**“E-KETHA” : ENRICHING RICE FARMER’S QUALITY OF LIFE THROUGH A MOBILE APPLICCATION.**

2022-81

Project Proposal Report

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B.Sc. (Hons) Degree in Information Technology

Department of Computer Science and

Software Engineering

Sri Lanka Institute of Information Technology

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# **DECLARATION, COPYRIGHT STATEMENT AND THE STATEMENT OF THE SUPERVISOR**

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

|  |  |  |
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| Name | Student ID | Signature |
| H.H.W.M.Binuka Sihan Paranagama | IT19129372 |  |

The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation

under my supervision.

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Signature of the supervisor: Date:

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Signature of the co-supervisor: Date:

# **ABSTRACT**

In our country of Sri Lanka, rice is the most common type of food that is consumed in a daily basis. Due to that rice farmers face a huge amount of stress to supply according to the massive demand. One of the main problems rice farmers are currently facing is the improper use of fertilizers and the negative consequences due to it. These can range from harming the environment and the paddy itself then even to the humans. These topics was chosen due to there been recent reports of people getting sick. The aim is to develop a mobile application that will help farmers solve this particular problem. The application will use images to conduct image processing to analyze the area of the paddy field then again use image processing to identify the fertilizer belonging to the farmer. Finally machine learning and deep learning will provide the adequate dosage and the instructions.

Keywords :- rice crops, machine learning, image processing, deep learning, fertilizer

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# **INTRODUCTION**

## **Background**

As the most popular food in Sri Lanka [1] that is concerned in a daily basis, rice has quite the high demand. One of the prime reasoning for not been able to fulfill this requirement is the improper use of fertilizers affecting the crops negatively.

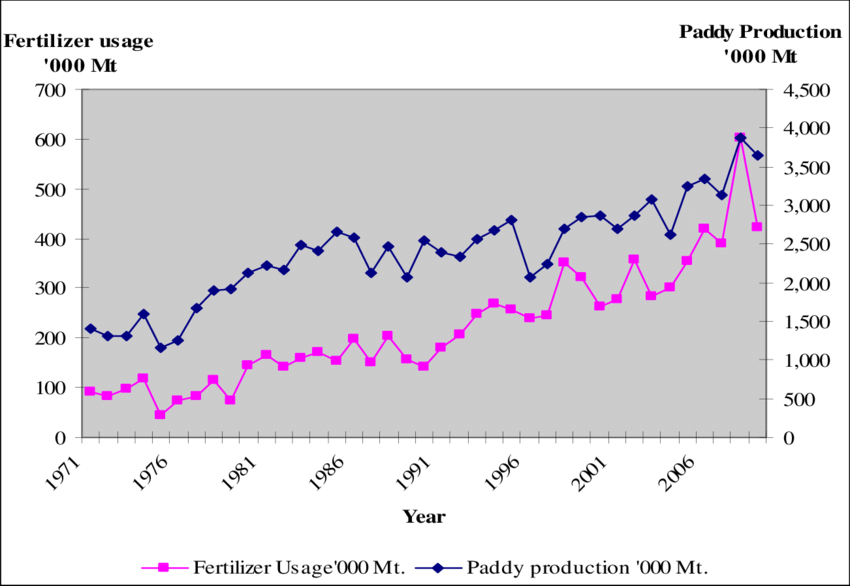


Figure 1: Paddy production according to the fertilizer usage

As it is shown in the above figure 1 [2] during the period of 1971 – 2010 the use of fertilizers has steadily increased in the country of Sri Lanka with it directly impacting the production of paddy. In the time duration of 1988 – 1991 there is a fluctuation in the usage of fertilization and if we see the same time period of paddy production the same exact fluctuation can be seen as well.

