Idea Specifications for

Innovation for Sustainable Development Hackathon

By Enzen and HackerEarth

Submission Idea: Pervasive-Agriculture (P-Agri)
Idea category: Open innovation

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Problem

World population is expected to grow by over a third by 2050. This means that market demand for food will continue to grow. Projections show that feeding a world population of 9.1 billion people in 2050 would require raising overall food production by some 70 per cent in order to feed the world. There is a gap between current food productivity growth and needed growth. To boost the yield farmers switched to extensive use of chemical fertilizers. Excessive fertilizer usage has its own negative impact like decreased yield, wastage of fertilizer, damage to soil and groundwater contamination. Currently, farmers mostly rely on guesswork, estimation, past experience when deciding the crop that should be grown and the fertilizer that should be used.

Objective

Our objective is to design a modern and systematic solution for improving/automating the present solutions for predicting the best suitable crop, fertilizers and many more.

Dream

The thin silver lining that differentiates an innovation from an invention is the fact that how much feasible and impactful it could be. Though India has one of the highest net areas under cultivation, it's net output/hectare is far below its counterparts. The Government of India is striving very hard to bridge this gap and we believe that our solution could just provide the break that this plan of government is aiming at.

Product/Idea

Major Goals

1. To create a model which would result in maximum productional efficiency of agricultural crops.
2. To achieve maximum revenue at minimal additional inputs for the farmers.
3. Route mapping system for the utilization of automated vehicles.

How does our idea address the problem?

1. Our idea deals with providing a solution for predicting the best crop to grow by considering various factors such as Weather, Soil nutrient levels and also Wholesale prices of the crops if and so when harvested. Thus, the farmer is supplemented with a technology which could essentially make all the calculations required to maximize revenue.
2. Our idea also plans on creating a platform which could be used for route guidance by local mechanics, who create custom automated vehicles. This idea focuses specifically on this segment since most of the farmers especially in the developing countries can't afford to procure automation systems from leading manufacturers and rely on locally sourced custom equipment.

Who are the target customers?

The yield per hectare values of developed countries (like the USA) is much higher (almost thrice) in comparison to the developing countries (like India), and thus farmers from these areas are expected to benefit highly from this solution.

What makes our idea unique?

There are many companies/organizations which focuses on higher yield using different products but almost none of them focuses on the yield efficiency, which is an important parameter for manufacturing but not considered important in agriculture. Currently the Suggestions / Predictions like the ones generated by the solution is mostly done using Intuition and Statistics by experts, i.e. manually performed.

Revenue generation model

In order to generate higher profits and to reach the maximum user base, the product could be featured as pay per use software i.e. Software as a Solution (SaaS) model.

By partnering with organizations which deal with soil testing (like Krishi Seva Kendra in India), the above-mentioned goal could be achieved at the earliest.

What are the geographies our idea would be suitable for?

The product would be ideal for farming in terrains such as plains and valleys since the field of automated farm vehicles of the current era are suitable only for such terrains.

What are the risks associated with your idea and how can you mitigate it?

1. The first and foremost risk associated with this solution is the copy of the solution since a software solution is not patentable in India as per section 3(k) of Indian Patent Acts.

This could be resolved by applying for a design patent which describes the design of the solution rather than the software.

2. The other risk would be the changes caused in the environment due to global warming, such as the increase in average temperature or the changes in soil quality due to acid rain or volcanic dust over the course of time, this could be done by making the model immune to such environmental changes.

Who are the stakeholders involved in order to take bring this idea/product to the market?

1. The major stakeholder in bringing the idea to the market would be the Krishi Seva Kendra and other organization dealing with soil testing (in the context of India).
2. The other stakeholder would be the Satellite Image providers as the part of the solution solely depends on it, currently, the prototype solution utilizes Google Earth Images.

Intellectual Property Assessment

Is our idea patentable or patented?

1. The idea is not patentable in India since Section 3(k) of the Patents Act prohibits from issuing business method patents.
2. But the software solutions are patentable in countries like the USA and France. So, we can patent it, if required, in the countries stated above.

Is our idea built on existing work? If so how is it different?

Partially the idea is similar to what Krishi Seva Kendra set up by Government of India does, like recommending crops and fertilizers; but our idea adds in some extra features and automates the work done by Krishi Seva Kendra.

Prototype/Proof of Concept

Submission

We are going to submit a software prototype. A GitHub repository will be shared with you.

