AI-Assisted Farming for Crop Recommendation & Farm Yield Prediction Application

1. Introduction

1.1 Overview

- Understand what is Artificial Intelligence
- Importance of choosing the right crop for the land
- Challenges faced in Agriculture with improper selection of crop.
- How we can choose right crop suitable for land with the Application of AI in Agriculture
- How to predict the yield & revenue with AI

1.2 Purpose

To help farmers in minimizing the risk of agriculture we propose creating an application that recommends the farmers about the best crops to be cultivated based on climatic parameters and also predicts the yield and revenue that would be generated for cultivated land.

What is Artificial Intelligence?

Artificial intelligence is based on the principle that human intelligence can be defined in a way that a machine can easily mimic it and execute tasks, from the simplest to those that are even more complex. The goals of artificial intelligence include

learning, reasoning, and perception.

Some examples, vision-recognition systems on self-driving cars, in the recommendation engines that suggest products you might like based on what you bought in the past, speech, and language recognition of the Siri virtual assistant on the Apple iPhone.

Agriculture and farming are one of the oldest and most important professions in the world. It plays an important role in the economic sector. Worldwide, agriculture is a $5 trillion industry.

The global population is expected to reach more than nine billion by 2050 which will require an increase in agricultural production by 70% to fulfil the demand. As the world population is increasing due to which land water and resources becoming insufficient to continue the demand-supply chain. So, we need a smarter approach and become more efficient about how we farm and can be most productive

Importance of choosing the right crop for the land

Different crops need different type of soils, different types and amounts of nutrients, and different types and amounts of water. The amount of water required by the plant is also dependent on the growing season and the climate where it is grown. By selecting the right crop for the given soil conditions and

climate, one can optimise yields and save water requirements for irrigation.

Improper selection of crop

Improper selection of crop causes poor yield and may require high cost of cultivation this results in loss of work, water, nutrients and poor yields and less income or loss for farmers.

2. Literature Survey

2.1Existing Problem

Can you imagine an industry that involves more risk than

agriculture? Usually, people say "You reap what you sow", but what they forget to add is "if you're lucky." When the weather strikes or cross gets affected by the disease, farmers can hardly talk about yields or when a global pandemic hits, suddenly it gets harder to manage various processes because most are not digital.

At the same time, the global population is growing, and urbanization is continuing. Disposable income is rising, and consumption habits are changing. Farmers are under a lot of pressure to meet the increasing demand, and they need a way to increase productivity. Thirty years from now, there will be more to feed, and since the amount of fertile soil is limited, there will also be a need to move beyond traditional farming.

We need to look for ways to help farmers minimize their risks, or at least make them more manageable. Implementing artificial intelligence in agriculture on a global scale is one of the most promising opportunities.

Proposed Solution

2.2.1 General Description

We plan to build a web application that recommends the farmers about the best crops to be cultivated based on climatic parameters and also predicts the yield and revenue that would be generated for cultivated land. We plan to make use of IBM services (Watson studio / Auto AI/ build machine learning model) and would like to use any SDK to create a web Interface.

Here's our plan of action:

1. Build Machine Learning model that predicts yield, revenue

and also recommends crops using IBM capabilities

2. Integrate the model with UI (User interface)

We hope that through this service farmers get a systematic procedure to cultivate the crops with a time-to-time recommendations and advice, hope they can grow good crop. This will benefit the farmer as well as the revenue.

2.2.2 Novelty / Uniqueness:

There may be many web applications for advising the farmers regarding the field-based soil, water resources available, crops they would like to grow etc. like physical environment around the field, but we plan to add a real time weather information to existing factors and train a AI based model to get time to time recommendations regarding different aspects of fielding to gain better yields and increase revenue.

For now, we want to provide a web platform to interact with this application but in the future, we try to make to available as mobile application for further reach.

