Intelligent AgriTrade to Abet Indian Farming

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Abstract. The present Indian agricultural system is embedded with advanced services like GPS, weather sensors, etc. which facilitate in communicating with each other, and analysis of the ground level real-time or near real data. Information and Communication Technology (ICT) provides services in the form of cloud to agricultural systems. Agriculture-Cloud and ICT offers knowledge features to farmers regarding ultra-modern farming, pricing, fertilizers, pest/disease management, etc. Scientists/Experts working at Agriculture research stations and extensions can add their findings, recommendations regarding up-to-date practices for cultivation, and related practices. In this work an attempt has been made to design and implement a simple Cloud based application on Agriculture System which is based on AgriTrade on cloud that will enrich agriculture production and also boost the accessibility of data related to field level investigation and also in laboratory. The impact of undertaking such a tool would cut the cost, time and will increase the agricultural production in a relatively much faster and easier way. The system is intelligent to tell the environment statistics to the farmer for improved approach towards agriculture.

Keywords: Cloud computing · ICT in agriculture · AgriTrade
Service oriented architecture

1 Introduction

Indian culture can be experienced through its villages and small towns. Rural India has been ignored for many years and the Intelligent AgriTrade cloud technology will bring the change that is required to bridge the gap between rural India and urban India, and will improve the Indian rural economy. The principal source of income of India is agriculture. The development of Indian farming is basically focused on the Indian agriculture sector. Cloud computing is a general term used to describe a new class of network based computing that take place over the internet. Latest technological development has brought about a dramatic change in every field, and agriculture is no exception to it. Intelligent cloud computing technology will have a positive impact in the agricultural field which can also progress to other traditional approaches being moved to cloud.

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Nowadays farmers are not able to cultivate the amount of crops needed because of new types of diseases and the unpredictable weather environment. The farmers also do not get paid fairly for their hard work because they sell their vegetables and crops at a very cheap price to the vendor and then the vendor sells it ahead to the customer at a very high price. Therefore the middle agent earns the profit completely, whereas the farmer faces a huge loss. This financial loop hole results in loans not being paid by the farmer as he is in huge dept, which results in suicides and the economic status of the farmer halts at being always very low with no improvement in the society. By implementing this tool AgriTrade we are trying to help the farmers in every possible way and reduce the number of farmer suicides by giving them the income they are actually worth of getting for his hardwork.

In this work an attempt has been made to make use of services such as real-time computation, data access without the need to know the physical location and configuration of the system that delivers the services. If we need to improve the economic condition of India as a developing nation then the only way to do that is to improve the Indian agricultural sectors. The proposed solution of Intelligent AgriTrade in this paper is an attempt to make improvement by using the technology in this sector.

The problems that the farmers are currently facing is lack of knowledge about crop related problems, weather, fertilizers to be used, actual selling price of the crops.

Due to the unpredictable weather the farmers are not aware of which crop to cultivate in the favourable season. This results in total wastage of the crops. Sometimes when the crops are affected by some disease, the farmer is unaware of what has caused it and they use any kind of low quality fertilizers which destroys the crops. The farmers are also not aware of the actual city prices of the yields. Although many technologies are available, these have not helped our farmers to use it for their crops. Hence they do not get the intended profit. These are the problems the farmers are currently facing.

A solution to the mentioned problems can be AgriTrade. It offers expertise service to farmers regarding cultivation of crops, pricing, fertilizers, and disease related help, and also teaches the farmers how to use this new tool. By implementing this system it would cut the cost of farming, time of cultivation due appropriate forecast of crop type based on climate and make the life of the farmers much easier.

The Cloud allows information technology to be infused into the smallest hamlet of India. This makes information available to the poorest of the community so they can aim for a better life with the knowledge obtained through laptops or mobile phone connected to the cloud.

Here, the farmers with the help of such a system can learn about new farming techniques, learn more about the quality of the fertilizers used, know more about the weather, sell their crops at a better rate to get more profit and also solve their doubts related to crop problems. As this system will be on the cloud and available on android every farmer from any part of India can get access to it.

