Smart Greenhouse

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ABSTRACT

Internet of things (IOT) has become increasingly popular in the past decade. It has incorporated itself into all parts of humans' daily lives and made it easier. In our project, we aim to push this by investigating whether we can grow plants at the most optimal conditions at all times therefore removing human and environment influences. Our project aims to provide real-time updates provided by the sensors to the user and automate the amount of light and water the plants gets so it grows in the most optimal conditions at all times.

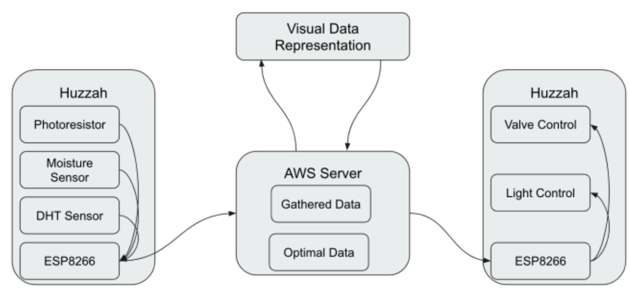
KEYWORDS

Internet of Things, Huzzah, Greenhouse, Sensors

1 Introduction

The smart greenhouse allows the plants to be grown at the optimal conditions, this is done by having light and DHT sensors that record the temperature, water moisture, and light that the plant is receiving. This is all part of the sensing Huzzah and then sent to the Amazon Web Server (AWS) RDS server to be stored and updated onto the user's phone providing real-time update. The water moisture and temperature recorded is then compared against our optimal data for the plant which then determines whether the plant needs more water or light. If it is determined that water or light is needed, the server then sends a signal to the controlling Huzzah which turns on the lamp or water valve for the plant. This is done every hour so the plant can stay at the most optimal condition every day without any monitoring.

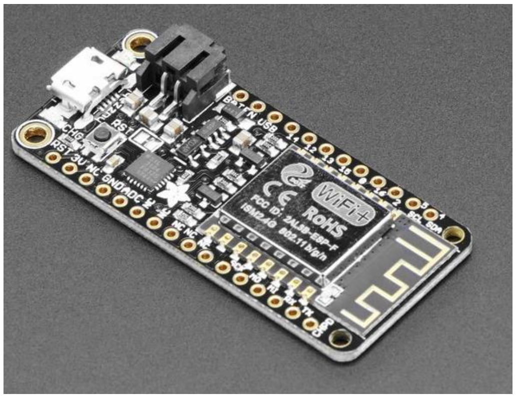
2 Implementation



Our overall implementation is shown in the above diagram. The Huzzah with the sensors would send the sensor data to the AWS server to be compared against the optimal data and then uploaded to a visual data representation. If it was determined that the plant needed water or light was then the AWS server would send another signal to the Huzzah controlling the water valve or light to be turned on.

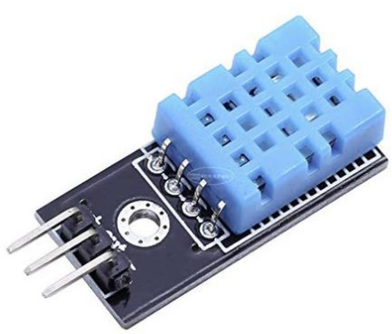
2.1 Hardware

2.1.1 Adafruit Feather Huzzah ESP8266



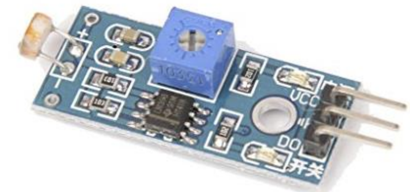
The Adafruit Feather Huzzah board hosts and ESP8266 WiFi card for the purpose of wireless communication. There are analog and digital read and write pins allowing for easy connection and usage of sensors or relays. This will be the backbone of the hardware system collecting information, distributing the necessary information, and then acting on that information through adjusting the environment of the household plant.

2.1.2 DHT Sensor



Sensor for the purpose of detecting the temperature and humidity for digital input. Used for monitoring the plants temperature and if necessary, humidity, to ensure proper control of environment for best possible growth of desired plant.

