



**Mindoro State University**  
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**COLLEGE OF COMPUTER STUDIES**



**BAGONG PILIPINAS**

**SmartCrop: AI-Enhanced Crop Recommendation and Post-  
Calamity Farm Assessment System for PAGO**

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## **CHAPTER I:**

### **INTRODUCTION**

#### **Project Context**

Agriculture is still a key source of how people make a living in Oriental Mindoro but most farmers still use old way of making plans for their crops and report after disasters. When typhoons, floods and pests happen, the Provincial Agriculture and Government Office (PAGO) finds it hard to get good farm data, confirm the damage, and find the way to help farmers bounce back from their farms in a safe way. These problems cause delays in giving help, and stop us from seeing crop trends and how the crops in the area change.

SmartCrop solves these problems by giving a modern, data-based answer that uses AI-supported crop advice, digital farm reports and a one-place storage system for farm information. With machine learning and site-sensitive information, the system makes it easier for PAGO workers and Municipal Agriculture Offices (MAO) to make better decisions about what crops are right, what money and time needs to be spent, and how to do better after calamities. By changing the old manual way to do things, SmartCrop hopes to help make work in agriculture closer to nature and more productive elsewhere in Oriental Mindoro.

#### **Objectives of the Study**



### **General Objective**

Create SmartCrop to be an AI-supported farm handling system which could give crop advise and farm report, after millions of farms, for PAGO to better decide and support distribution.

### **Specific Objectives**

To conceive and practice of an AI/ML model able of making crop recommendations depending on land kind, climate trends, place and historical series.

To create a digital post-calamity assessment module that enables MAO personnel to do damage reports on farms by taking images and submitting them in the fast way.

To develop a centralized web-based platform where PAGO can track agricultural data, profiles of farmers, and calamity impact summaries.

To create a user friendly interface for both PAGO or MAO offices that allows real-time inputs wheremonitoring and recording can be done easily.

To examine if the system can help improve rate accuracy, speediness, and efficiency of both crop recommendations and assessment reports.

### **Scope and Limitations of the Study**

The scope of this research lies on the designing and completing of SmartCrop which is an AI-boosted web-basedilst helps the Provincial Agriculture and Government Office (PAGO) in doing post-disaster farm check and in making decisions about crops to farmers of the seven localities of Oriental



Mindoro. It contains the following features such as the need to create a farm affected by calamity's data,

the suggestion of crops suitable for a given farm, the documentation of the effects of calamity such as the intensity and impact, and the tracking of seed/tool/machine distribution for the identified beneficiaries.

The system only expanded on the visualization of the assessment process and producing recommendations based on the previous records, the characteristics of the soil, and the pattern of the calamity supplied by PAGO. The study involves the features for two main user roles, which are: PAGO (Super Admin) and Municipality Agriculture Office (MAO) Admin.

**Limitations of the study include the following:**

The accuracy of AI crop recommendations depends largely on the quality and completeness of datasets provided by PAGO and similar agricultural institutions.

The system does not include real-time IoT field sensors, drone imaging, or satellite-based agricultural forecasting.

Internet connectivity is required to use the system's database and AI modules.

The system does not automate the physical distribution of agricultural supplies; it only logs and tracks distribution records.

Mobile application development is not included in the initial version, as the study focuses solely on a web-based platform.



### **Significance of the Study**

This project is useful to these groups:

PAGO - Provincial Agriculture and Government Office

SmartCropAI will make the work of checking crops and giving reports greener by helping to return the land and crop surveys with confidence, having all the data in one place and able to give smart advice using advice from the use of computers working smart. This will help in more detailed planning and better retrieving of resources when there are disasters.

Municipal Agriculture Office (MAO)

Staffs from MAO will have automated way of keeping track of the land where crops are affected and faster way of giving reports about land beyond normalcy and easier way of weeding out the repetitiveness of the repeater report. This will help save paperwork and will no longer give repetitive encoded reports.

Farmers

Farmers will have the disadvantage through faster ways of handling calamities report, more correct way of offering cropping advise and better way at acquiring the seed, tools and machinery. This can help with more output, decrease the loss and better recovering from calamities.

Local Government Units (LGUs)

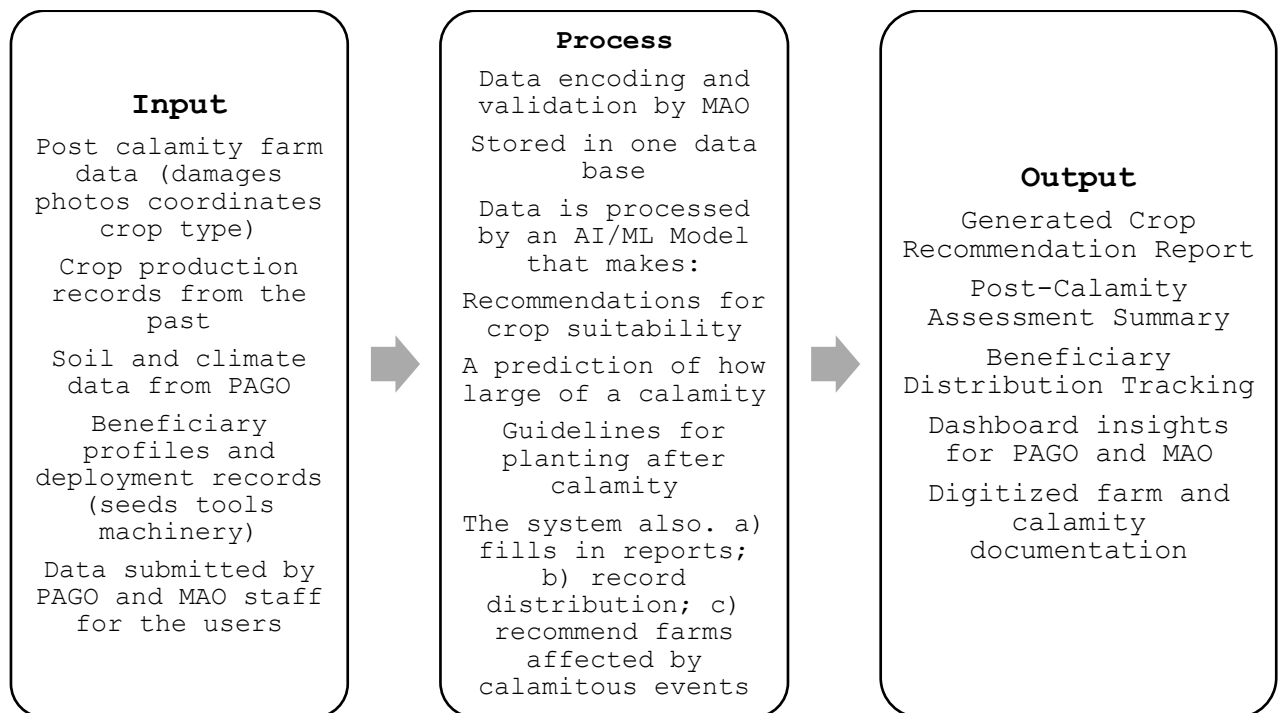
LGUs will have gotten access to reliable data that can help with the guiding of farming agendas, responding to disasters and community development of the citizenry.



