheetal, Cheetah, and Chetak.
- The Company takes up maintenance and overhaul services to cover the life cycle requirement of all the old and new products. Presently, 13 types of Aircraft/ Helicopters and Engines are being overhauled. In addition, facilities exist for repair/ overhaul of various Accessories and Avionics fitted on Aircraft of Russian, Western and Indigenous designs.
- In line with HAL's mission to become a global player, Exports have been identified as one of the thrust areas. HAL has supplied Dhruv, Lancer, Chetak & Cheetah helicopters, and Do-228 aircraft to international customers and is also providing product support for the above platforms. The company has established its credibility through the supply of high precision structural & composite work packages, assemblies, avionics, etc to Global Aviation majors like Airbus, Boeing, Rolls Royce, IAI, Rosoboronexport, etc.

- The major ongoing indigenous development programs are the Light Combat Aircraft (LCA) MK 1A, Light Combat Helicopter(LCH), Light Utility Helicopter (LUH), Basic Turboprop Trainer HTT 40 & Indian Multi-Role
- Helicopter (IMRH). Design and Development of HTFE-25 and HTSE-1200engines have also been taken up.
- Current upgrade programs include Jaguar DARIN-III upgrade, Mirage upgrade, and Hawk. In addition to the platforms, various Technology development projects have also been launched to increase self-reliance in critical areas like the Aircraft Display systems, Mission Computers, Automatic Flight Controls for Helicopters and Aircraft Accessories & Avionics.

Vision: To be a global leader in the Aerospace & Defence Industry.

Mission: We are committed to deliver superior technology solutions to the customers by leveraging our infrastructure and Design, Manufacture & Service skills, for achieving business excellence.

Divisions of HAL :

1. Bangalore Complex :

- Aircraft Division Bangalore
- Engine Division Bangalore
- Overhaul Division Bangalore
- Foundry & Forge Division Bangalore
- Aerospace Division Bangalore
- IMGT Division Bangalore
- Airport Services Centre Bangalore
- Facilities Management Division Bangalore
- LCA-Tejas Division Bangalore
- RWR&DC Division Bangalore

2. MiG Complex :

- Aircraft Manufacturing Division, Nasik
- Aircraft Overhaul Division Nasik
- Engine Division Koraput
- Sukhoi Engine Division Koraput

3. Accessories Complex :

- TAD-Kanpur Division
- Accessories Division Lucknow
- Avionics Division Hyderabad
- Avionics Division Korwa

4. Helicopter Complex :

- Helicopter Division Bangalore
- Helicopter MRO Division Bangalore
- Barrackpore Division
- Aerospace Composites Division

2.Products of HAL

2.1 Fighter Aircrafts

- **Sukhoi SU-30 MKI** :

The IAF's primary air superiority fighter, with additional air-to-ground (strike) mission capability, is the Sukhoi Su-30MKI. 272 Su-30MKIs have been in service as of January 2020 with 12 more on order with HAL. The aircraft is tailor-made for Indian specifications and integrates Indian systems and avionics as well as French and Israeli sub-systems.

- **Sepecat Jaguar** : The Jaguar, known as the Shamsher, serves as the IAF's primary ground attack force. The IAF currently operates 139 Jaguars. The first batch of DARIN-1 Jaguars are now going through a DARIN-3 upgrade being equipped with EL/M-2052 AESA radars, and an improved jamming suite plus new avionics. These aircraft are scheduled to be phased out by 2030.

- **Mirage 2000** : The Dassault Mirage 2000 is a French multirole, single-engined, fourth-generation jet fighter manufactured by Dassault Aviation . It was designed in the late 1970s as a lightweight fighter to replace the Mirage III for the French Air Force. The Mirage 2000 evolved into a multirole aircraft with several variants developed, with sales to a number of nations. It was later developed into the Mirage 2000N and 2000D strike variants, the improved Mirage 2000-5, and several export variants. Over 600 aircraft were built and it has been in service with 9 nations.

- **Mi-G 21**: The Mikoyan-Gurevich MiG-21 is a supersonic jet fighter and interceptor aircraft, designed by the Mikoyan-Gurevich Design Bureau in the Soviet Union. The MiG-21 was the first successful Soviet aircraft combining fighter and interceptor characteristics in a single aircraft. It was a lightweight fighter, achieving Mach 2 with a relatively low-powered afterburning turbojet, and is thus comparable to the American Lockheed F-104 Starfighter and Northrop F-5 Freedom Fighter and

the French Dassault Mirage III. Its basic layout was used for numerous other Soviet designs, delta-winged aircraft included the Su-9 interceptor and the fast E-150 prototype from MiG bureau while the mass-produced successful front fighter Su-7 and Mikoyan's I-75 experimental interceptor combined a similar fuselage shape with swept-back wings.

- **Mi-G 29** : The Mikoyan MiG-29 is a twin-engine jet fighter aircraft designed in the Soviet Union. Developed by the Mikoyan design bureau as an air superiority fight during the 1970s, the MiG-29, along with the larger Sukhoi Su-27, was developed to counter new U.S. fighters such as the McDonnell Douglas F-15 Eagle and the General Dynamics F-16 Fighting Falcon. The MiG-29 entered service with the Soviet Air Forces in 1982.

2.2 LCA Tejas : The HAL Tejas is an Indian single-engine multirole light fighter designed by the Aeronautical Development Agency(ADA) in collaboration with Aircraft Research and Design Centre (ARDC) of Hindustan Aeronautics Limited (HAL) for the Indian Air Force and Indian Navy. It came from the Light Combat Aircraft (LCA) program, which began in the 1980s to replace India's ageing MiG-21 fighters. In 2003, the LCA was officially named "Tejas". Tejas has a tail-less compound delta-wing configuration with a single vertical stabilizer. This provides better high-alpha performance characteristics than conventional wing designs. It integrates technologies such as relaxed static stability, fly-by-wire flight control system, multi-mode radar, integrated digital avionics system and composite material structures. It is the smallest and lightest in its class of contemporary supersonic combat aircraft.

2.3 Indigeneous Helicopters :

- **LCH :** The HAL Light Combat Helicopter (LCH) is an Indian multi-role attack helicopter designed and manufactured by the Hindustan Aeronautics Limited (HAL). The LCH has been ordered

by the Indian Air Force and the Indian Army. Its flight ceiling is the highest among all attack helicopters. The impetus for the development of the LCH came in the form of the Kargil War, a conflict fought between India and neighbouring Pakistan in 1999, which revealed the Indian armed forces lacked a suitable armed rotorcraft capable of operating unrestricted in the high-altitude theatre. Accordingly, both HAL and the Indian armed forces commenced exploratory efforts towards the conceptualisation of a combat helicopter to perform in this role.

- **ALH Mk-III CG/IN**: Against a contract signed during March 2017 towards supply of 16 Helicopters each to Indian Coast Guard (ICG) and Indian Navy (IN) towards Coastal Security and other demanding roles, HAL took up the challenging tasks of Integration, extensive Flight Testing (over land and over water) & Certification of User (ICG & IN) identified systems like, Maritime Patrol Radar / Surveillance cum weather Radar, Electro Optical PoD with short wave Infra Red, High Intensity Search light with IR capabilities, Loud Hailer, Glass Cockpit, AFCS, Automatically deployable Emergency Locator Transmitter, TCAS, V/UHF with Data modem, IFF and ATC transponders, Automatic Identification system, Search And Rescue Homer, 12.7 mm Heavy Machine Gun, Medical Intensive Care Unit (MICU) and along with other systems onboard ALH Mk-III helicopter.

- **Cheetah :** HAL signed license agreement for Cheetah with M/s SNIAS in 1970. First Cheetah manufactured from raw materials was delivered in 1976-77.

