LIVECAST

WEATHER STATION

DRIEMS UNIVERSITY

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Introduction

- This project, "LiveCast Weather Station," is a smart weather monitoring web application that displays 14-day weather forecasts, air quality data, and astronomical details using WeatherAPI and geolocation.

- It also integrates an IoT-based station with sensors for real-time local environmental data. The system supports smart farming by aiding in weather-based agricultural planning and monitoring.

Objective

- To develop a web platform that provides detailed, location-based weather forecasts, air quality, and astronomical data using WeatherAPI, enhancing decision-making for agriculture and smart farming.

- To integrate an IoT-based weather station that uploads real-time environmental data to ThingSpeak, supporting continuous monitoring of local climate conditions crucial for efficient and sustainable farming practices.

TECHNOLOGIES USED

WEB TECHNOLOGIES

FRONTEND

HTML

CSS

JS

JSX

NEXT.JS

Redux Toolkit

BACKEND

ex

node JS

DEV TOOLS

API TECHNOLOGIES

REST API

DATA FORMAT

{json}

x-www-form-urlencoded

IOT TECHNOLOGIES

HARDWARE

SOFTWARE

C++

adafruit

DEV TOOLS

ARDUINO

CLOUD SERVICE

ThingSpeak

C++ & Javascript

- Why C++ for IoT ?

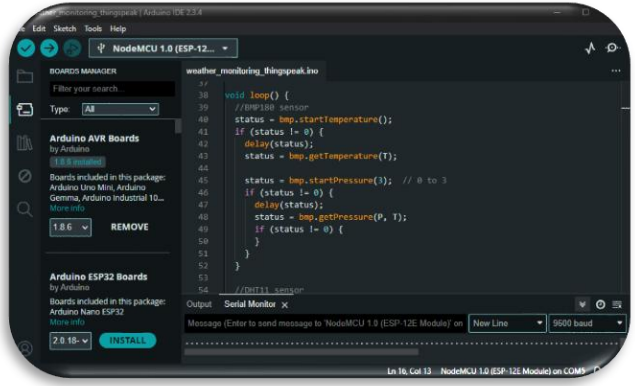
C++ offers low-level hardware control, efficient memory management, and high performance, making it ideal for programming microcontrollers like NodeMCU.

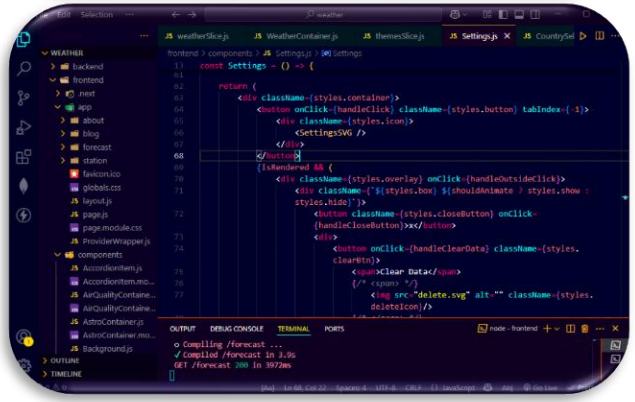
- Why JavaScript for Web Frontend and Backend ?

JavaScript is chosen for frontend and backend due to its versatility, fast development, real-time capabilities, and the seamless integration between Next.js frontend and Express.js backend for smooth API handling.

Arduino IDE & VS Code

- Arduino IDE is a simple, beginner-friendly platform for writing, compiling, and uploading code to microcontrollers. It supports C/C++ and is widely used for IoT and embedded system projects.
- Visual Studio Code is a powerful, customizable code editor that supports multiple languages, extensions, and debugging tools. It's ideal for web development, offering great integration with JavaScript, Node.js, and version control.





