

Research Article

Smart Drip Irrigation Integrated with Plant Nutrient Monitoring System

Yamuna Magenthiran¹, Saundarya Somasundram², and Kaarthigeiyan Malava Nair³

Abstract: Plants are producers in our food chain. Without plants there is no healthy and secure life. The art and science of growing plants for food and feed is termed agriculture. Malaysia is still highly dependent for agriculture with oil palm, rubber and paddy being major crops. However, the traditional way of agriculture is no longer the way forward in the 21st century. The current trend, IR 4.0 encourages the use of IOT and robotics to automate agriculture for easy, rapid and precise control for increased yield. Numerous factors control growth and development in plants, with water and nutrient being the major factors. The innovation proposed here is the Smart Drip Irrigation Integrated with plant Nutrient Monitoring System which allows efficient management of irrigation. This system contributes to water saving and produce more responsible users. Food security is a major concern, globally and nationally. According to the United Nation, nearly 9 percent of the global population faces hunger. With climate change in the horizon, agriculture can be faced with water scarcity. This is a reality in Malaysia, with states such as Kedah; Perlis and so on are faced with water shortage problems. Lack of water and inefficiency in agriculture can lead to lower yield. Drip irrigation systems and detection of moisture using sensors can help to ensure that water is supplied to the plants when required. The best way to overcome this problem is to start from home and school. Smart Drip Irrigation Integrated with Plant Nutrient Monitoring System can be an easy and efficient way to control water supply and reduce water making agriculture more sustainable. Our prototype can provide a solution and be able to compete in industry 4.0 because the programming overcome all these problems this product is by using arduino uno software for a small scale, for a larger and wider scale arduino opta can be used. This product can save excessive water consumption, time and energy and can indicate nutritional deficiencies in plants.

Keywords: Arduino uno; plants; water usage; nutrient



Copyright: © 2023 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. INTRODUCTION

Plants are producers in our food chain. Without plants there is no healthy and secure life. The art and science of growing plants for food and feed is termed agriculture. Malaysia is still highly dependent for agriculture with oil palm, rubber and paddy being major crops. However, the traditional way of agriculture is no longer the way forward in the 21st century. The current trend, IR 4.0 encourages the use of IOT and robotics to automate agriculture for easy, rapid and precise control for increased yield. Numerous factors control growth and development in plants, with water and nutrient being the major factors. The innovation proposed here is the Smart Drip Irrigation Integrated with plant Nutrient Monitoring System which allows efficient management of irrigation. This system contributes to water saving and produce more responsible users.

1.1 Problem Statement

Food security is a major concern, globally and nationally. According to the United Nation, nearly 9 percent of the global population faces hunger. With climate change in the horizon, agriculture can be faced with water scarcity. This is a reality in Malaysia, with states such as Kedah; Perlis and so

on are faced with water shortage problems. Lack of water and inefficiency in agriculture can lead to lower yield. Drip irrigation systems and detection of moisture using sensors can help to ensure that water is supplied to the plants when required. The best way to overcome this problem is to start from home and school. Smart Drip Irrigation Integrated with Plant Nutrient Monitoring System can be an easy and efficient way to control water supply and reduce water making agriculture more sustainable.

1.2 Objectives

- i. Reduce excessive water use in agriculture.
- ii. Indicate nutrient deficiencies in plans.
- iii. Cultivate the practice of careful use of natural resources.
- iv. Forming responsible human beings as well as fostering smart consumer practices.

2. METHODOLOGY

2.1 Target Group

- i. Primary school students.
- ii. Parents.
- iii. Teacher.

2.2 The Importance of Innovation Projects

The importance of this product nowadays is because the world is becoming more sophisticated towards progress and the standard of living has also changed. Paddy fields and gardening in traditional ways are less encouraged. Our prototype can provide a solution and be able to compete in industry 4.0 because the programming overcome all these problems this product is by using Arduino uno software for a small scale, for a larger and wider scale Arduino opta can be used. This product can save excessive water consumption, time and energy and can indicate nutritional deficiencies in plants.

2.3 Elements of Innovation



Figure 1. Prototype

Most products on the market can only detect any one problem, but the Smart Drip Irrigation Integrated with Plant Nutrient Monitoring System prototype that we have innovated can detect soil moisture and nutrient deficiency in plants. Arduino uno programming that uses a soil moisture sensor can detect soil moisture. If there is a lack of humidity, the indicator will indicate the humidity level in the screen display high, mid and low, if the indicator shows Low, then the rainwater collected in the tank will be pumped and dripped onto the plants and soil automatically until the soil moisture level shows high. In addition, another censor, the censor plant nutrient monitoring system, can detect the

lack of nutritional content in plants by displaying the word less nutrient detected when the leaves or plants themselves change colour such as yellowish and brownish. In this situation the user needs to take the necessary steps to treat the plant.

3. FINDINGS

3.1 Data and Results

Table 1. Amount of Water Consumption

To use	Amount of water usage per day	Assumption	Estimated water usage per week	Estimated water usage per month	Estimated water usage per year
18L Water	0.1L	When soil is dry	0.7L	2.8L	33L

Table 2. Estimated Cost

Materials	Price Per Prototype
Arduino uno set	RM70
Colour detector set	RM50
Connection wires	RM10
motor	RM50
buckets	RM30
	RM200

4. DISCUSSION

Smart Drip Irrigation Integrated with Plant Nutrient Monitoring System is a prototype that can be owned by nature lovers, farmers or gardeners. Although this prototype can only control a relatively small area which is 3 feet in size, the prototype can be built in a larger scale. Sensors detecting nutritional deficiencies are also very sensitive, but careful care is taken to maintain the quality.

5. CONCLUSION

We would like to recommend this prototype to all schools in Malaysia, as well as nature lovers who don't have time but want to plant your favourite plants and also to the agricultural industry. Careful and effective user practices can be born using our prototype. Future Plan/Project; Smart Drip Irrigation Integrated with Plant Nutrient Monitoring System using Solar Panel.

Acknowledgments: QR code of recommendation letter received from UPM; Dr.Uma (Senior Lecturer - Faculty of Agricultural), and Mr.Suria Mahsa (Lecturer – Faculty of Engineering).

References

- Adeel Javed. (2016). Building Arduino Projects for the Internet of Things Experiments with Real-World Applications. Berkeley, Ca Apress.
- Hidayat, H. (2018). Sustainable plantation forestry: Problems, challenges and solutions. Springer.
- Wilcher, D. (2014). Make : basic Arduino projects : 26 experiments with microcontrollers and electronics. Maker Media.