2 Literature Survey

In India, many attempts are made to improve the condition of Indian agriculture by the youth with technological variations and expert advice. This would help improve the condition of farmers and farming. Studies are being carried out to implement

E-Farming using Cloud Computing [4] that is selling of products for the farmers to different customers at different locations. It is proposed that there would a web portal to assist the farmers with the selling of their products. This could be done if the farmers have a knowledge about computers or else the company professionals would provide help to interested farmers to register and utilize these services. E-Farming doesn't comprise of total electronic farming but just helps the farmers to sell their valuable products by their own means through a cloud and web portal platform so as to reach out to the customers efficiently.

Another study is formulated to improve the Indian Agriculture through an Application of Cloud Computing in Agricultural Development of Rural India [1, 4, 7, 8] which emphasizes on the architecture of the usage of cloud computing with the devices and the user Interface for any particular web portal used to interface cloud with agriculture. Here the system is designed to perform database utilities and connection with the cloud to read the data so as to improve the local and global communication between the rural and urban India. This would indirectly help to improve the agricultural sector of the nation through reduction in man power, infrastructure etc. and will show progress in the economic condition of India.

Attempts have been made to incur technology in the field of agriculture through Agro Mobile: A Cloud-Based Framework for Agriculturists on Mobile Platform [2], an application on mobile phones with cameras to recognize and prevent the crops from the diseases. In this system the farmers will be educated about everything from weather forecast to the crop analysis and prevention by just a click on the mobile phones.

The Application of Cloud Computing to Agriculture and Prospects in Other Field [3] is developed and utilized by the farmers of Japan to keep a track of all the data regarding themselves as well as the cultivable land. Also they use this system to patrol their farms through sensors and camera on a hardware implementation which allows to analyze the growth in the agriculture and maintain graphs and records for the same.

These different forms of works carried out throughout India and outside India are portraying a part of the whole technological way in which agriculture could be improved. Thus all of these studies are very helpful to increase the Gross Domestic Product (GDP) of our country.

In our system we are providing E-commodity exchange where the farmer has access to all the vendors in the city to directly sell the goods, the E-farming service where all the information regarding the farming is provided and telemedicine in which assistance is given incase of infected crops. This tool will also provide real time data of the weather to cultivate crops accordingly. We will be implementing cloud based service which will be accessible through web or mobile app. The system will also help general population to purchase food grains and vegetables much cheaper as the actual price of the crops will be now directly awarded to the crops.

3 Proposed System

The proposed system aims to provide solution to the farmer in yielding productive crops, reduce cost of farming and increase farmers earning. In the process we too will pay less for the goods bought and will make farmer to earn more and boost the economy of the country.

The whole system consist of four modules Real-time computation, E-Farming, telemedicine for crops and E-Commodity Exchange. Real-time computation which gathers real-time data from various sources and database like soil database, weather database, farmer database which computes the required information according to the required real time data. Example, weather forecasting for a particular region for coming weeks [10, 11].

E-Farming aims to promote organic farming, provide assistance using new technologies in farming that yield more crops, provide tips and solution to general problems. Telemedicine for crops solves the crop related problems through expert advise who would help them with some solution.

E-Commodity Exchange enables the farmer to sell the products to the consumers directly at a reasonable price and the farmer will be able to sell the products to the customer reducing the involvement of middle agent and will help the farmer to earn maximum profits through an e-commerce website or an Android application.

The data required for this system such as crops, fertilizers, and their nutrient content etc. was obtained from government websites like farmer portal, agricoop and Mahaagri [5, 6]. The data obtained was either in word or pdf formats. Data collection was a very important part of this system to test and give the required results.

The approach applied here is called intelligent 'AgriTrade' because based on the results that we have obtained using R-programming the current status of the climate and environment is known to the farmer and the crops that can survive in that environment are encouraged to grow for better yield of the farmers. They also get information about current market condition due to the experts sharing their advise on the portal and can also get help about crop diseases through the portal by just uploading the picture of the infected crop.

