

DETECTION OF ANTHRACNOSE DISEASE IN CHILI USING IOT AND FIELD DATA

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Abstract— Internet of thing IoT introduced various opportunities for novel applications, which are utilized in agriculture and many more. In the world, Chilli is very significant plant due to its huge ingesting. Chilli has many medicinal properties and using in many foods in Pakistan. Anthracnose produced through *Colletotrichum* spp. consumes stayed one of the greatest vital viruses of Chilli and in worldwide which can cause in crop victims of up to 50%. Chilli can also decrease the danger of tumor by avoiding chemicals from mandatory to chromosome and decrease calorie consumption through growing thermogenesis. Traditionally, the findings and usage of the insecticide are more frequently complete in the fields but this procedure is more time-intense, risky, and not accurate method in most of the time. The main focus of this effort is to grow a system to detect disease detection using internet of thing IoT on the bases of epidemiology of anthracnose disease in chill to Enhancement of production. Controller collect data from field sensors and send to cloud sever and use of k-nearest neighbor (KNN) classifier for analysis the accurate results. The research is very important in terms to increase the production of agriculture system in Pakistan. The system will identify the diseases in the earlier time and categorize anthracnose disease and send information to the farmers to safe their crops.

Keywords—IOT, Chilli capsicum, Anthracnose, KNN classifier, Arduino.

I. INTRODUCTION

Chilli cultivated in all over the world and a common crop. Chilli is raised up an area of 1776 thousand in the world, with a productivity of 7182 thousand tons According the agriculture information. Chilli is well-known as parsimoniously very valuable cash crop in Pakistan. It belongs to family Solanaceae, as are potatoes, tomatoes and egg plants. (Abid, 2014) And is considered valuable cash crop around the world and also in Pakistan. In Pakistan during 2013, area under pepper Chilli cultivation was 66500 hectares with a total production of 23077 tons (FAOSTAT, 2013). Anthracnose produced through *Colletotrichum* spp. is most serious threat of crops in the tropical and subtropical places of worldwide. According to the scientific and economic status, *Colletotrichum* was the eighth maximum hazardous collection of plant pathogenic molds in the sphere's crop (Dean R, 2012).

In these crowds, Chilli pepper (*Capsicum* spp.), an valuable financial yield worldwide (JM, 1992), that is seriously attacked by chili disease called anthracnose which may result in yield damages of up to 50% (Pakdeevaporn P, 2005)

Chilli is a central vegetable because of its huge depletion worldwide. It's uses in many foods usually and it is also utilized in medical field. Moreover, chili can decrease the threat of cancer by stopping chemicals from binding to DNA and decrease calorie consumption by growing thermogenesis (Sahitya, 2014). The chili disease anthracnose due to *Colletotrichum* species extremely increase the excellence and crop of chili fruits causing in low earnings to farmers.

The traditional method of diagnostic and use of the chemical and pesticides are more often done in the fields to avoid a huge loss. It was the more time-consuming, risky, and incorrect method in most of the time with unnecessary practices of the pesticides (J. Ma, Nov. 2018). Another major problem is that

the farmers of Pakistan are uneducated and not easy to aware of the technology for them. They depend on traditional methods and practices. However, there is a need of involvement of advanced and automatic technology in agriculture.

Epidemiology is the reading of outburst of a transferable illness. Aimed at incidence of somewhat illness, four elements show an important part and is characterized as illness tetrahedron. Illness tetrahedron is typically the relationship of infectious pathogen(*Colletotrichum spp*) showing in figure .1, susceptible host, (chili) showing in figure.2 favorable ecological circumstances for pathogen and the time epoch for which all these aspects are interrelating (Singh, 2018)



Fig .1 Colletotrichum spp



Fig .2 chili affected by anthracnose disease

The key task of this effort is to invent a structure to detect early disease detection using internet of thing to Enhancement of chili production. Use some sensors called temperature and humidity sensor and soil ph sensor. Use a microcontroller called Arduino to collect data from sensors. The IoT is support becoming popular day by day in the today's world, around 5 billion items have communicate with the use of internet. Internet of thing

(IoT) introduced a lot of techniques and opportunities in home monitoring, healthcare system, agriculture department and many more. KNN classifier use to calculate the nearest disease values from collect data by sensors. In this project, the detection as wells the remedy for curing it is achieved.