The Cheetah Helicopter is a high performance helicopter designed for operation over a very wide range of weight, centre of gravity and altitude conditions. The five seater Cheetah helicopter is versatile, multi role, multi purpose, highly maneuverable and rugged in construction. It holds the world record in high altitude flying among all categories of Helicopters. The helicopter is powered by Artouste - III B turbo shaft engine.The helicopter is suitable for commuting, observation, surveillance, logistics support, rescue operations and high altitude missions.Till date, HAL has produced and sold more than 275 of these versatile Helicopters which are in service both in India and abroad. Recently, HAL has received orders for Cheetah helicopters from MoD Namibia.

- **Chetak :** The Chetak Helicopter is a two ton class helicopter. The seven seater Chetak helicopter is versatile, multi role, multi purpose, and spacious.

The helicopter is powered by Artouste - III B turbo shaft engine. the helicopter is suitable for commuting, cargo / material transport, casualty & evacuation, Search & Rescue (SAR), Aerial Survey & Patrolling, Emergency Medical Services, Off-shore

operations and Under slung operations. Till date, HAL has produced and sold more than 350 of these versatile Helicopters which are in service both in India and abroad. Recently, HAL has received orders for Chetak helicopters from MOD Namibia & MoD Suriname.

- **LUH :** LUH is designed and developed as a replacement for Cheetah & Chetak helicopters which are being operated by Indian Armed forces.

LUH is a new generation helicopter in the 3-Ton class incorporating the state of the art technology features like Glass cockpit with Multi-Function Displays (MFD) and powered by single Turbo Shaft engine with sufficient power margin to cater to demanding high altitude missions. LUH will meet the emerging needs in this class of helicopter in the coming decades.The helicopter will be capable of flying at 220 Kmph, service ceiling of 6.5 Km and a range of 350 Km with 500 kg payload.

FUTURE PROJECT:

Rotary Unmanned Aerial Vehicle (RUAV)

RWR&DC is currently working on the design of a Rotary UAV to primarily meet the Indian Army's requirements which call for lifting payload of 20-30 kg at 5.5 km altitude. This platform with minor modifications can also be used by the Navy (or IAF) for meeting specific roles at sea-level conditions, where the payload capacity is around 60kg.

3.RWR&DC Division, HAL.

About :

The Rotary Wing R&D Centre at Bengaluru was established in 1970 as Helicopter Design Bureau and later in 1998 it was renamed as “RWR&DC”. It was formed with the objective of researching, innovating and creating designs for helicopters. The Rotary Wing Research & Design Centre (RWR&DC) with modern facilities and state-of-the-art technologies, spearheads HAL’s thrust towards excellence in the field of helicopter design.

Expertise in the design and development of Rotary Wing aircraft has been built up over the last three decades by progressive induction of qualified designers, optimal design, prototype development, ground testing and flight testing. The design Centre is engaged in design, development, prototype manufacturing, ground & flight testing and Certification of Civil and Military helicopters. The objective of the Centre is to research, innovate and create designs for rotary wing aircraft to meet indigenous and global requirements.

The Centre holds recognition and approval from CEMILAC and DGCA for research, design and manufacture of Military and Civil helicopters. Rotary Wing R&D Centre is AS 9100D and ISO 14001:2015 certified organization.

The Centre has designed & developed indigenous helicopters, such as, the Advanced Light Helicopter (Dhruv & Rudra), Light Combat Helicopter (LCH) and Light Utility Helicopter (LUH) for military customers. The ALH Dhruv is certified for Civil applications also.

About IT Department:

The Information Technology (IT) Department at RWRDC within HAL (Hindustan Aeronautics Limited) serves as the technological backbone of the organization, supporting its diverse operations and initiatives. Committed to innovation and excellence, the IT department plays a crucial role in developing and maintaining robust IT infrastructure, systems, and applications tailored to meet the unique needs of HAL's Research and Development Wing. With a focus on efficiency, security, and reliability, the IT team ensures seamless integration of cutting-edge technologies, empowering RWRDC to achieve its mission of advancing aerospace research and development. Collaborating closely with other departments, the IT team at RWRDC in HAL is dedicated to driving digital transformation and enabling HAL to maintain its position as a leader in the aerospace industry.

Wings: Enterprise Resource Planning (ERP) , Product Lifecycle Management (PLM) , Cyber Security.

About PLM:

PLM is integral to RWRDC's IT department at HAL, facilitating the seamless management of product lifecycles from design to disposal. Through PLM solutions, teams collaborate efficiently, manage configurations effectively, and ensure accurate BOMs, enhancing manufacturing processes and regulatory compliance. Automated change management minimizes errors and maintains compliance, underscoring PLM's critical role in optimizing product development within HAL's aerospace endeavors.

The PLM division within RWRDC's IT department at HAL is dedicated to optimizing product lifecycles using cutting-edge software like TeamCenter and WindChill. With specialized roles in Support, Administration, and Coding, the team ensures seamless operation and continuous improvement of PLM infrastructure, driving innovation in

aerospace technology. Equipped with advanced tools such as CAD, CAM, CAE, and PDM, they meticulously manage data and processes from design to manufacturing, safeguarding critical information in monitored server rooms. Committed to excellence, the PLM team at RWRDC in HAL strives to innovate and enhance efficiency across the product lifecycle, pushing the boundaries of aerospace technology forward.

About Server Room Temperature Monitoring System:

A server room temperature monitoring system is crucial for ensuring the optimal performance and longevity of critical IT infrastructure. Fluctuations in temperature can lead to equipment failures, downtime, and data loss, making real-time monitoring essential for maintaining a stable environment. The system typically involves sensors like the DHT11, capable of measuring temperature and humidity levels accurately within specified ranges. These sensors are connected to the Arduino Uno, which serves as a cost-effective and versatile microcontroller platform to interface with sensors and control modules. Its compact size, low power consumption, and ease of programming make it ideal for applications such as temperature monitoring. The Arduino Uno collects data from the sensors and can perform various tasks based on the readings, such as triggering alerts, logging data to an SD card for analysis, or communicating with other devices or systems for corrective actions. Overall, the Arduino Uno enables continuous monitoring, data logging, and automation to maintain optimal conditions in server rooms and critical environments, making it a popular choice for such applications in both professional and DIY settings.The server room temperature monitoring system utilizes an Arduino Uno connected to a DHT11 sensor module for accurate measurement of temperature and humidity levels. The DHT11 sensor has specific ranges and accuracies for both temperature and humidity measurements. Additionally, the setup includes an SD card module for storing recorded data for future analysis. To establish connections between the components, jumper wires are used, connecting the Arduino Uno to the DHT11

sensor and the SD card module as per the specified pin configurations. The Arduino IDE software is utilized to include necessary libraries for the project, such as the Adafruit DHT11 library and Adafruit Unified Sensor library. Once the connections are made and libraries are installed, the Arduino Uno can be powered up using a USB cable connected to a power source, allowing it to collect data from the DHT11 sensor and store it on the SD card for further analysis and monitoring of the server room temperature.

We were able to design a web interface that would record this information using PHP and MySQL.For the same we utilised the XAMPP software.