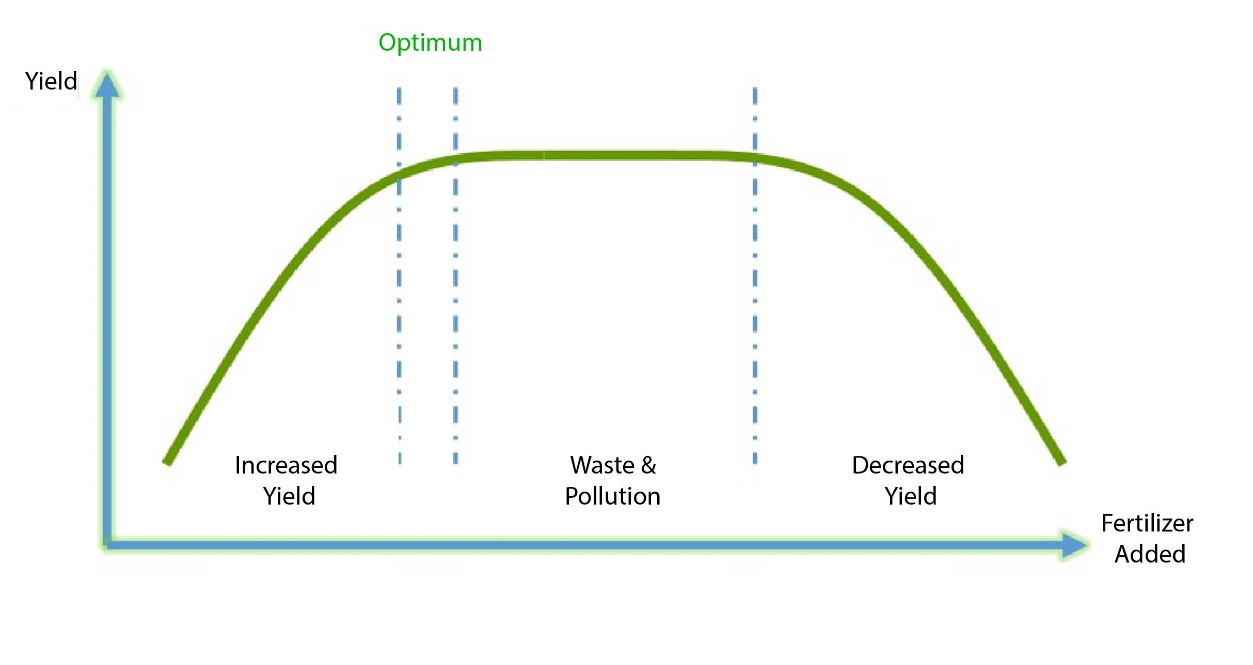


Figure 2:Increase of problems due to high improper fertilizer usage

When it comes to negative effects of improper fertilizer usage the above figure 2 [3] can be used as evidence. While reaching the optimum point, yield will steadily increase and after the optimum point, the surroundings will be polluted due to the buildup toxicity. And it further continued even the crops will be harmed.

As a solution for all these issues a mobile application will be proposed.

## **1.2 Literature Survey**

In literature survey I have looked for the same research areas and functionalities that are related to my research.

### **1.2.1 A nutrient recommendation system for soil fertilization based on evolutionary computation**

This study [4] is about predicting the fertilizers for different crops and give nutrients recommendations by analyzing the crop fertility and yield production. However, this application is limited to selected fertilizers (Nitrogen (N), Phosphorus (P), and Potassium (K)). This recommendation done by using improved genetic algorithm (IGA) which will uses time-series sensor data and recommends various crop settings. By analyzing the way that fertilizer works, the application will be able to give instructs farmers to get the maximum yield output.

### **1.2.2 On-line fertilizer recommendation system**

This application [12] will require several inputs from the user(Select state, select district, select soil type, select crop, select crop variety, select season). After providing the required information, the dominant of cropping systems in his district, the average soil fertility status of the district and also the agroclimatic zone in which the district occurs will be shown to the farmer. Finally when submitting farmer will be given the required quantities of nitrogen, phosphate, potash and straight fertilizers are shown in order to get the desired yield target. This application is available up-to 18 states.

