Light intensity design as a fishing tool on liftnet, with pulse width modulation system based on microcontroller

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Abstract. Fishing can be done in various ways, including by utilizing lights as fishing tools. The lights used for fishing tools are varied, ranging from torch lights, pressure paraffin lamp, fluorescent lamps (TL, PL, SL, CFL), mercury, and various types of led. However, light transition between one colors to another often scares the fish, driving them out of catchable area shocked by the color change. One solution to address this problem is by smoothly switching the color of the lamp using Pulse Width Modulation (PWM) system on the microcontroller. The color used are the lamp with basic colors of red, green and blue. With power capacity of 50Watt/12Volt, this lamp is classified as High Power Led (HPL) lamp. The light can be free- adjusted, where each lamp can be turned on by its own light or can also be turned on in combination. It can slowly be switch on from an off position to maximum and also can be dimmed from maximum to off. Thus the intensity of the light can be controlled. The HPL and control sections were created separately. Tools and materials used are consist of push-button, microcontroller, optocoupler, mosfet and Red, Green and Blue HPL, Radio-meter (ILT5000 Research Radiometer), Voltmeter, and Amperemeter. The method used was experimental in both laboratory and field. The result of research is in the form of RGB HPL lamp which can be adjusted through control system, such as adjusment for each lamp, or light combination with smooth color transition. Thus, when this technology is applied as fishing tool in liftnet fishing, the targeted fish would still remain on catchable area.

1. Introduction

The lights are one of the factors supporting the success of the step on fisheries chart. Use lights on fisheries step on to lure fish that is collecting, bringing closer [1] and concentrating fish [2] in the fishing gear coverage area so that more fish caught on hauling [3]. The intensity of the light can concentrate movement of fish [3] and can influence the behavior of fish to approach [4]. Ayodhya, 2001 explained that step charts are categorized into light fishing (Subani) and Barus 1989). The lights used by fishermen in light fishing start from the power that is empowered large 1500 Watt [5] up to a small lamp and energy saving 1 Watt [4]. The light used is from a combination of metal halide and LED [6], Petromacs [7], Tubular Lamp (TL), CFL, halogen, mercury, LED [8]; [9]; [10]; [11]; [12]. The shortcomings that exist in light fishing fisheries are that they have not been able to regulate light intensity with well, so it is difficult to regulate the light intensity of the lamp used, therefore it is necessary the right solution so that the amount of light used in light fishing can be regulated the intensity of the light emitted, as a solution is to use three basic color lights, namely lamps LEDs are red, green and blue (RGB), when the three colors are combined it will produce white [13] which allows the intensity to be adjusted according to what

is needed. The most lamp suitable for setting the light intensity is a type of high power LED (HPL) RGB lamp using three lamps of sufficient strength, ie between 0 to 50 Watt [2] Blue, green light and red, easily stimulated by the target fish caught in the chart and the target fish tends to move closer these light sources [14]; [15];[16] and LED lights also have durability high and long life [17]

The shape of the lamp anchor (armature) as a holder of the lights on a variety of light fishing fisheries to produce good distribution and intensity of light, so some researchers make their own armature, starting from simple armature to complicated to get the distribution and intensity of light accordingly with conditions on light fishing. The distribution and intensity of the light will affect the behavior fish behavior [18] There are various forms of armature in the market, from 0o to 180o angles from the point of the light source. Some armature made has the disadvantage that is not practical to use by fishermen step on the chart, because the shape is not in accordance with the type of lamp or the complicated shape of the terms of installation. In this study, the shape of the armature with a certain angle is determined according to the LED lights RGB HPL type 50 Watt, and easily available on the market with cheap and affordable prices.

According to [19] differences in hood angle design can cause differences in light intensity. Spread LED lights extend more to the side than non-LEDs, and are easily directed with an armature. The intensity of the light from the lamp, if mounted on the armature, directly does not produce intensity optimal light, therefore to get the optimal intensity it needs to be modified in parts hood armature. Changes in light intensity from large to small or vice versa will result in changes in normal fish movement patterns [20]. Previous researchers in the regulatory system for get light by changing or changing the lampshade [11]. Such arrangements has disadvantages, and will be difficult for fishermen. A good arrangement to produce intensity light is without changing the hood armature or without carrying several hoods to get intensity and the distribution of light, just one hood or one armature and that is changed is the color of the emitted light in the form of Watts/cm^2 energy. In this research, the color of the light changed. One solution The solution to the problem above is to create a Pulse Wide Modulation (PWM) system or settings pulse width modulation [21], The purpose of this study is to design a fish-luring lamp using an RGB lamp consisting of three lights and three light colors namely Red, Green and Blue. The results of this study are the first, can determine the type RGB LED type 50 Watt HPL as a fish-luring light on fishing light, secondly, can determine the layout 50 Watt HPL type LED lights which are suitable for flat heatsinks, third, can determine the seat LED lamp type HPL (armature) RGB.

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2. Materials and Method

2.1 Time and place

The design of the intensity control system was carried out in January-December 2018. Place Laboratory of the Department of Fisheries Resource Utilization (PSP), Faculty of Fisheries and Marine Sciences (FPIK), Bogor Agricultural University (IPB University) and this research was conducted in the dark moon phase, in the waters of Bokor Island, with the coordinates at 05056 '593 'LU-106037 '557' BT, Kepulauan Seribu, North Jakarta. Location map the research is presented in Figure 36.

