Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT

ISSN 2723-4509 (Online)

LED AND WATER PUMP CONTROL SYSTEMS FOR AGRICULTURE AND INTERCROPPING

Bachtiar Efendi
Computer System, Sekolah Tinggi Manajemen Informatika Dan Komputer Royal, Indonesia

***Corresponding author*:**
medo_bakti@yahoo.com

Keywords:

Intercropping
Led and Water pump
Control System

ABSTRACT

Demand for fresh organic vegetables is not balanced with the market supply often leads to unstable prices and tends to be expensive. Likewise, the demand for freshwater fish as a side dish continues to increase. While organic vegetable farming and freshwater fish ponds are getting fewer. Utilization of narrow land such as houses coated to grow vegetables and raising fish in a hydroponic and intercropping manner is one solution to the fulfillment of organic vegetables and minimal fresh fish for the family itself. However, narrow land such as the house territory was very poorly lit as a condition for growing vegetables well. The use of led growth as a substitute for a source of sunlight can help vegetables flourish. The intensity of the led light and the length of the irradiation are controlled by a microcontroller chip, as well as for regulating water flow using a water pump from the fish pond below.

INTRODUCTION

Intercropping in farming is common. This is done to maximize land use and crop yields. Intercropping systems are usually between two different types of plants, such as long beans with soybeans, cassava with peanuts or corn with sweet potatoes and many more types of plants that can be planted intercropping[1].

Now hobbies and farming businesses can be carried out anywhere, including on narrow land and critical land that is not possible to be planted such as sandy land, rocks and house walls. But with businesses and cultivation techniques that are also different from those on land. The preferred technique used is usually hydroponic farming. In addition to easy maintenance, hydroponic crop yields are much more and fresher when compared to farming on ordinary land[2].

This can occur because on land soils the possibility of losing soil nutrients is very high especially if the soil is often inundated and drained by rain water. Fertilizers that have been given to plants will be carried by the flow of water so that plants lack soil nutrients. In addition, weeds that grow around plants can also interfere. That may be some of the reasons why hydroponic farming promises better results.

Proceeding **ISSN 2723-4509 (Online)**
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT

Hydroponic gardening and raising catfish can also be combined into one. Catfish pond wastewater which contains fertilizers such as NH3, NO3, NO2, organic carbon, and on average has a pH of 7 to 8, much needed by vegetable plants picking the leaves for consumption such as water spinach, mustard greens, lettuce, and spinach. Catfish limba water is channeled in pots or vegetable plants that are above the catfish pond using a small water pump [3]. Catfish manure wastewater will be absorbed and filtered by the roots of vegetable plants into clear and fresh water which is returned again into the pond, so that the catfish pond water becomes cleaner. And so on, the circulation of water between fish ponds and the roots of vegetable crops[4].

The narrow terrace of the house and next to the wall of a neighbor's house can be used to raise fish and grow vegetables hydroponically. But the terrace of the house is usually less sun. Not good for growing vegetables. Now for the terrace of a house that is lacking solar lighting or even without sunlight at all, it can still be used with a note that there must be additional LED lights for growth[5].

The led growth lights emit ultraviolet light like sunlight needed by plants to grow and develop. The intensity of led growth lighting is adjusted according to the needs of the plant by an arduino uno R3-based microcomputer control device, as well as the pump on and off as well. This control is needed because the ultraviolet rays from the led growth must be as true as the actual sunlight, especially in terms of time and duration. While the water pump also does not pump water to the roots of vegetable plants. Only a few times a day the pump turns on to drain the water according to plant needs[6].

METHODE

The hydroponic axis system is the simplest hydroponic system. This system uses an axis to connect the nutrient solution with the planting medium. Hydroponics is a soilless planting system or cultivation of plants without soil. The hydroponic system utilizes water to meet the nutritional needs of plants, such as the origin of the word hydroponics namely hydro which means water and ponos which means power[7].

In hydroponic planting these nutrients are not present in water or growing media. Therefore, the grower must determine their own types of nutrients and their levels for these plants. The advantage of hydroponics is that nutrients needed by plants can be given accurately according to the wishes of the grower. While in ordinary planting, the planter cannot determine the nutrient content in the soil as he wishes.

Arduino Uno

Arduino is an electronic platform that is open-source. The Arduino board can read inputs and convert them to output by sending instructions to the microcontroller inside the board. Arduino uno is an ATmega 328P based microcontroller board. Arduino uno has 14 digital input / output pins (of which 6 pins can be used as PWM outputs) and 6 analog inputs[1].