Web Tech Frontend: Part 1

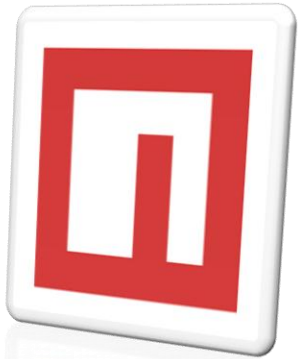
- This project uses HTML within JSX for structure, styled with both global CSS and CSS Modules for scoped styling. Additional JS script files are included for handling specific interactive functionalities.

- Next.js is a React-based framework that enables server-side rendering, fast performance, and SEO optimization. It simplifies routing, improves loading speed, and is ideal for building dynamic, scalable web applications.

Web Tech Frontend: Part 2

- Redux Toolkit simplifies state management in React apps by providing pre-configured tools and best practices. It reduces boilerplate code, improves scalability, and makes handling asynchronous actions like API calls more efficient.

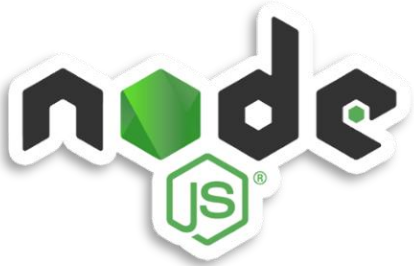
- Extra NPM packages:
  1. react-loader-spinner (6.1.6): Customizable loading spinners
  2. react-select (5.10.1): Stylish customizable select dropdown
  3. react-toastify (11.0.5): Toast notifications for React
  4. react-top-loading-bar (3.0.2): Top-loading progress bar
  5. world-countries (5.1.0): Country data in JSON



Web Tech Backend

- Express.js is a lightweight web application framework for Node.js. It simplifies backend development by providing robust tools for handling routes, middleware, and APIs, making it ideal for building RESTful services efficiently.

- Node.js is a runtime environment that allows executing JavaScript on the server side. It enables building scalable, high-performance backend services using non-blocking, event-driven architecture for real-time applications.

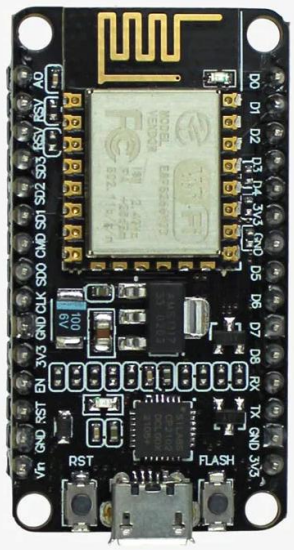


API

- API: An API allows different software systems to communicate and exchange data or functionalities seamlessly.
- REST API: A REST API uses HTTP methods to access and manipulate resources in a stateless architecture.
- JSON: Data sent as a structured string with keys and values, using JavaScript object format.
- x-www-form-urlencoded: Data encoded like URL query strings, with key-value pairs joined by & and =.

IOT Tech Hardware: Part 1

- NodeMCU, based on ESP8266, is a popular choice for IoT projects because of its compact size, integrated Wi-Fi connectivity, and affordability, enabling seamless integration into IoT systems for data acquisition and transmission.
- Its versatility extends to support for Arduino IDE and Lua scripting, empowering developers to leverage familiar programming environments and rapidly prototype and deploy IoT solutions for various applications with ease.



IOT Tech Hardware: Part 2

- The DHT-11 sensor is commonly utilized in IoT projects for its cost-effectiveness and simplicity in measuring temperature and humidity, providing essential environmental data for weather monitoring and indoor climate control applications.
- Its straightforward interface and wide availability make it accessible for hobbyists and professionals alike, offering reliable temperature and humidity measurements ideal for diverse IoT applications requiring environmental sensing capabilities.

IOT Tech Hardware: Part 3

- The BMP-180 sensor is valued in IoT projects for its precise barometric pressure measurements, crucial for weather forecasting and altitude sensing applications, enhancing the accuracy and reliability of environmental data collection.
- Its high resolution and low power consumption make it suitable for portable and battery-operated devices, while its compatibility with microcontrollers like NodeMCU ensures seamless integration into IoT systems for comprehensive weather monitoring.

