

**BUSITEMA UNIVERSITY**  
**FACULTY OF ENGINEERING**  
**DEPARTMENT OF COMPUTER**  
**ENGINEERING**

**MICROCONTROLLER-BASED HYDRAULIC CROP**  
**SPRAYER**

**BY**

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**BU-UP-2013-1572**

**MAY 2017**

## **DECLARATION**

I **BILUNGI GETRUDE**, do hereby declare that this Project Report is original and has not been submitted for any other degree award to any other University before.

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## **DEDICATION**

To my beloved parents, Mr. Ssenyonjo Livingstone Kityamuwesi and Mrs. Nakiyingi Aisha and my siblings. Am so blessed and honored to have you in my life.

## **ACKNOWLEDGEMENT**

Special gratitude is accorded to my Supervisor, Mr. Ocen Gilbert for his hard work and tireless efforts in guiding me and making sure that I successfully complete this project that subsequently led to the production of this report. I sincerely appreciate your guidance and advice.

I am so grateful to my parents who irrespective of their busy schedule at work, endured my inconveniences and provided me with support and encouragement, and the opportunity to use them as a sounding board as I wandered through the development of my project. Am also thankful to my sisters, brothers and all people who were involved in this process, I have no words to describe the logistical support you accorded me.

God is the center of everything and without his grace and power nothing is possible. Thank you God for being the headline in my life journey and it's by your mercy that this project was a success. Glory and honor go back to you Jesus Christ.

## **ABSTRACT**

In agriculture, a sprayer is an equipment that is used to apply pesticides (including fungicides, insecticides, herbicides, foliar feeds or liquid fertilizers) in a farm field; this could be to control weeds, insects, and plant diseases and also improve on plant growth [1]. There are many kinds of machine-operated sprayers, the most common of which are hydraulic, low pressure, high pressure and air carrier types [2]. The hydraulic sprayers have two types that is; a manual backpack-type sprayer which is carried on the operator's back and one hand is used to pump the chemical and the hand operated sprayers have an air pump which compresses air into the tank and pressurizes the spray mixture. They often lack any form of propulsion, requiring human power to move them over a farm field thus there is need for a system that automatically sprays crops without human intervention. The developed system is based on IR (Infrared) technology where an infrared remote is used to turn on/off the pump by sending signals to the infrared receiver. The system also has an ultrasonic sensor which detects the level of the chemical in the tank. If the liquid is below threshold, the pump goes off, the buzzer is turned on and the red LED (Light Emitting Diode) is lit. All these processes are controlled by the microcontroller.

## **LIST OF ABBREVIATIONS**

ADC:	Analog-Digital Converter
AGC:	Automatic Gain Control
AGSE:	Agriculture and Sustainable Environment
CDA:	Controlled Droplet Application
DC:	Direct Current
EEPROM:	Electrically Erasable Programmable Read-Only Memory
FAO:	Food and Agricultural Organization
IR:	Infrared
LED:	Light Emitting Diode
PIC:	Programmable Interface Controller
RAM:	Random Access Memory

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# CHAPTER ONE

## INTRODUCTION

### 1.0 Introduction

This chapter contains the description about the background of crop spraying, objectives and scope of the developed system.

### 1.1 Background

In agriculture, a sprayer is an equipment that is used to apply pesticides (including fungicides, insecticides, herbicides, foliar feeds or liquid fertilizers) in a farm field; this could be to control weeds, insects, and plant diseases and also improve on plant growth [1]. There are many kinds of machine-operated sprayers, the most common of which are hydraulic, low pressure, high pressure and air carrier types [2].

The balance between population increase and sufficient food production is one of the most important challenges in many African countries, including Uganda [3]. The use of pesticides is an effective method to protect crops from being damaged and to improve yields [4]. Over the past years there has been an increase in the use of pesticides in developing countries, and the developing countries now account for about 20% of the world's expenditure on pesticides [3]. However, improper use of pesticides can cause human poisonings, accumulate as residues in food and the environment which leads to resistance of pests [4].

In Uganda, a few large scale farmers use aerial sprayers and others use sprayers mounted on to tractor linkages. [5] Self-propelled sprayers are popular with large farms in other parts of the world but there are none in Uganda. The hydraulic sprayers are the most used by the small scale farmers. They contain the following components: tank, pump with an agitator, piping, nozzles, and support frame [6]. They have two types that is; a manual backpack-type sprayer which is carried on the operator's back and one hand is used to pump the chemical and the hand operated sprayers have an air pump which compresses air into the tank and pressurizes the spray mixture [1]. They often lack any form of propulsion, requiring human power to move them over a farm field thus there is need for a system that automatically sprays crops without human intervention.

## **1.2 Problem Statement**

Most commonly used crop sprayers are hand operated which leaves the operator vulnerable to human poisoning due to ignorance and negligence of the use of nose masks by the farmers, early fatigue to the workers hence less efficiency and are more time consuming. Therefore a new system that automatically sprays crops with less human intervention has been developed.

## **1.3 General Objective**

To design and develop a microcontroller-based hydraulic crop spraying system which reduces on human efforts.

### **1.3.1 Specific Objectives**

- i. To study the existing crop spraying systems in order to identify their weaknesses.
- ii. To construct the circuit used in the microcontroller-based hydraulic crop sprayer.
- iii. To program the microcontroller which automates the spraying process.
- iv. To test and validate the developed system.

## **1.4 Justification**

The crop sprayers currently used do not have any form of propulsion, requiring human power to move them over the farm field. Thou this needs to be done in a way that is safe to use, friendly to the environment, less time consuming and cost effective. The existing systems that are under use have not addressed such issues hence the need of this new developed system to do away with health problems and labor costs.

## **1.5 Scope**

The project involved designing and developing a microcontroller-based hydraulic crop sprayer which is used to switch on/off the crop sprayer by using a standard Remote control. All the processes are controlled by the 8 bit Microcontroller AT328P. The Microcontroller receives the Infrared Signal from the receiver and it decodes and switch on/off the sprayer. Then an ultrasonic sensor is used to detect the level of the chemical in the tank and notifies the user when the chemical is almost finished through sounding a buzzer and turning on a red LED (Light Emitting Diode).

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