3.1 System Architecture

The system consist of many different databases implemented in MongoDB and computation is done over cloud on Amazon AWS service for faster query response. The whole system is divided into four different modules, Real-time computation, E-Farming, Tele-medicine for crops and E-Commodity Exchange. All these modules can be accessed via Graphical User Interface through devices like laptops, desktops, and smartphones. End users of this system includes farmers, agricultural experts, administrators, and can be used by government services to know any kind of information anytime.

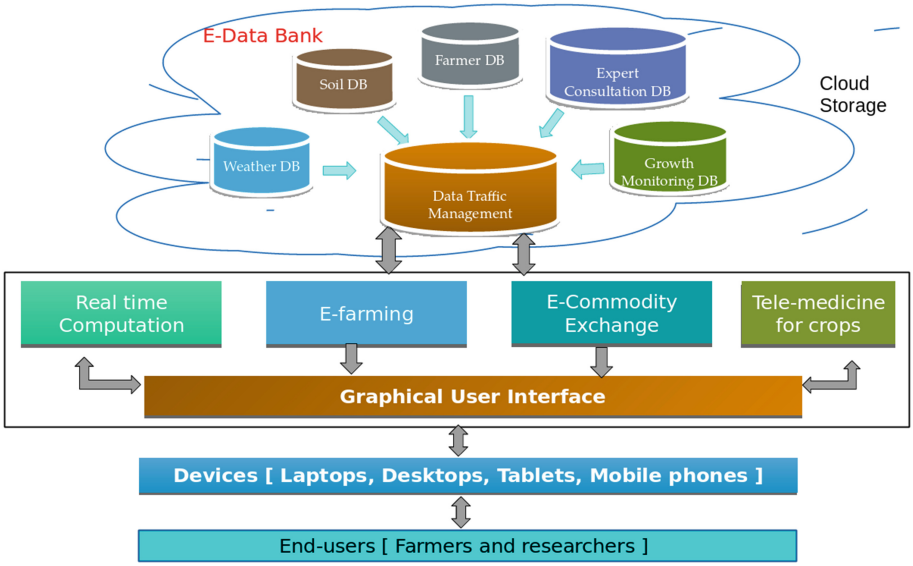

Fig. 1. System architecture

4 Implementation

The web portal depicts the exact analysis and view of the whole system through which all the services would be available to the farmers as well as the few authorities in charge of the whole system. This system is basically going to help the farmers to get all required informations related to farming under one roof. The proposed system provides a user interface along with a database which is used to store all the registered and available input data [9].

Real time computation can be administered and can monitor various databases such as farmer, soil etc., weather forecast information along with growth monitoring of particular sector. This makes the system intelligent. E-Farming provides learning tutorials to the farmers to improve their agricultural skills efficiently and Telemedicine helps the farmers to cure their affected crops and help protect those crops from diseases through fruitful guidance from experts. Next service most needed for the farmers is the E-Commodity Exchange which is an E-Commerce web page helping the farmer to sell their products to the customers at different locations by means of technology. Basically the farmer would have to register with the portal to use the services provided. Figure 2 shows the screen shot of the main page and services page of AgriTrade.

There would be computer professional to help the farmer out with the registration till they receive at least the first payment from the yield.

A Warehouse would be provided to the farmer to keep the yield so as to submit the product to the authorities for sale. Here the system helps the farmers to improve themselves as well their agricultural condition and reduce the number of suicides due to lack of crop or due to crop damage by diseases. As India has maximum of his economy

