Week 12 - 13: Inception of the idea

Project Objectives - Outlining the goals set out to achieve for my Smart Fan

Introduction :

During a moment of inspiration, the idea of the Smart Fan project came to me - literally in the bathroom. The introduction of the idea stemmed from contemplation of potential smart home projects, with a contender like a smart mirror I was also considering

Comparison: Smart Fan vs Smart Mirror

Smart Mirror :

Pros:

Aesthetically pleasing, merges functionality with decor

Potential for displaying information like weather, calendar and notifications

Cons:

Limited in-room applicability, often confined to specific spaces

Higher development complexity due to display integration

Smart Fan :

Pros:

University applicable, fitting seamlessly into any room

Simpler development with a focus on functionality and connectivity

Cons :

Limited display capabilities compared to a smart mirror

After careful consideration of the pros and cons, the decision leaned towards the Smart Fan for its versatility and straightforward integration. The focus shifted from aesthetics to functionality, aligning with the project's core objective of creating a seamless and universally applicable ioT device

Now delving into the research phase, exploring the intricacies of smart fan technology and laying the foundation for the 8-week journey

Week 12-13: Research Phase - Sensor Selection

Sensor Selection: Ultrasonic Sensor

Research Phase :

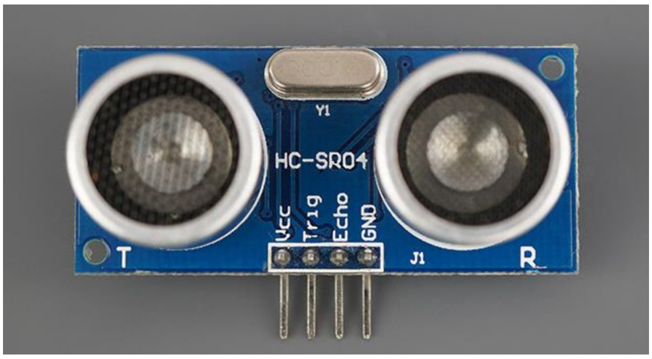
Sensor Selection :

Ultrasonic Sensor:

In-depth research revealed the functionality of the Ultrasonic Sensor, emitting waves for spatial mapping. Consideration of alternatives, such as Infrared, highlighted potential issues with pet interference due to heat signatures.

Why Ultrasonic?

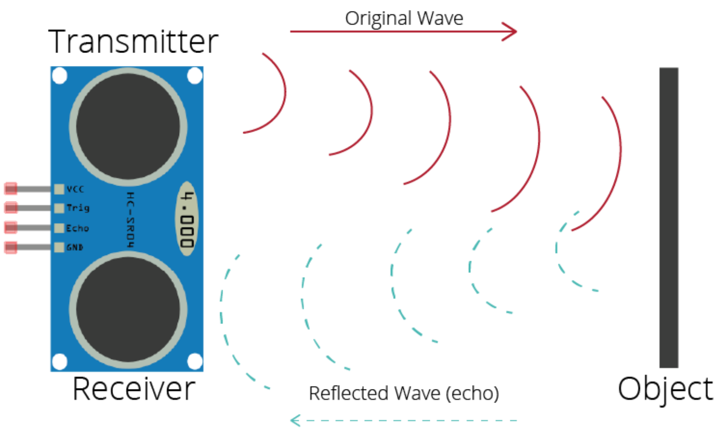
I Chose Ultrasonic for its accuracy and versatility in detecting human presence, essential for smart functionality.



