Software Proposal Document for project Wild Oat Detection.

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Proposal Version	Date	Reason for Change
1.0	1-October-2020	Proposal First version's specifications are defined

Table 1: Document version history

GitHub: *https://github.com/BonyGeorge/Graduationproject/*

Abstract

In the past centuries, Wheat planting has been deteriorated due to the growing of Wild Oat plant with it. If it had been expanded, it will decrease the production of wheat by 93 % for each one-meter square cube. We will use image processing to detect the Wild Oat plant at the beginning of the farming process, for decreasing its growth and increasing the farmer's income and product. Because, if the farmer didn't recognize it within the 15 days after the 30 days of growing the Wheat, it will kill the crop and spread about 250 of its seeds. Hence, detection in early stages is a must.

1 Introduction

1.1 Background

Throughout different centuries all over the world, planting Wheat plays a very important role Fig 2 2. For many countries, they depend on farming more than depending on importing their crops. It is important to protect the wealth of each crop to protect its quality and quantity, if they are using it for themselves or using it for profit from other countries and increasing their economic life style.

Wild oat kill and destroy more than 3/4 from the crop as it takes their food and water from the wheat plant so it grow faster and longer than wheat. It looks quite similar to the Wheat to it's color ,so it is somehow hard to be detected without a professional farmers eye as shown in Fig 1 2.

Our aim is to develop camera that will detect whether there are any Wild Oat or not. We will use camera that will scan area not lines as it will be easier to be detected , as shown in Fig 3 3. We have three different phases which are data collecting, image processing, and detecting the Wild Oats.

Figure 1: The left picture is Wheat and the right pictures is Wild Oats

Top Wheat Producing Countries

Rank	Country	Wheat Produced (Tonnes)
1	China	134,340,630
2	India	98,510,000
3	Russian Federation	85,863,132
4	United States of America	47,370,880
5	France	36,924,938
6	Australia	31,818,744
7	Canada	29,984,200
8	Pakistan	26,674,000
9	Ukraine	26,208,980
10	Germany	24,481,600

