International Journal of Scientific Research & Engineering Trends
Volume 5, Issue5, Sep-Oct-2019, ISSN (Online): 2395-566X

Smart Sugarcane Crop Growth Monitoring System using IOT and Image Processing

Someshwar Terkar[1], Saurabh Shinde[2], Sushma Potdar[3], Neha Chavan[4]
Guided by
Ms. K.S. Jadhav
Vidya Pratishthan'sKamalnayan Bajaj Institute of Engineering and Technology
Baramati, MH, India

Abstract **-Agriculture is the most important sector of an Indian economy. Sugarcane is the main source of sugar in India and holds a prominent position as a cash crop. People uses conventional way for the farming. Conventional way requires more human power. Around 55% people in India has been engaged in agriculture but only 15% goods we get from the agriculture. Though there is a large area under cultivation, we don't get maximum yield. The fact that most of our farmers have the lack of proper knowledge makes it even more erratic. A large portion of farming and agricultural activities are based on the predictions, which at times fail. Due to this, farmers have to bear huge losses. Since we know the benefits of proper irrigation and soil nutrients in the growth of sugarcane crop, such parameters can't be ignored. Diseases occurred to the sugarcane plant can affect the yield of sugarcane. Sothe "Smart sugarcane crop growth monitoring system based on IOT and image processing" is one of the best way to increase crop yields.**

Keywords **- IOT, Image Processing, irrigation, soil nutrients, Disease.**

I. INTRODUCTION

This is the automated system in which required amount of water is given to the crop automatically and if the nutrients of the soil gets below the minimum threshold frequency then this system automatically sends the notification about that to the farmer. Also if the disease is occurred to the sugarcane plant then due to lack of proper knowledge about the disease and the required fertilizers to overcome that disease plants can get die before harvesting.

So there is need to solve this problem. For that we are going to extract this system by image processing in which farmer can simply capture the image of the infected sugarcane crop leaf and find out the information about the disease and required fertilizers to overcome that disease. In this way we can reduce the loss in farming and increase the crop yields by implementing IOT and Image processing technology into agriculture. When IOT is implemented with the help of sensors, the sensors can sense the data continuously and notify the farmers about nutrients present in the soil and automatic irrigation system can be controlled by the farmers using mobile application. With the help of image processing farmers can capture the image of infected crop leaf and can get a brief understanding of the disease and fertilizers required to remove the disease. This system will thoroughly help farmers to increase the productivity of sugarcane crop and gain maximum profit.

II. LITERATURE SURVEY

Sachin D. Khirade, A.B Patil [1] worked on Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. This paper discussed the methods used for the detection of plant diseases using their leaves images.

This paper discussed various techniques to segment the disease part of the plant. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The accurately detection and classification of the plant disease is very important for the successful cultivation of crop and this can be done using image processing. This paper discussed various techniques to segment the disease part of the plant. This paper also discussed some Feature extraction and

classification techniques to extract the features of infected leaf and the classification of plant diseases. The use of ANN methods for classification of disease in plants such as self- organizing feature map, back propagation algorithm, SVMs etc. can be efficiently used. From these methods, we can accurately identify and classify various plant diseases using image processing technique.

H. Al-Hiary, S. Bani-Ah Mad, M. Reyalat, M. Braik And Z. A Lrahamneh, [2] describes the three methods of leaf disease detection: 1) To identify the affected part of leaf by using K-means Clustering. 2) To solve the affected part of leaf by using color co occurrence methodology for texture analysis. 3) To find and classify the type of disease by Neural Networks (NN's). In details; first is RGB images of leaves are acquired and apply for color transformation structure. After that image is segmented by K-means clustering technique and masked the green pixels value and remove the green masked pixels and obtained the threshold value of object by Otsu's method. The RGB images are sets the zero value for converting color co-occurrence technique. After that infected clusters was converted into Hue Saturation Value (HSV) and for texture analysis use the SGDM matrix for each image formation. Finally the recognize the process was execute the solution by Neural Network's.