II. LITERATURE REVIEW

In this purposed method, preparing a picture with any perceptual space isn't the most proficient strategy; every sort of picture perceptual space needs to choose. For this situation, HSI shading space was the best to recognize the ailment. A key advance is the change between RGB spaces and perceptual spaces generally utilized (HSL, HSI and HSV) and the approach for picture division, for example, edge and Prewitt channels (J. L. González-Pérez, 2013)

In this examination proposes that picture handling investigation is a proficient, compelling and fast strategy for illness discovery in the beginning phases. The outcomes likewise associated with color substance and affirmed that *C. gloeosporioides* contamination is available in the greeneries, harms the sprig chlorophyll, limits photosynthesis and eventually brings about the passing of the greeneries. It is the main investigation where IP and svm are utilized as compelling apparatuses for anthracnose illness location. We presented various calculations for computing malady seriousness by taking a straightforward picture (Srinivasan, 2018)

In the presented study, by supervisory the biotic components producing extreme misfortunes in the harvest crop, we can upgrade the profitability and nature of the plant life and its items. PC idea with AI approaches has beaten in settling various plant leaves ailment issues including design acknowledgment, classification, object extraction and so on. Along these lines in this effort, we intend an inventive ideal named as MCNN for the classification of Mango verdure tainted from the parasitic ailment called as Anthracnose (UDAY PRATAP SINGH 1, 2019)

In the year 2017, carried out a review on intelligent alarming techniques for enhancing the production of yields and whole

farmhouse. Farm monitoring was carried out by applying the smart objects networking techniques. Individual would be able to recognize the illness of the plant from anywhere. Several Studies with respect to variations in atmospheric conditions, disease detection and analysis, calculating the required manure, soil, and required water estimations were proposed in that work (Vol)

III. METHODOLOGY

3.1 Epidemiology of disease anthracnose in Chilli

Environmental factors play a vibrant role to decide the formation and diffusion of illness. The satisfactory swarm, pathogen and climate circumstances hint to formation of illness (Agrios, 2005). Summer and wet ecological circumstances support the spread of the disease. Temperature about 27°C with comparative moisture of 80% and mud pH of 5-6 have described to be the best favorable circumstances for effective formation of the illness in an assumed part (Roberts, 2001).

3.1.1 Role of IoT in Agriculture

Smart farming based on IoT technologies become very popular for the farmers to reduce the time-consumption and promote the quality and productivity of agriculture. IoT smart farming system work with some sensors and devices to monitor the field condition. The agriculturalists can screen the field circumstances from wherever and they can take better decision on time for enhancement in production of agriculture.

3.1.2 DHT-11 Humidity and Temperature Sensor

The DHT11 is named as temperature and Moisture instrument. The entire quantity of aquatic gas in air is defined as an amount of moisture. When there is an alteration in temperature, comparative moisture also reformed. The quantity of liquid dews in air is enlarged after irrigation. This reasons reduction in temperature which in go upturns the comparative moisture of the surrounds. The temperature and moisture analysis are frequently alerted to the operator so that the operator can be capable to identify the field situations from wherever (Chinmay Tadwalkar, 2019). Temperature nearby 27°C with relation

moistness of 80% take testified to remain the utmost finest situations for efficacious establishing of the ailment in an assumed region (Roberts, 2001). In this arrangement DHT11 is coupled to the controller board called arduino by connectors.

The resulting yield is sent to the edge node. This output is aggregated and forwarded to cloud system for storing.