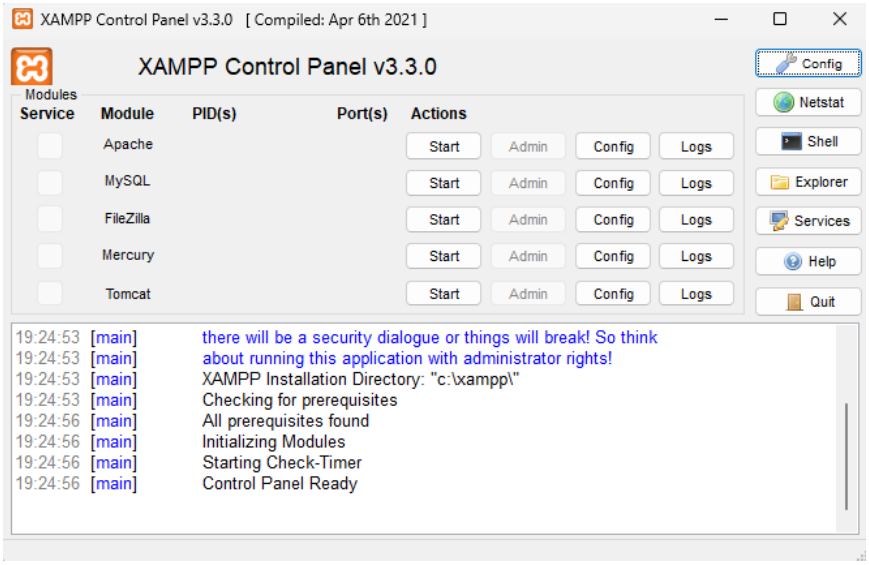
About XAMPP:

What is an XAMPP server?

The full form of XAMPP is "Cross-Platform (X), Apache (A), MySQL (M), PHP (P), and Perl (P)." This means that XAMPP is a tool that brings all these technologies together in one place.

Apache: Apache is a web server that displays your website on the internet. The Apache server that comes with XAMPP provides you with local development.

MySQL: MySQL is an open-source relational database management system. You can use it to create a database and store data.



PHP: PHP is a server-side scripting language that helps in creating dynamic web applications. XAMPP also provides you PHP environment.

Perl: Perl is a programming language used for server-side scripting.

XAMPP is a popular open-source web server package for website development. This gives you cross-platform functionality that allows you to easily use it on any platform. XAMPP is used in web development to set up a complete web server. XAMPP Supports multiple scripting languages. In addition, XAMPP also has the functions of an FTP server, Accelerated Mode, network download, etc.

To use XAMPP, you must first download it from the XAMPP website. After downloading, complete the installation process. Once installed, you can use your web server by running various XAMPP components. You can then add your website files to the public directory available in XAMPP. XAMPP is a useful and secure web server site that enables web developers to create high-quality websites.

How to download Xampp?

To download XAMPP, follow the steps given below:

•Go to XAMPP Official Website: Go to your web browser and reach XAMPP official website. This website is: https://www.apachefriends.org/

•Going to the Download Page: After reaching the website, you will find a section named "Download" or "Downloads". Click on this section.

•Selecting XAMPP Version: Now you will have to choose between different versions of XAMPP. You'll typically find options like "XAMPP for Windows," "XAMPP for macOS," or "XAMPP for Linux." You can choose a version according to your operating system.

•Click on the Download Button: After the selected version, you will get a "Download" button or link. Click on this.

•Download Process: After clicking on the Download button, the XAMPP installer will start downloading on your computer. This may take some time, so please wait until the download is complete.

•Run the Installer: After the download is complete, run the installer file on your computer. Now you have to follow some steps to install XAMPP.

•Installation Process: After running the installer, you will see the installation process of XAMPP. You must choose an installation directory, and you must decide which components you want to install (Apache, MySQL, PHP, Perl, etc.).

•Installation Complete: After the installation process is complete, you can start the Apache and MySQL servers by opening the XAMPP Control Panel.

How to install XAMPP?

•To install Xampp, you will have to open the file which you have downloaded.

•Double Left Click on that App. After this, you have to give Yes permission.

•After this, you have to click on the Next Button 2 to 3 times in its Setup Wizard.

•After this, you have to select its components. You can select all languages.

•After this, you have to select the location where you want to save the files.

•Then in a short while the setup is completed and it gets installed.

•At last, you have to click on the Finish button.

Note: Before starting this installation, some settings of your system should already be operational. Only after this your Xampp will run properly otherwise you may see errors in it.

How to set up Xampp Server?

It is easy to set up an XAMPP server. The step-by-step guide for the same is as follows:

•Install XAMPP: First, download and install XAMPP as I explained earlier. If you have not installed it yet, follow the instructions given above.

•Open the XAMPP Control Panel: After XAMPP is installed, open the XAMPP Control Panel. You can open it from the desktop shortcut or the Start Menu.

•Start Apache Server: In the XAMPP Control Panel, there will be a "Start" button next to "Apache". Click on this button. This will start your Apache web server.

•Start MySQL Server: Now, there will be a "Start" button in front of "MySQL" also. Click on this button. This will start the MySQL database server.

•Close the control panel: Now both your Apache and MySQL servers are running. Click the "Quit" or "Exit" button to close the Control Panel.

•Check Localhost in the Web Browser: Now your XAMPP server is ready. Open the web browser write "http://localhost" in the address bar and press Enter. If you see an XAMPP welcome page, your server is working properly.

•Create your Project Folder in Document Root (Optional): If you are developing a website, create your project folder in the document root folder of XAMPP. The document root folder is typically a folder named "htdocs" or "www". You keep your web files in this name.

•Upload Web Files (Optional): Upload your web files to your project folder. You keep your website's HTML, CSS, JavaScript, and PHP files here.

•Website Test: Now to test your website, type "http://localhost/your_project_folder_name" (use the name of your project folder) in the web browser and press Enter. You can view your locally hosted website.

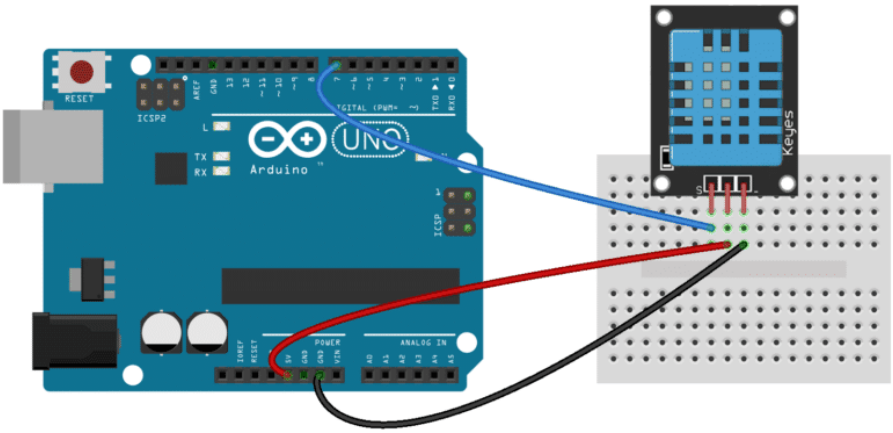
4.Server Room Temperature Monitoring System

Setup:

ARDUINO UNO AND DHT11 CONNECTIONS

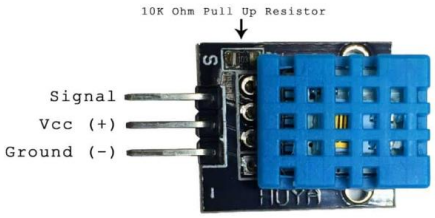
THE RANGES AND ACCURACY OF THE DHT11:

- Humidity Range: 20-90%
- Humidity Accuracy: ±5%
- Temperature Range: 0-50 °C
- Temperature Accuracy: ±2% °C
- Operating Voltage: 3V to 5.5V



REQUIREMENTS:

1. Arduino Uno
2. USB Cable type A to B
3. DHT11 SENSOR Module
4. Female to male jumper wire
5. Bread board



CONNECTION BETWEEN DHT11 SENSOR MODULE AND ARDUINO UNO:

You will require 3 jump wires:

