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SMART AGRICULTURE MANAGEMENT SYSTEM USING MACHINE LEARNING CLASSIFICATION ALGORITHMS

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Abstract:

India being an agricultural country, the most part of economy is depends on yield growth. Agriculture, is largely depends on rainwater, and also depends on diverse soil parameters namely nitrogen, phosphorous, potassium and weather aspects like temperature, rainfall etc. The technological growth in agriculture will increase the crop productivity. Remote sensing systems like IOT systems are being more widely used in smart farming systems, these systems produce generous amount of data. Machine learning is an emerging research filed to predict the crop based on the patterns of the data. The proposed system will integrate the IOT sensors like Ph., Moisture, Rainfall, Temperature and Humidity sensors observe the data from those sensors and applying machine learning algorithms: Logistic Regression, Decision Trees, Random Forest, and GDBoost. A prediction of most suitable crops according the current environmental is made. This work gives a better prediction for the farmers to plant which kind of crops to their farm field based on above mention parameters to improve the productivity of Smart Farming.

Keywords: ***Agriculture, IOT, Machine learning, Data Analytics, Prediction.***

1. Introduction

In this paper we proposed a type of crop prediction system for increasing the production based on the key technologies: Internet of things and machine learning techniques. Sensor technology has been advanced and types of sensors like Humidity, Temperature, soil moisture sensor, and pH sensors are used to sense the required elements of crop prediction. Machine Learning technology predicts the crop based on the sensor data. Uses of these technologies helpful to the farmer for better production rate in agriculture.

Agriculture

Improving crop yield production and quality while reducing operating costs and environmental pollution is a key goal in agriculture. The potential growth and yield depends onmany different production attributes such as the weather, soil properties, and irrigation and fertilizer management. Agriculture is the backbone of every economy. In a country like India, which has ever increasing demand of food due to rising population, advances in agriculture sector are required to meet the needs. From ancient period, agriculture is considered as the main and the foremost culture practiced in India. Ancient people cultivate the crops in their own land and so they have been accommodated to their needs. Therefore, the natural crops are cultivated and have been used by many creatures such as human beings, animals and birds. Since the invention of new innovative technologies and techniques the agriculture field is slowly degrading. Due to these, abundant invention people are been concentrated on cultivating artificial products that is hybrid products where there leads to an unhealthy life. Nowadays, modern people don't have awareness about the cultivation of the crops in a right time and at a right place. Because of these cultivating techniques the seasonal climatic conditions are also being changed against the fundamental as sets likes oil, water and air which lead to in security of food. By analyzing all these issues and problems like weather, temperature and several factors, there is no proper solution and technologies to overcome the situation faced by us. In India there are several ways to increase the economic growth in the field of agriculture. There are multiple ways to increase and improve the crop yield and the quality of the crops.

IOT in Agriculture

The Internet of Things is inter connection between computing devices, mechanical and digital machines, objects, that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. In agriculture domain few researches have proposed architectures based on IoT with machine learning to predict type of crops. IoT with machine learning is mature technology and lot of work has been done for agriculture domain. This system which handles the type of crop growth. Proposed system helps to take decision by prediction and its analysis on data sensed and collected from the sensors and stored into database and analyzed using machine learning algorithms .The data sensed from crop yield by sensor for various parameter humidity, temperature, rainfall, pHvalue. Etc ., are stored in storage through IoT platforms, which are further used for prediction of Varity of crop which are directly impact on crop growth after prediction decision taken will be convey to the end user for further action which will gain profit of end user.

Machine Learning

Machine learning is a technology, which is widely applied to agricultural problems. It is used to analyze large data sets and establish useful classifications and patters in the data sets. The overall goal of the Machine Learning process is to extract the information from a dataset and transform it into understandable structure for further use.

The main objective of this paper is design a system which can predict the type of crop based on the soil and weather properties. As in today's world the population is increasing and it is supposed to be in billions as the years pass on and in order to feed those billion peoples we need to improve the production of crops. The population is increasing and on the other hand the agricultural land is decreasing due to various reasons like industrialization, commercial markets and residential buildings are being made on those agricultural lands and to feed these billions we need to increase out production and this can be done by implementing suitable technology in farming. Smart Farming is most important thing that is needed in daily life.

