CHAPTER 1
INTRODUCTION

1.1 SIGNIFICANCE OF AGRICULTURE

Agriculture is the main occupation in India. Two-third of population is dependent on agriculture directly or indirectly. It is not merely a source of livelihood but a way of life. It is the main source of food, fodder and fuel. It is the basic foundation of economic development. Agriculture provides highest contribution to national income. “Agriculture needed top most priority because the Govt. and the nation would both fail to succeed if agriculture could not be successful”.

Contribution to National Income

Contribution to national income from agriculture, forests and other primary activities is 24%. In 1950-51 contribution of agricultural sector to national income was 59% and in 2004-05, it came down to 24.4%. Contribution of agricultural sector in national income is considerable. In rich countries the agriculture is quite developed but contribution is very little. In USA agriculture contributes only 2%. In under-developed countries like India, contribution of agriculture is national income was 27%.

Main source of Food

Agriculture's provides food for Nation. Before 1947, we had acute food shortage but after 1969 Green Revolution in agriculture has made us self-sufficient in food production. In 2003-04, production of rice was 870 lakh metric tones and of wheat 721 lakh metric tones.

Agriculture and Industrial development

For industrial development, agriculture plays active role. It provides essential raw materials to many industries like cotton textiles, jute, sugar, vegetables, oil, tinned food, Cigarettes and rubber etc

Sources of Revenue

Land revenue, excise duty on agro-based goods, taxes on production and sale of agricultural machinery forms a goods part of sources of Govt. Revenue.

Sources of Foreign trade

Foreign trade is associated with agriculture. We export tea, tobacco, spices and coffee etc. Other agricultural exports include cotton, textiles, jute goods and sugar etc. So total share of agricultural exports becomes 70%.

Economic development

India is agricultural state. 71% people live in villages and most of these depend on agriculture. So development of agriculture gives boost is economy. Progress of industry, trade and transport is impossible without progress of agriculture. Stability of prices also depends on agriculture growth.

1.2 TYPES OF AGRICULTURE

Shifting agriculture

This farming practice is mainly used by tribal groups to grow tuber and root crops. Land is obtained by clearing a forested area and planting crops there. When the land is no longer fertile, another area of land is cleared and the crops are shifted there.

Subsistence farming

This is a widely-practiced farming technique can be seen all over India. The farmer and/or his family grow grains for themselves or for sale at the local market.

Intensive agriculture

This farming practice can be seen in densely populated areas in India. It is an attempt to maximize the output of the land, through the use of every possible effort. It requires a huge amount of capital in addition to a great deal of human labor, but more than one crop can be raised per year.

Extensive agriculture

This is the modern type of farming that can be seen largely in the developed world and in some parts of India. It relies largely on machinery as opposed to a human labor force and raises one crop per year.

Commercial agriculture

The goal of commercial agriculture is a high yield, so that produce can be exported to other countries or areas for profit. Wheat, cotton, sugarcane, and corn are some commercial crops and they are grown in states including Gujarat, Punjab, Haryana, and Maharashtra.

Plantation agriculture

This style is often used for crops which require a lot of space and a long growing period, such as rubber, tea, coconut, coffee, cocoa, spices, and fruits. Plantations are only capable of producing a single crop. Plantation agriculture is practiced in Kerala, Assam, Karnataka, and Maharashtra.

Dry land farming

As the name suggests, dry land farming is practiced in the more arid and desert-like areas of the country, including northwest and central India. Crops such as gramjowar, bajra, and peas have lower water requirements and can therefore be grown in these conditions.

Wet land farming

Many areas of India are affected by heavy monsoon rains and subsequent flooding. Well-irrigated areas, such as those in the northeast India and the Western Ghats, are suitable for farming rice, jute, and sugarcane.

1.3 INDIAN AGRICULTURE

India's agriculture is composed of many crops, with the foremost food staples being rice and wheat. Indian farmers also grow pulses, potatoes, sugarcane, oilseeds, and such non-food items as cotton, tea, coffee, rubber, and jute (a glossy fiber used to make burlap and twine). India is a fisheries giant as well. A total catch of about 3 million metric tons annually ranks India among the world's top 10 fishing nations. Despite the overwhelming size of the agricultural sector, however, yields per hectare of crops in India are generally low compared to international standards. Improper water management is another problem affecting India's agriculture.

At a time of increasing water shortages and environmental crises, for example, the rice crop in India is allocated disproportionately high amounts of water. One result of the inefficient use of water is that water tables in regions of rice cultivation, such as Punjab, are on the rise, while soil fertility is on the decline. Aggravating the agricultural situation is an ongoing Asian drought and inclement weather. Although during 2000-01 a monsoon with average rainfall had been expected, prospects of agricultural production during that period were not considered bright. This has partially been due to relatively unfavorable distribution of rainfall, leading to floods in certain parts of the country and droughts in some others.

Despite the fact that agriculture accounts for as much as a quarter of the Indian economy and employs an estimated 60 percent of the labor force, it is considered highly inefficient, wasteful, and incapable of solving the hunger and malnutrition problems. Despite progress in this area, these problems have continued to frustrate India for decades. It is estimated that as much as one-fifth of the total agricultural output is lost due to inefficiencies in harvesting, transport, and storage of government-subsidized crops.

Current Scenario of Agriculture in India

India's food grain production reached 275.68 million tonnes in the year 2016-17 and is estimated to reach 274.55 million tones in 2017-18. Currently, Indian farmers are getting used to farm mechanization at a faster rate as compared to the past. This is can be reflected by but is not limited to the sale of tractors. Indian tractor industries have emerged as the largest in the world accounting for about one-third of total global tractor production as put by The Economic Survey 2017-18, but it also states that more needs to be done in this front. The economic survey also stated that Agricultural R&D is the main source of innovation, which can help in sustaining agricultural productivity growth in the long-term.

Currently with the growing urban migration by men, 'feminization of agriculture sector' is being witnessed with more and more number of women participating in multiple roles as cultivators, entrepreneurs, and laborers.

ICT

Home Small-business infrastructure and operations computing fundamentals ICT (information and communications technology, or technologies)

Definitions

ICT, or information and communications technology (or technologies), is the infrastructure and components that enable modern computing.

Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, nonprofit agencies, governments and criminal enterprises) to interact in the digital world.

ICT (Information and Communication Technologies) refers to technologies that provide access to information through telecommunications

medium such as the radio, television, cell phone, computers, satellite technology; internet including email, instant messaging, video conferencing and social networking websites which have made it possible for users across the world to communicate with each other to give users quick access to ideas and experiences from a wide range of people, communities and cultures.

Agriculture is an important sector with the majority of the rural population in developing countries depending on it. The sector faces major challenges of enhancing production in a situation of dwindling natural resources necessary for production. The growing demand for agricultural products, however, also offers opportunities for producers to sustain and improve their livelihoods. Information and communication technologies play an important role in addressing these challenges and uplifting the livelihoods of the rural poor.

Advantage of ICT in Agriculture

The benefits of ICTs for increased agricultural productivity and strengthening the Agricultural sector include timely and updated information on agriculture related issues such as new varieties release, emergence of new threats such as diseases, weather forecast, pricing control, warning alerts etc.

ICT in Enhancing Agricultural Productivity

Understanding and addressing global agriculture developments both advantageous and disadvantages are critical to improving smallholder livelihoods, in which ICT can play a major role.

The continued increase in globalization and integration of food markets has intensified competition and efficacy in the agriculture sector, and has brought unique opportunities to include more smallholders into supply chains.

Agriculture faces a range of modern and serious challenges, particularly in developing countries exposed to price shocks, climate change, and continued deficiencies in infrastructure in rural areas.

Use of ICT in Agriculture

Increasing efficiency, productivity and sustainability of small scale farms. Information about pest and disease control, especially early warning systems, new varieties, new ways to optimize production and regulations for quality control. Better of markets resulting from informed decisions about future crops and commodities and best time and place to sell and buy goods. Up-to-date market information on prices for commodities, inputs and consumer trends.

Strengthen capacities and better representation of their constituencies when negotiating input and output prices, land claims, resource rights and infrastructure projects. Reduce social isolation, widen the perspective of local communities in terms of national or global developments, open up new business opportunities and allow easier contact with friends and relatives.

