WeatherCloset Documentation

Created by

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# WeatherCloset Project

Introduction

The objective of the WeatherCloset project is to develop a weather monitoring website that provides real-time information on temperature, humidity, and light intensity. Additionally, the website predicts rain based on sensor data, enabling users to determine the time when it is going to rain in order to collect clothes from the dry line.

System Overview

The system consists of a STM32 Nucleo-411 microcontroller connected to DHT11 and LDR. The microcontroller acquires sensor data and communicates with a web server. The web server hosts a website that displays the sensor readings which are humidity, temperature and light intensity. There is also an image showing the status of the weather based on the sensor readings that provide rain prediction information. If it's cloudy or rainy there will be notification through line notify

cloudy condition : value of LDR < 300
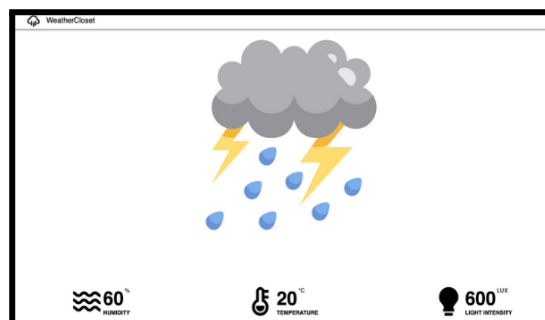
rain condition : temperature > 34 and humidity > 70
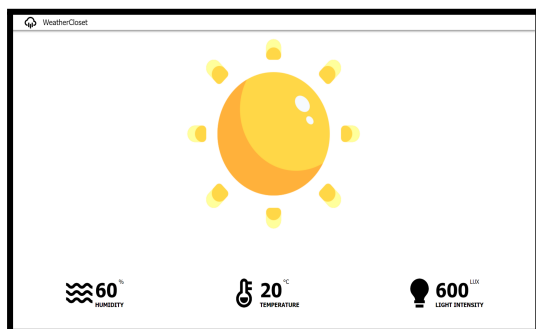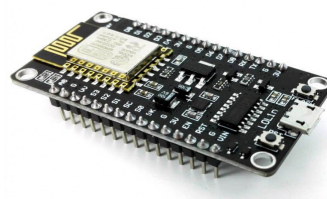

sunny
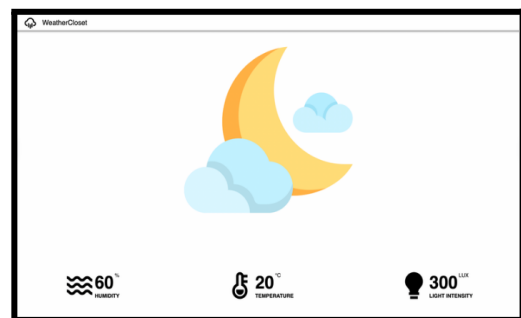
cloudy / at night

rain

line notify

Microcontrollers

In this project STM32 NUCLEO-F411RE is the main microcontroller, along with NodeMCU ESP8266 which is mainly used for connecting to wifi to get data.

STM32 NUCLEO-F411RE

NodeMCU ESP8266

Sensors

DHT11 : temperature and humidity
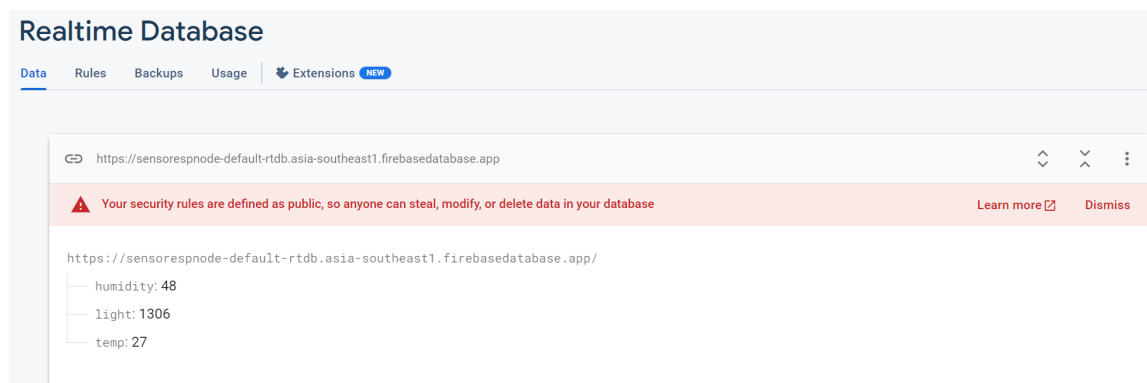
LDR : light intensity