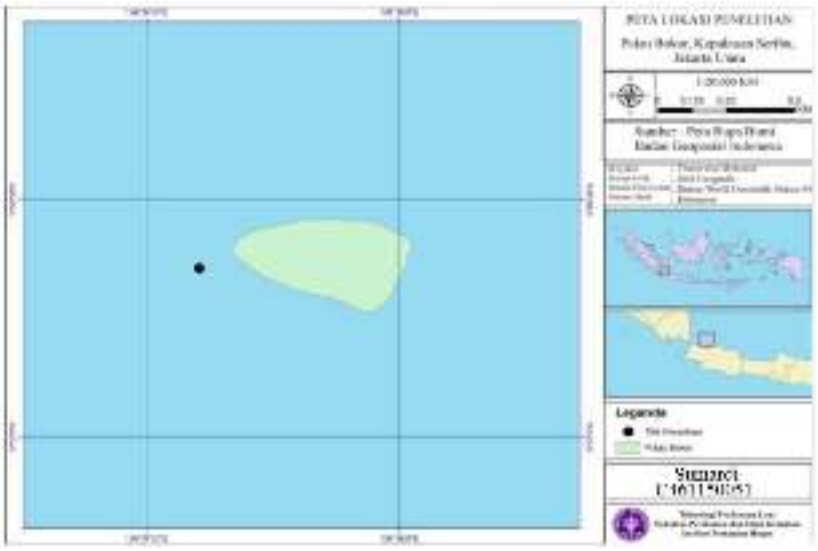


Figure 1. Map of research location

2.2 Tools and materials

The tools and materials used in the LED-RGB lamp design chapter are seen in Tables 3 and 4.

Table 1. Tools and Functions

No	Alat	Fungsi
1	Multitester	Measuring connections, Current, and Voltage
2	Watt Digital meter	Measuring Watt load
3	Solder	Connect components and cable jumpers
4	Tinol	Component Adhesives
5	Arpush	Tinol cleaner on solder
6	*Cutter Plier*	Cut component legs and cable jumpers
7	*Long Plier*	Install components on the breadboard
8	*Combination Plier*	Installing Components
9	Magnifying glass	View component connections
10	Laptop	Make a C language program
11	*Proteus*	Make a series
12	Arduino Ide	Creating programs and program transfers
13	*Osciloscope* Digital	Look at the PWM signal
14	Lux Meter	Measure the brightness of a dark LED HPL

Table 2. Material and Function

No	Bahan	Fungsi
1	*Push Button Switch*	Triger input PWM
2	IC Atmega 328	Data Process
3	*Capacitor* 22 nP	Charging and discharging an electric charge on the Pulse clock system
4	Xtall 1600MHz	Pulse Shaper
5	LED red 1 Watt	Signal indicator
6	LED green 1 Watt	Signal indicator
7	LED blue1 Watt	Signal indicator
8	*Optocoupler*	*Interfacing between control and HPL*
9	HPL Red 50 Watt	Red Load PWM Control System
10	HPL Green 50 Watt	Green Load PWM Control System
11	HPL Blue 50 Watt	Blue Load PWM Control System
12	Transistor	*PWM signal driver from OC*
13	Resistor 330 Ω/1 Watt	LED protection and reset
14	Resistor 20 Ω/20 Watt	HPL protection
15	*Power Supply* 10 Amper	HPL LED Voltage Source
16	*Jumper Cable*	Connector
17	Aclirik 5 mm	The basis for laying breadboard and components
18	Breadboard	Where components are placed

2.3 Block diagram

The block diagram below is the parts that are used in the design of light intensity. Push- button switch is useful for activating the pulse width on the microcontroller, the microcontroller will do the process pulse width and forwarded through the interface (interface) in the form of an optocoupler. Optocoupler serves to provide input the signal to the MOSFET, so that the MOSFET can function to control the HPL according to the pulse width through the MOSFET Gate.

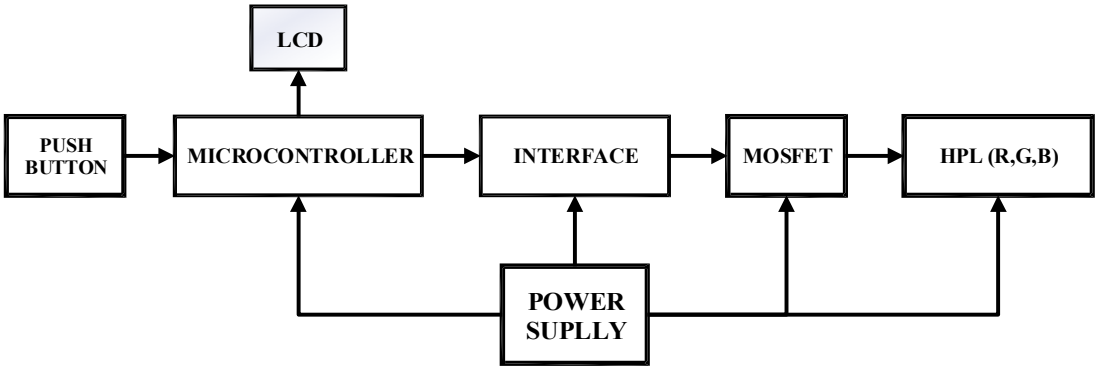
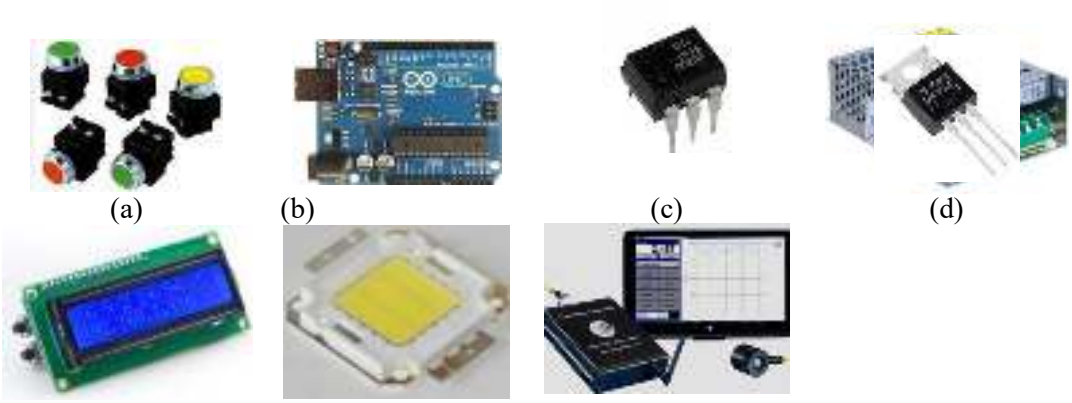