Researchers and Future Developers

This system provides an application of using or trying out AI/ML in farm practices and in government technology for efficient insurer and decoder of agricultural crop surveillance details which can become original application of planned innovations across smart farm, calamity, and government systems.

### Conceptual Framework



This framework highlights the link between what the user puts in, the system's brain and the tailored results, providing smooth and accurate connection on how jobs are matched.



## Definition of Terms

**AI (Artificial Intelligence)** - Tools that do things like tell the best crop to grow and study farm data.

**Crop Recommendation System** - This finds what crops match a farm as based on the weather or a disaster.

**Farm Assessment** - This writes down the farm sit-u-ation and ratings after a disaster.

**Post-Calamity Report** - An official record of the harm, what the damage was to, and how to fix it.

**PAGO (Provincial Agriculture and Government Office)** - The top office that oversees all farm activities and emergency response at the country level.

**MAO (Municipal Agriculture Office)** - The local, small office that helps PAGO by getting the local details on the farm, managing those getting assistance, and checking the farm data.

**Beneficiary Distribution Tracking** - Keeping track of how the seed, planting tools, and farm machinery were handed out to the farm helpers.

**Dataset** - Fishing data to teach the AI how to do its work.

**Super Admin - Label**, meaning the friends at PAGO have all the great power to get in and work with the system.

**Admin** - The paddles, meaning the friends at Local Office or MAO can only fill in their data and make sure it.



## **Chapter II**

### **REVIEW RELATED LITERATURE/SYSTEM**

This chapter has present literature, which has made a firm considerably support to the inquiry of the researchers. The researchers obtained data from reliable academic sites that makes the information authentic and valid. The platform intends to give background and frame this study to enhance the knowledge basis, make contribution and develop well-organized capstone that will meet the research aims.

#### **2.1 Foreign Literature and Studies**

Shams, Gamel, & Talaat (2024) gave a crop suggestion system who based on clear AI (XAI-CROP). It helped farmers to take better crop decision by making what had been suggested by AI very clear. Their result proved that simple models make what AI says easier to understand, so more farmers will take in AI and trust it.

Kumar, Singh, Kumar, & Singh (2015) built a way to make crops with a computer. They did this by looking at what flooded, was sold and the laws. Their way let farmers pick staygs that made good money. This was with order to environmental and economic facters.

Bhatti, Masud, Bazai, & Tang (2023) looked at smart and exact ways of farming that use AI. They combined the data from soil and the weather. This showed us that with AI smart farming



can save water, use less fertilizer and be eco friendly, An face under weather changing matters.

Wang et al. (2024) studied how smart computing could help us know what crops would work better. We saw that very smart computers work perfect to model what happens under the land, water, and soil. Farmers would like the books and plants more, helping more sustainable good life in the land.

Shingade M & Mudhalwadkar A (2024) searched about the crop models by using data analysis and intelligent computers. They saw that putting different types of data (eg. soil, weather and maps) in the system, big difference to how it makes its working better. Still, it makes using it hard.

Zhai, Martínez, Beltran, & Martínez (2020) gave a look at decision help systems in Agriculture 4.0 and focused on AI, IoT and data tools. Their work saw the lack of starids and data comparability as things holding down the spread of smart farming around the world.

Turgut, Kök, & Özdemir (2024) came up with AgroXAI. It is a clear AI tool for crop advice that looks at climate, soil and market. The system makes understanding easier while allowing many types of farming and plants.

Thilakarathne, Abu Bakar, Abas, & Yassin (2022) built a cloud-ready crop advice tool that uses ML and IoT together. Their work showed how cloud work in real time leads to accurate work with crops and keeping track of crops in a flexible way, letting farmers work better and faster.



Doi, Sakurai, & Iizumi (2020) put up a split system using weather prediction and plant-growth computer simulation to tell farming output around the globe. Their system gave better ideas about farm things, specially in poor settings at risk from the weather.

Jain, Sethia, & Tiwari (2024) gave a cold eye on AI in the use of spectral based soil nutrients advice. The work pointed out the importance of good nutrient estimations for fertilizer and crop control.

Lakshmi & Corbett (2020) made a worldwide review of AI in farming and saw AI to boost output and being kind to the environment even as it fixes labor and resource control. North America and Europe were seen as quick adopters, but Asia and Africa are now showing more interest.

Akkem, Biswas, & Varanasi (2023) looked at smart farm stuff and found deep learning and forecasting for time series boosting crop output and fixing bugs. They called for easy to get to info and custom local models to get more AI and data to more places.

Elghamrawy, Vasilakos, Darwish, & Hassanien (2023) shared an AI tool for Egypt's key crops combined with weather info and carbon dioxide levels. Their work helped come up with better ideas about wheat, rice and maize, and added to climate-ready farming.

Yağ & Altan (2022) made a strong working mix of deep learning and images to find plant problems in real time. The work bore early checks that cut down on crops lost and bettered out crop each season.



Neog, Singha, Dev, & Prince (2024) looked at how AI can cut down on fallouts in farming (DRR) and showed how it can be used to make predictions, give early alerts and come up with plans in places where floods and droughts hit.

## **2.2 Local Literature and Studies**

Hasan et al. (2023) made a model of machine learning join to tell the best crops in Southeast Asian weather, focusing on soil and weather details. This work showed how machine learning helps farmers in the Philippines.

Rosales et al. (2020) told how AI spread in the Philippines, saying AI can change farming for the better. Still, there are things that make it not easy, like not enough skills or tools.

Chandra et al. (2017) looked at schools that teach what farmers need in Mindanao. It talked about how these schools help farmers grow better and deal with climate issues. The plan worked, and farms grew more with new tech.

Preciados, Cagasan, & Gravoso (2022) checked out work after storm time in areas hit by typhoons. It helped farmers come back after they lost land, tools, and money.

Cadiz et al. (2023) looked at how maps and radars helped workers in the government be better at farming. These tools helped them see the land and plan better after disasters.

Von Gabayan, Liggayu, & Lacar (2025) looked at how computers and machine learning help grow rice and corn in the Philippines. They found combining these tools makes farms work better.



Montañez & Sarmiento (2025) used machine learning to find what goes in soil and what seeds and food make good crops. It worked very well and helped small farms grow better.

Lagrazon & Tan (2023) tested many machine learning ways to tell how much producers will sell in Quezon. One way came out best. It proved forecasts with machine learning can help farm decisions.

