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IoT-Based Intelligent Irrigation System for Paddy Crop Using an Internet-Controlled Water Pump

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ABSTRACT

IoT is a communal association of things or equipment that can interact with each other with the help of an internet connection. IoT services play an imperative responsibility in the industry of agriculture, which can feed 10 billion people worldwide by 2050. Irrigation systems are a backbone of agriculture that help to reduce wastage of water and decide the effective usage of water according to the specific crop and thereby increase the crop yield. In this paper, an irrigation system is developed to supervise the paddy crop field using sensors (soil moisture sensor, pH sensor, and flow sensor), and this irrigation system works based on the concept of IoT, so it is known as intelligent irrigation system (IIS). The soil condition data from sensors are sent to a web server database using wireless transmission to decide how much water needed. In the proposed server database, the data is saved, and the authors use the concept of a dashboard; it operates via http protocol to control water pump of farmland. The condition of soil is monitored based on the parameter of soil-like moisture and water flow amount using the IoT, which is capable to turn on/off water pumps. The used dashboard is developed using open source free server, namely "000webhost." This paper has considered the paddy crop that is rice because water is essential for growth and development of rice plants. The experimental results show this system is more proficient than the existing conventional and unadventurous irrigation approach.

KEYWORDS

Agriculture, Communicating Network, Intelligent Irrigation System, Internet of Things (IoT), Remote Monitoring, Sensor

1. INTRODUCTION

Agriculture is considered as the foundation of human life and only resource of food granule. In the agriculture field, innovative tools emerge, bringing automated, unremitting, and spontaneous features for communication through internet applications (Sharma & Kumar, 2020). It also provides a large number of employment opportunities to the nation's population. By implementing an intelligent and automated system in irrigation and using advanced automatic machines, the field has been improved compared to the conventional methods. In this research, automated irrigation control system is developed which can regulate the water supply with the internet through IoT communication system. Also, with this system, the status of paddy crop filed can be monitored from any location. Irrigation of paddy crops is one of the significant issues found in agriculture, mostly in developing countries. There are varieties of conventional paddy crop irrigation systems that have been followed from ancient times. For illustration, in a flow-based irrigation system, the water resources like tanks or

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reservoirs are positioned at great heights. The flow of water is automatically downward when it is connected to the tank or reservoir. Those categories of irrigation are regularly used and beneficial in open areas. The other category of irrigation is lift-irrigation, where the crop fields are situated at a higher level than the water resources (Rasooli, Bhushan, & Kumar, 2020). The crop field is irrigated by lifting aqua from wells, tanks, canals, rivers using electrical water pumps. At present, the underground water is also pumped to irrigate the crop field using electrical water pumps. To improve conventional irrigation methods, there have been many irrigation systems developed using advanced and intelligent technologies that help to reduce crop wastes, prevent excessive and scarce watering to crops, and thereby increase the crop yield. This problem can be eliminated if farmers use an automatic and intelligent irrigation system using sensors based IoT communication system. For example, IoT communication systems can be used to monitor environmental parameters through soil nutrition which can help in to predict the quality as well as the plant growth. IoT is helpful in the estimation of the required amount of irrigation using the parameters like pH, moisture weather monitoring and temperature of soil (Bhatt, Bhushan, & Kumar, 2019), and the architecture of Automated Irrigation System with IoT using the idea of the dashboard is shown in Figure 1.

In Figure 1 the utilization of the IoT communication system for agriculture were shown. The sensor nodes represented by green circles were deployed in the field. Communication process in between each sensor is achieved via Wireless links. User can remotely handle and monitor these sensor nodes via laptops or mobile phones. For e.g. in this paper if the water level rises above the set limit user can switch off the pump through his/her mobile phone. The designed IIS experimented on the paddy crop (rice) because enough supply of water is essential for the growth and development of rice plants. This paper focused on unlike factors to be determined for rice crops (Kumar & Sharma, 2020). So, farmers should be independent to monitor via installing a smart system. It could be possible when the prototype is converted into product and distributed among farmers via giving proper knowledge of our product. In this research, the irrigation system is designed for the paddy crop, and in Figure 2, the paddy crop is shown.

Paddy crop is powerfully predisposed by water supply. Water should be kept standing in the field throughout the growth period. The characteristics of flooded soil which useful for rice are:

- Rice plant is a semi-aquatic plant that requires near submergence.

Figure 1. Architecture of IoT based Intelligent Irrigation System

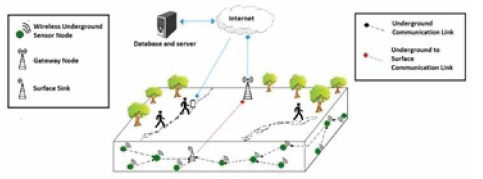

Figure 2. Paddy Crop in India