Smart Farmer - IoT Enabled Smart Farming Application

Literature Review:

IoT in farming is used to improve time efficiency, irrigation, crop monitoring, and reduce the usage of insecticides and pesticides due to early detection of disease etc. It also to reduces labour work and streamlines the farming. IoT in farming is used to collect data on temperature, humidity, wind speed, and soil fertility in real time. These data are used to automate the farming, minimize labour requirement and reduces difficulty required to monitor the crops.

Smart Irrigation System:

Farmer, usually pumps the water more or less to the crop which leads to wastage of water or insufficient water to the crop to overcome this situation smart irrigation comes into existence. The system is used in active supervision of the irrigation for agriculture field is designed with the WSAN technologies that are used to collect and control various heterogeneous environmental parameters and the functioning of the irrigation system. The Fuzzy Logic-based system is used which works based on the suggestion made by of the farmers to get more accurate result. The integration of WSAN and Fuzzy Logic system has an advantage in improved saving water and provide accurate suggestion to the farmers. The research is intensive on the combination of other sensors that are required for measuring the parameter that are required to support the farmers to undergo smart farming. The comparison between the threshold-based strategy and FL-based DSS results an average water saving 29.5%more by using the proposed FL-based DSS (i.e., an irrigated water volume V (t) = 7.9linstead of V (t) = 11.2 l). The system measures temperature and humidity, soil moisture and water level of the tank from the field without any human intervention. The system contains wireless sensor nodes which are used to collect the real time values from the field. The valves that are collected by each sensor nodes are sent to a master node through Zigbee. A master node act as a gateway between sensor nodes in the field and cloud server. It transmits information that are acquired from the nodes to the cloud for decision making. The cloud server makes prediction by comparing sensor values and predefined threshold values. Once the prediction is made then master node forwards the decision to control section, which helps to irrigate the field automatically without human intervention. The automated irrigation system was designed with GSM and weather forecast using Hargreaves equation. The system suggests a suitable amount of water required for particular crop by taking soil type, rainfall and

evapotranspiration (amount of water that are evaporated due to the temperature) into consideration hence it reduces the wastage of water resource. The information about the possibility of rainfall are collected from a weather forecasting. The fire accidents are also prevented by premature detection of smoke and temperature and automatically switch on the sprinklers . The automated irrigation system which monitors and controls all the activities of drip irrigation system efficiently in a real time. More over this system uses colour sensor to predict the level of soil fertility. Smart irrigation uses about 30% less energy per unit crop yield compared to the normal farming. The issue in this paper is colour sensor will not predict accurate and details of the nutrients.

Smart Insect and Pest Detection:

Excessive use of pesticides for crop to removal of pest will increase the danger to human beings and environment. According to World Health Organization (WHO) every year there are millions of cases of pesticides poisoning and death occurring. Farmers do not have information about accurate application of pesticides which leads harmful effects. Exposing to more pesticides leads to health effects like allergies and asthma and other health issues. There were different method used to kill the pests such as glue boards, toxic baits, pesticides. But due to technology growth there are various types of methods are emerging for removal of pest without applying pesticides. Use Electronic devices to avoid pests. Different pests exist at different range of frequency. Internet of Things will play an important role for pest detection and pest control. Almost pests are predicted in advance through monitoring device at the field. These values are given to or stored that can be used by farmers. Changes in the weather like temperature and humidity are measured using weather stations or through sensors for a particular area. Precaution measures are taken based on information or alert provided by IoT system. Farmer will get awareness or alerts about the pests on time and can avoid spread of pest and yield loss and when to use pesticides. The system uses image processing technique to identify pests in the greenhouse environment and the pests can be detected using the SVM classification with RBF Kernel function in which 100 sample are taken totally 80 samples were used to train and remaining 20 samples were used to test. The image processing with SVM method was effective in spotting the parasite with an error less than 2.5%. The system uses Hidden Marko Model for data analysis and to detect the diseases of grapes plant in early stage which help the farmer to use little amount of pesticide and also provide suggestion of pesticides to protect the crop from that particular diseases. This system also helps the farmer get the information regarding the use of

fertilizers, pesticides spraying and irrigation. It provides an efficiency rate of about 90.9% in classification. The system uses linear SVM algorithm with decision tree to predict the crop. The system is trained with a dataset and linear SVM and decision tree algorithm are applied on new data to predict the output. The system predicts the crop for the farmer based on the soil parameter given by the farmer. This system also helps the farmer by providing information regarding the pests that usually affect the crop. The information also includes what pesticides can be used for removal of pests. This system provides about 89.66% accuracy.

