

Internet of Things Implementation for Wireless Monitoring of Agricultural Parameters

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Abstract— Agriculture field is that the backbone of Indian economy. In Asian nation around seventieth of the population earn its resource from agriculture sector. Taking thought to the current state of affairs, during this paper system planned that attempt to develop a wireless system that monitors environmental conditions in agriculture field like temperature, soil pH, soil wet level and humidness beside leaf diseases detection. an efficient implementation for web of Things used for observance regular environmental conditions by means that of low value omnipresent sensing system and result with current all parameters, affected plant disease, its management measures is shipped to our e-mail account. System is designed because for the higher yield of crops some parameters from surroundings square measure necessary that directly have an effect on its growth. These parameters could also be environmental condition parameters, soil parameters, irrigation parameters etc. Leaf diseases additionally cause important injury and economic losses in crops worldwide.

Index Terms— Internet of Things (IoT), Leaf disease detection, soil parameters, Webcam, Zigbee communication.

I. INTRODUCTION

Agriculture has been one in all the first occupations of man since early civilizations and even now a days manual interventions in farming square measure inevitable. Asian nation is ranking second in farm output. Observance and dominant the agriculture is a vital task for the farmers as they need to frequently offer attention on crop growth for higher yield. Thus planned system consists the remote measure and dominant of various environmental parameters of field over the web. These parameters may be mechanized by sure network subject style ways and applying zigbee communication standards. The information transmission of good sensing devices increased with zigbee over the web may be done by integration associate in nursing computer or laptop computer with wireless zigbee network. In a zigbee network, devices collect and forward knowledge to an arranger [1].

Omnipresent sensing enabled by Wireless Sensor Network (WSN) technologies cuts across several areas of recent day living. This offers the power to live, infer and perceive environmental indicators, from delicate ecologies and natural resources to urban environments [12]. The proliferation of those devices in a very communicating-actuating network creates the web of things. With the advancements in web technologies and Wireless Sensor Networks (WSN), a replacement trend within the era of presence is being realized. Huge increase in users of web and modifications on the internetworking technologies modify networking of everyday objects. “Internet of things (IoT)” is all regarding physical things reproof one another, machine-to-machine communications and

person-to-computer communications are going to be extended to “things”[1]. The web of things refers to the interconnection of unambiguously acknowledgeable embedded computing-like devices at intervals the present web infrastructure. This method is combined with embedded system and image process for observance completely different irrigation parameters like humidness, pH level with temperature and plant leaf disease detection.

II. AIM & OBJECTIVES

A. Aim

Aim of the system is to mix the computer and image process half to observe leaf diseases at the same time. An efficient implementation for web of Things used for observance environmental conditions in agriculture field. Humans typically on their farm act with the surroundings settings like some irrigation parameters, temperature, light etc., and regulate consequently. This settings of the surroundings may be created to reply to human behavior mechanically. Leaf pictures square measure captured by separate USB camera connected to computer.

B. Objectives

To measure and management completely different soil and climatic parameters of farm together with leaf diseases detection remotely and send its details over the net is to be mechanized. Main objective is to get a good low-priced and versatile answer for condition observation and energy management in farm. To produce close intelligence to method on leaf pictures and detects diseases thereon through image process. System ought to support and schedule the soul in operation time consistent with the climatic changes and water level of the crops. To detect leaf disease with its name by comparing it with some stored images in the Matlab code is need to achieve. For sending details of that disease and what climatic parameters are responsible for that is saved in Matlab program is need to be send correctly over internet to implement the concept of Internet of Things.

III. LITERATURE REVIEW

S.D.T. Kelly et al. have gift the idea of IoT in 2013 in IEEE paper “Towards the Implementation of IoT for condition Monitoring in Homes” for automation functions in homes. With the advancements in web technologies and Wireless Sensing element Networks (WSN), a replacement trend within the era of presence is being completed. Huge increase in users of web and modifications on the internetworking technologies alter networking of everyday objects [1]. Same idea is employed here solely distinction is that rather than

home automation here we have a tendency to projected agricultural automation. “The Evolution of the internet of Things”, Strategic promoting Texas Instruments, white paper written by Jim Chase researched any on IOT that proves that the IoT creates an intelligent, invisible network cloth that may be detected, controlled and programmed. IoT-enabled merchandise use embedded technology that enables them to speak, directly or indirectly, with one another or the net [2].

Sanjay B. Patil et al. in paper “Leaf disease Severity measurement Image Processing” in 2011 have projected an image process technique for plant disease region identification. Sugarcane crop is chosen for experimental result in that. We have enforced same idea of image process during which four main steps concerned viz. image acquisition, image segmentation, leaf region segmentation, disease region segmentation [3].