1.4 SOIL

Soils in India vary widely, having been formed by the various agents of weathering such as wind, water and temperature. Climate, composition of parent rock and even altitude play a role in the types of soil found in different parts of the country. Indian soils support varying kinds of vegetation, depending upon the mineral content, moisture-holding capacity and levels of acidity. Indian soils support crops such as rice, tea and sugarcane.

Alluvial Soil (Wheat Field**)**

Alluvial soil is found in the northern plains of India. Alluvial soil is rich in potash but poor in potassium and nitrogen. Nevertheless, it is a very fertile soil, which can support a wide variety of crops such as rice, wheat, cotton, jute and sugarcane.

Laterite Soil (Tea Plantation**)**

Laterite soil is found in regions of heavy rainfall such as southern parts of the Western Ghats Mountain Range and in the Eastern Ghats Range in the state

of Orissa. Heavy rainfall leaches this soil of silica, and a deficiency in potash, magnesium and lime makes it acidic. It is brownish to yellowish in color due to the presence of iron oxides. Tea, coffee, cashew, rubber and coconut grow well in laterite soil.

Black Soil (Cotton Field**)**

Also known as regur soil, black soil is very good for growing cotton. It is dark gray to black in color. Its high clay content gives it excellent moisture-retention capacity. Black soil is rich in calcium, potassium and magnesium but deficient in nitrogen. Crops like tobacco, oilseeds, jowar, ragi and maize grow well in black soil.

Red Soil (Tobacco Field**)**

Red soil is sandy and is formed due to weathering of crystalline rocks. It is poor in nitrogen, lime and phosphorus. However, it has a high amount of iron, which is why it is reddish in color. Red soil is found in the states of Tamil Nadu, southern parts of Karnataka and some parts of Madhya Pradesh, Maharashtra, West Bengal and Rajasthan. It supports crops such as groundnut, millet, tobacco, potato, rice, wheat and sugarcane.

Desert Soil

Desert soil is 90 percent clay. Hence, it has poor moisture content. It is also deficient in nitrogen and phosphorus but has high amount of phosphates and nitrates. This soil is found in Rajasthan and parts of Punjab, Haryana and Gujarat. Indian farmers grow hardy crops like millet and barley in desert soil.

Other Types

The acidic nature of saline and alkaline soils, as well as peaty and marshy soils, make them unfit for agriculture.

Soil Nutrients

Soil nutrient management is a body of practices that aim to optimize crop yield and quality, minimize nutrient input costs and protect soil and water resources.

Fertilizer

Most fertilizers that are commonly used in agriculture contain the three basic plant nutrients: nitrogen, phosphorus, and potassium. Some fertilizers also contain certain "micronutrients," such as zinc and other metals, which are necessary for plant growth. Materials that are applied to the land primarily to enhance soil characteristics (rather than as plant food) are commonly referred to as soil amendments.

Fertilizers and soil amendments can be derived from:

- virgin raw material
- composts and other organic matter
- Wastes, such as sewage sludge and certain industrial wastes.
- Overuse of fertilizers has resulted in contamination of surface water and groundwater.

1.5 DATA MINING TECHNIQUES

Each of the following data mining techniques cater to a different business problem and provides a different insight. Knowing the type of business problem that you’re trying to solve, will determine the type of data mining technique that will yield the best results.

In today’s digital world, we are surrounded with big data that is forecasted to grow 40%/year into the next decade.. The ironic fact is, we are drowning in data but starving for knowledge. Why? All this data creates noise which is difficult to mine – in essence we have generated a ton of amorphous data, but experiencing failing big data initiatives. The knowledge is deeply

buried inside. If we do not have powerful tools or techniques to mine such data, it is impossible to gain any benefits from such data.

Below are 5 data mining techniques that can help you create optimal results.

Classification

This analysis is used to retrieve important and relevant information about data, and Meta data. It is used to classify different data in different classes. Classification is similar to clustering in a way that it also segments data records into different segments called classes. But unlike clustering, here the data analysis would have the knowledge of different classes or cluster. So, in classification analysis you would apply algorithms to decide how new data should be classified.

Association

It refers to the method that can help you identify some interesting relations (dependency modeling) between different variables in large databases .This technique can help you unpack some hidden pattern in the data that can be used to identify variables within the data and the concurrence of different variables that appear very frequently in the dataset. Association rule are useful for examining and forecasting customer behavior.

Outlier Detection

This refers to the observation for data items in the dataset that do not match an expected pattern or an expected behavior. Anomalies are also known as outliers, noelties, noise, deviations and expections. Often they provide critical and actionable information. An anomaly is an item that deviates considerably from the common average within the dataset or a combination of data. This technique can be used in a variety of domains, such as intrusion detection, system health monitoring, fraud detection, event detection. Analysis often remove the anomalous data from the dataset top discover results with an increased results with an increased accuracy.

Decision Tree Classification

Decision tree builds classification or regression models in the form of a tree structure. It breaks down a dataset into smaller and smaller subsets while at the same time an associated decision tree is incrementally developed. The final result is a tree with **decision nodes** and **leaf nodes**. A decision node (e.g., Outlook) has two or more branches (e.g., Sunny, Overcast and Rainy). Leaf node (e.g., Play) represents a classification or decision. The topmost decision node in a tree which corresponds to the best predictor called **root node**. Decision trees can handle both categorical and numerical data.

Regression Analysis

In statistical terms, a regression analysis is the process of identifying and analyzing the relationship among variables. It can help you understand the characteristic value of the dependent variable changes, if any one of the independent variables is varied. This means one variable is dependent on another, but it is not vice versa. It is generally used for prediction and forecasting.

All of these techniques can help analyze different data from different perspectives. Now you have the knowledge to decide the best technique to summarize data into useful information – information that can be used to solve a variety of business problems to increase revenue, customer satisfaction, or decrease unwanted cost.

CHAPTER 2
LITERATURE SURVEY

In this section the literature survey has been carried out. The main focus is on data mining techniques on agriculture. The rest of papers focused on android application projects. The literature survey gives a clear idea for proposed system.

Dr.Minet Julien, Dr.Curnel Yannick et'al [1] presented "Crowdsourcing for Agriculture". Crowdsourcing, understood as outsourcing tasks or data collection by a large group of non-professionals, is increasingly used in scientific research and operational applications. They reviewed crowdsourcing initiatives in agricultural science and farming activities and further discussed the particular characteristics of that approach in the field of agriculture. On-going crowdsourcing initiatives in agriculture were analysed and categorised according to their crowdsourcing component. They identified eight types of agricultural data and information that can be generated from crowdsourcing initiatives. Subsequently they described existing methods of quality control of the crowdsourced data. They analysed the profiles of potential contributors in crowdsourcing initiatives in agriculture, suggested ways for increasing farmers' participation, and discussed the on-going initiatives in the light of their target beneficiaries. While crowdsourcing is reported to be an efficient way of collecting observations relevant to environmental monitoring and contributing to science in general, they pointed out that crowdsourcing applications in agriculture may be hampered by privacy issues and other barriers to participation. Close connections with the farming sector, including extension services and farm advisory companies, could leverage the potential of crowdsourcing for both agricultural research and farming applications. The experimental results showed that the term of farmsourcing as a professional

crowdsourcing strategy in farming activities and provides a source of recommendations and inspirations for future collaborative actions in agricultural crowdsourcing.

Dr.Kishore Atreya et'al [2] intimated "Pesticide use in Agriculture". Pesticides are chemical substances used to control harmful organisms. Its use in agriculture can adversely affect human health, environment and eco-systems. Globally, agriculture sector consumes significant amount of pesticides – approximately 85 percent of the estimated 2.9 million tones used each year (Raven et al., 2008). Pesticide use is increasing worldwide, and at a rapid rate in developing countries. The developing nations utilize only 20% of world total pesticides applied. Despite increasing application of tons of pesticides worldwide, more than 40% of all potential food production and another 20% of the harvested crop is lost to pests. For example, a 33-fold increase in pesticide use in the United States since the 1940s, crop lost due to pest have not changed significantly. Only a small amount of the applied pesticide actually reaches the intended target organism and the vast majority ends up elsewhere in the environment. Less than one percent of pesticides applied to the agriculture reach their target pests, and more than 99% of it adversely affects unintended targets including the public and environmental health (Pimentel, 2005). And pesticides pollute environment and ecosystems and marginalize human populace thus its use and sale is under strict control in many developed countries.

Dr.P.Isakki et'al [3] represented "a study on crop yield forecasting using classification techniques". They discussed that farmers are struggling to produce yield because of unpredictable climate and reduction of water resources.to overcome this situation they used various data mining techniques which could provide best results and suggestion to farmers by comparing the historical data.

