
# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## Development of An Automatic Irrigation Sprinkler System for Corn Farm Using Arduino

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Electronics Engineering Technology (Industrial Electronics) (Hons.)

By

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## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Development of An Automatic Irrigation Sprinkler System for Corn Farm Using Arduino**

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# APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor Degree of Electronics Engineering Technology (Industrial Electronics) (Hons.). The member of the supervisory is as follow:

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**EN. SHAHRIZAL BIN SAAT**

# ABSTRACT

The high demand for corn is unpredictable nowadays since it is a healthy food which has high antioxidant. Since the demand is very high, the farmers find that they must be producing a very large amount of corn without using many energy, time and money by implementing the automatic irrigation sprinkler system based on soil moisture sensor and displays soil moisture level in the Blynk apps. This report also describes the history of the farming industry and how it has evolved over time. This paper proposes and demonstrates an economical and easy to use Wifi-based controlled irrigation system. The designed system deals with environmental factor which is moisture using soil moisture sensor. This project is using real-time clock widget in Blynk apps since it syncs real-time clock on Arduino. It will get the date and time from the server and datas are collected and received by the microcontroller which is NodeMCU which can be linked to the apps. It shows the real-time values along with the standard values of factor required by the crops. Since the revolution in industry now are more to the applications that is functioning with 4.0 industry element and Internet of Things (IoT) project, it allows users to control irrigation pump and valves from far distance through the apps and to meet the standard values which would help the farmers with optimum usage of water as well as to yield the maximum and quality crops.

# ABSTRAK

Permintaan yang tinggi untuk jagung tidak dapat diprediksi sekarang ini kerana ia adalah makanan yang sihat yang mempunyai antioksidan yang tinggi. Oleh kerana permintaannya sangat tinggi, para petani mendapati bahawa mereka harus menghasilkan banyak jagung tanpa menggunakan banyak tenaga, masa dan wang dengan melaksanakan sistem pengairan automatik berdasarkan sensor kelembapan tanah dan memaparkan tahap kelembapan tanah dalam aplikasi Blynk. Projek ini juga menggambarkan sejarah industri pertanian dan bagaimana ia berkembang dari semasa ke semasa. Projek ini mencadangkan dan membuktikan sistem pengairan kawalan berasaskan Wifi yang ekonomik dan mudah digunakan. Sistem yang dirancang berkaitan dengan faktor persekitaran iaitu kelembapan menggunakan sensor lembapan tanah. Projek ini menggunakan widget masa nyata dalam aplikasi Blynk kerana ia menyegerakkan jam nyata pada Arduino. Ia akan mendapat tarikh dan masa dari server dan data dikumpulkan dan diterima oleh mikropengawal iaitu NodeMCU yang boleh dihubungkan dengan aplikasi. Ia menunjukkan nilai masa sebenar bersama-sama dengan nilai piawai faktor yang diperlukan oleh tanaman. Memandangkan revolusi terkini di industri pada masa kini adalah menjurus kepada aplikasi yang berfungsi dengan mempunyai elemen industri 4.0 dan Internet of Things (IoT), ia membolehkan pengguna untuk mengawal pam dan injap pengairan dari jarak jauh melalui aplikasi dan untuk memenuhi nilai-nilai piawai yang akan membantu para petani dengan penggunaan air optimum serta menghasilkan tanaman maksimum dan berkualiti.

# DEDICATION

To my lovely parents and supervisor, this thesis is dedicated to them,

For their endless love, support and encouragement.

# ACKNOWLEDGEMENT

First of all, I would like to thank my lovely parents for their support and encouragement throughout this journey. Next, I would like to express my sincere gratitude to my supervisor, Encik Shahrizal bin Saat for always providing valuable guidance, comments and suggestions throughout making this project. I am really grateful because I managed to complete this project within the time given. This project cannot be completed without the help and effort from Encik Shahrizal. Other than that, I would like to thank Universiti Teknikal Malaysia Melaka (UTeM) especially Fakulti Teknologi Kejuruteraan (FTK) for always providing me some tools in making this project. Last but not least, I would like to express my deepest thanks to my friends and anyone who in one way or another shared their support, either morally, financially and physically. Above all, I would like to thank to the Great Almighty, Allah s.w.t. for giving me the strength, knowledge, ability and opportunity to complete this project.