Figure 2: Statistics by Oishimaya Sen Nag on January 11 2019 in World Facts

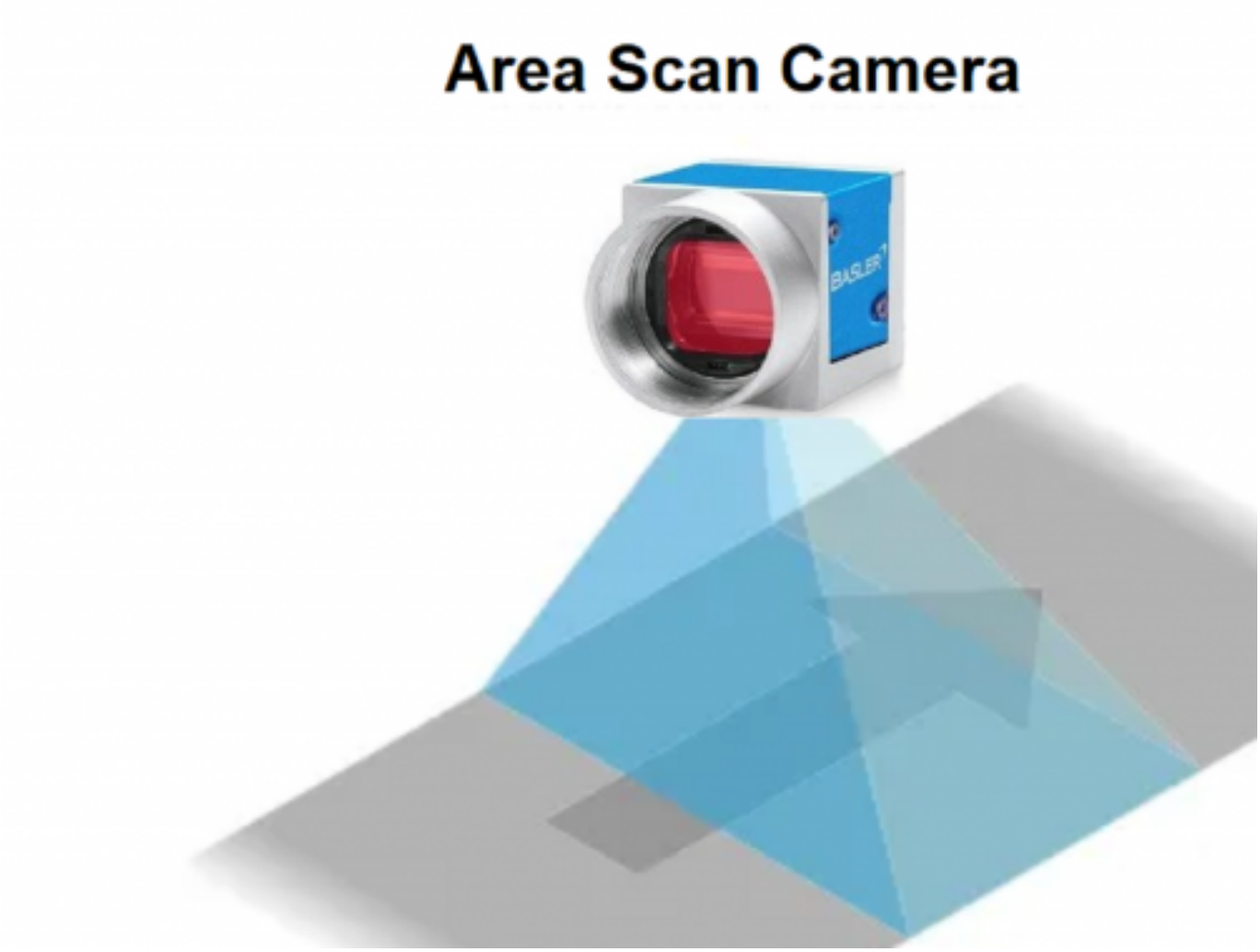

Figure 3: Scan shape

1.2 Motivation

1.2.1 Academic

Mask Region-based Convolutional Neural Network(Mask R-CNN) is one of the best algorithms for image recognition [8]. It's known that it is faster than the normal CNN as it is based on a Region Proposal Network(RPN) which acts as the backbone in the preprocessing stage in the algorithm [3]. The Mask R-CNN will help us to differentiate between the plants types if it is a wild oat, it will send an alert notification to an Android based mobile application [4] so the user may know that it isn't wheat and take it off the ground.

1.2.2 Business

Since that this problem is worldwide, this means that if it been solved the economics of each and every country that plant Wheat quality and quantity will be improved. Moreover, Farmers will suffer less from using chemicals and their payments, which drop the health of the Wheat, and from hard work for detecting the Wild Oats from their farms. Therefore, every country will have economic growth, increase the size number of crop product and the health quality and quantity of the Wheat itself.

1.3 Problem Statement

There are several problems that our aim is to solve. Our aim is to reduce the number of Wild Oats in the Wheat, increase the weight of crop each year, improve the quality and quantity of the Wheat, increase the gain of the farmer, minimize the farmer work to recognize the wild oats in the land, and cut off the usage of the chemicals that kills the Wild Oats but bring off the quality of the Wheat.

2 Project Description

2.1 Objectives

Our objective is very simple and it's never been done before. it's to automate the detection of Wild Oats within the wheat plants with the highest possible accuracy. So, the farmer can know where it's place and remove it as soon as possible. If it had been early detected, it will decrease harming the soil, spreading it's seeds or decreasing nutrition value of the wheat.

2.2 Scope

1. The farmer move with the camera in the field trying to figure out the wild oat from the wheat.
2. The camera will capture images from the field using Deep Learning approach.
3. IBM Watson [2] will begin processing these incoming images and classify them into wheat and Avena Fatua.
4. The farmer's mobile will receive a notification that there is a wild oat here which is made using Java for Android and Firebase.
5. The farmer will remove the plant from the field and it will die.