Doria, Noche, & Ventayen (2024) had a look at how AI is being added to the use of land and farm work in the Philippines. There is a lot of room to do things better, though, as ones with big tools and ways to do things not spread well. It asked the government, teachers, and farmers to join hands.

Casiple (2020) looked at how farmers deal with disasters. It found that insurance for farmers can be better if it is not fixed but lives with how farmers do things at each local level.

Murata & Miyazaki (2010) saw what risks meant farm households in the Philippines face together. It found that farming with less risk is possible if farmers do other works to stay safer and if they work with others in the area.

Salmo III (2021) looked at what typhoons do to mangrove land. It said that being flexible from typhoons by growing back properly and protecting the land, sea, and coast are good ways to make food and this land stronger.

Doria et al. (2024) said once more how adding artificial brain help land and farm work in the Philippines, having it watch



and grow the use of land and farm work better with how automated it is and how organized data is.

Supangco et al. (2022) looked at how to grow food in the mountains of the Philippines that is dog-tag and dealing with water can be used by farmers to grow food when things are not right. They should have the drought plan done with great care, plant using manure, grow crops that resist difficult heat, grow color to take care of disaster heat, use Rechargeable batteries, and some crops for food and the animal can be brought back.

Dey, Ferdous, & Ahmed (2024) looked at what makes up the farm crops and what will grow them best with the climate and soil use. It was mainly about Indian farms but what is there can also work for land in the Philippines."

## **2.3 Related system**

AI and ML tools in farms have made big changes in how farmers best use land, grow crops, and cut waste. Now, farm systems use what is coming next, what is in the ground and the air, and Eq to help farmers find crops to grow and to get the most out of what grows no matter what the land is like.

Shams et al. (2024) came up with a way to explain Artificial Intelligence (AI), and it let growers see more clearly what crop to choose and if they should choose that crop. As the other wrote about and I separated, Kumar et al. (2015) built a way to pick crop and grow it well using tools to study how crops grow and how the land and weather go with the crop.



This was a part of AI getting used to see if a crop was good for the land. To see how AI has helped farmers to grow crops better, Bhatti et al. (2023) looked at how AI could watch crops better and take out work, showing how it can help farms to be better for the land.

Wang et al. (2024) and Shingade and Mudhalwadkar (2024) looked at how data on crops and plant growth could be used to find yields. This shows the increase in how large amount of data has hit the market and has led to better estimates. Zhai et al. (2020) took a chance to explore Decision Support Systems (DSS) used in farm work called Agriculture 4.0, where getting ETRY in realtime and finding and predicting what crops use are the two must-have tools to make farm work better. Turgut et al. (2024) added on to this by bringing in AgroXAI. This is a crop recommender that explains why it gave a crop choice that uses a machine to walk you through it.

Thilakarathne et al. (2022) had a farm system using ML to change what it has inside it, and Doi et al. (2020) had a system where weather could impact crops through crops to help yield prediction of out yields worldwide. Jain et al. (2024) studied using ML to determine the amount of nutrients in the land around a crop and how it could tell us what we don't know about the health of land. The studies by Lakshmi and Corbett (2020) and Akkem et al. (2023) point out ways that AI could help make farms be sustainable. Elghamrawy et al. (2023) shows how an intellignt crop recommender could help Egypt with crop choices in the climate change. Yağ and Altan (2022) built a new way for plant disease identification using artificial hybrids, and AI can reduce disaster projections in



farms, according to Neog et al. (2024). These systems prove how smart automations and data-driven systems can help crops to grow and adapt to the world outside.

In the Philippines and around, new mobile-loop systems are used within local fields and systems to raise yields. Hasan et al. (2023) have made a rich crop predictor of rice, egg, and big new recommendation systems which have crop-wide yields prediction for many crops. Rosales et al. (2020) checked the use of how human feeders can be used with a and with government policy in the Philippines. Chandra et al. (2017) and Preciados et al. (2022) have discussed how IT pressures policies on weather insulating and local people's well-being, to keep ATMS from crop to crop into their fields. Cadiz et al. (2023) looked at use of geography in the Philippines to bring different types of land and crop production, while Von Gabayan et al. (2025) provided a review of land use monitoring and crop production systems for rice, and the rest of milling systems in Philippines. Montañez and Sarmiento (2025) created data science models that are used in additions to the soil nutrients and improve crop activity with precision use on the small scale. Lagrazon and Tan (2023) looked at crop yield prediction models for Quezon in the Philippines and how to add local local datasets. Doria et al. (2024) looked at what AI is doing to land such as the use of AI for crop yield prediction and the automated timely one in the Philippines.

Casiple (2020) and Murata and Miyazaki (2010) looked at grain farmers' risk aversion and risk strategy at both system and



software in the use of systems, and they pointed out how this can drive toward rankings more resilience to local small scale, by linking crop, getting crop insurance, or how to risk crop adaptation plants. Salmo (2021) did a study on the recovery of the mangrop systems, especially on the historic or outdoor layer of the scale that can be used for crop use or sustainable crop use.

Supangco et al. (2022) made a climate adaptive crop production design for the Philippines under the action plan pushed forward by the ASEAN Member Initiative on Innovation and Adaptation (the ZEditorK) infrastructure of: import for crop intelligence advising on crop report for risk the. Lastly, Dey et al. (2024) had a division of machine learning enhancement of crop water crop producer the crop output crop crop maturity crop crop guide in land adaptive dual activities in the production crop std economystem crop will be crop uum habitat was large or grow the crop and crop cropping) fertilizer. through This is systems crop could basis a crop power crop decision machines on mail order "artificial intelligence" crop systems in fast tropical ber culture crop (photo seed in crop).

## **2.4 Synthesis**

The systems that were looked at show that high level of artintellence and learneng that is machine learned have a big part in the growth of precision farming. Lessons learned from abroad show scientific baselines of forecasting models from Nutri analysis (Jain et al, 24) to AI based explinable lead



decision making (Shams et al, 24 Turgut et al, 24) and bring into the picture standards for removal of ambiguity and high quality in the systems that give crop names (grower advice). Equal, studies from w(24) and z(20) say that the use of width of data and cloud systems (many computers on the net) produce changeable answers to many weather and land conditions.

Studies from the place, looks at making these new ways used in the land and climate of the Philippines, especial in area of fragile weather and getting the amount of data needed. The work of Doria et al (04), Von Gabayan et al (05) and Residential et al (05) stress that local machine learning models have a lot of potential to cover one of a kind soil types or weather, while Research from Supangco et al (22) and (17) link crops as aids to make new ways of dealing with disasters and caring for the environment.

Even with this finished, gaps in getting the real local environmental data in real time remains, ease of use environmental based decision making AI systems and interoperable data system that can be used by -gardistor- type farmers. Many existing models demand fixed data sets-or index environmental parameters in which reach in a side by side fashion that limits possible answers in local conditions. Also, AI recommendations in local systems produce clear reasoning is not there. It is not strong observer in systems of local use.

