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IOT Based Disease Monitoring System For Apple Orchardin Himachal Pradesh

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Abstract:

IoT is the technology which has a huge contribution now a days in the diverse application areas. Apple, a cash crop, is one of the fruits which is high in demand throughout the year. Himachal Pradesh secured second largest placein India for apple production. The economy of this state is predominantly dependent on apple cultivation.Fluctuation in climate and weather conditionshave a huge impact on production and quality of apple and plant as well. The success of apple production highly depends on climatic and environmental factor like temperature and humidity. The present study is focusing to design an IoT based system to predict the various diseases and their impact on the apple during the different whether conditions. For this, some popular IoT boards with sensors, and Wi-Fi transreceiver will be used to monitor the data which can be evaluated for further recommendations.

Keywords: Internet of Things (IoT), Apple diseases, IoT Boards, IoT Sensors, Wi-Fi Transreceiver.

Introduction:

The Internet of Things (IoT) is atechnologyof interrelated physical devices or "things that are being combined with electronics, software, sensors, actuators and internet connectivity and powerful data analytic capabilities, which allows these objects to accumulate and share data. InternetofThings (IoT) risesasapowerful domainwhere connecteddevices andsensors canconnect andshare information overtheInternet.

At present many agriculture and horticultural industries areleaned to accept IoT platform for smart farming to increase efficiency, productivity, and minimize human involvement, time and cost etc. The revolution in the technology ensures that the sensors are getting smaller, refined and more economic. At present the internet are also easily accessible everywhere so that smart monitoring can be achieved with full security. Many of the problems regarding smart farming can be done using smart phones and IoT devices. Farmer can get any required data or information about the field as well can monitor his/her agriculture area.

India secured place in top ten apple producing nationsand its involvement to the totalcultivation is 3%. Although India secured a place in top countries for apple cultivation but, the cultivation and quality of production is not so good as compared to others because of several kind of diseases and pests, which cause great damage to the fruit in the state.[1]

In Agriculture/Horticulture each type of pest and diseases are considered asinjurious to fruits and plants, and has a great divergenteffect on it. In addition to overcome with falling crop

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productivity and quality, insecticides or fungicides are used by the farmers which could cause atmospheric pollution, so it becomes a need to destroydiseases and pests[2].

Himachal Pradesh is one of the foremostapple yieldingstate in India, where the production is going more than 90 percent of the total cultivation in domestic market. Apples individually constitute 89 per cent of the state's fruit economy.

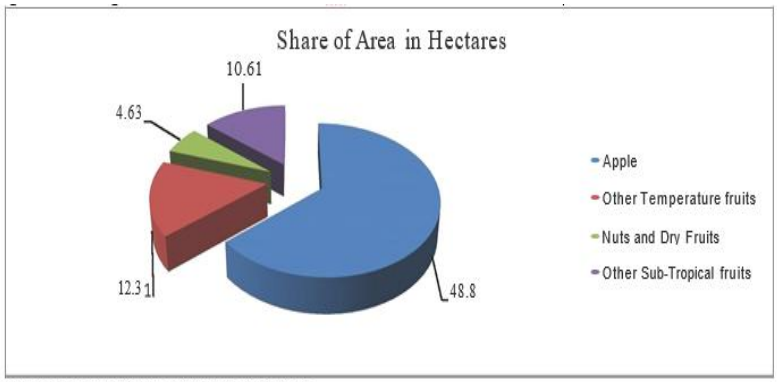
In the state of Himachal Pradesh, According to the official records, apple is produced on 2.25 lakh hectares in the state with productivity as low as 3-4 tons per hectare. Evenas the apple growers in Himachal Pradesh always have their fingers crossed over the uncertainty that hangs over the fruit crop in the midst of general climate change, the weather Gods have so far showered hope for them this season.