DHT11

LDR

GitHub

https://github.com/doublebams/embedded

Firebase

https://sensorespnode-default-rtdb.asia-southeast1.firebasedatabase.app/
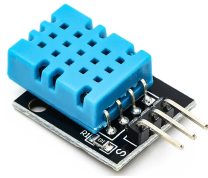
Libraries

FirebaseArduino

ArduinoJson

TridentTD_LineNotify

Role and Responsibility:

Papanin Kittawisinpoon 6431327021 - *System Architecture*

As a system architect in this project, my role and responsibilities are

1. Designing the system architecture: I am responsible for designing the system architecture for the project. This involves determining the hardware components, such as the STM32 microcontroller, DHT11 sensor, LDR, and the communication for data transmission. When planning the project, I need to ensure that the chosen components are suitable for the topic and requirement that we want 3 values including light intensity, temperature and humidity.

2. Sensor integration: After designing, the next step is wiring and configuring pins. There are 2 sensors, DHT11 sensor and LDR sensor, that I have to connect with the STM32 microcontroller. Since I have never used these sensors before, I gather technical information and ask friends about each component. I choose PA4 for DHT11 and PA0 for LDR ,then I use these pins to set up .ioc and write code. For LDR, I use ADC to get a value and for DHT11, I use functions to start and read data from DHT11.

3. Data transmission: The collected data are light intensity, temperature and humidity. The format of data is in string and I use UART communication, UART2 and UART1 to transmit it in order to be processed in the next step.

4. Testing: After I finish implementing code and wire all components, I have to test whether all modules operate as I wish ,so I start reading the values in various situations like turning on a flashlight to see if the value read from LDR changes, covering DHT11 with my hand to raise humidity and temperature.

5. Collaboration: In my team, each of us has a role and responsibility. We chat about each other's progress and have a meeting at the faculty. I have

a GitHub repository so that we can easily track the project and be up to date. In detail, I also need to ensure that the transmitted data format and protocol are compatible with my friend system, allowing seamless integration and easy data processing.

Role and Responsibility:

Napat Nitiwattananon 6431324021 - *Embedded System Development*

Even Though having little experience related to embedded systems, trying to learn new things, fixing problems and looking through different resources for additional knowledge has been a memorable experience.

I am responsible for connecting STM32 to nodemcu which is used as a channel to send the data from sensors and from nodemcu to a real time database to update values from each sensor through WIFI. During the process, I need to plan and utilize different kinds of communication protocols which help strengthen knowledge from the class. For example, using UART1 to communicate between nodemcu and STM32 and UART2 to connect to the laptop in order to display values through the terminal, or finding the right method for nodemcu to read data that comes as one - by - one character (Read_uart()) which was appending each character and extracting substring from each line of data from UART1 .

```
lkjl (CONNECTED)
L1063T25H48E
L1065T25H48E
L1064T25H48E
L1061T25H48E
L1061T25H48E
L1075T25H48E
L1066T25H48E
```

```cpp
Serial.println("l :" + light);
Serial.println("h :" + humid);
Serial.println("t :" + temp);

Firebase.setInt("light", light.toInt());
Firebase.setInt("humidity", humid.toInt());
Firebase.setInt("temp", temp.toInt());
if (Firebase.failed()) {
    Serial.print("set /number failed:");
    Serial.println(Firebase.error());
    return;
}
```

Another responsibility is setting up a real time database using firebase and fixing some outdated libraries needed for using nodemcu with firebase, in

this case, it required new GRC fingerprint from that database to replace in a certain file in a library. After setting up the connections between sensors and cloud, testing were mandatory to make sure each value was updated correctly and periodically according to the objective of this project, ready for backend and frontend development. Additionally, I connect nodemcu to line notify in order to notify user when the laundry should be collected.

