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Research paper

Rice-Blast Disease Monitoring Using Mobile App

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Abstract

This research paper focuses on implementation of image analysis algorithms on captured images for the purpose of detecting crop diseases and monitored through Mobile App. The purpose of this research is to find out the diseases in early stage, and reduce the yield loss. The system design includes sensors, controller, image analysis algorithm, Cloud storage and mobile app. Using the USB camera, images in the farm are captured and processed by controller module. This is sent to the cloud, which can be accessed by mobile App or remote user. Various image processing algorithms were used to process the images. The results are presented in this paper.

Keywords: *Agriculture, rice disease detection, raspberry pi, sensor and IoT (internet of things).*

1. Introduction

In agriculture, Rice production plays a vital role in the country economy and it is one of the chief grains in India. It is the principal food crop in the country with largest area of rice cultivation [1]. Almost it is cultivated in all parts of the country and major crops are from eastern and southern parts of India. The rice crops can be cultivated in proper climate conditions and water availability. More than 100 varieties of rice crops are cultivated in India with different land conditions. India ranks second in the rice production [3]. Although several problems arise during crop cultivation in the field, major impact occurs by diseases only. The diseases are caused by bacteria and virus and it may occur in both nursery and main field stage. The nursery diseases include blast, rice tungro diseases etc. The main field diseases include blast, brown spot and sheath rot etc. Considering all the types of rice diseases the most common occurring one is the blast disease, which occurs in paddy crop, irrespective of the cultivation geography. The estimated grain loss due to blast disease is up to 70% to 80% [2].
Section II of this paper contains the literature survey, section III describes the Architecture of the System, section IV explains the proposed method, section V deals the experiments and results, and section VI presents the conclusion.

2. Literature Review

The author D.Amutha Devi et al. (2014) proposed the image segmentation algorithm, to compare the segments on the diseased portion of the paddy leaves. The problem occurs in the image segmentation method while varying the gray level background. The following segmentation techniques are used: region growing segmentation and work mean shift segmentation. To improve the quality of the segmentation, median filter and color space transformation are used. Finally, from the mean shift algorithm with Luv color space transformation, performance has been obtained for segmentation of rice leaf diseases [4].
The method proposed by Nunik Noviana Kurniawati et al. (2009) sets up a diagnosis system, which identifies the crop diseases as blast, brown spot and narrow brown spot diseases. To get the best result from the diagnosing, ninety-four paddy leaf images, two thresholding methods are applied. From the two methods the accuracy of the local entropy threshold is found to be about 94.7% [5].
The author P. Mercy Nesa Rani et al. (2013) has proposed the rice disease diagnosis using expert system. The diseases diagnosed are blast, brown spot, sheath blight, sheath rot and false smut. The system is developed with a set of rules. First the diseases are uploaded in the database and stored in the farmer’s local languages, which helps them to easily access the system. If any new diseases arise, the farmers can upload the details of such diseases in the database and it will be monitored by the domain experts. Main aim of the research is to find out the diseases in early time and farmers can save their time and crops [6].
The author D. K. Sreekantha et al. (2017) has presented the challenges faced by farmers in the field, using IoT System. IoT collects the information about soil moisture, pest detection, weather, crop growth and animal invasion in the field. Sensors collect the information and send to the device for farmers’ access. WSN is used to monitor the farm condition. Wireless camera is used to view the image of the farm. Using this system, the farmers are able to monitor and view the farm plant from anywhere and anytime. The purpose of the technology is used to increase the production of crops and profits for the farmers as well [7].

3. Architecture of the System

The main aim of the reference architecture is to cover the multiple aspects of crop cultivation, which include server or cloud side architecture, which can analyze, manage and interact with the IoT Devices. The IoT platform is suitable for 32 bits or 64 bits. These computing platforms can run on Linux OS and support another operating system including Windows and Android [8]. The objective of this research is to give an architecture that supports integration between systems and devices. The requirements for reference architecture need connectivity and communications,

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device management, data collection, scalability, security, predictive analysis and integration [11].

Connectivity and Communications

The protocol HTTP is an important tool for connecting many devices. However, HTTP has two issues, when used with Raspberry pi, one is memory size and the other one is power requirement. In order to overcome these issues simple protocol would be used. Two protocols are used; one connects to the gateway and the other from the gateway to the cloud.

Device Management

The Device management should handle the software, update, manage the security credentials, remotely enable the hardware devices, and remotely reconfigure the Wi-Fi.

Data Collection, Analysis, and Actuation

The IoT devices consist of sensors, actuators, and a combination of both. Few IoT devices will depends upon the user interface (UI). Finally, it collects a huge number of data from the devices, analyzes and manages activity accordingly. The purpose of the reference architecture is to collect large amount data from the devices in real-time and perform the data analysis.

