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Conference Paper

Implementation of Smart Sensor Connected Hydroponic Shallot Seed (TSS) Planting Technology in Ketindan Village, Lawang Malang

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ABSTRACT

Hydroponics is a method or system of vegetable cultivation that does not require a large area of land. Therefore, hydroponics is one of the solutions to land limitations, and the products from hydroponics itself can be utilized by the community as materials that can be directly resold. One of the objectives of this community service activity is to provide a solution, namely a contribution from Higher Education institutions to teach people to start planting shallots from seeds so that they can provide their bulb vegetable needs independently. The location of the service is Ketindan Village, Lawang District, Malang Regency The stages of the activity include 1). Counseling to the community on hydroponic-based smart agriculture to plant shallots with seeds 2) hands-on practice by preparing quality-assured TSS seeds. TSS seeds are soaked overnight and then aerated. After that, the seeds are seeded first, for 10-14 days. Hydroponic preparation with net pots and nutrients, then the seeds are planted one by one in net pots Smart Farming, a technology-based smart agriculture method using a Smart Valve device connected to the Internet at the Ketindan Village office yard, Lawang Malang. The implementation of this activity has succeeded in significantly improving knowledge and skills. Overall, this activity succeeded in providing a positive impact on sustainable money, both in terms of technical, economic, and social aspects.

Keywords: Hydroponic, smart sensor, true shallot seeds

Introduction

The development of TSS production techniques is more directed to dryland agroecosystems in the highlands. The highlands (temperature 16-18C) are a suitable location to increase shallot flowering. Therefore, TSS as a seed source will be more optimal if produced in the highlands. The use of TSS for the production of seedling bulbs or consumption bulbs is not widely known by people in Indonesia. The open hydroponic installation is also the reason for the program. Planting with Smart Farming Smart Farming technology is equipped with a plastic roof. Thus, the plants can be protected from rainwater. "So the quality is maintained,". In addition, Smart Farming is also equipped with grow lights or growth-stimulating lights. The goal is to keep the plants growing at night so that the harvest time can be faster. This hydroponic shallot planting activity was carried out by the community (Malang City, located in Ketindan Village, Lawang District, Malang Regency. This activity promotes urban agriculture that utilizes a small area of land for hydroponic farming. The crop commodities can later be used for self-consumption or sale. To ensure the quality of shallots, which include vegetable commodities, there needs to be special attention to increasing plant productivity, one of which is by changing plants that were originally planted with shallot bulbs can also be planted with seeds (TSS). This activity is expected to be an alternative for the community to grow and encourage the economic activities of the local community.

The needs faced by the community of hydroponic lovers in Ketindan Village, Lawang District, Malang Regency are watering and providing nutrients that are not appropriate for vegetable commodities produced by hydroponic lovers. In recent years, open green land in urban areas has

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decreased to be utilized for vegetable cultivation, with the hydroponic method being a solution for urban residents in meeting their needs for vegetables, as well as a solution for people who want to garden but do not have enough space (Kurniawan & Lestari, 2020). The problems that occur in cultivation with the hydroponic method require time to monitor the problem so that the quality of vegetable yields is good periodically. A real-time clock (RTC) is an electronic device or module used to track time accurately and continuously in real-time. By combining hydroponic methods and Internet of Things (IoT) technology, it can create a transformation of indoor agriculture using Internet of Things technology in controlling the quality of water pH and room temperature in real time. The goal of smart agriculture is to increase productivity, reduce environmental impact, and increase efficiency and profitability (Prabowo et al., 2020).

Technological developments have entered all aspects of life, including the field of agriculture or agriculture which is utilized by farmers, plantation entrepreneurs to individuals. Hydroponics is a method of plant cultivation that utilizes water media instead of soil media so that in its application it prioritizes the need for plant nutrients. The hydroponic method is efficient in application in areas with limited green space such as urban areas (Bezas & Filippidou, 2023). However, the hope of the Abdimas UPN "Veteran" Jawa Timur Team is that the long term should not be forgotten just to pursue the short term. The use of application of this technology is expected to increase the community's request to further develop hydroponic systems in both leaf or tuber vegetables such as onions which are the ingredients of our daily needs, therefore the use of smart or smart agriculture can increase people's interest in being able to cultivate themselves to meet their needs and be able to do small-scale entrepreneurship to improve welfare which is the hope of the people of Ketindan Village, Lawang District, Malang Regency, to be able to increase agricultural production through hydroponic cultivation based on smart agriculture with organic nutrition, while maintaining our health with healthy vegetables. Therefore, one solution to overcome problems in hydroponic cultivation is to utilize Internet of Things (IoT) technology and use a Real-time Clock (RTC) to create a Smart Indoor Hydroponic Garden system that allows real-time control of water pH and room temperature using water quality sensors. This system can be utilized by urban individuals who do not have open land so that they can meet their daily vegetable needs directly from home.