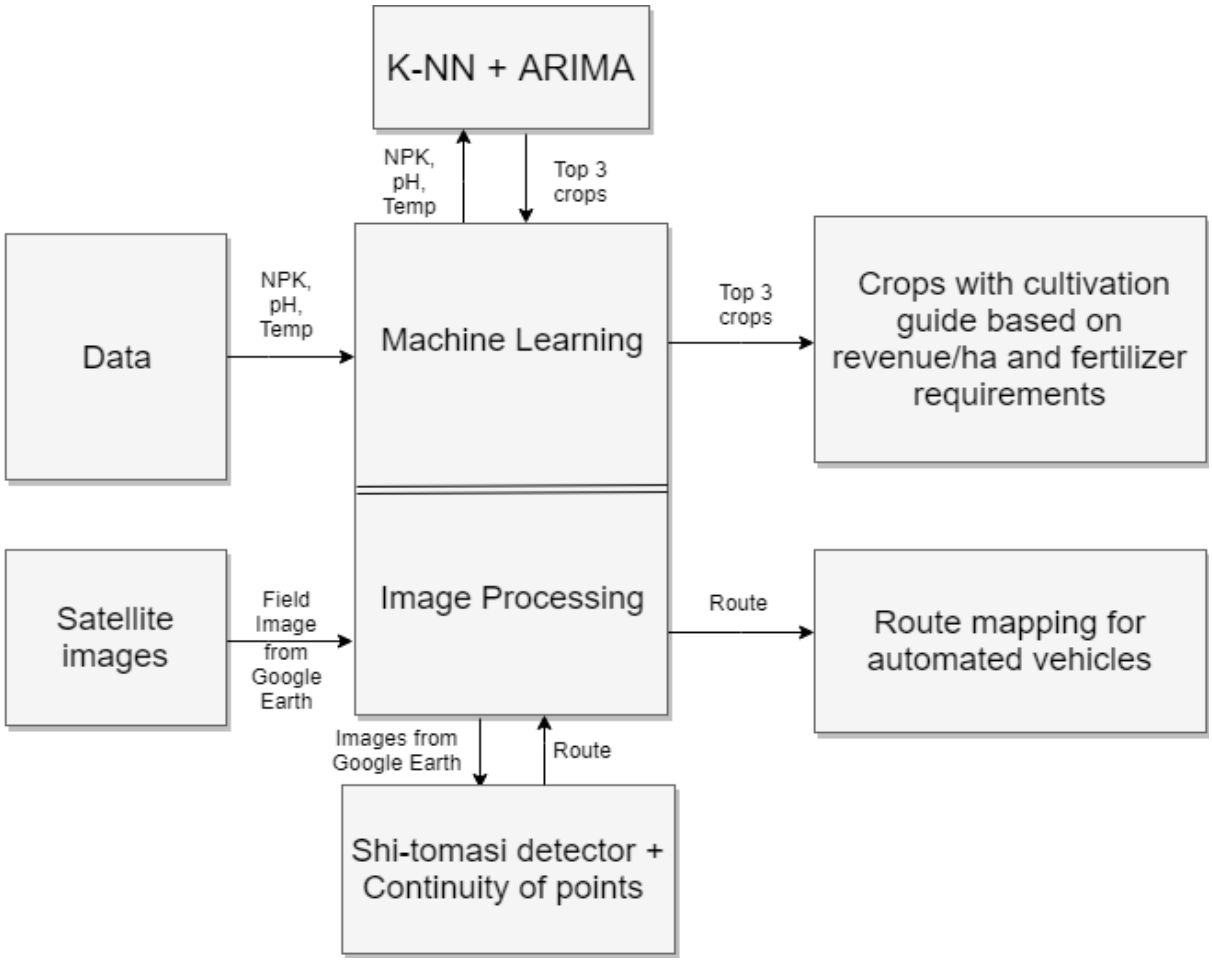
Pilot tests for our prototype

Yes, we have done pilot testing for soil data of Habibpur village, Muzaffarnagar, Uttar Pradesh, India. Data was taken from government website https://soilhealth.dac.gov.in/ .All the results were found based on actual data in that area.

Approximate cost of developing the prototype?

The main cost includes hosting this machine learning application on the Web. It would cost around ₹16000 per year (according to Microsoft Azure Machine Learning Service Prices).

