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Faulty Sensor Detection Mechanism in Smart Hydroponic System

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Abstract: Smart hydroponic is a method to cultivate various kinds of a plant using water as a medium to grow the plant. Smart hydroponic using sensors such as Total Dissolve Solids (TDS) sensors, temperature sensors, ultrasonic sensors, etc. However, the rapid degradation over a long period of use caused the TDS sensor to provide inaccurate readings and lead to malfunction in the system. Therefore, in this paper, the author designed a faulty sensor detection mechanism in a smart hydroponic system specifically for TDS sensors. Arduino Uno Board and TDS sensor is the main component used in this paper. A reference value was taken and used as the main comparison to the second reading of the TDS Sensor. In this paper, the faulty sensor detection mechanism in the smart hydroponic system successfully functions. For future use, this faulty sensor detection mechanism can be applied to the other sensor used in the smart hydroponic system.

Keywords: TDS Sensor, Faulty Sensor Detection Mechanism, Smart Hydroponics

1. Introduction

Agriculture is one of the important sectors in Malaysia. The agriculture sector alone contributed 7.1 percent (RM 101.5 billion) to the Gross Domestic Product (GDP) in 2019 [1] in Malaysia. Along with the growing population [2], the availability of food becomes a necessity that must always meet the agriculture sector. However, Malaysia is a developing country. A lot of agricultural lands have been converted to non-agricultural areas such as hotels, industrial, transportation systems, giant buildings, and public facilities which will certainly negatively impact the agricultural land and agricultural environment [3]. Hence, the increment of world food demand and the decline of agricultural land plays an important role in the combination of agricultural technology and the effective farming method

Therefore, agricultural technology such as smart hydroponics systems is a viable option in tackling these agricultural problems and food demand. Hydroponics is a method to cultivate plants in nutrient-enriched water, with or without the mechanical support of an inert medium such as sand or gravel, etc. [4]. In smart hydroponics systems, water temperature, pH, nutrient solution, water level, oxygen, and

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substrate need to be monitored and regular checks [5]. Few types of sensors are used to detect the selected parameter.

However, one typical problem in such a smart system is the rapid degradation of the deployed sensors [6]. Deployed sensors are categorized as faulty sensors. Conventionally, this problem is resolved by frequent manual maintenance by changing new sensors, which is considered ineffective, costly, and may harm the yields in a long run. Faulty sensors cause farmers to get the wrong data. Wrong data leads to system failures. Which give a huge impact on the crops and the whole hydroponics system.

Although, there is plenty of smart hydroponics system that was built. A few of the previous findings provide solutions on how to build a faulty sensor detection for the Total Dissolved Solids (TDS) sensor [6]. It is crucial for the smart hydroponics system to always make sure that the TDS sensor is functioning well. Therefore, designing a smart hydroponics system that has faulty sensor detection might be helpful to the communities, and farmers to maximize the yields.

This paper focuses to design and develop a system that would help farmers, and agribusinesses create a detection mechanism that functions as faulty sensor detection in smart hydroponics systems for TDS sensors.

2. Materials and Methods

This section describes all the necessary steps that are required to obtain the results of the study. The Arduino Uno board is powered and connected to the buzzer, and water pump through a relay component and the three types of sensors, TDS sensor, ultrasonic sensor, and temperature sensor. The Arduino Uno is the controller unit. Then all the sensors and controller units are connected to tank 2 in the hydroponic system as shown in Figure 1.

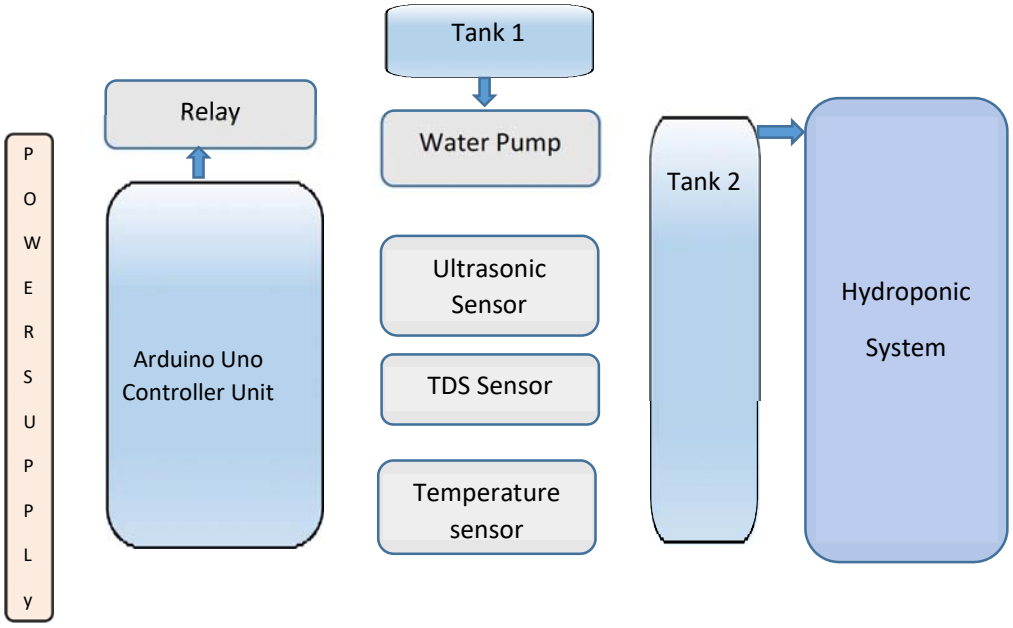

Figure 1: Block diagram of smart hydroponic system