Design and Implementation of a Novel Artificial Intelligence Based Technique for Yield Maximization in Agriculture

Dr.T.Rajesh, M.Muthamizh Balan, K.Tiwinkumar, M.S.Sidhartha
Department of EEE,Info Institute of Engineering,
Coimbatore, India.

Abstract

Agriculture is the backbone of Indian economy, because of the population development there exists a high requirement for the development of the particular agro- based sectors. The agro- based industry includes sectors associated with textiles, glucose, paper and veggie oil. These industrial sectors use agricultural items because their raw materials. But population plus agricultural lands are usually inversely proportional, hence it creates a huge demand for the particular agro-goods. Hence presenting the long run technologies such as Artificial intelligence and Internet associated with Things in Agriculture results in high and good produce which also results in the high profit for the farmers. The paper deals about the need associated with future technologies in agriculture, IOT and AI implementation and its functions plus advantages of implementing these types of technologies in agriculture.

Keywords— *Sensors, Microcontroller,IOT, AI, Userinterface*

I. INTRODUCTION

In the world, the central phase is always occupied by the agricultural industry. This disorder is irrespective of time plus lifestyle changes. Couple of years back, the success of agricultural market was critical, great the situation is usually contradictory where brand new developments in the industry have been made with the assist of technology. Areas like productivity, cost and labour have been highly enhanced or supported with the help of technologies. Factors determined simply by technologies in farming are Farm preparing, Field mapping, Ground sampling, Tractor assistance, Crop scouting, Variable rate applications plus Yield mapping. Nowadays agriculture routinely uses advanced technologies this kind of as robots, temp and moisture sensors, aerial images, plus GPS technology. IOT has been utilized keep track associated with the field by using a smart phone which usually gathers the data from the sensors and store this in the cloud. AI is usually another technology which usually process the stored data and provides useful information towards the finish user who is usually usually an together with live field

monitoring and suitable recommendations to get higher yield along with high income. With this document, IOT and AI combined technique within order to modernize the agriculture is usually discussed.

II. NEED OF TECHNOLOGY IN AGRICULTURE

Initially we need in order to analyse the necessity plus the scope of technology in agriculture. There are water sources facilities, pumps, engines, fencing, fertilizers, insect poison, and so forth; Then all of us may think what more is required here, but still information is required. Agriculture is dependent on climate and additional factors. It requires an all-round supervising. In that situation we need to develop the system that may monitor, regulate and manage crop growth within agriculture. We are unable to develop automated automated programs but we do it in the cost effective way. If we inform before to situations and various crisis which are usually arising, it furthermore contributes to effective crop growth.

Our objective is in order to showcase all problems that are associated to productivity associated with agriculture. We hence need to preserve a database which usually stores all details regarding the plants chosen for farming, on-field men involved, weather conditions and water bodies close by and we need to communicate it in order to the farmers utilizing a hand-held device such as a mobile phone upon the receiver side. But as we know, farming is adopted within large parts of INDIA. Hence immense quantity of information must be stored; hence we are able to adopt Cloud Processing where cloud storage space of information may be implemented. The separate cloud machine for each state could be maintained.

Therefore we have to completely realize how it features, let's have a condition such as Tamil Nadu. A cloud server for Tamil Nadu will end up being maintained. It homes information, geographically of different farmers plus their corresponding crops. Also other information such as ground water table degree, amount of manures and pesticides utilized, crop selling cost last harvest, etc.;

cloud computing is usually used because it makes up about easier data storage and collection. Then accordingly notifications are sent in order to the farmer via Web portals which reaches their telephone for performing the certain operation.

III.   FUNCTIONS OF IOT SYSTEM

Monitor, regulate and control are the important functions performed by the IOT program.

A.   Monitor

we have to monitor the essential factors that govern the crop growth in a field. Those already are discussed such since crop implemented drinking water table level, etc.; they are continually monitored by the cloud machine, in the event an element goes beyond the stipulated limit, alert is delivered to the farmer. In real time, say the farmer is usually at his home and the moisture content in the particular soil goes over and above the stipulated degree, then the impair server senses this particular and issues a warn to the character regarding the situation in order that he is able to take satisfactory measures, also the whole process may be automated when the cloud server acquires permission to irrigate the field plus hence automatically operate the motor plus pump the water to the field.

B.   Regulate

we have a system set up that will can monitor, but we need this to become versatile as we know in numerous times, different crops are grown in numerous geographical locations. Therefore if we feeling large scale implementation, we require the machine to differentiate among various crops plus locations. For this particular proper 'regulation' of prompt service is required. For this we are able to carry away a hierarchical method. That is we can use a devoted server for every condition that is twenty-eight servers for twenty-eight states. The necessity associated with regulating information movement is that right information reaches the right person. If we automate it regarding only monitoring, exact same activity will become carried out regardless of factors such because crop grown plus location. Regulating this cloud technology makes it provide self-intelligent, adaptable and also a prompt service.