How the UltraSonic sensor works

Ultrasonic sensor uses sonar to determine the distance to an object. Heres how it works ;

1. Ultrasonic transmitter (trig pin) emits a high frequency sound (40 kHz)
2. Sound travels through the air. Finds an object, bounces back to the module
3. Ultrasound receiver (echo pin) receives the reflected sound (echo)

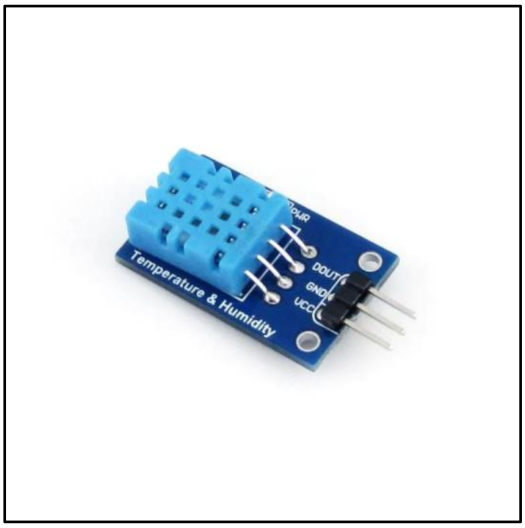


DHT11 Temperature and Humidity Sensor:

Recognising the importance of temperature and humidity control, I explored options like DHT22 and DS18820.

DHT22:

Reason for not choosing: Higher cost without significant performance gains. The Smart Fan project prioritises cost-effectiveness without compromising essential functionality, making the DHT11 the preferred choice.



Possible Sensor Options:

Explored additional sensors for air quality and CO2 monitoring but opted for a focused approach, prioritizing core functionalities for the initial project.

Next up, is the development phase, where the selected sensors will come to life in our Smart Fan IoT project.

Possible Sensor Options :

Investigation into other sensors for air quality sensors or CO2 sensors

Decided to focus on core functionalities for the inital project

Communication Protocols: WiFi vs Bluetooth vs MQTT

WiFi:

Comparative Analysis: WiFi offers high data transfer rates and extensive coverage, making it suitable for IoT devices that require a constant connection to the internet. However, it tends to consume more power compared to other protocols.

Chosen for Implementation: WiFi was selected for its widespread availability and compatibility with home networks. The aim was to ensure efficiency in communication for the Smart Fan IoT project.

MQTT:

Comparative Analysis: MQTT is valued for its lightweight, efficient publish-subscribe model, crucial for IoT applications with low bandwidth requirements and real-time updates.

Initial Consideration: Although not implemented in the final design, the idea to use MQTT was present from the start of the research phase.

The decision of Blynk App for Smart Fan :

Blynk App Features:

Explored IoT platforms for mobile app integration, comparing Blynk and ThingSpeak.

Chose Blynk for its user-friendly interface and strong community support.

Customization and Integration:

Explored Blynk's capabilities for customization and integration.

Utilized its drag-and-drop interface for accessibility, catering to users with limited programming knowledge.

Cost and Accessibility:

Selected Blynk for its freemium model, enabling development without significant financial investment.

Feedback and Community Input for Smart Fan :

Online Forums and Communities:

Gathered insights and feedback from experienced developers in online forums.

Leveraged community input to inform decision-making on the selection of components and technologies used in the Smart Fan project.

Week 14-15: Development

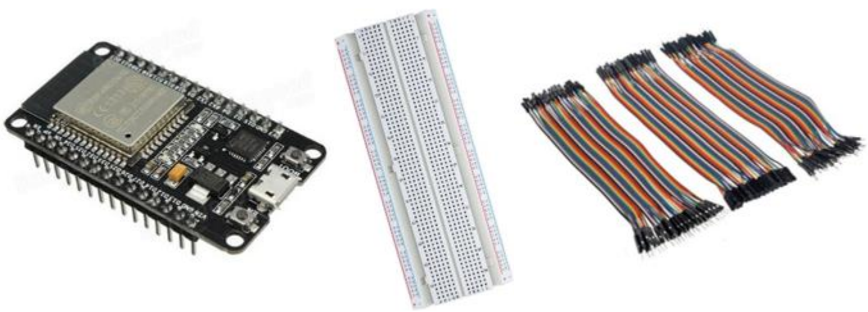
Setting up ESP32 on Breadboard:

ESP32 Configuration:

Referencing ESP32 Diagram:

Ensured accuracy in pin configuration by consulting the ESP32 diagram.

