**DevOps for AIoT - System Requirements Specification (SRS)**

**Automated Gardening System**

Class: DCPE/FT/2A/04

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1. **Purpose**

**1.1. Intended Audience**

This SRS document describes the System Requirements and Software Design for an Automated Gardening System, and the target audience are System and Software Engineers working on the development of this project.

**1.2. Intended Use**

The SRS defines the overall System Architecture and Requirements as well as the Software Architecture and Design. This document also contains the definition of the System Requirements which shall be used as the input for System Test cases and Software Unit Test cases.

**1.3. Scope**

The Automated Gardening System will support the monitoring and control of a hydroponics system for optimal plant growth. The following parameters are monitored continuously:

* pH level of the solution ("Potentiometer" readings)
* Ambient Temperature ("Temperature" readings)
* Relative Humidity ("Humidity" readings)
* Ambient lighting intensity ("LDR" readings)
* EC level ("Moisture sensor" readings)

The automated hydroponics system will be a closed loop system where the simulated EC level ("Moisture sensor" readings) is constantly adjusted to maintain the pre-set optimal level.

* When the simulated EC level is equal to 0, additional nutrient solution will be dispensed into the hydroponics solution by activating a pump based on a servo motor.

The light intensity will also be controlled based on the measured ambient lighting intensity ("LDR" readings) to ensure that plants have optimal lighting at all times.

* When the ambient light intensity level is lower than or equal to 200, a LED (Acting as UV light) will be activated.

Ambient temperature ("Temperature" readings) in the hydroponics system is also maintained at a constant level as much as possible.

* When the ambient temperature is higher than 20, a DC motor (Acting as a fan) is activated to reduce the ambient temperature.

To visualise the data from the different sensors, a dashboard will also be implemented via web page.

**1.4.** **Acronyms and Definitions**

|  |  |
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| **Acronym** | **Definition** |
| SRS | System Requirements Specification |
| pH | Potential Hydrogen |
| EC | Electrical Conductivity |
| UV | Ultraviolet |
| DHT Sensor | Digital Humidity and Temperature Sensor |
| LDR | Light Dependent Resistor |
| LED | Light Emitting Diode |
| DC | Direct Current |
| IP | Internet Protocol |

**1.5. Parameters and Features**

|  |  |
| --- | --- |
| **Parameters and Features** | **Sensors used to simulate/test Parameters and Features** |
| pH level of the solution | Potentiometer |
| Ambient temperature | DHT sensor |
| Relative humidity | DHT sensor |
| Ambient lighting intensity | LDR |
| EC level | Moisture sensor |
| Nutrient solution pump | Servo motor |
| UV light | LED |
| Fan | DC motor |

1. **Overall System Description**

**2.1. Use Case Diagrams**

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**2.2. System Architecture**

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**2.3. Functional Requirements**

**2.3.1. Start Up and Monitor Parameters**

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| --- | --- |
| **REQ\_ID** | **Requirement** |
| REQ-01 | When the Automated Gardening System is first powered ON, the text below shall be displayed on the web page.  “System running” |
| REQ-02 | The Automated Gardening System shall be able to continuously simulate the measuring of the pH level of the solution using the potentiometer. The measured readings shall be labelled as "Potentiometer" readings. |
| REQ-03 | The Automated Gardening System shall be able to continuously measure the ambient temperature using the DHT sensor. The measured readings shall be labelled as "Temperature" readings. |
| REQ-04 | The Automated Gardening System shall be able to continuously measure the relative humidity using the DHT sensor. The measured readings shall be labelled as "Humidity" readings. |
| REQ-05 | The Automated Gardening System shall be able to continuously measure the ambient lighting intensity using the LDR. The measured readings shall be labelled as "LDR" readings. |
| REQ-06 | The Automated Gardening System shall be able to continuously simulate the measuring of the EC level of the solution using the moisture sensor. The measured readings shall be labelled as "Moisture sensor" readings. |

**2.3.2. Dispense Nutrients**

The automated hydroponics system maintains the simulated EC level (“Moisture sensor” readings) at the pre-set optimal level by dispensing additional nutrient solution into the hydroponics system. This ensures that the plants always have the optimal nutrient level.

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| **REQ\_ID** | **Requirement** |
| REQ-07 | From the Moisture sensor, if the "Moisture sensor" reading changes from 1 to 0 then the flowchart defined in Figure 1 would be implemented. |

A diagram of a flowchart

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REQ-10

REQ-09

REQ-08

Figure 1. Simulated EC Level Optimisation

**2.3.3. Turn On UV Light**

The automated hydroponics system maintains the ambient light intensity at the pre-set optimal level by activating the UV light (LED). This ensures that the plants always have the optimal ambient light intensity.

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| **REQ\_ID** | **Requirement** |
| REQ-11 | From the LDR, if the "LDR" reading is lower than or equal to 200 the flowchart defined in Figure 2 would be implemented. |

A diagram of a light source

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REQ-14

REQ-13

REQ-12

Figure 2. Light Intensity Level Optimisation

**2.3.4. Turn On Fan**

The automated hydroponics system maintains the ambient temperature at the pre-set optimal level by turning on the fan (DC motor). This ensures that the plants always have the optimal ambient temperature.

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| **REQ\_ID** | **Requirement** |
| REQ-15 | From the DHT sensor, if the "Temperature" reading is higher than 20 then the flowchart in Figure 3 would be implemented. |

A diagram of a temperature measurement

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REQ-18

REQ-17

REQ-16

Figure 3. Temperature Level Optimisation

**2.3.5. Real Time Data Visualisation**

The Automated Gardening System supports “Real Time Data Visualisation” to monitor and visualise the data from the sensors in REQ-02 to REQ-06 on a dashboard via a webpage.

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| **REQ\_ID** | **Requirement** |
| REQ-19 | The user shall be able to access the IP address of the Automated Gardening System to view a web page. |
| REQ-20 | The web page on the Automated Gardening System shall allow the user to  monitor the following:   * pH level of the solution ("Potentiometer" readings) * Ambient Temperature ("Temperature" readings) * Relative Humidity ("Humidity" readings) * Ambient lighting intensity ("LDR" readings) * EC level ("Moisture sensor" readings) |

**2.4. Non-Functional Requirements**

**2.4.1. Power**

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| **REQ\_ID** | **Requirement** |
| REQ-21 | The Automated Gardening System needs to be connected to a power supply to power all its components. |

**2.4.2. Internet Connection**

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| **REQ\_ID** | **Requirement** |
| REQ-22 | The Automated Gardening System needs internet connection to upload and visualise the data on the web page. |

1. **Software Architecture**

**3.1. Static Software Architecture**

The Software Architecture defines the various Software Components that are developed to realise the implementation of the system requirements.

**Application Layer**

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**Hardware Abstraction Layer (HAL)**

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