IOT Tech Hardware: Part 4

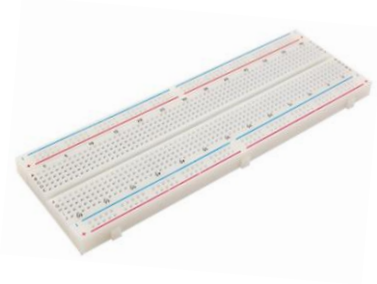
- The FC-37 sensor is instrumental in IoT weather monitoring systems for its ability to detect precipitation, contributing crucial data for assessing rainfall patterns and forecasting weather conditions accurately.
- Its simplicity, reliability, and cost-effectiveness make it an ideal choice for integrating into IoT projects, providing essential information on rainfall intensity and duration for various applications, from agriculture to flood management.

IOT Tech Hardware: Part 5

- The LM-393 LDR sensor module detects variations in light intensity, providing valuable insights into ambient light conditions for weather monitoring, security systems, and automatic lighting control in IoT applications.
- Its simple analog output interface and adjustable sensitivity make it easy to integrate into IoT projects, offering a cost-effective solution for accurately monitoring changes in light levels in real-time.

IOT Tech Hardware: Part 6

- Breadboard: A solderless board used for building and testing electronic circuits quickly during prototyping stages.



- Jumper Wires: Flexible wires with connectors used to link components or boards easily on breadboards or headers.

- Why used instead of PCB ?: Breadboards and jumper wires allow quick changes and testing before committing to a permanent PCB design.

