**Abstract**

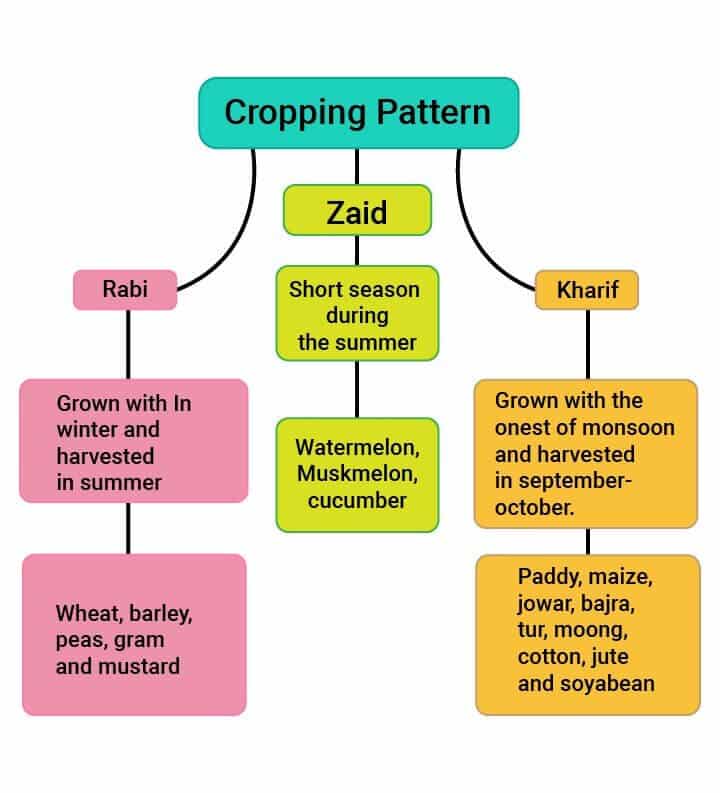
The cultivation of crops on land periodically throughout the year is a cropping pattern. This proposed work aims at prediction of major cropping patterns through only the cultivation-related factors like land, soil, and climate data using Machine Learning techniques. On a suitable land, farmers can grow 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#.

**CHAPTER 1**

**INTRODUCTION**

**1.1 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 1.1 : 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.

**1.2 MACHINE LEARNING**

ML concerns with construction and study of system that can learn from data. For example, ML can be used in E-mail message to learn how to distinguish between spam and inbox messages.

**1.2.1 FUNCTIONALITY:**

A computer program is said to be learn from experience E with respect to some task T and some performance P only if the program performance increases with experience E.

ML is a branch of AI which contains statistical, probabilistic, optimization technique that can learn from past experience and discover the pattern from large complex data sets.

For example, we can apply ML technique in predicting student performance based on their behaviors. Student performance depends on many factors such as living locality, SSLC result, PUC result, Family income, Parents education, use of internet, use of mobile, use of bike, use of Social Networking and other habits.

We can predict student performance using ML technique before exams so that we can improve student performance by knowing status of student.

ML based technique can be applied to classify the employees in an organization either to be class leave or stay based on their behavior.

**1.2.2 ML PROBLEMS:**

1. Is this disease cancer

2. Identifying types of cancer.

3. What’s the market value of a house?

4. In Social Networking we can use ML technique to find best friends based on their interaction.

5. Suggesting the interesting tourist places using ML.

6. Predicting Customer purchasing patterns in online shopping.

**1.2.3 TYPES OF ML:**

There are there types of Machine learning (ML), they are

i. Supervised Machine Learning

Here we have labels and the input is past examples.

Ex: 1-4

ii. Unsupervised Machine Learning

Extraction of patterns without labels.

Ex. 5 and 6

iii. Semi-Supervised Machine Learning

Mixture of both Supervised and Unsupervised Machine Learning

**1.2.4 SUPERVISED LEARNING TECHNIQUE**

It’s a predictive model used for the tasks where it involves prediction of one value using other values in the data-set. Supervised learning will have predefined labels. It classifies an object based on the parameters to one of the predefined set of labels. We have many algorithms to build model in supervised learning such as KNN, Naive bayes, Decision Tree, ID3, Random Forest, SVM, Regression techniques etc.…. Depending of the requirement, labels, parameters and data-set we select the appropriate algorithm for predictions. Algorithm is used to build a model that makes predictions based on evidence in the presence of uncertainty.