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# CHAPTER 1
# INTRODUCTION

## 1.0 Introduction

This chapter will discuss briefly the background of the Irrigation Sprinkler System. Besides that, this section will also be discussing about the problem statement, main objective, scope and summary of the project.

## 1.1 Project Background

A growing population of corn and changing corn consumption patterns are estimated to require a doubling of its production in the developing countries in the future since the demand of this food is very high. Most of this increase would need to come from higher crop yields and greater crop intensity given limited scope for agricultural land expansion. Expanding the use of efficient irrigation and agricultural water management technologies is a key part of the solution to increasing yields in a sustainable manner. Investments in efficient irrigation can also lead to major improvements in the standards of living of small farmers who produce the majority of food in developing countries [1].

Water is essential for socio-economic development as there are many farm owners who have large farms, which require maintenance such as watering. This maintenance can become very expensive for businesses where these plants are more of a periphery than a business focus. In the future, these wastes will represent a large amount of money. The

aim of this project is to reduce the overhead of maintenance of these farms through automation of the watering process. It will help save time, money and help the environment through reducing water loss due to overwatering and inefficient spraying. Sprinkler irrigation method distributes water to crops by spraying it over the crop area like a natural rainfall. The water under pressure flows through nozzles and sprays over the area. The pressure is provided by a pump of suitable capacity and horsepower. With careful selection of nozzle sizes, valves, operating pressure and spacing, the actual water required for maintaining the soil moisture at field capacity is applied uniformly at a rate to suit the infiltration rate of soil thereby obtaining efficient water application [2].

## 1.2 Problem Statement

The demand for corn is unpredictable nowadays since it is a healthy food which has high antioxidant. It helps protecting the body from cancer and heart disease. Besides that, it is one of the main food after rice and wheat.

Since the demand is very high, the farmers find that they must be producing a very large amount of corn without using many energy, time and money. The farmers have to enlarge their corn farms in order to plant more corn seeds. When the farms are larger, the number of workers must be expanded too. When there are a lot of workers at the farms, they have to prepare a lot of money to hire and pay them. Moreover, the farm owners who have large farms require maintenance such as watering. They tend to overwatering due to inefficient spraying and this will lead to wastage of water.

Generally, farmers visit their agriculture fields periodically to check soil moisture level and based on requirement water is pumped by motors to irrigate respective fields. Farmers need to wait for certain period before switching off motor so that water is allowed to flow in sufficient quantity in respective fields. This irrigation method takes lot of time and effort particularly when a farmer need to irrigate a large scale of agriculture fields.

Therefore, the irrigation sprinkler system controlled by apps is discovered. In this project, we do not upgrade the pump even though the farm is enlarged because an upgraded pump needs more money. We must maintain the usage of the low-pressure pump type because it requires a low maintenance while the watering system can be controlled by apps can reduce the amount of energy use and can save time too.

## 1.3 Project Objectives

The objectives of the project are important to ensure the research will fulfil the solution of the problem research. All the objectives are shown below:

i. To design a large-scale automated irrigation sprinkler system integrated by android apps using Arduino Uno that would use water in a more efficient way in order to prevent water loss and minimize the cost of labour.
ii. To implement the automatic irrigation sprinkler system based on soil moisture sensor and displays soil moisture level in the android apps.
iii. To design and develop the prototype of the agricultural based system.

## 1.4 Scope of Project

The scope of this study involves the study of the methods of watering the corns. The work scope of this project is to develop an automatic irrigation sprinkler system for corn farm using Arduino. Firstly, the soil moisture sensor will detect the soil whether it is wet, dry or needs watering. This project will use Arduino as a microcontroller. Next, Arduino will analyse the data follows by the coding. If the water level value in the soil is low, we will receive a message through the android apps and the automatic valve will be opened. There are several valves and the valve will be opened one by one just to avoid low pressure water. Next, if the water level value in the soil is high, the valve will stay close.