Access : <http://www.nic.in/>

### **1.2.3 Prediction of Crop Fertilizer Consumption**

This research [13] is focused on identification of nitrogen deficiency and prediction of fertilizers consumption in chilly. First images of chilly are taken in two stages. Leaf part will be used to identification of nitrogen deficiency. This application will give proper guidance for optimal usage of these fertilizers and also get the required yield outcome that the farmers are expecting by minimizing wastage.

### **1.2.4 Integrated Fertilizer Management System (urvarak.nic.in)**

Integrated Fertilizer Management System (iFMS) [14] is functional since 2016 June. This system continues all the functionalities regarding the fertilizer supplier chin.

Uses of the application will be able to monitor all the fertilizer sales all over the country. To keep up the system up to date, application will gather fertilizer information from Aadhaar enabled PoS devices and update the software according to the information gathered, while making the payment to the participated companies on a weekly basis.

Access : <https://dbtfert.nic.in/iFMS/>

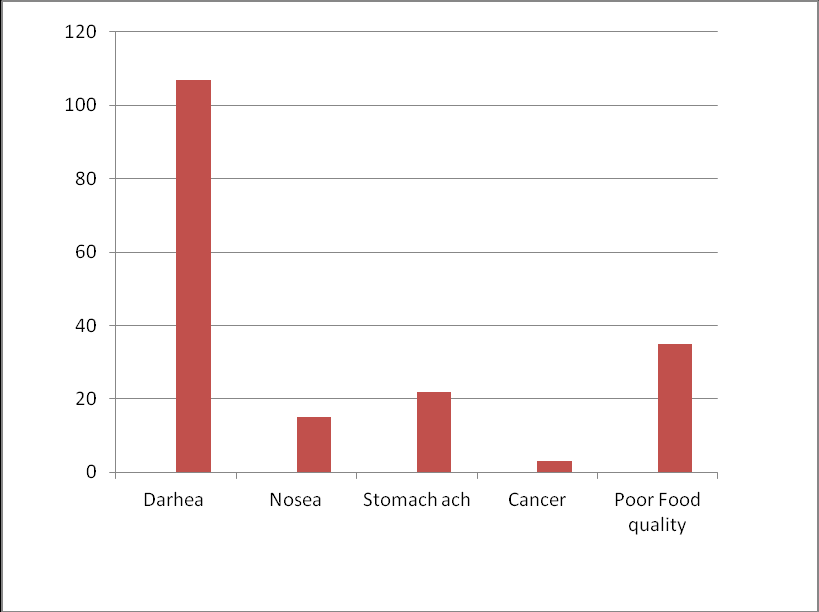
## **Research Gap**

The proposed application is to provide farmers proper guidance of how to apply fertilizers. Although there are several existing applications found, majority of them doesn’t achieve the main goal which is to give proper guidance to the farmers on how to fertilize their paddy field with their preferred fertilizer. The proposed application will have the ability to achieve the above mentioned goal.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Feature | A nutrient recommendation system | On-line fertilizer recommendation | Prediction of Crop Fertilizer | iFMS |
| Calculate paddy area | 🗶 | 🗶 | 🗶 | 🗶 |
| Identify fertilizer | 🗶 | 🗶 | 🗶 | 🗶 |
| Recommend fertilizer | ✓ | 🗶 | 🗶 | 🗶 |
| limited fertilizer range | ✓ | 🗶 | ✓ | 🗶 |
| Able to use for rice plant | ✓ | ✓ | 🗶 | 🗶 |
| Provide guidance | ✓ | ✓ | ✓ | 🗶 |
| Monitor fertilizer sales | 🗶 | 🗶 | 🗶 | ✓ |

Table 1: Comparing existing application and our application features

## **Research Problem**

Recognition of suitable fertilizers that are needed for the crops to grow healthy and abundant. Farmers due to lack proper guidance tent to use incorrect fertilizers, not only it effects the yields, fertilizers also have considerable side effects or even the correct fertilizers in wrong amounts thus making it harmful. This has become a major problem in Sri Lanka today due there being reports of various health concerns for the consumer such as increasing the risk of Alzheimer’s disease and Diabetes [5]. At worst, these fertilizers can cause the risks being expose to cancer in both adults and children adversely affecting fetal brain development [6] [7] [8].