Dr.Ramesh et'al [4] imparted "Analysis of Crop Yield Prediction using data mining techniques". They discussed to solve the problem of yield prediction based on available data. The main aim is to create a user friendly interface for farmers which give the analysis of crop production based on available data. They considered six variables as input parameters: year, rainfall, area of sowing, yield, fertilizers, and production. Hence the dataset collection is carried out for all districts of Andhra Pradesh in India. They use "multiple linear regression" and "density based clustering" techniques to solve the prediction of crop yield. Multiple Linear Regression (MLR) technique is based on least squares and probably the most widely used method in climatology for developing models to reconstruct climate variables from tree ring services. The statistical model Multiple Linear Regression technique is applied on existing data. The results so obtained were verified and analyzed using the Data Mining technique namely Density-based clustering technique.

Manav singhal et'al [5] presented "Krishi ville-Android based Solution for Indian Agriculture". They discussed about importance of ICT in Indian agriculture. It is Android based mobile application which would provide all the facilities to the farmers related to their agricultural activities. It would be helping them in getting the weather updates and they can also access the news related to agriculture and farms. Krishi ville would be based on client-server architecture. The server will provide all required agricultural market information, weather updates and forecasting. It is designed to meet the needs of the Indian farmers. They develop a mobile phone based solution that helps in farm's management, leads to agricultural yield improvement and helps in care/maintenance of the farms. This application for agriculture enables the farmer to calculate profitability based on where the grain markets are currently trading and to see how higher or lower grain markets are presently. They would

be able to get the current market prices depending upon the commodities. Krishi Ville presents the new updates of different agricultural commodities, weather forecast updates, agricultural news updates. The application could help in guiding the people to manage and organize their tasks and particularly help them in remembering those tasks during usual hectic routines.

Monali Paul et'al [6] represented "Analysis of Soil Behavior and Prediction of Crop Yield using Data Mining approach". They presented a system, which used data mining techniques in order to predict the category of the analyzed soil datasets. Their work included, classification of soil into low, medium and high categories are done by adopting data mining techniques in order to predict the crop yield using available dataset. The category, thus predicted will indicate the yielding of crops**.** They used K-Nearest Neighbor and Naive Bayes algorithm. The assumption behind the k-nearest neighbor algorithm is that a similar classification is produced by similar samples. The similar known samples used for assigning a classification to an unknown sample were described by the parameter K. Naive Bayes classifier assumes that the presence (or absence) of a particular feature of a class is unrelated to the presence (or absence) of any other feature. The Experiments were performed on the real world data obtained from the Soil Testing Laboratory in Jabalpur, Madhya Pradesh. Their dataset consists of 100 instances with 12 attributes. The tuples of dataset thus define the availability of nutrients and micronutrients in soil. With the help of Rapid Miner 5.3, training models from KNN and Naive Bayes algorithms were created. The results helped the soil analysts and farmers to decide sowing in which land may result in better crop production.

V. Jirapure et'al [7] intimated "Qualitative data analysis using Regression method for Agricultural data". They built an agricultural based information system for Customer and Farmer interaction where scalability, reliability and

integrity of information can be access through cloud based technology. They also analyzed and use data mining techniques specially Regression analysis to forecast the crop production. Regression is a method of finding correlation between different metric variables, datasets or fields also a way of learning a function in which data items are analyzed and provided a real valued prediction figure. Strong relationship or weak relationship between the variables is also calculated based on certain assumptions. The proposed system work includes building agricultural information system by bridging gap between farmer and customer. Using qualitative analysis of agriculture product, customer can easily differentiate among different farmers and their respective products. Regression analysis has been implemented to forecast the crop production and analyze the patterns between different set of data. Different researchers can access the data to find and analysis different patterns.

Vikas kumar et'al [8] presented "Crop Cultivation Information System on Mobile Devices". They discussed an information system for farmers which can be operated on their mobile phones. The system was developed using Service Oriented Architecture (SOA) to process spatial data and knowledge base. The knowledge base is maintained in the form of ontologies. They developed GIS data base and ontology for cotton crop in north Gujarat region. After successful implementation they will generalized the system for other crops and regions in India. Experimental results showed the complex queries processing, using GIS information and cotton ontology. Results for queries were tested on Android based mobile phone.

S.S Baskar et'al [9] demonstrated "Applying Data Mining Techniques on Soil Fertility Prediction". They dealt with various data mining techniques for analysis of soil dataset. This data mining algorithms were used for analyzing the soil datasets for classification purposes. The various techniques of data mining is used and compared. They carried out a comparative study of various

classification techniques with the help of data mining tool known as WEKA. They proposed an analysis of the soil data using different algorithms and prediction technique. In spite the fact that the least median squares regression is known to produce better results than the classical linear regression technique. From the given set of attributes, the most accurately predicted attribute was Nitrogen content of the soil, which was determined using the Linear Regression technique in lesser time as compared to Least Median Squares Regression. They also demonstrated a comparative study of various classification algorithms i.e. Naïve Bayes, J48 (C4.5), JRip with the help of data mining tool WEKA. J48 is very simple classifier to make a decision tree, but it gave the best result in the experiment.

Li Dongming et'al [10] presented "The Application of Decision Tree C4.5 Algorithm to Soil Quality Grade Forecasting Model". They proposed that the decision tree C4.5 algorithm is used to construct the data mining model for predicting the soil quality grade. The decision tree carries out data learning, according to each data of soil quality levels in the training sample, and then gets the decision tree that accords with learning rules. Their experiment proved that the decision tree generated by calculation can intuitively show the relationship between the composition of soil and soil quality grade. The decision tree algorithm is simple and efficient which handles the data to generate rules, and easy to program. Due to dispersion, large amount, and fast updating of the agricultural soil data, it takes difficulty to statistical evaluation for people. The decision tree C4.5 algorithm provided a train of thought and method to solve this difficulty, and it provides the reliable theory basis for precision fertilization.

M.Atchatha et'al [11] presented "crop rotation based on space and time". Here they try to suggest an alternate for this dependency by introducing the crop rotation based on the space and time. The proposed system works into four modules 1) sensing and gathering data 2) decision making 3) methodology and 4) algorithm**.** The methodology will help to improve the net profit of the farmers having a better organic farming practice. The method will help to get rid of poverty of farmers and agricultural runoff. Nowadays the information technology plays key role in agriculture industry.

CHAPTER 3
SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

- 'AdSurv' The Android based Application Solution for Indian Agriculture.
- The above system gives us "Data collection activity and Pesticide suggestion" information by using Knowledge Collection from Volunteer Contributors (KCVC).
- The system uses a Customized Database Application that receives data from the Android Application.
- The data collected is in the form of Geo-coded images of plants in gardens in the locality of the collector.
- This system enables farmers, extension workers and agricultural experts provide near real-time geo-tagged surveillance data for monitoring cassava crop health across Uganda.

Limitations

- Data available is not classified on the basis of locality.
- No real time traffic monitoring for crops available.
- Crop yield is not predicted using the crowd sourced database.
- Mobile application does not provide much relevant information to increase productivity.
- The existing does not give any awareness about fertilizers and pesticides.

3.2 PROPOSED SYSTEM

Agriculture and other allied agricultural activities still continue to provide employment to around 65% of the total workforce in India. Since the introduction of mobile phones, farmers have had access to knowledge at a minimal cost. However, this data is usually in the form of a one way

communication and not always relevant. The solution proposed in the work envisages the use of “wisdom of the crowd”, (i.e.), the creation of a crowd-sourced database which is created by the farmers. The farmers will be able to login and see information that the other farmers who have planted similar crops and/or have farmed in similar conditions have shared. Farmers share their farming experience to a database, by sharing the crop variety, pesticides and fertilizers used at particular time periods and so on.

By providing information like the crop variety, season, the area of the field, geographical location, the farmer can then learn about the types of diseases that the crop sown would be affected by and ways to avoid the diseases, or in case of infection, the solution to overcome it. The system uses a decision tree algorithm to classify the data entered by other farmers. In this way, the farmer can also know the right amount of fertilizers, pesticides and insecticides to be applied during certain time periods and the optimum harvesting period. Finally, the application also provides an estimated amount of harvest obtained by the farmer under the conditions he entered.