Proceeding **ISSN 2723-4509 (Online)**
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT

Image 1. Arduino uno board

In this system Arduino UNO is used as a control center that regulates the on / off of the growing lights and to determine when the water pump turns on according to the needs of plants and read RTC data and humidity sensors placed on the plant.

***Real Time Clock* (*RTC*)**

RTC (Real Time Clock) is an electronic time meter that is able to calculate and store time accurately and in detail (from years to seconds). RTC requires a CMOS battery as a power supply, so that it can maintain and run time (up-to-date) even though the system is not running.

Image 2. *RTC* (*Real Time Clock*)

The RTC sensor in this system is used to store time data which is useful for regulating the life of the lights and growing lights in the system[8].

Relay

Relays are electromagnetic switches that work with little current and low voltage to drive the on / off switch, and are capable of delivering high-voltage electricity.

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

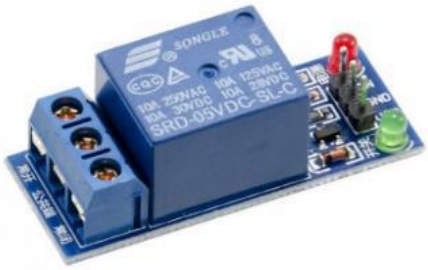

Image 3. *Relay*

Relay is an output device that functions to turn off and turn on growing lights as well as to turn off the water pump according to the schedule based on the clock from the RTC and according to the input from the humidity sensor that has been first processed by the microcontroller[5].

Sensor Soil Moisture

Soil moisture sensor is a sensor used to measure soil moisture or the amount of water content in the soil. This sensor is applied to plants that require certain humidity and must be in accordance with their needs. For example there are plants that don't like being too moist or dry like mushroom plants. So this tool is needed to measure and control soil moisture around the plant to grow.

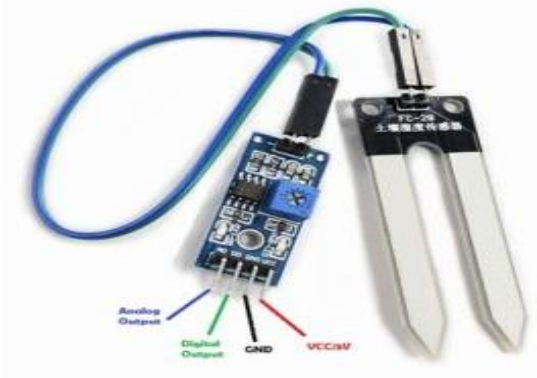

Image 4. *Sensor Soil Moisture*

LCD I2C

I2C LCD is used to display plant root ambulance and time. Data is taken from RTC and soil moisture sensor.

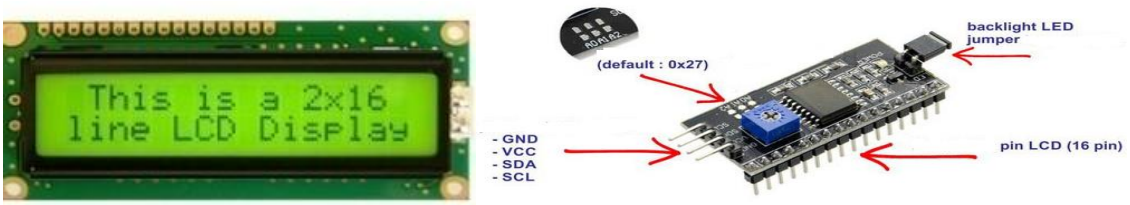

Image 5. *LCD I2C*

Proceeding **ISSN 2723-4509 (Online)**
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT

Water Pump

water pump used is a small electric aquarium water pump. the on and off water pump is adjusted according to the time and humidity sensor input.

Image 6. *Water Pump*

Led Growth

LED lights instead of the sun are actually the result of NASA research, but now are widely used in agriculture to help plant growth in indoors less sunlight[5].

Image 7. *Led Growth*

Ultraviolet light led growth lights have been adjusted to the needs of plants, it's just that the intention of the time must be adjusted again as needed.

