UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ARDUINO BASED AUTOMATIC PLANT WATERING SYSTEM USING SOIL MOISTURE SENSOR FOR BOTANICAL PURPOSE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor‟s Degree in Electronic Engineering Technology (Telecommunication) with Honours

by

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B071310483

930304-08-5826

FACULTY OF ENGINEERING TECHNOLOGY

2016

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TAJUK: **ARDUINO BASED AUTOMATIC PLANT WATERING USING SOIL MOISTURE SENOR FOR BOTANICAL PURPOSE**

SESI PENGAJIAN: **2016/17 Semester 1**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Telecommunication) with Honours (Department of Electronic & Computer Engineering Technology). The member of the supervisory is as follow:

.....

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ABSTRAK

Peningkatan suhu sekitar pada masa kini membuat orang merasa tidak selesa, dan masalah ini sedikit banyak disebabkan oleh kesan rumah hijau yang berpunca daripada pelbagai aktiviti manusia termasuk penggunaan elektrik, pembakaran bahan api fosil dari kenderaan dan industri dan juga penebangan hutan. Dalam erti kata lain, kekurangan tumbuhan adalah salah satu sebab yang membawa kepada pemanasan global. Idea mencipta sistem tumbuhan air automatik berdasarkan Arduino diilhamkan oleh keinginan untuk memelihara alam sekitar daripada kesan rumah hijau. Dengan usaha dan sumbangan penanam tumbuhan di rumah yang semakin meningkat, penggunaan teknologi dalam mereka bentuk sistem tumbuhan air yang boleh mengairi air tumbuhan secara automatik tanpa perlu usaha manusia boleh dilaksanakan untuk menangani gaya hidup manusia yang sibuk pada masa kini. Bersempena dengan objektif untuk melakukan projek ini, reka bentuk mengenai automatik sistem loji air telah dikaji dan dicipta menggunakan Arduino. Projek ini kemudiannya dibangunkan dengan menggunakan Arduino Uno sebagai pengawal mikro yang berantara muka dengan C dan C ++ bahasa himpunan. Sementara itu, Arduino diguna bersama-sama dengan sensor kelembapan tanah bagi mengesan tahap kelembapan tumbuhan dan menghantar isyarat untuk mengawal dan mematikan pam air tenggelam mikro. Prestasi dan fungsi sistem tumbuhan menyiram automatik dianalisis menggunakan alat Parallax Perolehan Data (PLX-DAQ) lembaran kerja dalam Microsoft Excel akibat pembalakan data yang juga membolehkan pemantauan masa nyata terus dari Arduino IDE. Secara keseluruhan, automatik sistem loji air ini berdasarkan Arduino mampu memberi manfaat dari segi penggalakkan penanaman tanpa memerlukan usaha manusia. Dalam jangka masa panjang, sumbangan orang dalam penanaman dijangka dapat membantu dalam mengurangkan kesan rumah hijau.

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ABSTRACT

The rising of surrounding temperature nowadays make people feel uncomfortable, and this problem more or less is caused by greenhouse effect that comes from all sorts of human activities which comprise of the usage of electricity, the burning of fossil fuels from vehicles and industries as well as deforestation. In other words, the lacking of plants is one of reason that leads to global warming. The idea of inventing Arduino based automatic plant watering system is inspired by the urge to preserve environment from greenhouse effect. With the effort and contribution of people in growing houseplants, the use of technology in designing a plant watering system that can water the plant automatically without the need of human effort can be implemented to deal with the hectic lifestyle of people nowadays. In conjunction with the objectives of doing this project, the design on automatic plant watering system is studied and is created using Arduino. This project is then developed using Arduino Uno as a microcontroller that interfaced by C and C++ assembly language. Meanwhile, Arduino works together with the soil moisture sensor upon detecting the moisture level of plants and send signal to control the on and off of the micro submersible water pump. The performance and functionality of the automatic plant watering system are analyzed using Parallax Data Acquisition tool (PLX-DAQ) Spreadsheet in Microsoft Excel as a result of data logging which also enable real-time monitoring directly from Arduino IDE. Overall, this Arduino based automatic plant watering system is beneficial in term of encouraging planting without the need of human effort. In the long run, the contribution of people in planting is expected to aid in minimizing greenhouse effect.