Material and Methods

Activity location and participants

This activity was carried out in Ketindan Village, Lawang District, Malang Regency, East Java in 2024. The participants were the community around Ketindan Village, Lawang Subdistrict, Malang Regency, East Java.

Materials and tools

Materials used include TSS seeds, organic nutrients, net pots, rockwool, and water. Tools used include the internet, smart farming equipment (humidity, temperature, nutrient, and watering regulators), hydroponics, 20-liter plastic buckets with lids, plastic bottles, sterofoam, cups, gaying, gloves, raffia, galvalume for hydroponics, used gallons, 30 cm paralon pipes.

Activity implementation method

Socialization and counseling of activities to the Ketindan Community

The community service team from UPN "Veteran" Jawa Timur conducted socialization in the form of counseling on the application of smart farming in hydroponic cultivation of shallot plants from TSS seeds to the people of Ketindan Village, Lawang District, Malang Regency.

Seedling

TSS seeds were mixed with insecticide before sowing. Seeds that have been mixed with insecticides are sown on rockwool with a seedling hole depth of 1 cm and the planting distance used is 1.5 x 1.5 cm. The sown seeds were covered with soil. The seedbed was covered with straw and opened 7 days after sowing. The seeds will grow 4 - 5 days after sowing.

Smart farming system creation

The stages of making smart farming are divided into 2 processes, namely making hardware, and making software. In detail, each of these stages is explained as follows:

1. Hardware manufacturing is carried out in 3 stages, namely hardware assembly, hardware coding and hardware installation on planting media. Assembling the tool using soldering techniques on the socket connecting the microcontroller with the sensor, installing the cable connecting the microcontroller with the sensor and solenoid tap and ending with giving the casing to the hardware.
2. Software Development is done using the IoT Panel application which can be downloaded via Google Playstore. The steps for making software are setting the connection on the initial display of the IoT Panel to connect to the address of the IoT Panel.

Results and Discussion

The penalty for paying compensation is a consequence of deceits or corruption that endangers the country's finances or the country's economy. A Juridical means is needed to recover the losses, namely in the remittance of replacement money. Replacement money is an additional form of punishment (criminal) in corruption cases. In essence, both legally and doctrinally, judges are not required to always impose additional penalties.

Socialization of the community service activity program

The community service team conducted socialization activities on the application of smart farming technology in hydroponic cultivation of shallot plants from TSS seeds to the target audience, namely the people of Ketindan Village, Lawang District, Malang Regency, East Java. Approximately 20 people from Ketindan Village attended the socialization activity on the application of smart farming technology in hydroponic cultivation of shallot plants from TSS seeds which took place at the Ketindan Village office yard (Figure 1).

Figure 1. Socialization of the application of smart farming in hydroponic cultivation of shallot plants from TSS seeds to the community of Ketindan Village, Lawang District, Malang Regency

The community was explained about hydroponic cultivation of shallot plants from TSS seeds and the application of smart farming in its cultivation. The level of participation of the participants was very high. Participants actively asked questions and had opinions during the material presentation (Figure 2).

Figure 2. Q&A Session by the Presenters

Demonstration of Hydroponic Cultivation of Shallots from TSS Seeds

Hydroponic cultivation of shallot plants derived from TSS seeds begins with sowing TSS seeds on seedling beds. The seedling bed is made of wet rockwool placed on a tray with a spacing of 1.5 x 1.5 cm. The TSS seeds used were the Bauji variety. Seeds were put into seedling holes with a depth of 1 cm, each hole containing 1 seed. The seedbed was kept in a humid and closed place. At 7 days after sowing, the seeds were ready to be transferred to the hydroponic holes (Figure 3). Each hole was filled with one shallot plant. The nutrients used were AB-Mix solution containing macro and micro elements. Gradual nutrient delivery was done using a smart sensor. The gradual application of nutrients is done so that the plants can adapt gradually to the increasing concentration of nutrients given. Thus, plants can absorb nutrients in optimal amounts to support their growth process (Sucahyo et al., 2023).