Pradnya Ravindra Narvekar et al. projected system to debate the effective manner employed in acting detection of grape diseases through leaf feature scrutiny. Leaf image is captured and projected to work out the health standing of every plant [4]. S. Arivazhagan et al. in paper “Detection of unhealthy region of plant leaves And classification of plant leaf diseases using texture features” have presents an application of texture analysis in police investigation and classifying the plant leaf diseases. By this technique, the plant diseases will be known at the initial stage itself and therefore the persecutor management tools will be accustomed solve persecutor issues whereas minimizing risks to individuals and therefore the surroundings [5].

IoT primer, “The Internet of Things: creating sense of successive mega-trend”, revealed in September three, 2014 offers plan concerning the fundamental ideas of IoT. It mainly focuses on Enablers, Platforms, & Industrials The IoT building blocks can return from people who will web-enable devices, offer common platforms on that they'll communicate, and develop new applications to capture new users [6]. Jayavardhana Gubbi et.al [7] in paper “Internet of Things (IoT): A vision, discipline components, and future directions”, offers future Generation laptop Systems in year 2013 that tells that good property with existing networks and context-aware computation victimization network resources is an important part of IoT. With the growing presence of Wi-Fi and 4G-LTE wireless web access, the evolution towards present data and communication networks is already evident. However, for the net of Things vision to with success emerge, the computing paradigm can get to transcend ancient mobile computing situations that use good phones and portables, and evolve into connecting everyday existing objects and embedding intelligence into the environment [7].

Arti N. Rathod et al. in paper “Image process Techniques for Detection of Leaf Disease”, revealed in Gregorian calendar month 2013, provides the survey of various techniques for plant disease detection. There is main characteristics of malady detection square measure speed and accuracy. Thus performing on development of automatic, efficient, quick and correct that is use for detection malady on unhealthy leaf. Work are often extended for development of hybrid algorithms & neural networks so as to extend the popularity rate of ultimate classification method. More required to reason quantity of malady gift on leaf [8].

G. V. Satyanarayana et al. in paper “Wireless Sensor Based Remote Monitoring System for Agriculture Using ZigBee and GPS” have gift system style to develop and implement a

wireless sensing element network connected to a central node victimization Zigbee, that successively is connected to a Central watching Station (CMS) through General Packet Radio Service (GPRS) or world System for Mobile (GSM) technologies. The system additionally obtains world Positioning System (GPS) parameters associated with the sector and sends them to a central watching station [9].

Gracon H. E. L. American state national capital et al. in paper “WSN as a Tool for Supporting Agriculture within the exactness Irrigation” revealed in Sixth International Conference on Networking and Services in 2010. Explained aspects associated with WSN were approached, in addition because the required technologies for his or her implementation and simulation. A simulation atmosphere that permits its users to look at and interpret the information obtained by sensors was developed. These knowledge square measure generated by events generated by the interaction between the users and also the application [11].

IV. RELATED WORK

A. Proposed Method

The System is combination of three completely different fields viz. embedded system, image process and wireless networking half for IoT. System consists of clusters of sensors, grouping differing kinds of information, concerning the sphere. The info transmission of sensible sensing devices connected with Zigbee network. Matlab software system is employed for detection of leaf pictures. For study purpose we have thought-about Grapes leaves and diseases related to it. Once image process half results are sent via Matlab to our e-mail account. That consist current environmental factors, if there is any spot or hole on leaf then its name, its causes and its management measures etc.

B. Block Diagram

Detailed Block diagram with combined embedded system plus image processing is as shown in Figure (1). Flow of the diagram is very simple. All sensors sense and collect data from environment around the crop and give it to the Arduino board. Arduino performs different necessary functions like analog to digital conversion, interfacing with different sensors, interfacing with LCD etc.

By performing various conversion factors results are sent to the LCD Display as well as towards the one Zigbee module for serial communication. There are two zigbee S1-modules are used to collect data from Arduino and transfer wirelessly to the computer. Personal computer or laptop can be used to perform image processing operation on the defective leaves. Usb camera take live pictures of plant leaves. Images are send to the PC for further operation. Matlab gives results finally on the web display as shown in fig. 1