The fruit market has, therefore plays a great role in the improvement of the rural economy of the State with respect to:

1. Generation of foundations for income to the rural people,
2. generation of employment openings in the pre and post-harvest sectors of the fruit industry,
3. Satisfaction of the aesthetic needs of the people, and
4. Development of a justifiable system of stable agriculture in the hilly areas.

Apples alone plays a major part in the economy of Himachal Pradesh, the production has a turnover of over Rs. 3500 crore and accounting for almost 10 percent of the gross domestic product. After the statehood in 1971, there has been a strong backing from the state for apple cultivation. Consequently the area under apple cultivation has increased substantially from a mere 400 hectares in 1950s to 114939 hectares in 2011-12 (presently 2.25 lakh hectare), of the total area under fruit production, apples make up for more than 49 percent and of the total fruit production, apple alone accounts for more than 74 percent. Considering the vital role that Apple has in the economy of Himachal Pradesh, there is a need to analyse the trends in area, yield, production and economics of apple and problems encountered by the orchardists in the state.[3]

DifferentFruitcrops area percentage inHimachalPradesh2015-16



Source: Economic Survey of Himachal Pradesh

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Apple cultivation is money-making activity in the state of Himachal Pradesh compared to other fruit/food crops. It is labour intensive, farm based and commercially attractive economic activity. The income earned from this fruit is much higher than any other horticulture crop, if it is done in a systematic way.

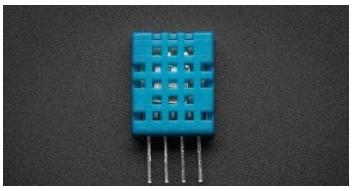
Common diseases of Apple

This part includes the most common diseases found in the apple orchards when flowering/ fruit is setting which affect the quality of fruit. Most of the time the fruitgrowers doesn't understands the disease appearance. So the fruit could not qualify the quality norms while grading, sorting and packing, due to which apple farmers have to tolerateheavy loss in their income. Following are some common diseases that may appear in the fruit due to the variation in temperature and humidity level in the orchard.

1. Apple Scab
2. Black rot canker
3. Powdery mildew
4. Sooty blotch and fly speck
5. Core rot
6. Brown rot

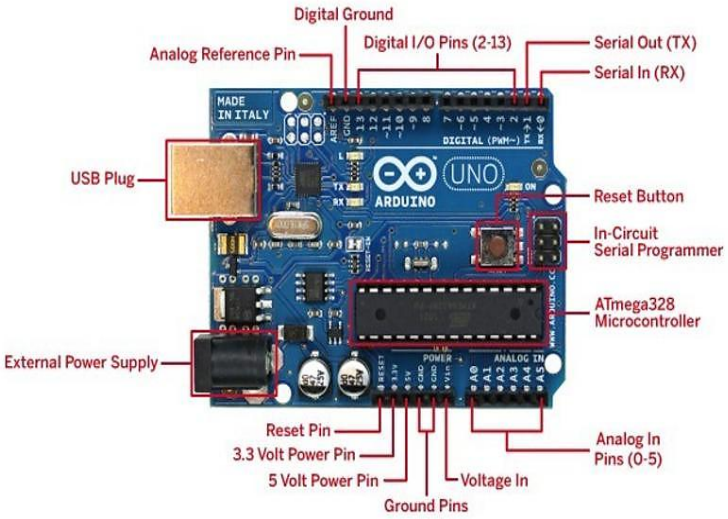
There are many diseases which can affect the apple fruit but it is to be mentioned here, that most of the common diseases of apple are occurs due to variation in temperature and moisture/humidity of soil and environment.
So it is to be proposed that to avoid the above situations, an IoT system that can predict the possibilities of diseases andalso can provide the possible solution that could be helpful for the farmers.

DHT11 basic Temperature and Humidity Sensor



The DHT11 is a sensor that is used to sense the Temperature and Humidity. It is a structureddigital signal output. It has the capability of sensing the temperature and humidity. A resistive element is included with it and a sensor for wet NTC temperature measuring devices.
The sensor has four pins and can be used with any IoT board.
It is a cost effective sensor for all user.