1st jump wire – Ground (GND) in Arduino to -ve pin (ground) in DHT11

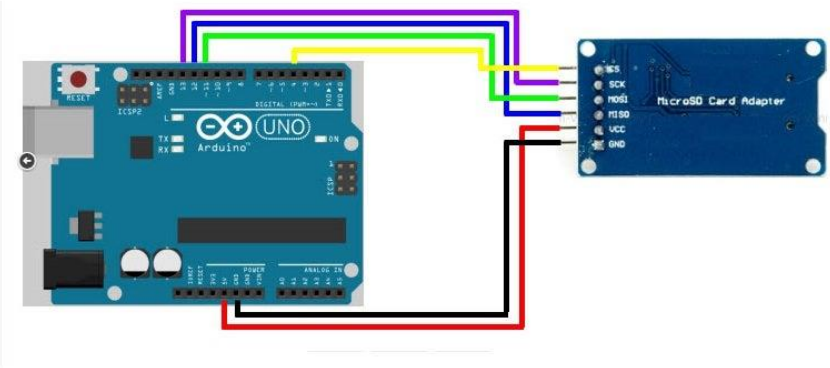
2nd jump wire –digital pin number 2or 3 in Arduino to (VCC) centre pin in DHT11

3rd jump wire –3.5 or 5-volt pin in Arduino to +ve pin in DHT11

STEPS TO INCLUDE LIBRARY IN ARDUINO IDE:

STEP 1: click on sketch
STEP 2: Include libraries
STEP 3: Manage library
STEP 4: search for DHT11 library by Adafruit
STEP 5: search for Adafruit Unified Library- Adafruit Bmp182 Uni library
STEP 6: Click and INSTALL

SD CARD CONNECTIONS



REQUIREMENTS:

1. Arduino Uno
2. USB Cable type A to B
3. Micro Sd Card Module
4. Female to male jumper wire
5. SD Card

NAME OF THE VARIOUS PINS IN SD CARD ADAPTOR

- CS (chip select)
- SCK (serial clock)
- MOSI (master out slave in)
- MISO (master in slave out)
- VCC (3.3V or 5V)
- GND (ground)

CONNECTION BETWEEN MICRO SD CARD MODULE AND ARDUINO UNO:

1. Connect VCC with 5V in the Arduino.
2. Then, connect the GND of SD card to the ground of Arduino.
3. Connect CS to pin 10(or any one of 8,9,10)
4. Connect SCK to pin 13
5. MOSI connect to the pin 11
6. Lastly, connect MISO to pin 12

After completing the connection, connect the Arduino to power supply with USB cable.

Hardware components required:

- Arduino Uno kit
- DHT11 sensor
- Jumper wires

Softwares required:

- Arduino IDE
- Version : Arduino 1.8.19

https://www.arduino.cc/en/software

The information was recorded in a database termed ‘r1’ under which the table ‘sensordata’ existed. This table consisted of the ‘Temperature’ ,’Humidity’ and ‘Timestamp’ columns . The webpage was developed using several PHP scripts .The database was stored in MySQL all of which used XAMPP .

The following PHP scripts are present in the webpage:

- demo.php
- table.php
- table_4hr.php
- Maxtemptable.php

demo.php:

This PHP script connects to a MySQL database, retrieves the latest sensor data, and dynamically generates an HTML page displaying the data alongside buttons for different reports. The retrieved data includes temperature and humidity values, which are displayed alongside corresponding icons. The HTML page also shows the current date and time.

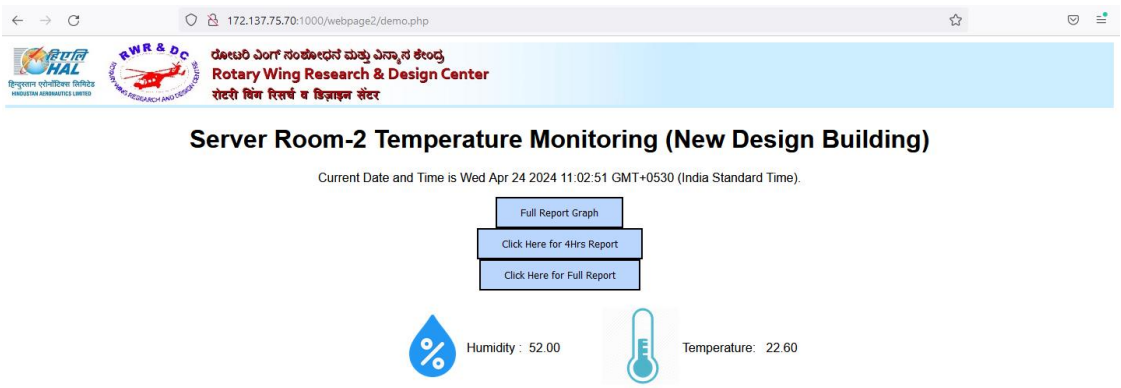


Fig 1.demo.php

table.php

The provided PHP script establishes a connection to a MySQL database named 'r1' on localhost using a username 'root' and no password. It then executes an SQL query to retrieve data from the 'sensordata' table, fetching humidity, temperature, and timestamp fields ordered by timestamp in descending order. The fetched data is displayed in HTML tables with color-coded indicators for humidity and temperature levels. Additionally, navigation buttons are included at the bottom of the page, redirecting to 'demo.php' and 'Maxtemptable.php' URLs respectively. The script defines CSS styles for buttons, tables, and text colors, ensuring proper formatting and alignment. Error handling is implemented to check for connection errors, displaying an error message if necessary. Lastly, resource management is addressed by closing the database connection and freeing result memory after data retrieval to prevent resource leaks. Additionally, the script includes functionality to display graphs. Typically, graph generation involves retrieving data from the database, processing it, and using a graphing library or tool to generate visual representations. It's common to use JavaScript libraries like Chart.js. Chart.js is a popular JavaScript library used for creating responsive and visually appealing charts and graphs on web pages. It provides a simple yet powerful API for developers to create various types of charts, including line charts, bar charts, pie charts, and more. We have included a bar graph and line chart at “Maxtemptable.php” using the same JavaScript library.

