VISVESVARAYA TECHNOLOGICAL UNIVERSITY, JNANASANGAMA, BELAGAVI – 590018

A Project Report

on

"CROPPING PATTERNS PREDICTION SYSTEM"

Submitted in partial fulfillment for the award of degree of

Bachelor of Engineering

In

INFORMATION SCIENCE & ENGINEERING

Submitted by

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2024-2025

CERTIFICATE

This is to certify that the Major project Seminar entitled *"CROPPING PATTERNS PREDICTION SYSTEM"* is a presentation done by **Ms. Aishwarya K L (4MO21IS003), Mr. Deepak D R (4MO21IS014), Mr. Kiran U (4MO21IS025), Ms. Sinchana G (4MO21IS041)** in partial fulfillment for the award of **Bachelor of Engineering** in **INFORMATION SCIENCE & ENGINEERING** of the Visvesvaraya Technological University, Belagavi, during the year 2024 - 2025. The Major project report has been approved as it satisfies the academic requirements in respect of seminar prescribed for the Bachelor of Engineering degree.

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DECLARATION

We Deepak DR, Sinchana G, Aishwarya K L and Kiran U bearing USN: 4MO21IS014, 4MO21IS041, 4MO21IS003 and 4MO21IS025 studying in 7th semester in the Dept. of Information Science and Engineering at Mysore College Of Engineering and Management, Mysore, hereby declare that this project work entitled "Cropping Patterns Prediction System" which is being submitted by us in the partial fulfilment for the award of the degree of Bachelor of Engineering in Information Science & Engineering, from Visvesvaraya Technological University, Belagavi is an authentic record of us carried out during the academic year 2024-2025, under the guidance of Dr. Jayaram CV, Professor Department of CSE, Mysore College of Engineering and Management, Mysuru.

We further undertake that the matter embodied in the report has not been submitted previously for the award of any degree or diploma by us to any other university or institution.

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ABSTRACT

The cultivation of crops on land periodically throughout the year is a cropping pattern. This proposed work aims at prediction of major cropping patterns through only the cultivation-related factors like land, soil, and climate data using Machine Learning techniques. On a suitable land, farmers can grow many types of crops and there is a need of knowing the right cropping patterns to attain best profits. In the current agriculture sector there are the changes of reduction in crop yield, crop damages if farmer choose the random method of cropping. This is because proper crop yield depends on many agriculture parameters like temperature, rainfall, soli type, season etc... Machine learning unsupervised learning algorithms applied to process the agriculture data and to predict the cropping patterns. Algorithms like Apriori algorithm, Eclat algorithm or SFIT algorithms used. The primary objective of this project work is to identify the best algorithm for predicting cropping pattern. Very less existing works on this pattern prediction, all existing works uses ready libraries for prediction and only model developed. Existing works uses static datasets for prediction. Existing works cannot be applied in real time. So in our proposed system we collect datasets manually and we build an automation for cropping pattern prediction useful for farmers and agriculture departments. System developed using tools such as Visual Studio front end tool and SQL Server as back end tool and we use more compatible and real time application supportive programming language C#

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CHAPTER1

INTRODUCTION

Cropping pattern refers to the proportion of land under cultivation of different crops at different points of time. This indicates the time and arrangement of crops in a particular land area. India is a country where agriculture and agriculture related industries are the major source of living for the people. Agriculture is a major source of economy of the country. It is also one of the country which suffer from major natural calamities like drought or flood which damages the crop. This leads to huge financial loss for the farmers thus leading to the suicide. Predicting the suitable crops to cultivate and suggesting suitable cropping patterns to improvise crop yield well in advance prior to its harvest can help the farmers and Government organizations to make appropriate planning like storing, selling, fixing minimum support price, importing/exporting etc. Predicting a cropping patterns well in advance requires a systematic study of huge data coming from various variables like soil quality ,pH ,EC,N,P,K etc. As Prediction of cropping patterns deals with large set of database thus making this prediction system a perfect candidate for application of data science. Through data science we extract the knowledge from the huge size of data. This system presents the study about the various machine learning techniques used for predicting the cropping patterns. The success of any cropping patterns prediction system heavily relies on how accurately the features have been extracted and how unsupervised learning algorithms have been employed.
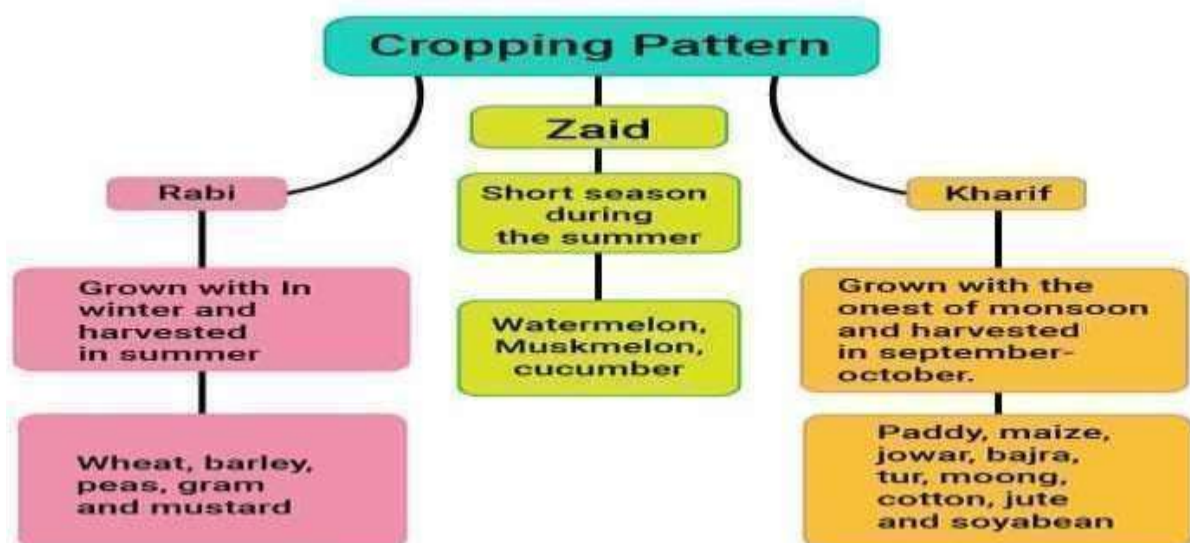

Fig 1: System Diagram

Machine learning algorithms applied to analyze data and to predict cropping patterns in advance for the good profits. Data-sets collected from agriculture departments. System developed as real time application which is useful for agriculture departments and farmers. We use suitable technology to work with real time application, that is "*visual studio*" as front end technology and "*SQL server*" as back end technology. These technologies are preferred because it supports more suitable libraries, tools and concepts required to work with real time application compared to other technologies. Proposed system helps farmers to cultivate right type of crops in right time and also helps farmers to increase crop yield and crop quality. Major population in India will benefit from this application.

1.1 Existing System

In real time it is very important to know the cropping patterns for the farmers to earn good profits. Current system is manual system where based on the previous crop cultivations and experience farmers will decide the crop types to grow. Sometimes farmers may get good crop yield and profits but sometimes crop selection may lead to poor crop yield and loss to the farmers. Many research papers worked on this topic where they mainly concentrated on crop prediction using machine learning but not cropping patterns prediction which proposed system does. All existing works are just models but not real time implementation. We require a system that can automatically predicts the cropping patters and helps farmers to know the right crop types to grow to get better yield and profits.

1.2 Motivation

It is very important to identify how agricultural factors effects crop growth. It is crucial for the farmers to know what all different types of crops can be cultivated in his/her land so as to get good crop quality and yield. As current system is the manual system which needs more time, experience and proper judgements which may lead to less crop yield and loss to farmers. There are important relationship between different types of crops so as to get better crop yields. As we do not have the proper system to find the cropping patters, we require an automation for cropping patterns prediction to help farmers to grow better crops types for better yield and profits.

1.3 Problem Statement

It is crucial for the farmers to know what all different types of crops can be cultivated in his/her land so as to get good crop quality and yield. As current system is the manual system which needs more time, experience and proper judgements which may lead to less crop yield and loss to farmers. There are important relationship between different types of crops so as to get better crop yields. As we do not have the proper system to find the cropping patters, we require a automation for cropping patterns prediction to help farmers to grow better crops types for better yield and profits.

1.4 Objective of Project

The specific objectives of the project include:

- System is an automation for cropping patterns prediction to know right crops to grow in the available land.
- System will predict the priority of crops to grow in order to get better crop yields.
- System helps the farmers in deciding better crops for cultivation.
- System is a real time application meant for agriculture departments and farmers.
- System is a GUI based browser based application where users of the application can access using browsers such as chrome, Firefox, Opera, Edge etc...
- System uses the datasets collected from agriculture departments.
- System uses all crop types such as Kharif, Zaid and Rabi.
- System uses efficient machine learning algorithms such as apriori algorithm, FP algorithm or Eclat algorithm for cropping patterns prediction.
- algorithms will be used for processing datasets and results will be compared to identify better algorithm.
- System developed using Full stack development technologies such as Visual Studio, SQL Server, HTML, CSS, JS, and JQuery.

1.5 Proposed System

- The major objective of the proposed system is to build a real time agriculture software with dynamic machine learning models to analyze the agriculture related data so as to predict cropping patterns in advance.

- To preprocess the training datasets using efficient preprocessing methods such as binning method or chi square method so as to remove the unwanted data and fetches the required to build machine learning models.

- To build machine learning models to process the training datasets which are downloaded from kaggle.com, githib.com and other online sources or manually from agriculture departments and to predict cropping patterns. Machine learning models build using Eclat algorithm or naïve bayes algorithm.

- To build efficient ML models to work with dynamic datasets in real time.

- To program confusion matrix method to evaluate the machine learning models and accuracy of the algorithm will be calculated.

- Comparative analysis of ML algorithms and finding better algorithm for cropping patterns prediction.

1.6 Scope of Study

- System is a real world application software accessed by farmers and agriculture departments.
- System is a browser based application accessed using real time browsers.
- System requires efficient 4G or 5G internet connection.
- System uses Microsoft technologies to develop application software for cropping patterns prediction.
- System can be accessed 24/7 worldwide in real time.

CHAPTER 2

LITERATURE SURVEY

2.1 Survey Papers

Serial No.	Title	Author	Year of publication	Method Used	Result	Remarks
1.	Data Mining Techniques and Applications to Agricultural Yield Data.	D Ramesh, B Vishnu Vardhan.	2013	k nearest neighbor, k means algorithm.	In this process, given the rainfall in a specific year the system is in a position to predict the average yield production by considering the cluster in which the estimated rainfall belongs to.	The K-Means algorithm is able to partition the samples in clusters, but no considerations are made on the compounds that are responsible for this partition. Bi-clustering can provide this kind of information.

2.	Analysis of Soil Behaviour and Prediction of Crop Yield using Data Mining Approach.	Monali Paul, Santosh K. Vishwakar-ma, Ashok Verma.	2015	K-Nearest Neighbor (KNN) and Naive Bayes (NB).	By the results we can see that the category having maximum confidenc e value is predicted as the category of that particular soil.	This study can help the soil analysts and farmers to decide sowing in which land may result in better crop production.
3.	Brief Survey of data mining Techniques Applied to applications of Agriculture.	Ami Mistry, Vinita Shah	2016	Classificati on technique: 1. Linear Regressio n 2. K - nearest neighbour. 3. Regressi o n Tree 4. Support Vector Machine. Clustering Technique : 1.K-means clustering. 2. Self organis e d maps. 3. Densit y based clustering . 4. Weigh t based clustering .	The results indicate that sunshine hours and daily temperatu r e range play critical roles in rice yield variabilit y in the current study area.	Farmer could plant different crops in different districts based on simple predictions made by this research and if that does take into effect, each and every farmer would get a chance at increasing their profits and increasing the country's overall produce. This will enable to have a

						better predictive model with more accurate results.
4.	A Study on Various Data Mining Techniques for Crop Yield Prediction.	Yogesh Gandge, Sandhya	2017	Classificati on Algorithm .	The output is the crop yield prediction per acre with some recomme n dation.	It is observed that the algorithm which is used by most of the authors does not uses a unified approach where in all the factors affecting the crop yield can be utilized simultaneo usly for predicting the crop yield.