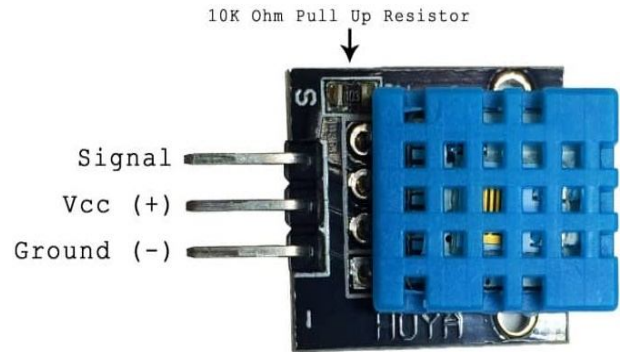


Fig .3 DHT11 sensor

3.1.3 Analog pH sensor

A pH beam is used to bear the quantity of nutrients in the liquid used for drenching mist over on the origins of the vegetation. Usual nutrients upturn the bitterness of the aquatic solution. We practice this as the standard pH for the tenacity of robotics (Felin Francis, 2018)

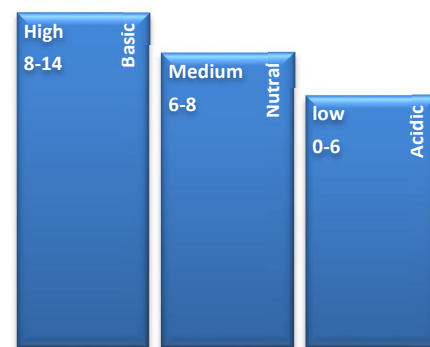


Fig.4 Soil ph

3.1.3 Arduino Uno

Arduino Uno stands a micro controller panel centered on the ATmega328P (datasheet). It takes 14 numerical

input/output bits (of which 6 can be used as PWM productions), 6 analog responses, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB linking, a control jack, an ICSP slogan and a rearrange key. It covers all wanted to care the micro regulator; humbly attach it toward a processor with a USB series or control it through an AC-to-DC connector or freestyle to get ongoing. We can fiddle with our Uno deprived of perturbing also abundant around exploit somewhat incorrect, most horrible case situation you can substitute the piece for a few moneys and start over for a second time.

DHT11 device has three bits and it's built-in on a panel. If yours has four bits, formerly you want to construct this circuit after the device.

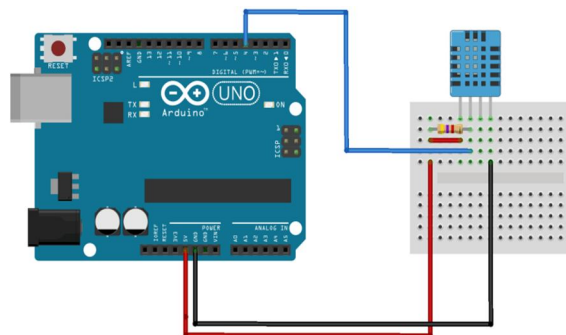


Fig .6 Configuration of Arduino Uno and DHT11 sensor

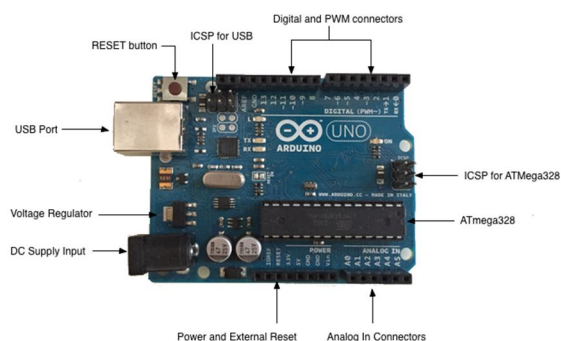


Fig .5 Arduino Uno

"Uno" stands unique now Italian and existed selected toward spot the issue of Arduino program (IDE) 1.0. The Uno panel and type 1.0 of Arduino program (IDE) were the allusion types of Arduino, currently changed to fresher reliefs. The Uno panel is the initially in a sequence of USB Arduino panels, and the orientation ideal for the Arduino policy; for a wide incline of present, previous or old-fashioned panels see the Arduino table of panels.

The system design

The general process of forming the structural design, components, crossing points, and fact for a structure to suit precise necessities is called Systems design. Systems design could be seen as the use of hypothesis of the systems to product development. Fig. depicts the abstract system design as a block diagram. Here, system hardware consists of sensors- that continuously collect the form data. Then it is forwarded to the Edge nodes. The edge node is a microcontroller based on Arduino Uno. All the sensors are connected to it. This system aggregates the collected data and send s the filtered data to the cloud. For predicting the chili plant disease Temperature, Humidity, and ph values are collected from the sensors.

