POLITEKNIK MELAKA

WhatsApp Based Guidance System For Hydroponic Farming

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JABATAN KEJURUTERAAN ELEKTRIK

SESI II: 2025 / 2026

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This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electronic Engineering (Control)

JABATAN KEJURUTERAAN ELEKTRIK

SESI II: 2025 / 2026

CONFIRMATION OF THE PROJECT

The project report titled " WhatsApp Based Guidance System For Hydroponic Farming" has been submitted, reviewed, and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

Checked by:

Supervisor's name :

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Verified by:

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"I acknowledge this work is my own work except the excerpts I have already explained to our source"

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DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : WhatsApp Based Guidance System For Hydroponic Farming

SESSION: II: 2025 / 2026

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2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.

3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **<u>Diploma in Electronic Engineering (Control)</u>** to me.

Made and in truth that is recognized by;
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In front of me, Widyawati Binti Misiran .....………………
( ) Widyawati Binti Misiran
As a project supervisor, on the date:

ACKNOWLEDGEMENTS

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ABSTRACT

This project mainly focused on the needs of simplified and determine the accessibility of smart hydroponic management, which is particularly targeted for small-scale indoor growers/farmers only by focusing on a crucial parameter which is Electrical Conductivity. The automation od dosing pump would help to make sure we can prevent human mistakes during dosing time and reduce a human need to do this job. The implementation of WhatsApp based notification which is common web chat app among us empowers the user to regularly monitor the system every time there is some action on the system and view the current sensor value. All the data is transmitted to MQTT and will be visualized in home assistant platform, providing farmers with a comprehensive dashboard for visualization and control. This project aims to the do-ability of a low-cost based smart hydroponic system which is readily accessible solutions for growers in optimizing hydroponic nutrient management by maintaining desired EC levels over time.

ABSTRAK

Projek ini memberi tumpuan kepada keperluan untuk mempermudahkan dan menentukan kebolehcapaian pengurusan hidroponik pintar, yang khusus disasarkan untuk penanam/petani dalaman berskala kecil dengan memberi fokus kepada parameter utama, iaitu Kekonduksian Elektrik (EC). Automasi pam dos akan membantu memastikan kesilapan manusia dapat dielakkan semasa proses pendosaan serta mengurangkan keperluan tenaga manusia dalam tugas ini. Pelaksanaan pemberitahuan berasaskan WhatsApp, yang merupakan aplikasi sembang web yang biasa digunakan, membolehkan pengguna memantau sistem dengan kerap setiap kali terdapat tindakan pada sistem dan melihat nilai sensor semasa. Semua data dihantar ke MQTT dan akan divisualisasikan dalam platform Home Assistant, memberikan petani papan pemuka yang komprehensif untuk visualisasi dan kawalan. Projek ini bertujuan untuk membuktikan kebolehlaksanaan sistem hidroponik pintar kos rendah yang boleh diakses dengan mudah oleh penanam dalam mengoptimumkan pengurusan nutrien hidroponik dengan mengekalkan tahap EC yang diingini dari semasa ke semasa.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This project provides a smart guidance system which focused on small indoor farmers in hydroponic area. This project consists of monitoring and controlling system for every growth stage of the plant.

User will receive a real-time sensor value to monitor the condition of main parameter for hydroponic which is EC (Electrical Conductivity) Sensor. Hence an EC sensor is used to monitor current EC condition. As we already know, the plant will consume the EC over time as this is like the food for them to grow besides sunlight and water so the EC value will be decreased over time. To increase the value of EC, a scheduled dosing sequence is introduced to pump the fertilizer A and B which will increase the EC value, and a water pump will pump the water that mixed with the fertilizer to the plant. A UVA lighting also introduced to imitate the sunlight to ensure the plant is in optimum growth state.

This hydroponic system is fully automated with the water pump, dosing and UVA lighting, EC reading, controlled by the ECP32 as the brain of the system and all of the control states of the output and sensors data will be published to the Home Assistant app which available on both the Apple Store and Google play Store. With the system in place, it’s like having buddy gardener that will help to ensure your plant is in optimum condition 24/7.