Followed the visual guide to identify and allocate pins correctly.



Fire beetle Setup with Arduino:

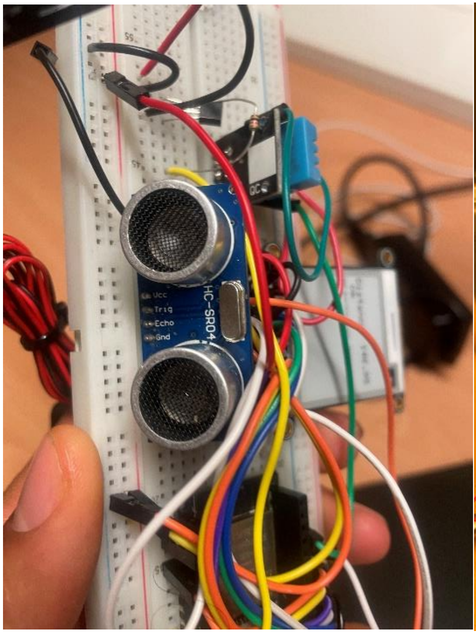
Incorporated insights from lectures to set up Firebeetle on Arduino.

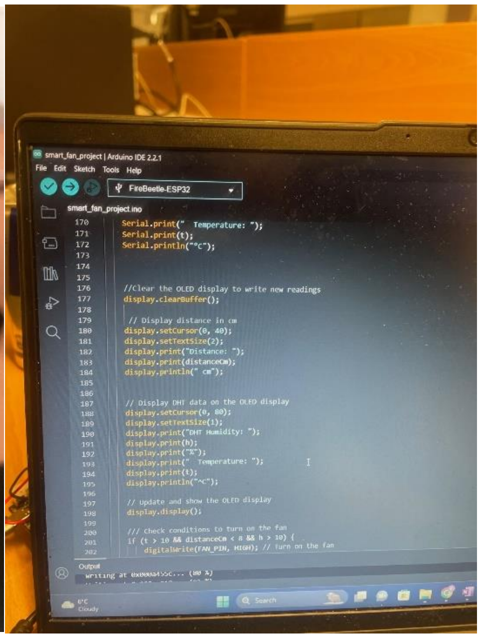
Setting up sensors on ESP32 and Breadboard :

Ultrasonic Sensor Setup:

Priorisied the Ultrasonic Sensor as the first component for setup.

Employed jumper wires for precise connections, consulting the ESP32 diagram for guidance.





DHT11 Sensor Setup:

Pin Configuration:

Referred to the DHT11 datasheet for accurate pin identification.

Aligned the sensor pins according to the specified connections on the breadboard.

Jumper Wire Connections:

Utilized jumper wires to connect the DHT11 sensor to the ESP32.

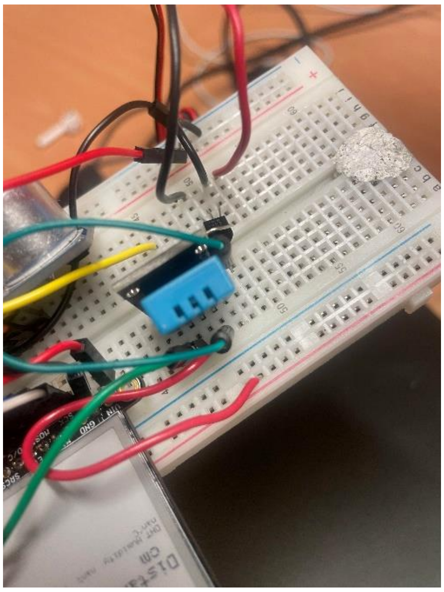
Ensured a systematic and error-free wiring setup, following a logical path.

