DEVELOPMENT OF AUTOMATIC FERTILIZATION USING ARDUINO

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This report is submitted in accordance with the requirement of the University Technical Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

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This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of University Technical Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Oleh kerana rasa tidak selamat terhadap makanan di banyak tempat dalam dunia, peningkatan produktiviti pertanian secara lestari kini menjadi sasaran yang realistik. Pertanian memainkan peranan penting dalam pengeluaran makanan dan pembangunan ekonomi di Malaysia dan dunia secara keseluruhan. Mendapat hasil yang tinggi dari hasil ladang bergantung pada kesuburan tanah, kelembapan tanah dan faktor iklim lain. Maka, analisa yang dijalankan ini bertujuan untuk mengembangkan sistem pengendalian dan pengurusan irigasi yang disenyawakan secara automatik untuk peningkatan keliangan tanah dan nutrien dengan aplikasi baja dan air yang tepat pada masa yang diperlukan untuk pertumbuhan dan pengembangan tanaman. Ini akan memetabolismekan tekstur tanah, memberikan nutrien kepada tanaman, membina tisu tanaman dan juga meningkatkan kadar produktiviti tanaman. Pelaksanaan sistem telah dicapai dengan menghubungkan beberapa komponen dan unit kecerdasan seperti sensor kelembapan, flow switch sensor, solenoid valve, Arduino Uno dan komponen lain untuk menerapkan baja dan air agrokimia larut secara automatik berdasarkan keperluan tanaman. Sistem yang dirancang dapat meyakin pada para petani di luar sana untuk lebih menceburi dalam bidang pertanian. Sesungguhnya berbudi pada tanah boleh menghasilkan pendapatan yang lumayan.

ABSTRACT

Given that significant food scarcity exists in many parts of the world, sustained development of agricultural production is a feasible goal today. Agriculture plays a significant part in the growth and economic development of food in Malaysia and the world at large. Getting high yield from farm produce depend on land fertility, soil moisture and other climatic factors. The goal of this paper is to establish an automated fertilized irrigation control and management system for soil porosity and nutrient enhancement through the timely application of fertilizer and water levels needed for crop growth and development. This will metabolize the soil texture, give the nutrient to the crops, build plant tissue as well as increase the rate of crop productivity. To implement the system, several components and intelligence units such as humidity sensors, flow switch sensor, solenoid valve, Arduino Uno and other components were interfaced to automatically apply soluble agrochemical fertilizer and water based on plant needs. Farmers out there to become more involved in agriculture can use the planned system. Indeed, being virtuous in the land can produce a decent income.

DEDICATION

In order on dedication, it should be for my family, friend and my supervisor for give me support each time. For complete this psm 1 until psm 2, it take much time and sincerity to build this project. Some improvement has been done for make this project more functional on daily life. If they have some mistake or goes wrong, I would like to apologize for everything have done.

ACKNOWLEDGEMENTS

Assalamualaikum, In the name of Allah the most gracious and the most merciful, first. I would like to extend my deepest praise to Allah S.W.T who has given me the patient, strength, determination and courage to implement this task.

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INTRODUCTION

1.0 Introduction

The innovation in designing fertilization in agriculture, timing, amount and concentration of fertilizers applied are easily controlled. The nutrient requirement of crop is very much dependent on the biological stage of growth, varying from seeding to harvest. This project is about facilitating farmers to be more systematic in keeping their crops. It also does not have to use main power as it can operate automatically with electronic equipment. The aim of this project is to design, provide reliable and maintain a fertilizer set A mixing process and use controller to set B at the set point. The electrical resistivity of the liquid mixing fertilizers is to be considered as a substitute for the nutrient volatility. The equipment that will use is, arduino as a controller connected with solenoid valve, flow switch, and ultrasonic sensor.

1.1 Background

Automatic fertigation control system using arduino is an upgrade project from the existing system in Malaysia. Existing system using a manual system fertilizers, the farmers should take a much time and using a lot of manpower to mixes a fertilizer where the fertilizers contain two type which is set A and set B to ensuring the nutrition of quality vegetable. Both fertilizers shall be mixed and stirred in water with a ratio 1:1. The EC measuring device will measure the nutrient of the solution to ensure that the nutrient level is no more than the requirement for the crop. This work proposed an automated nutrient solution mixing device for fertigation according to the standard of electrical conductivity (EC) required. This method guarantees the continuous delivery of a combined nutrient solution without having to test and combine fresh nutrients every day.

This system of this project, uses an EC sensor to automatically check the concentration level of the mixed nutrient solution. The controller will monitor the EC level and run the mixing process when the system us able to accurately keep the mixed nutrient solution concentration.

Other than that, the system only consists of electronic pumps for mixing process and an arduino as the controller. This project using microcontroller (Arduino) to operate the system of mixing fertilizers automatically.

