FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

AMI 4105. FINAL YEAR PROJECT

DESIGN AND DEVELOPMENT OF A ROBOT FOR MONITORING COMMON RUST, BLIGHT AND GRAY LEAF SPOT DISEASES IN MAIZE.

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DECLARATION

We group 1 members declare to the best of our knowledge that this project report is as a result of our research and effort and it has never been presented or submitted to any institution or university for an academic award.

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ABSTRACT

One of the most significant cereal crops in Uganda is maize. Smallholder farmers in particular depend on it as a source of food and income. Additionally, they raise it as a significant export crop. The overall amount of maize produced in Uganda has grown steadily throughout the years, rising from about 800,000 tons in 2000 to 2,575,000 tons in 2019. Its life cycles is short, around from 120 to 150 days. Approximately: 70–87% (carbohydrates), starch (amylose and amylopectin), 6–13% (protein), 4% (fat), 2-6% (oil), and 1-3% (sugar) are found in maize. Because it contains antioxidants, fiber, protein, is gluten-free, and is a great option for vegetarians, corn is good for human health. Some of the most serious diseases that affect maize productivity in Uganda include gray leaf spot, common rust, and blight. They not only pose a risk to maize production in the commercial farming sector but also lower maize yields on small farms. By personally visiting the garden and assessing the condition of the maize based on visual characteristics, such as the way the leaves look, it is possible to manually monitor the diseases attacking maize in Uganda, including gray leaf spot, common rust, and blight. A lot of work goes into the visual examination, and the farmer, agronomist, or extension officer's experience is a requirement for the identification of these illnesses. Due to this, results are inconsistent, which may result in incorrect disease diagnoses. To overcome the drawbacks of manual approaches, technologies like remote sensing, drones, and IoT have been created to carry out these duties. However, the currently available technologies also have drawbacks, such as the difficulty of data interpretation for remote sensing and the high cost of drones with more characteristics, necessitating the use of artificial intelligent based robot to monitor gray leaf spot, common rust and blight diseases in maize. The robot was designed, assembled, and had its performance assessed. It overcomes the mentioned issues with the monitoring techniques that are currently in use, such as remote sensing and drones. The robot is inexpensive and accessible to farmers, and data interpretation is simple. Due to the early discovery of these diseases that have major impacts on the harvests, the farmer can anticipate a decent yield output. The majority of farmers can afford the robot, and it is simple to use and maintain. The robot is made up of parts like the frame, the control box, which contains the circuit board, the web camera, which is used to take pictures in the field, an application for regulating motion, and an application that interacts with the farmer to provide him with the results. Mild steel angle bars and plates were used to construct it. A 26Ah battery powers the robot, while 12dc motors drive the wheels.

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List of Abbreviations

LIDAR- Light Detection and Ranging.

HTP -High Tech Performance.

RGB -Red Green and Blue.

RTK-GPS -Real-Time Kinematic Global Positioning systems.

NDVI -Normalized Difference Vegetation Index.

UAV -Unmanned Aerial Vehicle.

UGV -Unmanned Ground Vehicle.

PA -Pennsylvania.

AI -Artificial Intelligence.

MZs -Management Zones.

IoT -Internet of Things.

ML -Machine Learning.

FBP -Field -Based Phenotyping

UGX - Uganda Shillings

PVF -Present Value Factor

BCR -Benefit Cost Ratio

PV -Present Value

NPV -Net Present Value

PI -Profitability Index

CHAPTER ONE

1.0 INTRODUCTION

Uganda being predominantly an agriculturally based economy, the major source of occupation is agriculture[1]. About 70% of the population is engaged in Agriculture making it one of the biggest sectors employing most Ugandans. In a financial year 2020/2021 agriculture accounted for 23.7% of GDP and 31% of export earnings [2]. The most significant cereal crop in Uganda is maize, which provides more than 40% of the calories consumed in both rural and urban areas[3]. Uganda produced 2,750 thousand tonnes of maize in 2020. Before Uganda's maize production began to rise and was expected to reach 2,750 thousand tonnes in 2020, it had a trough and a low of 286 thousand tonnes in 1980[4]. However diseases stand to be a threat in maize production in uganda, with, Gray Leaf Spot disease, which can reduce grain yields by up to 100%, is regarded as the main hazard to maize crops[5], including Blight and common rust diseases. So, there is need to monitor the maize crop health to detect gray leafspot, blight and common rust, to give the farmer early knowledge about their availability in the maize garden, there ensuring early preventative measures to be taken so as to improve on the yields. Traditionally, it takes a huge amount of time and energy for farmers to monitor large areas of the field. To be specific, it is tiresome for farmers, extension officers and agronomists on large scale production to monitor these diseases affecting the maize crops. Computer vision technique has been studied and applied in agriculture due to its nature of accuracy and speed. The technique has been applied for quality inspection and sorting. However, a little attempt has been made using the techniques to predict these diseases that affect maize. Throughout the growing season, robots can be used to monitor the health of the crops in order to take timely, need-based action. Yield loss can be avoided with prompt and proper response. By using this technology, farmers won't need to visually monitor their crops anymore. Visual examination are the traditional techniques for gray leaf spot, blight and common rust disease monitoring in maize crop fields. Using sophisticated picture data analytical techniques, an autonomous with a camera identifies the maize plants that have diseases. With the help of artificial intelligence to give real time information about the spots affected in the field.

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