Advanced Green House Monitoring and Controlling System

Project Team

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1. Use cases Identified:

The system has 10 main functionalities. Start equipment, connecting equipment, choose connections (i.e.) tower or Wi-Fi, control equipment, Data Recording and filtering, facilities control and notifications of alarm messages, fingerprint scanning, Data match, Capture frames and detect face count. The main actor who interact with the system Greenhouse owners, Employee, camera, Arduino, sensors (Temp, humidity, soil moisture,co2,LDH).

2. Use Case Documentation

Use Case ID	1
Use Case Name	Start equipment
Actors Involved	Greenhouse owner
Description	User must have corresponding application to access the greenhouse monitoring system. Also all the equipment are well connected to the microprocessor to start the system.
Pre-Condition	User must have the corresponding application installed.
Main Flow	Start equipment functionality where, the admin opens the Green house monitoring and controlling application in his mobile to monitor and control the appliances of Green house.
Post Condition	Equipment started.

Use Case ID	2
Use Case Name	Connecting equipment
Actors Involved	Arduino
Description	The Bluetooth module and the ESP8266 module in the system in powered ON.
Pre-Condition	Pin connections should be done already.
Main Flow	The user should open the app and connection is established by clicking the connect option in the application menu.
Post Condition	Connection established successfully.

Use Case ID	3
Use Case Name	Choose connection
Actors Involved	Greenhouse owner
Description	The system has the ability to have choice of using Bluetooth or Wi-Fi.
Pre-Condition	The Bluetooth module and the ESP8266 module in the system in powered ON.
Main Flow	The Greenhouse owner can choose the connection mode. If it is Bluetooth connection, the user can pair the devices.
Post Condition	After successful connection the user (Greenhouse owner) can control the equipment.

Use Case ID	4
Use Case Name	Control equipment
Actors Involved	Greenhouse owner, Arduino
Description	The user can control the appliances through the app. The Arduino (microcontroller) controls the equipment.
Pre-Condition	User must have the application pre-installed and all the connections have been made already. The microcontroller(Arduino UNO) should be uploaded with sketches(codes).
Main Flow	User must select the needed option in the application to control the greenhouse appliances.
Post Condition	The changes are made in the greenhouse and the notification is sent to the user(Greenhouse Owner).

Use Case ID	5
Use Case Name	Data Recording and filtering
Actors Involved	Greenhouse owner, sensors
Description	Sensors carry out data abstractions in real time.
Pre-Condition	The sensors record the atmospheric values.
Main Flow	Data recording functionality is where the Sensors carry out data abstraction in real time. The sensors record temperature, light, humidity and soil ph. The values are converted from analog to digital values.
Post Condition	The values are converted from analog to digital signals.

| Use Case ID	6
Use Case Name	Context-aware service
Actors Involved	Greenhouse owner
Description	Context - aware service is a function that specifies numerical values which is set as the threshold for certain data recorded such as temperature or light.
Pre-Condition	The Threshold value is pre-defined.
Main Flow	Specifies numerical values which is set as the threshold for certain data recorded such as temperature or light.
Post Condition	The actuators control the greenhouse.

Use Case ID	7
Use Case Name	Event Processing
Actors Involved	Greenhouse owner
Description	Event processing service functionality involves having IOT analytics where the greenhouse Owner can view the trends of the environmental parameters.
Pre-Condition	The sensor should gather the environmental details.
Main Flow	Event processing service functionality involves having IOT analytics where the greenhouse Owner can view the trends of the environmental parameters.
Post Condition	Will receive e-mail notifications when the parameters surpass the set threshold.

Use Case ID	8
Use Case Name	Fingerprint Scanner
Actors Involved	Employees
Description	Scans the employees fingerprint who enters the green house.
Pre-Condition	Employee fingerprint should be stored in the database.
Main Flow	The fingerprint is scanned. if the fingerprint is matched with the existing one, then the servo motor is turned on and the gate gets open for the employee.
Post Condition	Door should be accessed as per constraints.

