OFF-GRID SELF-SUSTAINING VERTICAL HYDROPONICS WATER MAINTENANCE USING SUPERVISED CLASSIFICATION ALGORITHM

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Novilyn D. Falcatan
Trisha Joy T. Lansigan
John Lorence G. Padua
Thedreine L. Panes
Japhet Elisha B. San Miguel

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INTRODUCTION

The Off-Grid Self-Sustaining Vertical Hydroponics System is designed to help grow lettuce in urban environments. The system was developed using a combination of Arduino for hardware control and Next.js, AWS IoT Core, and MongoDB for the software and database management. The application features user authentication (sign-up and log-in pages), a dashboard for users to interact, and an alert notification system. The study was limited to indoor hydroponic setups and did not incorporate advanced technologies for pest or disease detection. The study has the following specific objectives: Off-GRID SELF-SUSTAINING VERTICAL HYDROPONICS WATER MAINTENANCE. The expected benefits of this research include increased crop production, reduced resource consumption, and a more sustainable approach to agriculture based on hydroponics. The deliberate exclusion of camera systems was to focus on how machine learning algorithms could enhance the management of environmental factors in urban farming. The study contends that the pandemic serves as an opportunity to usher in a new era of gardening, combining modern technology with traditional systems.

METHOD

The system architecture works as follows: The Raspberry Pi collects sensor data from the hydroponics system, such as pH, nutrient concentrations, humidity, and temperature. The web application processes and visualizes the received sensor data, displaying real-time data and graphs. Users can interact with the system remotely, adjusting nutrient levels, configure system settings, and receiving notifications. The system is self-testing and calibration to monitor water pH and TDS conditions. It can also be used to set custom conditions using phosphate levels, pH levels, and T DS for dosage. The hydroponics system comprises two microcontrollers: an Arduino Mega for sensor inputs and outputs, and a Raspberry Pi 4 that employs a Machine Learning algorithm to process data from the Arduino. The system's hardware and software components are represented separately in the diagram. The Web application will display a ?Tolerable? and ?Low? level for phosphate levels. The study was bound to use several modeling tools as a path for the system?s requirements for its proper functionality. The system was designed to maintain the water?s health in a hydroponics plantation. It was also designed to monitor its core values such as temperature, humidity and to come up with an estimated profit for every harvest. The researchers gave an explanation and demonstrated how to use the system. The system is connected to the Web Application. It also provides tools for data analytics and visualization, allowing the user to gain insights into the performance of your hydroponic system. It is designed to incorporate an off-grid solar system. The study is divided into four sections: Design, Design, Development, Operation and Testing Procedure, and Evaluation and Valuation. The researchers divided them into two groups: Hydroponic and Off-GRID SELF-SUSTAINING VERTICAL HYDROPONICS. The system allows users to monitor the status of hydroponics plants and make informed decisions to make decisions about plant growth. Users should be able to interact with buttons to control devices on the hardware, such as activating a water pump or turning on the grow lights. . 3-4mL of phosphoric acid was dropped into 1L of distilled water. The Likert Scale presented in Table 8 was used to interpret the weighted mean ratings into verbal description. The. LikERT Scale was presented as a weighted mean of the weighted average of the ratings. The weighted mean was then translated into verbal descriptions. The verbal description was then converted into a written description. For the first time, the Lik Bert Scale was used in this study to assess the capability to detect phosphate levels.

RESULTS

The results on both parts of the evaluation sheet (Hardware System and Web Application) as seen on Table 11 and 12, both have ?Strongly Agree? interpretation. The Web Application obtained the highest mean rating under the criterion ?Functional Suitability? with 3.73 score Functional Appropriateness. The mean score for the Compatibility criterion has the lowest score 3.60 which shows that respondents selected interoperability as an area for improvement. Both the humidifier and the fan can be controlled via a web application, allowing precise regulation of moisture levels. The ?Reliability? criterion received the highest mean score (3.68) which implies that respondents evaluated the hardware system to be reliable and consistent. The sensors used are: Off-GRID SELF-SUSTAINING VERTICAL HYDROPONICS WATER MAINTENANCE 93, DHT11 Sensor (Humidity and Temperature) 108, Water Level Sensor 109. The system uses a machine learning algorithm for a machine-learning detection to track water levels. The k-NN algorithm is designed to be used in Hydroponic Garden Planting. The system has a ready slot for the installation or implementation of alternative power in case of a power outage like a Solar Panel and a Battery. It makes use of the Internet of Things (IoT) by combining the two essential hardware: the Arduino microcontroller and Raspberry Pi. The k-nn algorithm can be controlled via a Web application. It can also be used to test the accuracy of the algorithm. The system?s Phosphate Detection using Supervised Classification algorithm can accurately detect the phosphate levels in the water. The system can also be configured on the Web Application under some conditions (e.g. running head: OFF-GRID SELF-SUSTAINING VERTICAL HYDROPONICS WATER MAINTENANCE) The software set-up is a cross-platform that can be accessed to in Android, iOS, and Linux Operating Systems using the browser. This valve can be controlled via a web application, allowing for precise management of water flow. The study is limited to lettuce cultivation due to its relatively quick growth cycle. The system has three readily conditionals mainly for lettuce which can be activated by the user Water Level Sensor. The Grow Lights Installed in the Setup provide mist, ensuring optimal humidity for the plants. The project is comprised of Hardware and Software systems that are vital to afully functional system. The user can choose to edit his/her profile or log out of the application. The software has an overall accuracy of 97%

DISCUSSION

The results of the evaluation and testing procedure formed the basis for the following conclusions. The Web Application demonstrated its portability and reliability by illustrating how convenient it is to plant, monitor, and control your system remotely using a variety of devices. The online application has successfully implemented a feature that lets users personally set the conditions, providing customized control over the settings. By continuously monitoring and adjusting the water quality, the system can enhance the efficiency and productivity of hydroponic farming. The system was able to keep key water quality parameters such as pH levels, nutrient concentrations, electrical conductivity, and temperature within the designated optimal ranges required for healthy plant growth. The Web application successfully implemented a dashboard page that allows users to control the mixer pump and grow lights. By combining hydroponics and aquaponics, the system can further optimize resource efficiency and sustainability. The researchers highly recommend integrating an aquaponics system into the off-grid, self-sustaining vertical hydroponic setup.