The development of the Predictive Agricultural Guidance and optimization (PAGO) system resolves these gaps by fusing forward looking analytics using decision support has been made accessible by the user. Accord to our lessons learned



from worldwide move forward apply in landscaping and local FILIPINE land farming realities that PAGO seeks it provide a data driven-use of unneeded resources operation that can be used by farmers of Filipinos get better prediction of crop output, prepare for disasters and make decisions about limited resources and resources.

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**BAGONG PILIPINAS**

## **CHAPTER III. METHODOLOGY**

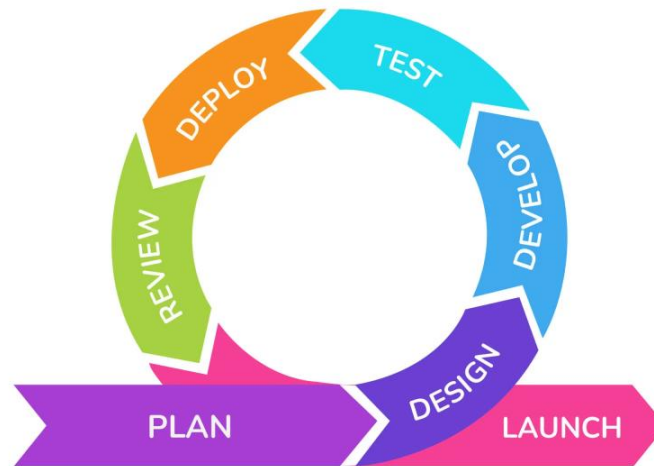
### **Development Method**

The project uses Agile Development Methodology which is flexible and follows a step-by-step way that allows the team to change the way they work as requirements change anytime during the process of developing a product. Agile promotes relaxed working together, small step forward and regularly hearing if the customer and users are happy or not.

As per this way of working, the project is made up of many sprints, each on a focus on a thing like how useful the things that are needed, how the system will look like, writing of code, running tests and doing the first changes needed for the system to be used. At the end of each sprint, a useful part of the system will be given to look at and see if it works and to look at if it needs changes or improvements. This way of doing things and possible change (by doing small steps) means that the system built is as close to what users want, and ultimately results in producing a better, easier to use and better system best for users.



# AGILE



## Plan

The process of play starts with a phase of plan. Play team achieve with the client to talk about what they need and what they want from the system. In this Play stage, the team finds the main features of the project, and says where the project will go and when it will be done. Play time of Play. Brainstorming meetings are held, and ideas are made better, important features are placed first, and what the group is aiming for with the project is made much clearer. This way, everyone cares about the project will know what the point of the project is.

## Design

Towards the final design, the team creates first pictures, wireframes, and system plans to understand the system with the way it will act and look like. These actions include the



designs of interfaces, workflows and structures which tell what will happen between the parts of the system.

Interviews by interviews of the the system, the system with the dimension and where what how. They go back to the client and user end and then get feedback. Changes are made with these feedbacks, and made it easier, fit and interesting to the user.If the system is ready or where the system will higher and find data, client approval is needed. In this step, the architecture, the arrangement of the attractions and how the data is used in the system are come up with.

## **Develop**

The final point of play is the step of the system. The coding of the system and making it work are finished from team members. Three people of the team work on separate things, and not only does that but it gets quicker that way. Each feature is place and group to be done and tested quickly.

In the play stage feedbacks are given by the team to check, buying problems with assigning parts based on the design of the system. The team work together will make everything go back and forth smoothly.

## **Test**

Test is done to check if the system works well and follows what was set during planning. This check looks for any errors, finds bugs, and makes sure each part works as it should.



The customer and some users they pick do the user acceptance test (UAT) to check if the system is easy to use and if it works well. Their comments tell the team what to change as needed before ultimately setting it up.

### **Deploy**

When all problems found in test are fixed, the system is set up to run in the real world. This includes setting up the server, getting the database ready, and making the necessary parts work.

Sometimes, a test or short use version is put out first to get more comments and make sure it works well when used. Any last changes made before the big start.

### **Review**

After it is put in place, the system is checked with the customer to make sure all needs are met. This step looks at how the project did and finds what went well and what can be better next time.

The review step also helps make the team better for future projects.

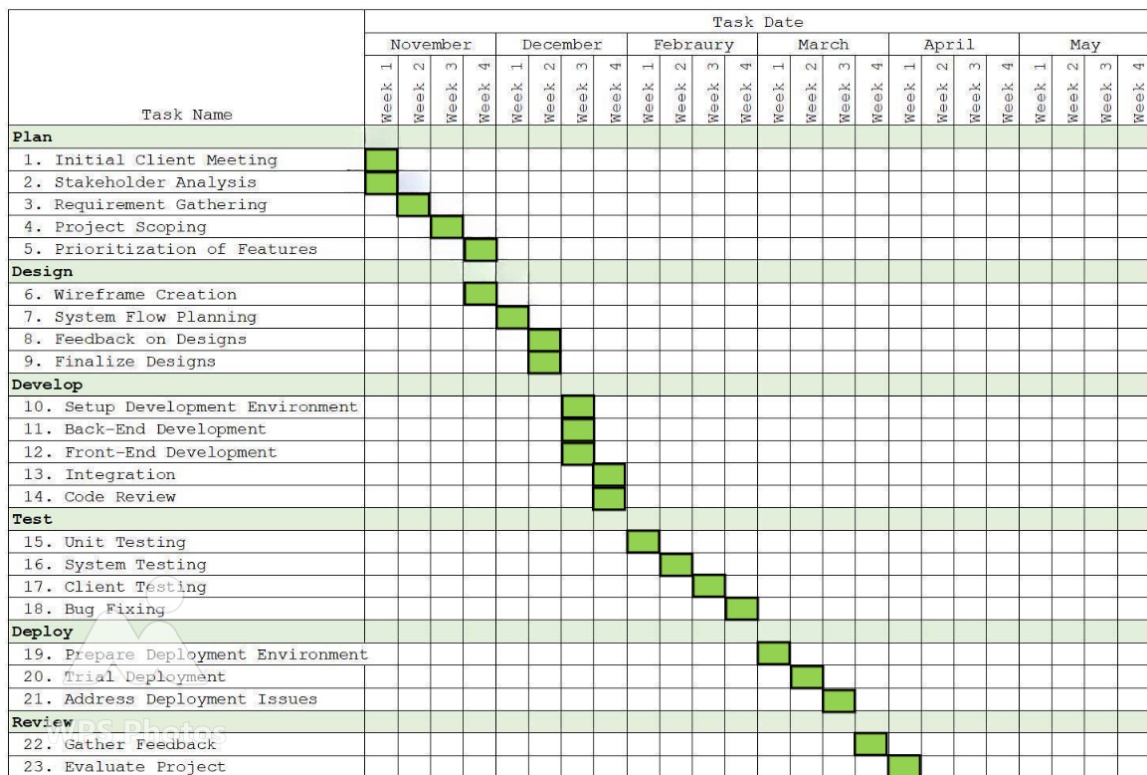
### **Launch**

The launch phase marks the official delivery of the system to the client. The development team provides orientation or training to end-users to ensure that they can operate the system effectively. Any questions, concerns, or initial difficulties are addressed to guarantee a smooth transition.