5.	Agricultural Production Output Prediction Using Supervised Machine Learning Techniques.	Md. Tahmid Shakoor, Karishma Rahman, Sumaiya Nasrin Rayta, Amitabha Chakrabarty.	2017	k-Nearest Neighbor, Decision Tree algorithm, ID3(Iterative Dichotomis) algorithm.	The result shows that Decision Tree Learning-ID3 algorithm gives a less value for percentage error than the KNN algorithm without omitting the outliers of the dataset.	Though the research is limited to some fixed dataset, the future ahead promises addition of more data that can be analysed with more machine learning techniques to generate crop predictions with better precision.
6.	Rice Yield Prediction Model Using Data Mining.	Umid Kumar Dey, Abdullah Hasan Masud, Mohammed Nazim Uddin	2017	k means algorithm, Multiple Linear Regression, Algorithm, SVM Regression, Modified Nonlinear regression.	It is observed that it does an admirable job by predicting the yield with SVM regression providing best values.	It could be concluded that using modified Nonlinear Regression equations works better than the other three predefined models. It also proves that the MNR equation is the best fit.
7.	Effect of Temperature and Rainfall on Paddy Yield using Data Mining	Kuljit Kaur, Kanwalpreet Singh Attwal	2017	Apriori Algorithm.	The result shows that it predicts the growth of paddy yield. It depends on various parameters	With increase in Rainfall the paddy yield also increased. During Reproductive phase

					such as Rainfall and Temperature.	the rainfall and temperature did not influence. During maturation phase, paddy yield was better expected at lower temp. and worse at high temp. Paddy yield was found to be high at low rainfall and low during high rainfall.

2.2 Proposed System Enhancements

Difference between Existing Works and Proposed Work

- Many existing research works presented an idea of recommending suitable crops for the farmers in the agriculture sector, but no implementation is done.

- All existing works used supervised learning algorithms for crop recommendations, but in our project we use unsupervised learning for cropping patterns prediction.

- In many existing works implementation is done but Algorithms used were not programmed, they have used ready libraries for algorithms and tools used for algorithms. But in the proposed system we program the algorithm means we write our own logic for the algorithm and results will be tested.

- Many research works uses less amount of training data-sets, in the proposed system we use huge data- sets for processing.

- All existing works uses PYTHON or R Language or Ready Data science tools for prediction and which works for static datasets, but in the proposed system we implement the concept for dynamic datasets (real time application).

- All existing works are just model development, can't be used in real time. Here we build this concept as real time application using front end technology as "*visual Studio*" and back end technology as "*SQL Server*" and C# as programming language.

- Proposed system is a real world application with model using Microsoft technologies useful for agriculture sector and farmers.

CHAPTER 3

SYSTEM REQUIREMENT SPECIFICATION

3.1 Tools & Technologies

Microsoft has a time-honored reputation for creating innovative technologies and wrapping them in buzzwords that confuse everyone. Microsoft now has a whole new technology called .NET. The .NET Framework is not a single application—it's actually a collection of technologies bundled into one marketing term.

The .NET Framework includes languages such as C# and VB .NET, an engine for hosting programmable web pages and web services (ASP.NET), a model for interacting with databases (ADO.NET), and a class library stocked with tools for everything from writing files to reading XML.

DOT NET framework is designed to deploy application across the enterprise and to scale to nearly size needed. Among the modern programming environments, .NET framework plays a pivotal role. In the field of development, it can apply in to multiple purposes very easily. Like any other product of Microsoft, .NET framework is also very easy to use. We can easily develop the application and enhance it using .NET technologies.
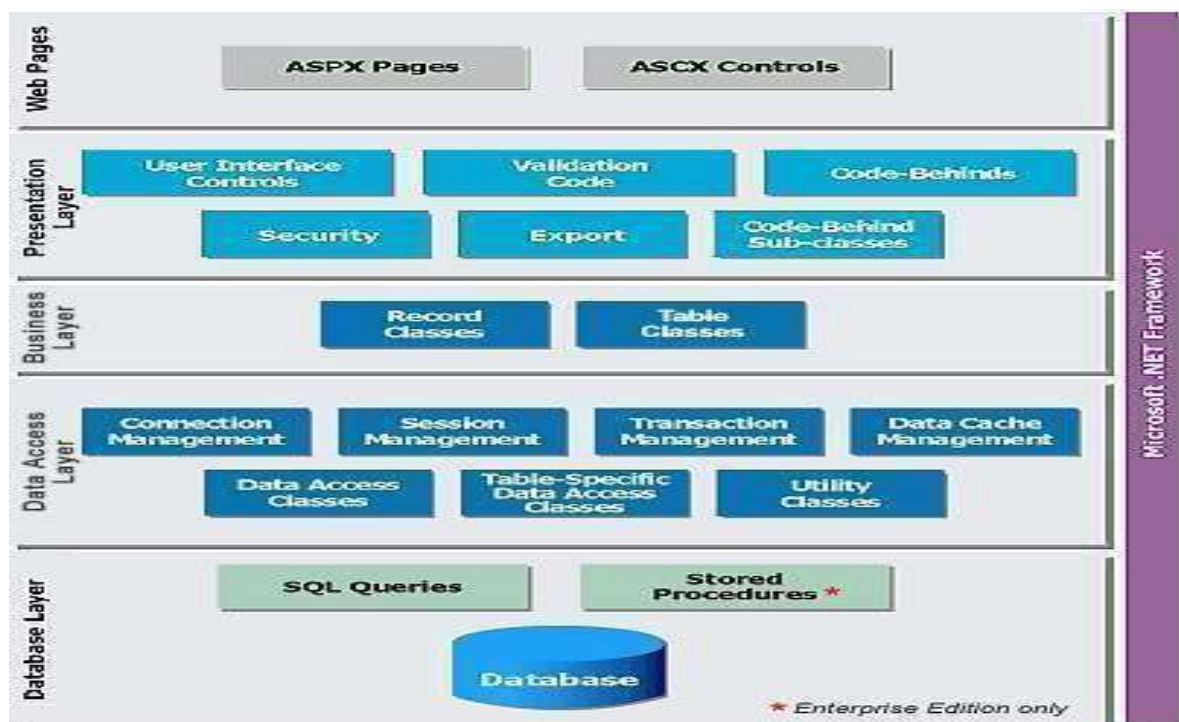

Fig 3.1: System Framework Diagram

Introduction to C#

C#, (pronounced as C Sharp) the new language introduced in the .NET Framework, is derived from C++. However, C# is a modern, objected-oriented type-safe language C# represents the next step in the ongoing revolution of programming languages.

It is created by Microsoft to support development of its. NET Framework, C# leverages time-tested features with cutting-edge innovations. It provides a highly usable, efficient way to write programs for the modern computing environment, which includes windows, the Internets, components, and so on. In the process C# redefined the programming landscape.

C# is a modern, object oriented language that enables programmers to quickly build a wide range of applications for the new Microsoft .NET platform, which provides tools and services that fully exploit both computing and communications. The C# language is an evolution of C and C++.

Platform independence

One of the most compelling reasons to move to C# is its platform independence. C# runs on major hardware and software platforms.

Object Orientation

C# is a true object oriented language. It does not merely provide the capability to implement object oriented principles, it enforces this principles.

Security

C# considers security as part of its language. C# language compiler, interpreter and run time environment were each developed in security in mind.

Reliability

Security and Reliability go in hand in hand. Security measures cannot be implemented with any degree of assurance without a reliable framework for programming execution. . NET framework provides multilevel of reliability measures, beginning with C# itself.

Simplicity

The C# was designed to be a simple language to learn, building on the syntax and many features of C++. However in order to promote security, reliability and simplicity C# has left out those elements of C and C++ that contribute to errors and program complexity.

Language features

The C# provides many language features tat make it preferable to C or C++ for modern software development. On the top of this list is C# intrinsic support for multithreading which is lacking in both C and C++.

3.1.1 Introduction to ASP.NET

The original definition of ASP.NET, right at the start of the chapter, portrayed ASP.Net as a powerful and flexible technology for creating dynamic web pages, and this holds true. However as you know it isn't the only way to develop WebPages, so lets refine our definition a little so it reads as follows.

ASP.NET is a powerful and flexible server side technology for creating dynamic web pages. Secondly, ASP.Net is one of a set of technology that comprises the dot net framework. For now, you can now think of it as a giant tool kit for creating all sort of applications and in particular, for creating applications on the web.

Features

ASP.NET combines unprecedented developer productivity with performance reliability and development.

1. Developer Productivity:

- Easy programming

- Flexible language option

- Great tool

- Rich class framework

2. Improved Performance and scalability

- Compiled execution,

- Rich output caching

3. Enhanced Reliability:

- Avoids memory leak,

- Avoids deadlock

- Crash protection.

4. Easy Deployment

- Dynamic update of application.

3.1.2   Advantages of Using ASP.NET

1. NET compatible

.NET compatibility feature of ASP.NET provides application to use the features provided by .NET. Some of these features are multi-language support, compiled code, automatic memory management, and .NET base class library. All ASP.NET code is compiled, rather than interpreted, which allow early binding, strong typing and Just-in-time (JIT) compilation to native code, automatic memory management, and caching.

The .NET base class library (BCL) provides hundreds of useful classes. This library can be accessed form any.NET-supported language.

2. Powerful database-driven functionality

ASP.Net allows programmers to develop web applications that interface with a database. The advantages of ASP.Net are that it is object-oriented and has many programming tools that allow for faster development and more functionality.

3. Faster Web applications

Two aspects of ASP.Net make it fast –compiled code and caching. In the past was interpreted into "machine language" before the user visits the site. Caching is the storage of information that will be reused in a memory location for faster access in the future.

4. Multiple language support

Programmers can actually write their code in more than 25 .Net languages (Including VB.Net, C# and JScript.net). This allows the programmers to develop the site in the language they know the best.

Internet Information Server [IIS]

IIS server includes a broad range of administrative features for managing Web sites and your Web server. With programmatic features like ASP, ASP.NET, you can create and deploy scalable, flexible Web applications.

ADO.NET

Accessing a database in an Internet application is a completely different scenario than accessing a database in a typical desktop or client/server program.

ADO.NET is the Microsoft's latest data access model. ADO.NET allows you to interact with relational databases and other data sources. Quite simply, ADO.NET is the technology that ASP.NET applications use to communicate with a database, whether they need to add a new customer record, log a purchase, or display a product catalog.

The .NET framework contains several Name spaces with dozen of classes devoted to database access. Microsoft has created separate name spaces that are optimized for working with different data providers.

- System.Data.SqlClient – contains classes for connecting to Microsoft SQL SERVER Version 7.0 or Higher.

- System.Data.Oledb – contains classes for connecting to a data source that has an Oledb Provider.

- Sytem.Data.ODBC – contains classes for connecting to a data source that has ODBC driver.

- System.Data.OracleClient – contains classes for connecting to an Oracle Data Base Server.

3.1.3   Microsoft SQL Server

SQL Server Express is a free, easy-to-use, simple-to-manage database without many of the features of the full-blown SQL Server such as Notification Services, Analysis Services, Integrations Services, and Reporting Services, to name only a few. SQL Server Express can function as the client database as well as a basic server database.

