Assignment 2: Design An IOT Egg Incubator

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TECH1102:Internet of Things

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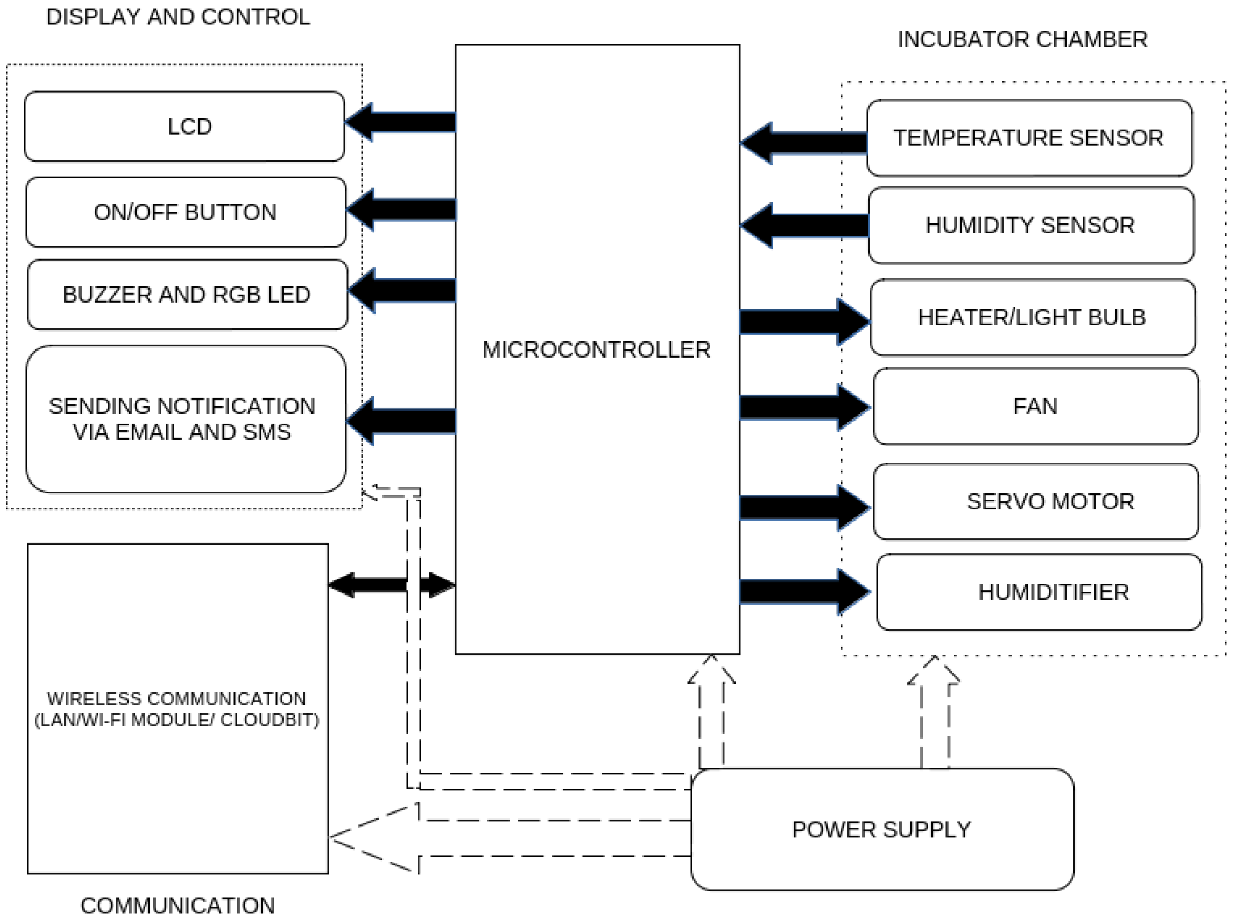
Ques 1) Paste the picture of the block diagram.

BLOCK DIAGRAM



Ques 2) Please paste in your spell-checked and grammar-checked design summary.

Ans:

This is an Ardunio-controlled incubator for chicken eggs. The aim is to create artificial incubators designed to maintain specific temperature and humidity levels required for successful egg hatching.

Components:

1. **Power supply:** The power supply for the system is 12 volts. The system functions at a maximum of 12 volts.
2. **Heater/Light Bulb:** A 25-watt bulb serves as a heat source. These light bulbs or heaters help maintain temperature within the incubator, which is important for the proper development of the chick that is inside the egg. To supply the necessary warmth to replicate natural incubation conditions for the eggs.
3. **DHT11 Sensor (Temperature and Humidity Sensor):** It senses temperature and humidity and gives digital values.
4. **Humidifier (designed to increase humidity levels in a room):** The humidifier converts water into a mist composed of very fine droplets as it passes through. The effectiveness of this equipment relies heavily on maintaining optimal moisture levels during the incubation and hatching phases. Consequently, the humidifier is responsible for precisely regulating the humidity level within the incubation chamber.
5. **Fan:** The fan runs all the time to spread heat and humidity evenly in the incubator. The Arduino keeps an eye on the fan's speed and will sound an alarm

if it stops working. The fan also helps cool down the heating wire, and if the fan stops, the heating is automatically turned off to prevent overheating.

6. **Servo Motor:** A servo motor rotates the eggs at specific intervals to ensure they receive consistent warmth.