In this project For prediction we make use to “*naive bayes algorithm OR KNN algorithm*” which is an efficient and works fine for all different sets of parameters. It also generates accurate results.

**1.2.5 DESCRIPTION**

**Description**

**Step 1: Raw data and Weather Statistics**

This is the first step in the agriculture crop prediction process where we collect agriculture data. Agriculture data collected from the region which contains agriculture parameters, crop details, farmer’s details and parameter details. Agriculture parameters includes rainfall, temperature, soil features such as PH, nitrogen, potassium, iron etc.…

**Step 2: Extract and Segment Data (Data Preprocessing)**

Here agriculture data analyzed and only relevant data extracted. The data required for processing extracted and segmented according to the different regions. Required data extraction is done because entire agriculture data not required for processing and if we input all data, it requires too much of time for processing, so data processing is done.

**Step 3: Train Data**

Once required data extracted and segmented, we need to train the data, train means converting the data into the required format such as numerical values or binary or string etc... Conversion depends on the algorithm type.

**Step 4: Supervised Learning**

ML concerns with construction and study of system that can learn from data.

*For example*, ML can be used in E-mail message to learn how to distinguish between spam and inbox messages.

**Supervised learning** is an approach to [machine learning](https://simplicable.com/new/machine-learning) that is based on training data that includes expected answers.

**Naive Bayes Algorithm and KNN Algorithm**

"*Naive Bayes Algorithm*" is used for agriculture crop prediction because of the following reasons;

1. efficient classifier
2. Works fine for less number of parameters as well as more number of parameters.
3. Works fine for small data-set as well as big data-set.
4. more accurate results

**Step 5: Agriculture Crop Prediction**

System predicts the agriculture crop based on the agriculture parameters using machine learning algorithm.

**Step 6: Results**

Here we find the accuracy of the algorithm by dividing the training datasets into training and testing datasets. 90% considered as training datasets and 10% considered as testing datasets.

**Step 7: Visual Representation**

Outputs displayed for the farmers on GUI. When users gets login to the application system outputs displayed on a GUI.

**1.2.4 UNSUPERVISED LEARNING TECHNIQUE**

**Unsupervised learning algorithms used to find Cropping Patterns**

**Step 1: Raw data and Weather Statistics**

This is the first step in the prediction process where we collect agriculture data.

**Step 2: Extract and Segment Data (Data Preprocessing)**

Here agriculture data analyzed and only relevant data extracted. The data required for processing extracted and segmented according to the different regions. Required data extraction is done because entire agriculture data not required for processing.

**Step 3: Train Data**

Once required data extracted and segmented, we need to train the data, train means converting the data into the required format such as numerical values or binary or string etc...

**Step 4: Unsupervised Learning Algorithms**

Efficient machine learning algorithms such as apriori algorithm, FP algorithm or Eclat algorithm for cropping patterns prediction.

**Step 5: Cropping Patterns**

**Step 6: Location and Year Based**

The cropping patterns prediction done based on the region wise as well as year wise.

**Step 7: Results**

2 algorithms will be used for processing datasets and results will be compared to identify better algorithm.

**Step 8: Visual Representation**

Cropping patterns for the farmers on GUI. When users gets login to the application system recommends suitable and high profit crops for the farmers on a GUI.

**CHAPTER 2**

**LITERATURE SURVEY**

* 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 considerin g 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 confidence 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 | | Classification technique: 1.Linear Regression   1. K - nearest neighbour. 2. Regression Tree 3. Support Vector Machine. Clustering Technique: 1.K- means clustering. 4. Self organised maps. 5. Density based clustering. 6. Weight based clustering. | | The results indicate that sunshine hours and daily temperatur e range play critical roles in rice yield variability 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 | | Classification Algorithm. | | The output is the crop yield prediction per acre with some recommen 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 simultaneously 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 such as Rainfall and Temperatu re. | | With increase in Rainfall the paddy yield also increased.  During Reproductive phase 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.

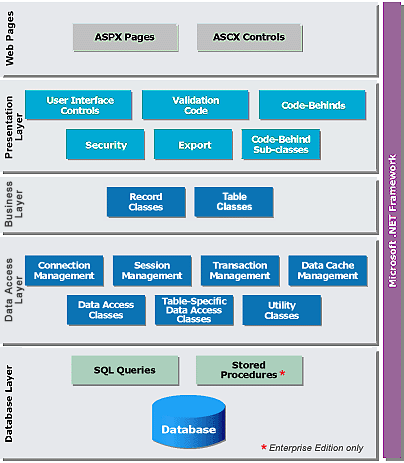
**2.3 TECHNOLOGY SURVEY**

**2.3.1 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 2.3.1 System Framework Diagram*

**2.3.2 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++.

**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. When you install ASP.Net you will install .Net framework at the same time. You will use bits and pieces of .Net framework.