SQL Server Express is a good option when all that's needed is a stripped-down version of SQL Server, typically among low-end server users such as small businesses, non-professional developers building web applications, and hobbyists building client applications.

MSDE first appeared with Office 2000. An updated version, known commonly as SQL Server Desktop Engine, came with Office XP. The latter was more popular than the original version, which went largely unnoticed.

Both early versions were limited (Microsoft likes to call it optimized) to five concurrent processes.

That really means you couldn't use MSDE or Desktop with more than a few users. SQL Server Express fills a specific niche in the database world:

- This scaled-down version of SQL Server is perfect for the small business with limited funds and personnel.

- Small businesses with few users will find SQL Server Express a more powerful alternative than the average desktop database.

- SQL Server Express is a great training tool for the full-blown version. Trainers and students don't need access to the real thing to learn the basics.

- This version is ideal for building web applications. Combined with Visual Web Developer Express and Visual Basic Express, it forms a complete web application solution for individuals and small enterprises.

3.2 Functional Requirements

Functional Requirement defines a function of a software system and how the system must behave when presented with specific inputs or conditions. These may include calculations, data manipulation and processing and other specific functionality. In this system following are the functional requirements:-

- System is a generic application used by the agriculture departments of different regions.

- System used by administrator, staffs (agriculture departments) and farmers.

- Administrator of the system creates staffs and unique Id and password for each staff.

- System is browser based application which predicts cropping patterns based on the soil test results and temperature , rainfall.

- System makes use of data science technique for cropping patterns prediction.

- System makes use of previous datasets for the cropping patterns prediction.

- System makes use of "*navie bayes algorithm*" for cropping patterns prediction.

- System generates accurate results based on the size of the datasets.

3.3 Non-Functional Requirements

Non-functional requirements are the requirements which are not directly concerned with the specific function delivered by the system. They specify the criteria that can be used to judge the operation of a system rather than specific behaviors. They may relate to emergent system properties such as reliability, response time and store occupancy. Non-functional requirements arise through the user needs, because of budget constraints, organizational policies, the need for interoperability with other software and hardware systems or because of external factors such as:-

- **Usability-** our application will be useful to government sector where system is an automation for crop patterns prediction using the previous agriculture datasets, here we make use of real time data for prediction. System is implemented for a government sector and which helps farmers. As it's a browser based application it can be accessed worldwide.

- **Reliable**-our application provides the services according the users satisfaction and interest, and designed as per user's requirements and more user friendly, so the application is more reliable.

- **Maintainability**-as we update the software regularly it will be easy to maintain it. Application is designed in such a way that future modifications and enhancements can be done easily.

- **Efficiency** - The application provides the efficient results as it uses data science technique for crop patterns prediction.

- **Re-usability** – The system is a web based application, once the user creates an account; user can access the system multiple times.

- **Quality of Service** - System provides the services as per the user requirements. System is more user friendly. Once user registered into the system, user can access the system multiple times. As we use data science techniques, system generates more accurate results.

3.3.1 Product Requirements

- **Portability:** Since the system is designed to run using browser, the system is portable.

- **Correctness:** It follows a well-defined set of procedures and rules to compute and also rigorous testing is performed to confirm the correctness of the data.

- **Ease of Use:** The front end is designed in such a way that it provides an interface which allows the user to interact in an easy manner.

- **Modularity:** The complete product is broken up into many modules and well-defined interfaces are developed to explore the benefit of flexibility of the product.

- **Robustness:** This software is being developed in such a way that the overall performance is optimized and the user can expect the results within a limited time with utmost relevancy and correctness .whereas evolution quality involves testability, maintainability, extensibility or scalability.

3.3.1.1 Organizational Requirements Process Standards:

IEEE standards are used to develop the application which is the standard used by the most of the standard software developers all over the world. This stage is the first step in moving from problem to the solution domain. In other words, starting with what is needed design takes us to work how to satisfy the needs

3.3.1.2 User Requirements

The user requirements document (URD) or user requirements specification is a document usually used to software engineering that specifies the requirements user expects from software to be constructed in software project. Once the required information is completely gathered it is documented in a URD, which is meant to spell out exactly

What the software must do and becomes part of the contractual agreement. A customer cannot demand feature not in the URD, whilst the developer cannot claim the product is ready if it does not meet an item of the URD. The URD can be used as a guide to planning cost, timetables, milestones, testing etc. The explicit nature of the URD allows customers to show it to various stakeholders to make sure all necessary

Features are described. Formulating a URD requires negotiation to determine what is technically and economically feasible. Preparing a URD is one of those skills that lies between a science and economically feasible. Preparing a URD is one of those skills that lies between a science and an art, requiring both software technical skills and interpersonal skills.

Administrator

Administrator is a person who maintains the entire application. System contains only one administrator.

Location In-charger/Staff

Staff is an actor who receives the services from the application. Staff is a person who is incharge of a particular location. Staffs created by the administrator.

Visitors/Farmers

Visitors are the users who can access the basic agriculture information.

3.4 Basic Operational Requirements

Operational requirement is the process of linking strategic goals and objectives to tactic goals and objectives. It describes milestones, conditions for success and explains how, or what portion of, a strategic plan will be put into operation during a given operational period, in the case of, a strategic plan will be put into operation during a given operational period, in the case of commercial application, a fiscal year or another given budgetary term

Modules of the Project

Administrator has the following modules;

1. **Login Module**

In this module administrator gets login to the application by specifying the credentials such as admin id and password.

2. **Create Location In-charger/Staff**

In this module administrator adds up the staffs/location in-charger for the future use of the application. Staffs basically created for location.

3. **Set Id and Password for Staff**

   Administrator sets a unique staff Id and password for each staff, using these credentials staff can get login.

4. **Update Password**

   Here administrator of the system can update the password for future use.

Location In-charger/Staff has the following modules;

1. **Login Module**

   In this module staff gets login to the application by specifying the credentials such as admin id and password.

2. **Manage Datasets based on Location [upload humidity, region, area, rainfall, temp, rice yield and soil features data]**

   In this module location in-charger manages the existing datasets for the agriculture Crop damage prediction. Here staff adds the existing datasets [sample soil attributes, humidity, region, area and temp, rainfall and crop yield details] based on daily, monthly and yearly.

3. **Agriculture Crop Prediction Module (Core Module - ML)**

   In this module the system predicts agriculture crop based on the previous soil data, here we make use of data science technique "*classification rules*" for the prediction based on the constraints humidity, region, area and sample soil attributes and temp and rainfall.

4. **Result Analysis -** algorithms results are analyzed to find the accuracy and efficiency.

5. **Cropping Patterns Prediction**

6. **Data Visualization**

7. **Update Password**

   Here staff can update the password for future use.

Visitor/Farmers has the following modules;

1. Home

2. About us

3. Contact us

4. Basic Agriculture Info

3.5 Hardware Requirements

- **Processor** – Intel Oct core, I3 or I5 or I7 processors
- **Speed** – 2.4 GHz onwards
- **Hard Disk** – 256 GB onwards
- **RAM** – 4 GB onwards
- Efficient Mouse and Keyboard required.

3.6 Software Requirements

- **Development Framework** – Microsoft Framework
- **Front End Tool** – Visual Studio
- **Front End Technologies** – HTML, CSS, JS, BOOTSTRAP
- **Back End Tool** – SQL Server
- **Programming** – C++ or C# or C Sharp
- **Browsers** – Internet Explorer or Google Chrome, or Opera or Firefox.
- **Internet** – 4G or 5G efficient internet required

CHAPTER 4

METHODOLOGY

4.1 Introduction

Design is a meaningful engineering representation of something that is to be built. It is the most crucial phase in the developments of a system. Software design is a process through which the requirements are translated into a representation of software. Design is a place where design is fostered in software Engineering. Based on the user requirements and the detailed analysis of the existing system, the new system must be designed. This is the phase of system designing. Design is the perfect way to accurately translate a customer requirement in the finished software product. Design creates a representation or model, provides details about software data structure, architecture, interfaces and components that are necessary to implement a system. The logical system design arrived at as a result of systems analysis is converted into physical system design.

4.2 SystemDevelopment Methodology

System development method is a process through which a product will get completed or a product gets rid from any problem. Software development process is described as a number of phases, procedures and steps that gives the complete software. It follows series of steps which is used for product progress. The development method followed in this project is waterfall model.

4.2.1   Model Phases

The waterfall model is a sequential software development process, in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of Requirement initiation, Analysis, Design, Implementation, Testing and maintenance.

- **Requirement Analysis:** This phase is concerned about collection of requirement of the system. This process involves generating document and requirement review.

- **System Design:** Keeping the requirements in mind the system specifications are translated in to a software representation. In this phase the designer emphasizes on:-algorithm, data structure, software architecture etc.

- **Coding:** In this phase programmer starts his coding in order to give a full sketch of product. In other words system specifications are only converted in to machine readable compute code.

- **Implementation:** The implementation phase involves the actual coding or programming of the software. The output of this phase is typically the library, executables, user manuals and additional software documentation

- **Testing:** In this phase all programs (models) are integrated and tested to ensure that the complete system meets the software requirements. The testing is concerned with verification and validation.

- **Maintenance:** The maintenance phase is the longest phase in which the software is updated to fulfill the changing customer need, adapt to accommodate change in the external environment, correct errors and oversights previously undetected in the testing phase, enhance the efficiency of the software.

4.2.2 Reason for Choosing Waterfall Model As Development Method

- Clear project objectives.

- Stable project requirements.

- Progress of system is measurable.

- Strict sign-off requirements.

- Helps you to be perfect.

- Logic of software development is clearly understood.

- Production of a formal specification

- Better resource allocation.

- Improves quality. The emphasis on requirements and design before writing a single line of code ensures minimal wastage of time and effort and reduces the risk of schedule slippage.

- Less human resources required as once one phase is finished those people can start working on to the next phase.
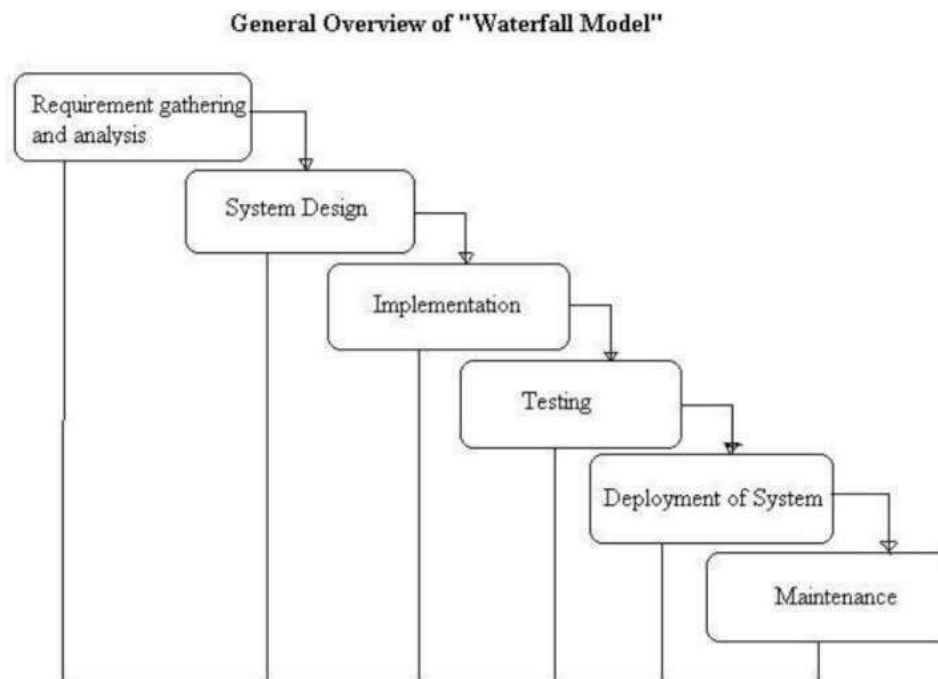
Fig 4.1: Waterfall Model

4.3 Design Using UML

Designing UML diagram specifies, how the process within the system communicates along with how the objects with in the process collaborate using both static as well as dynamic UML diagrams since in this ever- changing world of Object Oriented application development, it has been getting harder and harder to develop and manage high quality applications in reasonable amount of time. As a result of this challenge and the need for a universal object modeling language every one could use, the Unified Modeling Language (UML) is the Information industries version of blue print. It is a method for describing the systems architecture in detail. Easier to build or maintains system, and to ensure that the system will hold up to the requirement changes.

