Theme no. 1

Title: Smart Garden

Team members:
Țiprigan Tiberiu
Ciobotariu Andrei

Content:

- **Short Introduction:**
    - A smart agriculture system is a technology-driven approach to agriculture that uses sensors, data analytics, and automation to optimize crop yields, reduce waste and improve sustainability. As we know, agriculture is the backbone of the global economy, providing food and other essential products. However, traditional farming practices face many challenges, such as climate change, water scarcity, soil degradation, and population growth. To address these issues, it's only rational to turn to technology to create Smart Agriculture systems that can increase efficiency, productivity and resilience.

1. **Applicability domains**
    a. **use-cases**:
        i. Weather monitoring: this involves monitoring the weather and temperature using sensors in order to do the irrigation process in an efficient and productive way.
            1. Based on the sensors to measure humidity and monitor the temperature and on a database, the system can predict weather forecasts such as an unfortunate hailstorm that would ruin crops or some mild rain that would cancel irrigation schedules.
        ii. Water management: water is a scarce resource in many parts of the world. This "Smart Garden" system can help farmers optimize their water use by providing real-time information on soil moisture levels, weather conditions, and crop water requirements.

iii. Pest Control: this is another important use case for smart agriculture systems. Pests such as insects, weeds and diseases can have a significant impact on crop yields , quality and profitability. Smart Garden can help farmers monitor and control pests in a more targeted and efficient manner in a number of ways: Pest Detection, Disease Management, Integrated pest management, Precision Spraying, Weed Control. This can reduce the use of chemicals, increase crop yields, and improve sustainability.

iv. Soil Analysis: Soil is a critical component of agricultural production, and it's health and quality can have a significant impact on crop yields, nutrient levels, and environmental sustainability. Smart Garden can help farmers analyze and improve soil quality in a more precise and efficient manner as follows: Soil Sampling, Soil Testing, Crop Management, Precision Farming, Soil Health Monitoring.

v. Automated Irrigation: Smart Garden can help farmers automate their irrigation systems and manage water usage more efficiently.

b. **one of the use-cases is chosen and the system is defined in details**;

i. Automated Irrigation: This is an important use case for a "Smart Garden" system. Irrigation is a critical aspect of agricultural production, and its efficiency and effectiveness can have a significant impact on crop yields, water usage, and environmental sustainability. Smart Garden can help farmers automate their irrigation systems and manage water usage more efficiently. Here are some specific ways that the "Smart Garden" system can improve automated irrigation:

1. Sensor-Based Irrigation: this system can use sensors to monitor soil moisture levels and weather conditions in real-time. By analyzing this data, the system can adjust the amount and timing of irrigation, delivering water only when it's necessary.
2. Irrigation Planning: this system can also help farmers plan their irrigation schedules in advance, taking into account factors such as soil type, crop type, and weather patterns. This can help farmers optimize their water usage and minimize waste.
3. Precision irrigation: this type of system can enable precision irrigation practices that involve applying water more precisely

and efficiently. For example, by using drip irrigation systems, farmers can deliver water directly to the roots of plants, reducing water waste and improving water use efficiency.

4. Water management: this system can also help to manage water more efficiently. By monitoring water usage in real-time and using machine learning algorithms, the system can identify areas when the water usage can be optimized, reducing waste and improving efficiency.
5. Automated Irrigation Control: this system can automate the control of irrigation systems, reducing the need for manual intervention. By using automated valves, pipes and pumps, the system can adjust the flow of water to different parts of a field based on real-time data , thus improving efficiency and reducing labor costs.

Conclusion: By implementing a system such as "Smart Garden" for automated irrigation, farmers can reduce water usage, increase crop yields, and improve sustainability of their operations. This can be significantly important in regions where water resources are scarce or where regulations are becoming stricter regarding the use of water in agriculture.

2. **System definition**:

a. **components that enter the system infrastructure**:

The components that make up a Smart Agriculture system infrastructure can vary depending on the specific use case and system design, but the common compoments can be :

i. Sensors: Sensors are a critical component of Smart Agriculture systems. They can be used to monitor a wide range of variables such as soil moisture, temperature, humidity, light intensity, air quality, and more. Sensors may be deployed in fields, greenhouses, and other agricultural settings to provide real-time data that can be used to optimize farming practices.
ii. Internet of Things (IoT) Devices: IoT devices such as gateways, controllers, and routers may be used to connect sensors and other components of the Smart Agriculture system to the internet. This allows the data collected by sensors to be transmitted to a central server or cloud-based platform where it can be analyzed and processed.
iii. Communication Networks: Communication networks are necessary for transmitting data between IoT devices and other components of the Smart Agriculture system. These networks may include cellular, Wi-Fi, or satellite networks depending on the location and requirements of the system.

iv. Cloud-Based Platforms: Cloud-based platforms are often used to store and process the data collected by Smart Agriculture systems. These platforms may use machine learning algorithms to analyze data and provide insights that can be used to optimize farming practices.
v. Software Applications: Software applications may be used to interface with Smart Agriculture systems and provide real-time monitoring, analytics, and control of the system. These applications may be web-based or mobile-based and can provide farmers with alerts and notifications related to crop health, soil conditions, irrigation needs, and more.
vi. Actuators: Actuators are devices that are used to control various components of the Smart Agriculture system, such as irrigation valves. These devices can be controlled remotely using the software applications, allowing farmers to optimize their farming practices without having to physically be present in the field.

b. **protocols used in communication processes**;

i. MQTT (Message Queuing Telemetry Transport): A lightweight protocol commonly used in IoT applications for efficient and reliable messaging between devices.
ii. Wi-Fi: A widely used wireless communication protocol that allows devices to connect to the internet and transmit data over short to medium distances.

c. **process automation**;

i. In a Smart Agriculture system, process automation can be achieved through the use of software applications and IoT devices that can be programmed to control the irrigation system and soil quality. By automating these processes, farmers can save time and reduce the risk of human error. The automation process can be triggered by sensor data or pre-set schedules, and the results can be monitored in real-time through software applications

d. **estimated costs**;

- The cost of a Smart Agriculture system can vary widely depending on several factors:
  - System complexity
  - Number of sensors
  - IoT devices
  - Size of the garden
  - Etc.
- However, here are some estimated costs for the components of a basic Smart Agriculture system:
  i. Sensors: Depending on the type of sensor, prices can be between: costs and the quantity needed, costs can range from tens or even hundreds of LEI.
  ii. IoT Devices: Costs for IoT devices such as gateways, controllers, and routers varies between 200 LEI to 2000 LEI per device.
  iii. Communication Networks: The cost of communication networks such as cellular Wi-Fi, or satellite networks will depend on the service provider and the amount of data being transmitted. Costs can range from a few LEI (50-100) to several hundreds of RON per month.

iv. Cloud-Based Platforms: Cloud-based platforms may charge a monthly fee per user or per device connected to the platform. Costs can range from a few LEI (50-100) to hundreds of RON per month.
v. Software Applications: Costs for software applications can vary widely, depending on the specific features and functionality required. Some applications may be free, while others may charge a monthly or annual fee per user.

- In conclusion, a Smart Garden type system contains many more elements than we listed, and the final price I could say is close to 50,000 euros, maybe more.