**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

1. Improved Performance and scalability

* Compiled execution,
* Rich output caching

1. Enhanced Reliability:

* Avoids memory leak,
* Avoids deadlock
* Crash protection.

1. Easy Deployment

* Dynamic update of application.

**2.3.4 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.

**2.3. 5 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.

**CHAPTER 3**

**REQUIREMENT SPECIFICATIONS**

**3.1 SYSTEM REQUIREMENTS**

*Software requirements :*

* IDE: **Visual Studio** (efficient tool used for the development of real time applications, Microsoft technology which supports more libraries, tools and concepts required to work with real time application compared to other technologies, we can design very good UI designs)
* Programming Language: **C#** (programming language which is used for processing purpose, similar to C++, more compatible and supportive with visual studio, supports all required libraries to build real time applications)
* Back End – **MS SQL Server** (used to store the data, Microsoft technology more compatible with visual studio)
* Front end – HTML, CSS, JS, JQuery

*Hardware Requirements :*

* RAM: **4GB+**
* Processor: **Intel Dual Core on wards**
* Processor Speed: **2.4ghz+**
* Hard Disk: **500GB+**

**3.2 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.

**3.2.1 LIMITATIONS OF THE EXISTING SYSTEM**

* Only crop prediction not cropping patterns prediction
* Manual process
* Previous results and experience considered
* Leads to wrong estimations.
* Loss to farmers
* Less crop yield
* No real time implementations done

**3.3 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.

**3.4 PROPOSED SYSTEM**

* 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.
* 2 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.

**3.5 METHODOLOGY**

**Machine Learning :**

Machine learning is a process of studying a system based on data. Machine learning is a part of data science where we use machine learning algorithms to process data.

**Supervised Learning Technique :**

It’s a predictive model used for the tasks where it involves prediction of one value using other values in the data-set. Supervised learning will have predefined labels. It classifies an object based on the parameters to one of the predefined set of labels. We have many algorithms to build model in supervised learning such as KNN, Naive bayes, Decision Tree, ID3, Random Forest, SVM, Regression techniques etc…. Depending of the requirement, labels, parameters and data-set we select the appropriate algorithm for predictions. Algorithm is used to build a model that makes predictions based on evidence in the presence of uncertainty.

In this project For prediction we make use to “*naive bayes algorithm OR KNN algorithm*” which is an efficient and works fine for all different sets of parameters. It also generates accurate results.

**Unsupervised Learning Technique :**

Association (or relation) is probably the better known and most familiar and straightforward data science technique. Here, we make a simple correlation between two or more items, often of the same type to identify patterns.

*For example*, Market-basket analysis, where we track people's buying habits, we might identify that a customer always buys cream when they buy strawberries, and therefore suggest that the next time that they buy strawberries they might also want to buy cream.

System uses algorithms such as FP growth algorithm or Apriori algorithm or ECLAT algorithm or SFIT algorithms to find cropping patterns.

**3.6 METHODOLOGY – WATER FALL MODEL**

According to Software Engineering the approach adopted to develop this project is the Iterative waterfall Model. The iterative waterfall Model is a systematic approach that begins at the feasibility study phase and progress through analysis, design, coding, testing, integration and maintenance. Feedback paths are there in each phase to its preceding phase as show in the fig to allow the correction of the errors committed during a phase that are detected in later phase.

**Feasibility Study**

**Analysis**

**Design**

**Coding**

**Testing**

**Maintenance**

**Fig: 3.6 Waterfall model**

**3.7.1 FEASIBILITY STUDY:**

The main aim of this phase is to determine whether it would be financially and technically feasible to develop the product. The feasibility study activity involves the analysis of the problem and collection of all the relevant information relating to the product such as different data items which would be input to the system, processing required to be carried out on these data, the output data required to be produced by the system, as well as constraints on the behavior of the system.

**3.7.2 Requirement Analysis and Specification:**

The main aim of this phase is to understand the exact requirements of the customer and to document them properly.

**3.7.3 DESIGN:**

The goal of design phase is to transform the requirements specified in the SRS document into a structure that is suitable for implementation in some programming language. In technical terms, during the design phase the software architecture is derived from SRS document. Two distinctly different design approaches are available: the traditional approach and the object oriented approach. We have adopted traditional design to develop the product.