4.4 Data Flow Diagram

A data flow diagram (DFD) is graphic representation of the"flow" of data through an information system. A data flow diagram can also be used for the visualization of data processing (structured design). It is common practice for a designer to draw a context level DFD first which shows the interaction between

the system and outside entities. DFDs show the flow of data from external entities into the system, how the data moves from one process to another, as well as its logical storage.

There are only four symbols: 1. Squares representing external entities, which are sources and destinations of information entering and leaving the system. 2. Rounded rectangles representing processes, in other methodologies, may be called 'Activities', 'Actions', 'Procedures', 'Subsystems' etc. which take data as input, do processing to it, and output it. 3. Arrows representing the data flows, which can either, be electronic data or physical items. It is impossible for data to flow from data store to data store except via a process, and external entities are not allowed to access data stores directly. 4. The flat three-sided rectangle is representing data stores should both receive information for storing and provide it for further processing.

4.5 Use Case Diagram

A use case defines a goal-oriented set of interactions between external entities and the system under consideration. The external entities which interact with the system are its actors. A set of use cases describe the complete functionality of the system at a particular level of detail and it can be graphically denoted by the use case diagram.
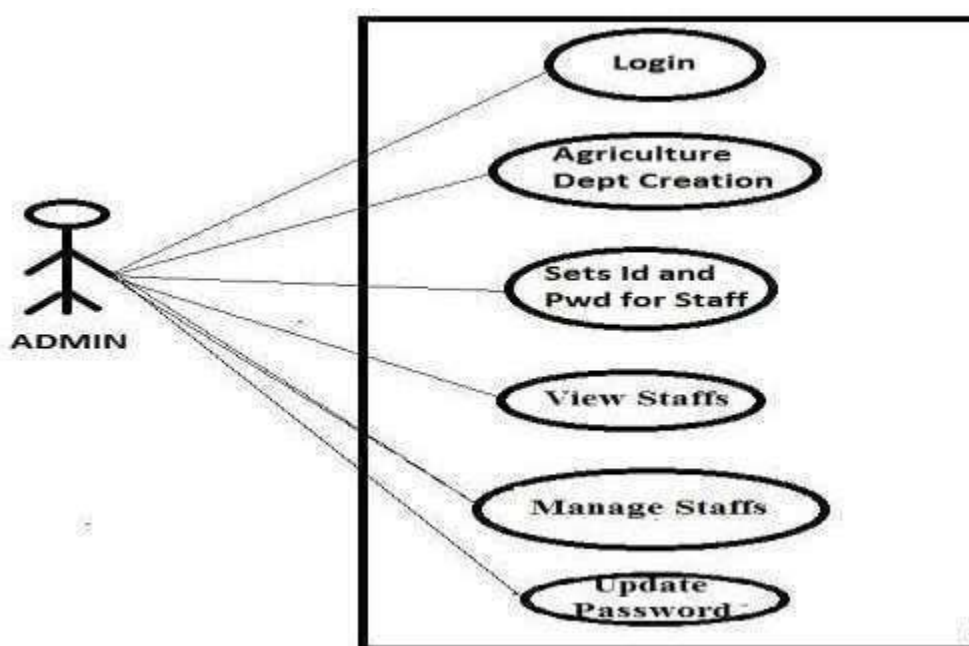
Fig 4.2: Use Case Diagram, admin
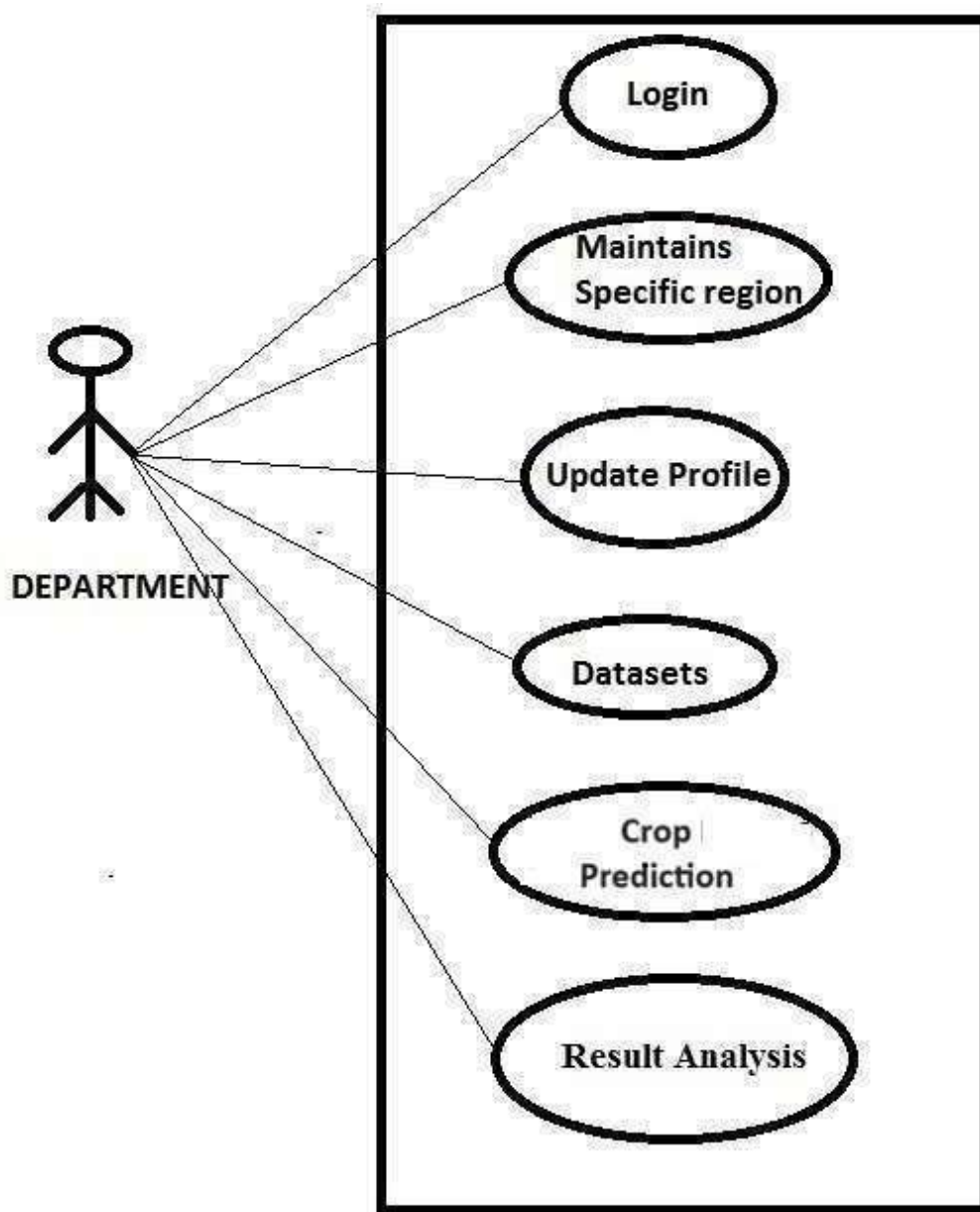
Fig 4.3: Use Case Diagram, Department/Staff

4.6 CFD Diagram

Description

   A Context diagram represents a high-level view of the overall business or system boundary of interest. A Context diagram defines the system's domain that is under investigation within an organization's environment. Within the domain, the diagram depicts the top process as a 'black box' together with its major incoming and outgoing data flows linked to participating external entities. It is a popular diagrammatic tool for process modeling and scoping systems.

Uses

A Context diagram is useful for establishing the boundary of the business or system domain (the sphere of analysis activity) under investigation. It identifies the external entities along with major data interfaces that interact with the target process – all of which the new system will need to consider. The diagram therefore can be a useful tool for helping identify the project scope and secure stakeholder agreement (sign-off) on the project scope.
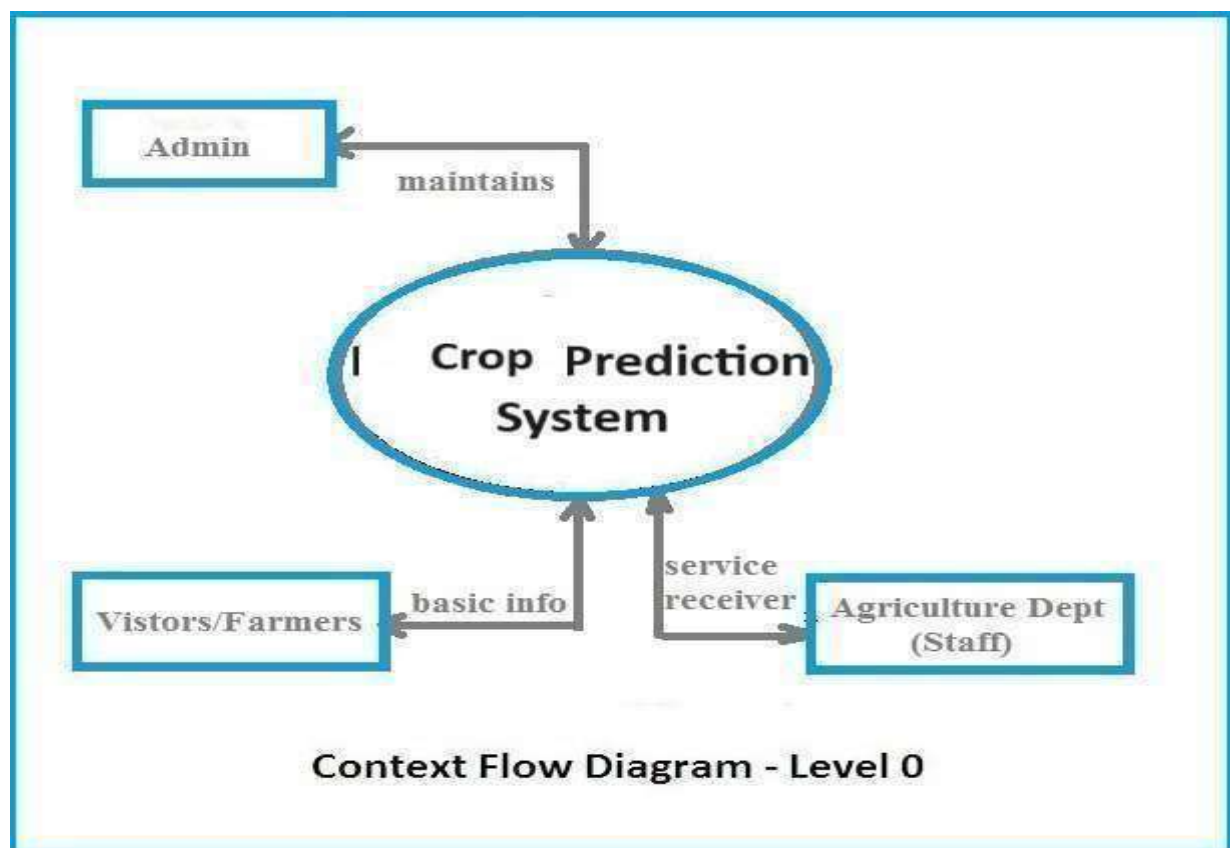
Figure 4.4: CFD Diagram

4.7 Sequence Diagram

Sequence diagram are an easy and intuitive way of describing the behavior of a system by viewing the interaction between the system and the environment. A sequence diagram shows an interaction arranged in a time sequence. A sequence diagram has two dimensions: vertical dimension represents time, the horizontal dimension represents the objects existence during the interaction. Basic elements:

- Vertical rectangle: Represent the object is active (method is being performed).

