SUP'COM
Ecole Supérieure des Communications de Tunis

Scope Statement
Smart Greenhouse

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Academic year : 2022/2023

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I. Concept of the project

1.Context

The worldwide farming sector has been put under great strain as a result of climate change, decreasing resources, and increasing populations. As unpredictability rises, growers are increasingly using cutting-edge technologies to improve production efficiency and crop resilience. In agriculture, the Internet of Things (IoT) is more prevalent than ever before, and smart greenhouses are a great example.
It is a task of monitoring the climatic conditions permanently in a greenhouse, to detect variations and to implement corrective action to maintain optimum conditions for plant growth.In our work, we propose to design a smart solution for greenhouses called"Smart Greenhouse'" to ensure optimal productivity.

2.Problematic

The greenhouse, an approach to urban agriculture, offers farmers the opportunity to provide optimal growing conditions by providing a controlled environment based on growing requirements. However, many farmers fail to obtain good profits and the desired yield of crops in the greenhouse, because they cannot monitor and effectively control important factors such as light, air, temperature,etc., which determine plant growth and productivity.

3. Ambitions

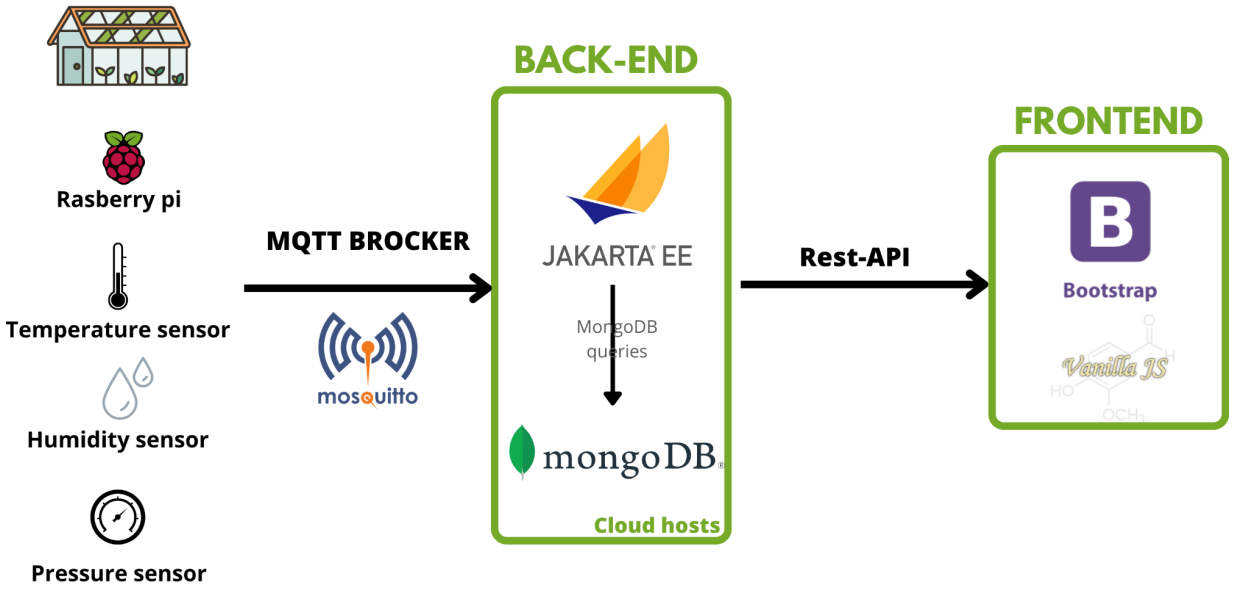
-Efficient control of temperature, humidity and pressure within each greenhouse by implementing effective solutions for ventilation and shading.
- Secure the greenhouse door in case of violation with an alarm . Also an alert will be sent to the user (farmer) through a mobile application .
-Irrigation in relation to the type of plants.

4.Clients

-The potential market: the Tunisian agricultural market.
-The profile of the target clientele: farmers

5. Architecture

This smart greenhouse irrigation system is one of the sensor-based systems that can work comfortably and friendly in agriculture in every greenhouse. He contains the different types of sensors for different potentials such as: sensor of atmospheric pressure, soil moisture sensor and soil temperature sensor.
Our architecture takes the following model described below:



6. Objectifs

Our SmartGreenhouse solution offers advanced microclimate control and optimization energy.
Growers can monitor and control the parameters mentioned below to ensure a better growth rate of the crop:
- Pressure management within the greenhouse
- Temperature acquisition
- Soil moisture management
- Secure the greenhouse door in case of violation with an alarm . Also an alert will be sent to the user (farmer) through a mobile application .