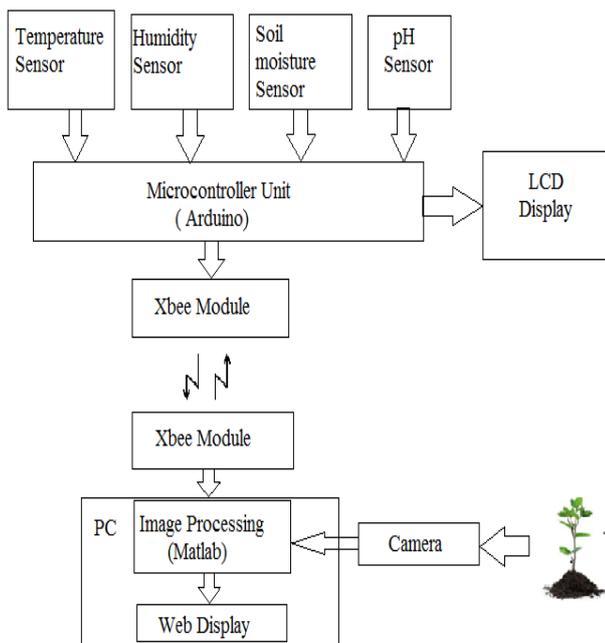


Fig. 1 Overall structure of System

C. Leaf Disease Detection

There are a unit four main steps for image process on leaf that includes:

- 1) Image Acquisition: Spot pathological leaves area unit taken for this study. Pictures area unit taken in controlled surroundings and area unit keep within the JPEG format.
- 2) Image Segmentation: Image segmentation is that the necessary step to separate the various regions with special significance within the image.
- 3) Leaf region Segmentation: Input image is initial reborn into gray scale image. Since image is taken in controlled surroundings putting pathological leaf on the white background, it makes massive distinction in grey values of 2 teams, object and background.
- 4) Diseases region segmentation: Segmentation of region with spots is completed here. For fulfillment of experiment it's necessary to section the unwellness region accurately [3].

D. Hardware Used

In proposed system hardware consists mainly five units as given below:

- 1) Arduino Board: Here we have a tendency to use Arduino board that acts as a microcontroller unit for embedded half. Associate degree Arduino board consists of Atmel 8-bit AVR microcontroller with complementary parts that facilitate programming and incorporation into alternative circuits.
- 2) Sensing Units: Four differing types of sensors are used. The sensing unit sort one live the attributes of a hydrogen ion concentration level of soil in farm i.e. pH of soil. The sensing unit sort two measures the wetness within the air. The sensing unit sort three is indicating the temperature detector which supplies the specified temperature level for that crop. The sensing unit sort four measures the soil wet level within the soil which supplies the thought regarding water level in soil.

- 3) Zigbee module: Xbee-S1 module is employed for wireless information transmission of all parameters from field to computer.
- 4) Web Camera: One i-ball ROBO K20 USB camera is employed for taking live leaf pictures which might be simply interfaced to the computer by USB port.
- 5) LCD Display: 20X4 alphanumeric display is employed to display the values of various parameters perceived by sensors ceaselessly.

E. Software Used

Along with the hardware software used is also equally important. Because to run the entire system both software and hardware are required. In planned system we would like to use two software packages viz. Matlab and Arduino software. Here Matlab is employed for plant disease detection i.e. image process yet as for causing e-mail of result to our e-mail id. Thus we have a tendency to use Matlab R2013a version for programming a part of image process.

Arduino 1.0.6 version is employed here for interfacing purpose. The Arduino integrated development atmosphere (IDE) is employed for the process programming language and therefore the wiring comes. It includes a code editor with options like syntax lightness, brace matching, and automatic indentation. It's conjointly capable of compilation and uploading programs to the board with one click. Arduino programs are written in C or C++.

V. RESULTS AND DISCUSSION

Results of embedded hardware that shows all recent values of various environmental parameters like temperature, humidity, soil hydrogen ion concentration and soil wet level area unit ceaselessly showed on the 20X4 alphanumeric display with its units. Same information is distributed to the computer by suggests that of Zigbee network.

For experimental setup we are able to select any plant like grape, mango or cucumber or any vegetable plant like tomato etc. Once completion of image process half rather than merely predicting that whether or not plant disease is found or not, the name of that malady is additionally determined. For that we have got capture image of leaf by live net camera and compare that leaf with pictures keep in Matlab one by one. Once it matches with explicit one then corresponding disease name and its causes that are already saved like few lines are send as email to email id given in Matlab program.

VI. CONCLUSION

An easy implementation for web of Things used for watching regular agricultural parameters conditions by means of low price omnipresent sensing system is achieved here with success. The outline regarding the integrated system and therefore the interconnecting mechanisms for reliable measure of parameters by good sensors and transmission of information via web is being bestowed in easy language.

By reviewing past literature we have a tendency to come to grasp that there is good to inform farmer regarding health condition of his field directly via web thus all results are directly sent to farmer via send mail command in Matlab.

Automation in agricultural field is easily achieved by using appropriate hardware and software.

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