.

Figure 3: Heath concerns in Buea

Above figure 3 [9] represent the average health issues occurred in Buea, Cameroon caused due to improper use of fertilizers.

Table

Description automatically generated

Figure 4:2013 Sri Lanka's Fertilizer consumption

According to the local newspaper [16] which was published in 2013, The World health Organization warded Sri Lanka because of high fertilizer consumption. At that time Sri Lanka was ranked as the number 1 country when it comes to fertilizer consumption among Asian countries. Above figure 4 [17] shows the fertilizer consumption amounts in 2013.

The environment is also damaged as a repercussion, examples being contaminated waterways, soil pollution and the destruction of algae [10] [11]. Therefor there is need of a proper guidance system which helps the farmers to continue their farming while preventing these issues.

## **OBJECTIVES**

### **2.1 Main Objectives**

Introduce a mobile application to Identify the fertilization information. Then give guidance to the farmer on how to use it properly according to fertilizer type.

The main objective of the application is to give proper guidance to the farmer on how to use fertilizers. In order to do that user will have the ability to take a picture of rice fields and fertilizers. This will help to identify the best utilization methods with detailed instructions including amount and dosage of fertilization that could be used to aid their growth using the machine learning. Then the farmer can easily conduct the fertilization according to the instructions given by the application.

### **2.2 Specific Objectives**

1. Calculate the area of the paddy field.

By using this paddy image taken by the farmer, first the application will analysis the image and calculate how much of a area does that particular paddy field contains. This information will be further used for the task of providing instructions.

2. Identify the fertilizer type.

By analyzing the fertilizer image, application will identify which type of a fertilizer that the farmer is trying to apply.

3. Providing the information on how to use the fertilizer properly.

After the completion of first 2 phases, application will analysis and get the optimum solutions to the farmer on how to fertilize their paddy field properly.

# **METHODOLOGY**

This section consists of a description about the techniques, mechanisms which will be used and what are the data sources and how they will be collected to build up this “Fertilizer recombination system”.

