FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF AGRICULTURAL MECHANISATION AND IRRIGATION ENGINEERING

FINAL YEAR PROJECT REPORT

DESIGN AND CONSTRUCTION OF A HYBRID PEDAL AND ENGINE-POWERED WATER PUMPING SYSTEM.

CASE STUDY: PAJWENDA VILLAGE, TORORO DISTRICT. BY

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SUPERVISOR: Prof. Titus B.

A final year project report submitted to the Department of Agricultural Mechanization and

Irrigation Engineering as a partial fulfillment of the requirement for the award of a bachelor's degree of Science in Agricultural Mechanization and Irrigation Engineering.

ABSTRACT

Irrigation refers to the process of providing controlled amounts of water to a specific land area to aid in the growth of lawns, landscaping plants, and crops. Irrigation has attained increasing importance over the world because of the growing demand for food by a rapidly growing world population. Water pumps are currently vital tools for farmers, especially for those who live in regions with little or no rainfall. Diesel, solar, and electric water pumps are the most often used. An electric pump operates under the theory that electrical energy is transformed into mechanical energy, which is then used to transport fluid from one place to another. The pumping system takes water from open wells, bore wells, streams, ponds, canals, etc. (W. Kiprono & Ibáñez Llario, 2020).

The existing diesel and petrol pumps for irrigation would solve this problem but they are not affordable to most farmers in terms of initial purchase and maintenance. Solar and electric pumps are however not well adopted due to uneven electricity distribution and higher initial costs for solar systems. The major purpose of this study was to design a hybrid pedal and engine-powered water pumping system that enables local small-scale farmers to irrigate their gardens in different locations at reduced costs, and increase crop yield, and food production.

The study therefore entails analysis of design requirements for a hybrid pedal and engine powered water pumping system, fabrication, and assembly of every part of a hybrid pedal and engine powered water pump for small to medium size farmers, carrying out cost benefit analysis of the system.

DECLARATION

We **MUJOMBA PAUL BARASA, ABUZEKU BRIAN AND NAFULA ALEXANDRINE** solemnly declare that this final year project report was prepared out of our own endless efforts and it has never been presented to any institution of higher learning for any award.

MUJOMBA PAUL BARASA BU/UP/2019/2872

Signature

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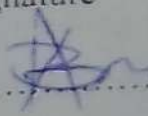
Date

11th.10.2023.....

ABUZEKU BRIAN BU/UG/2019/0034

Signature



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NAFULA ALEXANDRINE BU/UP/2019/0981

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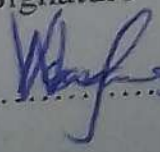

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ACKNOWLEGEMENT

We would like to first acknowledge God's hand of protection and provision throughout the implementation process of our project. We also thank Him for the unity, love, strength, resilience and determination that He has given us to always move on with the project work rather than abandoning it.

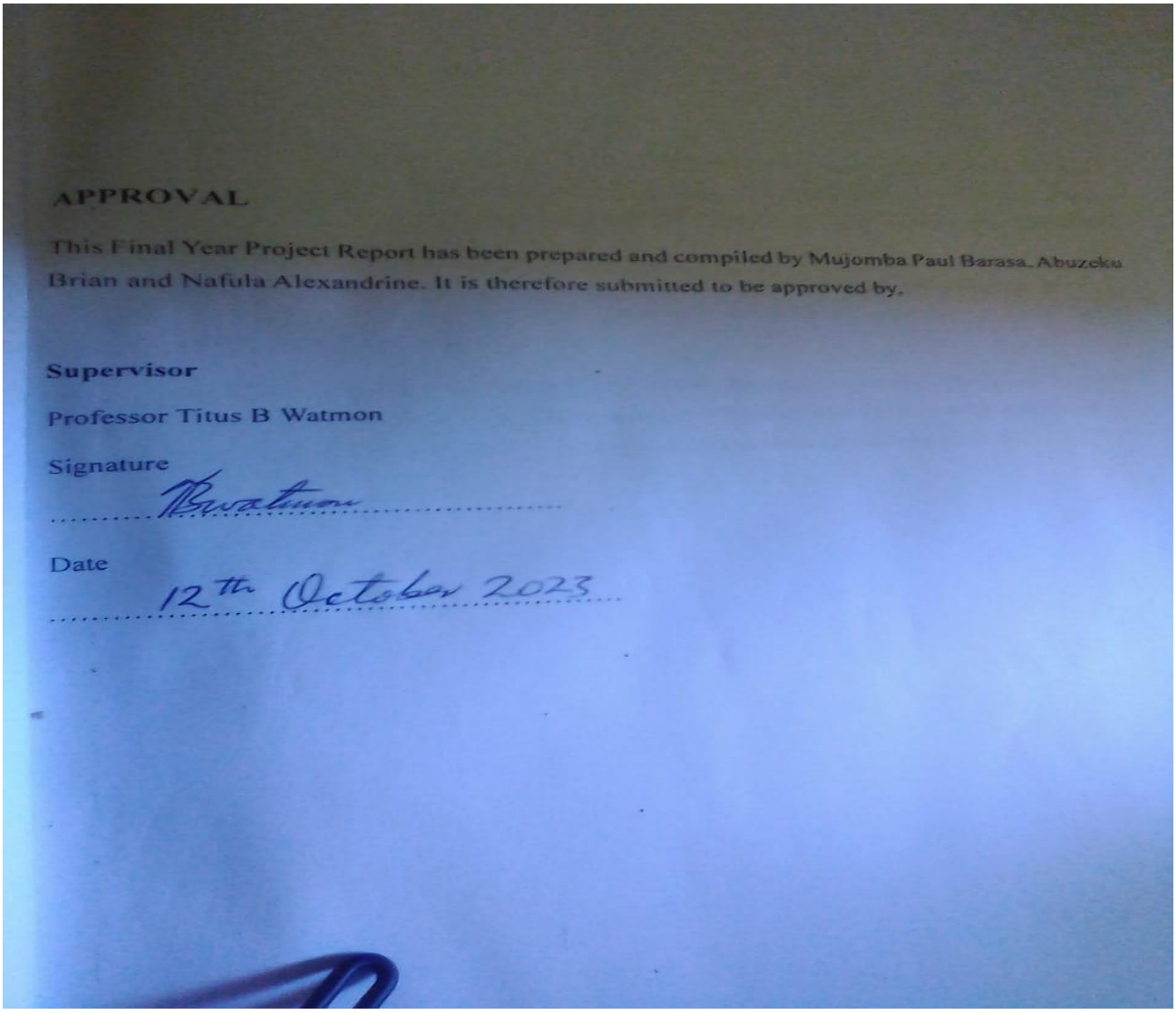
We extend our gratitude to our supervisor professor Titus B Watmon for the continual support given to us and more so for funding our project. We pray that may the lord always provide for you and your family.