- Vertical dashed line: Represent the life of the object.

- X: represent the life end of an object. (Being destroyed from memory)

- Horizontal line with arrows: Messages from one object to another.
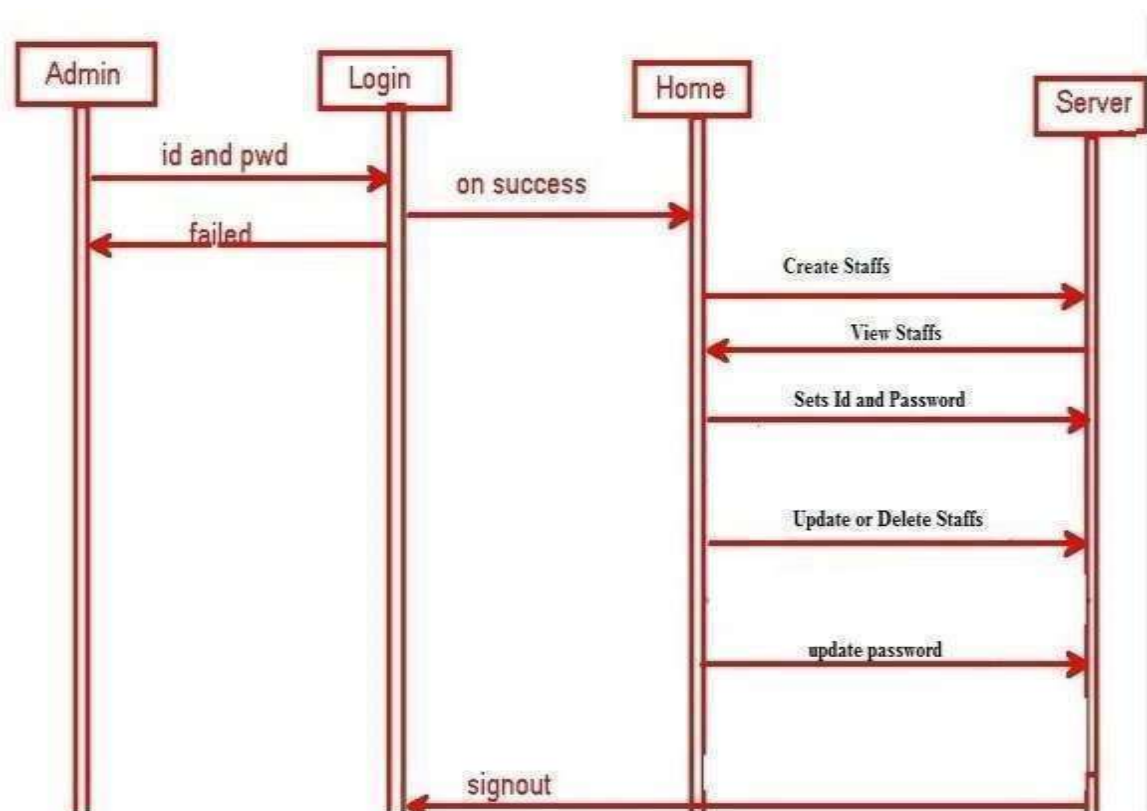
Sequence Diagram - Administrator

Figure 4.5: Sequence Diagram, Admin
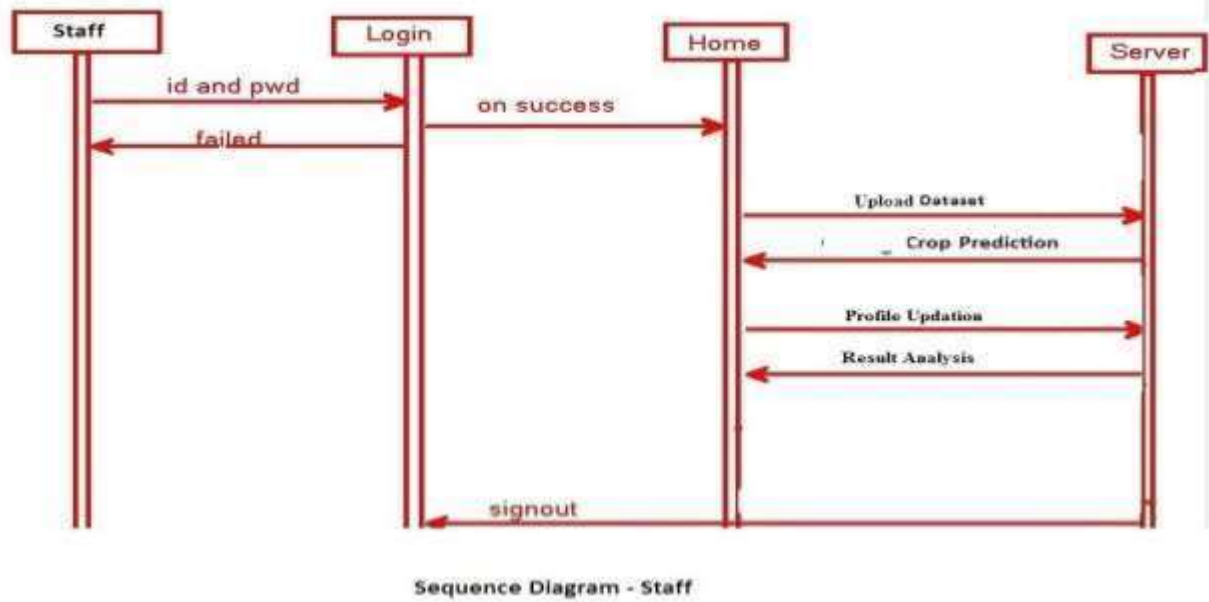
Figure 4.6: Sequence Diagram, Staff
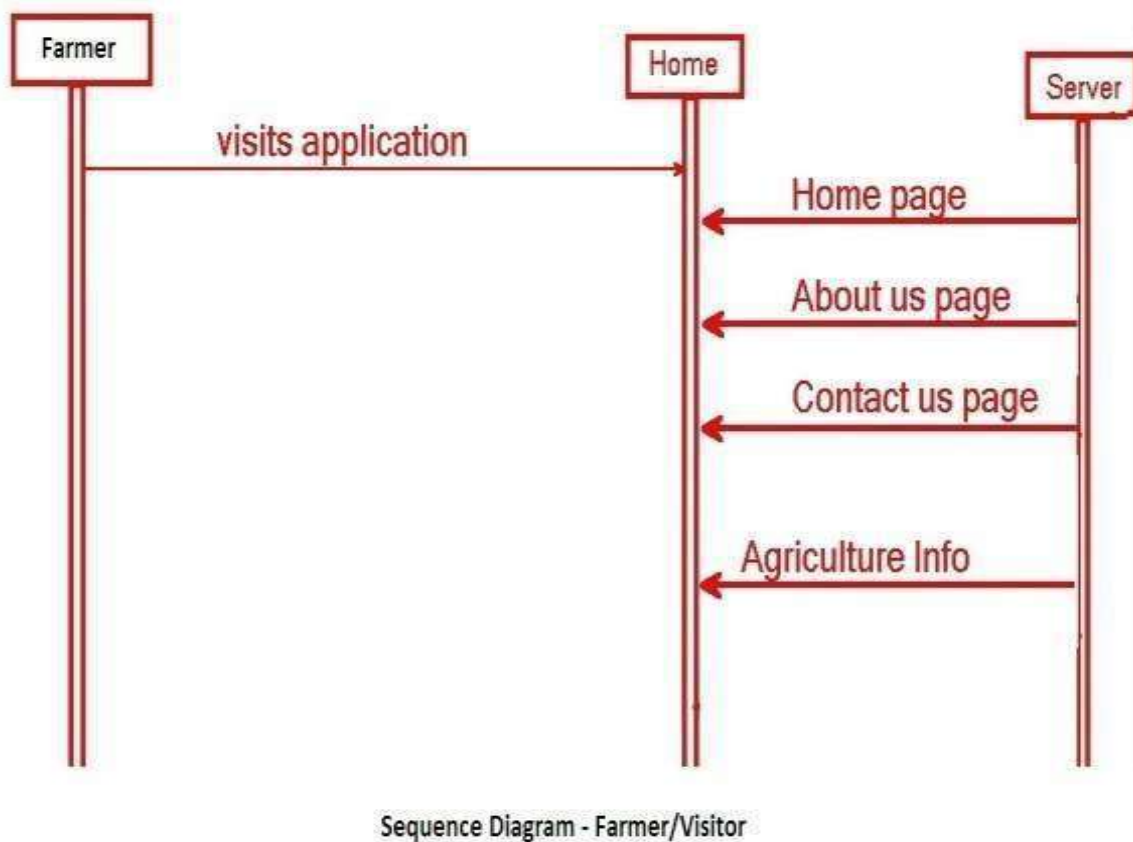
Figure 4.7: Sequence Diagram, Farmer

CHAPTER 5

IMPLEMENTATION

Introduction

This web application is implemented using object oriented programming language. Object oriented programming is an approach that provides a way of modularizing programs by creating partitioned memory area for both data and functions that can be used as templates for creating copies of such modules on demand.

5.1 Features of Object Oriented paradigm:

    i.   Emphasis is on data rather than procedure.

   ii.   Programs are divided into what are known as objects.

  iii.   Data structures are designed such that they characterize the objects.

  iv.   Methods that operate on the data of an object are tied together in the data structure.

   v.   Objects may communicate with each other through methods.

  vi.   New data and methods can be easily added whenever necessary.

 vii.   Follows bottom-up approach in program design.

viii.   Data is hidden and cannot be accessed by external functions.

This project is implemented using three tier architecture. ASP.NET is used in the presentation layer, C# classes are used in the Business logic, Table adopter is used in the data tier and MS SQL server 2005 (database) is used as the backend.

5.2 Implementation Steps:

➢ **Presentation Layer** is Asp.net (front end) which invokes the Business logic through button click or page load event or SelectedIndexChange event of the dropdownlist.

➢ **Business Logic** contains the class members and member functions. An object for Business logic class is created and object will invoke the methods.

The business logic object will call table Adopter method. Table Adopter will open the database connection. Since SQL server 2005 is used as the backend, to interact with the database SqlDataSource is used.

Connection String:

<connectionStrings>

<add name=" ASSOCIATION ConnectionString" ="Data Source= connectionString="Data Source=TORUS-21;Initial Catalog=ASSOCIATION_RULES;Integrated Security=True

providerName="System.Data.SqlClient"/>

</connectionStrings>

which is in the web.config file.

It will execute the method and returns the result to the business logic. Business Logic method will return the result to the Presentation Layer.

a) **Table Adapter:** This represents a set of data commands and a database connection that are used to fill the DataSet and update a SQL Server database.

b) **Data set:** This represents an in-memory cache of data.

This project is implemented using Data set "DL.xsd"

5.3 Algorithms Used

Science Technique -

Classification Rules

Naïve Bayes Algorithm Steps

Step 1: Scan the dataset (storage servers)

Step 2: Calculate the probability of each attribute value. [n, n_c, m, p]

Step 3: Apply the formulae

$$P(attributevalue(ai)/subjectvaluevj)=(n\_c + mp)/(n+m)$$

Where:

1. n = the number of training examples for which v = vj

    2. nc = number of examples for which v = vj and a = ai

    3. p = a priori estimate for P(aijvj)

    4. m = the equivalent sample size

Step 4: Multiply the probabilities by p

Step 5: Compare the values and classify the attribute values to one of the predefined set of class.

