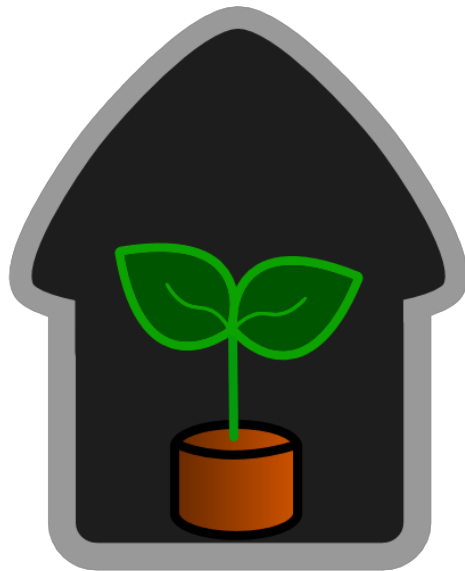# growth

Pablo Caro Martin - 0404489
Masoumeh Khaksari - 0392559
Negin Banaeianjahromi - 0392520
Juan Antonio Aldea Armenteros - 0404450

Project introduction, motivation

During the past decades, human has needed a higher performance in agricultural production, for which more efficient techniques has been researched. This is the main reason for people to started to create greenhouses. Furthermore, having greenhouses makes possibility to have fresh vegetables all year, especially during winter. Producing different kinds of plants leads to running a more productive business and to make higher profits. In addition, depending on the area or country with a greenhouse it is possible to grow tropical plants that could not be found naturally in the biozone.

A greenhouse can also offer an advantage when an amateur gardener living in a big city wants to grow delicate plants. Often, the air quality in towns is poor, and the climatological conditions are not adequate for some kinds of cultivations. Again, a greenhouse could be the solution.

Although greenhouses provide different benefits for the humans, greenhouses require a lot of attention and gardeners always worry about leaving their greenhouses when they are away on weekends or vacations.

Proposed monitoring system helps people to monitor their greenhouses environment any time they want. The most important factors for the quality and the quantity of plants are temperature, humidity, light which should be controlled all the time. This system maintains the right balance of these factors to take care of growing conditions. Monitoring the greenhouse environment gives information to understand the factors which affect plants growth. This helps researchers to receive useful information about the growth condition of plants.

The monitoring system improves the productivity and enables growers to save energy by optimizing the right amount of water and nutrients to the plants. Furthermore, any amateur gardener without enough knowledge and experience can use this system to maintain their greenhouse with the right balance of temperature, humidity, light and soil moisture.

This system provides real-time reports and growers can receive an update on their greenhouse conditions anytime, as well as historic graphs concerning the data from the last day, week or month.

Functionality and features

- ○ Greenhouse state stored in a cloud database.
- ○ REST API for querying database, to be compatible with all kinds of devices.
- ○ Desktop client displays greenhouse current state, as well as historical data charts and values.
- ○ Desktop client also has some placeholders for controlling actuators (fans, heaters, watering system, windows, humidifiers...)

In this system, the Microsoft Azure –the Microsoft cloud computing platform– is used to store the data.

As client application example, a Metro based desktop application has been implemented.

High points of your technical design

There are different technical points can be considered in this system. First, the storage could be local or cloud based. Using local storage we can be the holder of our own data and it is free of charge. However, using a cloud service, besides providing high availability and high scalability, gives the chance to have a simple sensor network in our greenhouse, without the worries of serving data from there.

Second point is the REST API, by using it any programming language capable of sending HTTP requests could interact with the server, so users could develop any client for smartphone, tablet, web and desktop. This increases market reach of the application and helps to create an active user community.

Also, in the case of the small devices located in the greenhouse, where a big application would not be acceptable, this API gives them a really easy way to upload data.

Reflection

This work system gives a team the chance of thinking a complete project to develop, and the resources to apply new technologies. In this case, a project using the "cloud" idea seemed attractive and useful.