2.2.3 Business / Social Impact:

Now world is digitalized in a way we can't even imagine. We are growing all types of areas like industries, technology, science etc. But there are lot of illiterate farmers out there who fail to cope up with the advancements that are undergoing in agriculture field, they need a trustworthy time to time recommendations accordingly with the present developments to gain more output within the same input. This will strongly influence the agriculture area.

2.2.4Technology Architecture:

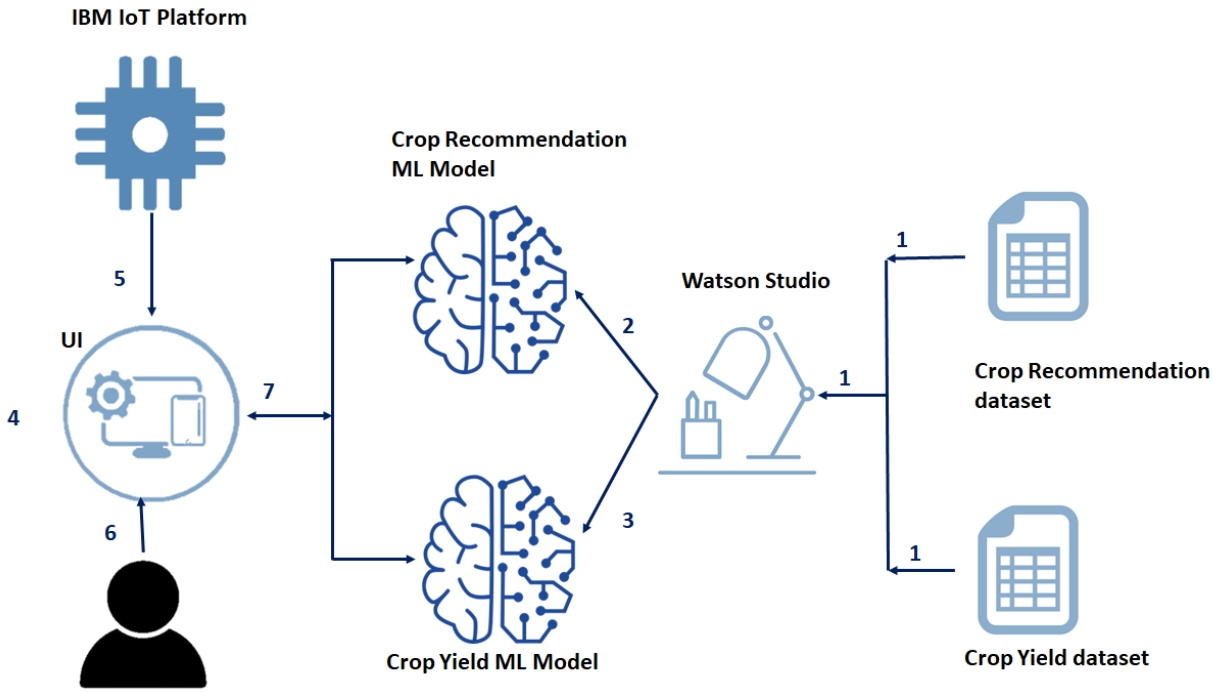
IBM Watson Desktop, IBM Cloud, IBM Auto AI, IBM Watson Studio, Android / any Web frameworks.

2.2.5 Scope of the Work:

As we planned our first version of this solution is to build a web platform for recommending farmers best suitable tasks to be done at the best suitable times with the help of ML models analyzing the current weather and various factors in order to gain best yield. We would like to make it available to as many people as possible to see the actual impact of the application.

3 THEORITICAL ANALYSIS

3.1 Block diagram



3.2 Hardware / Software designing

The solution is proposed to build upon IBM cloud using IBM cloud services like:

1. IBM Watson Desktop
2. IBM Cloud
3. IBM Auto AI
4. IBM Auto AI
5. IBM Watson Studio
6. Android / any Web frameworks

Hardware Requirements:

Temperature, Humidity, pH sensors and N, P and K values of a soil measurement tools.