The process of developing the proposed system involves the following modules:

- Crowdsourcing
- Dataset collection and classification
- Crop suggestion
- Fertilizer suggestion
- Pesticide suggestion

CHAPTER 4
SYSTEM SPECIFICATION

4.1 SOFTWARE REQUIREMENTS

Operating system	:	Lollipop (5.1)
Front End	:	Android studio
Back End	:	My SQL
Language	:	Java , Python , PHP

4.2 HARDWARE REQUIREMENTS

Processor	:	SnapDragon 456
Hard disk	:	128 GB
RAM	:	4GB

4.3 ABOUT THE SOFTWARE

Client/server software engineering blends conventional principles, concepts, and methods discussed earlier in the text with elements of object-oriented and component-based software engineering. C/S architectures dominate the landscape of computer-based systems. In C/S architectures, software residing on one computer (the client) requests services or data from another computer (the server). The process model used in C/S software engineering is evolutionary beginning with requirements elicitation. Functionality is allocated to subsystems of components that are assigned to either the client or the server side of the C/S architecture. Design focuses on integration of existing components and creation of new components. Implementation and testing must exercise both the client and server functionality within the context of the component integration standards and the C/S architecture. C/S software engineering relies on the same SQA practices as other software engineering processes. Formal technical reviews are used to

assess the quality of the analysis and design models. Specialized reviews consider issues associated with component integration and middleware. Testing is used to uncover errors at the component, subsystem, client, and sever levels.

Representative Client/Server Systems

- File servers (client requests selected records from a file , server transmits records to client over the network).
- Database servers (client sends SQL requests to server, server processes the request and returns the results to the client over the network).
- Transaction servers (client sends requests that invokes remote procedures on the server side, sever executes procedures invoked and returns the results to the client).
- Groupware servers (server provides set of applications that enable communication among clients using text, images, bulletin boards, video, etc.).

Software Components for C/S Systems

- User interaction/presentation subsystem (handles all user events).
- Application subsystem (implements requires defined by the application within the context of the operating environment, components may reside on either the client or server side).
- Database management subsystem (performs data manipulation and management for the application).
- Middleware (all software components that exist on both the client and the server to allow exchange of information).

Representative C/S Configuration Options

Distributed presentation - database and application logic remain on the server, client software is used to reformat server data into GUI format.

Remote presentation - similar to distributed presentation, primary database and application logic remain on the server, data sent by the server is used by the client to prepare the user presentation.

Distributed logic - client is assigned all user presentation tasks associated with data entry and formulating server queries, server is assigned data management tasks and updates information based on user actions.

Remote data management - applications on server side create new data sources, applications on client side process the new data returned by the server. Distributed databases - data is spread across multiple clients and servers, requiring clients to support data management as well as application and GUI components.

Fat server - most software functions for C/S system are allocated to the server.

Thin clients - network computer approach relegating all application processing to a fat serve.

Client Server Evolution

A long time ago, client-server computing was just using mainframes and connecting to dumb terminals. Through the years, personal computers started to evolve and replaced these terminals but the processing is still done on the mainframes. With the improvement in computer technology, the processing demands started to split between personal computers and mainframes.

The term client-server refers to a software architecture model consisting of two parts, client systems and server systems. These two components can interact and form a network that connects multiple users. Using this technology, PCs are able to communicate with each other on a network. These networks were based on file sharing architecture, where the PC downloads files from corresponding file server and the application is running locally using the data received. However, the shared usage and the volume of data to be transferred must be low to run the system well.

As the networks grew, the limitations of file sharing architectures become the obstacles in the client-server system. This problem is solved by replaced the file server with a database server. Instead of transmitting and saving the file to the client, database server executes request for data and return the result sets to the client. In the results, this architecture decreases the network traffic, allowing multiple users to update data at the same time.

Typically either Structured Query Language (SQL) or Remote Procedure Calls (RPCs) are used to communicate between the client and server. There are several types of client-server architecture. One of the architecture is the Two Tier Architecture, where a client is directly connected to a server. This architecture has a good application development speed and work well in homogeneous environments when the user population work is small. The problem exists in this architecture is the distribution of application logic and processing in this model. If the application logic is distributed to dozens of client systems, the application maintenance will be very difficult. To overcome the limitations of the Two-Tied Architecture, Three Tier Architecture is introduced. By introducing the middle tier, clients connect only to the application server instead of connect directly to the data server. By this way, the load of maintaining the connection is removed. The database server is able to manage the storage and retrieve the data well. Thus, the application logic and processing can be handled in any application systematically. To enhance the Three Tier Architecture, it can be extended to N-tiers when the middle tier provides connections to various types of services, integrating and coupling them to the client, and to each other.

JAVA Platform

There are two types of platforms software-based and hardware-based. Java provides a software-based platform.

The Java platform differs from most other platforms in the sense that it is a software-based platform that runs on the top of other hardware-based platforms. It has two components:

1. Runtime Environment
2. API(Application Programming Interface)

Java code can be run on multiple platforms, for example, Windows, Linux, Sun Solaris, Mac/OS, etc. Java code is compiled by the compiler and converted into byte code. This byte code is a platform-independent code because it can be run on multiple platforms, i.e., Write Once and Run Anywhere (WORA).

Java is an object-oriented programming language. Everything in Java is an object. Object-oriented means we organize our software as a combination of different types of objects that incorporates both data and behavior.

Python

Python is an interpreted, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales

Packages

sklearn

In python, sklearn is a machine learning package which include a lot of ML algorithms.

Here, we are using some of its modules like train_test_split, Decision Tree Classifier and accuracy score.

numpy

It is a numeric python module which provides fast maths functions for calculations.

It is used to read data in numpy arrays and for manipulation purpose.

pandas

Used to read and write different files.

Data manipulation can be done easily with data frames.

DJANGO REST Framework

Django REST framework is a powerful and flexible toolkit for building Web APIs.

Some reasons you might want to use REST framework:

- The Web browsable API is a huge usability win for your developers.
- Authentication policies including packages for OAuth1a and OAuth2.
- Serialization that supports both ORM and non-ORM data sources.
- Customizable all the way down - just use regular function-based views if no need of more powerful features.
- Extensive documentation, and great community support.
- Used and trusted by internationally recognised companies including Mozilla, Red Hat, Heroku, and Eventbrite.

Requirements

The requirements for this codelab are a basic understanding of Android. You should have your Android development environment setup and understand the basic concepts of Android development. If you are unfamiliar with Android, we highly recommend that you look at the Android developer website and familiarize yourself with developing on Android by trying out the code samples there.

Apache Tomcat

It is often referred to as **Tomcat Server**, is an open-source Java Servlet Container developed by the Apache Software Foundation (ASF). Tomcat implements several Java EE specifications including Java Servlet, Java Server

Pages (JSP), Java EL, and Web Socket, and provides a "pure Java" HTTP web server environment in which Java code can run.

Tomcat is developed and maintained by an open community of developers under the auspices of the Apache Software Foundation, released under the Apache License 2.0 license, and is open-source software.

Android Studio

It is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as the primary IDE for native Android application development.

Android Studio was announced on May 16, 2013 at the Google I/O conference. It was in early access preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released in June 2014 The first stable build was released in December 2014, starting from version 1.0. The current stable version is 3.3, which was released in January 2019

Features

The following features are provided in the current stable version:

- Gradle-based build support
- Android-specific refactoring and quick fixes
- Lint tools to catch performance, usability, version compatibility and other problems
- ProGuard integration and app-signing capabilities
- Template-based wizards to create common Android designs and components

- A rich layout editor that allows users to drag-and-drop UI components, option to preview layouts on multiple screen configurations
- Support for building Android Wear apps
- Built-in support for Google Cloud Platform, enabling integration with Firebase Cloud Messaging (Earlier 'Google Cloud Messaging') and Google App Engine
- Android Virtual Device (Emulator) to run and debug apps in the Android studio.