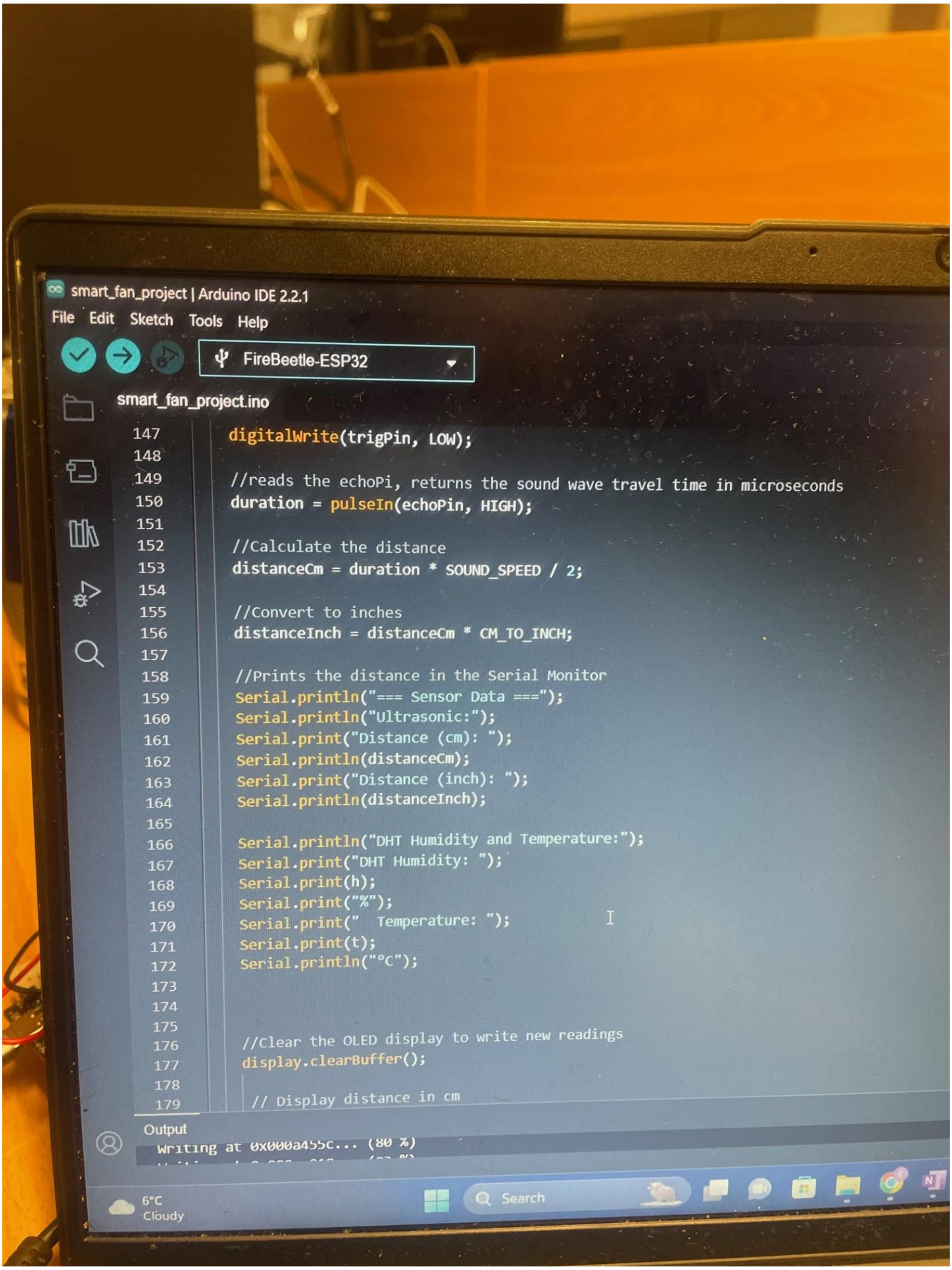
Arduino Library Integration:

Integrated the DHT11 Arduino library for seamless communication with the ESP32.

Leveraged the library to simplify data retrieval from the temperature and humidity sensor.

By methodically setting up the DHT11 sensor, the Smart Fan gains the ability to monitor and respond to environmental conditions, enhancing its overall functionality.