IoT Boards:



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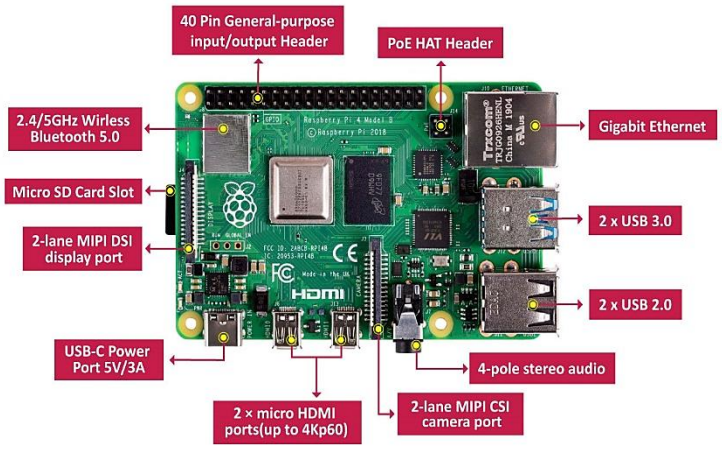
Arduino Uno - Arduino Uno is a general purpose IoT board. It comes with an 8-bit microcontroller. It has the following features-

1. Microcontroller
2. Circuit serial programmer
3. Digital ground
4. USB plug
5. External power supply
6. Digital I/O pins
7. Analog reference pin
8. Digital ground
9. Serial In/Out
10. Reset Button

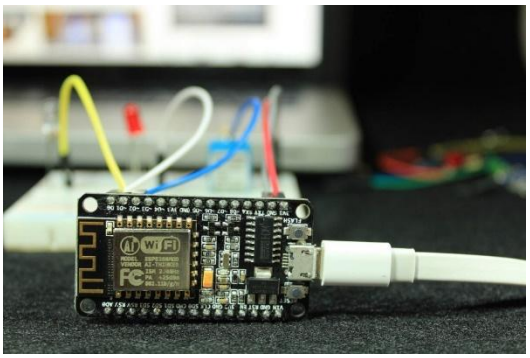
Raspberry Pi –Raspberry pi is a mini computer board. It has the following features–

1. Microprocessor
2. 40 pin general purpose input and output header.
3. Wireless Bluetooth 5.0 4. 2-Lane MIPI CSI Camera Port
5. 4-pole Audio
6. Ethernet
7. Micro SD Card slot in which Raspberry pi operating system could be installed.



Difference: Raspberry Pi runs an operating system, which is usually Linux. It's a mini computer, while Arduino is much simpler. It consumes much less power (~50 mA idle) than an a Raspberry Pi (700+ mA)

Wi-Fi Transreceiver- Wi-Fi transreceiver is a Wi-Fi module. It is a highly integrated chip. It is used with IoT gadget embedded on Raspberry Pi/Arduino Uno board. It is used to send and receive network signals.
Ex- ESP8266



Technique Used for Disease and pest Detection and prediction

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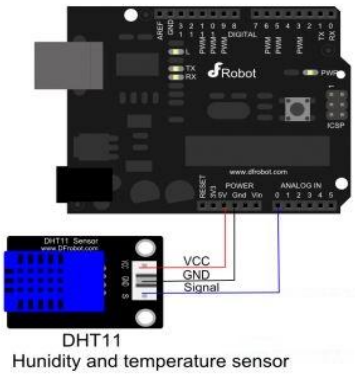
- As it is mentioned earlier that most of the diseases and pest attacks on the fruit/plant are due to excessive or less variation in humidity/ temperature. So the first step is to develop a hybrid gadget using IoT devices as described in above section.