2.3 Project Overview

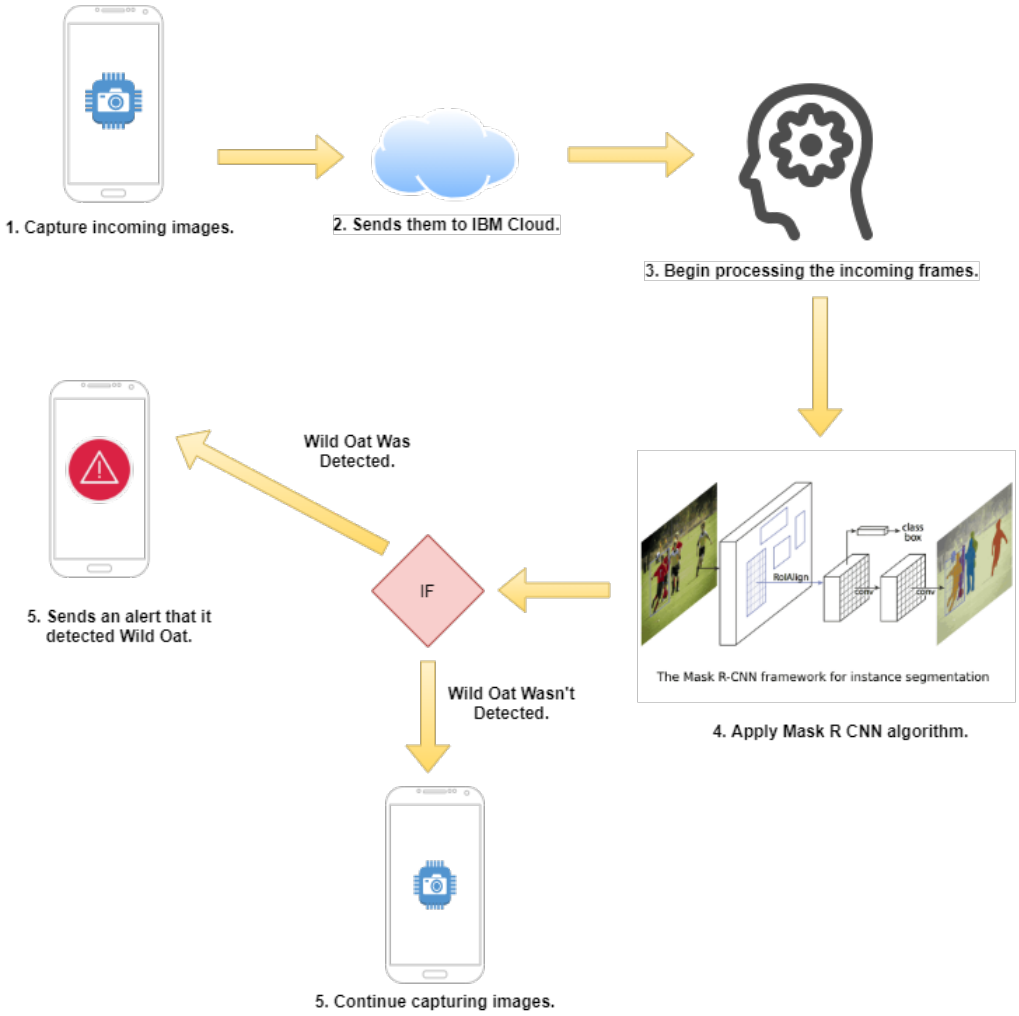

Figure 4: System Overview.

2.4 Stakeholder

2.4.1 Internal

#	Name	Job
1	Abanoub George	Full Stack Developer.
2	Ibrahim Fawzy	Back-end Developer.
3	Mai Mahmoud	Front-end Developer.
4	Nour Bahaa	Front-end Developer.

2.4.2 External

Our stakeholder is anyone who is willing to plant wheat and try to get it's maximum nutrition value from it, reach the highest productivity he can get from wheat planting and to protect his soil from any seeds that would harm the soil.

3 Similar System

3.1 Academic

1. Image Recognition Method Based on an Improved Convolutional Neural Network to Detect Impurities in Wheat [7]: Impurities in wheat seriously affect wheat quality and food security. They are mainly produced during the operational process of combine harvesters. In this paper, constructed six datasets of labeled images of wheat, namely normal wheat, insects, grass, stalks, spikelets, and awns of wheat. The training set was composed of 25,200 images and the validation set consisted of 10,800 images. These datasets can be used to investigate automatic recognition applications and testing on wheat. These datasets also provide important insights into other grain impurities and began with processing these images so they can reduce the influence of motion, shading, and differences in light before classifying and labeling them. Then they a method for the recognizing wheat impurities based on CNN, improved by Inception_v3 network that analyzes the image characteristics of the impurities in wheat. Their results indicate that the WheNet network achieved the most efficient results. It also shows a shorter training time, and its recognition accuracies for Top_1 and Top_5 of the test set are 98.59 % and 99.98 %, respectively. The mean values of both the AUC and recall rate of the network on the recognition of various images of impurities are higher than those of the ResNet_101 and Inception_v3 networks. Consequently, the WheNet network can be a useful tool in recognizing impurities in wheat. Furthermore, this method can be used to detect impurities in other fields.