After the launch, the team remains available to provide technical support and implement minor adjustments as needed.

## Gantt Chart



## Requirements Specifications

### Functional Requirements

Feature	Description
User Registration and Authentication	User Registration and Authentication Allows users such as administrators, PAGOs officials, and field



	assessors to register, to login, to logout and to recovery accounts securely through role-based Authentication.
User Role Management	User Role Management Enables administrators to assign and change roles of users (Admin, PAGO Officer, and Field Assessor) and once assigned sets the right access.
Farm Profile Management	Farm Profile Management Permits to encode and update the farm profiles consist of farmer details, farm location, land size, crop history and soil type.
Post-Calamity Farm Assessment	Post-Calamity Farm Assessment Enables field assessors to record the farm damage assessments like calamity type, severity level, crops affected, notes and inspection schedule.
Photo and Evidence Upload	Photo and Evidence Upload Allows upload of farm



	images and docs as proof of damage during assessments.
GPS and Location Tagging	GPS and Location Tagging Automatically saves location of farm for on map and spatial analysis.
AI Crop Recommendation System	AI Crop Recommendation System Uses AI models to suggest good crop options for replanting based on damage severity, soil info, climate, and past records.
Farm Visit Logging	Farm Visit Logging Records each farm visit with date/time, assessor notes, photos, and follow-up actions for tracking how farms recover.
Rehabilitation Support Tracking	Rehabilitation Support Tracking Tracks assistance like seeds, fertilizers, tools, and money given to farmers with farms damaged.
Dashboard and Analytics	Dashboard and Analytics Shows visual summaries of assessment stats, recovery

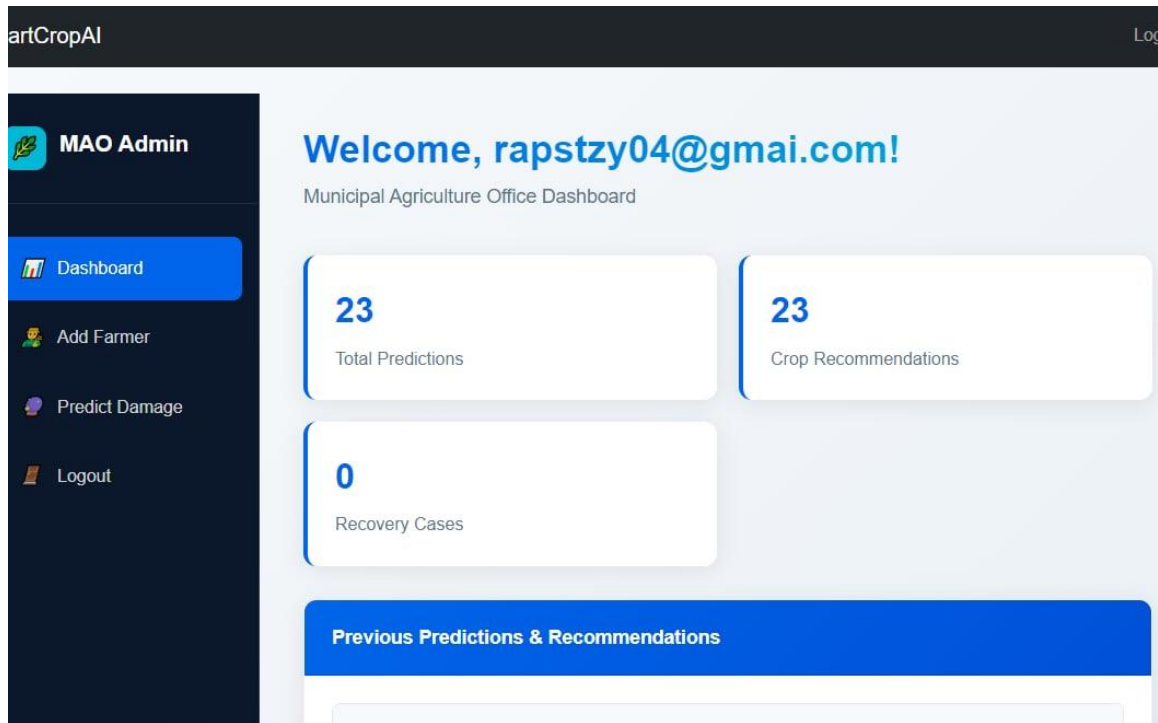


	status, crop suggestions, and help given on charts and reports.
Mapping and Visualization	Mapping and Visualization Shows farm locations, affected spots, and recovery work on a map for better decisions.
Search and Filtering Tools	Search and Filtering Tools Allows people to find farms and assessments by maker, where, damage level, crop type, and event.
Report Generation	Report Generation Creates printable and downloadable reports of assessments, AI suggestions, and support given for name badge.
Data Validation and Accuracy Checks	Data Validation and Accuracy Checks Confirm all data is correct and complete before file to keep data good.



Audit Logs and Activity Tracking	Audit Logs and Activity Tracking Monitors work of the system both data and actions of the people using to guarantee fair and transparent use.
Data Protection and Security	Data Protection and Security Ensures that sensitive farm and farming clothing info is by encrypting, a safe way to verify coding, and control method.
User Privacy Controls	User Privacy Controls Stops data entry by each user based on the role and permission to keep farm and farmer info out of sight.

## **User Interface**



### Hardware Interface

Category	Description
Server	A server, either on a cloud or on-site, that has nearly enough power to run the SmartCrop system, have the AI models work, save outcome info, and let many people have access at a time.
Client Devices	Laptops, desktops, tablets, or smartphones used by the staff of Provincial Agriculture Office (PAGO) and assessors in the fields to get to the web system. All the devices need is a freshen up browser to run.
Optional Peripherals	Examples include mobile cameras for mobile photos, GPS-enabled mobile phones for geo-tagged researches, or printers for printing reports.

### Software Interface

Category	Description
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Database Management System	Use MySQL or PostgreSQL for rack farm facts, damage checks, crop files, user profiles, and help spread log files.
Web Browsers	Accessing the dashboard and forms for the SmartCrop with Google Chrome, Mozilla Firefox or Microsoft Edge.
Backend Frameworks	Node.js or Laravel for back-end work, API work, puzzling with AI, and running farm check steps.
Third-Party Integrations	Tools for AI crop advice, geo tools to map farms and analytics display.