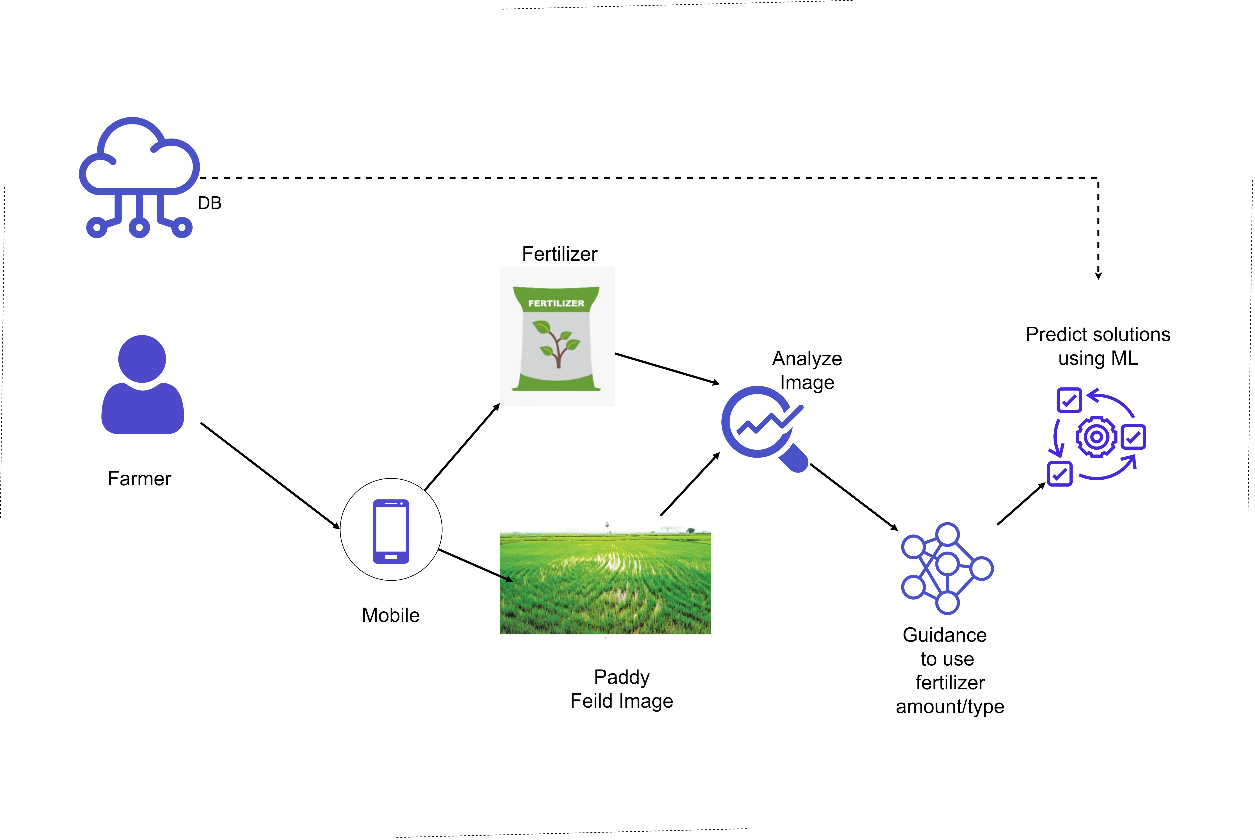
3.1 Component overview

Figure 5: fertilizer recommendation overview

S shown in the figure 4 this component has 3 major functionalities.

1. Calculate the area of the paddy field.

To give proper guidance for the farmer, first we need to identify how much of paddy field does the farmer needs to fertilize. By using this information the application will be able to give exact fertilizer amounts that has to apply for a specific paddy field. In order to predict this image processing technology will be used to identify and calculate the area of the specific paddy field. Farmer just have to take an image of the paddy field by using their mobile’s camera and the application will analyze the image then record the information.

2. Identify the fertilizer type.

To identify which type of a fertilizer that farmer is trying to use, image processing will be used. In this phase also farmer has to take a picture of the fertilizer. Then the application will analyze the fertilizer image to identify type of the fertilizer. In order to do this application will keep up a labeled image dataset of fertilizers. Results gained from recognition process will be recorded. Later this information will be used to predict optimum solutions.

3. Providing the information on how to use the fertilizer properly.

After the first 2 phases completed to predict the optimum outcome machine learning algorithms will be used. By using the fertilizer type application will look for the best ways of utilizing that particular fertilizer. Then the by using the paddy field area the application will give a proper guidance for the farmer on how to utilize the fertilizer. What amount should be applied, How the fertilization has to conduct, What are fertilization during different time phases, etc.. Refer the figure 5 [15].

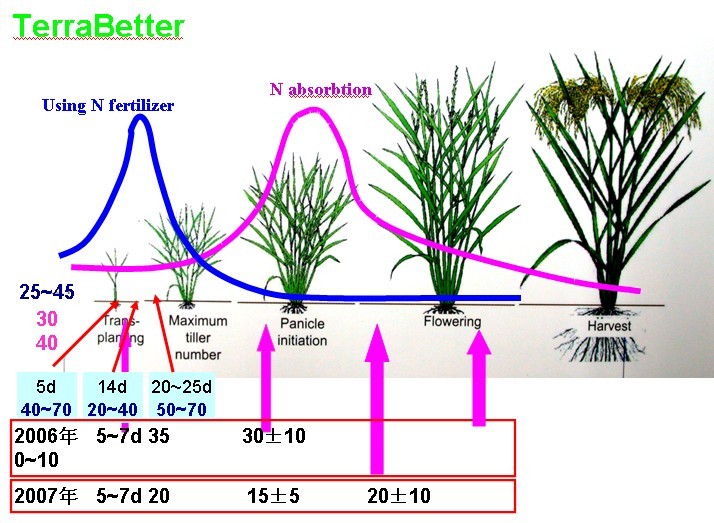


Figure 6:fertilization stages

## **3.2 Research Area**

When it comes to research area, four features were identified. Such as Image processing activities, Classification activity, Detection activities and finally solution prediction. In order to conduct the research, deep learning technology has been taken as the core foundation.