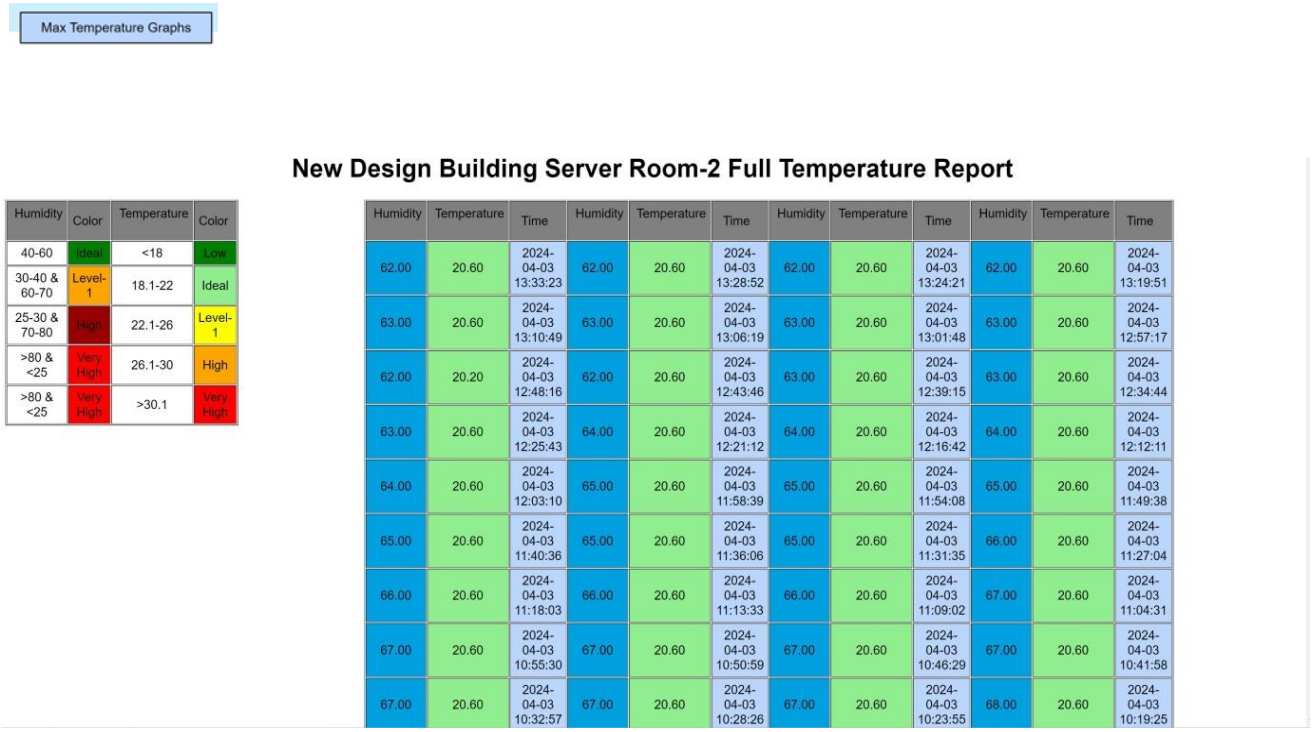


Fig 2. table.php

table_4hr.php:

The script begins by setting up database connection parameters and establishing a connection to the MySQL database using mysqli. It then checks for successful connection and terminates with an error message if unsuccessful. A SQL query is constructed to retrieve sensor data from the 'sensordata' table, selecting dates and maximum temperatures within specified time ranges, grouped by date and ordered in descending order. The query result is executed and stored. The HTML structure is defined, including metadata, title, CSS styling, and the layout of the webpage using HTML tags. A temperature color legend table is created, followed by a sensor data table displaying retrieved data with temperature values color-coded based on predefined ranges. JavaScript code utilizing Chart.js library is added to create bar and line charts representing temperature data from the HTML table, with a back button for user navigation. Finally, the HTML document is closed to complete the webpage structure.

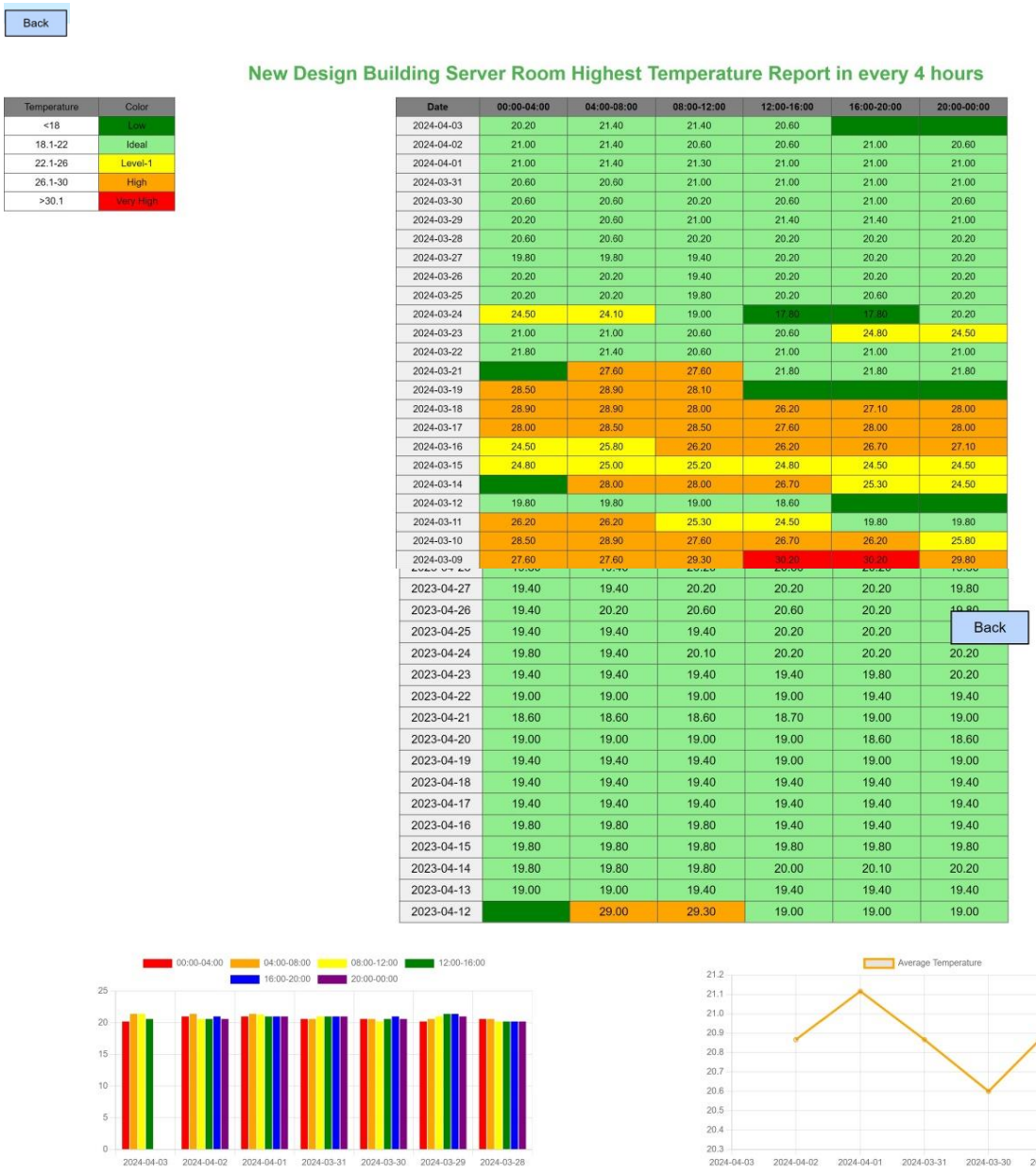


Fig 3. table_4hr.php

Maxtemptable.php

The PHP code begins by setting up database connection parameters and establishing a connection to the MySQL database through mysqli. It then checks the connection's success, terminating the script and displaying an error message if unsuccessful. An SQL query is formulated to fetch data from the 'sensordata' table, selecting dates and the maximum temperature recorded for each date, grouped by date and ordered in descending order.

The query is executed, and the result is stored. HTML structure is established, including metadata, title, CSS styling, and webpage structure defined using HTML tags. Sensor data is displayed in an HTML table, iterating through the result set to show dates and maximum temperatures. JavaScript charts are created using Chart.js library, fetching temperature data from the database with PHP and embedding it into JavaScript variables to generate bar and line charts representing dates on the x-axis and maximum temperatures on the y-axis. A back button is added for user navigation, and HTML tags are closed to complete the document.