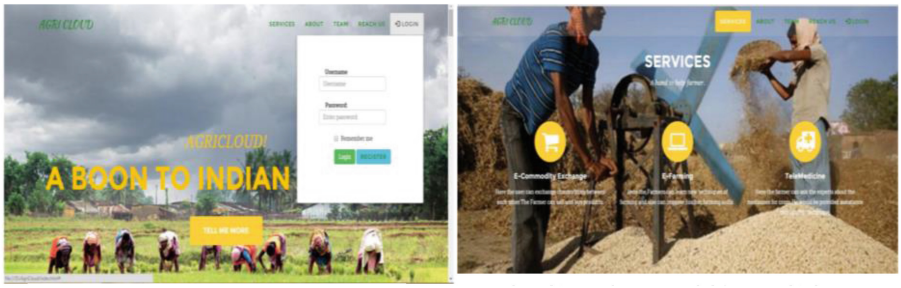

Fig. 2. Main web page and the service page for E-exchange of crops, E-farming, telemedicine inquiries

dependent on agricultural sector this will indirectly improve the conditions and livelihood of farmers as well as the economy of India to a greater extend.

The implementation of the system starts with the user interface development for the web portal which is implemented using Bootstrap which includes HTML and CSS libraries. The pages for the services are designed and would create a proper user interface for the farmers to use it easily which will include regional languages too.

The second section of work is with the database which is implemented using MongoDB as a database and integrating it with the web portal through PHP script.

5 Results

The results are performed by doing live analysis using R-programming.

The result in Fig. 3 that is generated using this software gives the graphical interpretation of the weather attributes such as Temperature, dew point etc.

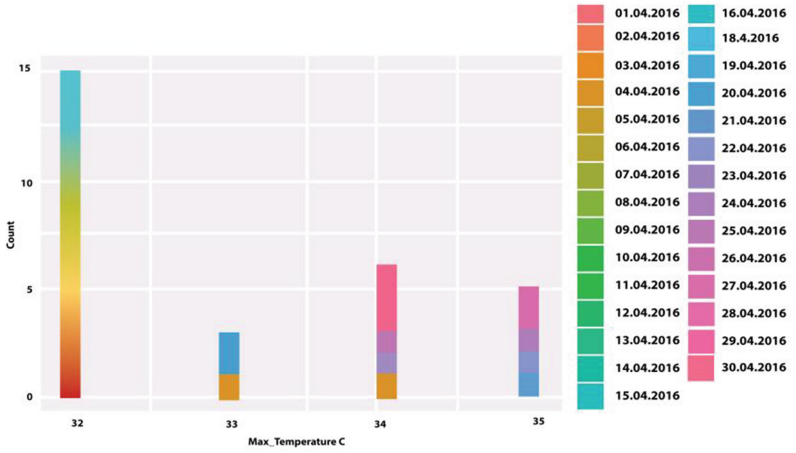

Fig. 3. R-programming temperature analysis

This graph shows the month of April along with its maximum temperature.

The result in Fig. 4 is generated by using dew point as a parameter and the graphs shows the number of days with its respective dew point. The different colors indicate the different days of the month. Figure 5 is a similar graph but is generated by taking humidity as a parameter.