Display and control:

1. An LCD to display the current temperature.
2. On/Off button: To turn on the incubator; Set the temperature and humidity.

Here's a step-by-step procedure outlining how the Arduino-controlled incubator works for hatching chicken eggs:

1. **Power On and Initializing the Process**: The user switches on the incubator, supplying power to all components and integrating the NodeMCU ESP8266 with Arduino Mega 2560. I used Wi-Fi connectivity for communication, enabling remote monitoring, control, and data exchange capabilities.
2. The DHT11 sensor starts taking readings of temperature and humidity inside the incubator at regular intervals.
3. The Arduino processes the sensor readings and sends the data to the LCD for the user to see.
4. The user interacts with the on/off button or keypad to input the parameters, like setting the target temperature and humidity.
5. The DHT11 sensor has a user-defined temperature. If the temperature is too low, the Arduino activates the light bulb or heater to increase the temperature. If it is **too high**, it turns off the light bulb or heater.

6. **Humidity Control**: Similarly, the humidity reading matches the user-defined humidity. If the humidity is too low, the Arduino **activates the humidifier** to increase humidity. If it's too high, it **turns off the humidifier**.
7. **Fan**: The fan runs continuously to ensure a uniform distribution of heat and humidity inside the incubator. If it fails, it turns on the buzzer.
8. **Turning of eggs with a servo motor**: The servo motor rotates the eggs at some intervals. This prevents the embryos from sticking to the shell membrane and promotes uniform development.
9. **Monitoring and Feedback**:
   - Throughout the incubation process, the Arduino continuously monitors temperature, humidity, fan operation, and egg turning.
   - If any parameter deviates from the desired range or if there's a system malfunction (e.g., fan failure), the Arduino triggers an alarm to alert the user.
   - The data is stored on the memory card to prevent data logging, and we can check our data any time we want from any smartphone, laptop, etc. by placing the memory card on the device.
10. **Completion**: Once the incubation period is complete and the chicks have hatched, the user can power off the incubator and remove the chicks for further care.

Ques 3) Please list three alternative network communication methods you considered for the Arduino, and indicate why you selected the one in your design. Be specific!

Ans:

1. **Wi-Fi modules using ESP8266:** The NodeMcu ESP8266 module enables your microcontroller to connect to Wi-Fi networks and establish basic IP connections using simple commands. Due to built-in Wi-Fi features in NodeMcu ESP8266, allowing communication with web servers, and cloud platforms. And made programming easier.
2. **CloudBit:** The easiest way to create internet-connected devices. Retrofit your temperature, humidity, and other parameters from anywhere in the world using a smartphone, tablet, or computer. We can use cloudBit, and no programming, soldering, or wiring is required.
3. **Bluetooth:** Bluetooth technology can be really helpful in our incubator project. It allows us to connect sensors wirelessly to our system, making setup a breeze. Plus, we can check in on our incubator from anywhere using our smartphone or computer. Bluetooth makes our incubator smarter, more convenient, and easier to manage.
4. **LAN:** We can utilize a LAN connection directly with a computer to link the Arduino incubator and computer, which allows us to be informed as well as monitor from any device.

Ques 4) Please list three alternative data logging strategies you considered for the incubator and indicate why you selected the one in your design. Be specific!

Ans:

1. **Memory Card (e.g., SD card):** For data logging, your egg incubator offers several advantages. Firstly, memory cards provide **non-volatile storage**, meaning data is retained even when the power is turned off, ensuring the secure preservation of your incubator's environmental data even during power outages. Additionally, memory cards are **easily accessible**; they can be removed from the incubator and inserted into a computer for retrieving data.
2. **Cloud-based data logging:** This method provides a strong solution for keeping a permanent record of your incubator's conditions. It works by sending data from the incubator to a cloud platform for safekeeping. Even if the incubator loses power, data stays securely stored in the cloud. This means we can easily check and analyze the data from anywhere with internet access.
3. **ROM memory (e.g., EEPROM):** EEPROM is like a mini storage unit inside microcontrollers, such as Arduino boards, used to save small bits of data even when the power is turned off. It's quite similar to an SD memory card, however, the key difference is that it is built right into the microcontroller, while memory cards are separate devices that can be plugged into a microcontroller or computer.
4. **Battery-Backup System:** It guarantees that our data logging tools keep running smoothly even if there is a power outage. This ensures that we do not miss any

important information about the incubator. It makes maintenance much easier, boosting the reliability of the incubation process.

Ques 5) Please list two alternative notification strategies you considered for your incubator and indicate why you selected the one in your design. Be specific!

Ans: **For local notifications:** Two alternative warning methods are a buzzer and an RGB LED.

1. The **buzzer** can be used to notify the user when an egg is damaged or collapsed due to a high temperature.
2. An **RGB LED** could be used to change color to notify the user when an egg hatches, as well as to indicate failure.
    - Bright **red LED**: When the incubator is too hot or a mistake has occurred.
    - Egg hatching is indicated by a **green LED.**
    - When it is too cold inside the incubator, the **blue LED** is turned on to display that the temperature is low.
3. Sending notifications via email or messages to the mobile device or computer (Another Method). When the device is connected to smartphones, tablets, or computers through a CloudBit, LAN, or WI-FI module.

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