After a brief brainstorming, a monitoring system was decided to be the most attractive idea, and the greenhouse concept fit in our requisites.

Concerning the work system, the tasks were divided at the beginning of the project, so every part knew exactly what should be done. Of course, collaboration between each part, as well as between other groups, was beneficial for the group learning.

Conclusion

To conclude, in this Code Camp, we had almost one week for implementing our ideas, 21st to 25th of January 2013. In the beginning of the process on Friday 18th, we became familiar with the environment by having an introduction lecture for ASP.Net and Metro UI desing. At the end of this day and the beginning of the next day we came up with the idea of what we wanted to implement. The remaining days were allocated for coding and implementations.

At the end we had a complete project with the following features:
- Greenhouse state stored in a cloud database
- REST API for querying database
- Metro UI Desktop client
    - Displays greenhouse historical data charts and current state values of the monitored environmental conditions.
    - Has some placeholders for controlling actuators

The features that we have decided to add next are as follow:

- Authentication, authorization and accounting (AAA Protocol): It refers to a security architecture for distributed systems, which enables control over which users are allowed access to which services, and how much of the resources they have used [1].
- Push notifications.
- Find a more efficient way to draw charts on the clients (currently Google Charts is being used)
- Greenhouse side of the application

- ○ Sensors needed to continue development.
  - ○ Actuators needed to continue development.
- Implement an Industrial control system (ICS) to provide automatic management of the greenhouse.
- SCADA interface: Supervisory control And Data Acquisition is a type of interface showing a simplification of an industrial process that shows the values of the process variables.
- Functionality to load & save the desired values of the environmental conditions inside greenhouse.
  - ○ App could have example profiles for some common plants.
  - ○ Users can share their configuration for a specific plant
  - ○ This feature allow users to share their configurations which helps to create an active community of user.
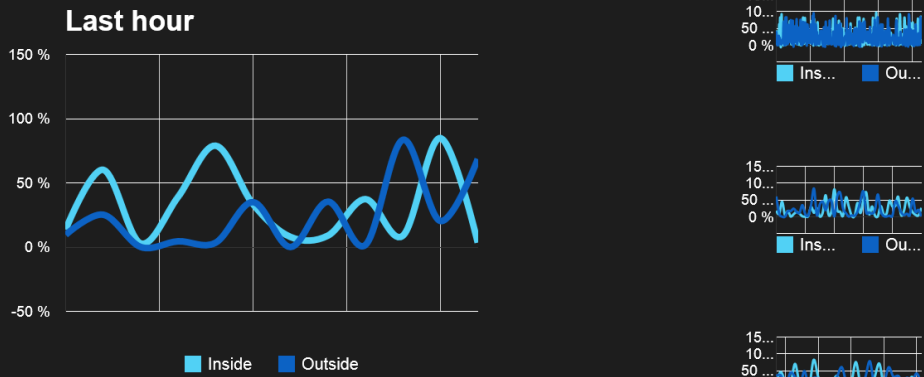
Apendix: Desktop application screenshots
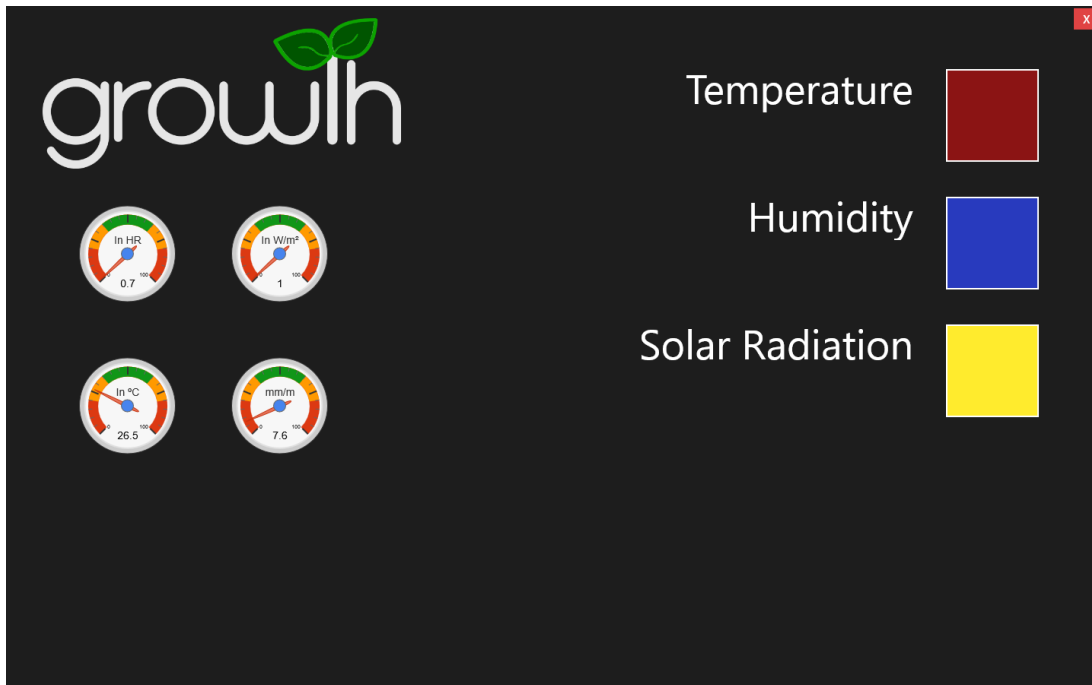
Main menu
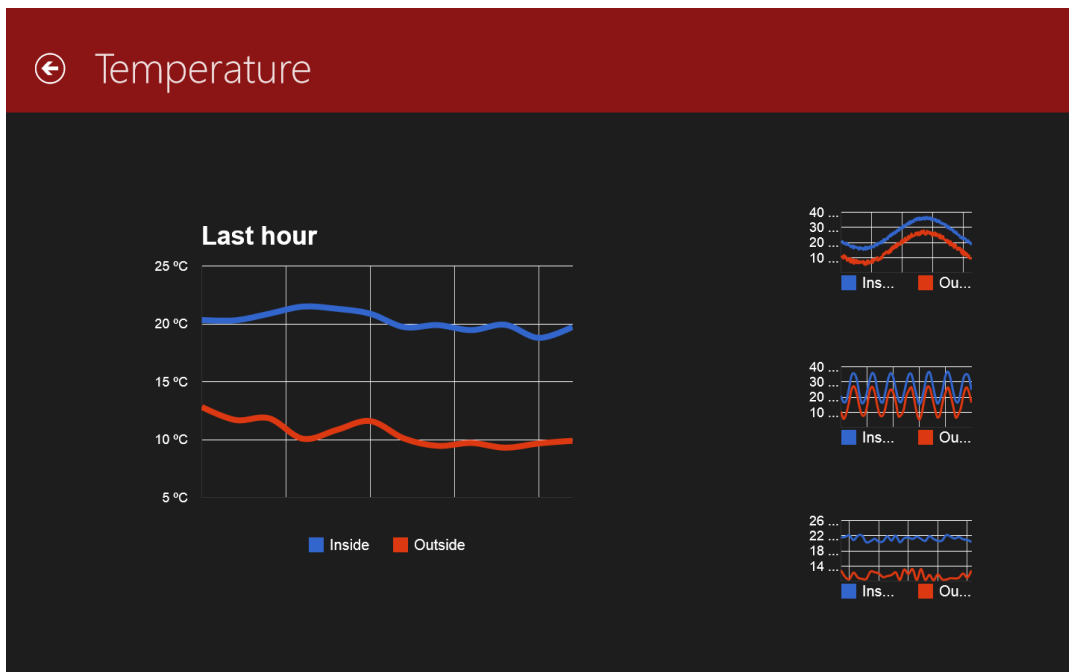
Temperature historical data

Humidity Historical data

Solar radiation historical data

Actuators manual control