Figure 3. Demonstration of hydroponic cultivation of shallots from TSS Seeds

Smart farming implementation

A control system for onion irrigation has been developed, utilizing microcontrollers such as the Arduino Atmega 2560 to manage the functions of the device (Figure 4). In this system, the Arduino Atmega 2560 is responsible for the watering and irrigation schedule for the red pepper garden, utilizing information about the soil moisture level obtained from the soil pH sensor. A water velocity sensor is used to monitor the amount of water flowing through the pump, providing the necessary data to regulate water delivery. Each pipe is equipped with a moisture sensor, which allows customized settings of the watering schedule according to the soil moisture conditions in each bed. Solenoid valves are installed at the base of the irrigation pipes to control the water flow, and the entire system can be set up and monitored via an ArduinoAtmega 2560. Hariono et al. (2024) said that the implementation of smart farming in hydroponic cultivation can minimize errors in fertilization and watering, and reduce the need for manual labor.

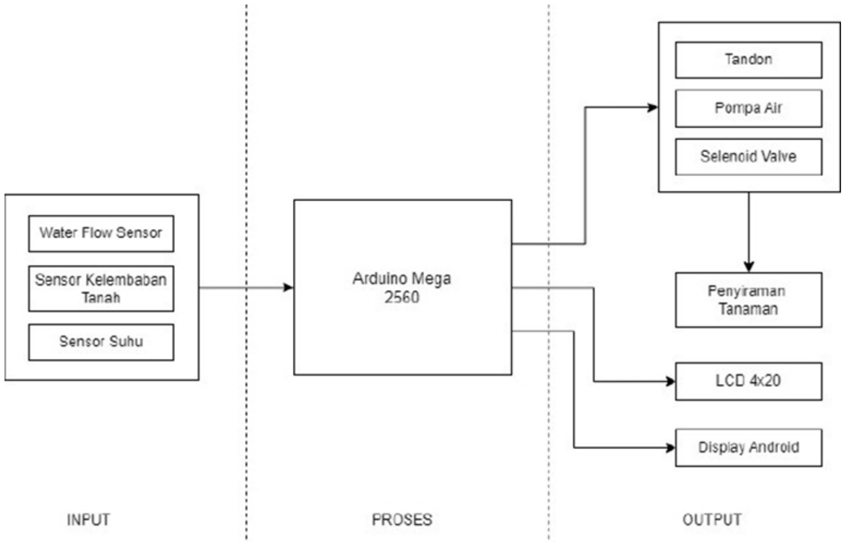

Figure 4. Demonstration of hydroponic cultivation of shallots from TSS Seeds

The program design for the overall system is first that the device is powered on. After that, when the program starts, the ADC port is set to read the soil moisture sensor at A0 and the soil temperature sensor at A1. The data generated from the soil moisture and temperature sensor readings are input into the Arduino Atmega 2560. If the soil pH value meets the predetermined criteria, the solenoid will be activated. Activation of the solenoid indicates that the program has successfully read the data from the soil moisture or temperature sensor. If the soil moisture level is appropriate, the pump will automatically irrigate the plants. Next, the Water Flow sensor is used to measure the speed of water flow. Data from the humidity, soil temperature, and water flow sensors will be displayed on the 4x20 LCD. If the soil moisture and temperature values do not match the preset parameters, the program will return to the beginning. However, if all requirements are met, the process will be completed.

Conclusion

The implementation of the Smart Sensor-connected hydroponic shallot seed (TSS) planting technology implementation program in Ketindan Village, Lawang District, Malang Regency, has succeeded in significantly improving knowledge and skills. The training, which involved 20 participants, showed a high level of participation during the counseling. Overall, this activity succeeded in providing a positive impact on sustainable money for the community around Ketindan Village, both in terms of technical, economic, and social aspects.

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