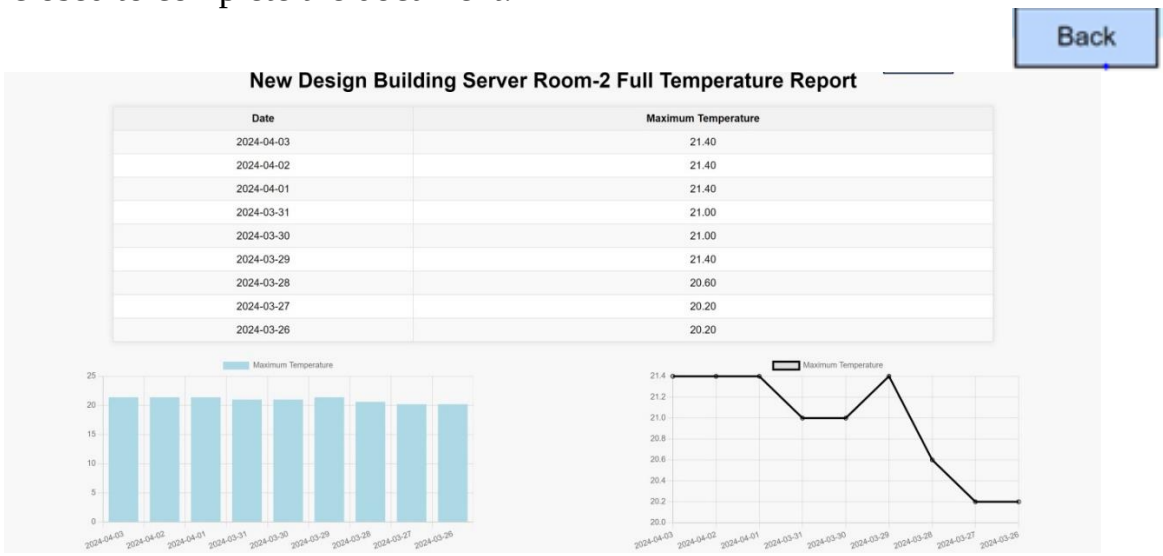


Fig 4. Maxtemptable.php

graph_report.php

The PHP code begins by setting up database connection parameters and establishing a connection to the MySQL database through mysqli. It then checks the connection's success, terminating the script and displaying an error message if unsuccessful. An SQL query is formulated to fetch data from the 'sensordata' table, selecting dates and the maximum temperature recorded for each date, grouped by date and ordered in descending order. The query is executed, and the result is stored JavaScript charts are created using Chart.js

. The Graph for today's maximum temperature its shows of EveryHour and Last 7 days maximum temperature and Last month of every week maximum temp and this year temp and last year temperature and All years maximum temperature is updated in FULL REPORT GRAPH.