ThinkInk Display Setup:

Pin Configuration:

Examined the ThinkInk display datasheet to identify the correct pin mapping.

Allocated pins on the breadboard based on the specified connections for the display.

Jumper Wire Connections:

Established connections between the ThinkInk display and the ESP32 using jumper wires.

Followed a structured approach to ensure accuracy and reliability in the wiring setup.

Library Integration:

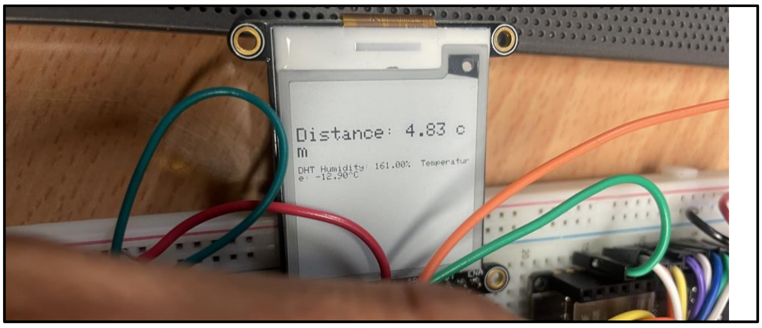
Integrated the necessary libraries for the ThinkInk display into the Arduino IDE.

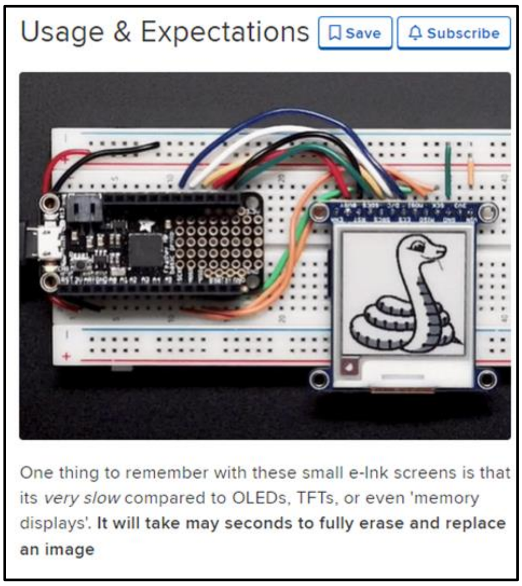
Ensured compatibility between the display and the ESP32 for smooth data exchange.

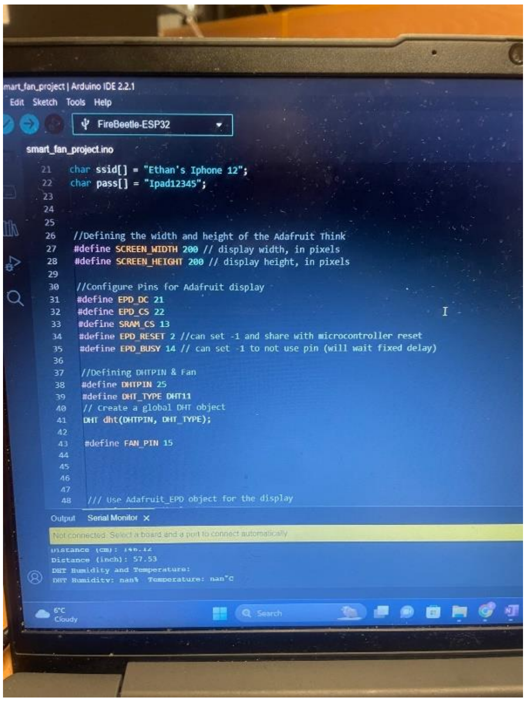
Testing and Calibration:

Conducted initial testing to verify the functionality of the ThinkInk display.

Calibrated the display to align with the project requirements and visual aesthetics.







Blynk App Integration:

Blynk Account Setup:

Created a Blynk account to access the Blynk app and cloud services.