4 EXPERIMENTAL INVESTIGATIONS

4.1 Collection of Data:

To build AI models to recommend best suitable crop for a land based on its environmental facts and the soil's N, P and K etc. values we need some structured data obtained from careful experiments and analysis of different crop yields in different kind of lands with respective factors considered are to be noted. This data is prepared and fed to the AI models to recommend the crop with given new factors based on previous observations.

Data collection is considered with lot of gathering of information and a long process, there are already many datasets are available on internet regarding crop recommendations based on respective factors, so for this project we have used "CropRecommendation.csv" and "cropYield.csv" datasets from Kaggle.

4.2 Factors:

For recommendation of crop and for predicting yield and revenue the factors considered are:

For recommendation:

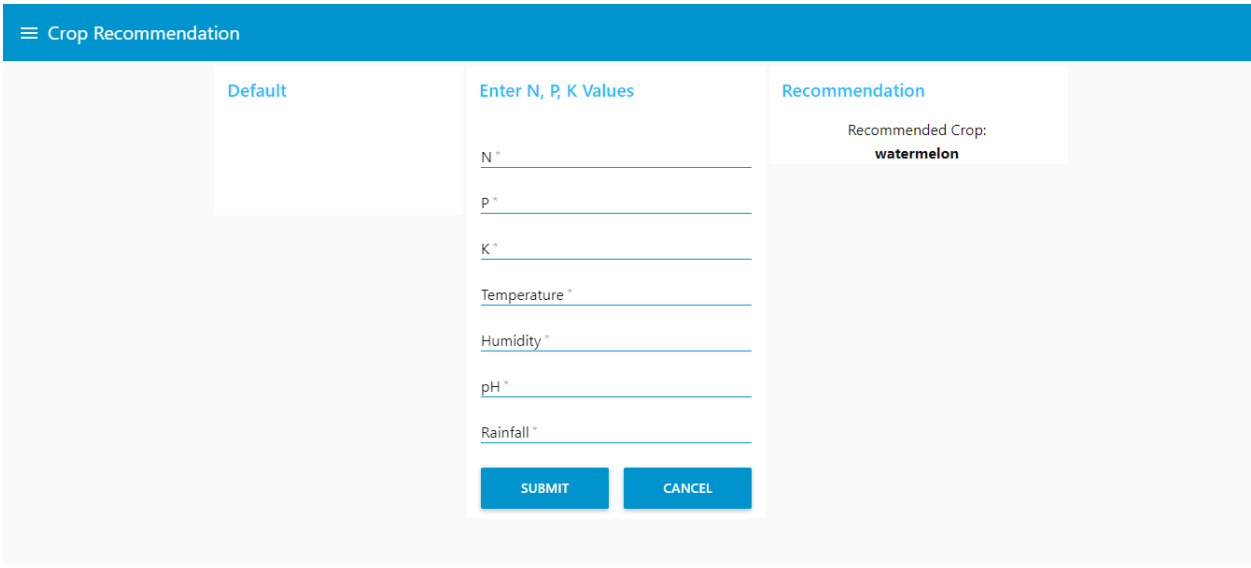
1. Nitrogen(N) value of the soil
2. Potassium(K) value of the soil
3. Phosphorus(P) value of the soil
4. Region(state) and Humidity, Temperature of the region
5. Annual average Rain fall of the region