Figure 2. Block diagram of light intensity and color spectrum design



(a) (b) (c) (d)

(e) (f) (g) (h)

Figure 3. Color spectrum design material

a) Push-Button, b) Microkontroler, c) Optocoupler, d) MOSFET,
e) LCD, f) HPL, g) Radio-meter, h) Power supply

2.4 Design of Light Intensity and Spectrum

Light intensity design here is making a series with the main material used, namely push- button, microcontroller, LCD, interface, mosfet and HPL are arranged into one unit.

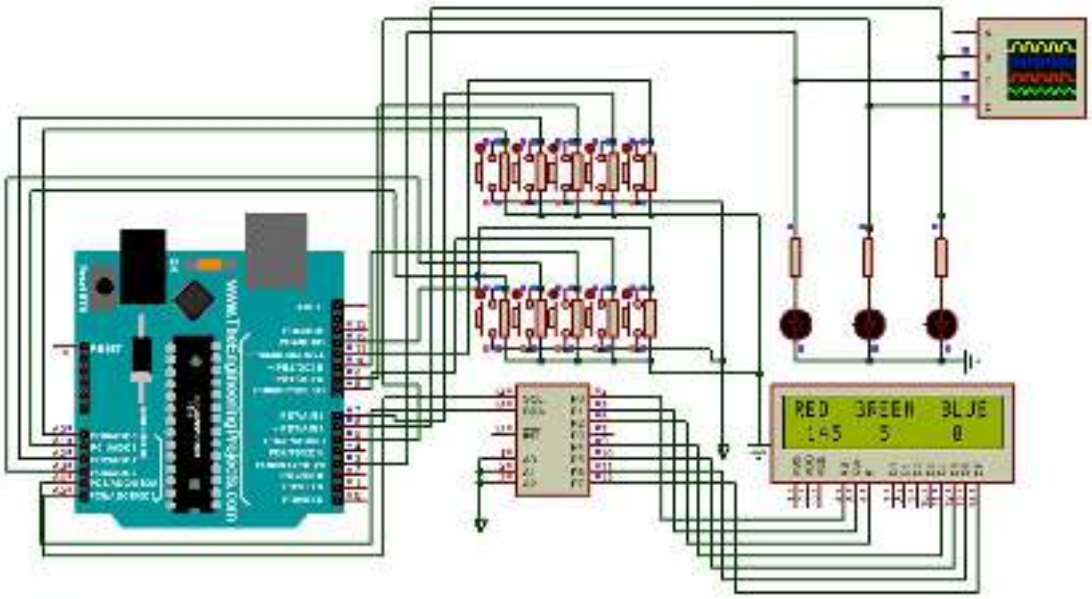


Figure 4. Design Series of light intensity and spectrum

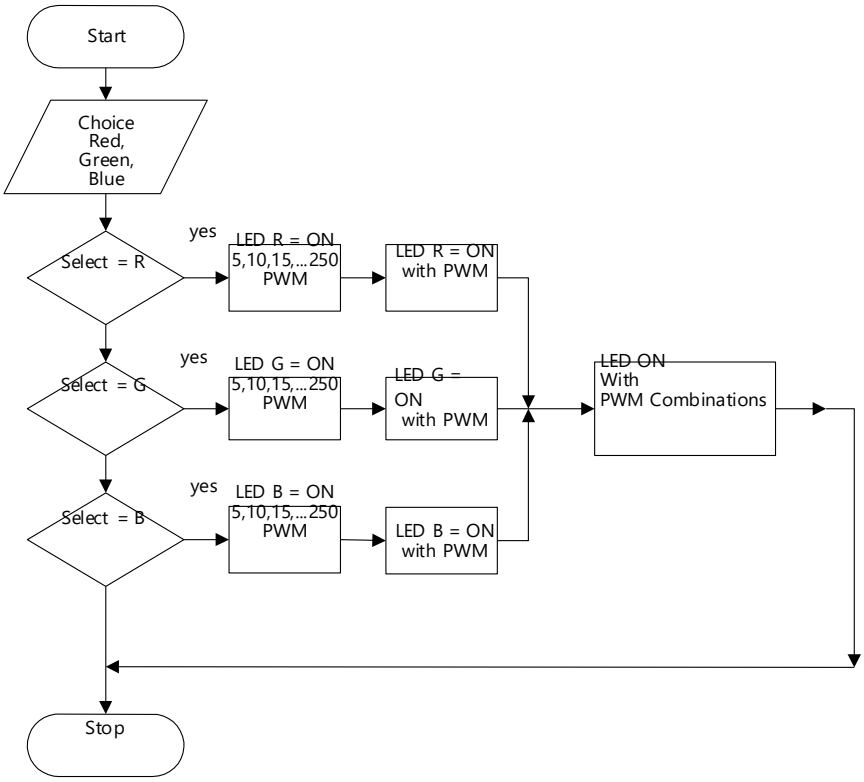


Figure 5. Flowchart of how the program works

2.5 Type of RGB lamp type of HPL

RGB color is an additive principal color model used in display systems. The RGB color model is an additive principal color model, that is, colors that are formed with combining the three main colors of light energy in various comparisons.The use of lights light fishing uses red, green, yellow, and white lights, which are large in shape and large in power, this is less practical, as a solution using a practical lamp with the same power that is the LED light HPL type which has a maximum power of 50 Watt is equivalent to other lamps. Use HPL lamps on step on the chart is able to produce a higher species composition and catch weight compared to TL lamps [11].