Generated an authentication token for secure communication between the ESP32 and the Blynk app.

Blynk Library Integration:

Installed the Blynk library in the Arduino IDE for seamless integration with the ESP32.

Ensured that the library was compatible with the selected hardware and software components.

Widget Configuration:

Added relevant widgets in the Blynk app for temperature and humidity monitoring.

Customised the interface to align with the Smart Fan IoT project's requirements.

Authentication Setup:

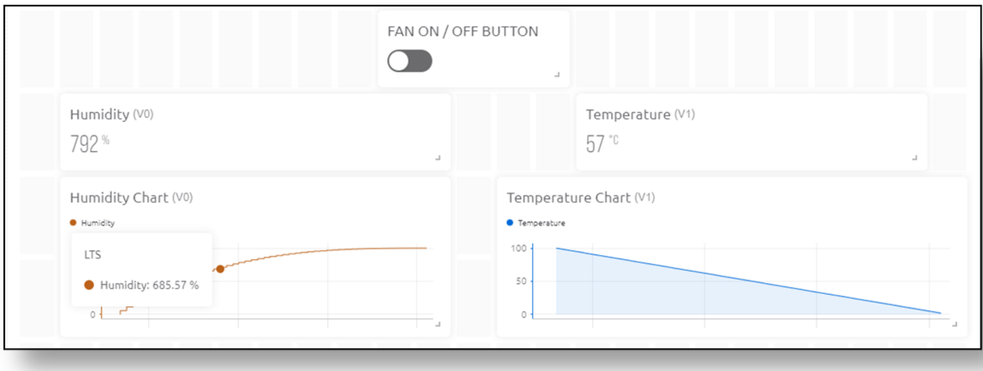
Implemented the authentication token within the ESP32 code for secure communication with the Blynk app.

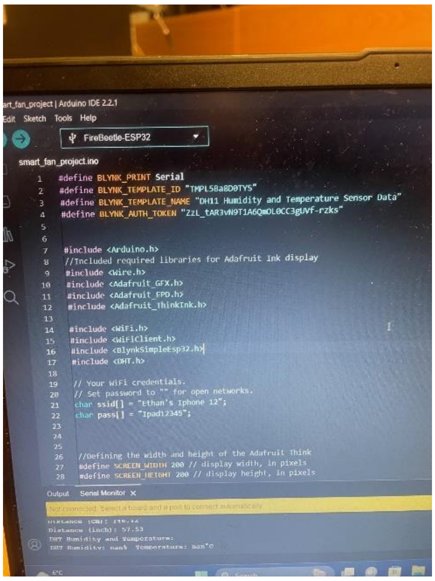
Verified the connection between the ESP32 and the Blynk app for real-time data exchange.

Testing and Troubleshooting:

Conducted thorough testing to ensure the Blynk app's functionality and responsiveness.

Addressed any connectivity issues or discrepancies through troubleshooting.





The integration of the Blynk app adds a user-friendly interface to the Smart Fan project, enabling remote monitoring and control for enhanced user experience.

Development Challenges :

MQTT Connection Stability:

Issue: Faced challenges in maintaining a stable MQTT connection during the development phase.

Resolution: Implemented error-handling mechanisms to reconnect automatically when the connection dropped. Adjusted MQTT settings for optimisation in specific network environments, addressing stability concerns. However was still facing issues so decided to leave the project

DHT11 Sensor Wiring Issues:

Issue Faced: Encountered problems with inaccurate readings from the DHT11 sensor due to wiring issues.

Resolution: Consulted wiring diagrams to identify and correct wiring problems, ensuring proper connectivity and reliable sensor readings.

Fan Control and Motor Compatibility:

Issue: Integration of the on/off switch for the fan posed ongoing challenges throughout the project.

Resolution: Collaborated with electrical engineering students and staff, seeking solutions for improved fan control. Continued exploration for a satisfactory resolution. Wasn't successful before the end of product deadline day.

