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Review Paper

An Efficient IoT Based Smart Irrigation System and Plant Diseases Detection: A Review

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Abstract

The irrigation control and monitoring of the involved variables on the plant growth are actions that farmers must implement in their crops to save water resources and assessing the growth of the plant. In this paper, the literature is conducted on several authors' works, their modern way of doing agriculture with IoT and image processing combination, thus the paper gives information about various techniques, algorithms, and architectures employed to detect the crop diseases in advance so that proper care can be taken to avoid it. Hence incorporating IoT with image processing gives improved detection ability in the agricultural system. The survey comprises several authors' workouts of automated Irrigation and crop diseases Detection practices which are currently in use..

Keywords: *Disease Diagnosis; Internet of Things (IoT);MATLAB; Image Processing; Sensing network.*

1. Introduction

India is blessed with a huge amount of cultivable land, but the output produced does not do justice to the country's potential. The World Bank data reveals that around 60% of the land is under cultivation [1]. The use of technology in agriculture is on the rise, but a large portion of agriculture, especially irrigation remains a manual exercise. It is known that the output of a plant depends on various factors. The availability of optimum quantity of water is highly imperative in this regard. Interaction with farmers from the Kerala Rice Station, and agricultural enthusiasts revealed that the existing automated irrigation facilities are expensive and inaccurate to some extent. This was the driving factor behind choosing automated irrigation as a topic for our project. The automation of the irrigation system, and providing a platform to monitor the irrigation conditions, using soil moisture, temperature and humidity readings will have an everlasting impact on the output of the plant. In this current era, the usage of technology in modern agriculture system lets the farmers achieve better crop yield by incorporating IoT with image processing. Building an IoT application requires the right selection and combination of sensors, networks and communication modules. The above setup, then collaborates with concepts of image processing, cloud computing, etc. IOT has received much attention in the last four years, because of several companies gained highest benefits by adopting IOT.

Digital image processing makes use of various computer algorithms to perform image processing on digital images. It is widely used for classification (identifies to which class does a newly found observation belong), pattern recognition (recognize known and discover unknown patters), feature extraction. The block diagram of IoT is as shown in figure 1.

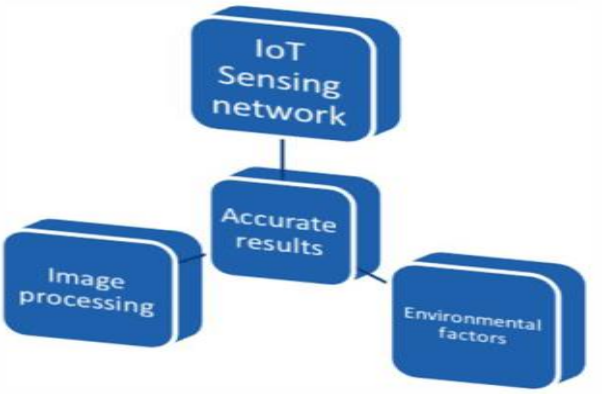


Fig 1. Block diagram of IoT

There is a considerable amount of literature on IoT and Image processing used in farming to get better yield and try to reduce crop growth failure. Few studies have been published on how to monitor crop growth by using sensors, IoT unit and camera to capture images at regular intervals to investigate the diseases in the crop. If any discrepancy is found in capturing images, it is intimated to the farmer for taking necessary actions or precautions at earliest, thus to improve the productivity and reduction in crop failure. The main contributions and organization of this paper are summarized as follows: In section 2 we describe literature review of IoT based smart irrigation systems. The section 3 Recommended outline work. The section 4 explains brief results and discussions. Finally, in section 5 we concluded the paper.

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2. Literature work

In [2], the authors studied discrepancies using pattern and color based technique in paddy crop. In [4], the authors recommended a procedure to control water in farming lands. In [5], the authors addressed the fast growth of agricultural renovation and benefit to agriculture and resourcefully crack the issues associated with farmers. In [6], the authors used the IoT for implementing the modern type of techniques in their agriculture. Authors in [7] have deliberated various applications of image processing in a smart way of doing agriculture.

In [8], the authors have designed a new management model to examine the quality of agricultural products to promote new ways of farming methods, thus to promote the modern agriculture system. Authors in [9] concentrated mainly on the factors that impact the water resources scarcity with the help of hardware and network architectures. Also, they worked on control mechanisms for precision agriculture. In [10], the author's major work deals with the application of cloud computing in the farming by incorporating IoT.