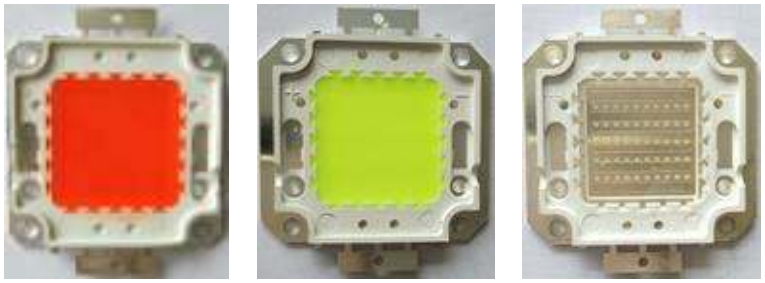


Figure 6. LED lights are 50 Watt HPL type and Hetsink

Figure 7. Heatsink

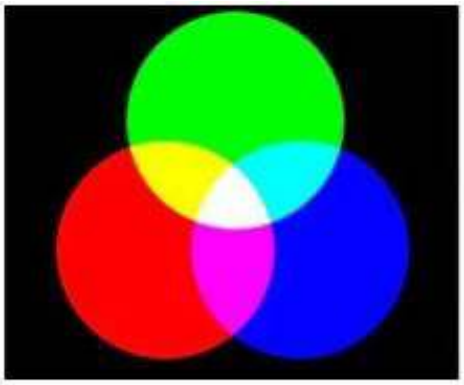


Figure 8. RGB color

2.6 Cooling Construction Design and HPL

Layout HPL holder in the form of a cooler in the form of a pendingn beririf (heatsink) with length and height of 135 x 110 x 50 mm3 with a height of 4 cm. High Power LED (HPL) measuring 40 x 40 mm2. Design and construction The cooler for HPL can be seen in Figure 3 below.

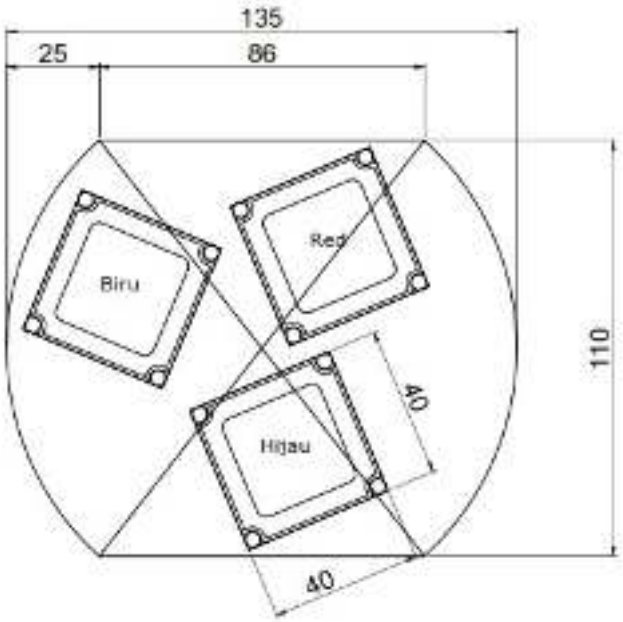


Figure 9. Position of HPL Lights on heatsnik

2.7 Desain Konstruksi Armature

Armature (Lampshade) used is made of nickel with a diameter and height of 320 mm and 220 mm. Design drawings and armature construction can be seen in Figure 13 below. The use of hoods with the direction of the HPL 90o lamp distribution [11] produces high light intensity. The armature used in this research is an armature that produces a 90° light distribution, shown in Figure 10.