2. Northern Maize Leaf Blight Detection Under Complex Field Environment Based on Deep Learning [9]: Maize is one of the major food crops in the world. The planting area and output of maize in the world are only lower than that of wheat and rice. In addition to be an excellent feed for animal husbandry, maize is also an important raw material for the development of light industrial products. However, maize is usually suffered from Northern leaf blight (NLB). In recent years, the decrease of maize yield caused by NLB has been steadily increasing. The proposed technique incorporates three major steps of data set preprocessing part, fine-tuning network and detection module. The NLB data set (Dataset images) is produced in response to the terrible disease, which is the largest open data set on NLB. Each image is calibrated by human plant pathologists and has high accuracy. The NLB data set includes three different parts. The first part is the hand-held set, which is taken by hand. The second part is the boom set, which is taken by mounting the camera on a 5 meters boom. The last data set is unmanned drone set, which is taken by mounting the camera on a DJI Matrice 600. In the first step, the improved retinex is used to process data sets, which successfully solves the problem of poor detection effects caused by high-intensity light. In the second step, the improved RPN is utilized to adjust the anchor box of diseased leaves.Therefore, the efficiency of the whole model has reached the efficiency of the one-stage model. In order to further optimize the detection effect of the model, we replace the loss function with generalized intersection over union (GIoU). After 60000 iterations, the highest mean average precision (mAP) reaches 91.83 %. The experimental results indicate that the improved model outperforms several existing methods in terms of greater precision and frames per second (FPS).

3. Detection of Weed and Wheat Using Image Processing [5]: As the increase in the world population the demand of the wheat is also increases. In order to increase the growth wheat in the wheat crop it is necessary to detect the weed in the wheat crop and the barren land to minimize the growth of weed so that the growth of the wheat can be increased. Unmanned Air Vehicle (UAV) is used for data acquisition of wheat crop in different phases so that high quality of RGB images can be captured. The proposed method facilitates the extraction of weed, wheat, and barren land in the wheat crop

field using background subtraction. The result shows that background subtraction method is good for detection the weed, barren land, and wheat.

4. Image segmentation algorithm for disease detection of wheat leaves [1]: (PS)Wheat diseases are harmful to wheat production, but there are few segmentation algorithms that can effectively identify common diseases of wheat leaves.(how to solve) This paper proposes an automatic and efficient solution with K-means clustering.(dataset)The images used in this study consist of images of powdery mildew, leaf rust and stripe rust that were gathered from the literature and the Internet.(results) They select 90 images of wheat disease (30 each for leaf rust, stripe rust and powdery mildew) and apply our algorithm to each image.And implemented and compared the results of grey level segmentation, single channel threshold segmentation and the Lab-based K-means clustering algorithm for wheat (leaf rust, stripe rust and powdery mildew). So The results show that the segmentation accuracy rates for three common diseases (powdery mildew, leaf rust and stripe rust) is more than 90 %, which proves the efficacy of our method.

5. Novel Image Processing Technique for Feature Detection of Wheat Crops using Python OpenCV [6]: (PS) The job of this research is to filter the diseased part of the leaf from the leaf images.(how to solve) The authors proposed and implemented image processing technique using OpenCV for separating the diseased part of the leaf from the image of the leaf (Foreground Extraction, Edge Detection, Color filtering and Combination of Edge Detection with Color Filtering is done for wheat images).This research made use of KNN and SVM for detection of diseases and achieved an accuracy of 88 % with SVM and 85 % with KNN on neighbor size of 5.

3.2 Business Applications

Describe available business applications the the market with figures. (Optional)

4 What is new in the Proposed Project?

Our project is going to be used in detecting wild oat in wheat, which has never been done before. Other projects made to detect different things in wheat like impurities and black spikes. In other similar systems they use CNN but we gonna improve it by using Mask RCNN.

5 Proof of concept

Explain the 10 % implemented in your project so far.

6 Project Management and Deliverables

6.1 Tasks and Time Plan

Use some software for primitive plan of your project.

6.2 Budget and Resource Costs

7 Supportive Documents

Add sections covering one or more of the following:

- Dataset.
- Contact documents
- users/survey
- Contacting authors.

References

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[3] B. Liu, W. Zhao, and Q. Sun. "Study of object detection based on Faster R-CNN". In: *2017 Chinese Automation Congress (CAC)*. 2017, pp. 6233–6236.

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[8] C. Ma et al. "Remote Sensing Image Recognition Method Based on Faster R-CNN". In: *2020 International Conference on Computer Engineering and Application (ICCEA)*. 2020, pp. 869–872.

[9] J. Sun et al. "Northern Maize Leaf Blight Detection Under Complex Field Environment Based on Deep Learning". In: *IEEE Access* 8 (2020), pp. 33679–33688.