

Arsenik: Online Monitoring System to Improve Efficiency and Effectivity for Hydroponic Farming Community in Gempol, Pasuruan

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ABSTRACT

Hydroponics is one of the agricultural techniques with great potential for producing herbal products. Hydroponics is a kind of plant cultivation that is environmentally friendly and does not require a large amount of land. Hydroponics was developed a long time ago, but there are not many notable results in terms of quality and quantity. Improving the quality of agricultural products requires a step of modernization by implementing automation systems based on the Internet of Things. Therefore, the solution offered to overcome the problems of current hydroponics systems is green hardware namely Airlangga Sahabat Petani Hidroponik (Arsenik). This firstly prototype hardware is real-time monitors the system, measuring various aspects such as the environment, ie; acidity level, total dissolve solids, water temperature, dissolve oxygen then translates them into visualization that can be read directly by the user. The expected result of this hardware is to enable communities to develop hydroponic systems and improve hydroponic crop yields by internet of things.

KEYWORDS

Hydroponics;
Automation systems;
Sustainable community;
Sustainable development;



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1. Introduction

Hydroponics is an agricultural technique that aims to maximize the potential of vacant land. Hydroponics is done by growing consumption plants in a limited container [1]–[4]. Due to its nature that does not require a large area, hydroponics is classified as an environmentally friendly farming method [5]. The hydroponic farming method has very high potential when viewed from a financial and business perspective [6]. The resulting plant product, when developed through hydroponic techniques, can be maximized even though it is done with a minimum of effort [7]. The hydroponic system is not a farming technique that has recently been born in the community [8]. The hydroponic system has been carried out even from the colonial era [9]. However, the progress of this hydroponic method of farming only dwells there, or in another sense, there is no significant progress [2].

Hydroponic farming methods are still considered unable to meet the needs of people's consumption, and the quality of the plants produced is still relatively low [10]–[12]. In this case, hydroponics needs to be developed by giving a touch of the Internet of Things [10], [13], [14]. The main thing that needs to be improved is an integrated monitoring system and measurement of several aspects such as the degree of acidity of water and soil, nutrients in plants, and interpreting it into an output that can be read directly by the hydroponic farmer [15]–[18].

Thus, the solution offered to this hydroponic problem is Internet of Things-based automation system packaged in green hardware, namely Airlangga Sahabat Petani Hidroponik (Arsenik). Arsenik hardware consists of sensors and an ESP 32 microcontroller board used to read the sensor, process the data, then send it to the server simultaneously [19]–[23]. The measurement of the planting process uses a set of monitoring equipment based on the Internet of Things consisting of a temperature sensor, TDS sensor, acidity/pH sensor [10], [11], [13], [24], [25]. The temperature sensor uses DHT 11 and DS18B20, the TDS sensor uses a Gravity TDS sensor, the pH sensor uses a Gravity pH sensor [5], [7],

[18], [26]. The electricity needs of the monitoring device include ESP 32, 2 temperature sensors, 1 TDS sensor, 1 pH sensor, 16X2 LCD [12], [27]–[30].

2. Method

Hydroponic farming modernization modeling

In developing the potential of hydroponic farming techniques, it is necessary to have the community's will. Therefore, it is necessary to empower the community through community service, socialization, and training for hydroponic agriculture modernization.

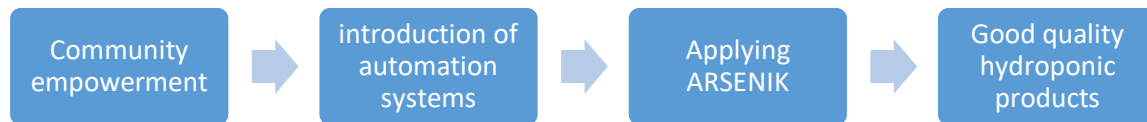


Fig. 1. Agricultural modernization flow chart

Through humanist approaches, the community can be maximally empowered. With the introduction of an Internet of Things-based automation system, it is hoped that the community will be able to apply ARSENIK to achieve quality hydroponic results. The scope of material that will be provided to the community is:

1. SOP introduction material so that they are aware and understand to increase self-awareness.
2. Making a measuring device for hydroponic farming process parameters.
3. Making Android-based applications to monitor hydroponic farming processes.