## **3.3 Requirement Gathering and Analyzing**

Due to the importance of requirement gathering and analysis, major emphasis was put to this section. Since there is a need for this process to be strictly on the “fertilizer management” part below mentioned approaches were used.

* Reading research papers relevant to the research problem.
* Studying existing systems related to our research area.
* Contacted experts in Rice Research and Development Institute(RRDI) , Bathalagoda.
* Met with Sri Lankan paddy farmers.

To get an idea about the research problem, studying related research papers are a must. Next step was to understand what types of systems that already exists, so as to see what are lacking and needs improvements. Finally to see if the proposed solution is viable in the current environment, specialists on the field and traditional farmers were contacted.

### **3.4.1 functional requirements**

* Ability to upload paddy field imagery.
* Calculate paddy field area.
* Ability to upload fertilizer imagery.
* Identify fertilizer type.
* Propose solutions.
* Show proposed solutions.

### **3.4.2 Non-functional requirements**

* Reliability
* Accuracy
* Availability
* Performance
* User friendly

## **3.5 Design**

Design phase encompasses what is needed for the estimation of hardware and system requirements by the creation of a system architecture, due to the needs and specifications being included. The architecture will entail the components separated into manageable levels according to the respective research project member. In this case it will be the “fertilizer management” component.

## **3.6 Tools and Technologies**

### **3.6.1 Ttools**

* Android studio
* PyCharm
* OpenCV
* Jupiter notebook
* DB

### **3.6.2 Technologies**

* Machine learning/Deep learning
  + CNN
* Image processing
* Android – java
* Python

## **3.7 Implementation**

In this stage of the project, the implantation of the system will be started. This will be in accordance with the system architecture proposed in the previous design phase. “Identification weeds and proposing solutions” component will be further split into three subcomponents, with them being

* Calculate paddy area using paddy imagery
* Identification of fertilizer using imagery
* Proposing solutions.

## **3.8 Testing and Maintenance**

As the final phase of the Software development life cycle(SDLC) is the testing and maintenance phase which will be done under the discipline of functional and nonfunctional testing. The functional testing will mainly consider the functional requirements of the system and unit testing will be taken as the basis. Then in order to check the nonfunctional requirements such as performance and availability various nonfunctional testing will be conducted. As for the maintenance of the application after the publication various support features will be added.