So growers can monitor the following parameters to understand the plant growth cycle and take proactive action by receiving alerts if any of the factors are affected.

7.Benefits of our solution :

-Ensure greenhouse security (alarm , alert) to protect against crop theft.
-Create the right environment for better performance with Smart Greenhouse, farmers can adapt an environment for their crops that provides a climate-smart and nutrition-sensitive atmosphere for increased crop quality.
-Monitor, control and detect plant growth
Our Smart Greenhouse solution will allow growers to monitor their parameters essential for healthy crop growth, to send alerts in case of problems and to manage everything remotely on any device.

8.Limits

The routing of data from different greenhouses always goes through the cloud, which strongly depends on the Internet network used. Poor internet speed can result in poor monitoring of our greenhouse parameters.
We necessarily need a high-performance network allowing the transfer of data with a negligible delay time to ensure the proper functioning of our solution.

II. Technological choices

1. Server side :

MongoDB : MongoDB Atlas is the cloud-based global database for modern applications. It's distributed and secure by default, and available as a fully managed service on AWS, Azure, and Google Cloud.

Mosquitto -MQTT Broker : Mosquitto is an Open Source MQTT server (Broker) that facilitates communication between connected objects (M2M).

Flogo: manages data collected by sensors based on specific events.

2.Middleware :

JakartaEE : is a mature, Java-based framework that helps developers move towards using modern technologies while still leveraging the existing Jakarta EE code. It is primarily used for creating APIs that enable communication between different applications.
Wildfly : formerly JBoss Application Server or JBoss, is a Free Java EE application server written in Java.

3.Client side:

Bootstrap: bootstrap is a free and open-source CSS framework directed at responsive, mobile-first front-end web development.

VanillaJs: Vanilla JS is a fast, lightweight, cross-platform framework for building incredible, powerful JavaScript applications.

4.IOT side:

Card used:

- Raspberry Pi:

The Raspberry Pi 4 is a nanocomputer that comes in the form of a processor board. It can plug directly into a screen or monitor. The Raspberry Pi 4 has all the connectors of a standard size desktop PC. Ever more powerful, this fourth generation allows you to browse the Internet, watch 4K videos, do word processing, and even play some video games.

Required Sensors :

- Pressure sensor.
- Humidity sensor.
- Temperature sensor.

Actuators :

- Alarm
- Irrigation actuator
- Ventilator

III. Business Model

4P Marketing Matrix

Product Policy:

Our Product will be the center of our Marketing strategy.

Brand: “Smart Greenhouse” solution that combines two hardware and software parts that summarizes in a hybrid application.

Product related services:

- After-Sales Service.
- Daily updates, new features and improvements.
- Guarantees of up to 3 years.

Features: Diversification and variety in terms of features, options, design..

Pricing policy: The price is at the heart of the positioning and the key element of the communication.
The policy followed is the skimming policy following the absence of concrete competition in Tunisia. The price of the solution depends on the functionalities that the customer wants to implement in his greenhouse.
The commercial discount policy:
● Discounts and promotions will take place if there are more than 3 features to implement.
● Payment terms vary from bank transfer or online payment.
● Exceptional discounts granted to customers due to quality problem
or non-compliance Payment methods vary from bank transfer or online payment.

Distribution policy: The distribution and the choice of its channel conditions the visibility and
product accessibility.
Distribution channels: Delivery directly to our farmers.

Communication Policy: We offer all advertising and promotional techniques
intended to support a product.
● Offline advertising measures: television, radio, newspapers, magazines, posters, etc.
● Personal communication: Exchanges with the client face to face.(the most recommended) .
● Sales: Canvassing, Demonstration, Participation in exhibitions and fairs...
● Advertising: radio, press, newspapers, posters, brochures, brochures,
● Public Relations: press releases and press kits,

IV. Deliverables

● Design book: This document presents in a detailed and structured manner the specifications, the services to be rendered, the constraints of this Solution as well as the architectural design and the detailed design.
● Executables and Sources: All the instructions and files in a Github directory containing the code for the IoT solution and the mobile application developed.
● Technical documentation: All of the libraries and technologies used in the development of this solution as well as the references used.
● Demonstration video: A video in mp4 format that contains a demonstration of the proposed solution.