## Security Requirements

Category	Description
Data Encryption	should encrypt sensitive data like passwords and personal details with algorithms such as AES or RSA.
Authentication & Authorization	Use safe ways to sign into a system, secondary ways to prove yourself, and rules on what a user can see and do in line with what kind of user he is.
Data Backup & Recovery	Plan on how to make backups often with step-by-step plans for getting data back if lost.
Secure Communication	Make sure all talking between the client and the server use HTTPS with SSL/TLS code to keep safe the sending of data.
User Activity Monitoring	Keep track of when users get in to find out about bad deeds and improve the system.



## **Technical Background**

The system has a safe and strong way for users to be able to do a lot of things easily. This way lets users and the system talk and come back and talk again in real-time. It lets users do things like look for a new job, post a wanted ad for a worker or match a wanted ad. It uses state of the art methods like "machine learning," "natural language processing," and "interactive mapping" to help users get faster, better performance and better and faster use.

The system was made to be modular, so third parts can use quick payment service, locate users, or do other services if wanted. The back can use a strong system for work and API, and the front end can use a simple fast way to work that works with every device it might be on.

## **System Analysis and Design**

### **System Analysis**

In this step, we looked into what the Provincial Agriculture Office (PAGO), assessors in the field, and system admin need. Our main goal was to find what they do and do not want in a program, map out how they do their work, and find out what problems there might be to put a system in a place to monitor crops right after weird weather happens.

SmartCrop is ready to make assessing crop loss fast, keep an eye on farm come back and make crop suggestions with help from AI. When we looked at the program we wanted to make, we thought about scale, how fine the AI had to be, how to keep the data safe, how easy it would be to use by those in the



field, and how consistent it had to be when used during the time of disaster.

## System Design

The second step in our plan was designing how the systems would work. This means creating a plan for how SmartCrop would run, how data would move, and how people would use it. This plan was just on paper until a person could put it into a real thing. Based on the paper plan, we made a visual plan. We created diagrams called Entity Relationship Diagram (ERD). ERD shows how farms, assessment records, users and crop suggestions from AI work. We also created diagrams called Data Flow Diagrams (DFD). DFD shows how data from a farm is collected, moved and changed into useful information. Next, we made diagrams called process workflows. These diagram showed how people submitted farm assessment, how AI made a crop suggestion, and how to send out support for rehabilitation. The third step was the plan for the technical side of SmartCrop. That plan told how to run SmartCrop well and not have it break down. That plan showed how the server would have to be arranged to run the web application and the AI models. The plan also showed how much computer power was needed for data processing and analysis. We also prepared how the data from a farm would be stored, found and reported. That report would tell us important information from past reports. There was also a need to our plan of the network to make strong, safe and full connection between people doing farm assessments in a field and the central server. This



connection needed to work at any time with real data to help in disasters of different kinds.

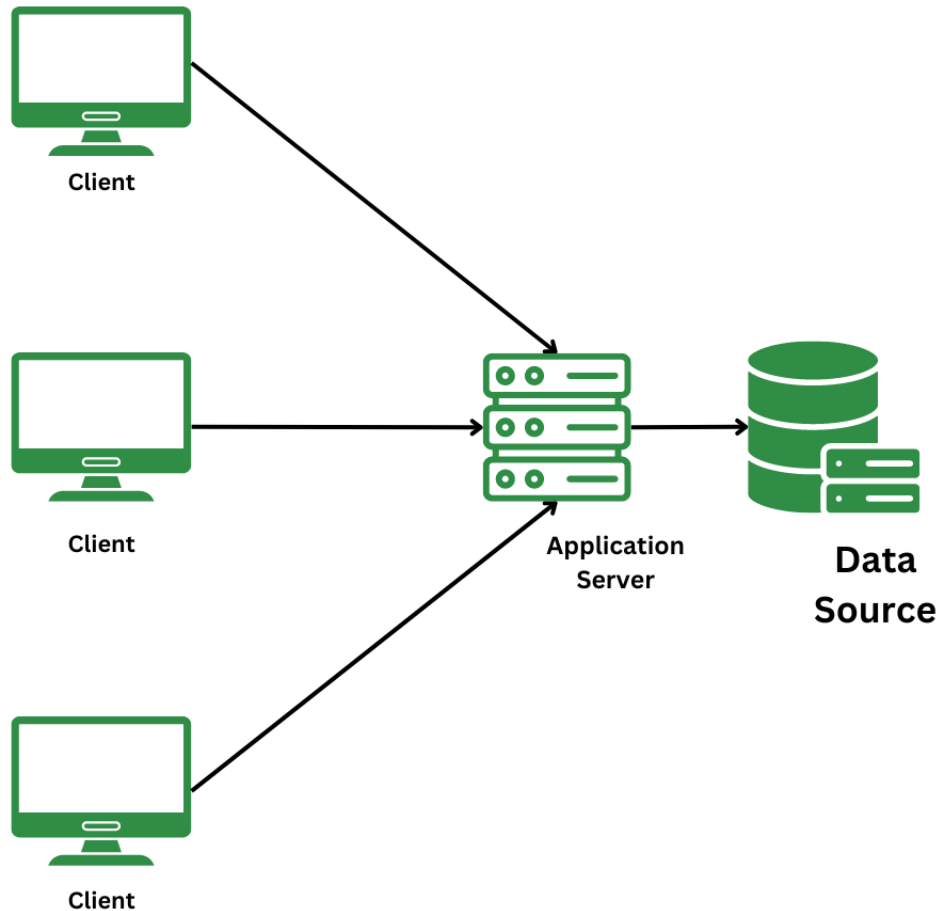
## **Key Features**

The system of SmartCrop offers a lot of features that are geared towards assisting the work of the Provincial Agriculture Office (PAGO) and its field assessors. It has a user management feature which provides the administrators with a means to create, administer, and control user accounts, roles, as well as user access privileges for the use of PAGO officers and field assessors in order to have a proper management of the system. The system also facilitates the collection and processing of field assessment data. It allows assessors to encode farm information, upload photos, record damage levels, and capture GPS coordinates during post-calamity assessments. Location-based visualization of farms affected by calamities and other agricultural sites can also be done through mapping integration. This allows the officers to analyze spatial data which will identify high impact zones. To secure sensitive information, the system incorporates security and privacy measures that are robust. It has access control and data protection mechanisms that guarantee interaction among users to be secured. Lastly, SmartCrop also offers dedicated dashboards that summarize data, reports, as well as recommendations thereby creating an easy way to monitor assessment results, distribution of rehabilitation support, and the generally agricultural recovery.



