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

2022-81

Project Proposal Report

P.Y.D Jayasinghe

B.Sc. (Hons) Degree in Information Technology

Department of Computer Science and

Software Engineering

Sri Lanka Institute of Information Technology

Sri Lanka

February 2022

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

2022-81

Project Proposal Report

P.Y.D Jayasinghe – IT19117256

Supervisor: Mr. Adeepa Gunarathna

Co Supervisor: Ms. Amali Upeka Gunasinghe

B.Sc. (Hons) Degree in Information Technology

Department of Computer Science and

Software Engineering

Sri Lanka Institute of Information Technology

Sri Lanka

February 2022

# **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.

|  |  |  |
| --- | --- | --- |
| Name | Student ID | Signature |
| P.Y.D Jayasinghe | IT19117256 |  |

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.

------------------------------ ------------------------------

Signature of the supervisor: Date:

------------------------------ ------------------------------

Signature of the 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 prevalence of weeds that plague the rice fields. These weeds because they occupy rice fields, absorbs nutrients from the soil all the while taking valuable space. These topics was chosen due to 11% of all harvest potentially being lost because of weeds. The aim is to develop a mobile application that will help farmers solve this particular problem. The application will use areal images to conduct image processing to analyze crops and highlight the weed infested areas. This will enable the farmer to find the weed and take a picture of it to identify the type of weed also using image processing to finally receive solutions using machine learning and deep learning.

Keywords :- machine learning, image processing, deep learning

# **TABLE OF CONTENTS**

[**DECLARATION, COPYRIGHT STATEMENT AND THE STATEMENT OF THE SUPERVISOR** iii](#_Toc95428298)

[**ABSTRACT** iv](#_Toc95428299)

[**TABLE OF CONTENTS** v](#_Toc95428300)

[**LIST OF FIGURES** vi](#_Toc95428301)

[**LIST OF TABLES** vi](#_Toc95428302)

[**1.** **INTRODUCTION** 1](#_Toc95428303)

[**1.1** **Background** 1](#_Toc95428304)

[**1.2** **Literature Survey** 3](#_Toc95428305)

[**1.2.1** **Deep Neural Networks to Detect Weeds from Crops in Agricultural Environments in Real-Time** 3](#_Toc95428306)

[**1.2.2** **Detection of Weed and Wheat Using Image Processing** 3](#_Toc95428307)

[**1.2.3** **Weed Detection in Rice Fields Using Remote Sensing Technique** 3](#_Toc95428308)

[**1.3** **Research Gap** 5](#_Toc95428309)

[**1.4** **Research Problem** 6](#_Toc95428310)

[**2.** **OBJECTIVES** 7](#_Toc95428311)

[**2.1 Main Objectives** 7](#_Toc95428312)

[**2.2 Specific Objectives** 7](#_Toc95428313)

[**3.** **METHODOLOGY** 8](#_Toc95428314)

[**3.1 Weed Detection of Rice Fields** 8](#_Toc95428315)

[**3.2 Research Area** 9](#_Toc95428316)

[**3.3 Requirement Gathering And Analyzing** 9](#_Toc95428317)

[**3.4.1 functional requirements** 9](#_Toc95428318)

[**3.4.2 Non-functional requirements** 9](#_Toc95428319)

[**3.5 Design** 10](#_Toc95428320)

[**3.6 Tools And Technologies** 10](#_Toc95428321)

[**3.6.1 tools** 10](#_Toc95428322)

[**3.6.2 technologies** 10](#_Toc95428323)

[**3.7 Implementation** 11](#_Toc95428324)

[**3.8 Testing and Maintenance** 11](#_Toc95428325)

[**3.9 WBS** 12](#_Toc95428326)

[**3.10 Grant Chart** 13](#_Toc95428327)

[**4.** **DESCRIPTION OF PERSONAL AND FACILITIES** 14](#_Toc95428328)

[**5.BUDGET** 15](#_Toc95428329)

[References 16](#_Toc95428330)

[**REFERENCE LIST** 16](#_Toc95428331)

# **LIST OF FIGURES**

[Figure 1:Percentage of rice yield lost due to weeds in multiple countries 2](file:///C:\Users\shiha\Desktop\Research\E%20-%20ketha\Project%20proposal\Pests\IT19117256\IT19117256%20-%20Project%20propsal.docx#_Toc93939474)

[Figure 2:Percentage of economic loss due to weeds in multiple crops 2](#_Toc93939475)

[Figure 3:Weed detection overview 2](file:///C:\Users\shiha\Desktop\Research\E%20-%20ketha\Project%20proposal\Pests\IT19117256\IT19117256%20-%20Project%20propsal.docx#_Toc93939476)

# **LIST OF TABLES**

[Table 1: Comparing existing application and our application features 2](#_Toc93939481)

# **INTRODUCTION**

## **Background**

As the most consumed food in Sri Lanka, the demand for rice is quite high. One of the major reasons why we cannot supply according to the demand is the produce lost due to the weeds that plague the field.