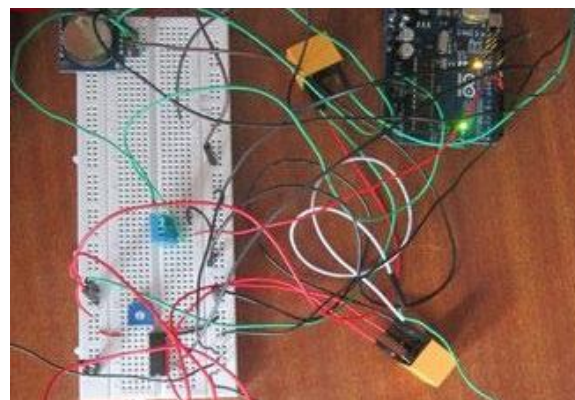


Fig .7 Microcontroller and sensor interfacing

IV. DATA ANALYSIS PROCEDURE & RESULTS

Cloud Server

Things Speak (P. R. Rothe, 2015) Cloud server module is the brain of the whole system. It has the Data Storage Component, Learning Model and the Suggestion Model. The data is stored in the cloud and is fetched by the learning algorithm for predicting the diseases. The KNN Classifier is used in the proposed method as it is simple and need less training data. The predicted results are sent to farmer through mail. Expect we are given a dataset where X is a network of highlights from a perception and Y is a class mark. We will utilize this documentation all through this article. k - Nearest neighbors at that point, is a technique for arrangement that assesses the contingent dissemination of Y given X and orders a perception to the class with the most noteworthy likelihood. Given a positive whole number k, k - nearest neighbors takes a gander at the k perceptions nearest to a test perception x0 and gauges the contingent likelihood that it has a place with class j utilizing the recipe

$$\Pr(Y=j|X=x_0) = \frac{1}{k} \sum_{i \in N_0} I(y_i=j)$$

where N0 is the arrangement of k - nearest perceptions and I(yi=j) is a pointer variable that assesses to 1 if a given perception (xi,yi) in N0 is an individual from class j, and 0 assuming in any case. Subsequent to assessing these probabilities, k - nearest neighbors relegates the perception x0 to the class which the past likelihood is the best.

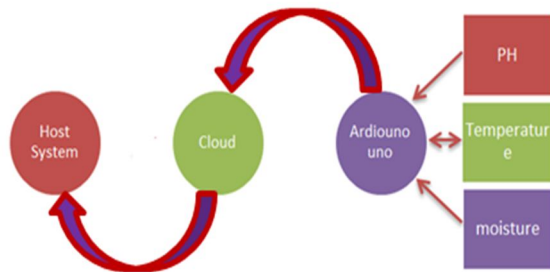
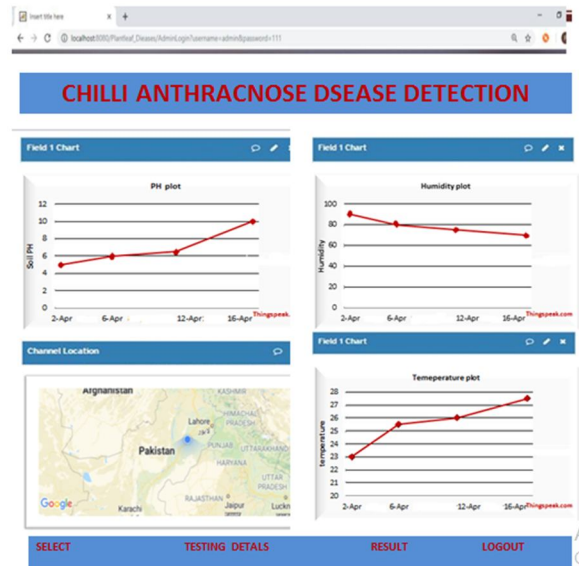


Fig 8. Diagram of developed system

Client or User interface

A simple and easy to use user interface is developed. The client module allows the user to register and visualize the real time data using the developed interface. User home page are showing below. Obtained the values of temperature, humidity and soil ph and send this information to the farmer.