Scalability

The server side architecture should be to highly scalable, because it would be connected to millions of devices for sending and receiving the data.

Security

In the IoT devices, security is the most important aspect, as it collects the millions of personal data from real-time on a daily basis.

4. Proposed System

The study from the literature survey, indicates clearly that the rice disease detection is very important research in recent times. Hence, a system is proposed to improve the crop yield by detecting the disease during the early stage itself. The architecture of the proposed system includes Camera, Raspberry Pi3 module, communications tools, data Storage and a mobile app. The proposed IoT based architecture shown in the Figure 1.

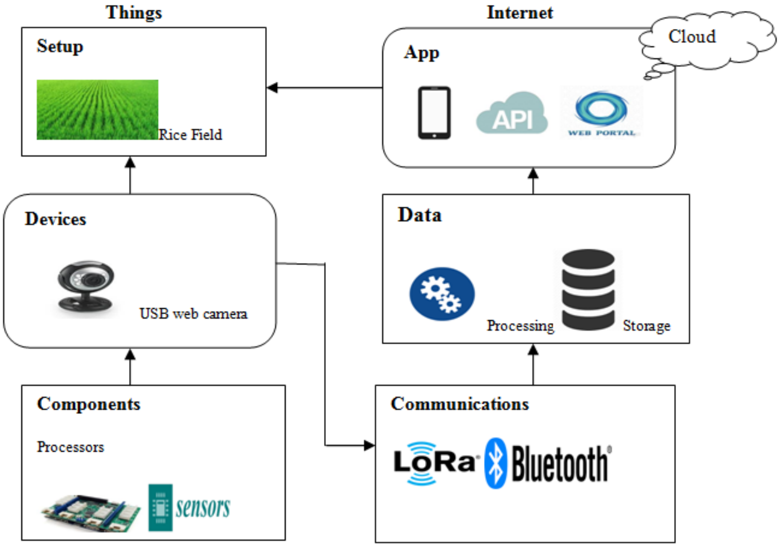


Figure 1: IoT based rural agricultural architecture

USB Camera

This forms the initial part of the proposed architecture. The purpose of the USB camera is to capture the image from the field. The images are captured from the Panpoli area, Tamil nadu, India (Rural area). Some of the images captured using the USB Camera are shown in Figure 2.

Figure 2: Captured images

As seen in the last clip of Figure 2, the blast disease tends to infect the leaves of the rice plant initially and spreads to other parts of the plant.

Raspberry Pi 3

Raspberry Pi 3 is the mini credit size computer, which does all the processing tasks [9] and called as the mobile embedded hardware platform. USB camera is interfaced with the Raspberry Pi module. The images captured by it, will be processed on Raspberry Pi using Open CV-Python module. The image set is processed using various algorithms such as edge detection, thresholding etc.

Cloud Analytics

The purpose of cloud analytics is to store the data and send to remote users. The cloud accounts are already synchronized with the Android mobile. Once the data is processed, it gets uploaded to the cloud and it can be viewed through mobile from anywhere. Huge data is stored in the cloud for future analysis. [10].

5. Experiments and Results

The work is separated into two stages as software and hardware part. Stage 1 is software part and carried out using Python scripts from the captured images. However, Stage 2 is implemented with the help of Raspberry Pi3 module. The system configuration includes USB web camera (Zebronics Crystal plus 2.0), Raspberry Pi 3 model B, Microsoft One Drive for cloud account and Micromax Android mobile . The output of the various algorithms

extracted on the captured images can be viewed through the mobile and it is shown in Figure 3. The Figure 3a shows that edge detection output viewed through the mobile app, Figure 3b shows the Frangi filter output, Figure 3c shows the GLCM Texture feature output, and Figure 3d and 3e shows the various methods of thresholding. Using this proposed system, the farmers can check whether the farm is infected with blast disease or not. The results discussed here show only the images of infected crops.
The system shows the status of healthy crops as well.

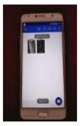
Fig.No	Original Image	Cloud based Disease Monitoring using Mobile
a		 Edge Detection
b		 Frangi Filter
c		 GLCM Texture Features
d		 Thresholding Histogram
e		  Thresholding Local Otsu Method

Figure 3: Mobile app output

6. Conclusion

In this paper, the plant disease detection which is a challenging task is considered. Most of the diseases are found in the leaf of the plant. Hence, the crops are photographed and the captured images are processed in Raspberry Pi 3 module, which sends the data to cloud. The cloud account is synchronized with Android mobile. So, the farmers or end users can monitor the field using this app from anywhere and anytime with the help of Internet. Extensive use of IoT technology will greatly help in the agriculture production and thus leads to improved productivity.

7. Future Work

The work could be extended to other types of crop. and diseases. While applying to other crops, the symptoms of the diseases, and other critical factors should be considered. The proposed work suggests that it will be suitable for other crops and diseases.

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