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FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

AUTOMATION OF DRIP IRRIGATION SYSTEM USING SOIL MOISTURE AND RAIN SENSORS.

CASE STUDY: BUSITEMA UNIVERSITY RESEARCH FIELD

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ABSTRACT

Water in the form of precipitation or irrigation, is one of the most critical crop inputs that is needed to achieve a potentially high-value crops fruits i.e., vegetables, tobacco and nursery stock which must be of top quality to win acceptance in the market place. Attaining quality requires timely management decisions especially of crop production inputs. Natural rainfall is unpredictable hence there is need to detect the rainfall before the irrigation is performed.

Water must be supplied in sufficient quantity or desired quantity when the crop needs it. By efficiently controlling crops' water supply, an essential production variable is being controlled beyond good soil management methods. Irrigation is the best management technique available to meet crop water requirements. The problem of water stress and water logging on the yield of the crop due to the conventional methods of irrigation of the farmland has led to the new thinking of automated water management i.e.," Automated Drip Irrigation using soil moisture and rain sensors" can boost the yield and the economy.

Automated Drip irrigation system is a computerized technique of watering the field, saving labour effort and the time incurred in the manual exercise. More so, agricultural practices can be on the line throughout the year and the technique also provides the means of extracting raw data from the soil which is transformed to information that would be useful for future planting of the crop. This is essentially the major difference between the economy of advanced countries and the Developing countries. The method makes use of soil moisture sensor which is one of the devices for measuring the moisture content of a particular soil which needs irrigation, an ultrasonic water level sensor for ensuring the level of water in the reservoir, rain sensor that detects the presence of rainfall in the atmosphere thus interfacing with the computer system. The maximum watering level is obtained from annual rainfall data.

The key objective of this project is to develop low-cost solar powered Automatic drip irrigation system model controlled by a microcontroller which uses soil moisture and rain sensors. The microcontroller performs user defined functions by monitoring the set point of the soil moisture sensor along with weather station sensor i.e., Rain sensor then checks the water level sensor and outputs commands to drive appropriate actuators (relay, switch and motor pump).

This control system is built around Arduino Uno microcontroller programmed using embedded C language.

Inputs are the signals from three sensors namely soil moisture sensor using hygrometer module, water level sensor using the LM 324 Op-amp, and the rain sensor using FC 37. All the three sensors operate under the principle of electrical conductivity. The microcontroller processes the input signals by using the control software embedded in its internal ROM to generate five output signals, using one of the output signals to control a relay that enables the switching on and off of the Dc Motor water pump connected to the dripline system that irrigates the field, the second output signals to detect the presence of rainfall (rain sensor), the third output signal to check whether the soil is dry or wet at field capacity and wilting point respectively, using a soil moisture sensor while the other to output signal is to monitor the level of water in the reservoir tank using a water level sensor, before the water is pumped. The project can be applied in agricultural area of any type where there is water readily available for irrigation or even desert areas since water pumping can even be achieved by using solar power energy (clean and SMART energy) and still using that water for irrigation without hindering the ecosystem.

Keywords; Automation, *Irrigation, Agriculture, Soil Moisture, Rainfall, crop, Ultrasonic.*

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DEDICATION

I dedicate this project report to a caring and loving Family at large *i.e.*, wife, ***Ms. Mary Sandra,*** my beautiful children *i.e.,* ***Lopezi Lucky Yasmin*** *and* ***Nekesa Nelly Tasha,*** *then finally my Grandmother i.e.* ***Ms. Namakoye Naume*** for their prayers, endless support and contribution of part of the efforts which have been vital in the development and production of this report.

DECLARATION

I ***Makabuli Yasin,*** hereby declare that Am the sole writer of this research project report and the details herein describe my involvement of the research design and implementation.

Signature..........................

Date 18th/..01.../..2021..

APPROVAL

This is to certify that the final project proposal report has been compiled under the supervision of;

Mr. Bwire Denis

Signature…………………………………

Date………/………/………

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ACRONYMS AND ABBREVIATIONS

Dc: Direct current

V: Volts

Ah: Ampere hours

IDE: Integrated Development Environment

LCD: Liquid Crystal Display

USB: Universal Serial Bus

CPU: Central Processing Unit

A: Ampere

LED: Liquid Electrostatic Display

AC: Alternating Current

Ω: Ohm

ROM: Read Only Memory

A_O: Analog pin zero

D_O: Digital pin zero

MH_Z: Megha Hertz

PCB: Printed Circuit Board

W: Watts

ANOVA: Analysis Of Variance

CRD: Complete Random Design

PWP: Permanent Wilting Point

FC: Field Capacity

FAO: Food Agricultural Organisation

Ha: Hectare

L: length

N_P: Number of emitters per plant

Q: discharge

R: Rainfall

S_e: Emitter Spacing

RZD: Root Zone Depth

S_r: Row spacing

CHAPTER 1: BACKGROUND OF THE STUDY

1.0 INTRODUCTION

1.1 Background of the study

Hungund, Karnataka- World's Largest Integrated Fully Automated Drip Irrigation Project Constructed by Jain Irrigation Systems Ltd.) JISL(Jalgaon, at Ramthal (Marol) in Karnataka was executed under Krishna Bhagya Jal Nigam Limited a Division of Water Resources Department of Karnataka; 12,300 Ha of area covering 7382 farmers of Hungund and nearby talukas, Work order value about INR 4,850 Million completed in 18 months, Reinforcing JISL's micro irrigation expertise, solutions and global leadership, The integrated East Side Package of the project would irrigate 12300ha of land with fully automated Drip Irrigation System. Under this integrated project, water is delivered directly from source to the root zone using HDPE/PVC piping network and on farm drip irrigation systems.

Automatic irrigation equipment refers to electric/battery-operated components that are used to automate irrigation systems in end-user industries, such as agriculture, commercial and residential. automatic irrigation equipment market analysis considers sales from automatic irrigation equipment, automatic irrigation controllers, automatic irrigation sensors, automatic irrigation valves injectors, and automatic irrigation flow meters. The analysis also considers the sales of automatic irrigation equipment in APAC, Europe, North America, South America, and MEA. In 2018, the automatic irrigation controllers segment had a significant market share, and this trend is expected to continue over the forecast period. Factors such as innovative product offering can play a significant role in the automatic irrigation controllers' segment to maintain its market position.

Smart irrigation controllers such as soil moisture sensor systems (SMSs) have proven that they can save significant amounts of water in controlled turfgrass plots under normal/wet weather and, even, under dry weather conditions.

These water savings have been achieved without a decline in the turfgrass quality (Cardenas-Lailhacar et al., 2008, 2010; McCready et al., 2009; Cardenas-Lailhacar and Dukes, 2012; Grabow et al., 2013). Haley and Dukes (2012) reported that the homes with an SMS in the same area as this study, applied 65% less water than the homes without sensor feedback.

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