Real-Time Data Synchronization:

Issue: Difficulty in achieving real-time synchronisation between the physical display on the ThinkInk display, serial monitor, and the Blynk App.

Resolution: Incorporated user feedback to enhance the overall user experience, ensuring a synchronised and responsive data display across all platforms.

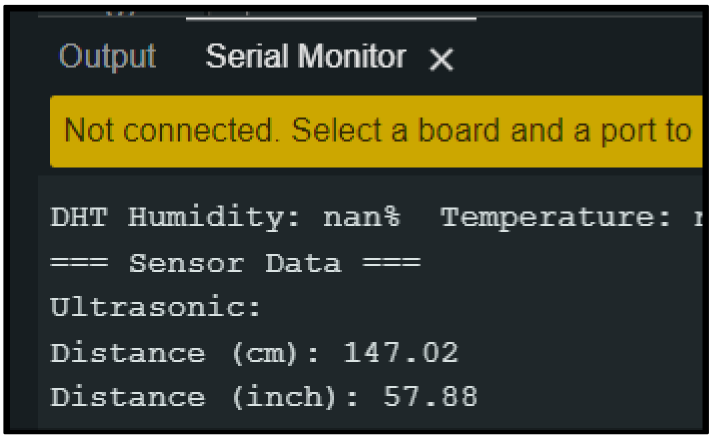
Week 16-17: Testing Phase - Individual Component Testing

Ultrasonic Sensor Testing:

Verification: Checked the accuracy of the ultrasonic sensor in detecting human presence.

Adjustments: Tweaked sensitivity to exclude animal presence, ensuring precision.

Lighting Conditions: Tested the sensor's performance under various lighting conditions for reliable distance measurements.

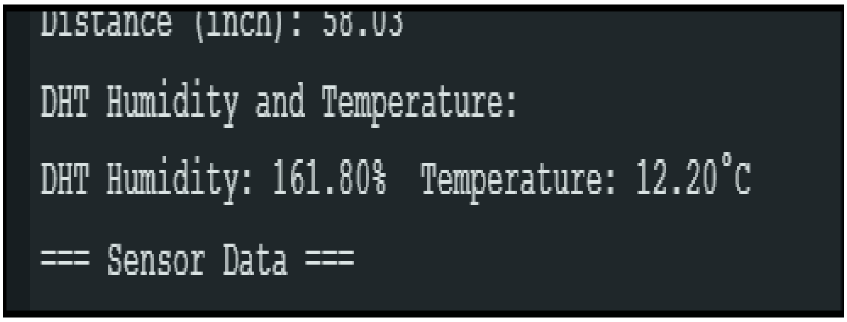


DHT11 Sensor Validation:

Continued Testing: Ensured ongoing testing of the DHT11 temperature and humidity sensor.

Validation: Verified accuracy and responsiveness in temperature and humidity readings.

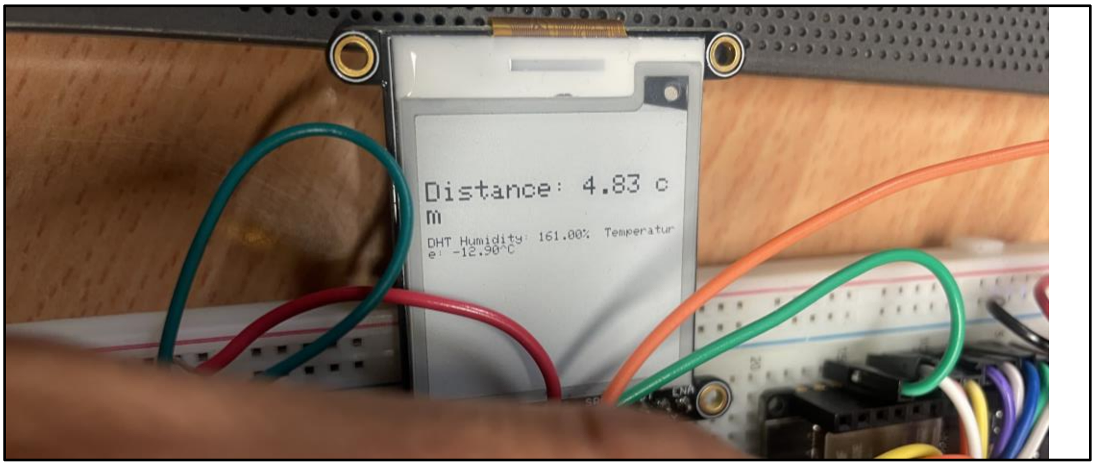
Display Check: Ensured correct display on both the ThinkInk display and the Blynk App.