DHT11
Hunidity and temperature sensor

- The gadget will monitor the temperature and humidity level of the orchard using IoT boards with sensors and sends this information to the farmer's mobile.
- In the farmer's mobile an android application will be installed which will be developed using android studio.
- A database will be maintained regarding diseases/ pest details and their survival as well as the favorable conditions in which they may attack the plant/ fruit.
- When data is received from sensors then it will be compared with the database and based on the favorable conditions (for diseases/ Pest), an alert will be generated and a prediction for disease will be flashed on farmer's mobile app.
- After getting notification regarding diseases/ pest probability on fruit the application will provide the suggestion/ recommendation regarding what action farmer could take.
- It could be either spraying or maintaining the humidity and temperature level of the orchard by available mode.

Review of Literature & research gap identification:

[1] This research describes an IDSS system to implement and enhancepest and disease protection decision making process within moderateareas of the country; this author explains to develop a hybrid algorithm using Case Based Reasoning and Database Technology and that could be implemented by using the same architecture. The paper focuses on the accuracy of decision making system that will be provided by the mentioned IDSS. This system can provide substantialsupport to the apple growers in decision making towards Environment-friendly diseases and pest controllingactivities.

[2]The paper describes that the rain increasesthe possibility of disease appearance and makes it feastquickly. So the author emphasis to determine the specific time and volume of rainfall and also do the needful spray of agricultural pesticides to prevent the crop from disease. By this the author wants to conclude that the frequency of pesticides can be compact by monitoring climate variation data like rainfall volume and moisture level of the field.

[3]The thesis report by K. Kireeti has focuses on considering the vital role that Apple has in the economy of Himachal Pradesh, there is a need to analyses the trends in area, yield, production and economics of apple and problems encountered by the orchardists in the state. He also consider the production analysis and important points about apple production in Himachal Pradesh.

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[4]Author focuses on the application of wireless sensor technology that canlowerthe management costs of apple orchards, improve the quality of fruit, and provide detailed, completeand preciseelectronic information for planting works, generate warning about pest appearance.

[5]Author says that the effect of temperature in the productivity and growth which are measuredamong the most multifaceted mattersin environmentalcomposition, because temperature affects basicallyall processes involved in farming.Frequent climatic changes in temperatures could have effects on fruit cultivation yet the author does not fully recognisehow, as the temperature is not the only factor which isfluctuating.

[6]This paper focuses that - India secured a great position in the production of various fruits like mango, guava, papaya, banana, oranges, grapes and the most important in apple cultivation. Horticulture sector is an important component for the development in the state of Himachal Pradesh. It provides various job opportunities for more than one lakh common peopleof the state directly or indirectly.

[7]Author says that plant diseases and insect pests seriously affect the normal growth of plants, the yield and quality of agricultural products. In recent years, with the dramatic changes in climate, the natural environment of the plant growth has been damaged by pollution, frequent natural disasters, as well as the development of agricultural production.

[8]The state annually produces 1.31 lakh metric tonnes apple fruit from an area of 1.28 lakh hectares. It forms the pillarof the state's economy and is a major cash crop for the small farmers. However, because of various factors likepest and diseasesthe quality and production of apple is being poor if compared with other developed countries.

[9]Author says that Climate fluctuation is an important encounterfor horticulture industry for future. Thissector is profoundand susceptible. The present study reveal the impact of climate fluctuationto the future period on appleproduction in Iran.

[10]Author targetclimate change and variability are serious concerns for apple production. Climate is an important environmental variable factor affecting the production of fruit crops.

[11]This article focuses on Fruit Diseases of Apple that can cause substantialdamagesin harvestand quality of fruit. Often, these diseases go ignoreduntil just prior to harvest, during crop harvest, or after fruit has been stored. Although there are no healingtreatments for fruit which got infected, many diseases can be prevented with spraying of pesticides/ fungicides. Accuratefinding, is critical to determine the best management practices and to prevent future losses.