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DEDICATION

To my beloved parents, supervisor and all friends.

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ACKNOWLEDGEMENTS

The completion of this undertaking could not be possible without the participation of so many people. It is a must to reflect on people who gave me support and assistance throughout this intensive period to complete my entire Bachelor Degree Project (BDP) as their contributions are sincerely appreciated and gratefully acknowledged.

Most importantly, I would like to single out my supervisor, Madam Siti Asma binti Che Aziz together with my co-supervisor, Sir Fakrullah bin Idris and acknowledge them with gratitude for the timely expert guidance, cheerful encouragement, boundless patient and fully support that helped me a lot in accomplishing this project. I do appreciate all the useful ideas and noteworthy suggestions that make me come to know about so many new things. In addition, I dedicate part of the project to my panels, Sir Ahmad Fauzan bin Kadmin and Sir Mohd Faizal bin Zulkifli for giving me suggestion such as the addition of data logging to make improvement on my project.

In the same vein, I wish to convey my gratefulness to my parents particularly my beloved mother, Madam Chuah Saw King for always being there for me. Her wise counsel and sympathetic ear are the greatest support that energized me throughout these hard times. Not to forget, I want to thank all the help rendered by my fellow coursemates and housemates. Thanks a lot for the undying support and important inspiration that helped me come across all the difficulties faced. I am really thankful. To all others who have contributed immensely either directly or indirectly for my BDP and are not enumerated in details, thank you.

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LIST OF ABBREVIATIONS

AVRRISC	-	Advanced Virtual RISC
BDP	-	Bachelor Degree Project
COM	-	COMMON
DC	-	Direct Current
EPROM	-	Erasable Programmable Read-only Memory
GSM	-	Global System for Mobile
HW	-	Hardware
I/P	-	Input
IDE	-	Integrated Development Environment
LCD	-	Liquid Crystal Display
NC	-	Normally Closed contact
NO	-	Normally Open contact
O/P	-	Output
OP-AMP	-	Operational Amplifier
PC	-	Personal Computer
PIC	-	Peripheral Interface Controller
PLX-DAQ	-	Parallax Data Acquisition tool
PVC	-	Polyvinyl Chloride
RX	-	Serial In
SMS	-	Short Message Service
SRAM	-	Static Random-access Memort
SW	-	Software
TX	-	Serial Out
USART	-	Universal Synchronous/Asynchronous Receiver / Transmitter
USB	-	Universal Serial Bus

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CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

This project mainly focuses on the plant watering system which can water the plant automatically before the plant is dehydrated. In this case, a soil moisture sensor is used to detect the soil moisture level. In fact, the main component will be Arduino Uno which functions to check the feedback from the soil moisture sensor in order to sense if the plant is hydrated or dehydrated. To initialize the process, a micro submersible water pump will be placed inside a bucket or a tank of water to enable the flow of water to the plant. If the plant is detected to be in dehydrated condition whereby the soil moisture level is under certain level, the micro submersible water pump will be switched on, and water will begin to flow to the plant. At a time, only certain amount of water will flow to the plant as programmed into the Arduino Uno before the soil moisture sensor checks if the moisture level of plant is sufficient or not. Therefore the micro submersible water pump will only continue to run if the moisture level still below low so that the plant will never get drown. In contrast, if the moisture level of plant is sufficient, the micro submersible water pump will be switched off automatically and the moisture sensor will continue to sense and wait till the moisture level reduces in furtherance of getting the pump to turn on again. This process will keep repeat to ensure the plants stay hydrated and grow healthily. Lastly, data logging is utilized to monitor the soil moisture level in real-time directly from Arduino IDE serial monitor into Microsoft Excel using Parallax Data Acquisition tool (PLX-DAQ) Spreadsheet.

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1.2 PROBLEM STATEMENT

The invention of an Arduino based automatic plant watering system is for the sake of saving time and effort apart from encouraging people to grow plants. This is because the rising of surrounding temperature nowadays make people feel uncomfortable, and this problem more or less is caused by greenhouse effect. Basically, greenhouse gases come from all sort of human activities which comprise of the usage of electricity, the burning of fossil fuels from vehicles and industries as well as deforestation. In other words, the lacking of plants is one of reason that leads to the rising in surrounding temperature.