C.   Control

A farmer will develop some crop for some period and after that might switch the plants; in that situation the cloud server won't be accountable. This can be a case, one more is we might go through a patch where drinking water scarcity may happen, now the impair server if automatic has to control the particular inflow of drinking water to utilize it carefully. Hence we need to draft a good 'Adaptability' solution. To maintain 2 cloud server, the first is the crop machine and other is the Phase server. The crop server, stores the varieties of crops suitable to be grown in some dirt, to ensure that even

when the farmer switches the crop, the cloud adapts appropriately in order that it syncs with the specific crop's growth time period, water, fertilizer plus pesticides requirement plus monitors accordingly. The crop growth must proceed through the lot of stages such as tilling, weeding, irrigation, upkeep and cost initialization. The resource necessity is going to be varying regarding different phases. That will is, in the particular tilling phase, spices from the soil regarding so that it is fertile will certainly be done, therefore here water requirement will be less, this water could be directed to a close by field within irrigation phase, and hence efficient usage of resource will be carried out. Managing hence means producing a system versatile to ensure it never ever is static yet changes in line with the require and requirement and prompt information is always provided.

IV. IMPLEMENTATION OF IOT SYSTEM

Nowadays, Technologies play a major role in every one's life style, but farmers are lacking in the use of modern technologies to adapt farming. Implementation of the system is also simple which is shown in the figure.
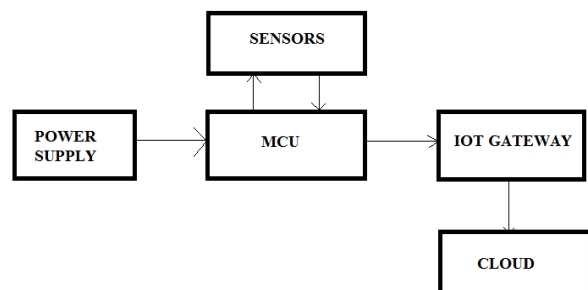

Fig. 1 System Architecture

A.   Microcontroller

Microcontroller used is an Arduino board. This is a microcontroller board based upon Atmega 2560 microcontroller. You can find variety associated with boards like Arduino Uno, Arduino Nano, and Arduino Professional Mini. Each one of these planks function similarly in one way or the other. There are some basic features like PCB layout design, size, number of analog hooks and breadboard friendly nature that create them different through each other. Within phrases of code, all these boards are programmed in Arduino IDE software program and don't require to attach additional pieces or devices to put all of them in the working condition. Everything is usually already built-in the board that makes this particular device readily obtainable. Just plug and play with the particular board as for each your requirement. All the boards mentioned above work properly for several Arduino Projects once you require a basic task to end up being completed with much less number of I/O pins and storage. Nevertheless, when the nature of task goes complex,

the board with much less memory does not full the task. This is when Arduino Mega 2560 comes handy. This particular board comes along with 54 pins and 16 analog hooks with additional memory to keep code.

B. Sensors

The sensors utilized in area to measure the bodily parameters of industry are,

1) PIR

It can be used in order to the growth of a crop in the field.

2) Soil Moisture

To calculate the moisture level associated with the soil.

3) Humidity

Humidity is described as the amount associated with water contained in the particular surrounding air.

4) Temperature

Temperature sensor is a device, typically, a thermocouple, that gives for temperature measurement through a good electrical signal. A thermocouple (T/C) is usually made from 2 dissimilar metals that will generate electrical volt quality in direct proportion to changes within temperature.

C. IOT Device

The ESP8266 Wi-Fi Module is the self-contained SOC along with integrated TCP/IP process stack that may give any microcontroller accessibility to your Wi-Fi network. The ESP8266is capable of either hosting an application or offloading almost all Wi-Fi networking functions from another application processor. The ESP8266 Wi-Fi Module is usually a self-included SOC with built-in TCP/IP protocol collection that can give any microcontroller accessibility to your Wi-Fi network. The ESP8266 is capable of possibly hosting a credit card application or offloading all Wi-Fi networking functions from another application processor. Arduino is a Microcontroller. It helps in order to communicate with the particular physical world. Because Arduino are the particular microcontrollers which may be used in the items which are attached to IOT.

D. Cloud Storage

Cloud storage space is really a cloud processing model in which usually data is stored on remote web servers accessed from the web, or "cloud." It is maintained, managed and managed with a cloud storage service provider on a storage server that are built on virtualization techniques. Cloud storage space works through information center virtualization, supplying ending users plus applications having a virtual storage architecture that is scalable based on application requirements. Generally, cloud storage works through a web-based API that is remotely implemented by means of its interaction with the client application's in-house cloud storage infrastructure for input/output (I/O) and read/write (R/W) operations.