V. DISCUSSION

Include the Arduino controller in the system to collected data from all sensors. The cloud server consist some trained algorithms on obtainable data. The cloud process the data and match the values and then show then result. The possibility that the accuracy of the results will be over eighty. That is the generated output should be correct at least eighty. Then the result alert should be sent to farmers for making them aware of the disease

VI. CONCLUSION

The main focus of this work on Chilli diseases anthracnose detection system. This work done by implementation in real time and generate accuracy in results. The research is an important source to enhance the productivity of agriculture in Pakistan. The technical developing system will be helpful for

the farmers to save their crops from huge losses. Finally achieve that system will identify the diseases in the earlier time and categorize anthracnose disease and send information to the farmers for safe their crops.

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REFERENCES

- (n.d.).
<https://innovate.mygov.in/wpcontent/uploads/2018/09/mygov1536109003113172.pdf>.
- (n.d.). *Volume: 05 Issue: 09 | Sep 2018 P 866-869*.
- Abid, F. H. (2014). PESTS AND DISEASES OF CHILLI CROP IN PAKISTAN. *International Journal of Biology and Biotechnology*.
- Agrios, G. N. (2005). *Plant Pathology*. St. Louis, MO: Academic Press.
- Anonymous. (2012). Agricultural statistics of Pakistan. *Ministry of Food and Agriculture. Govt. of Pakistan. Food and Agriculture Division. Planning Units, Islamabad*.
- Arauz, L. (2000). Mango Anthracnose: Economic impact and current options for integrated management. *Plant Diseases* 84 (6), 600-611.
- Barot ZR, L. N. (2015). An approach for detection and classification of fruit disease: a survey. *Int J Sci Res*, 838-84.
- C. Kanchana-udomkan, P. W. (2011). "Development of a bioassay to study anthracnose infection of chili fruit caused by Colletotrichum capsici. *Thai Journal of Agricultural Science*, pp. 293-297.
- Chinmay Tadwalkar, A. S. (2019). PRECISE AND COMPUTERIZED FARMING USING IOT TECHNOLOGY. *Journal of Analysis and Computation*.
- CHRISTIANA DE FÁTIMA BRUCE DA SILVA^{2*}, S. J. (2014). BIOLOGY OF COLLETOTRICHUM SPP. AND EPIDEMIOLOGY OF THE ANTHRACNOSE IN TROPICAL FRUIT TREES. *ISSN 0100-316X (impresso)*.
- Coates L, G. D. (1994). Infection process of Colletotrichum species in subtropical and tropical. *Australian Centre for International Agricultural Research, Canberra*, 162-168.
- Coates LM, J. G. (1993). Postharvest disease control in mangoes using high. *Annals of Applied Biology* 123, 441-448.
- Dean R, V. K. (2012). The Top 10 fungal pathogens in molecular plant pathology. *Molecular Plant*, 414-430.
- Dodd JC, B. R. (1991). Pre and post harvest control of mango anthracnose in the Philippines. *Plant Pathology* 40, 576-583.
- FAOSTAT. (2013). <http://faostat3.fao.org/download/Q/QC/E>.
- Felin Francis, P. L. (2018). IOT-Based Automated Aeroponics System. *Springer Nature Singapore Pte Ltd.*
- FITZELL, R., & PEAK, C. D. (1984). The epidemiology of anthracnose disease of mango: inoculum sources, spore production and dispersal. *Annals of Applied Biology*, 53-59.
- Gundappa AT, S. P. (2016). Prediction of mango thrips using thermal indices. *GERF Bull Biosc* 7(1), 17-20.
- Humplík JF, L. L. (2015). Automated phenotyping of plant shoots using imaging methods for analysis of plant stress responses – a review. *Plant Method*.
- Isa, I. (2019). Detection of Maize Streak Virus Using Raspberry Pi. *international of integrated science*.
- J. L. González-Pérez, M.-G.-B.-R. (2013). Color image segmentation using perceptual spaces through