ThinkInk Display Functionality Testing:

Real-Time Data Display: Checked the ThinkInk Display's ability to update and display real-time data.

Readability Evaluation: Evaluated display readability under different lighting conditions, making adjustments if necessary.



Blynk App Integration Testing:

Real-Time Updates: Ensured the Blynk App reflected real-time data updates from individual components.

Consistency Validation: Validated the consistency of data displayed on the ThinkInk display and the Blynk app for a seamless user experience.

Real-World Simulation:

User Interaction Scenarios: Simulated scenarios where users interact with individual components.

ThinkInk Display Check: Tested the ThinkInk display's ability to provide clear and legible information independently.

This testing phase ensures each component functions as intended, laying the foundation for a robust and reliable Smart Fan IoT system.

Week 18-19：Reflections on the Smart Fan project :

Reflections on the Smart Fan project :

What Went Well:

Successful Sensor Integration:

The integration of sensors, including the ultrasonic sensor for human presence and the DHT11 for temperature and humidity, was successful. Accurate and reliable data enhanced the smart fan's overall functionality.

User-Friendly Blynk App:

The decision to use Blynk as the IoT platform proved beneficial. Its user-friendly interface and drag-and-drop functionality simplified development and prototyping.

Successful ThinkInk Display Integration:

The ThinkInk display added a valuable visual component to the project. Real-time display of distance, temperature, and humidity information provided users with immediate and clear feedback.

Lessons Learned from Challenges:

Interactive Testing is Crucial:

Challenges during the development phase highlighted the importance of interactive testing. Regular testing and calibration, especially with sensors and communication protocols, were key for reliability.

User Input Enhances Design:

Actively seeking and incorporating user feedback played a significant role in adjusting the user interface and overall user experience, leading to improvements in usability and satisfaction.

Skills Improvement:

Technical Skills:

Enhanced skills in IoT development, sensor integration, and communication protocols, overcoming challenges with MQTT and successfully integrating Blynk.

Problem-Solving and Troubleshooting:

Hone problem-solving and troubleshooting skills through diagnosing issues, researching solutions, and implementing effective fixes.

Project Management: Improved project management skills by handling various components, from sensors to communication protocols and user interfaces. Planning, organization, and timely execution were crucial for successful project completion.

Steps to Consider in the Future:

Machine Learning Integration:

Investigate the incorporation of machine learning algorithms to analyze historical data and predict user preferences, leading to intelligent automation and optimizing fan settings based on learned patterns.

Voice Control Integration: Implement voice control using platforms like Amazon Alexa or Google Assistant, allowing users to control the smart fan and access information through voice commands.

Community Engagement: Foster a community around the smart fan project, creating forums, social media pages, and a dedicated website for users to share experiences, provide feedback, and contribute ideas for future developments.

Conclusion

With closing this logbook, I celebrate the success of the integration of the sensors, the creation of the user-friendly Blynk app, and the inclusion of the Think Ink Display in the Smart Fan project. Challenges became a stepping stone for skill enhancement I gained along the way of the project, from the technical side to the problem-solving aspect.

I have extreme gratitude to those who supported me along the way with this project, Keith and Dan in the hackspace, and my seminar teacher for giving ideas and pointing in the right way during the development phase. With building the fan I am more encouraged to explore implementing more within the project, machine learning integration, voice control and much more.

This logbook may conclude, but the innovation will continue!