Block Diagram



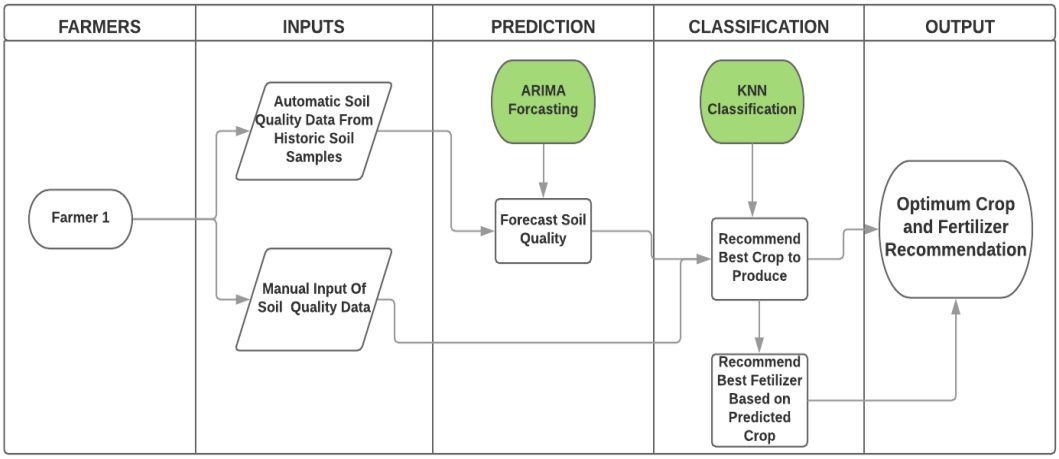
Our proposed solution, if implemented at the soil health centers which have been set up by the government, could help all the farmers to use minimum fertilizers, so as to maintain the soil health and also would provide them with an opportunity to gain atmost revenue from the same piece of land. Thus, it would be a win-win for all the parties involved. Our solution will be provided with technologies such as Machine Learning and Image Processing. Machine Learning algorithm is used for prediction analysis i.e. to suggest the best crop and also the corresponding bio-fertilizer. Image Processing provides a technological base that could be used for further developmental projects in the field of automated drone or tractors as this generates a route through the field with the least number of turns. The scope of the solution can be increased after building this prototype.

1. The Web application mainly consists of four services, namely predictive analysis to suggest the top three more suitable crop based on the nutrition levels of the soil, temperature and also the expected revenue that this particular crop could generate. There are two ways by which this could be used.
    - One would be the automatic way i.e. wherein the farmer just selects their location and based on the previous test that was conducted at or near that place, a suitable crop would be suggested.
    - The second way is to manually enter the details relating to the soil and to obtain a suitable crop for the entered in value.
2. A technological base for further development for automated vehicles such as drones and automated tractors. This fundamentally consists of the image processing algorithms which are required to plot the routes to traverse the vehicle/drone throughout the field. The image for the same is obtained from Google maps API.
3. This feature further suggests the farmers over the substance to be used for the minor deviations that the current soil possess from the ideal requirements. Bio-Fertilizers such as Azotobacterial, Penicillium etc... are suggested based on the entered in values.
4. A portal for the farmers where they could send in their query to an agro expert and also contact them for further details.

Software Architecture- Control/Dataflow

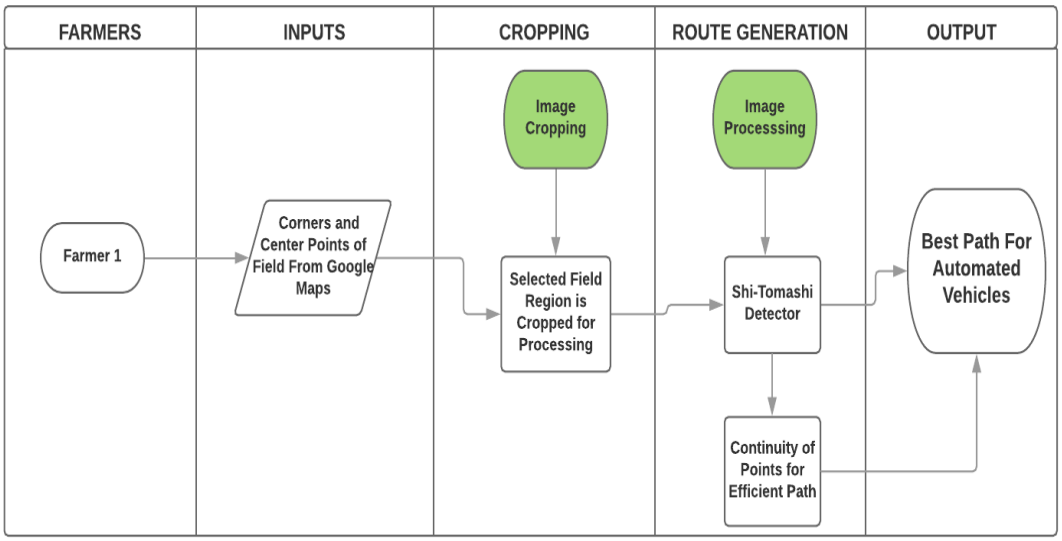
CROP RECOMMENDATION

P-Agri



ROUTE MAPPING

P-Agri



Supporting details

What regulatory requirements have to be met to bring the idea to life?

No regulatory requirements needed as of now, at this stage of the project.

What is a rough estimate of manufacturing costs?

Since the solution is complete software so no manufacturing cost required.

What is the volume of products/amount of revenue do we expect to make in the first year?

Our product will be subscription based, so we estimate about 200 customers/farmers. And each customer will have an option to go through various subscription packages. But for the first year we have to sell this product at a discounted cost and as per the growth in the number of subscriptions, we will increase the price of subscription next year.