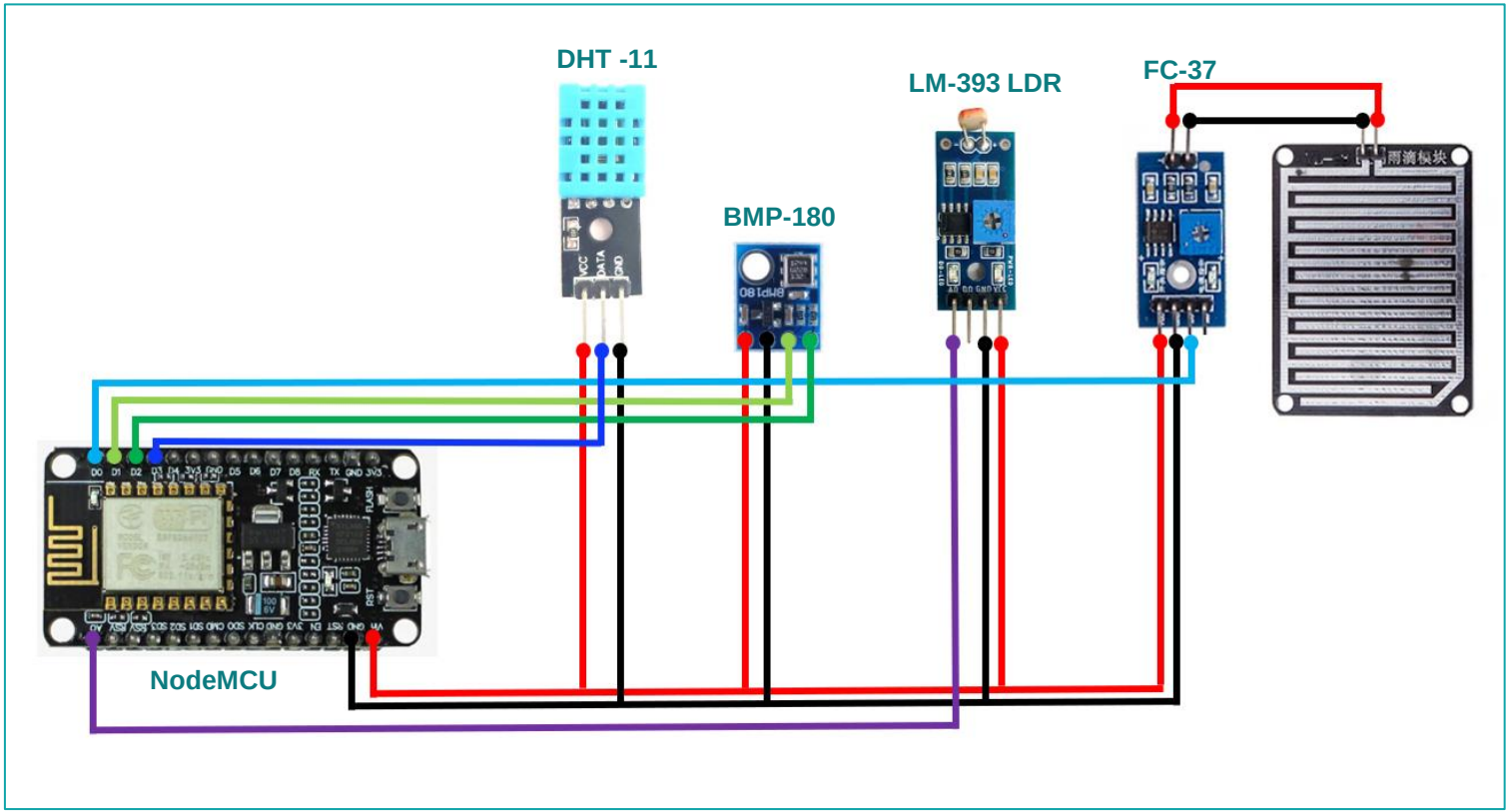
IOT Tech Software

- Along with the core logic written in C++, several compulsory C++ packages are used.
- NodeMCU ESP8266 Board Manager: Enables Arduino IDE to compile and upload code specifically for ESP8266-based NodeMCU boards.
- DHT-11 Library: Reads temperature and humidity data from DHT11 sensor using timing-based digital signal protocol.
- BMP-180 Library: Communicates with BMP180 sensor to read temperature and pressure via I2C using simple functions.
- Adafruit Sensor Library: Provides a common interface for sensors, standardizing data handling across different Adafruit sensor libraries.