CHAPTER 5
SYSTEM DESIGN

5.1 SYSTEM ARCHITECTURE

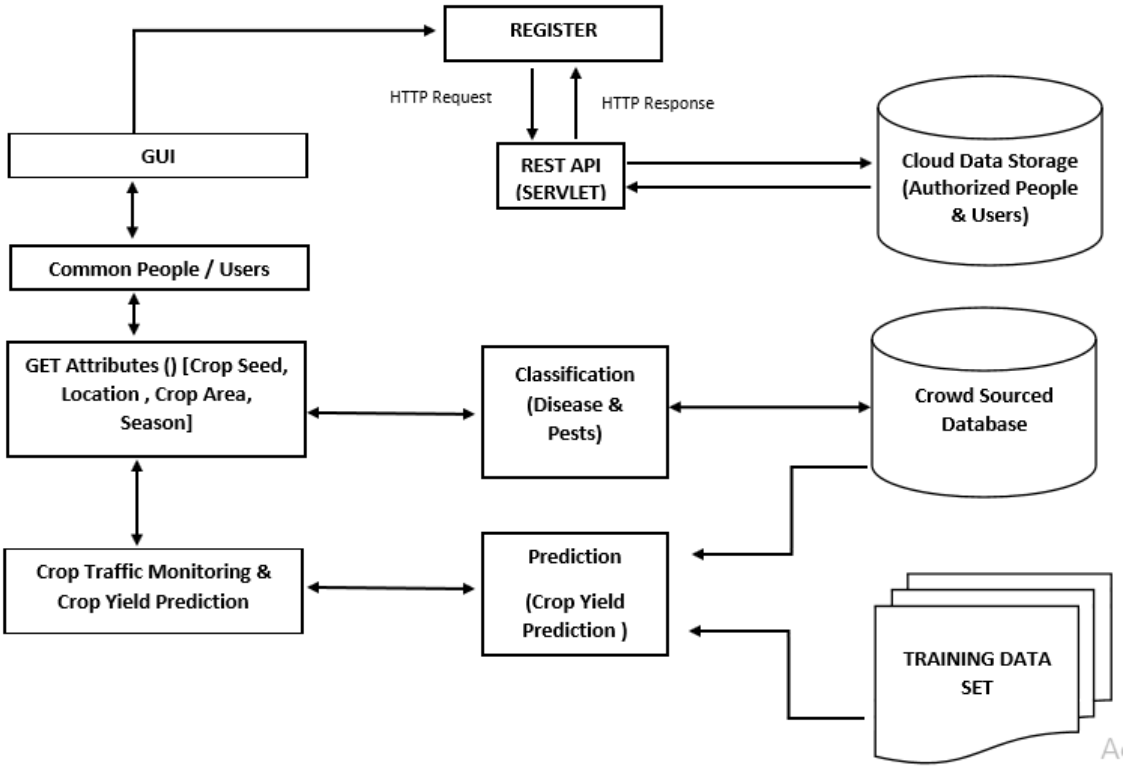


Figure 5.1 Overall Architecture

5.2 MODULE DESCRIPTION

The above Figure 5.1 shows the process of developing the proposed system that involves the following modules:

1. Crowdsourcing
2. Dataset collection and classification
3. Crop suggestion
4. Fertilizer suggestion
5. Pesticide suggestion

5.2.1 CROWD SOURCING

Crowdsourcing.org said the platform got its start when founder Jesse Lasater heard that a friend of his couldn't get a loan to put in a new sprinkler system for his farm. Around the same time, one of Lasater's cousins wrapped up a fairly lengthy but ultimately unsuccessful stay on The Voice, a singing competition. Looking to parlay that modest success into a career, the cousin took to Kickstarter to raise cash without giving up creative control to a record label.

Initially, the plan was only to help people in his area, near Bayfield, Colorado. But he then realized that the site can help farmers nationwide. After building the site from scratch with help from a developer team, Harvest Funders was ready for launch on March 25, the National Agriculture Day.

Lasater said he surveyed farmers across the nation and found that 40 percent of individuals surveyed had been denied for an agricultural loan. Part of that is the fact that the industry is relatively risky — a farm can have a great year and follow it up with a terrible one, something that scares off potential investors or lenders. Reward-based crowdfunding can help alleviate that need for cash.

Harvest Funders allows both fixed and flexible funding campaigns, and has a fairly standard fee structure. The projects that meet their goal give up 5%; those that fall short but go the flexible funding route give up 8% (fixed funding campaigns that don't meet the goal don't keep any of the money and thus pay no fee). There's also a PayPal transaction fee.

5.2.2 DATASET COLLECTIONS AND CLASSFICATION

The collection of dataset is the second module and major part in the proposed system. Here we collect data from 'data.gov.in'. The data consist of four attributes (Crop Name, Crop Location, Crop Area (in acres), Season,

Periods) and 342 instances. The data's are preprocessed and refined into CSV format. The preprocessing consists of four steps: data cleaning, data integration, data reduction, and data transformation. Further the preprocessed data is loaded into weka.

ATTRIBUTE DESCRIPTION

There are four attributes considered. They are Crop Name, Crop Location, Crop Area (in acres), Season, Periods

5.2.3 CROP SUGGESTION

Crop loss is the main reason behind this third module creation. It occurs due to incorrect selection of crops. Framers didn't know what crops to be sown in their land. As a result of this an incorrect crop is grown and does not produce any increase in productivity. Our proposed system suggests suitable crop according to the production rate. Here farmers can enter their crop variety, crop location, season, duration.

The Figure 5.2 shows the process of crop suggestion. Input contains the following parameters: crop name, crop duration, crop area, crop season, crop location. After typing these values there will be a crop button. If we click it the system will compare the given values with the database and produce the appropriate crop for that land. The system produces accurate crop for the given attributes. It classifies the crop according to the four given parameters. The production rate is calculated using regression

Our system identifies only for five crops namely: Rice, Onion, Banana, Cotton and Wheat by matching the values with the classified output stored in the database. Matching is done using regression technique. By suggesting crops the farmers can get best idea about crops that could reduce crop loss and increase productivity.

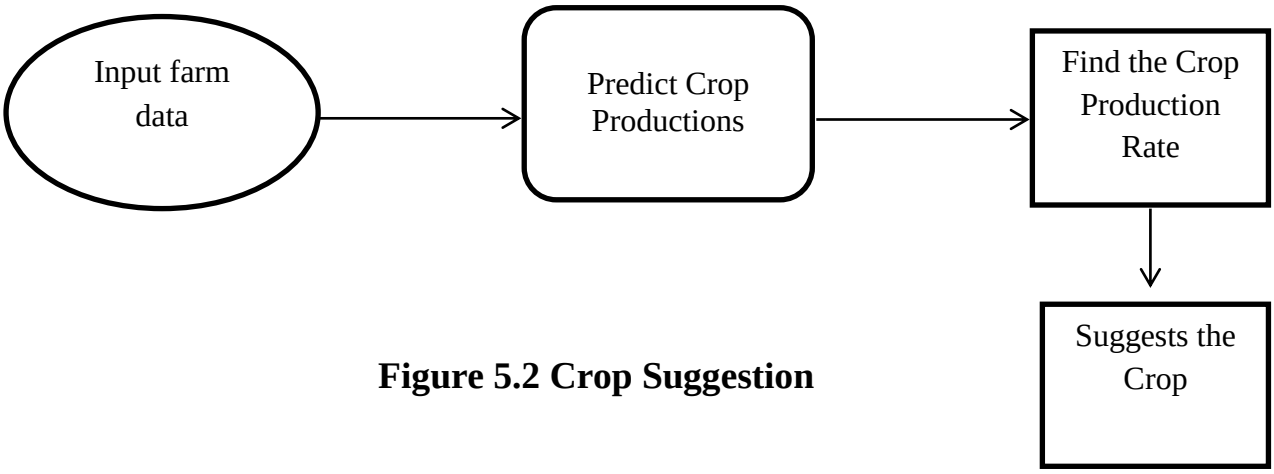


Figure 5.2 Crop Suggestion

5.2.4 FERTILIZER SUGGESTION

The Figure 5.3 shows the process of fertilizer suggestion which is the fourth module to suggest crops to the farmer for his land. But there is an alternate case in which a farmer wants to use his own desired crop into his field. In such controversial situation the proposed system has an added advantage of suggesting the fertilizer for his land for his desired crop. Also it says, whether the desired crop of the farmer, can yield productivity or not. Here the Crop id is taken as the class label and then the crop is identified with the existing parameter along with the disease. The farmer is identified by matching the crop id and the fertilizer is suggested which is used by that particular farmer for the given condition. Fertilizer is the main component for healthy growth of crops. There are many kinds of fertilizers. People are unaware of some banned fertilizers. The proposed system suggests fertilizers for suitable crop and gives more information about banned fertilizers.