In Section 2 describes related work whereas Section 3 analyses the Proposed System and Architecture, Section 4 gives the results and Section5 concludes the paper.

2. Related Work

The statistical method namely Multiple Linear Regression technique and Data Mining method namely Density-based clustering technique were taken up for the estimation of crop yield analysis [1]. In proposed technique, Kalman filter (KF) is used with prediction analysis to acquire quality data without any noise and to transmit this data for cluster-based WSNs. Decision tree is used for decision making using prediction analytics for crop yield prediction, crop classification, soil classification, weather prediction, and crop disease prediction. IoT components, such as and cube (IOT Gateway) and Mobius (IOT Service platform), are integrated in this system to provide smart solution for crop growth monitoring to users [2]. In machine learning algorithm using logistic regression was developed to process a raw data and predict result. It gives the result but it is less accurate than other algorithms[3].In [4] authors have explained the use of spatial data mining in agricultural domain. They have used K-means algorithm along with optimization method progressive refinement for spatial association analysis. Temperature and rainfall is given as initial spatial data and analyzing it for the

improving the crop yield and to reduce the crop losses. In [5] authors consider the problem of predicting the average yield of a type of crop (e.g., soybean) for a region of interest based on a sequence of remotely sensed images taken before the harvest and convolutional neural networks applied data to predict the type of crop. In this [6] discusses research developments conducted with in the last 15years on machine learning based techniques for accurate crop yield prediction and nitrogen status estimation and it is concludes that the rapid advances in sensing technologies and ML techniques will provide cost-effective and comprehensive solutions for better crop and environment state estimation and decision making. In this system [7], a combined approach with internet and wireless communications, Remote Monitoring System (RMS) is proposed. Major objective is to collect real time data of agriculture production environment that provides easy access for agricultural facilities such as alerts through Short Messaging Service (SMS) and advices on weather pattern, crops etc.

3. Proposed System

The proposed research work focuses on the use of effective IOT devices and decision learning for prediction. In system design, we have included flow of communication between different system components and input and output for different modules present in system. Sensed data is compare with data set which are stored on past experience, and result is produced.

The system architecture is shown in Fig. 1. Main components of system are

- IOT devices
- Machine learning algorithm for prediction.

As per the result obtained from the analysis, farmer will take decision from this system for the selection of best crop for that particular soil for increase the production rate of the crop.

IoT Devices

In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere.

This research aims to provide a system which will monitor the Temperature & Humidity values of particular crop, pHsensor for soil and water pHvalues and fertilizer management, soil moisture sensor to sense the moisture rate in soil. All those sensors are used to monitor crop as well as it is generate the data. Sensor interfaced to IoTdevice:

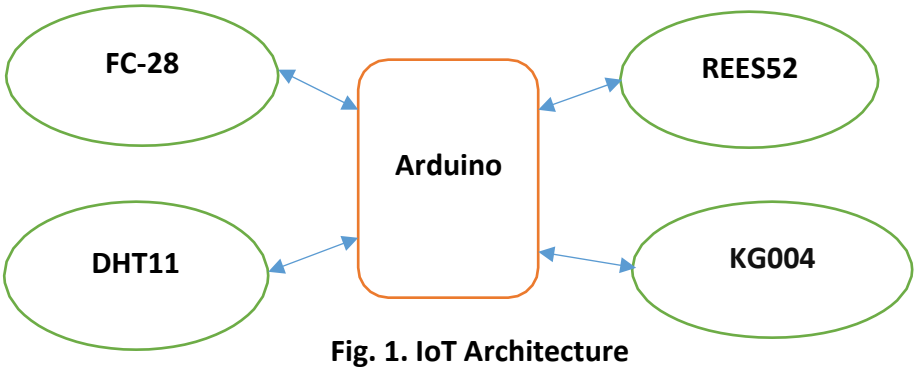

Fig. 1. IoT Architecture

Machine Learning Algorithm For Prediction.

Machine learning is widely applied to agricultural issues. It is used to analyze large data sets and establish useful classifications and patters in the data sets. The overall goal of the Machine Learning process is to extract the information from a data set and transform it into understandable structure for further use. This paper analyzes the type of crop yield based on available data. The Machine Learning technique was used to predict the crop yield for maximizing the crop productivity.Figure6 shows the flow of proposed crop yield prediction.