Fertigation is the method of growing plants with added nutrients, but without soil, in media such as coconut peat, rock fibre, gravel or liquid. Now a day, resend technology fertigation is the famous techniques of supplying fertilizer to crops through an irrigation system by injection. Fertigation is an agricultural technique that maximizes yield by means of controlled water and fertilizer application. This method will also avoid the negative effects of leaching fertilizers to the roots, media and groundwater.

In Malaysia, there is some vegetable mostly using this method system to grow up the vegetable such as, chilies, cucumbers, and tomatoes. One of these benefits is the need to prevent soil-borne diseases and nomadic agriculture in small highlands that tend to have a negative effect on local ginger production.. In addition, analysis was also carried out to establish techniques to replace the local items available as growing media, such as coco peat and rice husk. Not only is this method relatively cheaper but it also provides solutions for the use of unused agricultural waste.

1.2 Problem Statement

There are the problem statements carried out of this project.

I. Helping the community out there using existing technology in agriculture.

II. Making it easier for farmers to mixing the fertilizers without using a lot of energy. The system only consists of electronic pumps for mixing process and an arduino as the controller. This project using microcontroller (Arduino) to operate the system of mixing a fertilizers automatically.

III. The EC measuring device will measure the nutrient of the solution to ensure that the nutrient level is no more than the requirement for the crop. The method helps

one to control precisely the concentration of the combined nutrient solution The crop need continuous supply of mixed nutrient solution without the need to daily check and mix new nutrient.(Manas & Ariffin, 2013)

1.3 Objective

The objective of this project is to upgrade an existing system that using nowadays to a new system that make easier to a former in agriculture process. The system must be simple and not too complicated for troubleshoot any breakdown while it on working.

I. Provide new knowledge regarding to fertigation system and business proposal to youth and helping them generate extra income.

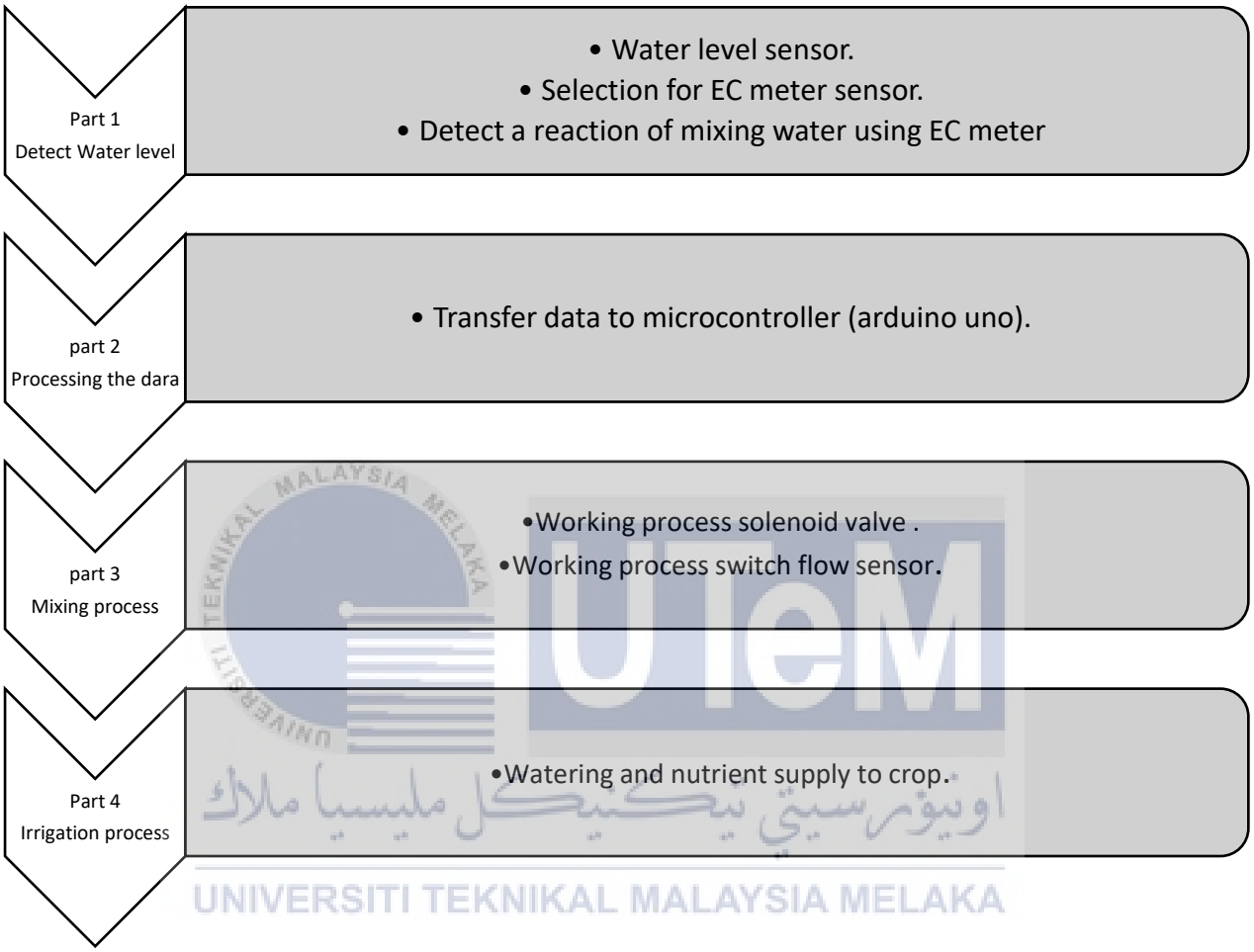
II. Buildings and basic equipment available to carry out this project is the protection of the water system, water tanks, water pump engines, and building the foundation for the storage of raw materials, water tanks and equipment including the raw materials consisting of steel, rope, seeds and pesticides to crops fertigation.