V. Constraints

Methodology of work:

We will work with Extreme Programming (XP) which is a software development framework agile which aims to produce better quality software, XP is the most specific of the agile frameworks regarding appropriate engineering practices for the development of software.
The principles of the XP method are not new since they are those of agile methods. The difference and the originality lie in the fact that they are taken to the extreme.
The XP method is based on:
● Strong responsiveness to changing customer needs
● Teamwork
● The quality of the work provided
● The quality of the tests carried out as soon as possible

Time constraint

9 weeks will not be enough to complete the development of this solution
with all the necessary specifications and get a stable version of the application.

Hidden defects

A robust solution must contain unit tests to ensure the perfect functioning of the application, we can then obtain hidden defects in the developed solution if we cannot cover all possible scenarios with unit tests.

Lack of experience

Due to the lack of experience of team members, mistakes can be made in estimating the time needed for development tasks.

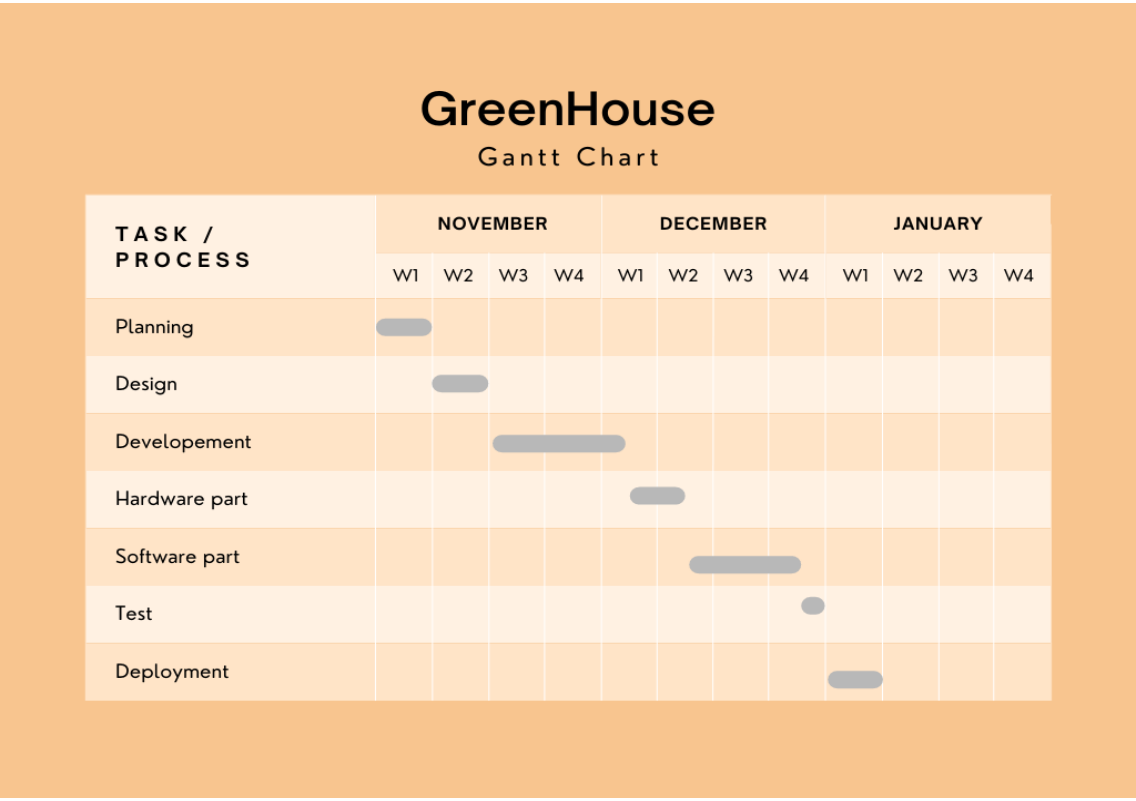
GANTT Chart

The Gantt method consists in determining the best way to position the various project tasks to be carried out, over a determined period, according to:

-Durations of each task

- Anteriority constraints existing between the different tasks
- Deadlines to be met
- Processing capabilities

The development of our solution will be on 9 parts:



Gantt Chart