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Smart Farm Management System for Precision Agriculture Using IoT

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Abstract: Agriculture has been the most important practice from very beginning of the human civilization. Traditional methods that are used for irrigation, such as overhead sprinkler and flood type, is not that much efficient. They results in a lot of wastage of water and can also promote disease such as fungus formation due to over moisture in the soil. Automated irrigation system is essential for conservation of the water and indirectly availability of the farm since it is an important commodity. In automation system water availability to crop is monitored through sensors and as per need watering is done through the controlled irrigation. The almost infinite capabilities of storage and processing, the rapid elasticity makes cloud computing an attractive solution to the large amount of data generated. The Idea is to focus on parameters such as temperature, humidity, in Air Moisture, There are three main objectives of this project are to control the water supply using air moisture. Then using Piezoelectric sensor control the insect attract, after that we are analysing plant growth by image, additionally using algorithm for soil nutrients detection through colour of soil ,To manage all the required information and the complexity of plants growth a system, able to measure, analyze, and act is needed. IOT is a solution for precision agriculture.

Keywords: IoT, Piezoelectric sensor, colour detection algorithm

I. INTRODUCTION

World population has increased from 1.65 billion in 1900 to 7.4 billions today. The pace of this increase is not changing and Earth is estimated to have 11.2 billions by the end of this century. In contrast with that growth, the arable land is decreasing from 0.5 Ha per person in 1960 to 0.2 Ha per person in 2020. The world will not have enough food to cover the needs of all the inhabitants without any changing the way we do agriculture today. The development of automated agricultural monitoring system has gained a great value in recent years due to its capacity to increase yields and to decrease water use. Water is distributed through a network of small tubes, pipes, and water storage tanks and it is then dripped steadily, but directly to the root .The uses of computers and electronics in the area of agriculture, specifically, in the irrigation systems have created new engineering and research challenges. In particular, wireless control of actuators for agricultural purposes has some technical difficulties because of the limited budget and power resources. However, in recent years, many different technologies have been developed to efficiently set up WSANs (Wireless Sensor and Actuator Networks). And many studies are conducted to examine their impact on transforming the agriculture. On the other hand, Cellular networks, such as GSM or LTE, are capable of providing long range transmission to form WSANs, and they have been successfully tested to control irrigation systems, but solar panels are required for each node to Compensate higher power consumption of cellular network. The paper presents the system we are working on, IoT to allow small and medium farmers to introduce technology in their farms and to improve the yield of the soil. Technologies have been developed for efficient use of water for irrigation purpose. In India agricultural area receives power supply usually in non-peak hours; also frequent power cuts and low voltage supply creates a big problem to farmers. The off-peak hours are usually night hours after 11 pm. If farmer fails to attend the irrigation, there is chance of wastage of water and electricity. Also, excess watering leads to soil damage. In order to control and monitor the irrigation process, smart and automated irrigation system is developed, Implemented and tested. There is a need for automated irrigation system because it is simple and easy to install. This system uses values ON and OFF to control water motor. Python programming language is been used for automation purpose.

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The rest of the paper is organized as follows: Section II introduces literature survey. Section III deals with proposed system. Compound description is presented in section IV. Implementation are discussed in section V followed by conclusion in section VI.

II. LITERATURE SURVEY

This system developed an automated irrigation system for the farmer on the basis of wireless sensor network .This system continuously monitors the parameters temperature, humidity, and moisture of soil. An algorithm was used with threshold values of soil moisture to be maintained continuously. System starts or stops irrigation based on moisture content of the soil. This system proposes low cost moisture sensor based data acquisition system required for automated irrigation system.

The authors have developed an impedance based moisture sensor. Sensors works on the change of impedance between two electrodes kept in soil. This paper represents irrigation management system using WSN and water pumps. This System monitor the air moisture present in air, for efficient irrigation system. These sensors are connected to wireless gateway which sends data periodically to web server. Database connected to web server monitors irrigation water level at all main .The web based IMS analyze the data stored in database and compares with specified values. Then it (IMS) sends SMS to farmers and engineers to make aware of water requirement.

This system is smart irrigation techniques using internet of things (IOT). In this system sensors are placed in the agriculture field, measures the air moisture value, water level in the tank and well-water through mobile data communication network. The web servers use intelligent software to analyze the data and act according to the result obtained to perform desired action.