III. Build an automatic system using arduino for supply an enough nutrient for the crop, by ensuring that this will save farmers energy and time.

IV. Share and accept new ideas in an effort to improve performance and technology used for project control system, security, and structure.

V. Given a new look with injection technology to increase revenue, more secure and minimizing the use of labour

1.4 Scope



Today the farming sectors, as it becomes an even more important contributor to the food supply. This project consists of four part which is, at the first part, the ultrasonic sensor is used to detect water level of water treated by the government inside mixing tank. Solenoid valve will perform when ultrasonic sensor transmit data of water level in mixing tank. While the EC meter will measure the value of electrical conductivity (EC) of fertilizer. The microcontroller (arduino) will process the data and transmit gesture on the tool such as, motor pump, solenoid valve and flow switch sensor to perform the process of mixing fertilizer. And the last part, the process of watering and supply to crop will perform after all the above processes was done according to time set

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In agricultural businesses, crops require water to develop strongly. Three quarters of the soil surfaces are covered with water which incorporates the streams, oceans and lakes. The sources of water system for the largest area depend on rainfalls. In Malaysia, particularly, there are 3000mm rainfalls for 200 days per year and it permits variety of crops to develop. Water system and fertigation are imperative within the agrarian industry as agriculturists utilize these strategies to control the plants' development, quality, and natural product abdicate. The presentation of this system is able to assist ranchers to ideally control these two strategies. In fertigation framework, the two types of solvent fertilizers are broken up into water and will be provided to the crops through the irrigation line by utilizing infusion pump.(Abd Rahman et al., 2018) It could be a strategy of cultivating whereby total excrement is given to the vegetation within the shape of arrangement, which is channeled to the root zone through a dribble water system. In arrange to realize higher efficiency and to wilt.

Control of the fertilizer concentration and pH value in the irrigation planting system is vital. The fertilizer, which falls into the planting framework, imposes an imperative angle in plant development. In Malaysia, manual strategy is utilized to plan the fertilizers as the rancher will pour the precious stone fertilizer into a tank containing water and blend it physically some time recently putting it into the most tank. There are two forms of fertilizer to be combined into entirely separate containers, and it can take time and a lot of effort. The farmer will then take the perusing of the concentration of the fertilizer and the pH confidence to maintain the plant output. A mechanism for monitoring and sustaining the concentration and pH level of fertilizer by the use of an electronic conductivity (EC) sensor and an Arduino system will be developed and implemented on three tanks.

2.1 Methodology

In arrange for fertigation framework to be effectively working, the framework must be able to run a number of important assignments consequently. The assignments incorporate controlling supplements required by the crops, dissecting the condition of the environment, blending supplements within the arrangement tank and pumping them into an irrigation line.(Xiukang & Yingying, 2016) Programmed fertigation framework will include computer program and equipment usage. The most microcontroller is utilized in this framework is Arduino Uno. The sensor is additionally imperative to control the saltiness and pH esteem to blend the fertilizer arrangement. The sorts of sensor utilized in this inquire about are electrical conductivity.

2.1.1 Available System

Developing the fertigation program maximizes the income of the farmers by reducing the cost of production for the crop. In addition, more work is required to grow more productive crops with the lowest fertigation device costs possible.