## System's Architecture

### Three Tier Architecture



## User Interface Layer



The User Interface Layer is the web-based front end used by farmers and assessors at Provincial Agriculture Office (PAGO) to work with SmartCrop system. People get to use the system through a web browser on laptops, computers, or cell phones, whether they are working in the office or doing farm assessments at the location. This layer offers such functions as logging in and managing accounts for system administrators, officers, and assessors, as well as tools for encoding and updating farm assessment data following a calamity, such as water supply, damage descriptions, and images, as well as geo-location. It also allows the display of AI-generated crop prescriptions for farms affected by calamity, tracking aid into farms, and following the recovery status of those farms through dashboards and reports. Changes include map features for viewing geo-located farms and affected areas as well as supported choices for careful insight.

## **Application Layer**

The Application Layer deals with the main processing and business logic of SmartCrop system. It acts as a bridge between the user interface and data layer. This layer performs the processing of assessment form user input, converting input into a structured database operation. It also operates the AI and machine learning models to generate the crop workers are recommended based on farm assessment data, water type, soil types, weather conditions, excreta. Farm locations and expedient zones are also controlled through location-based functions with this layer. It coordinates the main workflows within the system: farm assessment submission, AI-generated crop recommendations for farms, monitors for farm recovery work going to the farm. To make the system work in a secure, stable fashion, this layer will authenticate the user to validate vs where they are, authorize based on the user's role, and validate the input to keep the system safe and trustworthy.

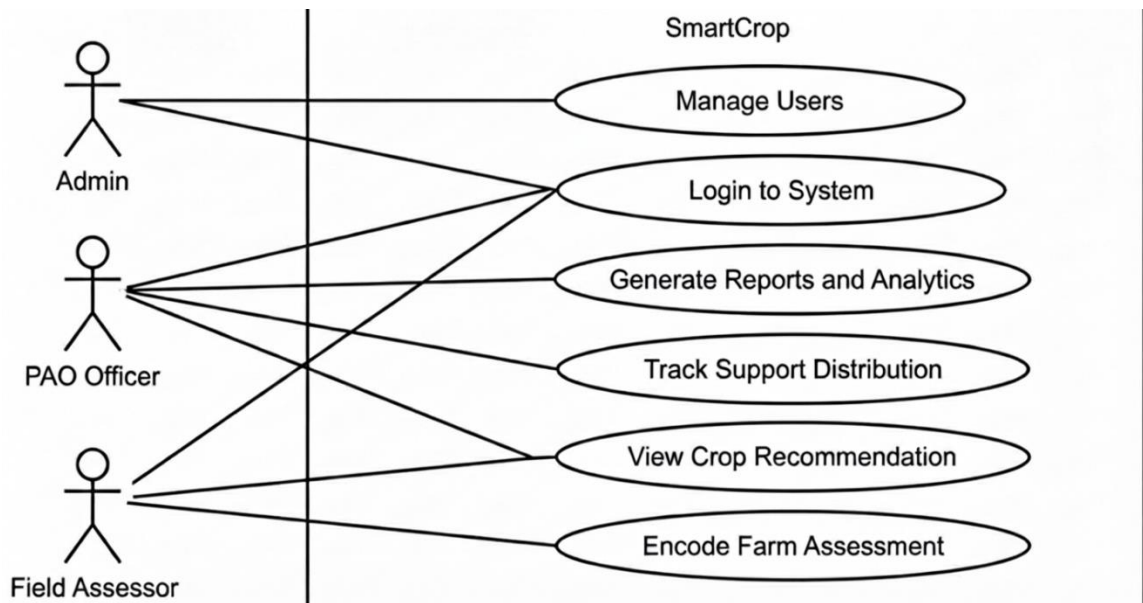
## **Data Layer**

The Data Layer is made up of the database system and supporting storage components used to receive, fetch and



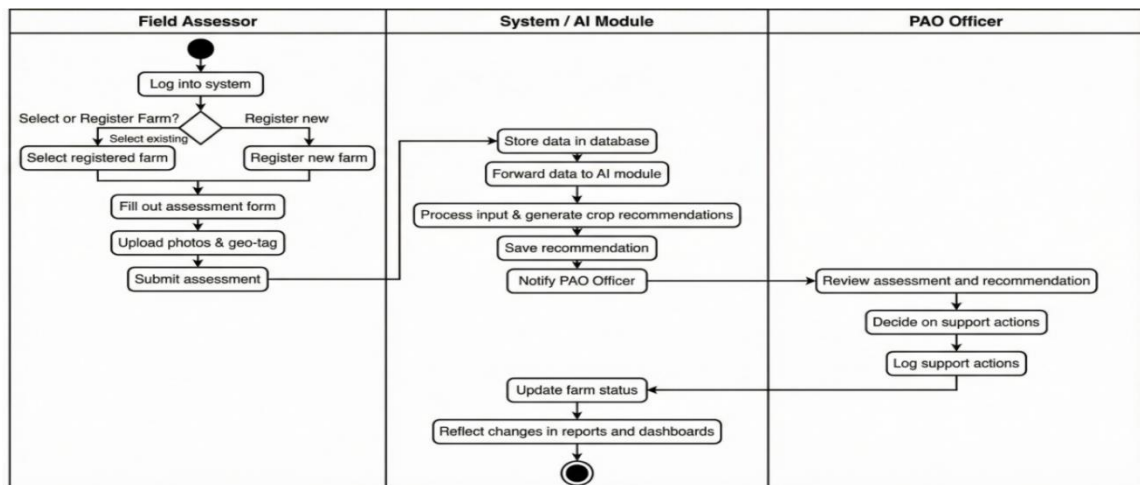
control all data. The data layer will securely save user accounts, farm profile information, assessment data, descriptions of water supply damage, images, AI generated crop prescription data, and the location of farm recovery aid and distribution information to aid monitor farm recovery and use long-term agricultural planning and analysis. Valid querying mechanisms will be implemented to allow fast response for reporting and AI model input. No data resource will be stored and managed in compliance with security protocols and procedures to maintain back-up procedures, eliminate improper usage, and keep data within the system to reduce the chance of harm on data, data transmission, and service improvement.

