

Chapter 16

Smart Hydroponic Monitoring System Using IoT

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ABSTRACT

The burden on agricultural productivity is growing as the global population continues to increase at a rapid rate. Due to the growth of metro areas, agricultural land is being lost daily, which could result in a shortage of arable land. Vertical farming (VF) is the answer to this issue. IoT system can be utilized to monitor and control these vertical farming systems. By using the latest technology such as IoT, it becomes very easy for the farmers to monitor the growth of their plants. It becomes easy for them to monitor plants in terms of what action is needed and how much care is required at appropriate time. It is important for determining the optimum growth of plants.

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INTRODUCTION

For supporting human in the world farming plays a very vital role. Nowadays drinking water is scarce and out of which the largest part of it is being used in the farming process. As the population is growing the interest for both more food and more land is also increasing so we need a new method of farming that can bring conventional farming in urban areas (SDG-2). The idea of Vertical Farming (VF) was proposed by Dickson Despommier in 1999, he is professor of Public and Environmental Health at Columbia University (Bhowmick et al., 2019; Taha et al., 2022; Tatas et al., 2022). VF is the method of growing plants in vertically stacked layers with a controlled environment for proper growth of plants and this is a soilless farming technology such as hydroponics, aeroponics, and aquaponics. A major issue is the unpredictability of the weather and the uneven distribution of water resources throughout the entire year, both of which contribute to an inadequate yield and issue is addressed by VF. This scientific method's success in the realm of cultivation has the potential to significantly alter how crops are produced. By employing this technique, crop yield increase while utilizing much lesser space (Beacham et al., 2019; Vadivel et al., 2019).

Urban farming can be replaced by vertical framing. It is a method of industrial manufacturing that involves mass food production. These structures might produce fruit, vegetables, and other consumables throughout the year utilizing cutting-edge greenhouse technology and controlled environment. In contrast to the conventional rural farming approach, the concept calls for growing and harvesting a wide variety of plants in densely populated urban areas and selling these crops to the local population directly (bin Ismail & Thamrin, 2017; Crisnapati et al., 2017; Tatas et al., 2022). To raise plants, animals, fungus, and other living things for use as food, fuel, building materials, or other goods or services, VF, is a commercial agricultural approach. Further with the newer cutting-edge technologies such as IOT, Machine learning and Artificial Intelligence, VF, processes can be made automated as well as an healthy crop can be raised by taking necessary steps at required time.

VERTICAL FARMING (VF)

The technique of vertical farming (VF) involves layering plants vertically to increase food production per square foot of land. Plants are grown without soil via vertical farming while the plants receive the correct amount of water and nutrition for healthy growth using different techniques discussed in this chapter. Architecture of vertical farming is depicted in Figure 1. It makes use of Controlled Environment Agriculture (CEA) technology and indoor farming methods where a variety of variables, including humidity, temperature, light exposure, gases, and the quantity of nutrients to be given to the plants, may be managed (Bacco et al., 2018; Kumar et al., 2022). In difficult conditions, such as those where arable land is few or unavailable, vertical farms try to generate food. By combining skyscraper-like architecture and precision agriculture techniques, this style of vertical farming allows communities that are situated on mountainside, people who are living in the desert area, and cities grow various types of crops. VF grows plants using a variety of techniques, such as the hydroponic approach, which consumes up to 70% less water (Al-Chalabi, 2015; Ruengittinun et al., 2017; Salvi et al., 2017; Yusof et al., 2016). The amount of water needed is even less with the aeroponic approach. The artificial lighting used in VF is LED-based, with the ability to employ different coloured LEDs. The electricity needed for this method is generated by a sustainable energy source, like solar or wind energy.

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