Circuit Work System

In simple terms the intercropping and hydroponic systems are as follows. Catfish ponds are under vegetables. Vegetable plants are placed on the media pipe in such a way that the water from the catfish ponds is pumped to be flowed into the pipe that contains vegetable plants. The pump turns on for a predetermined time or according to the humidity of the plant roots from the humidity sensor input indicator

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

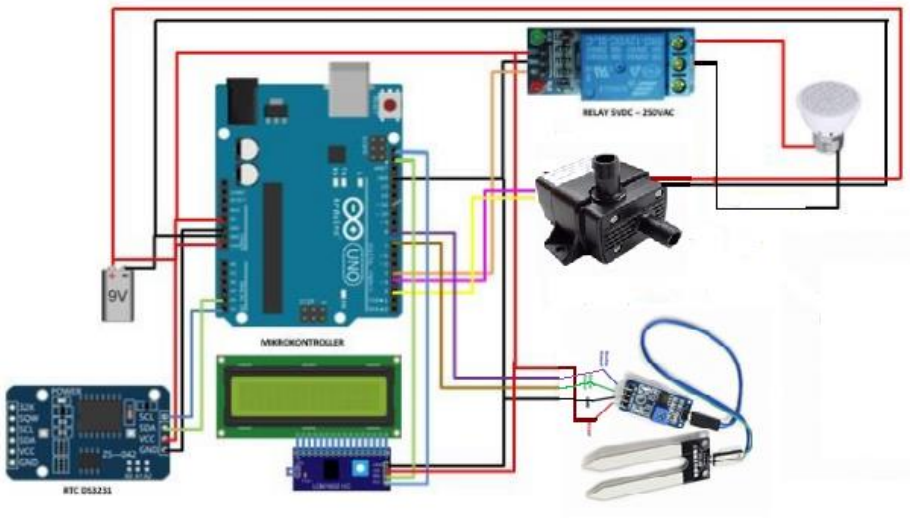

Image 8. *Circuit Work System*

If it is not wet enough, the pump can turn on again after the microcontroller has been ordered. Circulation of dirty water from catfish ponds to plant roots continues as needed. And the water that is absorbed and filtered by the roots of plants is returned to the fish ponds to become clear and oxygen-rich water.

While the led growth lights are used to help illuminate plants, because plants do not get sunlight. Nayala the death of the led growth lights adjusted to the needs of plants. Intendity data and the length of this artificial sun dsetting using RTC time input. So the RTC gives input to the microcontroller how long the LED growth light has been on or how long has been off.

RESULT AND DISCUSSION

The lamps used as plant growth lamps have wavelengths of light ranging from 380 nanometers (nm) called ultra violet light, to 880 nm called infra red light. Plants need visible light with a spectrum between 400 nm - 700 nm. To the human eye, the wavelengths associated with green and yellow appear much brighter when compared to red and blue which are the main colors in the photosynthesis process in plants. From the picture above, it appears that the absorption of chlorophyl produces strong growth in the spectrum between 390 nm - 510 nm. The 610 nm - 700 nm spectrum is the main spectrum for the photosynthesis process. Deep red light, which is located on the spectrum of 700 nm - 730 nm is very good for the flowering process[9].

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

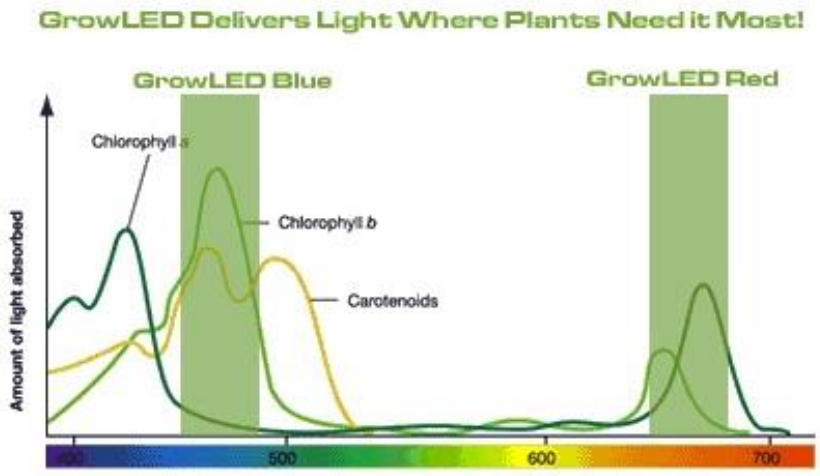

Image 9. *Wavelenght of light*

Results from plants using lighting led growth without sunlight districted rice tables and graphics below:

Table 1. Growth of plants each week

Vegetable	Week 1 (cm)	Week 2 (cm)	Week 3 (cm)	Week 4 (cm)
Spinach	1.8	3.8	5.5	7.8
Mustard green	2.0	4	5.7	8.1
Kale	2.3	4.1	5.4	7.6

From the data in the table. 1 above, it is known that the growth and development of spinach, kale and mustard greens are planted overlapping with catfish ponds and using led growth as a substitute for sunlight.