## 1.5 Thesis Outline

There are 5 chapters in this thesis which are included of introduction, literature review, methodology, result and discussion and subsequently an end and recommendation. Each chapter will discuss about personal elements that associated with the project.

In chapter one, there is introduction to the project and the objectives. There are their own statements, object and scope of the along had been discussed and presented in this chapter.

Next, chapter two, previous research are reviewed in this chapter. This chapter is discussing the methods and techniques used in previous research. The evaluation of power and weakness can be used because the suggestions to expand a green automatic watering system. The own concept also proposed and justified in this chapter.

Chapter three focuses on the methodology and processes on the task. This consists of the software program implementation and hardware development of the task.

Results and discussion will be provided in chapter four. Finally, the chapter five that presents a complete conclusion of the task. The suggestion and recommendation for future improvement inside the functional is also referred.

## 1.6 Project Significant

This project will be useful to the society mainly for those small farmers who are going to enlarge their farms. Other than that, it will be useful for the farmers who wants to avoid the wastage of money and water because this project does not need many workers. Moreover, this project only requires a low maintenance to keep producing the corns. Similarly, studies on the system's techniques and technique can be used to develop in order that relevant in the wide areas consisting of watering the plantation with a massive

variety of plants. This assignment also contributes ideas for researchers to develop watering and irrigation system using Arduino system.

# CHAPTER 2
# LITERATURE REVIEW

## 2.0 Introduction of project

This section will be discussing about the studies and the information after making a great contribution in the scope of this reflection, auto irrigation system method or systems delivered. Further discussion on the related past studies and information that make significant contributions in this location of study, auto watering system or closely related machine. There is a huge source of information of the associated areas published on the web about a watering system. The collected information gives recommendations at the approach and samples current opinion. Consequently, the idea is supported and justified with significant past studies.

## 2.1 Irrigation Techniques for Small-scale Farmers

Irrigation has been around for as long as people had been cultivating plants. Man's first invention after he discovered how to grow plants from seeds was perhaps a bucket. Historical humans should have been strong from having to haul buckets full of water to pour on their first plants. Pouring water on fields continues to be a common place irrigation approach these days. But other extra efficient and mechanized techniques also are used. (Simonne, Hochmuth, Breman, Lamont, & Treadwell, 2012)

### 2.1.1 The Watering Can

The watering can present an easy and reachable irrigation method that is understandable and broadly practiced by small-scale farmers for vegetable production. The technology provides low investments, but is labour intensive and allows irrigation of only a small garden/area (50 to 100 $m^2$.)

Figure 2.0: Vegetable irrigation by cans from the water

Irrigation through watering can or bucket (Figure 1 & Figure 2) presents many small-scale farmers with a simple method of developing irrigated plants. In some cases, domestically sourced natural substances (e.g. Bottle gourds) are used, but in maximum cases the watering can is locally produced from galvanized iron or plastic. Carrying the cans from the water supply to the crop is labour extensive and every day watering is required. In standard, the water supply ought to now not be greater than 50 m away from the location to be irrigated; not be too deep; and allow smooth access for filling the watering can.

A reservoir filled by small pump is every now and then built to facilitate access (Figure 3). Usually, irrigated gardens are discovered along rivers and streams or where surface and groundwater can effortlessly be reached. The quantity of labour required to hold water from supply to area limits the location that may efficiently be irrigated by using a family, which is commonly between 50 and a 100$m^2$. Watering cans were provided in lots of emergency interventions, normally for small-scale vegetable manufacturing in organizations, frequently women's organizations. To assist generate extra income, nearby

markets are essential for the sale of the veggies. Consequently, maximum irrigated vegetable gardens are typically located around urban centres and settlements.

Figure 2.1: Watering with a bucket

Figure 2.2: Using a watering can to access water from a concrete reservoir

Table 2.0: Watering can conditions, requirements and constraints

| Technical conditions | Requirements | Constraints |
|---|---|---|
| 1. Water source (rivers, streams, canals, drains, open | 1. Watering cans commercially available | 1. High labour input<br>2. Access to a nearby water source |