Chart, bar chart

Description automatically generated

Figure 1:Percentage of rice yield lost due to weeds in multiple countries

As it is shown in figure 1 [1], an average of 35% rice is lost annually in the country of Sri Lanka along. When it comes to majorly developed countries and continents such as Australia and Europe, have fluctuating averages with the likes of 52% and 20% each. This is enough evidence to understand the threat that weeds possess to the rice yields. Due to these losses Sri Lankan farmers lose much of their profit as well as the Sri Lankan general populous who has to depend on foreign imports since the supply does not match the demand.

Chart, waterfall chart

Description automatically generated

Figure 2:Percentage of economic loss due to weeds in multiple crops

Even when looking at economic losses due to weeds in a multitude of crops, rice takes the most losses at a whopping 4420 million USD in India with only wheat coming close second at 3376 million. This is proof enough that rice demand the most attention rather than any other crop [2].

How these weeds affect rice crops is by absorbing the many nutrients that should have gone towards rice crops as well as occupying the already limited space of paddy fields. Since weeds tend to widespread in a swift manner, traditional farmers have difficulties removing them one by one. Since there are many types of weeds, choosing the proper weedicide can be an arduous task.

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

## **Literature Survey**

### **Deep Neural Networks to Detect Weeds from Crops in Agricultural Environments in Real-Time**

This study mainly done by Ildar Rakhmatuiln and Andreas Kamilaris, aims to use machine vision with artificial intelligence and deep learning methods. This is due to pre-trained models, large datasets and deep learning tend to be more accurate than other previous techniques. This is all with the additional use of even detecting pests. This research proposes an AI based system that has the capability of detecting weeds by emphasizing new deep learning trends. This is so that this can be used by robots to effectively control the spread of weeds. While it has been concluded that there is no current neural network that is best suited for real-time weed detection, nonetheless this research encourages scientists to continue their efforts with the expectation that more solutions will be discovered in the near future [3].

### **Detection of Weed and Wheat Using Image Processing**

This study mainly done by Sarmad Hameed and Imran Amin, aims to use image processing as the main technology to detect weed in the field of wheat production. What is being proposed here is the use of UAV (Unmanned Aerial Vehicles) to acquire data of wheat crops in the model of RGB images. Then background subtraction is used to identify weed, wheat and the barren land in the field. In the end even though this was found to be good enough, the use of Neural Networks, if applied in the future would grant better results. Other main challenge was the sunlight intensity issue that also plagued the images [4].

### **Weed Detection in Rice Fields Using Remote Sensing Technique**

This study done by mainly Rhushalshafira Rosle, Nik Norasma Che’Ya and few others, aims to detect the weeds in rice fields using remote sensing techniques. The process is to first use a device such as a camera or UAV (unmanned aerial vehicle) to capture images paddy fields from above. Then the different types of sensors attached to those devices will collect the data with the image capturing process. The sensors are the RGB Sensor, Multispectral Sensor and Hyperspectral Sensor with each of them having their own sets of advantages and disadvantages, acting together to capture the best images possible. Finally machine learning and deep learning algorithms will be used to classify the images with them being found to generate a map that ranges from 85% to 99% accuracy [5].

* + 1. **Weed Classification for Site-Specific Weed Management Using Automated Stereo Computer-Vision**

This study is done by Mojtaba Dadashzadeh , Yousef Abbaspour-Gilandeh ,Tarahom Mesri-Gundoshmian , Sajad Sabzi with the goal of classifying weed in a specific site using stereo vision system to distinguish rice plants and weeds. This system is further augmented using an artificial neural network and two other metaheuristic algorithms, them being y particle swarm optimization (PSO) and the bee algorithm (BA). With stereo videos being recorded of the site beforehand and decomposed into singular frames, rice plants were extracted out using the color, shape and even texture. Then the previously mentioned metaheuristic algorithms were used to optimize the neural network and classify the weed detected as well. According to K-nearest neighbors (KNN) classifier this reached f 88.74% and 87.96% for right and left channels without accounting arithmetic or the geometric means as the basis and with it o 92.02% and 90.7% respectively [6].

## **Research Gap**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 |
| Weed Detection | Yes | Yes | Yes | Yes |
| Rice Centric | No | No | Yes | Yes |
| Aerial Imagery Used | Yes | Yes | Yes | No |
| Classify Weed | No | No | Yes | Yes |
| Propose Solution | Yes | No | No | No |
| Preparation Needed | No | No | Yes | Yes |

Table 1: Comparing existing application and our application features

## **Research Problem**

One of the major issues found is the growth of unwanted weeds that are prevalent in paddy fields. While weeds do not directly harm rice crops, weeds absorb nutrients from the paddy fields that should have gone for the development of healthy rice plants. The identification of weeds however is not difficult for the common farmer on small fields, but it becomes arduous for larger ones. Another challenge lies in the recognition of proper weedicide to combat the identified weed. This is due to vast amount of weed types and the equally wide variety of weedicides being difficult to recollect for the common famer.