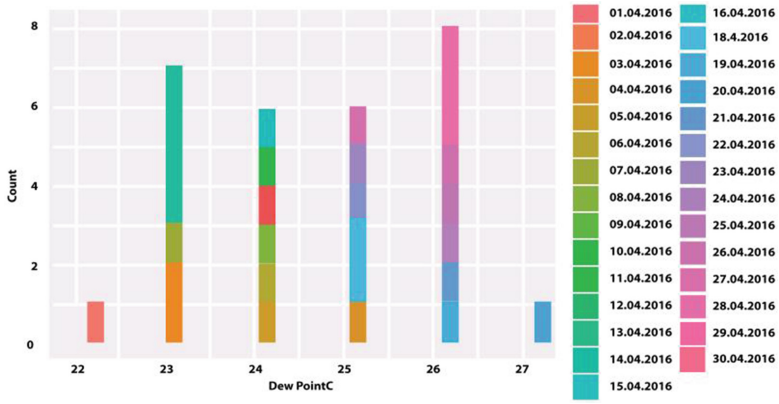

Fig. 4. R-programming dew point analysis

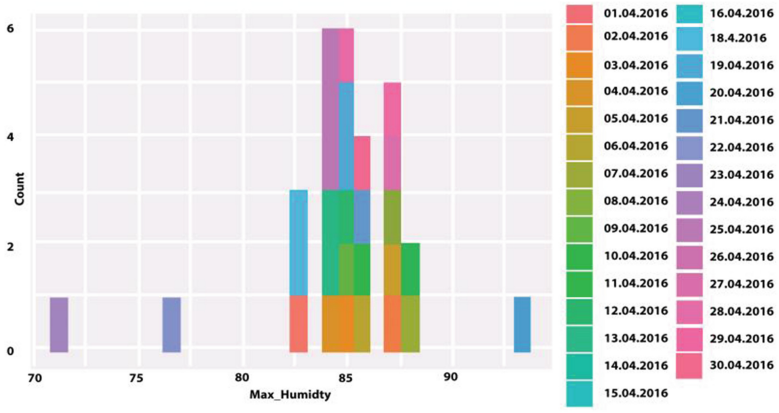

Fig. 5. R-programming humidity analysis

The data is collected with the help of a pre-defined package: Weather data. The dataset once received is stored in a CSV file. This process is repeated for a number of past years. The forecasted weather is obtained by taking the mean of all the years for every parameter. This dataset is then imported back into R-studio and then analysis is done on it.

Entire web portal is language friendly as the language could be changed into different Indian Languages with respect to the farmer's requirement. This will help the farmers to access the web portal in his regional language.

Along with Real Time Computation there are three more services such as E-Farming which provides learning tutorials to the farmers to improve their agricultural skills efficiently through textual help and videos which teach farming. Telemedicine helps the farmers to cure their affected crops and help protect those crops from diseases through fruitful guidance from experts.

Here the farmers have to upload an image of their damaged crop and then check for the experts answers to their queries and also check for the one which have been already asked by other farmers, last but the most needed service for the farmers is the E-Commodity Exchange which is an E-Commerce web page helping the farmer to sell their products to the customers at different locations by means of technology. The customer is able to buy all the commodities sold out by the farmer and the farmer is also benefited as he earns profit by directly selling the products rather than going through a middleman. Basically the farmer would have to register with the portal to use the services provided.

All the three services E-Farming, E-Commodity Exchange and Telemedicine would be available to the farmer to utilize it to the fullest limit. If the farmer does not have any knowledge about computers there would be a computer professional to help them out with the registration till the receivable of payment from the customers for their yield. Along with the farmer the customer can also use the services if customer wants to learn new techniques regarding farming and more importantly he can buy commodities fresh and at very less price.

The tutorial page will help the farmers learn new techniques in farming and would help them improve their way of farming and achieve better outcome. With farmers producing better yields their economic condition is improved. The textual and video are as per the regional languages of the state, for now we have taken only languages of India but it can expanded to all the languages of the world.

The system helps the farmer to earn more profit through the web page as the main disadvantage of middleman is reduced and thus the farmer can sell his yields to the customers directly through the web page and the customers can also access it to buy the sold out yields helping the farmers directly.

The reason why cloud computing is included in this system is that the data processing and storage needed is dynamic and will keep on increasing with time. Therefore the system should have enough storage and processing capabilities.

6 Discussions

The developed system needs to be deployed in the farms. At initial stages there will be an agent who will be helping the farmers to use the system. He will train them as well as help them in selling their crops online and show them how their queries can be answered online. Farmers will be trained to know that he is not alone and there are many people out to help him out. The farmer will get web as well as mobile app training till he becomes fluent to use the AgriTrade tool.

7 Conclusion

This system has been completely developed and all the connections of the website, database and the cloud has been established. All the mentioned modules have been developed and tested as per the requirements. As of now we have only considered Maharashtra for this project but the future scope can include all the states of India. In the e-commodity exchange module online payments methods such as credit/debit can also be included. As our requirements were less we have used Amazon's EC2 layer which can also be changed when there is more data and processing to be done. When this system will be available to the farmers it will help solve many of their problems and make their lives easier. This Intelligent approach presented in this paper help the farmers better visualize their yield and make them aware of the current market condition. The approach makes the farmer more knowledgeable, which can help them bring improvement in their production and financial condition.

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