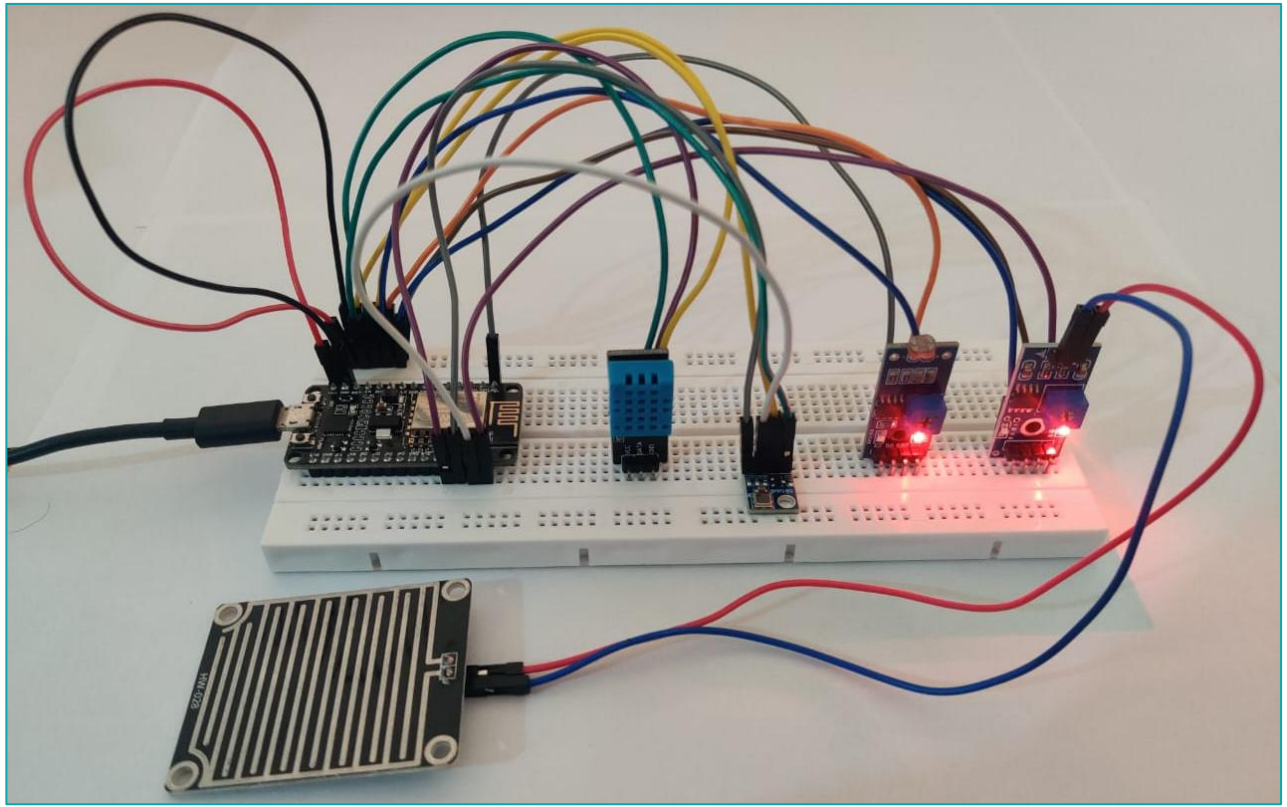
IOT Tech Cloud Service

- ThingSpeak serves as an IoT analytics platform, enabling seamless data collection, visualization, and analysis from connected devices, such as sensors in weather monitoring systems, facilitating informed decision-making based on real-time information.
- Its user-friendly interface and extensive customization options allow users to create personalized dashboards, graphs, and alerts, empowering them to gain insights into trends, anomalies, and patterns in the collected data, enhancing the efficiency and effectiveness of IoT applications.

IOT Tech Circuit Diagram



IOT Tech Hardware Setup

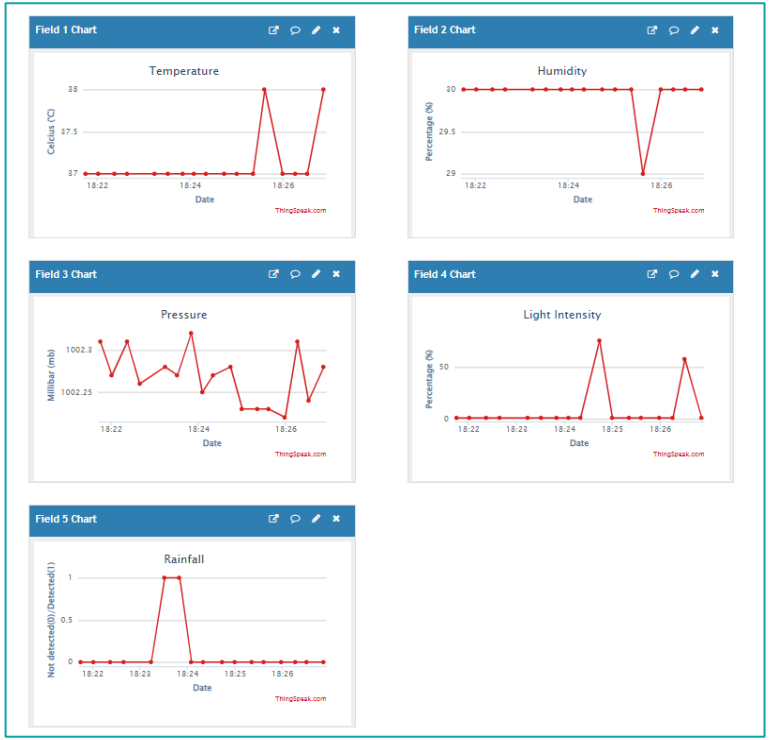


IOT Tech Results

Arduino IDE Serial Monitor

```
....
WiFi connected
Temperature: 38.00
Humidity: 29.00
Pressure: 1002.24
Light: 1
Rain: Not Detected
Temperature: 38.00
Humidity: 29.00
Pressure: 1002.23
Light: 1
Rain: Not Detected
Temperature: 37.00
Humidity: 30.00
Pressure: 1002.26
Light: 1
Rain: Not Detected
```