## **3.9 WBS**

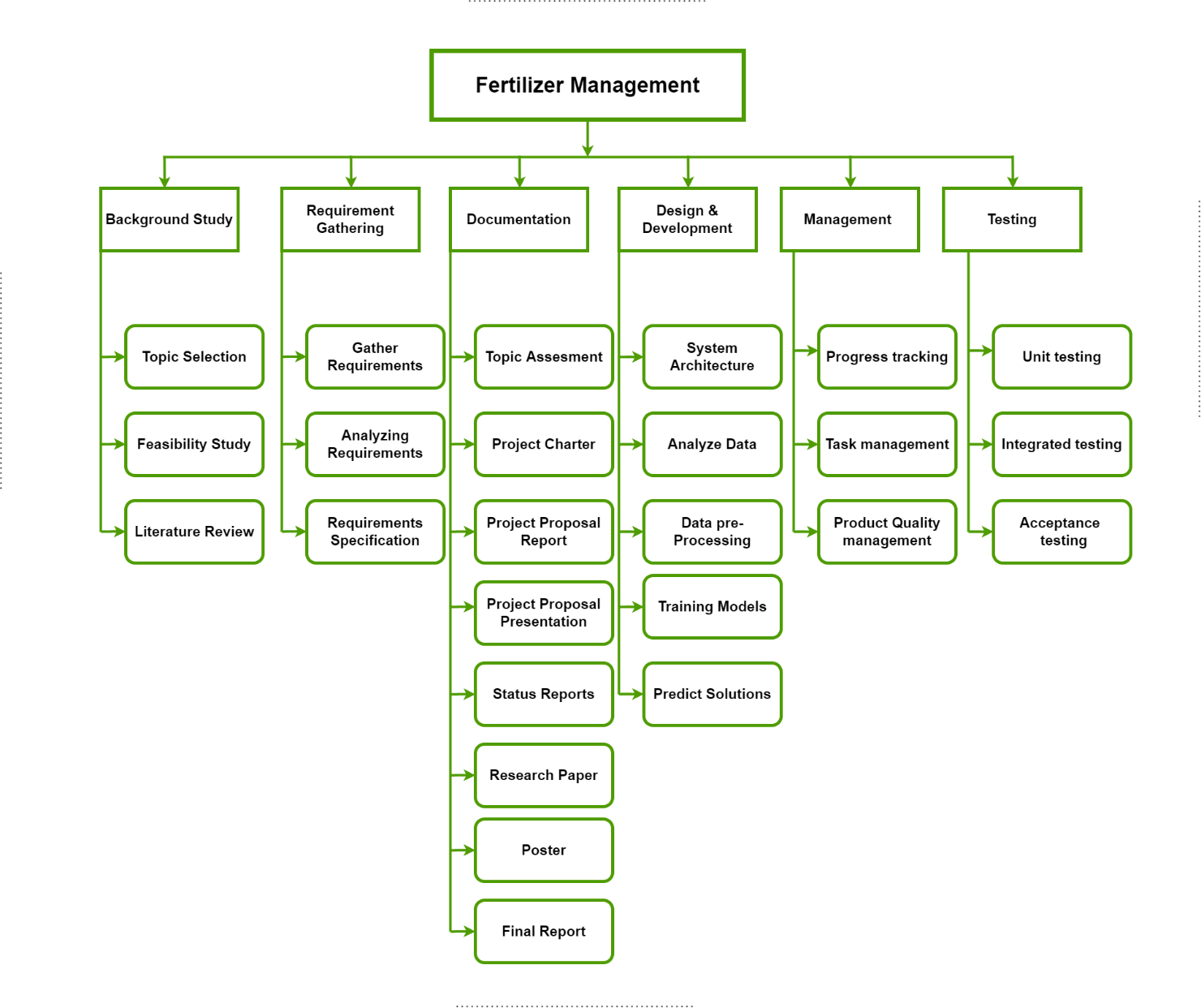


Figure 7:WBS chart

## **3.10 Grant Chart**



Figure 8:Grant chart

# **DESCRIPTION OF PERSONAL AND FACILITIES**

|  |  |  |
| --- | --- | --- |
| **Student Details** | **Role** | **Tasks** |
| IT19129372 | Group Member | Calculate rice paddy field area by using images.  Finding relevant fertilizer type using image datasets.  Finding the most suitable algorithms for the component in order to do image segmentation and classification.  Providing appropriate guidance by using the paddy area and fertilizer type information. |

