Final Project - Precision agriculture

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Abstract

The goal of this project is to implement a smart agriculture gadget with a Fishino Piranha board. It can measure the environmental conditions of a particular plant, plantation or greenhouse, upload them to a remote database and control actuators to maintain the environmental conditions in the desired range.
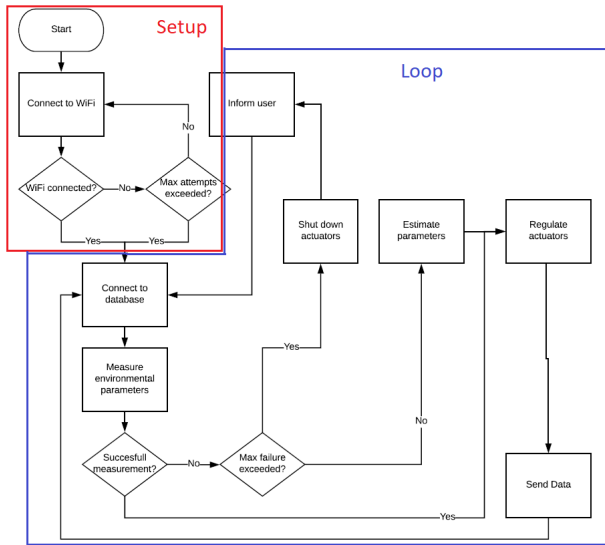
Operation

Setup

- Connect to WiFi and database
- Define parameters

Loop

- Acquire data
- Estimate and control
- Send data

Algorithm

Hardware used

- Fishino Piranha board
- DHT11 temperature and humidity sensor
- Proto board
- Flat cables
- Computer [1]
- 5V USB power source
- USB to micro USB cable (also used for flashing the device)
- LEDs
- 100Ω resistors

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[1]used to flash the device, store the database and visualize the data. In a real deployment, these three functions would be carried out by different entities.
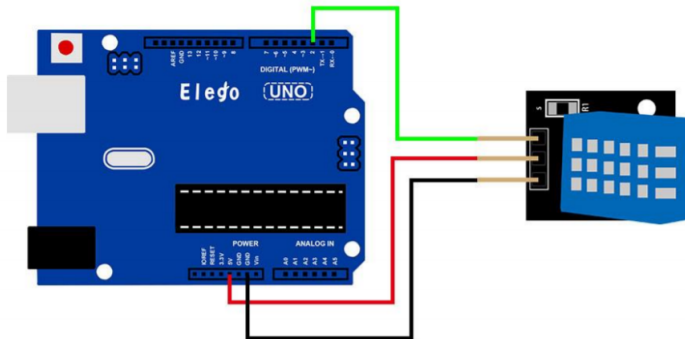
Hardware

Picture of the device

Flashing the device

1. Install Fishino drivers and libraries
2. Connect to computer with USB to micro USB cable
3. Press reset button until LED start blinking
4. Upload the code via Arduino IDE

Sensors

- We use the DHT11 humidity and temperature sensor
- 16 bit resolution
- Serial communicatios
- Common V_{cc} and ground

Sensors

Estimation

The last few samples are saved and a moving average prediction is made. If a sample is lost the prediction is used in its place

Control

- *on/off control*
- Estimated value used if measurement fails
- System shuts down and informs user if sensors are lost

Storage

- Open source time-series database system InfluxData
- Database in the same network as the end device
- Packets sent through HTTP requests

Storage

HTTP format

Visualization

- Grafana software provides a solution for visualization
- Integrated with InfluxData
- As well as data, errors are recorded

Visualization

Grafana screenshot

Conclusions

1. The project was successful
2. Control algorithm and actuators can be easily modified
3. InfluxData, grafana, Arduino IDE, Fishino libraries provide a great deal of help

Future work

1. Specific, more complex control algorithms
2. Exploration of different wireless protocols
3. Battery optimization