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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

AI DRIVEN FARMBOT FOR CROP HEALTH MONITORING AND DISEASE DETECTION

BY

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A final year project report submitted to the department of water resources engineering as a partial fulfilment for the award of a bachelor of science in water resources engineering at Busitema university

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ABSTRACT

The increasing population in urban areas is associated with a number of problems like limited land for carrying out agriculture which leads to over dependence on buying food from the market. With an increase in food prices, the cost of living in urban areas increases leading to hunger. It can be seen that the land use pattern in urban centres is greatly affected leaving land used for agriculture in urban centres with a risk of being used for other activities like settlement and industrialization. A high growth rate of urbanization reduces the agricultural production resulting in the loss of potential crop yield due to the transformation of productive land to its non-productive usage. This reduces soil quality in terms of soil nutrients and aeration which leads to food insecurity.

The farmbot project was developed to make farming possible in urban areas where people have limited land, knowledge about farming and have busy schedules thus limited time to practice it effectively using their mobile devices. In this report we have improved the existing farmbot by introducing three systems that is; disease detection system, the water stress determination and crop growth monitoring systems which are all equally important for the crop health and high productivity. We aim at using locally available materials so that we can make the farmbot affordable to people who would like to have a small garden at their homes for constant food supply. With no improvement in the existing farmbot, there will be continuous poor crop yield from small-scale farms in urban areas hence low food production and low food supply to meet the food demand. The cost of living of people in urban areas will increase due to over dependency and reliance on buying food from market places at high prices. The low-income earners will not be able to afford the heightened food prices leading to malnutrition and hunger.

Design of components was made basing on the load requirements, the material used and the purpose. Components were fabricated, others 3D printed and later they were connected and the system was implemented following the circuit diagrams generated from circuito.io and proteus and flow charts to come up with algorithm of the system and programmed in raspberry pi3 and Arduino for the hardware section and various languages for the software section were used such as C++, MATLAB, python and JavaScript.

The system was tested at different levels, for example unit testing, integral testing and finally system testing and results discussed accordingly, indicating the efficiency of the system. An economic analysis was carried-out to establish the viability of the project, the Net Present Value was greater than 1 showing that the project is viable, the payback period was calculated giving

a period of about one and a half years. The conclusions were drawn, which indicated the efficiency of the system in improving the crop yield by detecting disease, determining water stress and monitoring growth of the crop with minimal human interaction.

Prototype was developed using available materials and components and it was able to move from one crop to the next crop and as well able to pick the desired tool and use it at the desired points. The quality of the crop produced with an improved AI driven farmbot showed great improvements than the one produced with the already existing farmbot in terms of the leaf appearance.

DECLARATION

We hereby declare to the best of our knowledge, that this report is our own research and has never been submitted before to any other university or institution of higher learning for any academic award. We stand to account for all the information contained in this report.

NAME	SIGNATURE	DATE
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Firstly, we would like to thank the almighty God for keeping us in good health condition granting us all this opportunity to undertake this project.

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Finally, yet importantly we thank our classmates for their advice and we appreciate their support.

APPROVAL

This proposal on Design and construction of an improved Farmbot to determine water stres monitor growth and detect pests and diseases in crops has been written under the supervisi of;

Name: MR. MASERUKA BENDICTO.

Signature: ..... Date 1st Feb 2023

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATION

TDR – time domain reflectometry

FDR – frequency domain reflectometry

EC – electrical conductivity

LWP – leaf water potential

ABA – abscisic acid

RWC – relative water content

FI – full irrigation

DI – deficit irrigation

CWSI – crop water stress index

VPD – vapour pressure deficit

IR – infrared radiations

MWIR – middle wavelength infrared

MySQL – My Structural Query Language

LWIR – long wavelength infrared

SVM- Support Vector Machine

GLCM- Gray Level Co-occurrence Matrix

SNR- Signal-to-noise ratio

Wi-Fi – Wireless Fidelity

RAMPS – RepRap Arduino Mega Pololu Shield

IDE – Integrated Development Environment

HTML – Hypertext Markup Language

CSS – Cascading Style Sheets

1.0 CHAPTER ONE: INTRODUCTION

This chapter include the background of the study, problem statement, justification of the study, the purpose of the study, objectives of the study, scope of the study which include geographical scope, conceptual scope and finally time scope.

1.1Background of the study

The people living in urban centres over took those in the rural areas in 2007 (united Nations,). More than half of the world's population live in urban areas (Hanna & Max Rose, 2018). In 2015, the population that was evaluated to be living in urban areas was 567 million people and the population is projected to double by 2050. As of 2015, 50% of Africa's population lived in 1 of 7,617 urban agglomerations (Africa's urbanization dynamics,2020). Urban population in Uganda was reported to be 11,414,209 people in 2020 (Balasubramanian, 2010).

The increasing population in urban areas is associated with a number of problems like limited land for carrying out agriculture which leads to over dependence on buying food from the market. With an increase in food prices, the cost of living in urban areas increases leading to hunger. It can be seen that the land use pattern in urban centres is greatly affected leaving land used for agriculture in urban centres with a risk of being used for other activities like settlement and industrialization. A high growth rate of urbanization reduces the agricultural production resulting in the loss of potential crop yield due to the transformation of productive land to its non-productive usage. This reduces soil quality in terms of soil nutrients and aeration which leads to food insecurity.

According to Food and Agriculture Organization of the UN, more than 850 million people are chronically hungry (Ghattas & FAO, 2014); almost one in seven people around the world don't have enough food to live a healthy and active life. Moreover, the percentage of under nourished people also persistently increasing since 2014. The number of malnourished people in the world reached approximately 834 million in 2017 (Ghattas & FAO, 2014). Food insecurity became a crucial issue that needs to be solved as it becomes a substantial risk in the achievement of sustainable development goals (SDGs) and leads to many economic and non-economic problems. The second SDG which directly deals with zero hunger, how to achieve food security, improve nutrition and promote sustainable agriculture by providing food and establishing sustainable food production.

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