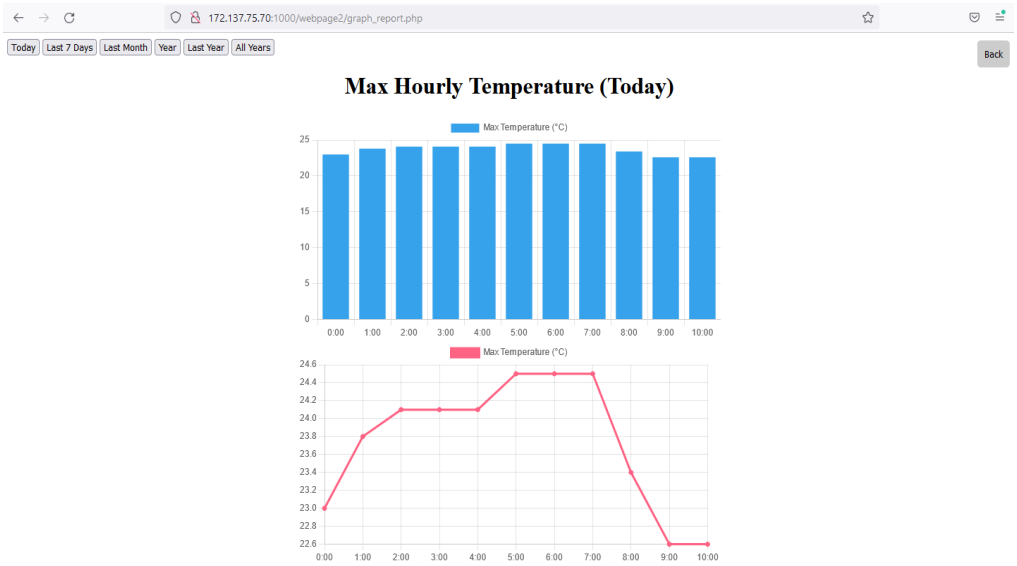


Fig: Today's Maximum Temperature

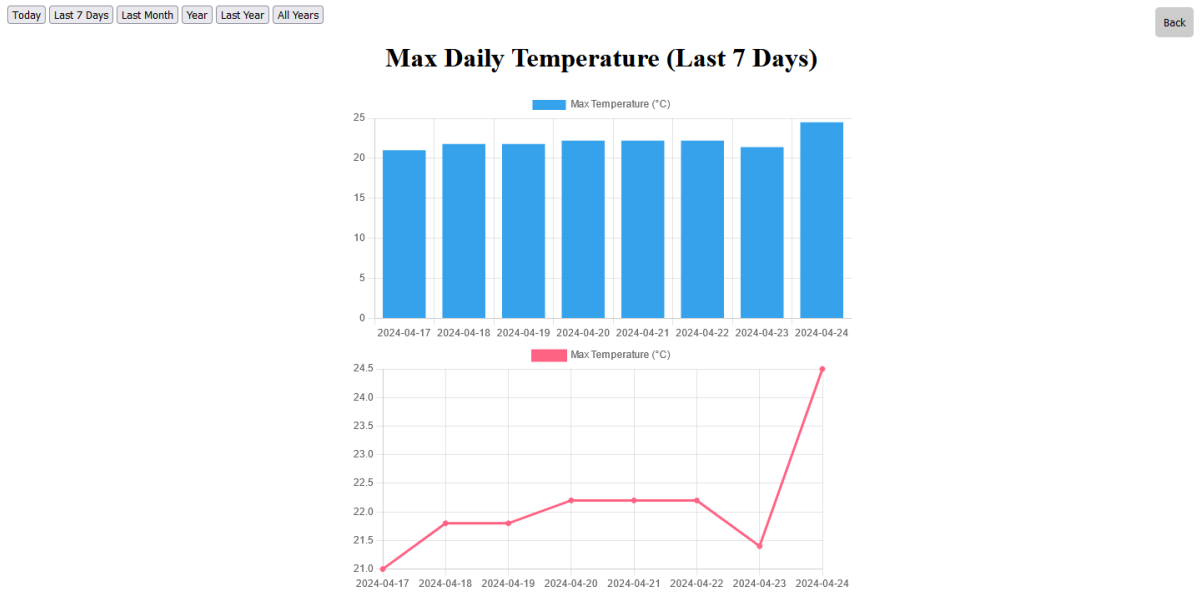


Fig: Last 7 Days Maximum Temperature

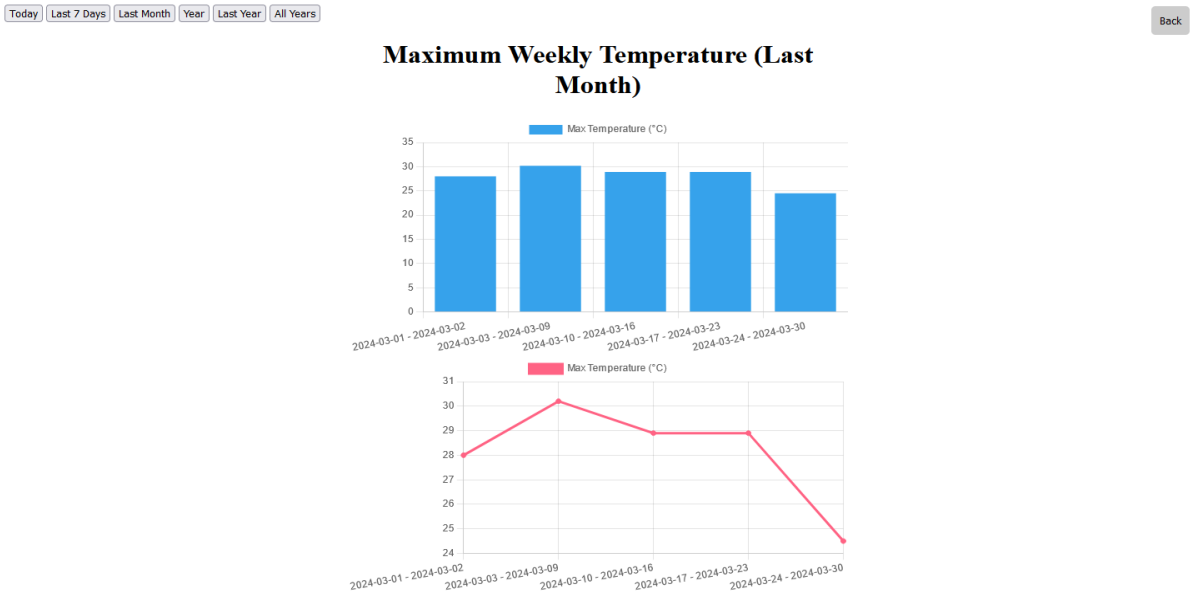


Fig: Last Month Maximum Temperature

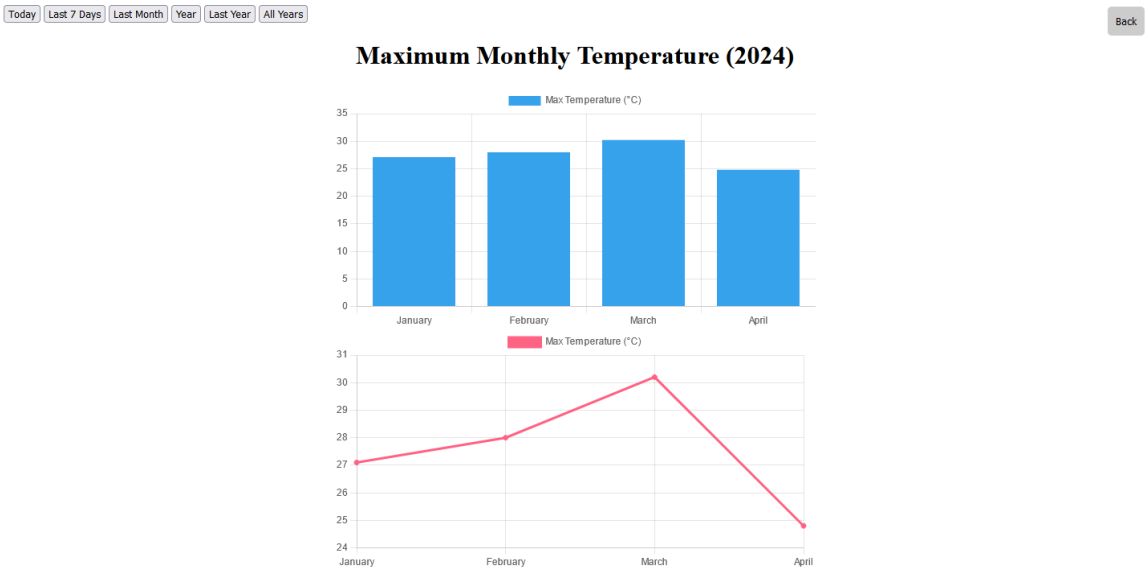


Fig: Year Maximum Temperature

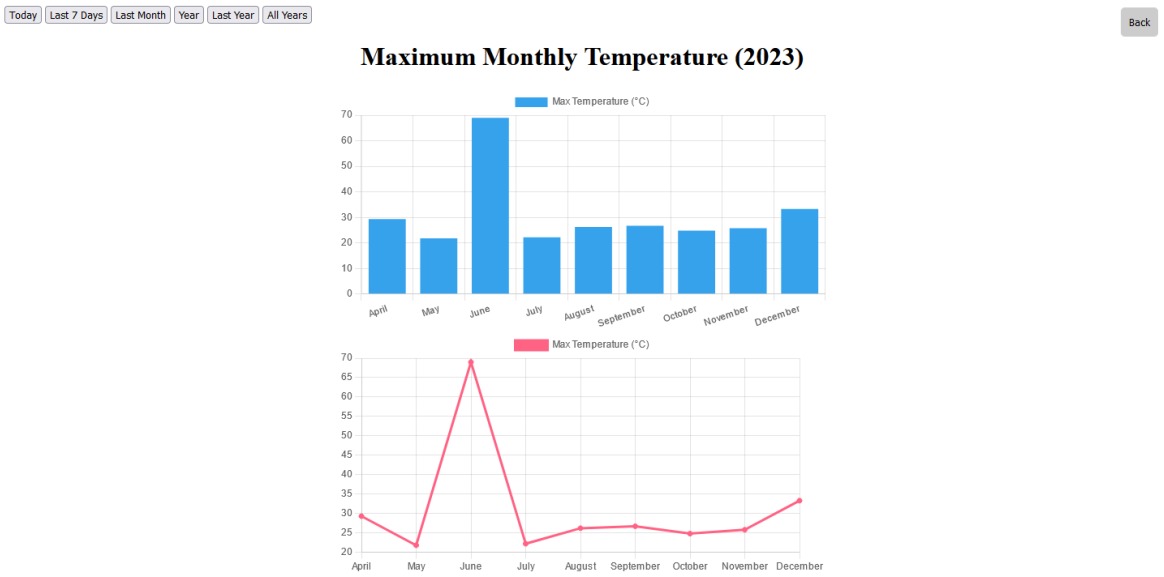


Fig: Last Year Maximum Temperature

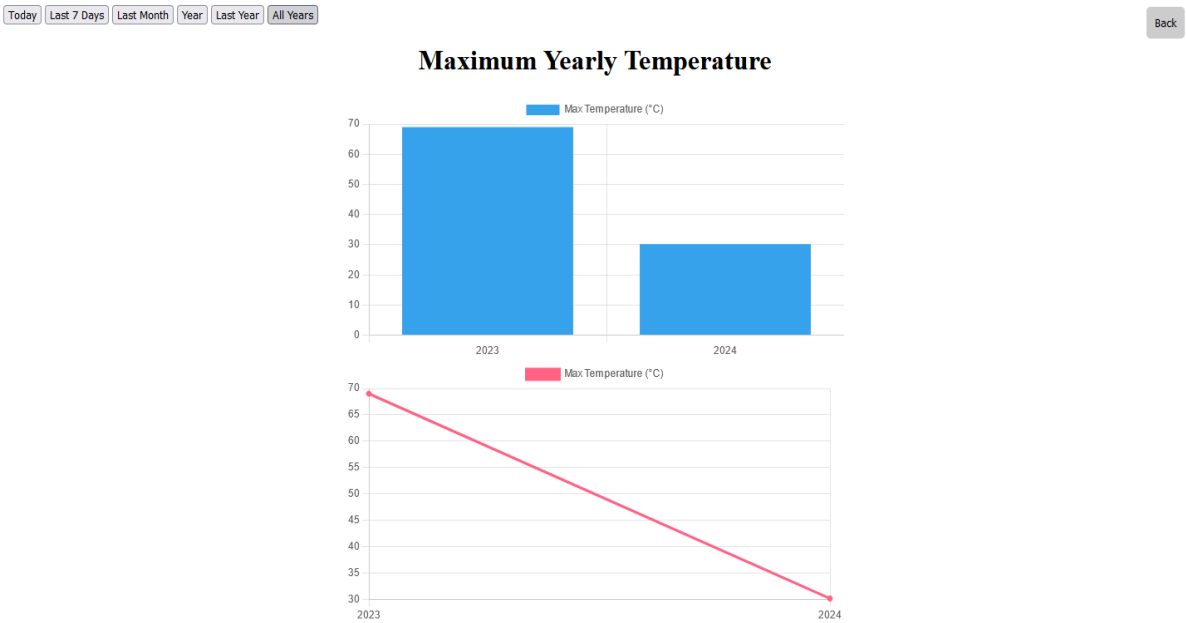


Fig: All Year Maximum Temperature

5.SCOPE OF THE PROJECT

The development of a comprehensive server room temperature monitoring system utilizing Arduino Uno, DHT11 sensor module, and a Micro SD Card module encompasses various critical aspects aimed at ensuring effective environmental control and management within server room environments.