In [11], the authors introduced SensorScope Architecture that contains environmental monitoring based WSN system. This system completely substitutes old-fashioned unit their by reducing cost, time and increased reliability. The sensor scope system has the potential of transmitting gathered data from the stations to sink node at regular intervals. Thus the data received in the Database are made to available to all other servers in the network as depicted in fig.2

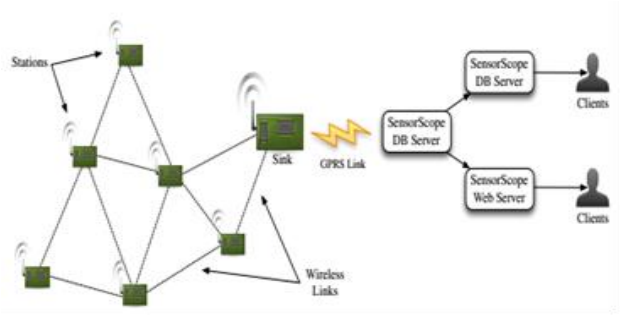


Fig 2. Sensor Scope Architecture adapted from [11]

The authors deliberated the complete details of hardware components and its behavior in different environmental conditions. To know the system performance and goodness they even conducted simulation tests before deploying the system in the field. Also, the system is checked for withstanding ability in advance and acquired data to be stored for future statistics.

In [13] the implementation of an irrigation control system systematized in the city of Kelowna, Canada. This space is essentially on a short grass, portrait, view, which is separated in Zones where this short grass part is watered at the same time, controlled by apparatuses for controlling liquids. Thus the system tries to come to a decision about when, and how much water, to send to each section. To reduce waste water, the system uses an amended irrigation algorithm that works out the amount of water to put to use in a certain zone depending on the maximum water amount that the soil can store. The systems have the facility of sending water to each section intelligently by employing a novel algorithm that reduces the usage of water by storing water in zones based on the quantity of water that a soil can accumulate. As depicted in the figure.3 the system stores all the events of watering to crop with the assistance of the controller. The practical usage of the system showed improvement in water reserves by 47% as related to traditional controller.

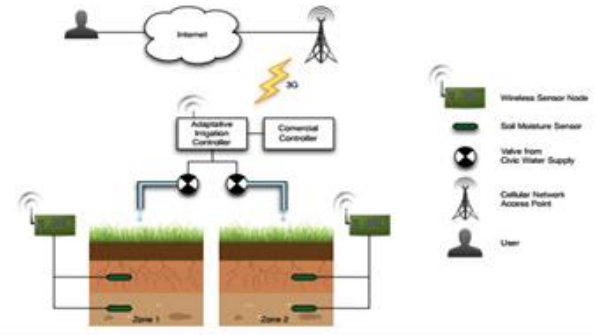


Fig.3 End-to-end System

In [12], the authors suggest the principle of measuring soil moisture state of the grass with the software tool. To evaluate its performance, they used Oeiras Golf & residence golf direction use-case. The main objective of this study is to provide data about Golf sense system behavior and operation mechanisms to control water. Figure.4 shows its 3 measurement parameters along with the batteries for power purpose.

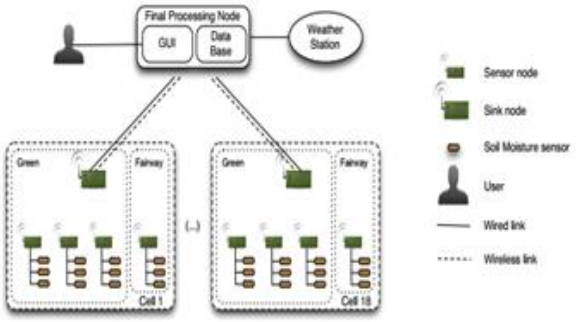


Fig.4 GolfSense system architecture, adapted from [12]

Winery computing venture [14] studied the vineyard staff' wants and priorities to be able to furnish a WSN which assists the employees to get better results. For getting this authors put their efforts with the websites and observation works.

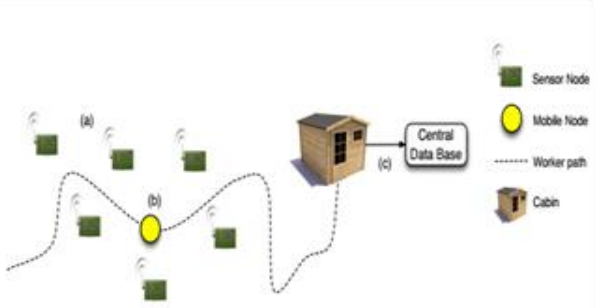


Fig.5 Data mule architecture system in the vineyard

The system shown in figure.5 consists of following events that make the system more resourceful

(a) The sensor nodes attached to the unit can gather environmental data

(b) In this mobile node acts as workers tool that can gather data without knowing him

(c) The gathered data can be uploaded to the central server database by the shovel

In [16], the authors conducted an investigation of monitoring the production life cycle of the Sicilian vineyard. The system takes necessary design considerations thereby saves product preservation. In this, a sensing mechanism is utilized to control productive chain, nodes that are installed in the field, thus the gathered information recollects the quality of grapes. In [15, 17], the authors discussed security issues in IoT and the designed system architecture is well elaborated with its security issues present in 3-layer architectures. They also explained key management and its corresponding access control mechanisms. In [18, 24], the authors devised a model for monitoring and controlling environmental parameters in terms of efficiency. The system can monitor at multipoint send data wirelessly. As the system is little bit power hungry, so it requires intelligent resource management in the network.