Sample Example

Attributes(Features) – PH, Nitrogen, Phosphorus [m=3]

Subject/Classes (Crop) – Ragi, Paddy [p=1/2=0.5]

table 5.1: Training Dataset

Soil Type	PH(X,Y,Z)	Nitrogen(A,B,C)	Phosphorus(P,Q,R)	Crop(subject)
Soil Input1	X	A	P	Ragi
Soil Input2	X	B	Q	Ragi
Soil Input3	Y	B	P	Paddy
Soil Input4	Z	A	R	Ragi
Soil Input5	Z	C	R	Paddy

New Soil Input6 Features – PH - X, Nitrogen – A, Phosphorus - R Crop– Ragi/Paddy ?

P=[n_c + (m*p)]/(n+m)

Ragi	Paddy
X P=[n_c + (m*p)]/(n+m) n=2, n_c=2,m=3,p=0.5 p=[2+(3*0.5)]/(2+3) p=0.7	X P=[n_c + (m*p)]/(n+m) n=2, n_c=0,m=3,p=0.5 p=[0+(3*0.5)]/(2+3) p=0.3
A P=[n_c + (m*p)]/(n+m) n=2, n_c=2,m=3,p=0.5 p=[2+(3*0.5)]/(2+3) p=0.7	A P=[n_c + (m*p)]/(n+m) n=2, n_c=2,m=3,p=0.5 p=[2+(3*0.5)]/(2+3) p=0.3
R P=[n_c + (m*p)]/(n+m) n=2, n_c=1,m=3,p=0.5 p=[1+(3*0.5)]/(2+3) p=0.5	R P=[n_c + (m*p)]/(n+m) n=2, n_c=1,m=3,p=0.5 p=[1+(3*0.5)]/(2+3) p=0.5

Ragi= 0.7 * 0.7 * 0.5 * 0.5 (p)   Paddy = 0.3 * 0.3 * 0.5 * 0.5 (p)

=0.1225   =0.0225

Since Ragi> Paddy

So this new SoilInput6 is classified to Ragi

Output

Crop Preference

Crops (priority)	Preference
Ragi	0.12

Eclat Algorithm

Step 1: Get tidlist for each item (DB Scan)

Step 2: Tidlist of {a} is exactly the list of transactions containing {a}

Step 3: Interest tidlist of {a}with the tidlist of al other items, resulting in tidlists of

{a,b},{a,c},{a,d},…

Step 4: Repeat from 1 on {a} – conditional database

Step 5: Repeat for all other items

table 5.2:

Dataset

Sample

Output

Dataset

TID	Itemset
T1	A,C,D
T2	A,C,E
T3	A,B,C,E
T4	B,E

Minimum Support Count = 2

Minimum Confidence = 80%

Item set   A, B, C, D, and E

C1		L1	

C1

Items	Support
A	T1,T2,T3
B	T3,T4
C	T1,T2,T3
D	T1
E	T2,T3,T4

L1

Items	Support
A	T1,T2,T3
B	T3,T4
C	T1,T2,T3
E	T2,T3,T4

C2	
Items	**Support**
AB	T3
AC	T1,T2,T3
AE	T2,T3
BC	T3
BE	T3,T4
CE	T2,T3

L2	
Item	**Support**
AC	T1,T2,T3
AE	T2,T3
BE	T3,T4
CE	T2,T3

C3	
Items	**Support**
ACE	T2,T3
ABC	T3
ABE	T3
BCE	T3

L3	
Items	**Support**
ACE	T2,T3

FREQUENT ITEM SET (L)

Item	Support
A	T1,T2,T3
B	T3,T4
C	T1,T2,T3
E	T2,T3,T4
AC	T1,T2,T3
AE	T2,T3
BE	T3,T4
CE	T2,T3
ACE	T2,T3

GENERATE CONFIDENCE:

RULE X - RULE Y	CONFIDENCE
{A} -⌐ {C}	100.00%
{C} -⌐ {A}	100.00%
{A} -⌐ {E}	66%
{E} -⌐ {A}	66%
{B} -⌐ {E}	100%
{E} -⌐ {B}	66%
{C} -⌐ {E}	66%
{E} -⌐ {C}	66%
{A} -⌐ {CE}	66%
{C} -⌐ {AE}	66%
{E} -⌐ {AC}	66%
{CE} -⌐ {A}	100%
{AE} -⌐ {C}	100%
{AC} ⌐ {E}	66.00%

STRONG ASSOCIATION RULE:

- {B}-->   {E}

- {CE}--> ⌐   {A}

- {AE}--> ⌐   {C}

- {A} --> ⌐   {C}

- {C}--> ⌐   {A}

CHAPTER 6

TESTING AND RESULTS

6.1 Introduction

Testing is an important phase in the development life cycle of the product this was the phase where the error remaining from all the phases was detected. Hence testing performs a very critical role for quality assurance and ensuring the reliability of the software. Once the implementation is done, a test plan should be developed and run on a given set of test data. Each test has a different purpose, all work to verify that all the system elements have been properly integrated and perform allocated functions. The testing process is actually carried out to make sure that the product exactly does the same thing what is suppose to do. Testing is the final verification and validation activity within the organization itself. In the testing stage following goals are tried to achieve :-

- To affirm the quality of the project.

- To find and eliminate any residual errors from previous stages.

- To validate the software as the solution to the original problem.

- To provide operational reliability of the system

During testing the major activities are concentrated on the examination and modification of the source code. The test cases executed for this project are listed below. Description of the test case, steps to be followed; expected result, status and screenshots are explained with each of the test cases.

6.2 Testing Methodologies

There are many different types of testing methods or techniques used as part of the software testing methodology. Some of the important types of testing are:

6.2.1 White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level. Using white box testing we can derive test cases that:

- Guarantee that all independent paths within a module have been exercised at least once.

- Exercise all logical decisions on their true and false sides.

- Execute all loops at their boundaries and within their operational bounds.

- Execute internal data structure to assure their validity.

6.2.2 Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot see into it. The test provides inputs and responds to outputs without considering how the software works. It uncovers a different class of errors in the following categories:

- Incorrect or missing function.

- Interface errors.

- Performance errors.

- Initialization and termination errors.

- Errors in objects.

Advantages:

- Thetest is unbiased as the designer and the tester are independent of each other.

- Thetester does not need knowledge of anyspecific programming languages.

- Thetest is done fromthe point of view of the user, not the designer.

- Test cases can be designed as soon as the specifications are complete.

6.2.3 UnitTesting

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases. Test strategy and approach Field testing will be performed manually and functional tests will be written in detail. Test objectives

6.3 Test Cases: table 6.1: TestCases

TC#	Description	Expected Result	Actual Result	Status of Execution Pass/Fail
TC01	Execute/run the application	Application should run without any interrupts	Application is executing properly	Pass
TC02	Verification of Login Page	Enter User Name and Password. It should verify with database.	Entered User Name and Password are successfully verifying with database.	Pass

| TC03 | Verification of Admin Page input User Name and password | If Admin Login Name & Password is valid then it should navigate to respective Admin home page. If invalid then show message that Input Username & Password is wrong. | Admin User Name & Password is valid then successfully navigating respective home page. If User Name & Password is not valid or wrong input then message box shown that User Name & Password wrong. | Pass |