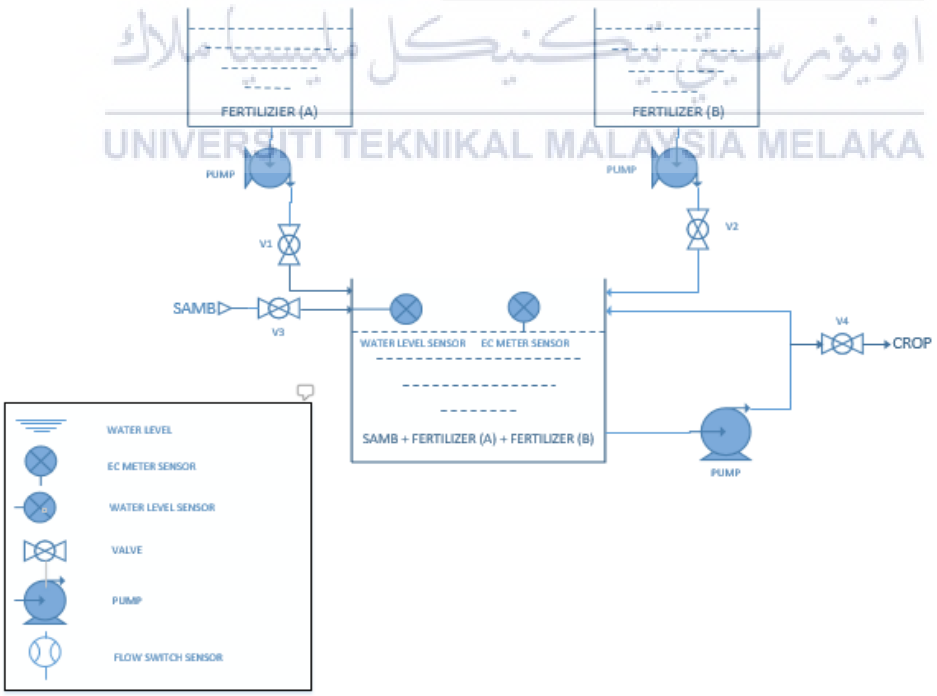


Figure 2.1: System of the Project

This system as shown in figure 1, consists of several main components such as main tank where is consists of water mixed with fertilizer A and B, pump, valve, flow switch and two nutrient tank which is tanks A and B. First the main tank will be filled with water resources until predefined level. This task will be perform by ultrasonic sensor which is that device with calculate the level of water filled in the main tank and solenoid valve (v3).

Figure 1 shows the main tank standby the water for the system. The fertilizer A and B will filled in the main tank. The performing of supply fertilizer to mixing tank when the pump trigger and solenoid valve (v1 & v2) allowed the fertilizer fill into a main tank. The value of steel that filled will be measured by flow switch sensor since this necessary should 1:1. To mix the supplements nutrient and water within the main tank, the concept of water circulation is connected to the system. The water will mix when the pump start operate then pump the water and sends it back into the main tank until a certain time that make sure the nutrient completely mix with water(Ramadani et al., 2014). When the electric conductivity (EC) reading achieve the level that crop required, the pump and valve (1&2) will close. That mean the nutrient filled into the main tank is enough.

The next process is to supply the mixed fertilizer to the crop. Valve 4 will open while another valve will be closed. The process will repeated when the fertilizer in the main tank is at the low level.

The crop more needs two to six times the fertilizer arrangement's infusion into the irrigation system in one day. Timer is often used in the method to monitor the time to deliver the fertilizer to the crop for the process. A system was easier to install than other systems, which were more complex to operate Although the implementation of this model was not as successful as the other method, the time for the farmer to blend the fertilizers would then be simpler and quicker, the most valuable aspect is the farmer who would be willing to produce more profits because the farmer will not have to hire labour (Aisham & Rahim, 2019)

2.2 Component to Implement

From the system design, this is the best system to implement in this project. Compared to the current model the device implementation became simpler out there was more complicated. This section consist of two part, which is mechanical part and electronic part.

2.2.1 Mechanical Part

I. Fertilizer Tank

This tank used in this system consist of two tank which is to fill the nutrient fertilizer A and fertilizer B. This tank able to cope 11 liter of liquid fertilizer and also come with cover. The dimension is 28cm X 28cm X 32cm. This product suitable for fertilizers storage because the material of the tank is not recycle material which is not give a side effect into an effective of a fertilizer.

Figure 2.2: Fertilizer Tank

II. Mixing Tank

This tank used in this system, which is to mix the fertilizers A, fertilizer B and water. The mixed fertilizer in this tank will decide the value of nutrient should supply to the crop. The nutrient of the fertilizers will determine by EC meter. This tank able to cope 22 liter of mixed fertilizer. The dimension is 38cm X 38cm X 38cm. This tank can cope more value of liter compare with fertilizer tank A & B, which is mixed more used to supply nutrient to an crop This product suitable for fertilizers storage because the material of the tank is not recycle material which is not give a side effect into an effective of a fertilizer.