Prakash M. Mainkar, ShreekantGhorpade and Mayur Adawadkar [3] worked on plant disease recognition technique, in which first phase is to create color transformation structure for the RGB leaf image and convert color values from RGB to the space specified in that structure. Then apply color space transformation and image is segmented using the K-means technique. In the second phase called as Masking of green pixels, the unnecessary part such as green area within leaf area is removed. In third phase authors calculate the texture features for the segmented infected object also remove masked cells inside the boundaries of the infected cluster. Infected cluster are converted from RGB to HSI and SGDM matrix is generated for H and S. In the fourth phase GLCM function is used to calculate the features and compute of texture statistics. Finally, the extracted features are passed through pre-trained neural network for disease recognition.

Ms. Kiran R. Gavhale, Prof. Ujwalla Gawande and Mr. Kamal O. Hajari [4] present image processing technique for detection of unhealthy region of Citrus leaf. There are four types of citrus diseases namely: (i) Citrus canker, (ii) Anthracnose, (iii) Overwatering, (iv) Citrus greening. Author proposed methodology in which image acquisition is first step for capturing image by digital camera in high resolution to create database. Color space conversion and image enhancement is done in image pre-processing. Discrete cosine transform domain is used for color image enhancement. YCbCrcolor system and L*a*b* color space are chosen for color space conversion. In feature extraction author present statistical method, using Gray-Level Co-Occurrence Matrix (GLCM) to see statistics such as contrast, energy, homogeneity and entropy using graycoprops function. Two types support vector machine (SVM) classifiers: SVMRBF and SVMPOLY are used for differentiating citrus leaf diseases.

P.Revathi, M.Hemalatha [5] worked on Image Edge detection Segmentation techniques in which, the captured images are processed for enrichment first. Then R, G, B color Feature image segmentation is carried out to get target regions (disease spots). Later, image features such as boundary, shape, color and texture are extracted for the disease spots to recognize diseases and control the pest recommendation. In this Research work consist three parts of the cotton leaf spot, cotton leaf color segmentation, Edge detection based Image segmentation, analysis and classification of disease.

Satish Madhgoria, Marek Schikora, and Wolfgang Koch [6] Proposed automatic pixel based classification method for detecting unhealthy regions in leaf images is presented. The algorithms have been tested extensively. Linear SVM has been used to classify each pixel. We have also shown hoe the results from SVM could be improved remarkably using the neighborhood check technique. The presented algorithm could well extended for other detection tasks which also mainly rely on color information, but extension to other features is easily possible. The task is performed in three steps. First, we perform segmentation to divide the image into foreground and background. In the second step, support vector machines are applied to predict the class of each pixel belonging to the foreground. And finally, we do further refinement by neighborhood-check to omit all falsely-classified pixels from second step.

Malvika Ranjan, Manasi Rajiv Weginwar, NehaJoshi, Prof.A.B. Ingole [7] describes a diagnosis process that is mostly visual and requires precise judgment and also scientific methods. Image of diseased leaf is captured .As the result of segmentation Color HSV features are extracted. Artificial neural network (ANN) is then trained to distinguish the healthy and diseased samples. ANN classification performance is 80% better in accuracy.

Prof. Sanjay B. Dhaygude, Mr.NitinP.Kumbhar [8] worked on The application of texture statistics for detecting the plant leaf disease has been explained Firstly by color transformation structure RGB is converted into HSV space because HSV is a good color descriptor. Masking and removing of green pixels with

pre-computed threshold level. Then in the next step segmentation is performed using 32X32 patch size and obtained useful segments. These segments are used for texture analysis by color co-occurrence matrix. Finally if texture parameters are compared to texture parameters of normal leaf.

P. Rajalakshmi and S Devi Mahalakshmi [9] worked on Sensors such as soil moisture, luminosity, temperature and humidity sensors are used to determine the appropriate schedule for irrigation. The sensors are integrated to an Arduino Uno board and this data is used for operating the pump in terms of turning it on when the soil moisture level is less and when the temperature is extremely high, the amount of water let from the pump is more when the temperature is high to compensate for the loss of water due to evaporation. In their system the use of NRF24L01 for wireless transfer of data is different from our system where data is transferred through our Wi-Fi module NodeMCU and then uploaded to cloud.

