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Internet of Things: A Survey on Smart Farming System

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Abstract

Internet of Things is one of the highly used concepts today. These days, sensors and other devices facilitate communication techniques. Wireless sensor nodes are one such technique which makes use of IOT and its concepts to simplify day to day lifestyles. One such application is on agriculture where WSN is implemented to optimize the use of energy, water, fertilizers to increase the food production as well as create a food profile for different kinds of crops. Many regions require many different kinds of maintenance which is hard to monitor. The changing weather conditions are also a challenge to the farmers. Currently the population is 7.3 billion, and it's estimated to be 10 billion by the year 2050. The demand for food, energy and water resources are increasing simultaneously the world population is also increasing. Hence a system is required to manage and increase FEW resources by optimizing the use of resources on agriculture and farming.

Keywords: *IOT, Smart Farming System, WSN, Agriculture*

INTRODUCTION

In today's world, IOT plays a major role in many applications. One such application is smart farming. Smart farming makes use sensors and smart devices to optimize the use of FEW resources on food production. Owing to the increment in population and corresponding decrement in rainfall amount, there is a substantial scarcity of food and water – which are the most basic

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needs of life. Hence, the importance of precision agriculture has become more pronounced leading to a plethora of researchers being conducted in the field over the recent decades. In most countries, the family economy depends on agriculture, thus, principled and productive agriculture is of paramount importance to them. Unfortunately, in the most countries and regions where farming is done on small farms, primitive methods are still widely being used. There is an increase in population and also increase in demand for food, energy and water resources. To solve this challenge, we make use of IOT concepts in order to increase food, water and energy resources.

Smart agriculture or precision farming is a recent concept that came out of the Internet of Things (IoT) applications. The growing IoT landscape can almost be applied to different sectors and the agriculture field has been the recent one. The combination of IoT along with predictive data analytics in agriculture can equip farmers with critical information on soil and environmental parameters to take actions.

The driving factor behind smart agriculture has been the demand for more food production to increase yields, optimize interdependent resources of energy, water and land and impact of urbanization. With advances in technology, there is more push by global stakeholders like the Food and Agriculture Organization (FAO) for farmers to use innovative tools and digital technologies. The agricultural sector is faced with challenges connected to limited availability of arable land, water and energy, global climate change, and labor supply. The IoT framework can be used to understand the interdependency of energy, water and food resources through wireless sensor networks (WSN) for each sub-system. With real-time data, farmers can predict their yield, optimize water utilization through smart irrigation control and precisely know when to harvest thereby reducing energy and labor input.

LITERATURE SURVEY

Yemeserach Mekonnen et al. in his paper “IoT Sensor Network Approach for Smart Farming: An Application in Food, Energy and Water System “ explained as the global population soars from today’s 7.3billion to an estimated 10 billion by 2050, the demand for Food, Energy and Water (FEW) is expected to more than double. Such an increase in population and consequently, in the demand for FEW resources will undoubtedly be a great challenge for humankind. A challenge that

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will be exacerbated by the need for humankind is to meet the greater demand for resources with a smaller ecological footprint. This paper is proposing a system developed to optimize the use of water, energy, fertilizers for agricultural crops as a solution to this great challenge. It is an automated smart irrigation system that uses real time data from wireless sensor networks to schedule irrigation. The test-bed consists of a wireless network monitoring soil moisture, temperature, solar radiation, humidity, and fertilizer sensors embedded in the root area of the crops and around the test-bed. Wireless sensor data transmission and acquisition is managed by an Access Point (AP) using Zig Bee protocol. An algorithm was established based on threshold values of temperature and soil moisture automated into a programmable micro-controller to control irrigation time. The system's energy demand is completely supplied by a solar Photo-voltaic (PV) panel supplemented with an energy storage unit.

Jan Bauer et al. in his paper "Design and Implementation of an Agricultural Monitoring System for Smart Farming" have explained that the integration of modern information technologies into industrial agriculture has already contributed to yield increases in the last decades. Nowadays, the emerging Internet of Things (IoT) along with Wireless Sensor Networks (WSNs) with their low-cost sensors and actors enable novel applications and new opportunities for a more precise, site-specific, and sustainable agriculture in the context of Smart Farming. In this paper, we present a holistic agricultural monitoring system, its design, and its architectural implementation. The system primarily focuses onin-situ assessment of the leaf area index (LAI), a very important crop parameter. Moreover, we introduce real-world challenges and experiences gained in various deployments. Finally, first results are exemplarily demonstrated in order to briefly address the potential of our system.