The advantage of this invention to detect the moisture level of soil and thereafter, water the plant automatically is compatible with the hectic lifestyle of people nowadays. It is believed that there are people who loves planting but have no time or not so dedicated to take care of plants. Therefore, this invention can ease human lives and deal with their laziness in watering plants, particularly during summer or during hot weather days. To add on, this system will be useful for travellers. Before they are away from home, they can set up the invention to keep they plants healthy and alive. In the long run, the contribution of people in planting more or less can help to tackle greenhouse effect and to lower surrounding temperature.

1.3 OBJECTIVES OF PROJECT

The objectives of this project are:

1. To study on the design and create the automatic plant watering system using Arduino.
2. To develop the automatic plant watering system.
3. To analyze the performance and functionality of the automatic plant watering system.

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1.4 SCOPE OF PROJECT

The scope of this research is limited to the following items so that the research could be focused to achieve the stated objectives. In order to achieve that stated objectives, the work scopes are listed as below:

i. The Arduino based automatic plant watering system is designed and created using Fritzing software.

ii. The automatic plant watering system is developed on the Arduino board with the soil moisture sensor connected. The soil moisture sensor is then programmed using C or C++ assembly language to detect the soil moisture level and control the water flow to the plants.

iii. Obtain the result of the automatic plant watering system from the project developed.