2.1 Agri Sys: A Smart and Ubiquitous Controlled-Environment Agriculture System

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With new technological advancement in controlled-environment agriculture systems, the level of productivity has significantly increased. Agriculture systems are now more capable, reliable, and provide enhanced productivity. An agriculture environment can range from a single plant in a house, a backyard garden, a small farm, to a large farming facility. These agricultural automated systems will help in managing and maintain safe environment especially the agricultural areas. In this paper, we propose a smart Agriculture System (Agri Sys) that can analyze an agriculture environment and intervene to maintain its adequacy. The system deals with general agriculture challenges, such as, temperature, humidity, pH, and nutrient support. In addition, the system deals with desert-specific challenges, such as, dust, infertile sandy soil, constant wind, very low humidity, and the extreme variations in diurnal and seasonal temperatures. The system interventions are mainly intended to maintain the adequacy of the agriculture environment. For a reduced controller complexity, the adoption of fuzzy control is considered. The system implementation relies on state-of-art computer interfacing tools from National Instruments as programmed under Lab VIEW.

2.2 Smart Farming – IoT in Agriculture

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IoT is a revolutionary technology that represents the future of communication & computing. These days IoTis used in every field like smart homes, smart traffic control smart cities etc. The area of implementation of IoT is vast and can be implemented in every field. This paper is about the implementation of IoT in Agriculture. IoT helps in better crop management, better resource management, cost efficient agriculture, improved quality and quantity, crop monitoring and field monitoring etc. can be done. The IoT sensors used in proposed model are air temperature sensor, soil pH sensor, soil moisture sensor, humidity sensor, water volume sensor etc. In this paper I surveyed typical agriculture methods used by farmers these days and what are the problems they face, I visited poly houses for further more information about new technologies in farming. The proposed model is a simple architecture of IoT sensors that collect information and send it over the Wi-Fi network to the server, there server can take actions depending on the information.

2.3 A Model for Smart Agriculture Using IoT

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Climate changes and rainfall has been erratic over the past decade. Due to this in recent era, climate-smart methods called as smart agriculture is adopted by many Indian farmers. Smart agriculture is an automated and directed information technology implemented with the IOT (Internet

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of Things). IOT is developing rapidly and widely applied in all wireless environments. In this paper, sensor technology and wireless networks integration of IOT technology has been studied and reviewed based on the actual situation of agricultural system. A combined approach with internet and wireless communications, Remote Monitoring System (RMS) is proposed. Major objective is to collect real time data of agriculture production environment that provides easy access for agricultural facilities such as alerts through Short Massaging Service (SMS) and advices on weather pattern, crops etc.

2.4 IOT Based Smart Agriculture System

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Smart agriculture is an emerging concept, because IOT sensors are capable of providing information about agriculture fields and then act upon based on the user input. In this Paper, it is proposed to develop a Smart agriculture System that uses advantages of cutting edge technologies such as Arduino, IOT and Wireless Sensor Network. The paper aims at making use of evolving technology i.e. IOT and smart agriculture using automation. Monitoring environmental conditions is the major factor to improve yield of the efficient crops. The feature of this paper includes development of a system which can monitor temperature, humidity, moisture and even the movement of animals which may destroy the crops in agricultural field through sensors using Arduino board and in case of any discrepancy send a SMS notification as well as a notification on the application developed for the same to the farmer's smartphone using Wi-Fi/3G/4G. The system has a duplex communication link based on a cellular- Internet interface that allows for data inspection and irrigationscheduling to be programmed through an android application. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas.

These the survey taken by previous papers, which has drawbacks given below,

- The advances in pervasive computing and the Internet-of-things are to reach every aspect of life including local agriculture practices.
- The advances in pervasive computing and the Internet-of-things are to reach every aspect of life including local agriculture practices.
- Over period, weather patterns and soil conditions and epidemics of pests and diseases changed.

III. Existing Systems

A system for precision agriculture, that will be distributed in the field, far from energy and communication sources needs to be low power and able to process the received information and just sending the most relevant information to the cloud for further statistical analysis. This system will be able to measure the most important parameters for plant growth through a set of sensors and act to fix some of those parameters through actuators when needed as well.