To the parents, we thank you for being there for us throughout. You have been a strong pillar in our success because of the financial muscle that you provided whenever need arose. May the almighty Lord who never sleeps grant what your hearts desire

We also express our appreciation to the department of Agricultural Mechanization and Irrigation Engineering for standing with us throughout this struggle. In this, we would like to recognize the efforts of the project coordinator Mr. Ambrose Ashabahebwa, head of department Mr. Eriau Emmanuel and other departmental staffs.

APPROVAL

This Final Year Project Report has been prepared and compiled by Mujomba Paul Barasa, Abuzeku Brian and Nafula Alexandrine. It is therefore submitted to be approved by;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This Final Year Project Report has been prepared and compiled by Mujomba Paul Barasa, Abuzeku Brian and Nafula Alexandrine. It is therefore submitted to be approved by,

Supervisor

Professor Titus B Watmon

Signature

.....Bwatmon.....

Date

.....12th October 2023.....

DEDICATION

I Mujomba Paul Barasa dedicate this report to my beloved family. I this regard I recognize the tremendous support of Miss Anyenge Melda-my mother, Mr. Barasa David- my father, Miss Tamubula Angella, my wife and all other family members who successfully played the mid-field role in my academic journey.

I Abuzeku Brian dedicate this report to Nabirye Dezilanta – my mother, Abuzeku Robert- my father, Abuzeku Jordan – my brother and all other family members who continuously stood for me whenever I needed their assistance.

I Nafula Alexandria dedicate this report to Wafula Jackie Brenda- my mother, Kaihura Vincent Kabagambe- my father, Wafula Ignatius Emmanuel- my brother and all my family and friends who were strong pillars for me to lean on and eventually to achieve this great success.

ACRONYMS

AMI	Agricultural Mechanization and Irrigation Engineering
MWE	Ministry of Water and Environment
MAAIF	Ministry of Agriculture Animal Industries and Fisheries
UN	United Nations
SDGs	Sustainable Development Goals
ASABE	American Society of Agricultural and Bio systems Engineers
FAO	Food and Agricultural Organization
NIR	Net Irrigation Requirement
GIR	Gross Irrigation Requirement
NPV	Net Present Value
BCR	Benefit Cost Ratio
CWR	Crop Water Requirement
ET_o	Reference Evapotranspiration

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CHAPTER ONE

1.0 INTRODUCTION

This chapter briefly gives the general information relevant to the design topic whilst clearly showing the problem of interest for the design. It as well shows how this study helps to reduce the problem through the fulfillment of several objectives and activities listed therein.

1.1 Background

Irrigation refers to the process of providing controlled amounts of water to a specific land area to aid in the growth of lawns, landscaping plants, and crops. Irrigation has attained increasing importance over the world because of the growing demand for food by a rapidly growing world population.

According to projections made by the United Nations in 2013, the world's population currently at 7.2 billion, will reach 9.7 billion by 2050, rising at a rate of roughly 1.14% annually. Africa's population, currently estimated at 1.1 billion, is expected to reach roughly 2.1 billion by 2050. The population of Uganda is predicted to be about 45 million, growing at an average annual rate of 3%. (Wanyama et al., 2017). Correspondingly, pressures on earth's finite natural resources, of which arable land is one, are rising in tandem with this growing human population

The majority of the world's agriculture is rain-fed, and as a result, climate change and variability, manifest as unpredictable rainfall patterns and extended dry spells. (Gitz et al., 2016). currently, Irrigation agriculture accounts for 20% of all agricultural land worldwide and generates only 40% of global food production(Transformation & Irrigation, 2017). By allowing for greater crop diversification and production intensification, irrigated agriculture is typically twice as productive per unit of land as rain fed agriculture. (Documented et al., 2022).

The total area in Uganda that is equipped for irrigation expanded from 4,000 hectares in 1971 to 11,000 hectares in 2020, expanding at an average annual rate of 2.40%.(Guanabara et al., n.d.) Despite prior attempts by the Government of Uganda (GoU) to promote irrigation through several supportive programs like the Ugift micro-scale irrigation program, and BADEA, among others, less than 1% of agricultural families in Uganda employ irrigation.(Wanyama et al., 2017).

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