Jia Uddin, S.M. Taslim Reza, QaderNewaz, Jamal Uddin, Touhidul Islam, and Jong-Myon Kim [10] design a model of automatic irrigation system which is based on microcontroller and solar power was used only for source of power supply. Various sensor are placed in paddy field. Sensors sense water level continuously and give the information to farmer through cellular phone. Farmer controls the motor using cellular phone without going in paddy field. If the water level reaches at danger level, automatically motor will be off without conformation of farmer.

Zhang Feng Yulin University Yulin University tfnew21@sina.com[11], worked on automatic irrigation technique irrigated using wireless sensor network i.e. Zig-bee and internet technology. The idea was developed for improve irrigation system and reduced cost of irrigation water. Sensors are placed in farm and sense continuously and collect he information. This information stored at center monitor and also passes to data collection interface and then transmits to the wireless sensor node. Using this information system was control automatically using internet.

Joaquin Gutierrez, Juan Francisco Villa-Medina, and Alejandra Nieto-Garibay, Miguel Angel Porta-Gandara [12]worked on Automated Irrigation System Using a Wireless Sensor Network and GPRS Module mentioned about using automatic irrigation system in which irrigation will take place by wireless sensor units (WSUs) and a wireless information unit (WIU), linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology. It takes a measure of temperature and moisture using sensor and controlled by microcontroller. The WIU has also a GPRS module to transmit the data to a web server via the public mobile network. The information can be remotely monitored online through a graphical application through Internet access devices. This irrigation system allows cultivation in places with water scarcity thereby improving sustainability and it is feasible system. But due to Zigbee protocol this system becomes more costly.

Karan Kansara, Vishal Zaveri, Shreyans Shah, SandipDelwadkar and KaushalJani [13] worked on Sensor based Automated Irrigation System with IOT mentioned about using sensor based irrigation in which the irrigation will take place whenever there is a change in temperature and humidity of the surroundings. The flow of water is managed by solenoid valve. The opening and closing of valve is done when a signal is send through microcontroller. The water to the root of plant is done drop by drop using rain gun and when the moisture level again become normal then sensor senses it and send a signal to microcontroller and the value is then closed. The two mobile are connected using GSM. The GSM and microcontroller are connected using MAX232. When moisture of the soil become low moisture sensor sense it and send signal to microcontroller, then the microcontroller gives the signal to mobile and it activate the buzzer. This buzzer indicates that valve needs to be opened by pressing the button in the called function signals are sent back to microcontroller. Microcontroller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extra ordinary features.

Pavithra D.S, M. S .Srinath [14] States features of their system which are as follows:

- The system supports water management decision, used for monitoring the whole system with GSM(RS-232) module
- The system continuously monitors the water level (Water level Sensor) in the tank and provide accurate amount of water required to the plant or tree (crop).
- The system checks the temperature, and humidity of soil to retain the nutrient composition of the soil managed for proper growth of plant.
- Low cost and effective with less power consumption using sensors for remote monitoring and controlling devices which are controlled via SMS using a GSM using android mobile.

Y. Kim, R. Evans and W. Iversen [15] worked on A remote sensing and control irrigation system using distributed wireless sensor network aiming for variable rate irrigation, real time in field sensing, controlling of a site specific precision linear move irrigation system to maximize the productivity with minimal use of water was developed by Y. Kim . The system described details about the design and instrumentation of variable rate

irrigation, wireless sensor network and real time in field sensing and control by using appropriate software. The whole system was developed using five in field sensor stations which collects the data and send it to the base station using global positioning system (GPS) where necessary action was taken for controlling irrigation according to the database available with the system. The system provides a promising low cost wireless solution as well as remote controlling for precision irrigation.