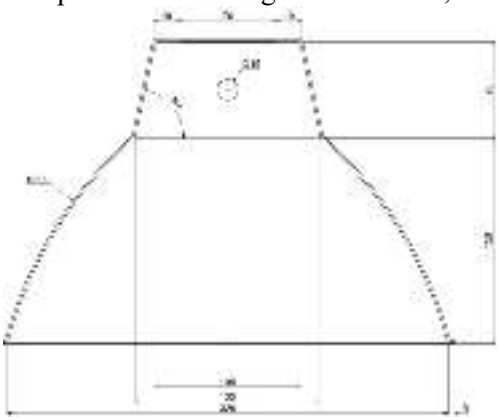


Figure 10. HPL Armature Specifications

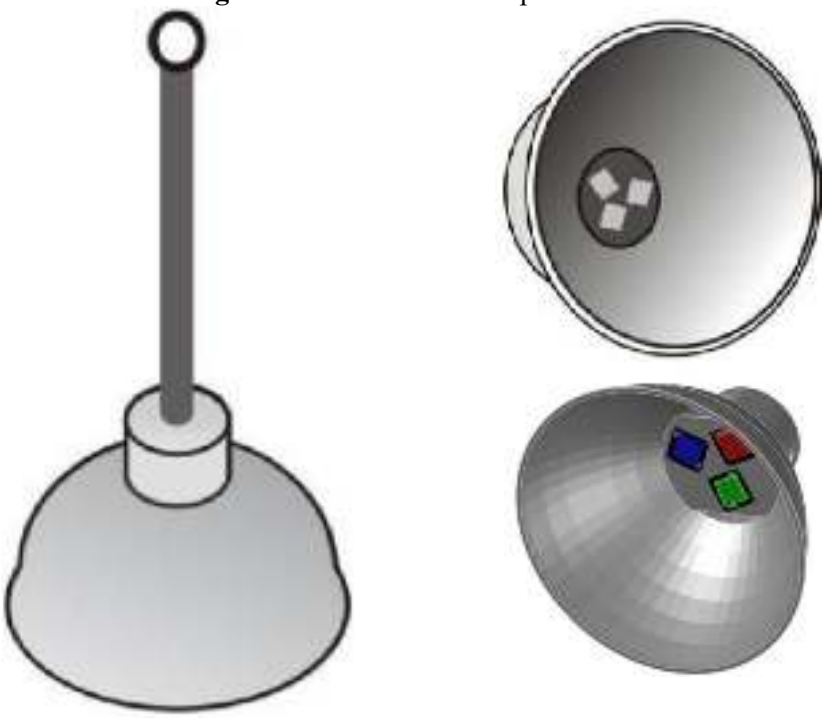


Figure 11. Design and construction for cooling and armature

Pulse Width Modulation can be used to generate repetitive pulses [22] Duty cycle can be determined from periods of high signal and low signal generated from one period. Duty cycle is expressed as a percentage, directly proportional to the average voltage produced [23]; [24]; [25].

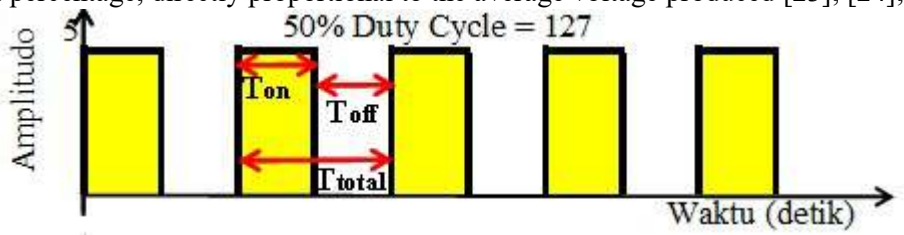


Figure 12. Pulse waveforms condition high 5 volts and low 0 volts

$$T_{□□□al} = T_{□□} + T_{□□□}$$

$$D = \frac{T_{□□}}{T_{□□}+T_{□□□}} = \frac{T_{□□}}{T_{t□□□al}}$$

$$V_{i□} = \frac{(T□□a□□a□\ _{hi□h}\ x\ T_{□□}) + (T□□a□□a□\ _{□□□w}\ x\ T_{□□□})}{T_{t□□□al}}$$

$$V_{□□□} = D\ x\ V_{i□}$$

$$V_{□□□} = \frac{T_{□□}}{T_{□□□al}}\ X\ V_{i□}$$

T_{on} = high-value pulse time (seconds)
T_{off} = Low value pulse time (seconds)
T_{total} = one cycle time (seconds)
D = Work cycle or duty cycle (D*)*
V_{in} = Input Voltage (Volt)

V_{out} = Output Voltage (Volt)

2.8 Laboratory Measurement Techniques

2.8.1 ***Measurement of LED-RGB***

Light intensity on the air medium RGB-LED lights before being applied to the operation of the step on the chart, tested on a laboratory scale for know the characteristics of light in the air. Measurements are made with the same distance and different angles emitted from the angle of light using ILT500, as did [25] (Figure 7). Measurement of light intensity in the air by means of sensors placed at a distance of 1 meter from the placement point of the lamp. Measured at an angle of 00 to an angle of 1800 with an interval of 100.

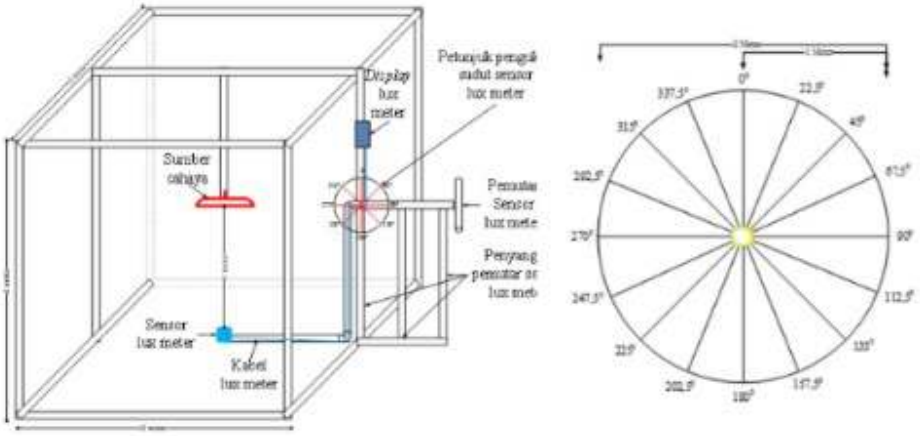


Figure 13. Illustration of light distribution measurement method on 50 Watt LED lamp **[25]**

Light intensity is measured by using ILT5000 Research Radiometer, to the side (angle 90^0) starting from the light source then shifting to the right or left at 1 meter interval to the distance where the measured light illumination value is zero [26]. The characteristic of the LED lamp was measured by using Radian-meter with the radiation unit (Watt/m2). Measurements are carried out at a distance of 1 meter from the light source and performed at an interval angle of 10 degrees.

2.8.2 Field Measurement Techniques

Measurement of LED-RGB light intensity in water medium Measurement of light intensity is done to find out the distribution of light in the water during the operation of the step on the chart. The method of measuring the distribution of light in the water method the same as previous researchers [12]. The treatment of light intensity starts with intensity high light 250 PWM, medium light intensity 195, 145, 95 PWM and low light intensity 5 PWM. Measurement performed at a distance of 1x1 m from the RGB-LED light point (Figure 14).