Beside technical tasks, there were occasional meetings between team members to allocate tasks that are suitable for each team member to make it efficient and process updates, to keep everyone on the same page of what we were doing, and help one another when they faced a problem. Lastly, complete the document and presentation.

Role and Responsibility:

Maekin Namwong 6430324921 - *Frontend Development*

As a frontend web developer, my role in the development of the WeatherCloset application is crucial. I am responsible for designing and implementing the user interface, ensuring a seamless and visually appealing experience for the application's users. This involves utilizing web development technologies such as HTML, CSS, and JavaScript to create a responsive and interactive webpage.

The creation of the webpage is at the core of my responsibilities. I designed visual concepts and turned them into functional web pages. I ensure that the webpage adheres to best practices in web development, including accessibility, usability, and cross-browser compatibility. By employing efficient coding techniques, I strive to optimize the webpage's performance and loading speed, enhancing the overall user experience.

In addition to web development, another responsibility I undertake is the preparation of slide presentations. These presentations play a vital role in communicating the features, functionalities, and benefits of our application. Through well-designed slides, I effectively convey complex technical information in a concise and visually appealing manner, ensuring clarity and comprehension.

Throughout the project, effective collaboration and communication with other team members are crucial. I actively participate in meetings, discussions, and brainstorming sessions to gather requirements, provide input, and align my work with the overall project objectives.

In conclusion, as a frontend web developer, my role and responsibilities in the development of the WeatherCloset application revolve around creating a visually appealing and user-friendly webpage. I ensure that the webpage aligns with the project's objectives, adheres to web development best practices, and delivers a seamless user experience. Additionally, I contribute to the project's success by preparing slide presentations that effectively communicate the application's features and benefits. Through collaboration and effective communication, I work with the team to achieve the desired outcomes and deliver a high-quality product.

Role and Responsibility:

Pattapon Vichanukroh 6430222521 - *Backend Development*

Setting Up Firebase:

The WeatherCloset project commenced with the creation of a Firebase project on the Firebase console. This process provided a unique project ID, which was essential for project initialization. I then integrated Firebase into the embedded system, ensuring the necessary Firebase SDKs and credentials were configured appropriately. By doing so, the embedded system gained the required permissions to interact with Firebase's services.

Real-time Data Integration:

To achieve real-time data synchronization, I utilized the Firebase Realtime Database SDK. This enabled seamless communication between the embedded system and Firebase's real-time database. The SDK facilitated the transfer of humidity, temperature, and light data from the embedded system to Firebase, ensuring that any updates or changes were instantly reflected in the database.

Front-End Integration:

For effective data visualization, I leveraged Firebase's hosting service to create a user-friendly website. This website was designed to interact with the Firebase real-time database, retrieving the latest weather data from the embedded system. By utilizing Firebase's JavaScript SDK, the website was able to subscribe to real-time updates, ensuring that any modifications made to the database were immediately displayed on the website. Users could therefore access up-to-date weather information at any given time.

Challenges and Learnings:

Throughout the WeatherCloset project, several challenges were encountered. Ensuring a stable and reliable connection between the embedded system and Firebase was crucial for accurate data transmission. Factors such as network latency, data integrity, and error handling required careful consideration. Additionally, optimizing data transfer and addressing potential security concerns played a significant role in the project's success.

Working on WeatherCloset provided valuable insights into the capabilities of Firebase and its potential for real-time data synchronization. The project demonstrated the seamless integration between an embedded system, Firebase, and a website, showcasing the effectiveness of this technology stack. Moreover, it deepened my understanding of backend development and emphasized the importance of efficient data management.

Conclusion:

The WeatherCloset project successfully bridged the gap between an embedded system and real-time weather data, using Firebase as the backbone. By leveraging Firebase's real-time database and hosting services, I accomplished the goal of continuously monitoring humidity, temperature, and light levels. This project showcased the power of Firebase in facilitating the connection between embedded systems and web interfaces, enabling real-time data visualization. Through this endeavor, I gained valuable knowledge and skills applicable to future projects in the realm of embedded systems and web development.