3. Results and Discussion

3.1 Advances in Hydroponic Method Agriculture

The use of Internet of Things-based monitoring, using ARSENIK devices, has a significant impact on several aspects of farming. In hydroponic product quality, monitoring agricultural products using this automation system provides far optimal results compared to conventional methods.

The modernization of hydroponic farming, which was initiated, provides superiority in the field of yield quality. Through this device, modernization is also intended to minimize the effort given. In another sense, they are minimizing this effort so that farmers can produce hydroponic plants as much as possible with minimal energy. Thus, the touch of modernization is felt especially for hydroponic farmers. In order to balance supply and demand, which has been a big problem for hydroponic farmers, the application of an automation system has had a considerable impact. Plants monitored by ARSENIK devices will not experience problems such as dehydration and temperatures that are too high or low so that the growth hormone and nutrients contained in the plant will be maintained. Based on this, the thing that is affected is the growth ability of the plant itself. The fast time it takes for plants to balance supply and demand.

3.2 Community Empowerment Improvement

As one of the critical outputs of the Airlangga Sahabat Hydroponics (ARSENIK) device, increasing community empowerment to drive the economy is an important focus. In this case, the given automation system has facilitated the community. The community only needs to provide plant seeds, land and hydroponic media. After that, hydroponic farmers do not need to carry out manual monitoring processes to check plants. The farmers only need to take action based on the visual data displayed by the ARSENIK device.

Based on the convenience offered by ARSENIK equipment in carrying out hydroponic farming methods, the public interest is increasing. Further development of hydroponic agriculture based on this automation system can become a business commodity that is expected to reduce unemployment in Indonesia.



Fig. 2. Outreach to the community

3.3 ARSENIK

Airlangga Sahabat Petani Hidroponik (ARSENIK) is a Hardware consisting of sensors and an ESP 32 microcontroller board used to read, process, and send them to the server simultaneously in a series of strings. The measurement of the planting process uses a set of monitoring equipment based on the Internet of Things consisting of a temperature sensor, a TDS sensor, and a pH sensor. The temperature sensor uses a DHT 11 type sensor for air temperature and DS18B20 for water temperature. In its application, the TDS sensor uses the Gravity TDS Sensor. Meanwhile, the pH sensor uses a Gravity pH sensor. Details or specifications of electricity requirements in this automation system include ESP 32 as many as a pair of temperature sensors, one TDS sensor, one pH sensor, 16x2 LCD.



Fig. 3. Arsenik device

In maximizing its potential in helping farmers, ARSENIK is also made in software. This software is used to monitor hydroponic activities. This application makes it easier for users to visualize data on plant temperature, soil acidity/pH, and available water content using this ARSENIK application, using the Google Firebase database service.



Fig. 4. ARSENIK software interface.

4. Conclusion

Hydroponics is an agricultural technique that aims to maximize the potential of vacant land. In its mechanism, hydroponic farming is done by growing plants in a limited container. Due to its nature that does not require a large area and minimal maintenance, hydroponics is classified as an environmentally friendly farming method. The development of hydroponic agriculture from time to time does not show significant results. This is because hydroponic farmers still use manual methods, so further handling or action regarding plant care is still not appropriate. Airlangga Sahabat Petani Hidroponik (ARSENIK), is the answer to these problems. Through ARSENIK, hydroponic farmers are able to monitor the water content and temperature of the plants so that preventive measures so that plants do not lack nutrients can be immediately addressed. With the ARSENIK automation system, hydroponic farming is easier to do to encourage community empowerment.

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Author Contribution

The activity plan in order to develop the potential of hydroponic farming techniques requires the will of the community. Therefore, community empowerment is needed through community service, outreach, and training in the modernization of hydroponic farming.

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Conflict of Interest

The authors declare no conflict of interest.

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