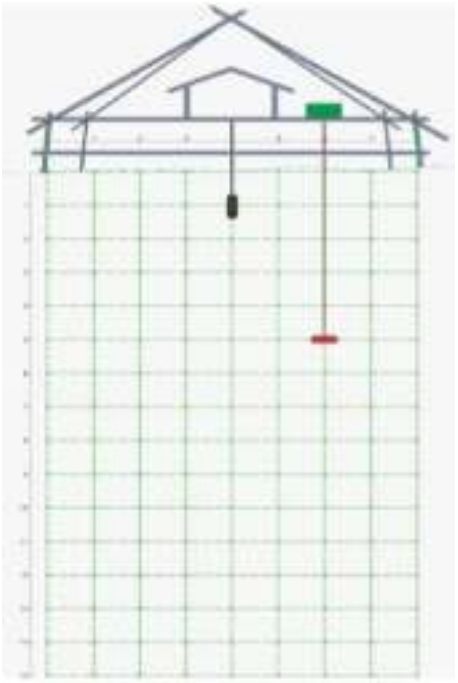


Figure 14. Water medium measurement technique

3. Result and Discussion

3.1 Light Intensity and Spectrum Design Tests

Before being assembled on a PCB, hardware testing is carried out, in the nput section, the process part and the part the output. This trial was carried out based on the circuit design using proteus software. Based on the results of the trial, the use of a push button as an input can work perfectly, that is giving a pulse to the PWM system contained in the microcontroller. The results of giving pulses issued in the form of light at the outpt form Hing Power LED (HPL) lights are blue, green and red (HPL RGB).

Figure 15. Light intensity and color spectrum design tests

After getting the results of the electronic circuit trials that are designed next are made in the form of a circuit PCB. Component layout is arranged in such a way that the control panel is designed as a design control tool light intensity, as shown in figure 16.

Figure 16. Component layout and panel control

Then after the component is placed on the panel box, the output lamp in the form of HPL-RGB is placed on the heatsink and armature, with a triangle position, so that if turned on it will produce white color. Design of the HPL-output section RGB is shown in figure 2.

Figure 17. HPL-RGB on heatsink and armature

3.2 Light Intensity and Color Spectrum

High Power LED Light was measured is by using ILT5000 Research Radiometer owned by the Labolatorium. The color spectrum of reception is shown in Fig 4 below. The intensity of the light produced is a color spectrum has a different distribution of light with units of watts / cm2.

3.3 Characteristics of light intensity in a blue-green color combination

The characteristics of the HPL RGB LED lights for blue and green are done by adjusting the width modulation pulses at 250 PWM, 145 PWM and 5 PWM. The three modulation widths are combined in blue and green becomes a color combination with a pulse width modulation 250-0 PWM Blue Green (BH), i.e. the color blue with pulse width modulation settings 250 and green with pulse width modulation settings 0. Other color combinations from blue green are 145-5 PWM BH, 5-145 PWM BH and 0-250 PWM BH. The three color combinations were measured the characteristics of the light is to find out the amount of light distribution and the amount of light intensity energy in the distribution produced in units of energy, Watts per square meter (W/ m2).

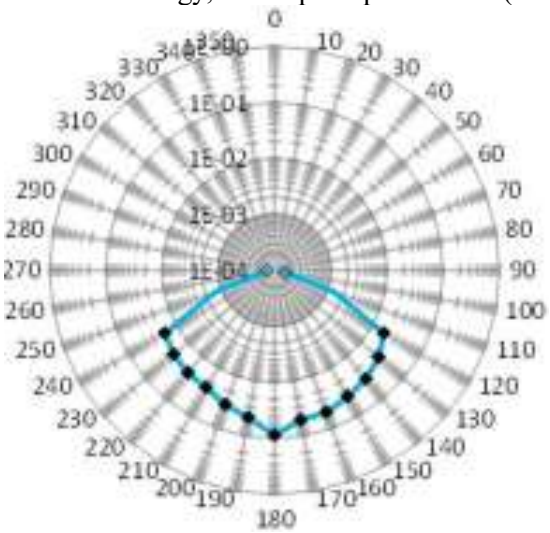


Figure 18. Characteristics of the HPL RGB LED light distribution on air medium with a 250-0 PWM Blue Green setting

The intensity of the light with blue green light settings where the color of blue light at 250 PWM and color green light at 0 PWM, also known as 250-0 PWM Green-Blue. In this characteristic light produces patterns distribution ranging from an angle of 1200 to 2400. The amount of light intensity energy produced ranges from 1.78E- 02 W / m2 - 1.78E-02 W / m2. These characteristics can be seen in Figure 18.

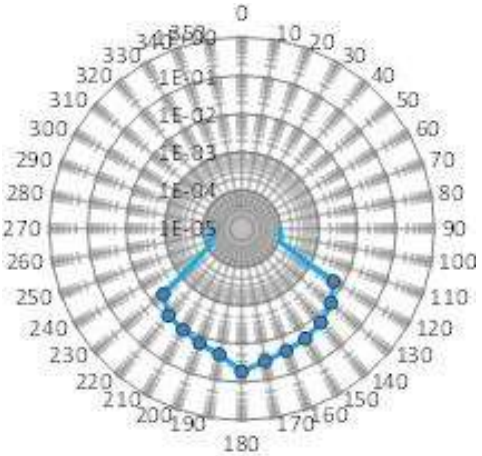


Figure 19. Characteristics of the HPL RGB LED light distribution on air medium with 145-5 PWM Blue Green settings

The intensity of the light with blue green light settings where the color of blue light at 145 PWM and the color of green light at 5 PWM, also known as 145-5 PWM Green-Blue. In this light characteristic produces a distribution pattern starting from angle of 1200 to 2300. The amount of light intensity energy produced ranges from 5.69E-03 W / m2 - 4,56E-03 W / m2. These characteristics can be seen in Figure 19.