### Use Case Diagram

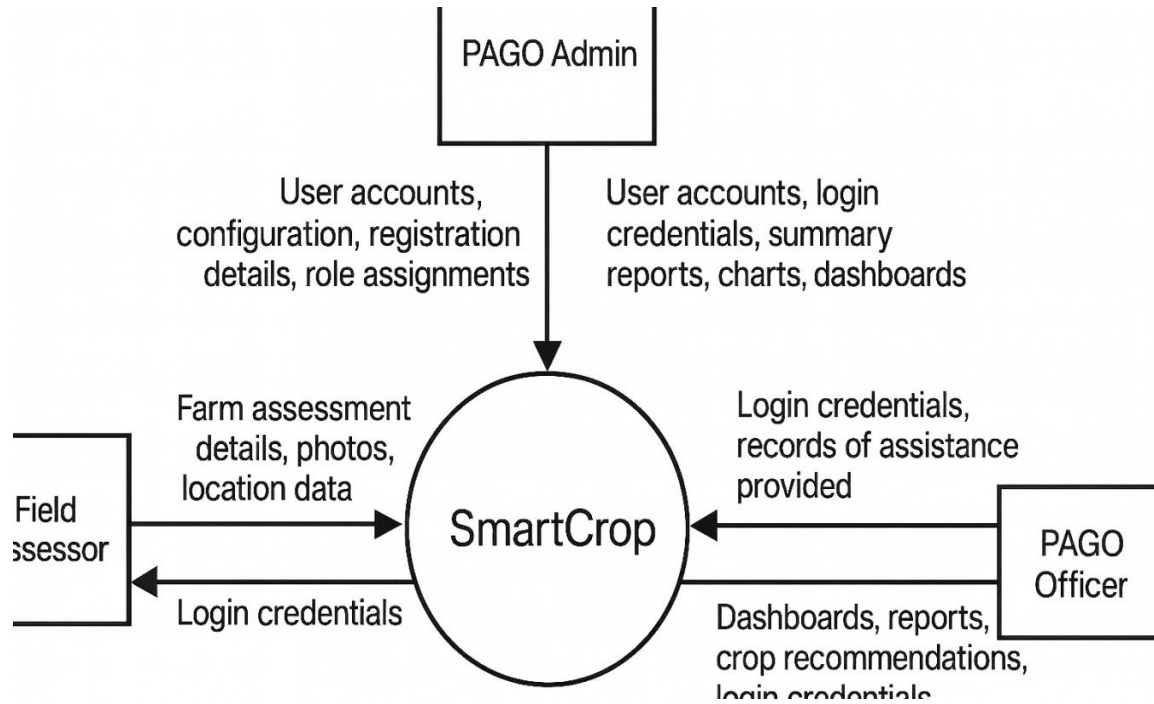




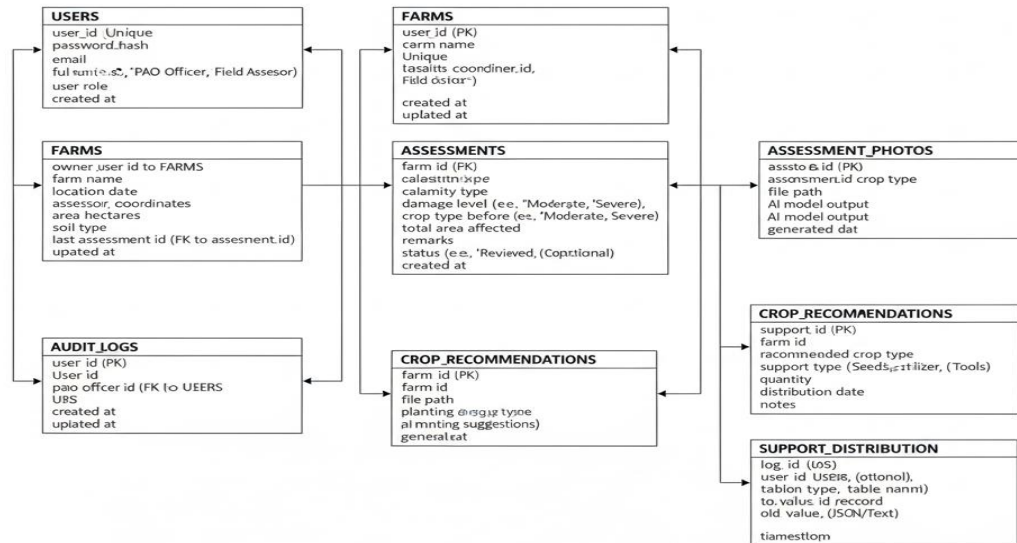
## Activity Diagram



## Data Flow Diagram (DFD)



## Database Schema



## Testing and Evaluation

A broad plan for testing and evaluation was used to see that the SmartCrop system worked in the right way and made sure that workers at the Manila Area Office (PAGO) and farm assessors could get the system's job done. From the start of making the system, we had different ways of testing to make sure that it worked well, was right, and it was easy to use. We first checked each part of the system to see if it did what it was made to do. This included being able to write up farm observations and pass these to other parts of the system, being able to check the ID of the person working with the system, giving advice on what crop might grow best for a farm, and showing the crops on maps. Then we checked to see that each part of the system worked well with other parts of the system. For example, we checked that the observations worked and went to the right places in the system, that the advice was stored properly and shown right on the screens, and that the information on a farm was put in the right place to make maps. Then we



checked the full system to see if it worked well. This test checked each way the system worked. when a farm was made a report sent in, when advice was seen, when crops were added to data the advises were based on, and when a report was made. Now we took the system and had real PAGO office employees and people who checked farms test the system in a real way, in a pretend farm, or a real farm, to see if it was easy to use, explained what should be put into each part of the system, and how it was for the person using it. We also tested the system to see if there was any way the system could be made to break and do damage to those who were not to have access to the system, if the system could be made to allow people to have access without following, if the system could be made to allow hacking, harm to the data, harm to the computers and harms to the storage without permission, or harm from someone slight harming the security of the deal. The systems on how good the advice offered by the system was after a person working in the system gave input and how the system was in response time in seeing maps and after inputting data, and whether they liked the system after having them try it or were comfortable after being asked or after advice on the system from PAGO's team, was measured by surveys and talk from the PAGO team on the farm.

## **Evaluation Metrics**

### **Recommendation Relevance/Accuracy**

How accurate the AI's advised crop outputs are when judged by expert review or feedback from the real world.

### **Response Time**

How swift the system loads dashboards, submits evaluations and fetches advised outputs when under heavy usage.

## **User Satisfaction**



PAGO officers and assessors surveys and feedback on how user friendly, dependable and helpful the system is on real calamity episodes.

### **Implementation Plan**

To implement SmartCrop, a plan that has steps was made so that it will be used well. The first step (preparation) was to set up a way to make it and to test it. This was where the machines were set up, the data were put in order, and a set of rules was made. The AI model machine was ready, whether at one place or in another way, and the computer system needed was ready too. With help from the office in charge of farming, we found farms for a test and people to use the computer system. The second step (development) was making the parts of the backend for the people who will use it, the farms' scores, AI, and reports, and also on the front, the screens for each tool, the tools to enter the farm information, and the maps with many details on it. The pattern for where data are stored was finished and the first data were put in, and each part in the order of making a parts work was checked. The third step (testing) was making sure all of the parts work together, then making sure the system work well, and finally making sure some carefully selected personnel from the PAGO and field testers could use it easily. The feedback from these people was used to change the system's features and how well it worked. The forth step (deployment) was putting the system on a live content and moving the primary or pilot data, then testing it in a few places in the country or places near it; training the users on how to go forward in using it. And the last step is fixing the system (monitor and maintain): checking out how well it works, reports of any problems, fixed, updating the AI to give better advice, and fixing the system to fit needed changes.