In [19], the authors explained the implementation details of WSN based monitoring of environment by soil moisture sensor. The system is designed to detect the rainfall and alerts immediately, thus the measurements are noted at regular intervals. The main purpose of this project is the faster response of the system in the event of rainfall, which increases the lifetime of the overall network. In [20], the authors suggested a system that can be applied in every corner of agriculture sector for improving the production of farming by using all the resources in a clever manner without wasting any of them. The designed architecture of farming system enhances the crop yield reduces errors in managing of agricultural tools. In [21], the authors gathered information about beehive behavior with the help of WSN technology. The system uses less power by employing new sensing techniques. The system can send the data to a cloud server to monitor with the help of IoT devices.

In [22], the authors found that major issue crop provision is to monitor regularly pest insect population. The system capable of capturing automatically trapped areas and transmits this data to remote stations. The system measures the insect density at different farm locations and generates the beep alarm upon reaching the threshold value. The client nodes are deployed in the farm for monitoring and master nodes organize the network and get the captured images from client nodes. However, after connecting the data for 4 weeks, the compare it with visual observations of the trap to get a final decision. In [23-24], the authors find a solution of improved accuracy in environmental monitoring and need of less human power, thus the investigated is conducted on the labview with GUI. The system design consumes less power and cost effective and better suited for medium type farming. The designed system possesses high scalability for farming.

3. Recommended outline

From the above survey, some purpose of the work is identified and gathered with the explosive growth of agriculture has its possess elucidations responsible for the crop destruction is infected the plant, watering the crops. Hence it has emerged as significant to determine plant diseases and watering the crops properly within the particular time interval. The detection of disease accurately is the important thing to restrict the agriculture loss. For this reason, automation must be applied in agriculture to overcome these problems, making agriculture sensible making use of automation and IoT technologies provide more accuracy and it gives a boost to productiveness. The objective of the study is to improve agriculture shrewd using automation and IoT applied sciences. In order that Controlling and monitoring of all these Agri-field operations by means of any remote smart device or computer linked to the internet and the operations shall be performed by using interfacing sensors, Wi-Fi modules. However web application also used to monitor the dynamic crop filed information employing IoT server[30-33]. To use the Plant disease detection method that is capable of improving the plant productivity and economic growth to the farmer with the simplest method..

4. Results and Discussions

Table.1 describes the comparison of the expert system, which has presented during different eras. In the previous expert system, the user manually inputs the symbol of diseases, and they use web-based, ontology based and expert system tool for the development of expert systems. In previous literature, they did not use the concept of IoT for the collection of data. In our proposed solution, we develop an expert system based on the concept of IoT. Different kind of sensors is deployed in the fields which monitor the crops, and send the data to the server, the server processes the data and send a recommendation to the farmer.

Table.1 Comparison of IoT based expert system with other embedded systems

Authors	Crops	Technology Used	Diagnosis	Testing
Sharma et al.[25]	Soybean	Web based expert system	Finding Pests based on morphology of insects	Tested by Experts
Pradesh et al.[26]	Tomato	Web based expert system, ID3 algorithm , optimization algorithm	Provide information about the diseases, symptoms, chemical control	Nil
Fahad et al.[27]	Wheat	Web Based Expert System	Diagnosis of diseases in wheat	Recommendation for wheat diseases
Andujar et al.[28]	Cereals	Microsoft Visual Basic	Used for diagnosis and identification of disease	System is validated and verified
Kolhe et al.[29]	Oilseed	Web based and fuzzy logic	Used for diagnosis of diseases.	System is validated and verified.

5. Conclusion

In this paper, the problem of finding agriculture irrigation process and plant disease detection techniques is investigated. The development phase of the prototype IoT based intelligent Irrigation system with disease analysis is explained in this paper. The aim of this survey was to summarize the recent researches and its demerits in automated irrigation and plant disease detection techniques. It is clear that applying of IoT concepts to image processing in agriculture sector improves the productivity and reduces the crop failure rate. With this, the farmers have the provision of connecting to any device, from anywhere at anytime globally to get updated information on modern ways of doing agriculture with ease.

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