CHAPTER 7

OUTCOMES
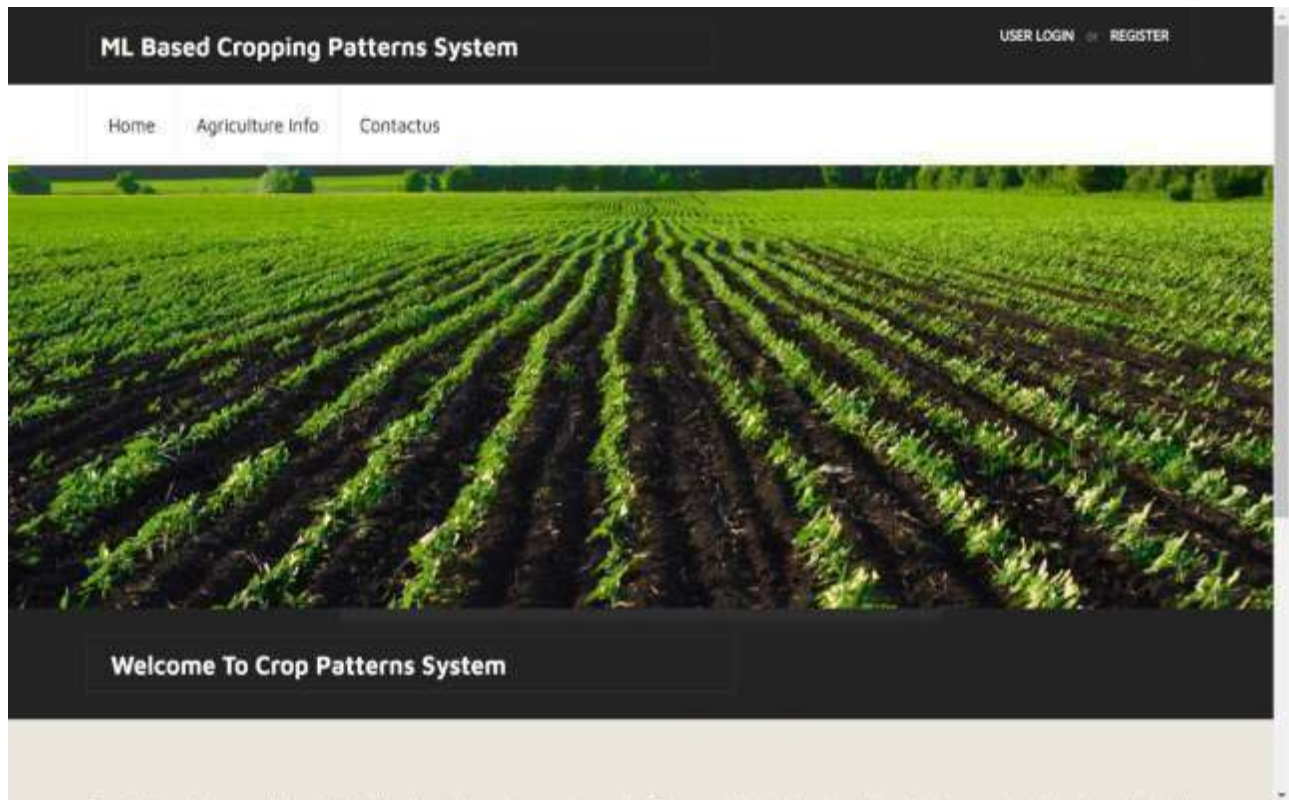
Snapshot 7.1: Home page
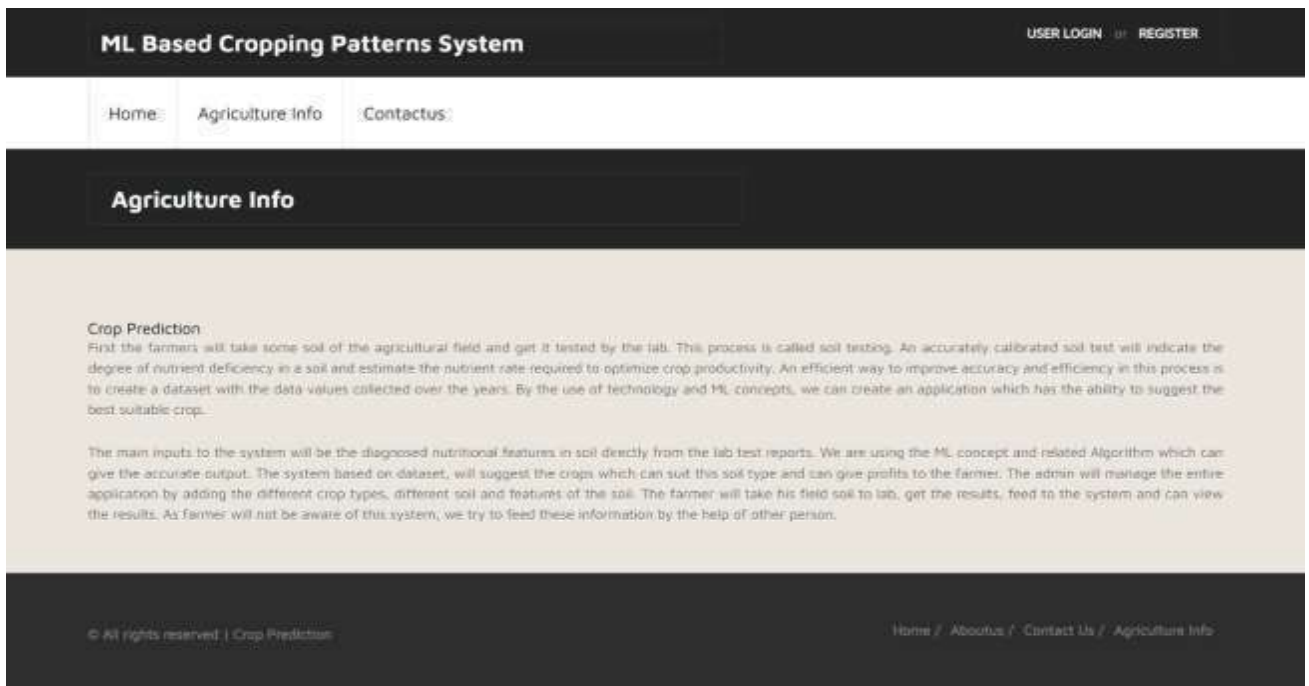
Snapshot 7.2: Agriculture Info page
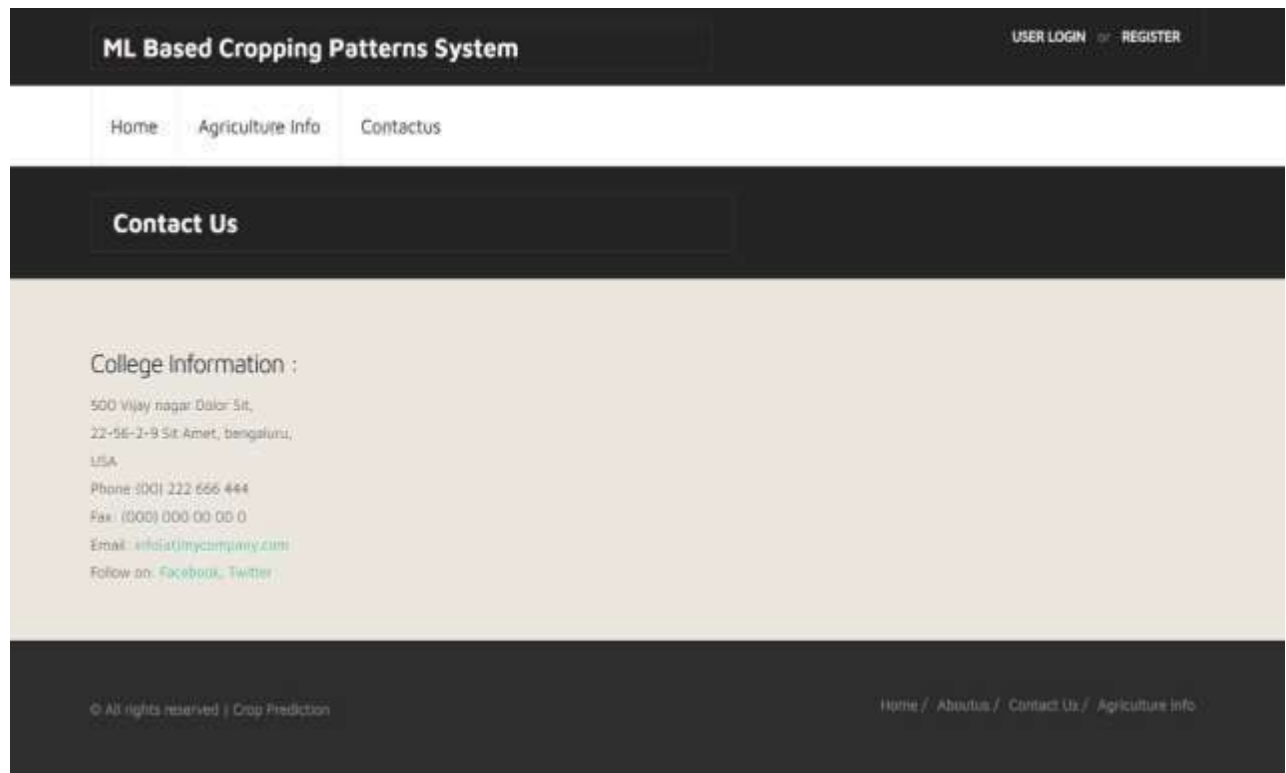
Snapshot 7.3: Contact Us page
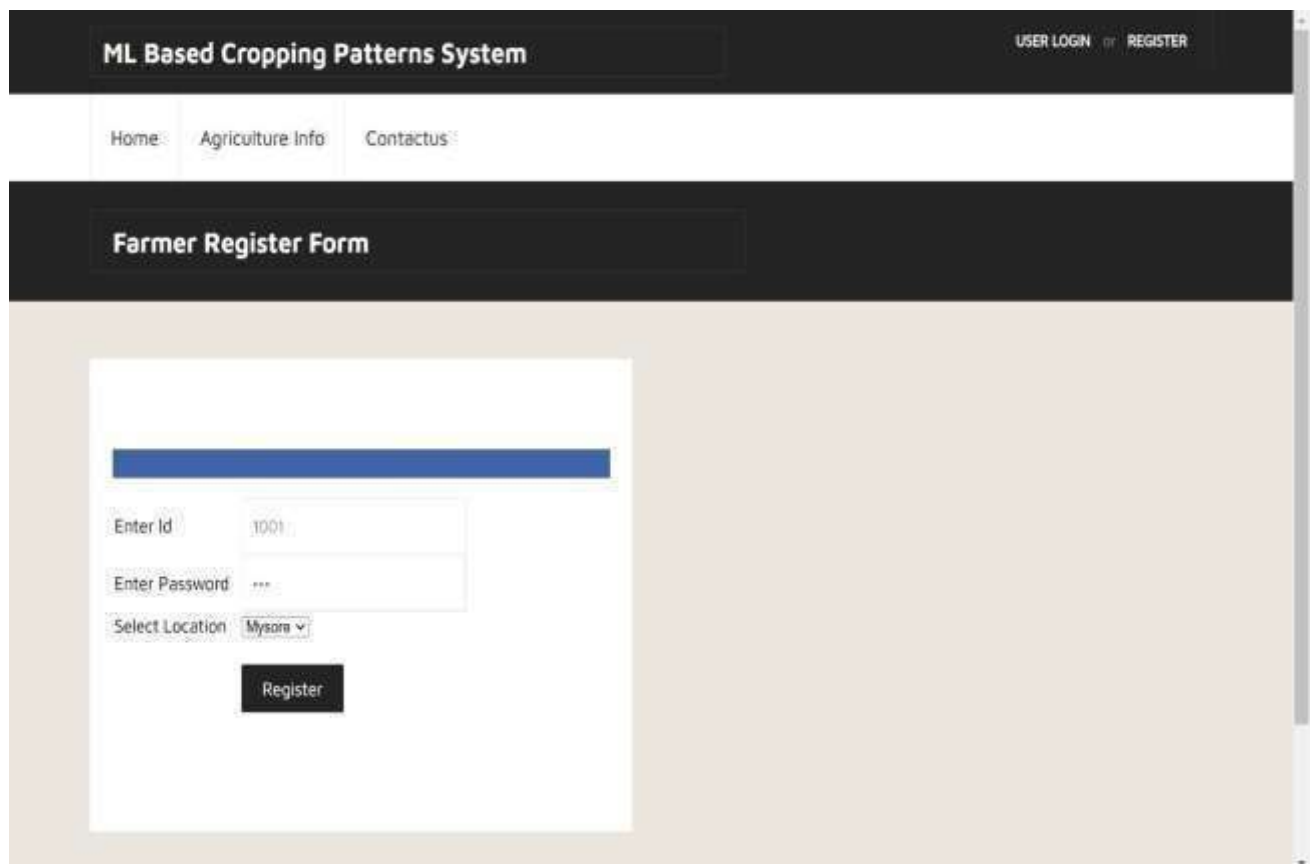
Snapshot 7.4: Farmer Registration Page