## **OBJECTIVES**

### **2.1 Main Objectives**

The main objective of this component is to identify weeds that are commonly spread in rice fields. This is done using a mobile based application and images that are inputted to it. First part is to highlight the areas of the paddy field that are rich in weed through the use of aerial imagery fed to the application. Then image processing technology is used to compare and contrast the weed rich areas and show to the app user. Then the user has the ability to take an image of the weeds up close to identify their types also with the help of image processing. Finally the application will use machine learning and deep learning to show the best solution to combat the particular weed type.

### **2.2 Specific Objectives**

01. The application identifies the weed infested areas using the aerial imagery provided.

The application user inputs aerial imagery captured using application device or any other. The application compares the rice crops to any other weeds and vice versa using the data in the database to identify weed ridden areas.

02. Application identifies the type of weed using the images captured.

Once the images are taken, the application identify and classify what type of weed is prominently growing in the rice field. This is then shown to the user.

03. Application will provide solutions on how to best deal with the weeds.

The application will suggest treatments and solutions on the best on how to remove the weeds from the paddy field.

# **METHODOLOGY**

This section will entail the details on the techniques and mechanisms that are employed to create the Weed Detection component, belonging to the “e-ketha” application from the data gathering stage all the way to implementation.

## **3.1 Weed Detection of Rice Fields**

When it comes to rice fields or any other related crop fields, weeds are one of the primary concerns that a farmer has to deal with.

In order to prepare a solution, large databases and datasets were analyzed to create a comprehensive database for the application to function. This database contains various kinds of weed information, let it be their type, color, shape, etc.

Once the user uploads an image of the weed as an aerial image, image processing technology that was implemented will highlight the areas with weeds.

User will also have the capability to upload images containing weed up close, which will in turn prompt the image processing technology to identify the weed information such as their type. Using this information, the machine learning and deep learning algorithms in the application will give the best solution possible so as to remove them without harming the rice crops.

Diagram

Description automatically generated

Figure 3:Weed detection overview

## **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 “weed identification and solution finding” 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 aerial imagery.
* Mapping the weeds.
* Ability to upload weed imagery.
* Identify weed 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 “identification weeds and proposing solutions” component.

## **3.6 Tools and Technologies**

### **3.6.1 Tools**

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

### **3.6.2 Technologies**

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

## Diagram Description automatically generated**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

* Mapping of weeds using aerial imagery
* Identification of weeds using imagery
* Proposing solutions.

## **3.8 Testing and Maintenance**

As the final phase of the 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**

Diagram

Description automatically generated

Figure : WBS Structure

## **3.10 Grant Chart**



# **DESCRIPTION OF PERSONAL AND FACILITIES**

# **5.BUDGET**

Text

Description automatically generated

# References

|  |  |
| --- | --- |
| [1] | S. and K. , "Weed Management in Dry Direct-Seeded Rice: A Review on Challenges and Opportunities for Sustainable Rice Production," *Agronomy,* vol. 10, p. 1264, 2020. |
| [2] | G. and Y. , "Assessment of Yield and Economic Losses in Agriculture due to Weeds in India," *Crop Protection,* vol. 107, p. 12–18, 2018. |
| [3] | R. and I. , "Deep Neural Networks to Detect Weeds from Crops in Agricultural Environments in Real-Time: A Review," *Remote Sensing,* vol. 13, p. 4486, 2021. |

# **REFERENCE LIST**

[1] Shekhawat, Kapila, et al. “Weed Management in Dry Direct-Seeded Rice: A Review on Challenges and Opportunities for Sustainable Rice Production.” Agronomy, vol. 10, no. 9, 26 Aug. 2020, p. 1264, 10.3390/agronomy10091264. Accessed 28 Sept. 2020.

[2] Gharde, Yogita, et al. “Assessment of Yield and Economic Losses in Agriculture due to Weeds in India.” Crop Protection, vol. 107, May 2018, pp. 12–18, 10.1016/j.cropro.2018.01.007. 28 Sept. 2020.

[3] Rakhmatuiln, Ildar, et al. “Deep Neural Networks to Detect Weeds from Crops in Agricultural Environments in Real-Time: A Review.” Remote Sensing, vol. 13, no. 21, 8 Nov. 2021, p. 4486, 10.3390/rs13214486. Accessed 12 Dec. 2021.

[4]https://www.researchgate.net/publication/330796498\_Detection\_of\_Weed\_and\_Wheat\_Using\_Image\_Processing

[5] Rosle, Rhushalshafira, et al. “Weed Detection in Rice Fields Using Remote Sensing Technique: A Review.” Applied Sciences, vol. 11, no. 22, 1 Jan. 2021, p. 10701, www.mdpi.com/2076-3417/11/22/10701, 10.3390/app112210701. Accessed 24 Jan. 2022.

[6] Dadashzadeh, Mojtaba, et al. “Weed Classification for Site-Specific Weed Management Using an Automated Stereo Computer-Vision Machine-Learning System in Rice Fields.” Plants, vol. 9, no. 5, 1 May 2020, p. 559, www.mdpi.com/2223-7747/9/5/559, 10.3390/plants9050559. Accessed 24 Jan. 2022.