Crop Selection:

The system uses IoT and machine learning algorithm to predict suitable crop for particular land based on climatic factors such as temperature, humidity, soil moisture, soil nutrient content such as nitrogen, phosphorus, potassium. The system analysis and predict soil nutrient by getting real time data from sensor in the field. It measures nutrients like Nitrogen, Phosphorus, and Potassium (NPK). The system upload soil nutrient level required for various crops. Decision is made by comparing real time sensor data with database data. The result is displayed using a developed mobile application. The issue is it consider only few nutrient values to decide the soil nutrients. An Intelligent Agriculture platform, in which IoT sensors are used to collect various environmental parameter that are required to predict suitable crop. The data from the IoT sensors are transmitted to the server using 4G networks for processing purpose. The sensor data is cleaned before processing to accurate result. This system uses 3D cluster correlation to predict a suitable crop for particular land based on sensor data. This helps farmer to increase crop production.This paper mainly discusses on network requirement such as throughput, latency and mobility for smart farming application. The communication between component in field are carried out by 6LoWPAN. Usually, the connection between the field and cloud are carried out by Wi-Fi connection. This connection increases latency to overcome this issues fog computing concept come into existence, which has lesser delay and this saves bandwidth in the network. The system is designed as an Android Application, in which user has to feed their inputs to get the necessary information. Artificial Neural Network is used for modelling that help in prediction and it is implemented using Feed forward Back Propagation Network. This paper suggest farmer a suitable crop for their land and also help in suggesting the fertilizer and also suggest whether the farmer chosen crop will provide high yielding or not. Disadvantage of this paper is user have to collect data by testing his soil in laboratory and weather data from weather station to feed the input to system. The system provides 92% prediction accuracy.

CHALLENGES OF IOT IN AGRICULTURE:

A. Poor Internet Connectivity :

Most of the farming lands are in isolated locations where internet connectivity may not be sufficient to allow fast transmission. The communication path may be blocked by crops, trees and other physical barriers.

B. High Hardware and software Costs:

Components required to implement smart farming with IoT is expensive. Though sensors are available at least cost, farmer has to invest on software, cloud and other technologies. Maintenance of hardware is also expensive. In some cases, the sensors used in farming are more expensive because to get accurate result. Moreover, farmer must learn to use the components used in smart farming.

C. Interoperability issue:

Interoperability means the ability of components that communicate with each other, irrespective of their manufacturer or technical specifications. As many sensor hardware and software are used to create a smart farming system, however it is difficult to integrate heterogeneous data from different sensors.

D. Storage issue:

In smart farming large amount of data are generated by each sensor which were deployed in the field, normally database in some cases used to store the collected but it is not enough to store. Cloud storage has been preferred for storing the sensor data which has to be paid for usage.

CONCLUSION:

This paper discusses about the Smart farming in detail. IoT have a major role in developing smart farming that increases the production of agriculture products by monitoring different factors such as temperature, humidity, soil moisture, soil fertility which are important in the growth and production of crops. Smart farming increases the income of farmers by increase the production reduces labour requirement, wastage of water, suggest required amount of fertilizer. In this paper a survey on technologies along with Internet of Things (IoT) in Smart farming and the challenge of IoT in agriculture is explained. Even though several researches have been existing but they are all not user friendly (i.e illiterate farmers cannot handle it.) and not taking the demand of the crop in the market as a parameter to select a suitable crop for the

particular land. This will be implemented in future which will improve the economic life of farmers.

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