- applets for determining and preventing diseases in chili peppers. *African Journal of Biotechnology*.
- J. Ma, K. D. (Nov. 2018). 'A recognition method for cucumber diseases using leaf symptom images based on deep convolutional neural network,. *Comput. Electron. Agricult*, 18–24.
- JM, P. (1992). Problems and Progress of Chilli Pepper Production in the Tropics. , *Proceedings of the Conference on Chilli Pepper Production in the Tropics*, 98-129.
- Kumar, M. K. (2016). Colletotrichum gloeosporioides : Pathogen of Anthracnose Disease in Mango (Mangifera indica L. *Springer International Publishing Switzerland* .
- Mongkolporn, O.-u. (2004). .Genetic analysis of resistance to pepper anthracnose caused by Colletotrichum capsici. . *Agri. Sci. 35,,* 259–264.
- Montri, P. T. (2009). Pathotypes of Colletotrichum capsici, the causal agent of chili anthracnose, in Thailand. *Plant Dis. 93*, 17–20.
- Nelson, S. C. (2008). Mango anthracnose (Colletotrichum gloeosporioides) . *Plant Disease*.
- O. Mongkolporn, P. M. (2010). "Differential reactions on mature green and ripe chili fruit infected by three Colletotrichum species. *Plant Disease*, pp. 306-310,.
- P. B. Jawade(&), D. C. (2020). Disease Prediction of Mango Crop Using Machine Learning and IoT. *Springer Nature Switzerland*.
- P. R. Rothe, R. V. (2015). :Cotton leaf disease identification using pattern recognition techniques. *International Conference on Pervasive Computing (ICPC)*.
- Pakdeevaporn P, W. S. (2005). Inheritance of resistance to anthracnose caused by Colletotrichum . *plant breeding*, 124-206.
- R, P. (1999). Anthracnose: The most important disease in much of the mango producing world. . *The News Letter of the Plant Pathology 3* , 1-6.
- Ray, P. (2015,). A survey on Internet of Things architectures. *IEEE Access* , 678–708.
- Regarding the development of predictive models of disease, F. e. (1984). A model for estimating infection levels of anthracnose disease of mango. *Annals of Applied Biology*, 451-458.
- Roberts, P. D. (2001). Anthracnose Caused by Colletotrichum sp. on Pepper. *Available online at: http://edis.ifas.ufl.edu/PP104*.
- RS, S. (2000). Diseases of Fruit Crops,. *Science Publications, Plymouth, UK*.
- Sahitya, L. (2014). Anthracnose, a Prevalent Disease in Capsicum. *ISSN: 0975-8585*.
- Singh, R. M. (2018). Rhizoctonia bataticola: A serious threat to chickpea production . *International Journal of Chemical Studies*, ; 6(4): 715-723.
- Srinivasan, M. S. (2018). Anthracnose disease diagnosis by image processing, support vector machine and correlation with pigments. *Journal of Plant Pathology*.
- Srinivasan1, M. S. (2019). Anthracnose disease diagnosis by image processing, support vector machine and correlation with pigments. *Società Italiana di Patologia Vegetale* .
- Syed Atif Hasan Naqvi1, R. P. (2014). Occurance of mango anthracnose on inflorescence in Multan (Punjab) and it's in vitro control through various fungicide. *International Journal of Biosciences*, 184-19.
- Taylorb, O. M. (2020). Chili anthracnose: Colletotrichum taxonomy and pathogenicity.
- Than, P. P. (2008). Characterization and pathogenicity of Colletotrichum species associated with anthracnose

disease on chilli (*Capsicum* spp. *Plant Pathol.* , 57,
562–572.

UDAY PRATAP SINGH 1, S. S. (2019). Multilayer Convolution
Neural Network for the Classification of Mango
Leaves Infected by Anthracnose Disease. *IEEE*.

UDAY PRATAP SINGH 1, S. S. (2019). Multilayer Convolution
Neural Network for the Classification of Mango
Leaves Infected by Anthracnose Disease. *IEEE*.

UDAY PRATAP SINGH 1, S. S. (2019). Multilayer Convolution
Neural Network for the Classification of Mango
Leaves Infected by Anthracnose Disease. *IEEE*.