ThingSpeak Client Dashboard



WEBSITE SNAPSHOT #1

WEBSITE SNAPSHOT #2

WEBSITE SNAPSHOT #3

AIR QUALITY FORECAST 5 DAYS

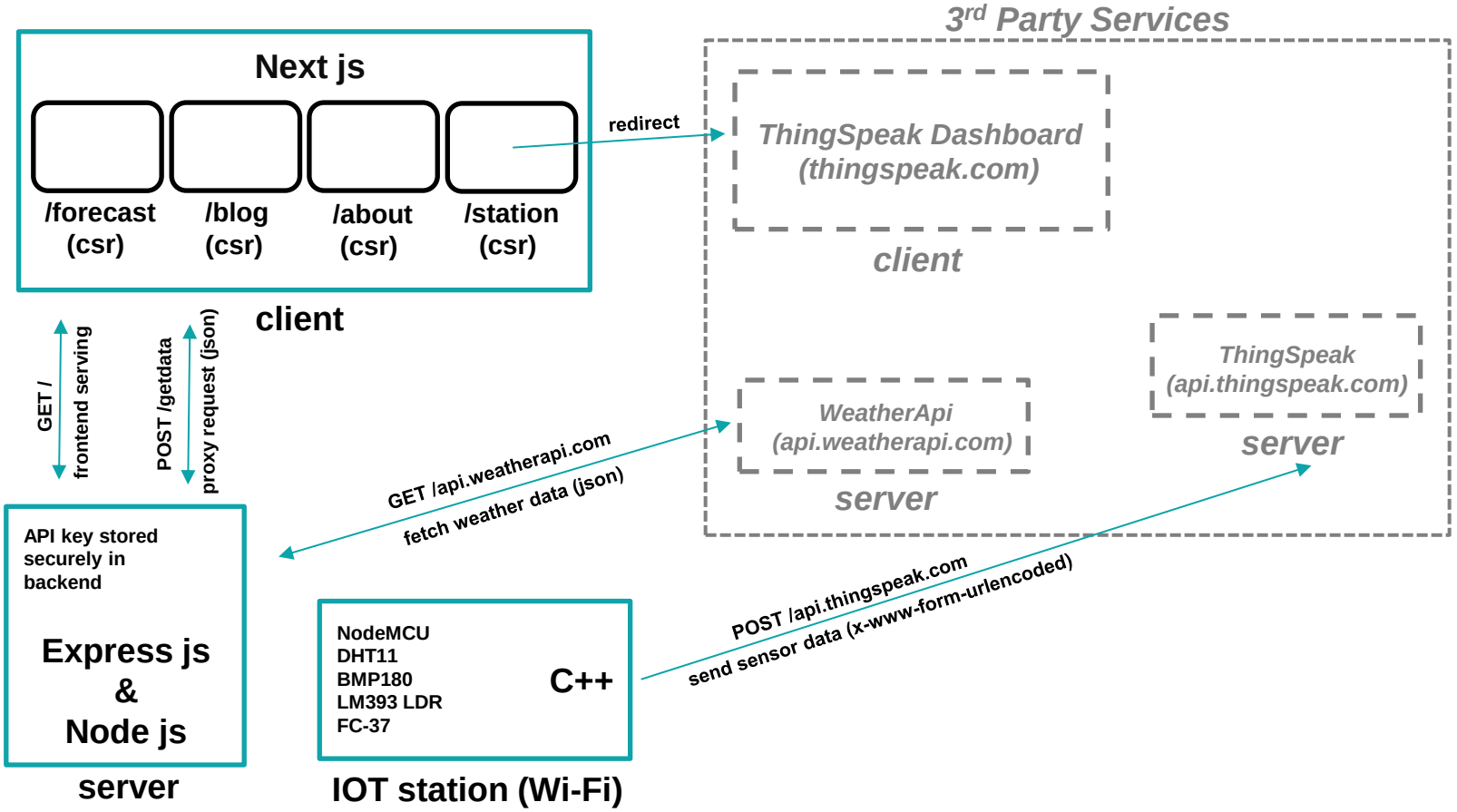
Wednesday 09 Apr 2025	AQI 2/6	Thursday 10 Apr 2025	AQI 2/6	Friday 11 Apr 2025	AQI 2/6	Saturday 12 Apr 2025	AQI 3/6	Sunday 13 Apr 2025	AQI 3/6
CO:	345.256 µg/m³	CO:	413.244 µg/m³	CO:	529.948 µg/m³	CO:	593.310 µg/m³	CO:	465.737 µg/m³
NO_2:	8.787 µg/m³	NO_2:	11.963 µg/m³	NO_2:	8.017 µg/m³	NO_2:	6.436 µg/m³	NO_2:	3.068 µg/m³
O_3:	59.417 µg/m³	O_3:	58.333 µg/m³	O_3:	77.917 µg/m³	O_3:	116.833 µg/m³	O_3:	122.833 µg/m³
SO_2:	1.943 µg/m³	SO_2:	2.274 µg/m³	SO_2:	5.126 µg/m³	SO_2:	7.893 µg/m³	SO_2:	4.301 µg/m³
PM2.5:	24.420 µg/m³	PM2.5:	23.896 µg/m³	PM2.5:	28.066 µg/m³	PM2.5:	53.958 µg/m³	PM2.5:	61.636 µg/m³
PM10:	29.091 µg/m³	PM10:	27.257 µg/m³	PM10:	35.566 µg/m³	PM10:	69.375 µg/m³	PM10:	85.917 µg/m³