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1.5 PROJECT OVERVIEW

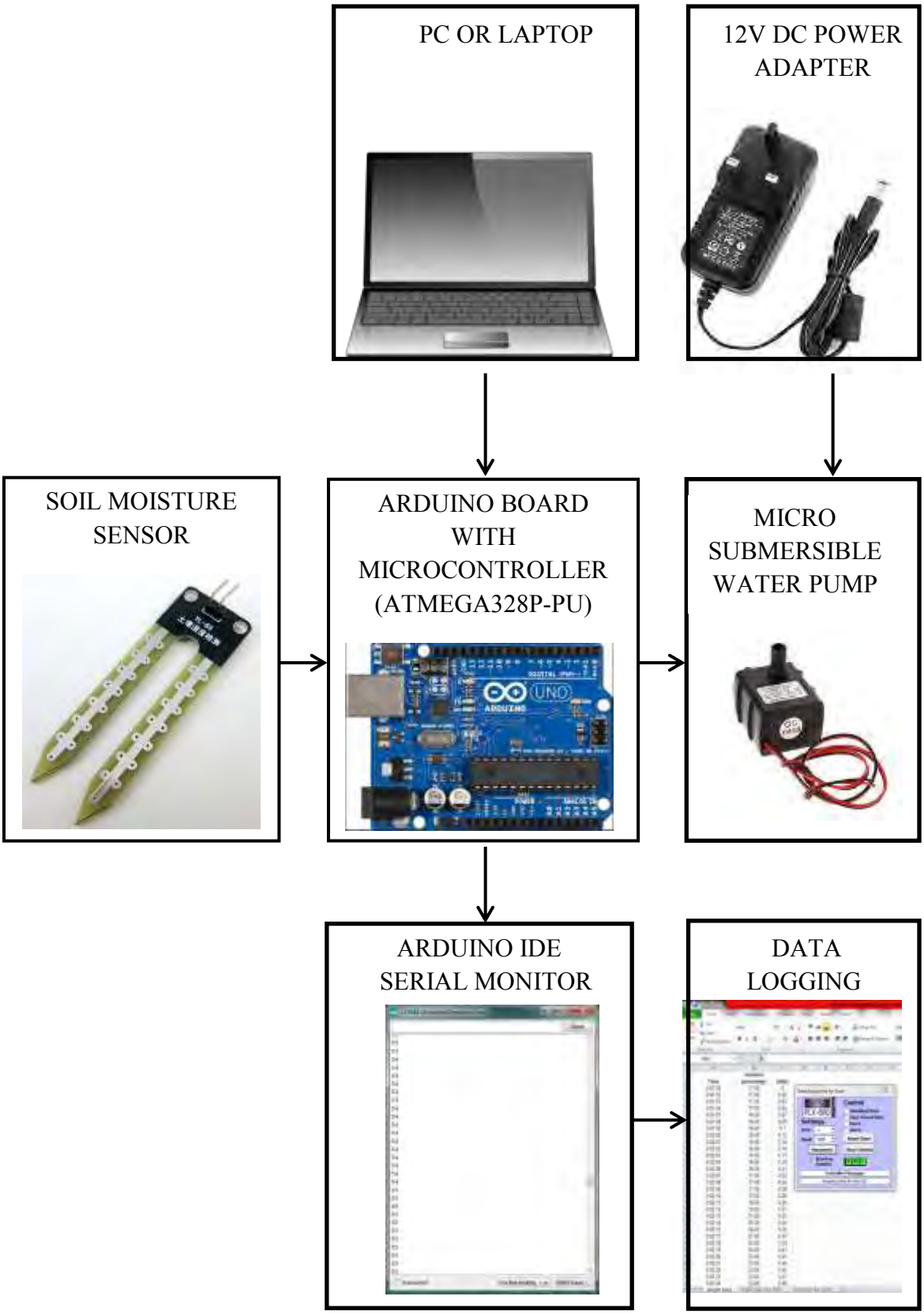

Figure 1.1: Project Overview Block Diagram

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1.6 THESIS OUTLINES

This report consists of five chapters. All these chapters discuss about the implementation of this project, which is about Arduino based Automatic Plant Watering System using Soil Moisture Sensor.

I. Chapter 1 will discuss about the overview of this project that include introduction, objectives, problem statement, work scope, methodology and thesis outlines of this project.

II. Chapter 2 will consist of previous project that has been researched. The information about several components, technology and tools used. In addition, Chapter 2 will also discuss about the details of software and hardware design.

III. Chapter 3 will explain the details on the methodology used in solving this project on automatic plant watering system. This has been accomplished in pursuance of obtaining better results for this project.

IV. Chapter 4 is the discussion on the hardware and software results obtained from the system created. Also, there will be discussion on the analysis based on the result as well as the overall project discussion and summarization of the system work.

V. Chapter 5 will conclude the overall project and recommendation for the project enhancement in term of future work.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter contains the study, review and discussion on related work based on Automatic Plant Watering System and literature survey on the Automatic Plant Watering System. The reason why this project is chosen instead of other project is stated as well. Other than that, this chapter also includes details in hardware devices and software that are used in this project.

2.2 Automatic Plant Watering System

According to (Naga & Gunturi, 2013), water shortage is getting to be one of the greatest issue on the planet. Various strategies are produced for preservation of water. Water is required in every single field and is essential to not only human, but also to other creatures and plants. Also, water is required in huge amount particularly in agriculture sector. In order to tackle with the excess of water given to the fields, there are numerous strategies to control water wastage from agriculture. One of the strategies is the invention of automatic plant watering system. Automatic irrigation systems are beneficial, notably to travellers. Basically these automatic irrigation systems need to install and program properly to offer assistance in water preservation. In these circumstances, the automatic watering systems have to be programmed so that they can release much more water in a focused range, which can aid in water conservation. Therefore, the main aim of creating automatic plant watering system is to help save water and money.

There are several techniques used to control water wastage from agriculture

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which are ditch irrigation, terraced irrigation, sprinkler system and rotary systems and drip irrigation.

2.2.1 Ditch Irrigation

Ditch irrigation is a conventional technique whereby the ditches are dug out and seedlings are planted in rows. Siphon tubes are utilized to flow the water from main trench to the waterways.

2.2.2 Terraced Irrigation

Terraced irrigation is an exceptionally work concentrated technique of irrigation whereby the area is cut into steps and bolstered by retaining walls. The flat areas are utilized for planting with the idea that water will stream down each step and water each plot. In this case, crops are planted in steep lands.

2.2.3 Sprinkler System

Sprinkler system is an watering system in view of overhead sprinklers, sprays or guns, introduced on perpetual risers. Likewise, the system can be buried underground so that the sprinklers are able to rise up with the rise in water pressures. An example of sprinkler watering system is prevalent watering system framework used on golf courses.

2.2.4 Rotary System

Rotary system is most appropriate for bigger territories since that the sprinkler can achieve separations of up to 100 feet. The phrase “rotary” is the characteristic of the mechanical driven sprinklers that move in circular, thus

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