Table 2:Description of personal and facilities

# **5.BUDGET**

Text

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Table 3:Budget

# **REFERENCE LIST**

|  |  |
| --- | --- |
| [1] | N. D. Office of Agricultural Affairs, "Sri Lanka: Rice Rebounds - Grain and Feed Annual 2019," USDA Foreign Agricultural Service, 19 09 2019. [Online]. Available: https://www.fas.usda.gov/data/sri-lanka-rice-rebounds-grain-and-feed-annual-2019. [Accessed 23 01 2022]. |
| [2] | J. Weerahewa, S. S. Kodithuwakku and A. Ariyawardana, "Fertilizer subsidy programme in Sri Lanka," ResearchGate, 01 2010. [Online]. Available: https://www.researchgate.net/publication/256186294\_Fertilizer\_subsidy\_programme\_in\_Sri\_Lanka. |
| [3] | "5 Common Fertilizer Software Mistakes Growers Make," smart-fertilizer, 12 02 2020. [Online]. Available: https://www.smart-fertilizer.com/articles/common-fertilizer-management-mistakes/. [Accessed 23 01 2022]. |
| [4] | Q. Zhang, "Computers and Electronics in Agriculture," *ScienceDirect,* vol. 193, 2022. |
| [5] | B. Khiatah and M. , "The Health Impacts of Chemical Fertilizers," amosinstitute, [Online]. Available: https://amosinstitute.com/blog/the-health-impacts-of-chemical-fertilizers/. |
| [6] | P. Kristensen, A. Andersen, L. M. Irgens, A. S. Bye and N. Vagstad, "Testicular cancer and parental use of fertilizers in agriculture," *Cancer Epidemiology and Prevention Biomarkers,* vol. 5, pp. 3-9, 1996. |
| [7] | T. Devitt, "Pesticide, fertilizer mixes linked to range of health problems," news, 15 03 1999. [Online]. Available: https://news.wisc.edu/pesticide-fertilizer-mixes-linked-to-range-of-health-problems/. [Accessed 23 01 2022]. |
| [8] | H. KULATUNGA, "Effects of chemical fertiliser on human health and environment," Sunday Observer, 03 07 2021. [Online]. Available: https://www.sundayobserver.lk/2021/07/04/news-features/effects-chemical-fertiliser-human-health-and-environment#:~:text=One%20of%20the%20key%20environmental. [Accessed 23 01 2022]. |
| [9] | L. Toyoh, L. M. I. Kiyo and M. N. Francis , "Chemical fertilizer application and farmers perception on food safety in Buea, Cameroon," ResearchGate, 01 2017. [Online]. Available: https://www.researchgate.net/publication/311582569\_Chemical\_fertilizer\_application\_and\_farmers\_perception\_on\_food\_safety\_in\_Buea\_Cameroon. [Accessed 23 01 2022]. |
| [10] | Occupational Health & Safety, "The Hidden Dangers of Chemical Fertilizers," Occupational Health & Safety, 01 04 2018. [Online]. Available: https://ohsonline.com/Articles/2017/12/07/The-Hidden-Dangers-of-Chemical-Fertilizers.aspx?Page=2. |
| [11] | Department of Primary Industry, "Fertilisers and the environment," Department of Primary Industry, 2021. [Online]. Available: https://www.dpi.nsw.gov.au/agriculture/soils/guides/soil-nutrients-and-fertilisers/environment. |
| [12] | national informatic center, "On-line fertilizer recommendation system," national informatic center, [Online]. Available: https://www.nic.in/. |
| [13] | K. Hampannavar, V. Bhajantri and S. , "Prediction of Crop Fertilizer Consumption," IEEE Xplore, 2018. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/8697827 . |
| [14] | Government of India Department of Fertilizers, "Integrated Fertilizer Management System," Government of India Department of Fertilizers, [Online]. Available: https://dbtfert.nic.in/iFMS/. |
| [15] | terrabetter, "Rice plant nutrition and Rice Fertilizer," terrabetter, [Online]. Available: http://www.terrabetter.net/html\_news/ricefertilizer20110727-3.html. [Accessed 24 01 2022]. |
| [16] | දිනමිණ EPaper, "දිනමිණ EPaper : Dinamina Online EEdition - Lake House - Sri Lanka," දිනමිණ EPaper, [Online]. Available: http://archives.dinamina.lk/epaper/?tday=2013/12/09. [Accessed 31 01 2022]. |
| [17] | S. J. Wimalawansa, "Impact of changing agricultural practices on human health: Chronic kidney disease of multi-factorial origin in Sri Lanka," Researchgate, 5 2014. [Online]. Available: https://www.researchgate.net/figure/Annual-chemical-fertiliser-usage-in-Southeast-Asian-countries-in-2013-fertiliser\_fig3\_264978995. |