Snapshot 7.5: User Login Page

Snapshot 7.6: Admin – Create Staff Page
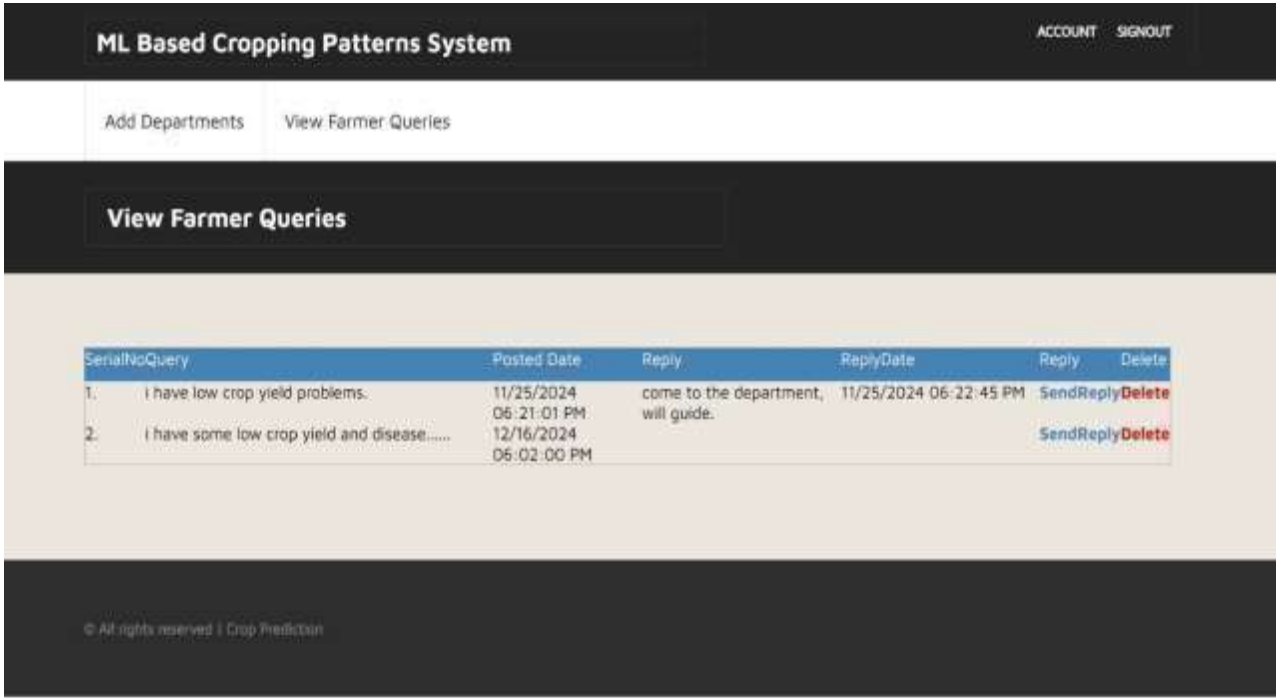
Snapshot 7.7: Admin – Send Reply to Farmers Queries
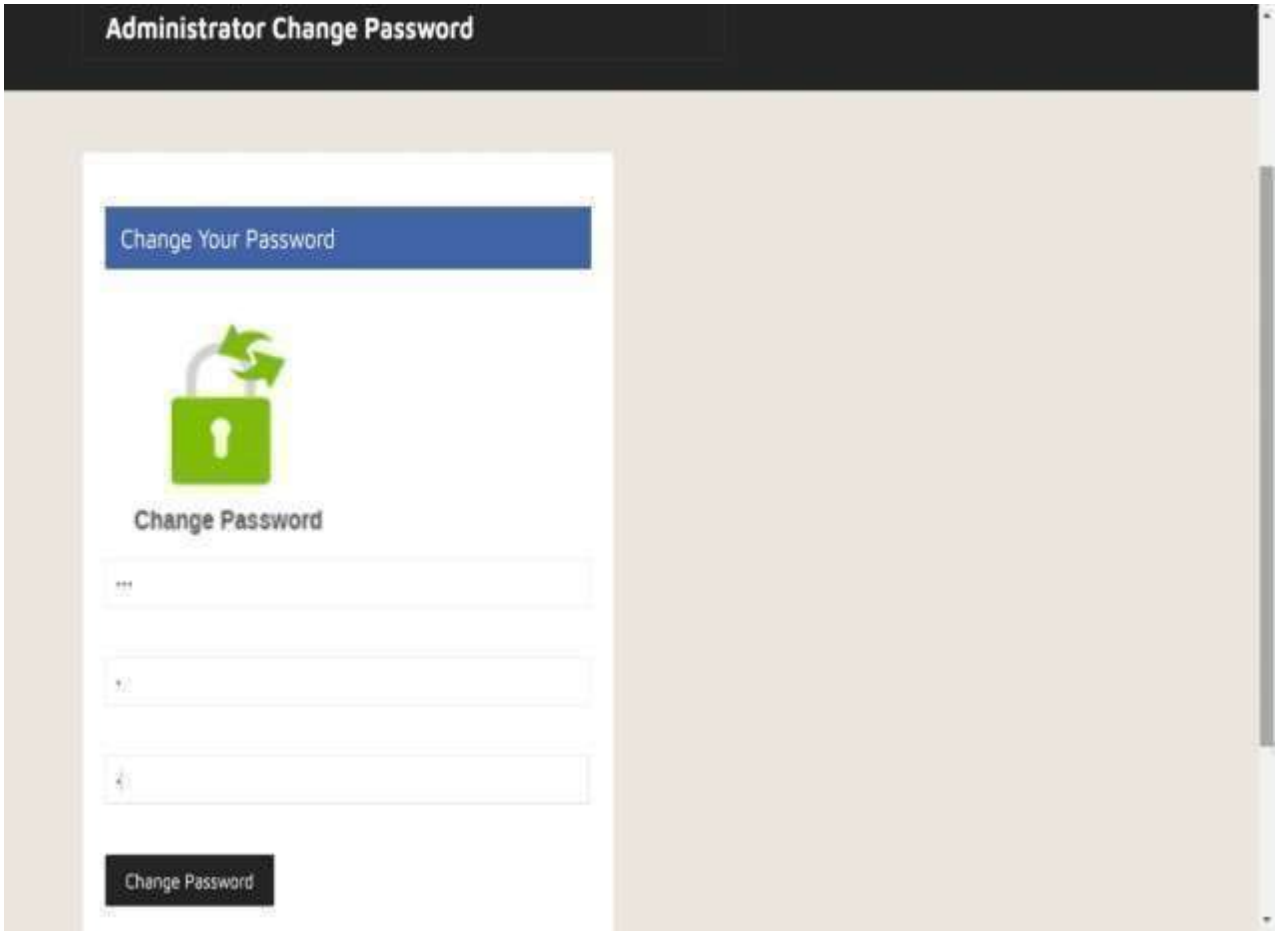
Snapshot 7.8: Admin – Update Password

Snapshot 7.9: Staff – Crop Prediction Form

Snapshot 7.10: Staff – ML Model Results
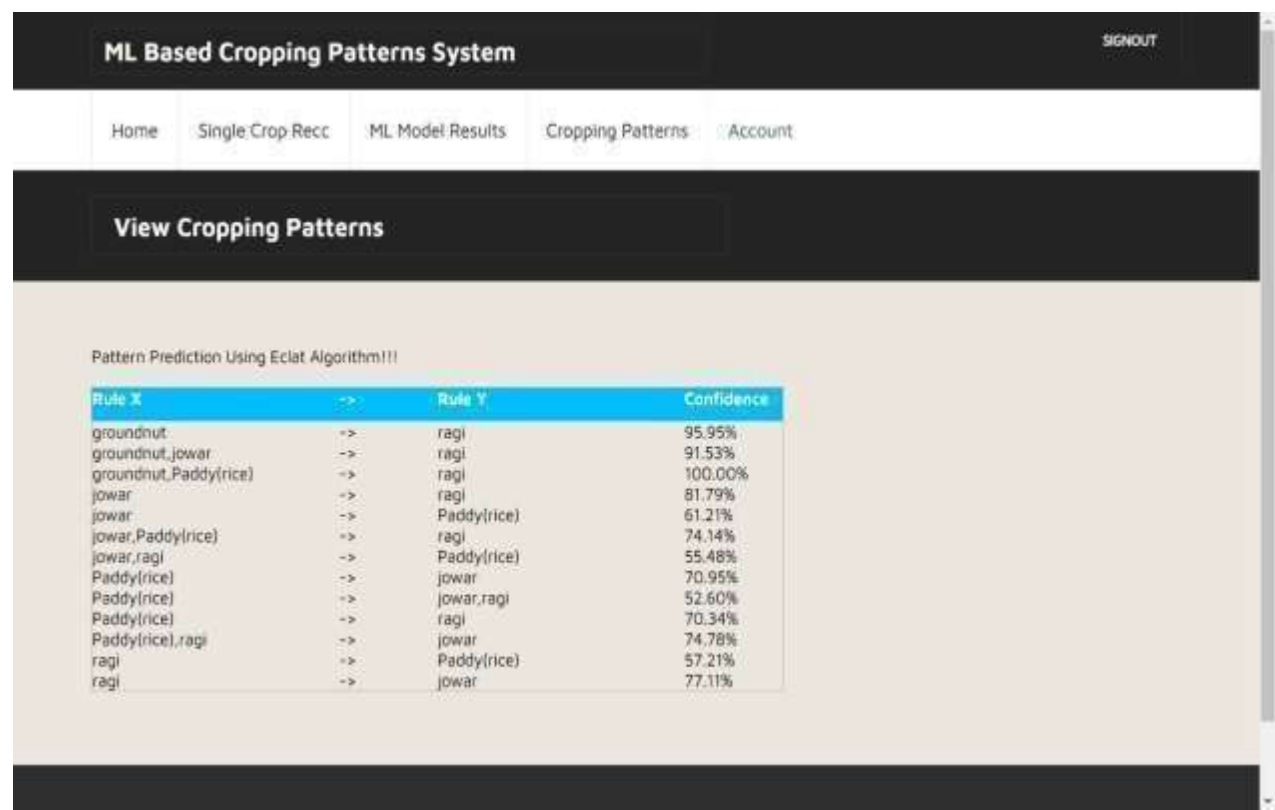
Snapshot 7.11: Staff – Cropping Patterns Page
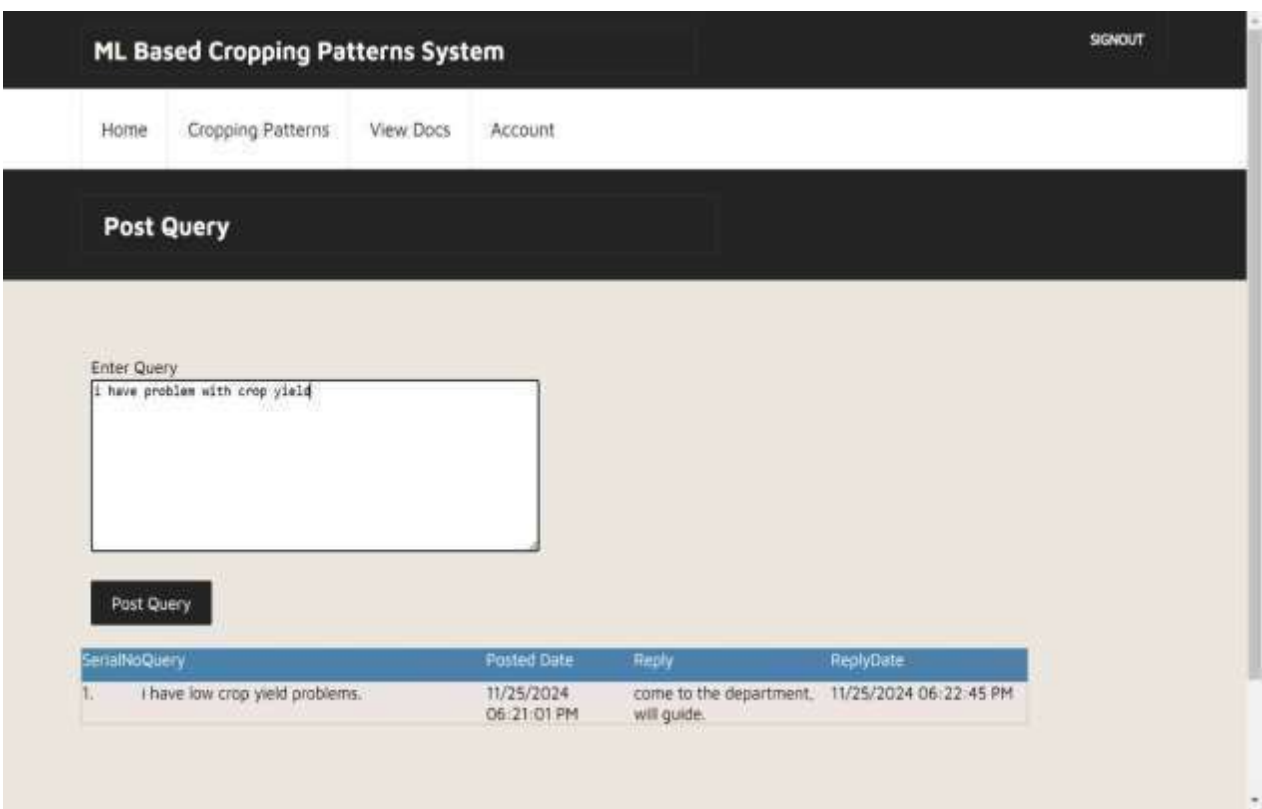
Snapshot 7.12: Farmer – Post Query page

CONCLUSION

Agriculture department plays vital role in the country economy. It is crucial for the farmers to know what all different types of crops can be cultivated in his/her land so as to get good crop quality and yield. As current system is the manual system which needs more time, experience and proper judgements which may lead to less crop yield and loss to farmers. There are important relationship between different types of crops so as to get better crop yields. As we do not have the proper system to find the cropping patters, we require an automation for cropping patterns prediction to help farmers to grow better crops types for better yield and profits. Proposed system does that and provides profits for the farmers.

The goals that have been achieved by the developed system are: Simplified and reduced the manual work.

- large volumes of data can be stored.
- it provides Smooth workflow.

Future Enhancement:

- More algorithms can be used to identify which algorithm is better for prediction.
- Query module can be added where farmers can post queries to the agriculture departments and can clear their doubts.

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