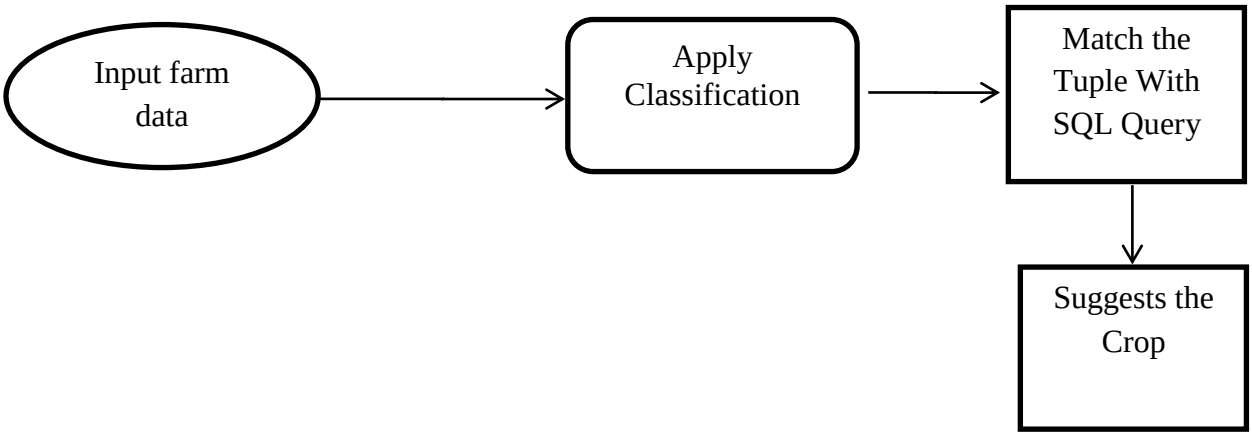


Figure 5.3 Fertilizer Suggestion

5.2.5 PESTICIDE SUGGESTION

The Figure 5.4 pesticide suggestion is the fifth module that suggests pesticide to avoid diseases while growing .People is not aware of some banned pesticides. The proposed system maintains a database that consists of disease and pesticide details. It also contains the name of the banned pesticides.

There are, many kinds of disease like black rot pathogen, Xanthomonas campestris, pathovar camps, Powdery mildew, Crown gall disease caused by Agrobacterium, Tobacco mosaic virus etc.so farmers can easily abscond from fungal and other diseases. When the farmers input the crop details along with the area the classification algorithm returns the disease of that crop and suggest the solution and pesticide by matching values in the database. A dataset which consist of different diseases and pesticide details .Therefore it may help farmers to avoid diseases attacking the plants.

The pesticide database consists of three columns i.e. name of the pesticide, name of the disease and banned pesticides.

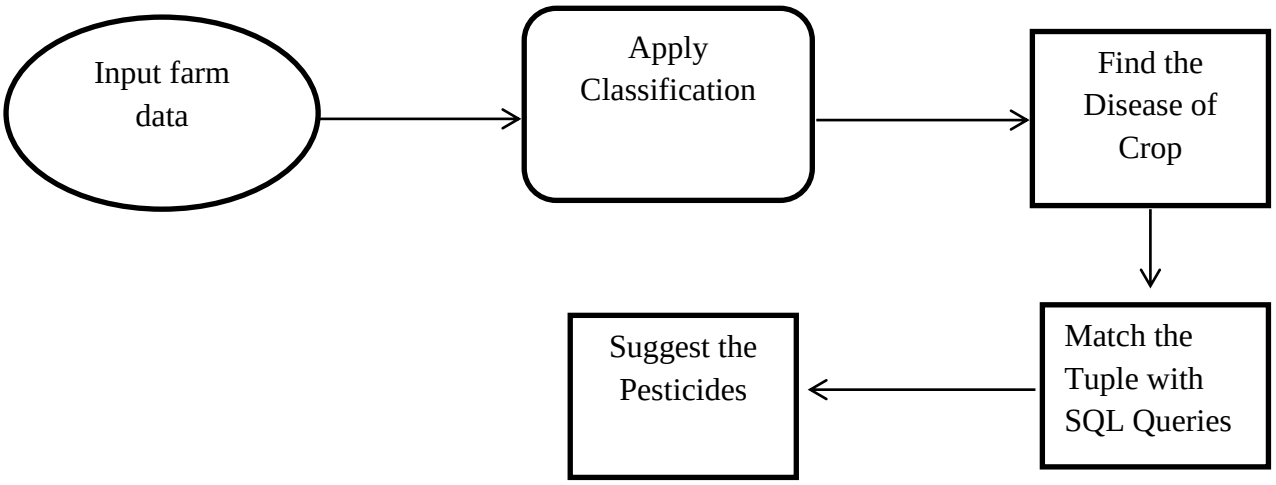


Figure 5.4 Pesticide Suggestion

5.3 ANDROID APPLICATION

The rapid growth of mobile telephony and the recent introduction of mobile enabled information services provide a means to overcome existing information asymmetry. It also helps to bridge the gap between the availability and delivery of agriculture inputs and agriculture infrastructure. The increasing penetration of mobile networks and handsets in India therefore present an opportunity to make useful information more widely available. This could help agricultural markets operate more efficiently, and overcome some of the other challenges faced by this sector. The main objective for such project is to develop a mobile phone based solution that helps in farm's management, leads to agricultural yield improvement and helps in care/maintenance of the farms. Android, the open-source mobile operating system developed by Google, is quickly becoming the smart phone of choice for activists. It's growing in popularity around the world, and has recently turned out to be stand on number two in smart phones' popularity in the world behind Nokia's Symbian operating system.

Here our mobile application consists of user login, admin login, crop suggestion, fertilizer suggestion and pesticide suggestion. Crop suggestion gets

the input from farmers and provides the desired output. Fertilizer suggestion provides suitable fertilizer for suitable crop.as same as pesticide suggestion gives clear idea about pesticides and also banned pesticide.

5.4 ALGORITHM AND TECHNIQUES

Decision Tree Algorithm

A decision tree is a flowchart-like tree structure where an internal node represents feature (or attribute), the branch represents a decision rule, and each leaf node represents the outcome. The topmost node in a decision tree is known as the root node. It learns to partition on the basis of the attribute value. It partitions the tree in recursively manner call recursive partitioning. This flowchart-like structure helps you in decision making. It's visualization like a flowchart diagram which easily mimics the human level thinking. That is why decision trees are easy to understand and interpret.

Attribute Selection Measures

Attribute selection measure is a heuristic for selecting the splitting criterion that partition data into the best possible manner. It is also known as splitting rules because it helps us to determine breakpoints for tuples on a given node. ASM provides a rank to each feature (or attribute) by explaining the given dataset. Best score attribute will be selected as a splitting attribute. In the case of a continuous-valued attribute, split points for branches also need to define. Most popular selection measures are Information Gain, Gain Ratio, and Gini Index.

Information Gain

Shannon invented the concept of entropy, which measures the impurity of the input set. In physics and mathematics, entropy referred as the randomness or the impurity in the system. In information theory, it refers to the impurity in a group of examples. Information gain is the decrease in entropy. Information gain computes the difference between entropy before split and average entropy

after split of the dataset based on given attribute values. ID3 (Iterative Dichotomiser) decision tree algorithm uses information gain.

$$\text{Info}(D) = -\sum_{i=1}^{m} pi \log_2 pi$$

$$\text{Info}_A(D) = \sum_{j=1}^{V} \frac{|Dj|}{|D|} \text{ X Info}(D_j)$$

$$\text{Gain}(A) = \text{Info}(D) - \text{Info}_A(D)$$

Gini Index

Another decision tree algorithm CART (Classification and Regression Tree) uses the Gini method to create split points.

$$\text{Gini}(D) = 1 - \sum_{i=1}^{m} Pi^2$$

Where, pi is the probability that a tuple in D belongs to class Ci.

In case of a discrete-valued attribute, the subset that gives the minimum gini index for that chosen is selected as a splitting attribute. In the case of continuous-valued attributes, the strategy is to select each pair of adjacent values as a possible split-point and point with smaller gini index chosen as the splitting point.