ASTRONOMY FORECAST 14 DAYS

Wednesday 09 Apr 2025	Thursday 10 Apr 2025	Friday 11 Apr 2025	Saturday 12 Apr 2025	Sunday 13 Apr 2025	Monday 14 Apr 2025
Moon Up ?: YES	Moon Up ?: NO	Moon Up ?: NO	Moon Up ?: NO	Moon Up ?: NO	Moon Up ?: YES
Sun Up?: NO	Sun Up?: NO	Sun Up?: NO	Sun Up?: NO	Sun Up?: NO	Sun Up?: NO
Moon Illumination: 86 %	Moon Illumination: 92 %	Moon Illumination: 96 %	Moon Illumination: 99 %	Moon Illumination: 100 %	Moon Illumination: 99 %
Phase: Waxing Gibbous	Phase: Waxing Gibbous	Phase: Waxing Gibbous	Phase: Waxing Gibbous	Phase: Full Moon	Phase: Waning Gibbous
Moonrise: 03:14 PM	Moonrise: 04:03 PM	Moonrise: 04:52 PM	Moonrise: 05:40 PM	Moonrise: 06:29 PM	Moonrise: 07:20 PM
Moonset: 03:25 AM	Moonset: 03:57 AM	Moonset: 04:27 AM	Moonset: 04:58 AM	Moonset: 05:29 AM	Moonset: 06:02 AM
Sunrise: 05:37 AM	Sunrise: 05:36 AM	Sunrise: 05:35 AM	Sunrise: 05:34 AM	Sunrise: 05:33 AM	Sunrise: 05:33 AM
Sunset: 06:06 PM	Sunset: 06:06 PM	Sunset: 06:07 PM	Sunset: 06:07 PM	Sunset: 06:07 PM	Sunset: 06:08 PM