[12]Author focuses on the development of a disease forecasting system. This study aid to warn the growers in advance when environmental conditions are favorable for diseases appearance and crop can get infected. The important parameters are less temperatures at the start of rainy season, the duration of rainy season and sunny time or wind succeeding rain fall that can support in the drying of fruit.

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[13]The paper revealed about Pesticides that may be present in food, either as remainsfrom the treatment of crops, as a result ofinfection. Deposit of pesticides in food from agricultural treatmentmay cause possiblerisk to the children due to growing disclosure.

[14]Author says thatdisease of plant, fruits, and particularly in apple, enduresto harvestalarm within the community which is related to research. And will attempt to define and control the problem and among growers who are getting struggle to utilize no disinfectant measures to manage the disease.

Conclusion and Future Scope:

An IoT based prediction system has been proposedin this paper, to inform apple growers about the climatic situation when theinsects and diseases can make an unexpected appearance in apple. In other words, the aimforthis study is to develop a system for predicting pests and diseases appearing condition by analysing factors like humidity and temperature which can affect the fruit using IoT sensors. Also the proposed system will recommend a possible solution for the control/ avoidance of disease appearance in the fruit. As a result, orchard owners can use this system to help them to takenecessary and instant control actions/ decisions.

References:

[1] T. Padma, S. A. Mir, and S. P. Shantharajah, “Intelligent Decision Support System for an Integrated Pest Management in Apple Orchard,” pp. 225–245, 2017.
[2] H. Lee, A. Moon, K. Moon, and Y. Lee, “Disease and Pest Prediction IoT System in Orchard : A Preliminary Study,” pp. 525–527, 2017.
[3] K. Kireeti, “PRODUCTIVITY ANALYSIS OF APPLE ORCHARDS IN SHIMLA DISTRICT OF HIMACHAL PRADESH Thesis by MASTER OF SCIENCE (Ag .) CERTIFICATE-I,” 2013.
[4] C. Feng, H. Wu, H. Zhu, and X. Sun, “The Design and Realization of Apple Orchard Intelligent Monitoring System Based on Internet of Things Technology,” vol. 547, pp. 898–902, 2012.
[5] G. Calderón-zavala, A. N. Lakso, and R. M. Piccioni, “Temperature Effects on Fruit and Shoot Growth in the Apple (Malus domestica) Early in the Season,” no. 1990, pp. 447–453, 2004.
[6] F. A. Wani, “Marketing of Fruit Products : A case of Apple Fruit in Himachal Pradesh Marketing of Fruit Products : A case of Apple Fruit in Himachal Pradesh,” no. December, 2017.
[7] Y. Shi, Z. Wang, X. Wang, and S. Zhang, “Internet of Things Application to Monitoring Plant Disease and Insect Pests,” no. Asei, pp. 31–34, 2015.
[8] A. Sherwani, “Insect Pests of Apple and their Management,” no. January, 2016.
[9] H. Ahmadi and M. Baaghideh, “Impacts of climate change on apple tree cultivation areas in Iran,” 2018.
[10] N. Singh, D. P. Sharma, and H. Chand, “Impact of Climate Change on Apple Production in India : A Review,” vol. 11, no. 1, pp. 251–259, 2016.
[11] N. W. Gauthier, “Fruit Diseases of Apple.”
[12] B. Wang, B. Li, X. Dong, C. Wang, Z. Zhang, and C. Protection, “Effects of Temperature , Wetness Duration , and Moisture on the Conidial Germination , Infection , and Disease Incubation Period of Glomerella cingulata,” no. February, pp. 249–256,

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Vol-22-Issue-17-September-2019

2015.
[13] I. Jyothi and S. Devi, "A REVIEW ON-PESTICIDE RESIDUES OF FRUITS AND VEGETABLES," vol. 4, no. 11, pp. 71–78, 2016.
[14] M. Mazzola and L. M. Manici, "Apple Replant Disease : Role of Microbial Ecology in Cause and Control."