CHAPTER 6
CONCLUSION AND FUTURE WORKS

CONCLUSION

Agriculture is the backbone of Indian economy. It is the cumulative activity of millions of smallholder farmers in India. The correct and timely assessment of problems on the field can improve yields and therefore incomes for the smallest of farmers. The solution proposed in this paper envisages the use of “wisdom of the crowd”, (i.e.), the creation of a crowd-sourced database which is created by the farmers. A decision tree algorithm is used to classify the data shared by various farmers. This way, the farmer can know about a wide variety of information such as possible diseases, and timely action to be taken to avoid them, the use of fertilizers and pesticides, as well as the expected crop yield. The solution proposed reduces the risks of loss for farmers, by providing information from the previous experiences of farmers, and hence increases their income.

FUTURE ENHANCEMENT

In the future, the proposed system can be extended to accept inputs in the form of speech instead of textual inputs. This would make it easy for farmers with less knowledge of technology to also obtain the benefits provided by the system. Another enhancement to the system could be that instead of entering the crop variety manually, the farmer could upload a picture of the crop and the system could automatically recognize the crop and provide the information necessary. This is also another improvement designed to provide the benefits of the system to famers who have less knowledge of present day technology.

APPENDIX –I

SAMPLE SOURCE CODE

ANDROID APPLICATION

LOGIN ACTIVITY

```
package com.agri.duraivel.myapplication;
import android.app.AlertDialog;
import android.app.ProgressDialog;
import android.content.Context;
import android.content.DialogInterface;
import android.content.Intent;
import android.content.SharedPreferences;
import android.net.DhcpInfo;
import android.net.wifi.WifiInfo;
import android.net.wifi.WifiManager;
import android.os.StrictMode;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.text.format.Formatter;
import android.util.Log;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.TextView;
import android.widget.Toast;

import com.android.volley.AuthFailureError;
import com.android.volley.*;
```

```
import java.io.IOException;
import java.io.UnsupportedEncodingException;
import java.math.BigInteger;
import java.net.InetAddress;
import java.net.NetworkInterface;
import java.net.SocketException;
import java.net.UnknownHostException;
import java.nio.ByteOrder;
import java.util.Enumeration;
import java.util.HashMap;
import java.util.Map;

public class LoginActivity extends AppCompatActivity {
Button b1;
String usernmae;
String passw;
EditText uname ,passwrd;
ProgressDialog pd;
TextView signup;
RequestQueue SQueue;
SharedPreferences;
AlertDialog alert;
   @Override
   protected void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);
      setContentView(R.layout.activity_login);
      signup=(TextView)findViewById(R.id.signup);
      signup.setOnClickListener(new View.OnClickListener() {
```

```
    @Override
        public void onClick(View v) {
        Intent i = new Intent(LoginActivity.this,SignupActivity.class);
        startActivity(i);
    }
});
        if (android.os.Build.VERSION.SDK_INT > 9)
        {
            StrictMode.ThreadPolicy policy = new
StrictMode.ThreadPolicy.Builder().permitAll().build();
            StrictMode.setThreadPolicy(policy);
        }
        SQueue = Volley.newRequestQueue(this);
        sharedPreferences = getSharedPreferences("sp",
Context.MODE_MULTI_PROCESS);
        b1=(Button)findViewById(R.id.bt);
        unma=findViewById(R.id.e1);
        pd=new ProgressDialog(LoginActivity.this);
        passwrd=findViewById(R.id.e2);
        b1.setOnClickListener(new View.OnClickListener() {

    public void login(final String username, final String passwd) throws
UnknownHostException
    {
        String url = "192.168.43.169";


Toast.makeText(getApplicationContext(),url,Toast.LENGTH_LONG).show();
```

```
StringRequest request = new StringRequest(Request.Method.POST,
"http://192.168.43.169/Login.php", new Response.Listener<String>() {
    @Override
    public void onResponse(String response) {
        pd.dismiss();
        Intent i = new Intent(LoginActivity.this, GIS.class);
        Bundle extras = new Bundle();
        // extras.putString("mobil", phonenum);
        i.putExtras(extras);
        startActivity(i);
        finishAffinity();
        SharedPreferences.Editor editor = sharedPreferences.edit();
        editor.putString("username",usernmae);
        editor.putString("password",passw);
        editor.putString("flag","1");
        editor.commit();
    }
}, new Response.ErrorListener() {
    @Override
    public void onErrorResponse(VolleyError error)
    {
        String message = null;
        String body=null;
        pd.dismiss();

})
{
    @Override
```

```
        protected Map<String, String> getParams() throws AuthFailureError
        {

            Map<String,String> map = new HashMap<String, String>();
            map.put("Farmer_ID", username);
            map.put("Password", passwd);
            return map;
        }
    };
    SQueue.add(request);
    request.setRetryPolicy(new DefaultRetryPolicy(
            2000,
            DefaultRetryPolicy.DEFAULT_MAX_RETRIES,
            DefaultRetryPolicy.DEFAULT_BACKOFF_MULT));
  }


}
```

PYTHON CODE

CLASSIFCATION

```
import pandas as pd
from sklearn.preprocessing import LabelEncoder
from sklearn import tree
df = pd.read_csv("crowdsource1.csv")
df.head()
inputs = df.drop(['dummy','disease'],axis='columns')
print(inputs)
target = df['dummy']
le_district = LabelEncoder()
le_crop = LabelEncoder()
le_season = LabelEncoder()
le_periods = LabelEncoder()
inputs['district'] = le_district.fit_transform(inputs['district'])
inputs['crop'] = le_crop.fit_transform(inputs['crop'])
inputs['season'] = le_season.fit_transform(inputs['season'])
inputs['periods'] = le_periods.fit_transform(inputs['periods'])
inputs
inputs_n = inputs.drop([],axis='columns')
print(inputs_n)
target
model = tree.DecisionTreeClassifier()
model.fit(inputs_n, target)
model.score(inputs_n,target)
print(model.predict([[2,0,3,4]]))
```

```
print(model.predict([[0,1,0,1]]))
```

REST API PHP SCRIPT

LOGIN SCRIPT

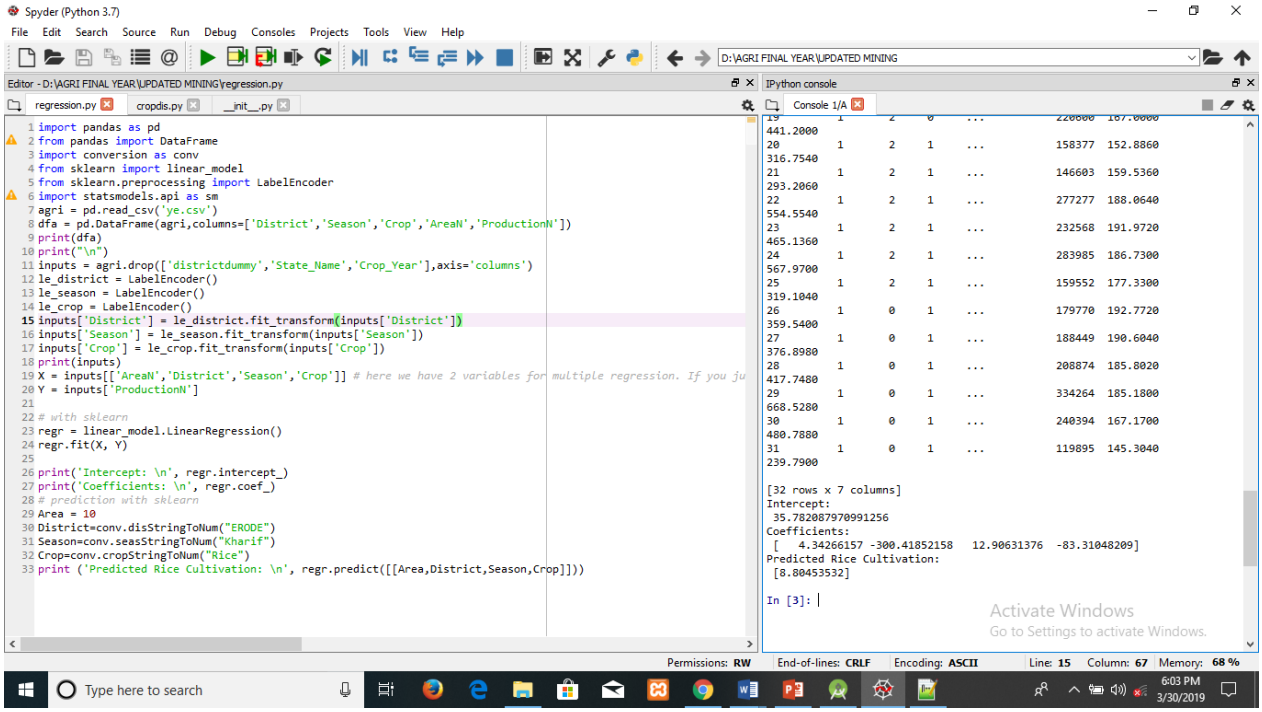
```
<?php
if($_SERVER["REQUEST_METHOD"]=="POST")
{
$servername = "localhost";
$username = "root";
$password = "";
$dbname = "sample";
$Phone_no=$_POST["Farmer_ID"];
$Password=$_POST["Password"];
login($Phone_no,$Password);
}
else
{
echo "It doesnot support GET Method";
}
function login($Phone_No,$Password){
$servername = "localhost";
$username = "root";
$password = "";
$dbname = "sample";
$conn = new mysqli($servername, $username, $password, $dbname);
```

```
if ($conn->connect_error)
{
   die("Connection failed: " . $conn->connect_error);
}
$sqlid = "SELECT Phone_No FROM users WHERE
Phone_No='$Phone_No'and password='$Password'";
$resultid = $conn->query($sqlid);
$id=0;
if ($resultid->num_rows > 0)
        {
     http_response_code(200);
     $_SESSION['active']="1";

   }
 else
 {
         http_response_code(401);
        echo "Incorrect Username or Password";


 }

$conn->close();
}
?>
```