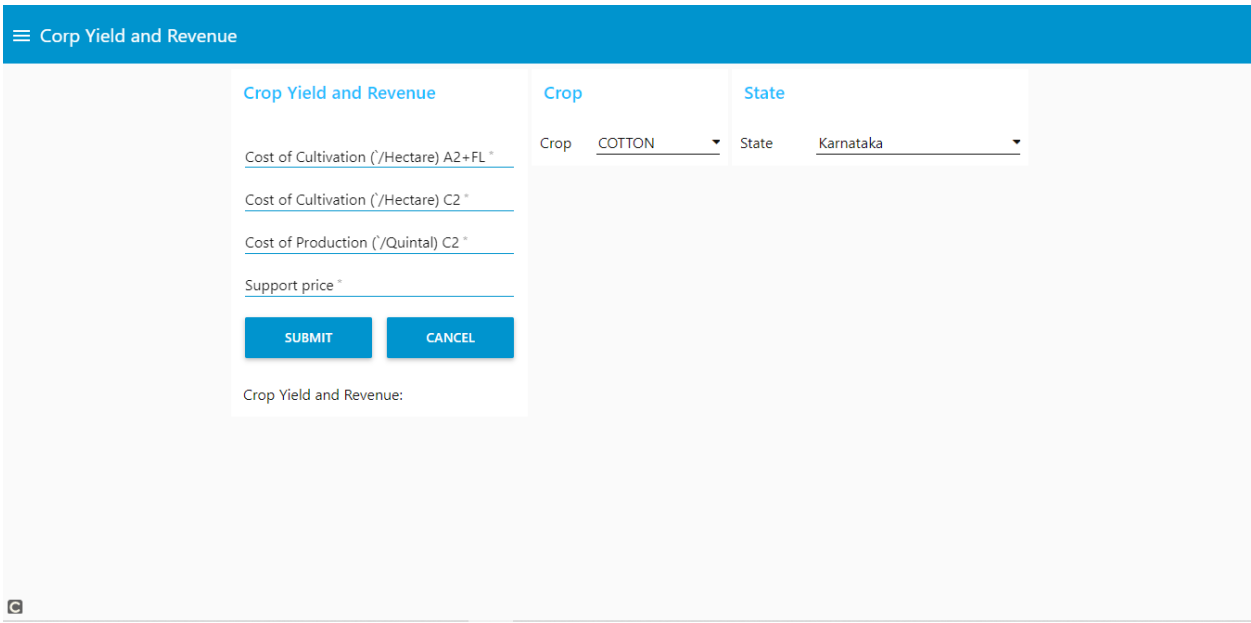
5. RESULT

5.1 AI Models

Two models are trained, one on CropRecommendation dataset and other on CropYield dataset using AutoAI experiment feature of of IBM watson Studio.

These two models are deployed online on IBM cloud. An User Interface Is designed using NodeRed service of IBM Cloud to interact with customer (like taking inputs and giving the output).





6. ADVANTAGES & DISADVANTAGES

6.1 Advantages

This application suggests best suitable crop to be cultivated in the land with past observations using Artificial Intelligence. This reduces the average cost cost of cultivation, increases the yield per hector and helps the farmer to obtain increased output with the same amount of effort.

Just the good selection of crop according to the environment and soil conditions may increase the yield by 1.5 times. So this is a big advantage for farmers.

6.2 Disadvantages

This application just tells the best crop suited and predicts the yield and revenue generated from land, cultivation of land consists of many intermediate tasks that we don't consider where techniquical decisions can make the dfference. Our scope is limited to selecting crop and predicting yield with given set of parameters.

7. APPLICATIONS

There are many farmers in India who just merely choose the crop according to demand, water facility and trending among the other farmers in the region, but don't consider the condition of the soil and environmental changes, this is where they lose a great amount of information and opportunity.

With the help of this application they will be recommended a crop by considering real time fertility of the land and environmental changes so that the yield is maximum. This will help a lot to boost their outputs.

8. CONCLUSION

Using Artificial Intelligence for improving agriculture. There are many aspects from seed plantation to gathering crop outcome in cultivation which can be optimized with help from previous experinces to gain maximum output with same amount of input. It can be tidious for person keep track of previous outcomes and analyse, so here AI can play a major role. Using AI we can build models by training them on previous data to make present decisions effectively.

Perticularly in this project we have taken the task of chosing best crop suited for given land and predicting the yield and revenue for the same with given parameters.

Here we have built AI models trained on CropRecommendation and CropYield datasets and are deployed on IBM cloud. They are made available to use by an interface created using Node-Red.