Whenever delivered through a public service supplier, cloud storage is known as energy storage. Private cloud storage provides the particular same scalability, overall flexibility and storage system with restricted or non-public access.

V. AI ANALYSIS IN AGRICULTURE

Artificial Intelligence is emerging as part associated with the solutions towards improved agricultural efficiency. Individual agricultural routines on the plantation takes effort, regarding example planting, keeping, and harvesting vegetation need money, power, labor and assets. We can make use of technology to replace a few of the human actions and improve effectiveness by artificial cleverness. Agriculture is gradually becoming digital plus AI in agriculture is emerging within three major classes, (i) agricultural robotics, (ii) soil plus crop monitoring, plus (iii) predictive analytics. Farmers are progressively using sensors plus soil sampling in order to gather data and this data is usually stashed on plantation management systems which allows for better digesting and analysis. These information and other related information is paving a way to set up AI in agriculture.
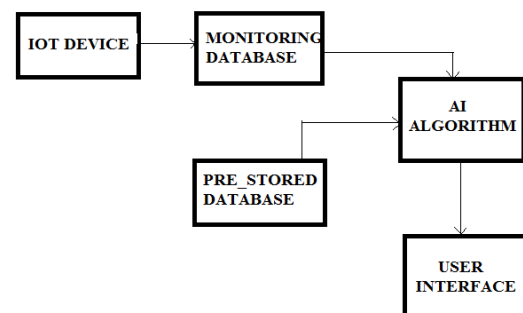

Fig. 2 Software Architecture

VI. DATA PROCESSING

For predictive analysis there is usually a need of past historical data's which are stashed in the data source and additional used regarding the analysis. In crop and dirt monitoring, the actual period data's will also be possessed to be stashed within a database and can be recovered for the consumer view later.

Harvest monitoring is the particular main time supervising database which gathers the real time data from sensors using an Internet of Things. The data's collected and stashed based on thirteen fields by the particular database. The database also collects data's like crop within the field which is monitored, Soil type in the field, present temperature using the

particular sensor, humidity of the field, PH LEVEL of the soil that is to become maintained permanently development, Moisture level within the soil, location from the field, manure plus pesticide data's plus number of massive areas where the farm is usually monitored.

Pre-crop is usually the primary table used for an AI based predictive analysis which involves major data's regarding the crop growing problems. The user farm's physical conditions would certainly satisfy these data to get a good yield at a perfect time period. This table includes the fields which usually stores the plants growing soil problem, minimum and optimum pH of the soil to become maintained for any specific crop, minimum plus maximum temperature that will a crop can withstand, humidity necessary for the plant, minimal and maximum dampness level of the crop to be taken care of, the number associated with days that this crop taken to collect and the period for each and every cycle of manuring and pesticides are included in the table.

The data's collected plus stashed in the particular databases are processed to obtain a useful information. Here data digesting is utilized to select a proper plant for the field as well as the recommendations whilst monitoring and the post-harvest information too. The data is usually classifying into area based, soil condition based and after that pre-sales and current gardening data. This is actually the location where the protocol developed can work as an AI simply by choosing best plants in all the conditions and recommending appropriate suggestion in order to the user.

In line with the above data's and the crops suggested below each category are given a prioritized ranking by which the particular selection of appropriate crop is produced. For example, to the particular profit classification higher priority is provided than others because that's the main aspect which determines the particular yield profit plus other categories get next priority as well as the crops under every category are directed with ratings which means for high concern category its five and for others lower than that and finally the plants with more rating is suggested towards the users. The harvest suggestion is provided with the price investment per acre and maintenance price per acre plus the steps used to get the high yield plus all the data's that are necessary for the user to get high produce. By what this means is here Crop C will be suggested because which is suitable below all the major categories than other people. By yielding it user can obtain a good yield with a higher profit than others.

Following the suggestion, the crop data is usually classified into three categories they are usually sowing, monitoring and harvesting. Before seeding using the AI algorithm the consumer could possibly get the information regarding a great investment cost for each acre, maintenance cost per acre plus the local estimated profit while harvesting.

The next thing is monitoring that's the user may monitor the dampness of his industry, pH content from the soil, Fertilizers and Pesticides spraying data's and the drinking water level to become maintained at the industry. If any change or improvement required in the over mentioned monitoring data's the user could possibly get a suggestion perform an appropriate to sustain the physical problems of the farm which enriches the farm and decides the quality of the yield.

VII. CONCLUSION

In this paper the usage of AI and IOT in agriculture is discussed. Implementing a technology is the only way to satisfy the demand, hence IOT reduces man power by labor effort and monitoring time and also collects real time data of the fields while AI processor that data into a useful information to the farmers by suggesting better crop to their field in getting high yield and profit. In future AI enabled robots are used in the field to reduce the poor yield and robust

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