**3.7.4 CODING:**

Once design is complete, goal of the coding phase is to translate the design of the system into code in a given programming language. For a given design, the aim in this phase is to implement the design in the best possible manner. We have coded the design using C# language to develop the product.

**3.7.5 TESTING:**

Testing is the major quality control measure employed during software development. Its basic function is to detect errors in the software.

**3.7.6 MAINTENANCE:**

Maintenance is not a part of software development. It is an extremely important activity in the life of software product. Maintenance involves performing any one or more of the following kinds of activities:

* Correcting errors that were not discovered during the product phase. This is called corrective maintenance.
* Improving the implementation of the system, and enhancing the functionalities of the system according to the customer’s requirements. This is called perfective maintenance.
* Porting the software in a new environment. This is called adaptive maintenance.

# CHAPTER 4

# SYSTEM ANALYSIS

### **4.1 INTRODUCTION**

The first phase of software development is the system study analysis. The importance of system analysis is the establishment of requirement of the system to acquire develops and installed. Analyzing the project to understand the complexity from the vital part of the system. Problematic areas are identified and information is collected. Fast finding are gathering is essential to any analysis of requirements. It is also highly essential that the analyst familiarize himself with the objective, activities and functions of organization in which system is to be implemented.

System analysis includes investigation and possible changes to existing system. Analysis is used to gain and understand the existing system and changes required for it. At the end of the system analysis phase there is a system description and set of new requirements.

**4.2 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.

**4.3 PROPOSED SYSTEM**

* 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.
* 2 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.

**Datasets**

Training datasets collected from online sources or manually.

<https://www.kaggle.com/code/jaseemck/crop-damage-classification>

**Parameters List**

* Rainfall
* Temperature
* PH value
* Nitrogen
* Potassium
* Phosphors
* Zinc
* Iron
* Sodium

**4.4 FEATURES OF THE PROPOSED SYSTEM**

* Proposed system meant for agriculture departments.
* System helps farmers to know cropping patterns and suitable crop prediction.
* System is an automation for agriculture cropping prediction.
* System uses efficient supervised learning and unsupervised learning algorithms to predict agriculture outputs.

**4.5 FEASIBILITY STUDY**

The feasibility study proposes one or more feasible conceptual solutions to the problem set of the project. The conceptual solutions give an idea of what the new system will look like. This indicates what inputs are needed by the system and what outputs will be produced.

Three things to be done to established feasibility. They are:

* First, it must be checked that the project is technically feasible.
* Second, operational feasibility must be established. It is necessary to consult the system users to see if the proposed solution satisfies user objectives and can be fitted in to current system operation.
* Third, economic feasibility must be checked. The study must determine whether the project’s goal can be achieved within the resource limits allocated to it. It must also determine whether it is worthwhile to proceed with the project at all or whether the benefits obtained from the new system are not worth the cost.

**4.5.1 TECHNICAL FEASIBILITY**

Technical Feasibility is the study of resource availability that may affect the ability to achieve an acceptable system. Technical Feasibility is the most difficult area to ensure at initial stages. Since the objectives functions and performance cannot be predicted to its fullest, everything seems possible provide, proper assumption are made. It is essential that the process of Technical Feasibility.

* + 1. **ECONOMIC FEASIBILITY**

Development of this application is highly economically feasible .The organization needed not spend much money for the development of the system already available. The only thing is to be done is making an environment for the development with an effective supervision. If we are doing so, we can attain the maximum usability of the corresponding resources .Even after the development, the organization will not be in condition to invest more in the organization. Therefore, the system is economically feasible.

* + 1. **Operational Feasibility**

An estimate should be made to determine how much effort and care will go into the developing of the system including the training to be given to the user. Usually, people are reluctant to changes that come in their progression. The computer initialization will certainly affected the turn over, transfer and employee job status. Hence an additional effort is to be made to train and educate the users on the new way of the system.

* + 1. **Motivational Feasibility**

An evaluation of the probability that the company is significantly motivated to support the development and implementation of the application with necessary user participation, resources, training etc. The participation and support by the organization during system study was encouraging thus eliminating any resistance in this regard. So from the Behavioral aspect the new system is supposed to have efficient from the company.

* + 1. **Schedule Feasibility**

The time schedule required for the development of this project is very important since over-runs result is escalated projects costs and also hinders in the development of the other system.