Use Case ID	9
Use Case Name	Capturing Frame
Actors Involved	camera
Description	Capture frames is the functionality which involves camera for detecting the number of people entering the Greenhouse.
Pre-Condition	The camera should be placed at the door.
Main Flow	The camera captures the image in RGB and convert the image into gray scale and forms the boundary box.
Post Condition	The image is captured in camera.

Use Case ID	10
Use Case Name	Detect count
Actors Involved	Greenhouse owner
Description	Count details sent to the owner.
Pre-Condition	The count limit should be pre-defined.
Main Flow	computes the current entry of the people inside the Green house and the information viewed by the greenhouse owner.
Post Condition	The door is accessed.

3. <u>Use case diagram :</u>
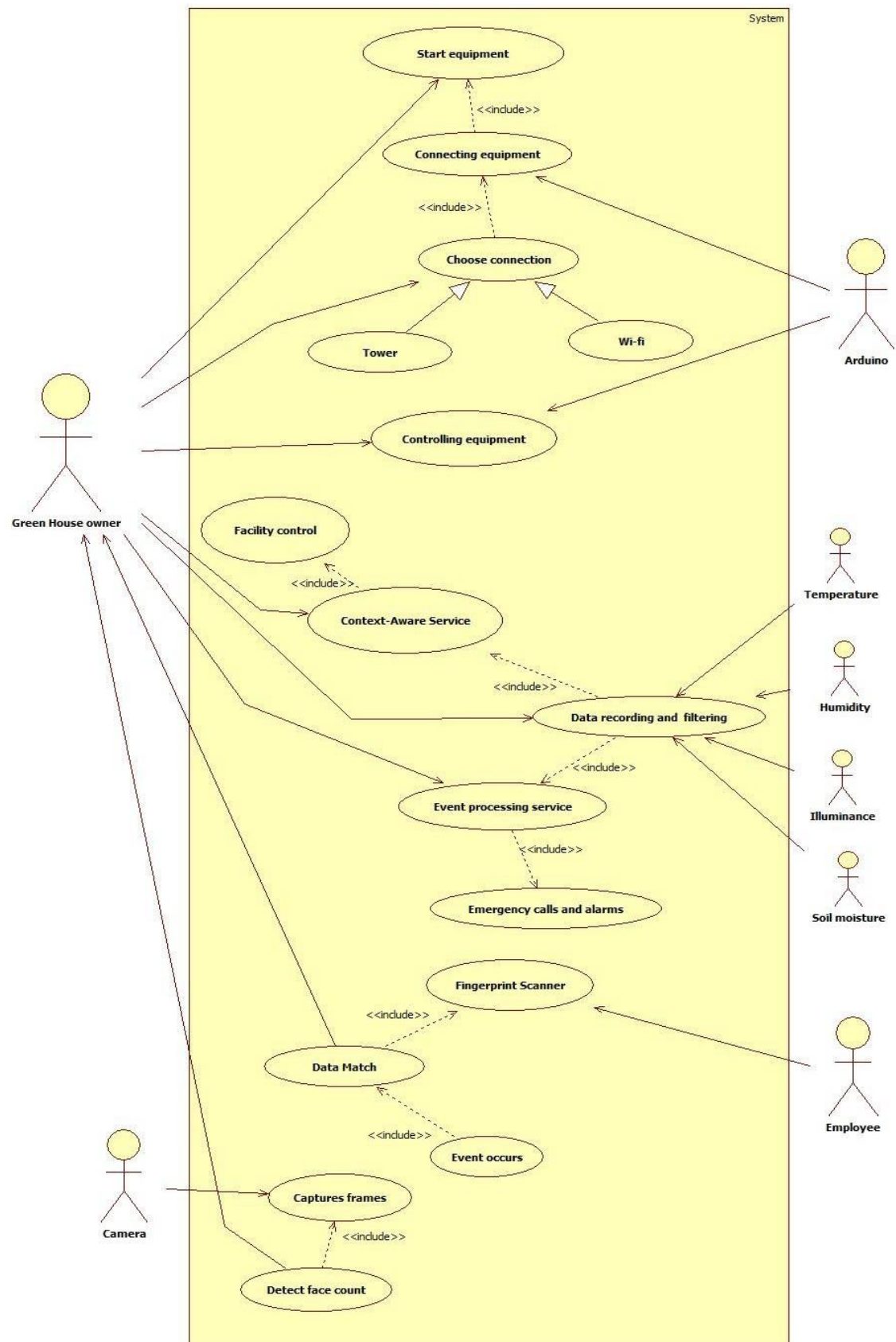
Use cases description:

- Start equipment functionality where, the admin opens the Green hour monitoring and controlling application in his mobile to monitor and control the appliances of Green house.

- The Bluetooth module and the ESP8266 module in the system in powered, on through which the connection is established. The Arduino Uno board is used to connect the appliances with the system.

- The system has the ability to have the choice of using Bluetooth or Wi-Fi.

- After the connection has been established, the user can control the appliances of greenhouse like fan can be turned ON / OFF so as Air cooler, light and the user can control the doors of the Greenhouse through phone or tablet also the smart sprinkler can be accessed. The Arduino uno(microcontroller) is powered on which is considered as the heart of the system.

- The changes which is done by the user through the application is received by the microcontroller .The microcontroller transmits the signal to activate the corresponding appliances.

- Data recording functionality is where the Sensors carry out data abstraction in real time. The sensors record temperature, light, humidity and soil ph. The values are converted from analog to digital values.

- Context - aware service is a function that specifies numerical values which is set as the threshold for certain data recorded such as temperature or light. The function activates the respective actuations which control the greenhouse optimum conditions.

- Event processing service functionality involves having IOT analytics where the greenhouse Owner can view the trends of the environmental parameters. In addition, they also receive e-mail notifications when the parameters surpass the set threshold.

- A biometric fingerprint scanner, is a device for security system, which scans the employees fingerprint who enters the green house. The scanned fingerprint is compared with the fingerprint which is stored in the database if the fingerprint is matched with the existing one, then the servo motor is turned on and the gate gets open for the employee , if the fingerprint does matched the existing one it displays the warning message ,if the fingerprint does not matched for more than three times the camera captures the person and sends the photo along with the fingerprint to the greenhouse owner as a alert message and the door does not open.

- Capture frames is the functionality which involves camera for detecting the number of people entering the Greenhouse. The camera captures the image in RGB and convert the image into gray scale and forms the boundary box. By counting the boundary box the number of people entering the green house will be detected.

- The detected count is compared with the count of the person / people inside the greenhouse and computes the current entry of the people inside the Green house and the information viewed by the greenhouse owner.

4. Major assumptions and constraints

- It is assumed that the Arduino uno (microcontroller) is connected or powered up with the efficient battery and the code/sketch is fed into the Arduino board already.

- The ESP8266(wi-fi) and Bluetooth module in the system are powered on to establish the connection.

- It is assumed that the appliances to be controlled are connected with the micro controller.

- The threshold value for each sensor is already pre- defined in the Arduino uno sketch(code).The sensor senses the environmental condition, simultaneously checks with the pre-defined threshold value to automate the appliances.

- It is assumed that the employees of the greenhouse are already registered with their fingerprints attached with their profile database.

- To automatically open the greenhouse door for the employee, a condition is set (i.e.,) The fingerprint should match with the existing fingerprint in the employee profile database.

- The door should not be opened if the fingerprint does not match and the greenhouse owner should be notified with the alert message only if the scanner error count exceeds three times(error>=3).

- To allow the people inside the greenhouse, the limit (human entry limit) is already set.

- The number of people inside the greenhouse is detected and the current entry count is computed using the present count inside the greenhouse.

Based on these constraints and assumptions the system is drawn.