2.1.3 Digital Photoresistor Sensor

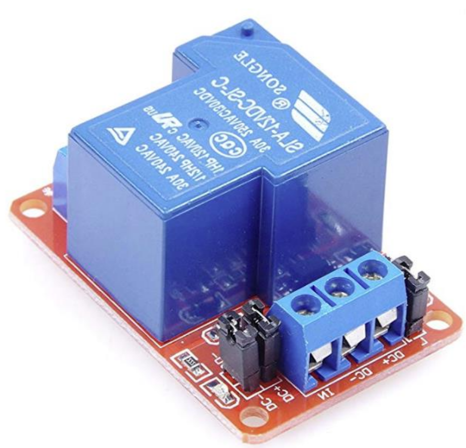


This sensor gives binary output on whether it detects light or not. Resistance, and thus tolerance, of sensor can be easily modified by a user through turning the screw visible on the board to accommodate for different lighting scenarios.

2.1.4 Capacitive Soil Moisture Sensor

Capacitive soil moisture sensor for the purpose of monitoring ground moisture and ensuring plants are provided adequate water for growth.

2.1.5 Relay Module



Given input and power from a board the relay will complete the circuit for the automatic valve allowing for watering of the plant. This relay is required because the Feather Huzzah board only supplies 3.3 volts where the valve requires 12 volts to operate.

2.1.6 12 Volt Battery Pack

Battery pack used to power the electric water valve at the necessary voltage.

2.1.7 Electric Water Valve

Water valve that is controlled through electric currents. The valve is closed normally, but when a current is provided the valve opens and allows water to flow through.

2.1.8 Outlet Power Relay

This relay outlet allows for relay control of an outlet and thus for control of any light source connected to that outlet. This mechanism is for the purpose of providing additional light to the plant as seen necessary.

2.2 Software

2.2.1 AWS RDS

AWS RDS is a cloud service. This meant that it only needed to run and did not need to be managed. It was primarily used only to store the data about the plant received from the Huzzah. The data was also used to be compared against the optimal data table stored in the RDS as well. The data after being compared would then send another signal to the Huzzah about whether it needed to turn on the lamp or water valve.

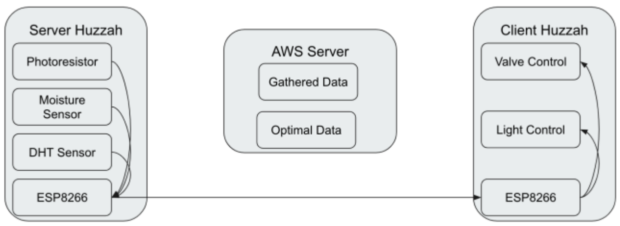
	GREENHOUSE_ID	TIMES	MOISTURE	TEMPERTURE
1	1	30-JAN-19 10.00.00.000000000 AM	400	60
2	2	30-JAN-19 11.00.00.000000000 AM	390	65
3	3	30-JAN-19 12.00.00.000000000 PM	380	70

	OPTIMAL_ID	OPT_MOISTURE	OPT_TEMPERTURE
1	1	350	70

2.2.2 Arduino IDE

The Feather boards are programmed using Arduino IDE 1.8.9. Since the board we are using is not a built in Arduino supported board we need to add the board through the additional boards manager and install necessary ESP8266 libraries on the Arduino IDE to make use of the WiFi capabilities of the board.

3. Evaluation



The proposed implementation did not go as plan. The end result implementation ended up looking like the figure above. We could not figure a way to get the server Huzzah to send the information from the sensor to the AWS server. Instead we sent the information form the server Huzzah directly to the client Huzzah.

4. Conclusion

In this project we implemented an autonomous reactive system for monitoring and adjusting the environment for a greenhouse or personal plant. We were able to achieve this result through implementation of IoT concepts and automation of physical processes through software and hardware.

For future works, a database to store trends in environmental data of a plant to allow for predictions of when to adjust environment can help further improve performance and care of plants. Other areas of improvement include multiple different sensors for monitoring large seedbeds or simultaneous control of multiple different seedbeds with different required environments.

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