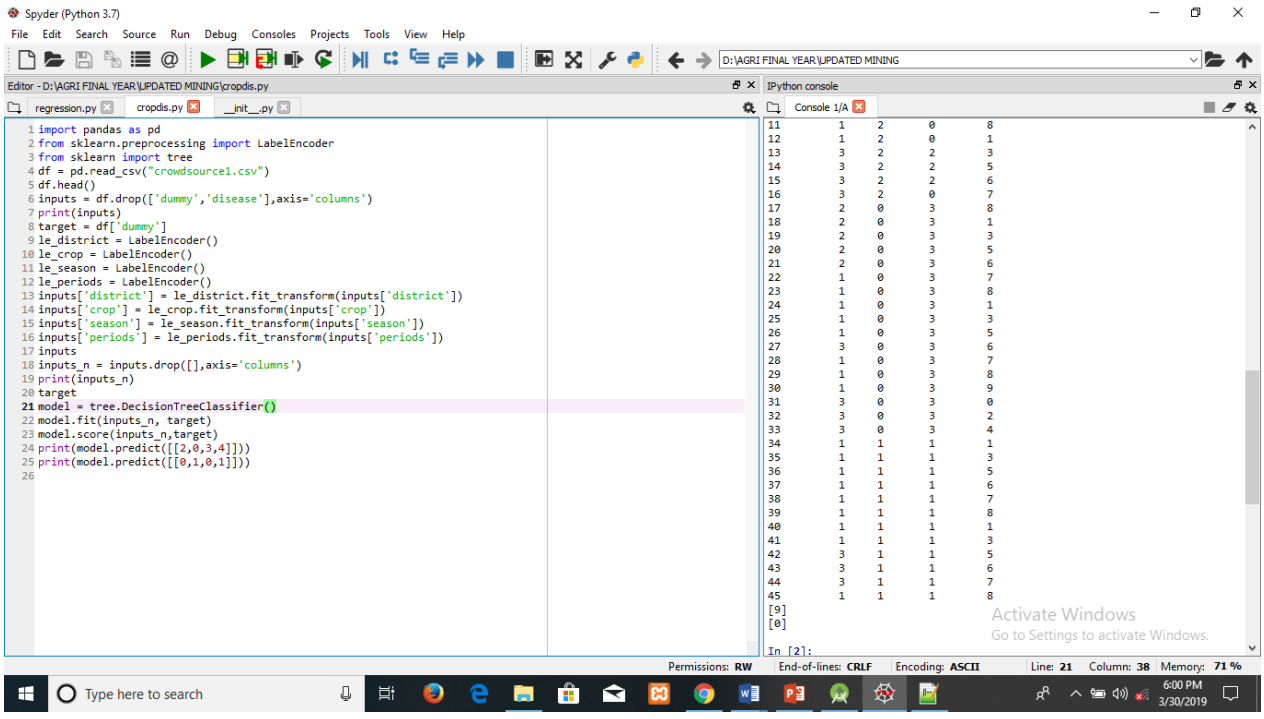
APPENDIX II

SAMPLE SCREENSHOT

CLASSIFICATION

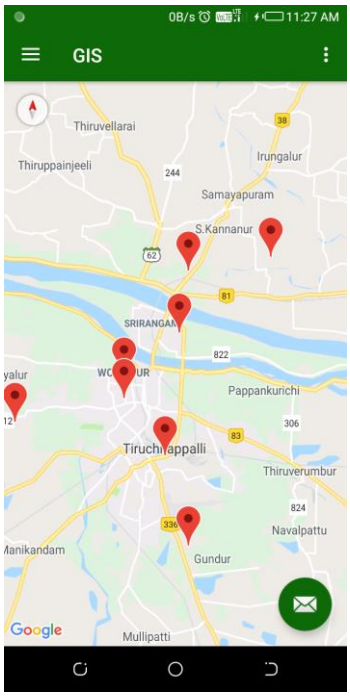


REGRESSION

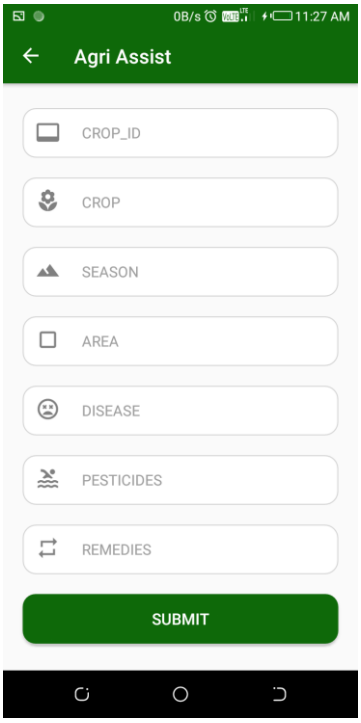


ANDROID OUTPUT

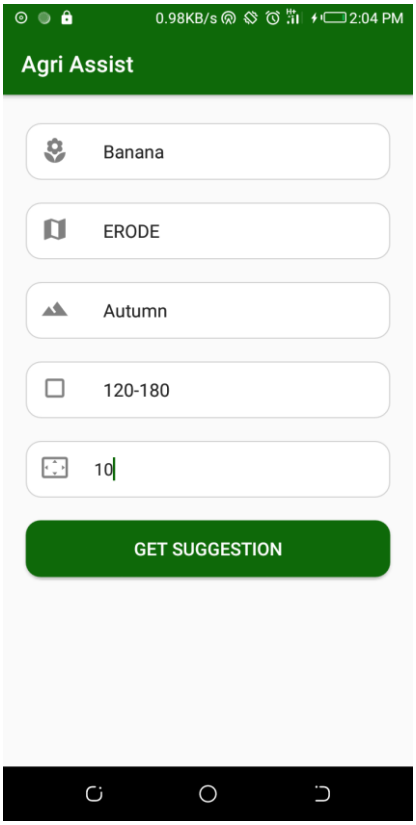
HOME SCREEN

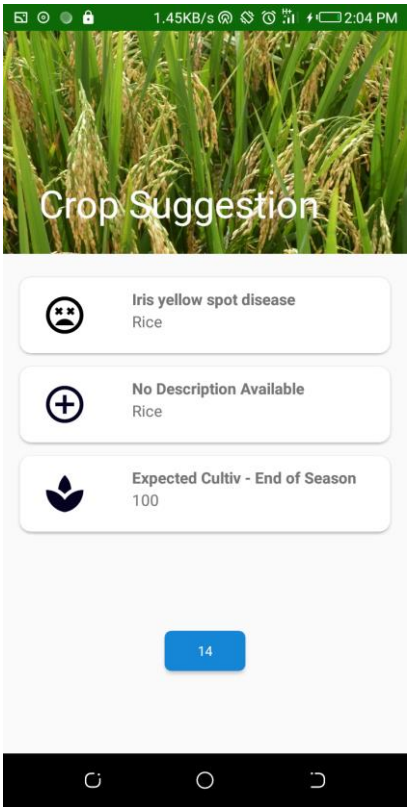


CROP SUGGESTION INPUT



FINAL RESULT





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