A first analysis shows that the parameters that influence a plant growth could be categorized as soil parameters and environment parameters. Among the soil parameters we have moisture, nutrients, pH, temperature, and texture. Environment parameters are light, temperature, and weather. Another important classification is the one that divided the relevant parameters in the ones we can automatically act if they are out of the defined range and the ones we can just inform that they are out of the desired range. So far, we have concluded that the parameters the proposed system can automatically act are soil moisture, soil nutrients and the soil pH. Other parameters act as indicators that will help to know how to act on the parameters that can be changed automatically. The system is composed by a processor, a set of sensor and actuators, a display to provide relevant information, LEDs to provide visual information, batteries and a communication module. The Smart Image Recognition Mechanism for Crop Harvesting System in Intelligent Agriculture: This study proposed a harvesting system based on the Internet of Things technology and smart image recognition. Farming decisions require extensive experience; with the proposed system, crop maturity can be determined through object detection by training neural network models, and mature crops can then be harvested using robotic arms. Keras was used to construct a multilayer perception machine learning model and to predict multiaxial robotic arm movements and position. Following the execution of object detection on images, the pixel coordinates of the central point of the target crop in the image were used as neural network input, whereas the robotic arms were regarded as the output side. A MobileNet version 2 convolutional neural network was then used as the image feature extraction model, which was combined with a single shot multibox detector model as the posterior layer to form an object detection model. The model then performed crop detection by collecting and tagging images. Empirical evidence shows that the proposed model training had a mean average precision (mAP) of 84%, which was higher than that

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of other models; a mAP of 89% was observed from the arm picking results.

IV. PROPOSED SYSTEM

The proposed automated irrigation and monitoring system consists of the raspberry pi, water pump, piezoelectric sensor, moisture and temperature sensors. In the proposed work, crops or plants are considered along with their water requirement at different stages. The crops or plants are irrigated with respect to the water requirements at different stages of their growth.

First to monitor the water serving by the moisture of the air and the motor is automatically ON/OFF, and then the Acknowledgement is sent to the mobile using Wi-Fi. Secondly Using Piezoelectric Sensor the ultrasonic Sound is produced with irritates the Insects, and control the insects attack into the field. Then we are using the Portable Pi camera which to capture the image of the crop and detects the age of that for check its growth stages.

Additionally using colour detection algorithm the nutrients are analysed by the soil change in the soil, this helps to reduce our time on soil testing, this all are the things which can be done with our smart irrigation system.

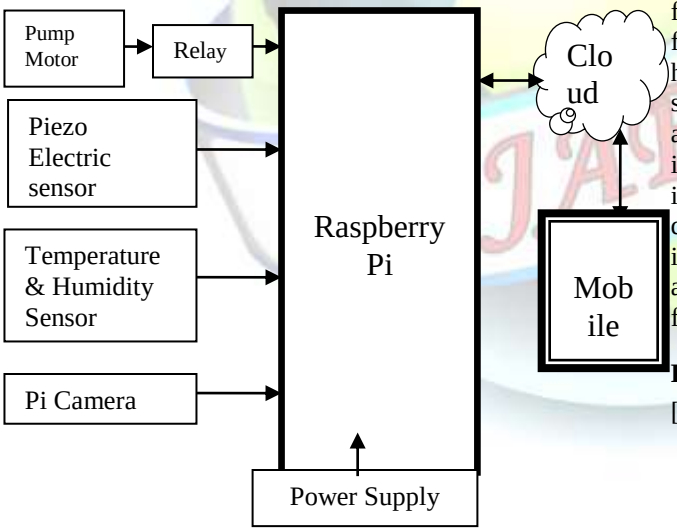

Fig. 1. Proposed System Design

V. COMPONENT DESCRIPTION

1. Raspberry-Pi

The sensor technology to automate irrigation improves water usage efficiency. The raspberry pi is a small single board computer which is been used to teach computer science. The raspberry pi is been used as a computer where external memory can be used and it has four ports where any input devices can be connected. This project uses raspberry pi for easy process
and installation.

2. Piezo Electric sensor:

Piezoelectric sensors are versatile tools for the measurement of various processes.

3. Temperature and humidity Sensor:

The humidity sensor senses, measures and reports both moisure and air temperature. The ratio of moisture in the air temperature, the ratio of moisture in the air to the highest amount at particular air temperature is called relative humidity.

Operating voltage: 3.3v to 5.5v

4. Software Requirements:

- Raspbian JessieOS
- Python

VI. CONCLUSION

Our proposed system integrated IoT to monitor precisely agriculture, we have almost finish the development of the first prototype and we are going to start the tests in the field.In this work we successfully develop a system that can help in automated irrigation system proves to be useful system as a automates and regulates the watering without any manual intervention . Piezoelectric sensor control the insect attract, after that we are analysing plant growth by image, additionally using algorithm for soil nutrients detection through colour of soil ,To manage all the required information and the complexity of plants growth a system, able to measure, analyze, and act is needed. IOT is a solution for precision agriculture.

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