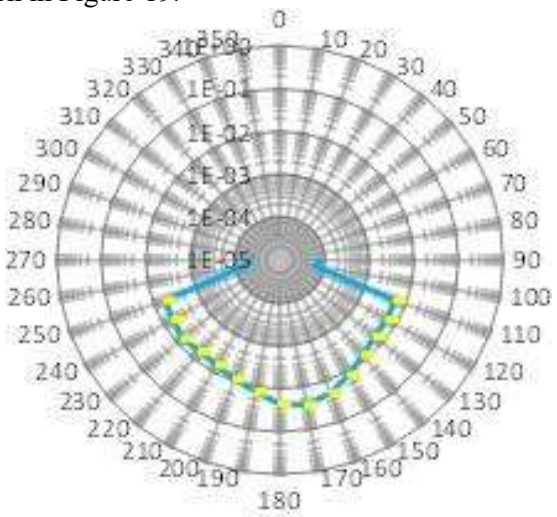


Figure 20. Characteristics of the HPL RGB LED light distribution on the air medium with a setting of 5-145 PWM Blue Green

The intensity of the light with blue green light settings where the color of blue light at 5 PWM and the color of green light at 145 PWM, or called 5-145 PWM Green-Blue. In this light characteristic produces a distribution pattern starting from angle of 1100 to 2500. The amount of light intensity energy produced ranges from 5.88E-03 W / m2 - 5.58E-03 W / m2. These characteristics can be seen in Figure 20.

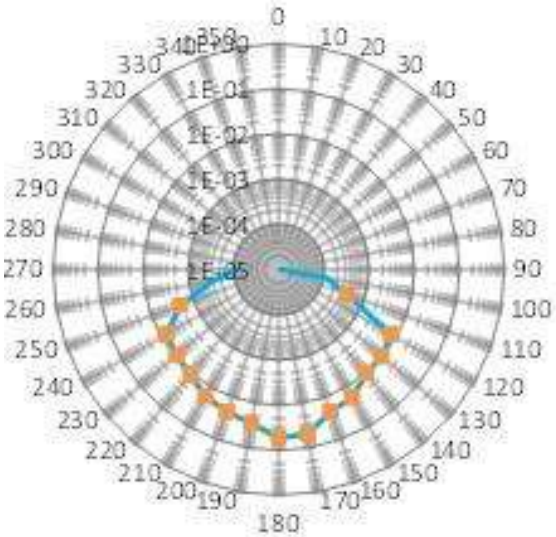


Figure 21. Characteristics of the HPL RGB LED light distribution on the air medium with 0-250 PWM Blue Green settings

The intensity of the light with blue green light settings where the color of blue light at 0 PWM and the color of green light at 250 PWM, or so-called 0-250 PWM Green-Blue. In this light haracteristic produces a distribution pattern starting from angle of 1200 to 2400. The amount of light intensity energy produced ranges from 7.48E-03 W / m2 - 7.48E-03 W / m2. These characteristics can be seen in Figure 21.

The full distribution of light and HPL-RGB light intensity is shown in Figure 22.

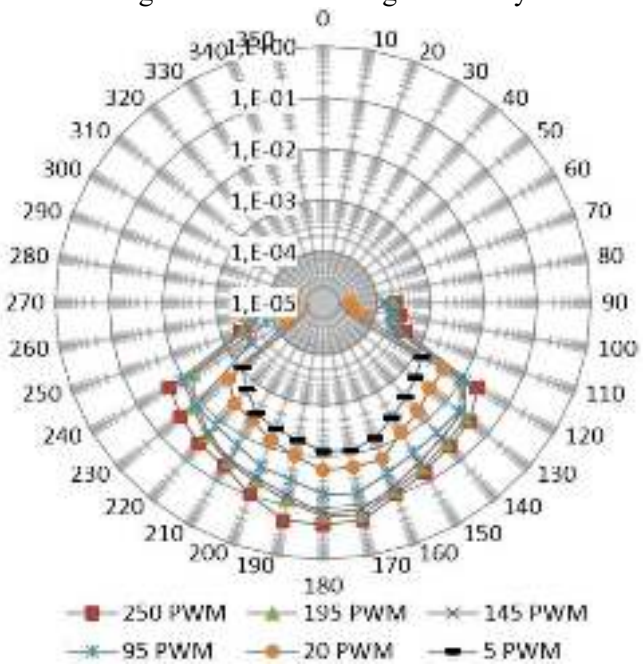


Figure 22. Light intensity (Color Spectrum) of HPL-RGB with PWM

The results of the measurement of the intensity of light in the water by using a sonar instrument produced in vertical and vertical horizontal The difference in the intensity of the LED- RGB light in seawater affects the change in the pattern of light distribution adjusted for the strength of the light intensity and affect the distance of the zone space and between zones at one light intensity. Changes in the pattern of light distribution in water are also affected by the presence of environmental factors that inhibit water light emission area. It is important to know in analyzing the characteristics of each light intensity, so it can determine the intensity of the light required when operating the step on the chart. The intensity of the light used in the step on the chart based on the characteristics of light intensity. The function of light in fishing in the step on chart is for collect fish until a catchable area. The intensity of the LED-RGB light with a value of

250 PWM produces four zones. The deepest zone of the surface water between 18-20 m and 8-9 m Zone with a depth of 13-17 m and 6-7 m of light coming out of the building step on the step called the influence zone (IZ). Zones with depths of between 7-12 m and 4-5 m of light found in the nets called the main zone (MZ). Zones with a depth of 0-6 m and 0-3 m of strong light are called the center zone (CZ). On main zone and center zones vertically and horizontally are areas of light contained within the scope of the chart called nets also catchable area (CA) as presented in Figures 23, 24.