1.2 Background Research

Hydroponic is a method of growing plant without soil, which the name came hydro as the plantation only involved using water and "*ponic*" comes from Greek word "*ponos*" which refers to labor or work and putting them together means *working with water*. The hydroponic technique has already gained so many popularities due to the efficiency water usage, space consumption and of course faster plant growth. It's a beneficial solution for urban farmers and small-scale farmers that's trying to find a cost-effective hydroponic solution.

Challenges in conventional Hydroponic Farming

- **Nutrient Monitoring**: Every plant rely on nutrient (Electrical Conductivity) to grow which makes the EC as the critical parameter for the plant's growth. Usually farmers will use a manual EC meter to measure the EC level by hand
- **Human Error in dosing**: To perform dosing function to the plant, the farmer needs to make sure the quantity of the A and B fertilizer is the same and make sure the EC level is meet depends on the plant's growth stage. Mistakes during manual dosing can lead to poor plant growth
- **Lack of Remote Monitoring**: Many small-scale farmers lacks the tools to monitor and control their hydroponic system remotely as it's require frequent physical check when it comes to hydroponic technique which needs monitoring 24/7

1.3 Problem Statement

One of the major challenges in hydroponic farming is to ensure the nutrient balance of the plants is in optimum level. To control the UVA level is also important to keep the plant's growth healthy. This is the list of problem statement that this project will be focused on:

Lack of Smart Monitoring and Control Solutions for Small-Scale Hydroponic Farming :

Small-scale indoor farmers often face challenges in monitoring and managing hydroponic plant growth using traditional methods. Existing smart hydroponic solutions are often too expensive, complex, or designed for large-scale operations, making them inaccessible to small farmers. Without an affordable and automated solution, maintaining optimal plant health and nutrient balance becomes difficult, leading to inefficiencies in hydroponic farming.

Limited Remote Control and Automation in Conventional Hydroponic Systems :

Conventional hydroponic systems require frequent manual intervention to monitor Electrical Conductivity (EC), nutrient levels, and water circulation, which can be time-consuming and prone to errors. Many small-scale farmers lack access to an automated system that can remotely monitor and control essential parameters. There is a growing need for a cost-effective solution that enables automated dosing, water circulation, and remote monitoring via a user-friendly interface, allowing farmers to manage their hydroponic farms with minimal manual effort.

1.4 Research Objectives

The main objective of this project is to develop a fully automated and cost effective hydroponic smart solutions that will simplifies nutrient management and constant monitoring for small scale farmers. To achieve this, the following objectives have been identified:

- To develop a smart monitoring system using a custom ESP32-based PCB, which will serve as the main controller for the hydroponic system. The ESP32 will be responsible for reading Electrical Conductivity (EC) values, activating the dosing pumps based on a scheduled timer, and controlling the water circulation process to ensure optimal nutrient distribution for plant growth.
- To design and implement a low-cost smart hydroponic system specifically for small-scale indoor farmers who want to adopt smart farming techniques at an affordable price. The system will provide an easy-to-use, cost-effective solution that simplifies hydroponic farming without requiring extensive technical knowledge.
- To integrate a historical data logging and monitoring system, which will store past sensor readings and system states for analysis and optimization. This will be achieved through a WhatsApp-based notification system that informs users about every state change in the water pump, dosing system, and EC levels, ensuring they receive real-time updates on their hydroponic setup.

1.5 Scope of Research

- This project is focusing on developing a smart hydroponic solution which can integrates real-time monitoring sensor and output control, automated scheduled dosing control, and remote notifications via WhatsApp to help small-scale indoor farmers efficiently manage their plant.
- The emphasis is on creating a low-cost and user-friendly hydroponic solution and at the same time can ensures optimal plant's nutrient by maintaining Electrical Conductivity (EC) levels through automated scheduled dosing system. Plus, this project also offers real-time data visualization via home assistant app which can track sensor value in date range and WhatsApp notification to inform current EC value, dosing control status and output status such as lamp and water pump
- The main controller is using ESP32 custom PCB which served as the brain of this project which will read the sensor data, controlling water pump, run the scheduled dosing system and sending updates via WhatsApp notifications. The system is ideal for running 24/7 with less intervention.