Farzad Kiani et al. in his paper "Wireless Sensor Network and Internet of Things in Precision Agriculture" has explained that Internet of Things is one of the most popular subjects nowadays where sensors and smart devices facilitate the provision of information and communication. In IoT, one of the main concepts is wireless sensor networks in which data is collected from all the sensors in a network characterized by low power consumption and a wide range of communication. In this study, architecture to monitor soil moisture,

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temperature and humidity on small farms is provided. The main motivation for this study is to decrease water consumption whilst increasing productivity on small agricultural farms and precisions on them. This motivation is further propelled by the fact that agriculture is the backbone of some towns and most villages in most of the countries. Furthermore, some countries depend on farming as the main source of income. Putting the above-mentioned factors into consideration, the farm is divided into regions; the proposed system monitors soil moisture, humidity and temperature in the respective regions using wireless sensor networks, internet of things and sends a report to the end user. The report contains, as part of the information, a 10-day weather forecast. We believe that with the above information, the end user (farmer) can more efficiently schedule farm cultivation, harvesting, irrigation, and fertilization.

K. Lokesh Krishna et al. in his paper "Internet of Things Application for Implementation of Smart Agriculture System" has explained that over the past few years, there has been significant interest in designing smart agricultural systems. The use of smart farming techniques can enhance the crop yield, while simultaneously generating more output from the same amount of input. But still, most of the farmers are unaware of the latest technologies and practices. In this paper a novel wireless mobile robot based on Internet of Things (IoT) is designed and implemented for performing various operations on the field. This proposed wireless robot is equipped with various sensors for measuring different environmental parameters. It also includes Raspberry Pi 2 model B hardware for executing the whole process. The main features of this novel intelligent wireless robot is that it can execute tasks such as moisture sensing, scaring birds and animals, spraying pesticides, moving forward or backward and switching ON/OFF electric motor. The robot is fitted with a wireless camera to monitor the activities in real time. The proposed wireless mobile robot has been tested in the fields, readings have been monitored and satisfactory results have been observed, which indicate that this system is very much useful for smart agricultural systems.

Lamar Burton et al. in his paper "Exploring Wireless Sensor Network Technology In Sustainable Okra Garden: A Comparative Analysis Of Okra Grown In Different Fertilizer Treatments" has explained The smart garden consists of

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two different varieties of Abelmoschus esculentus (okra) planted in raised beds, each grown under two different fertilizer treatments. Soil watermark sensors were programmed to evaluate soil moisture and dictate irrigation events up to four times a day, while soil temperature and photosynthetic solar radiation sensors also recorded data every six hours. Solar panels harvested energy to power water pump and sensors. The objectives of the experiments were to evaluate and compare plant and soil parameters of the two okra varieties grown under two different fertilizer treatments. The plant parameters evaluated and compared were basal diameter, plant height, fruit production, and fruit size. Soil parameters measured were soil moisture, soil temperature, and soil nitrate concentration.

Schubert Rodríguez et al. in his paper "A System for the Monitoring and Predicting of Data in Precision Agriculture in a Rose Greenhouse Based on Wireless Sensor Networks"

In order to provide the best growing conditions for roses in a greenhouse, a Wireless Sensor Network has been designed and implemented that allows for agricultural environment data collection such as temperature, humidity and light. Each sensor node can transmit monitoring data to the cloud. Data mining techniques were used with the purpose of identifying behavioral patterns given the environment conditions captured by the sensor network. The operationalization of this research was taken as a case study within the rose greenhouses available to Universidad de las Fuerzas Armadas – ESPE, Ecuador.

TABLE: 1 COMPARISON TABLE

TITLE OF PAPER	YEAR	DESCRIPTION
Design and implementation of an agricultural monitoring system for smart farming	2018	Internet of Things (IoT) along with Wireless Sensor Networks for smart farming.
Exploring Wireless Sensor Network Technology In Sustainable Okra Garden: A Comparative Analysis of Okra Grown in Different	2018	To explore commercial agricultural and irrigation sensor kits with the help of Solar Panels.

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Fertilizer Treatments		
Wireless Sensor Network and Internet of Things in Precision Agriculture	2018	System monitors soil moisture, humidity and temperature in the respective regions using wireless sensor networks, internet of things and sends a report to the end user.
Internet of Things Application for Implementation of Smart Agriculture System	2017	A novel wireless mobile robot based on Internet of Things (IoT).
A System for the Monitoring and Predicting of Data in Precision Agriculture in a Rose Greenhouse Based on Wireless Sensor Networks.	2017	A Wireless Sensor Network Has Been Designed And Implemented That Allows For Agricultural Environment Data Collection
Proposed System	2018	Iot along with WSN to monitor soil, water, temperature, humidity, fertilizers, solar radiation, as well as weather monitoring with the help of PV cell.

CONCLUSION

Agriculture is one of the sectors with smart farming that relies on machine to machine communication to get precise and reliable data. The experimental data obtained from this prototype will be modeled and optimized to investigate food production profile as a function of energy and water consumption. It will also attempt to understand the effect of extreme weather conditions on food production. The abundance of vast amount of data and the ability of analyzing data to make decisions have quickly become part of any sector with the advent of IoT technologies. The paper explains about surveys on different types of papers in designing a smart farm prototype to further investigate and model the energy, water and food.

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