III. METHODOLOGY

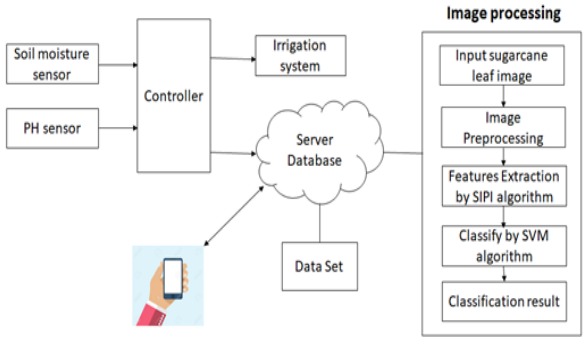

Fig.1. System Architecture.

1.Auto Irrigation

Soil moisture sensor is connected as an input to the controller which gives moisture values from the soil. Water pump is connected at the output. Soil moisture sensor gives values ranges from 0 – 1024. that values can be converted into moisture percentage with the formula moisture percentage = (100.00 - ((analog Read(sensor pin)/1024.00) * 100.00)) . we can set the minimum and maximum threshold frequency ranges of moisture percentage required to sugarcane crop. If the moisture percentage goes below the minimum moisture frequency then water pump get start and If the moisture percentage goes above the maximum moisture frequency then water pump get stop.

2.Soil Nutrients detection

PH sensor is connected as an input to the controller which gives PH values from the soil. PH sensor gives values ranges from 0 – 14. If the value is between 0-6 then soil is acidic and there is more than required nutrients in the soil. If the PH value is between 6-8 then soil is neutral and all required nutrients present in the soil. If the value is between 8-14 then soil is basic and there is less than required nutrients in the soil and needs to add required nutrients. Information about the nutrition is sent to the farmer.

PH Values	Ranges
LOW	0-6(Acidic)
MEDIUM	6-8(Neutral)
HIGH	8-14(Basic)

3. Disease Detection

3.1 Dataset:

Dataset of sugarcane Disease images is generated with the help of attributes of 100 images of each disease.

3.2 Data Prepossessing:

Data Cleaning: Gather open source raw data of Sugarcane Diseases. Data does not contain the name of the attribute so first we have to assign the names to the attribute. Missing values in the dataset like NA's or blank values are removed by using WEKA function "Replace MissingValues" used, which replaces NA's with the mean values of that attribute.

Data Reduction: select important attributes required to build predictive model.

3.3 Training and Testing Dataset: The dataset is divided into two sub datasets.

Training data: training dataset is derived from main dataset and it contains 75% records in main dataset of Sugarcane Disease. Testing data: testing dataset is of 25% records from main Sugarcane Disease dataset.

3.3.1Classifier

Support Vector Machine: "Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for both classification and regression challenges. However, it is mostly used in classification problems. In this algorithm, we plot each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then, we perform classification by finding the hyper plane that differentiate the two classes very well Support Vectors are simply the coordinates of individual observation. Support Vector Machine is a frontier which best segregates the two classes (hyper-plane/ line)

Steps for Calculation of Hyper plane:

1. Set up training data
2. Set up SVM parameter
3. Train the SVM
4. Region classified by the SVM
5. Support vector

1. Prediction

Following steps are performed for prediction

1. Input sugarcane leaf image
2. Image pre-processing
   In image pre-processing actions like unwanted part removal, converting image in standard resolution, adjust brightness these tasks are performed.

3. Feature Extraction
   In feature extraction features like colour, texture is extracted from the image.
4. Classification
   In classification image is classified with extracted feature by using SVM algorithm.
5. predicted output
   At the output name of the disease is generated.

IV. FUTURE SCOPE

This work can be installed by any individual who doesn't have the proper knowledge about farming. Also extension to this work This system can be scaled up using PIR sensor which is used to detect animals which may lead to damage or effect the crop. PIR sensor don't detect or measure heat, instead detect infrared radiation emitted or reflected from an object. It is used to detect the movement of people, animals or other objects. They are commonly used in burglar alarms and automatically activated lightning system. When an animal passes in field, the sensor automatically triggers the detection and thereby system takes necessary actions.