1.5.1 Project Limitation

This project only focused on important parameter of the plants which is Electrical conductivity and does not include other hydroponic parameters related such as PH and temperature monitoring in current phase

This project is designed for small-scale farmers and requires a modification if the hydroponic system for large-scale is required such as for commercial use.

Whatsapp based notification, online control and monitoring depend on internet connectivitym which may affect the real-timeness of the system in certain areas with unstable/reluctant 4G network

1.6 Project Significance

Hydroponic cultivation has become increasingly popular as a substitute for conventional soil farming. Its advantages are soilless plants, quicker plant growth, and more efficient use of available space. However, the small-scale farmer has one main drawback: maintaining a balance of nutrients particularly Electrical Conductivity (EC). Individuals have attempted to mitigate this issue with automatic hydroponic systems. Although, most are costly, hard to operate, or lack real-time monitoring and simple-to-comprehend alerts.

Many researchers have been studying various parts of automated hydroponic systems to enhance productivity and ease of use:

1. Sulaiman et al. (2025) studied hydroponic automation. The research focused on EC and pH dosing systems. EC and pH control help plant growth. The study reviewed sensor-based dosing methods. It highlighted automation benefits in hydroponics. The research found manual dosing errors. It showed automation improves nutrient accuracy. Cost was a major issue for farmers. The paper reviewed various automation frameworks. It compared existing hydroponic control systems. It found high-cost solutions limit adoption Conclusively, the study determined that automated dosing systems substantially minimize human errors and advocated for the implementation of real-time monitoring to improve crop yields. Looking ahead, they suggested that future research should concentrate on further reducing the costs associated with these technologies.
2. Fadillah et al (2025) Hydroponic farming uses six methods. These include deep water culture. Others are wick systems. Nutrient film technology is another. Ebb and flow systems too. Drip and aeroponics complete the list. Plants grow horizontally or vertically. Alternative mediums replace soil. Examples: coconut pellets, perlite, gravel. Rockwool and sand also work. Vertical farming has three steps. Monitor humidity, temperature, CO, EC, pH. Regulate plant conditions optimally. Detect diseases and deficiencies. Check maturity stages. Send updates via smartphones. Essential factors: pH, temperature, CO, EC. Sensors: DHT11, ultrasonic, EC, pH. Controlled by Arduino UNO. Hydroponics needs balanced nutrients. Macronutrients: N, P, K. Micronutrients: Ca, Mn, Zn, Fe. Proper ratios maximize productivity.
3. Kenny Kueh et al (2025) Farmers today employ wireless sensors in intelligent hydroponic systems to save water and nutrients. Farmers have minimized waste and maximized how much the crops yield through the use of IoT devices. New methods like aeroponics and

aquaponics augment hydroponics—all without soil. Hydroponic systems once needed to be constantly adjusted manually.

1.7 Chapter Summary

This is a project to develop a smart hydroponic monitoring and control system for indoor small scale growers. It automates EC monitoring, nutrient dosing, and UVA lighting control to give maximum plant growth. It uses an ESP32 custom PCB with real-time data visualization via Home Assistant and WhatsApp notification for monitoring remotely. Such restriction is avoided in this project with the use of automated EC-based dosing schedules and remote monitoring with minimal human intervention. logging of historical sensor data is also employed to allow farmers to track trends and optimize nutrient management. Manual nutrient dosing and EC measurements in traditional hydroponics can be inaccurate and ineffective. This project is a more affordable and simplified option, thus making high-end hydroponic technology more accessible to small-scale growers and promoting the use of more efficient and sustainable farming methods.

Hydroponic cultivation is a mature soilless cultivation technique, but small scale farmers are troubled by the maintenance of EC levels, remote monitoring, and automation. Current literature highlights the need for inexpensive and versatile smart hydroponic systems Sulaiman et al., 2025; Fadillah et al., 2025. Literature supports the fact that IoT connectivity and wireless sensors improve water. The available solutions in the market tend to be costly and do not provide real-time control. With ESP32 based automation, IoT connectivity, and real-time alerts, the system optimizes the efficiency of hydroponic farming with precise control of nutrients and reduced operational expense for small farmers. This project fills in the gap by offering a low-cost, self-contained hydroponic system with adjustable EC on demand, data logging, and real-time notification.