Tuesday 15 Apr 2025	Wednesday 16 Apr 2025	Thursday 17 Apr 2025	Friday 18 Apr 2025	Saturday 19 Apr 2025	Sunday 20 Apr 2025
Moon Up ?: YES	Moon Up ?: YES	Moon Up ?: YES	Moon Up ?: YES	Moon Up ?: YES	Moon Up ?: YES
Sun Up?: NO	Sun Up?: NO	Sun Up?: NO	Sun Up?: NO	Sun Up?: YES	Sun Up?: YES
Moon Illumination: 96 %	Moon Illumination: 92 %	Moon Illumination: 86 %	Moon Illumination: 79 %	Moon Illumination: 70 %	Moon Illumination: 61 %
Phase: Waning Gibbous	Phase: Waning Gibbous	Phase: Waning Gibbous	Phase: Waning Gibbous	Phase: Waning Gibbous	Phase: Last Quarter
Moonrise: 08:12 PM	Moonrise: 09:07 PM	Moonrise: 10:01 PM	Moonrise: 10:56 PM	Moonrise: 11:48 PM	Moonrise: No moonrise
Moonset: 06:38 AM	Moonset: 07:18 AM	Moonset: 08:02 AM	Moonset: 08:52 AM	Moonset: 09:46 AM	Moonset: 10:43 AM

LIVECAST WEATHER STATION'S SYSTEM ARCHITECTURE DIAGRAM



Conclusion

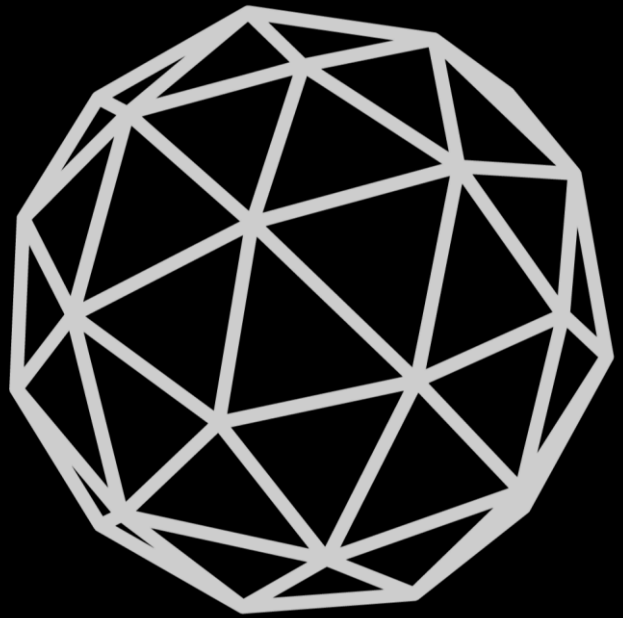
- The LiveCast Weather Station effectively combines web technologies and IoT to deliver accurate, real-time environmental data, aiding in smarter agricultural decisions and enhancing overall productivity in farming practices.

- By integrating WeatherAPI, geolocation, and custom sensor data via ThingSpeak, the project demonstrates a practical, scalable solution for weather monitoring, tailored specifically for the needs of modern smart farming.

References

- Deepanjan Biswas, Asis Mondal, Suvadip Ghosal, Bikramjit Prasad Ghosal. IoT-Based Real-Time Weather Monitoring and Reporting System. RCC INSTITUTE OF INFORMATION TECHNOLOGY.
- R. Suresh Babu, Palaniappan Thillainathan. IoT Based Weather Monitoring System. ResearchGate, ISSN2394-3777 (Print), ISSN2394-3785 (Online).
- Girija C, Andreanna Grace Shires. Internet of Things (IOT) based Weather Monitoring System. International Journal of Engineering Research & Technology (IJERT). ISSN: 2278-0181.
- Dhannjay Verma, Ishan Choudhury, Manish Singh, Abhijeet Shukla, Dharendra Kumar. An IOT Based Weather Monitoring System. © 2019 JETIR April 2019, Volume 6, Issue 4. ISSN-2349-5162.
- Puja Sharma and Shiva Prakash. Real Time Weather Monitoring System Using Iot. Madan Mohan Malaviya University of Technology, Gorakhpur.

ANY QUERIES ?



THANK YOU