Real-Time Monitoring of Temperature and Humidity:

The core functionality of the system revolves around real-time monitoring of temperature and humidity levels within server rooms. The DHT11 sensor module, known for its reliability and accuracy, is employed to continuously measure these environmental parameters. By providing real-time data, the system enables administrators to promptly identify fluctuations or anomalies in temperature and humidity, which are crucial for maintaining optimal operational conditions for servers and other sensitive equipment.

Data Logging and Storage:

In addition to real-time monitoring, the system incorporates data logging capabilities facilitated by the Micro SD Card module. This functionality allows the system to log sensor data periodically, providing a historical record of environmental conditions within the server room. By logging data onto an SD card, the system ensures data integrity and reliability even in the event of network disruptions or system failures. This historical data serves as a valuable resource for trend analysis, performance optimization, and troubleshooting.

Database Management:

To further enhance data management capabilities, the system integrates with a MySQL database, enabling centralized storage and efficient retrieval of sensor data. The database stores sensor readings along with timestamps, facilitating organized data management and retrieval for analysis and reporting purposes. By leveraging database management systems, the system ensures scalability, data integrity, and flexibility in handling large volumes of sensor data over extended periods.

Web-Based Visualization of Sensor Data:

One of the key features of the system is its web-based visualization interface, which provides stakeholders with intuitive access to sensor data from anywhere with an internet connection. Utilizing PHP scripts and HTML/CSS, the system generates dynamic web pages that display real-time sensor readings, historical data logs, and graphical representations of environmental trends. This web interface enhances accessibility and usability, empowering administrators to monitor server room conditions remotely and take proactive measures as needed.

Overall, the comprehensive server room temperature monitoring system encompasses a holistic approach to environmental management, combining real-time monitoring, data logging, database management, and web-based visualization to ensure optimal operational conditions and mitigate risks associated with environmental fluctuations in server room environments. By leveraging readily available hardware components and open-source software tools, the system offers a cost-effective and scalable solution suitable for a wide range of applications and deployment scenarios**.**

6.RELATED WORK AND IMPACT

6.1 Related Work

While various projects integrating Arduino-based sensor modules for environmental monitoring exist, this project stands out due to its specific focus on server room temperature monitoring and its emphasis on cost-effectiveness, scalability, and flexibility.

Cost-Effectiveness:

Unlike some proprietary monitoring solutions that may require expensive hardware or software licenses, this project prioritizes affordability by utilizing readily available and cost-effective hardware components. The Arduino Uno microcontroller, DHT11 sensor module, and Micro SD Card module are widely accessible and affordable, making the system economically viable for deployment in server room environments, particularly for small to medium-sized enterprises with limited budgets.

Tailored Solution for Server Room Monitoring:

Server rooms have unique environmental requirements compared to other spaces, necessitating specialized monitoring systems. This project addresses this need by tailoring the solution specifically for server room temperature monitoring. By focusing on key parameters such as temperature and humidity, the system provides targeted monitoring capabilities essential for maintaining optimal operational conditions for servers and IT infrastructure.

Scalability and Flexibility:

The project's architecture is designed to be scalable and adaptable to different server room environments. The use of modular components such as the Arduino Uno and open-source software tools allows for easy expansion and customization based on

specific requirements. Whether monitoring a small server closet or a large data center, the system can scale accordingly, accommodating varying levels of complexity and scope.

Open-Source Software Tools:

By leveraging open-source software tools such as the Arduino IDE, PHP, MySQL, and Chart.js, the project benefits from a vibrant community of developers and contributors, ensuring continuous support, updates, and improvements. Additionally, the use of open-source software fosters transparency, flexibility, and interoperability, enabling seamless integration with existing IT infrastructure and facilitating future enhancements or modifications.

Versatility and Deployment Options:

The flexibility inherent in the project's design allows for versatile deployment options. Whether deployed as a standalone monitoring system within a single server room or integrated into a larger network of environmental monitoring systems across multiple facilities, the system can adapt to various deployment scenarios. Furthermore, the availability of comprehensive documentation and support resources facilitates easy installation, configuration, and maintenance, regardless of the deployment scale.

6.2 Impact

The impact of this project is multifaceted:

Cost-Efficiency: Utilizing Arduino Uno and off-the-shelf sensor modules significantly reduces the cost of implementation compared to proprietary monitoring solutions, making it accessible to small and medium-sized enterprises with budget constraints.

Customizability: The modular nature of the system allows for easy customization and expansion based on specific requirements, enabling users to tailor the monitoring system to their unique server room configurations.

Real-Time Monitoring: By providing real-time temperature and humidity data, the system empowers administrators to promptly identify and address environmental anomalies that may affect server performance and longevity, thereby minimizing downtime and potential hardware failures.

Data Visualization: The integration of web-based visualization tools enables stakeholders to access sensor data remotely, facilitating informed decision-making and proactive maintenance strategies.

7.TASKS PERFORMED

The development of the server room temperature monitoring system involved several key tasks:

1. Hardware Setup: Configuring Arduino Uno and connecting DHT11 sensor modules to facilitate accurate temperature and humidity sensing within the server room environment.
2. Software Configuration: Installing necessary libraries and configuring Arduino IDE to interface with the sensor modules, ensuring reliable data acquisition and processing.
3. Database Integration: Establishing connectivity with MySQL database using PHP scripts to store and manage sensor data efficiently.
4. Web Interface Development: Creating dynamic web pages using PHP, HTML, and CSS to visualize real-time sensor data, generate reports, and facilitate user interaction.
5. Graphical Representation: Implementing JavaScript-based charting libraries (such as Chart.js) to generate graphical representations of sensor data, enhancing data interpretation and analysis capabilities.
6. Documentation: Documenting the project's scope, implementation details, and operational procedures to facilitate replication and future maintenance.

8.REFLECTIONS AND PROGRAM OUTCOMES

8.1 Reflections:

- This internship has been a journey of growth, learning, and hands-on experience in the field of Internet of Things and Data Analytics.
- It provided valuable insights into real-world challenges and solutions, fostering professional development and skill enhancement.
- Collaboration with mentors and team members facilitated knowledge exchange and mentorship, contributing to personal and professional growth.
- Overcoming obstacles and adapting to dynamic project requirements instilled resilience and problem-solving abilities.
- The internship experience has reinforced the importance of continuous learning, adaptability, and effective communication in achieving project goals and professional success.

8.2 Program Outcomes:

- Successful development and implementation of a server room temperature monitoring system using Arduino Uno and sensor technologies.
- Establishment of a robust web interface for real-time data recording and analysis using PHP and MySQL through XAMPP software.
- Integration of various PHP scripts for dynamic data retrieval, visualization, and user-friendly navigation.
- Generation of temperature graphs using Chart.js library, enhancing data visualization and interpretation.
- Deployment of error handling mechanisms and resource management techniques for efficient database connectivity and script execution.

9.CONCLUSION

Overall, this internship was a really good experience, it gave us a deep overview of how a Temperature Monitoring System works and how the IT Department is one of the core departments at RWR&DC Division. The internship program was a great opportunity for us to get close to our Indian Aircrafts and get to know how they operate along with the softwares and tools responsible for PLM, quite necessary for the long-term maintenance of these aircrafts. It gave us a better understanding about all the departments involved in the designing and functioning of an aircraft. This will be a boost for us in future, when we enter into Aviation Industry.