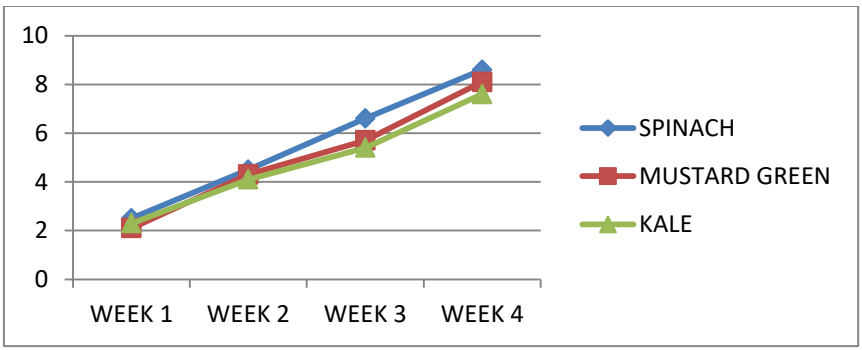

Image 10. *Growth Graphics*

From the graph above, plant growth using led growth can be relied upon. So that the use of an empty room that does not get sunlight can also be used to grow vegetables.

Proceeding **ISSN 2723-4509 (Online)**
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, page. 251 - 258
DOI: https://doi.org/10.33330/icossit.v1i1.801
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT

CONCLUSION

The application of the intercropping technique of vegetable crops with catfish ponds on narrow land that lacks sunlight can be easily done as long as all the plant needs for nutrients and sunshine are met. The provision of nutrition to vegetable plants is carried out by the performance of the pump engine which is controlled by a microcontroller with the help of sensors and timers. Likewise, solar lighting is a little assisted by using led growth which is also controlled automatically according to the needs of vegetable plant growth.

BIBLIOGRAPHY

[1] O. Christopher, "Upland rice based intercropping system among farmers in selected villages in Ogun State in South west of Nigeria," 2012.
[2] F. P. Putra, P. Yudono, and S. Waluyo, "Growth and Yield of Upland Rice Under Intercropping System with Soybean in Sandy Coastal Area," *Ilmu Pertan. (Agricultural Sci.*, vol. 2, no. 3, pp. 130–136, 2017.
[3] J. Abdul, A. Riaz, I. H. Bhatti, Z. A. Virk, and S. N. Vains, "Effect of different rice-based intercropping systems on rice grain yield and residual soil fertility.," *Pakistan J. Bot.*, vol. 42, no. 4, pp. 2339–2348, 2010.
[4] M. El-Nemr and S. Abozaher, "Decision support system for fish ponds mechanical aeration management.," *Int. Agric. Eng. J.*, vol. 21, no. 3/4, pp. 41–50, 2012.
[5] B. Efendi and E. A. Eliyanto, "MIKROTEKNOLOGI HIDROPONIK TANAMAN BAYAM DENGAN METODE FORWARD CHAINING BERBASIS ROCKWOOL DAN LAMPU LED GROWTH," in *Seminar Nasional Royal (SENAR)*, 2018, vol. 1, no. 1, pp. 55–60.
[6] I. Sodikin and J. Triyono, "Rancang Bangun Alat Pemacu Tumbuh Tanaman Guna Meningkatkan Produktivitas Hasil Pertanian Pada Industri Kecil Herbal," 2014.
[7] Y. Wei, W. Li, D. An, D. Li, Y. Jiao, and Q. Wei, "Equipment and Intelligent Control System in Aquaponics: A Review," *IEEE Access*, vol. 7, pp. 169306–169326, 2019.
[8] H. Candra, "Design And Test Performance System Automatic Control On Drip Irrigation Using Microcontroller Arduino Mega," *J. Tek. Pertan. Lampung*, vol. 4, no. 4, pp. 235–244, 2015.
[9] S. K. Singh, S. K. Singh, and S. Singh, "Vegetable crops as most efficient and economical intercrops: a brief review," *Plant Arch.*, vol. 18, no. 1, pp. 923–929, 2018.