V. CONCLUSION

In this paper we conclude that with the help of this system we can save 70%-80% water requirement and also it reduces the time and efforts of the farmer. This system can be installed by any individual who doesn't have the proper knowledge about farming. It also increase rate of growth of plant. This system can detect the disease occurred to sugarcane crop and farmers can take actions accordingly. It also helps for maintain the level of nutrients in the soil. Farmers can get everything notified with the help of mobile application.

VI. ACKNOWLEDGEMENT

We express our deep sense of gratitude to our respected and knowledgeable guide, parents and lecturers of VPKBIET Baramati and others who provide their valuable guidance and time for guiding us.

REFERENCES

[1]. Sachin D. Khirade, A.B Patil, "Plant Disease Detection Using Image Processing", International Conference on Computing Communication Control and Automation", 2015.

[2]. H. Al-Hiary, S. Bani-Ah Mad, M. Reyalat, M. Braik And Z. A Lrahamneh, "Fast And Accurate Detection And Classification Of Plant Diseases", IJCA, 2011, 17(1), 31-38, IEEE-2010

[3]. Prakash M. Mainkar, ShreekantGhorpade and Mayur Adawadkar "Plant Leaf Disease Detection and Classification Using Image Processing Techniques" International Journal of Innovative and Emerging Research in Engineering Volume 2, Issue 4, 2015, e-ISSN: 2394 – 3343, p-ISSN: 2394 – 5494.

[4]. Ms. Kiran R. Gavhale, Prof. Ujwalla Gawande and Mr. Kamal O. Hajari "Unhealthy Region of Citrus Leaf Detection Using Image Processing Techniques" 2014 IEEE International Conference for Convergence of Technology, pp. 978-1-4799-3759-2/14.

[5]. P.Revathi, M.Hemalatha, "Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection U sing Image Edge detection", ICCCNT'12.

[6]. Satish Madhgoria, Marek Schikora, and Wolfgang Koch, "Pixel-Based Classification Method for Detecting Unhealthy Regions in Leaf Images", 2009.

[7]. Malvika Ranjan, Manasi Rajiv Weginwar, NehaJoshi, Prof.A.B. Ingole, "detection and classification of leaf disease using artificial neural network", International Journal of Technical Research and Applications, 2015.

[8]. Prof. Sanjay B. Dhaygude, Mr.NitinP.Kumbhar, "Agricultural plant Leaf Disease Detection Using Image Processing", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 1, January 2013.

[9]. P. Rajalakshmi and S Devi Mahalakshmi "IOT Based CropField Monitoring And Irrigation Automation" Intelligent Systems and Control (ISCO), 2016 10th International conference.

[10]. Jia Uddin, S.M. Taslim Reza, QaderNewaz, Jamal Uddin, Touhidul Islam, and Jong-MyonKim,"Automated Irrigation System Using Solar Power" ©2012 IEEE

[11]. Zhang Feng Yulin University Yulin University tfnew21@sina.com, " Research on water-saving irrigation automatic control system based on Internet of things Institute of Information Technology", 2011 IEEE

[12]. Joaquin Gutierrez, Juan Francisco Villa-Medina, and Alejandra Nieto-Garibay, Miguel Angel Porta-Gandara, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module", IEEE Transaction on Instrumentation and Measurement,2013.

[13]. Karan Kansara, Vishal Zaveri, Shreyans Shah, SandipDelwadkar and KaushalJani,"Sensor based Automated Irrigation System with IOT", International Journal of Computer Science and Information Technology Vol. 6, Issue 6, 2015.

[14]. Pavithra D.S, M. S .Srinath, "GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Vol 11, Issue I, Jul-Aug 2014, pp 49-55.

[15]. Y. Kim, R. Evans and W. Iversen, "Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network", IEEE Transactions on Instrumentation and Measurement, pp. 1379–1387, 2008.