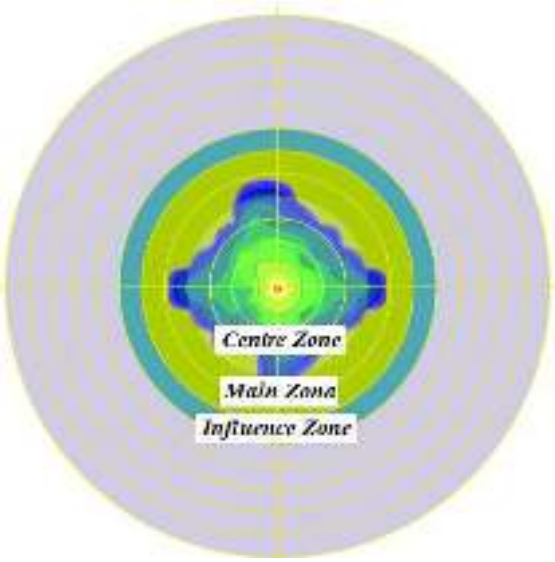


Figure 23. Horizontal zone Blue-Green Central Zone, Main Zone and Influence Zone

The white circle in the picture is the central zone (CZ), the light green circle is the main zone (MZ) and finally is a dark green circle showing the influence zone (IZ)

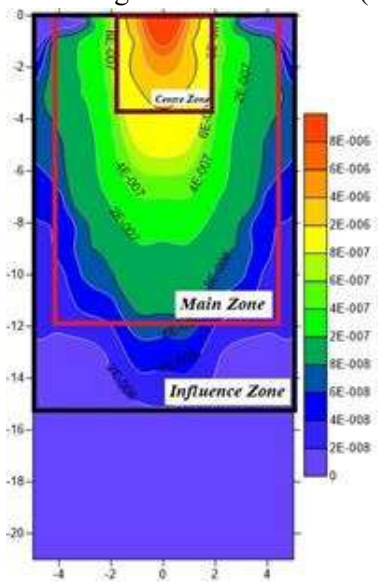


Figure 24. Vertical division of the Blue-Green zone Central Zone, Main Zone and Influence Zone

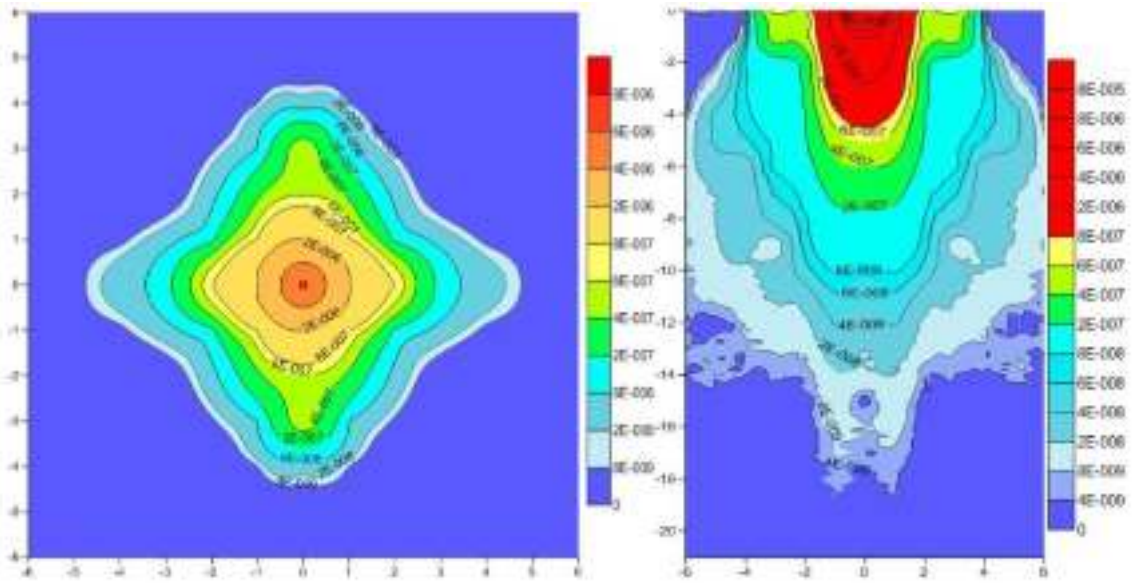


Figure 25. RGB light distribution

The characteristics resulting from the design of the light intensity produce a blue-green and green-red light distribution, show in table 3.

Table 3. Charakteristik intensitas cahaya mengahsil zona sebaran cahaya

Blue-Green	Central Zone (CZ)		Main Zone (MZ)		Influence Zone (IZ)	
	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
	meter	meter	meter	meter	meter	meter
250-0 PWM	0-4	0-4	5-12	5 - 6	13-15	6-7
145-5 PWM	0-3	0-3	4-11	4-5	12-14	5-6
5-145 PWM	0-2	0-2	3-12	3-5	-	-
0-250 PWM	0-3	0-2	4-9	3-4	10-13	5-6

Green-Red	Central Zone (CZ)		Main Zone (MZ)		Influence Zone (IZ)	
	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
	meter	meter	meter	meter	meter	meter
145-5 PWM	0 -2	0 -2	3-12	3-6	-	-
5-145 PWM	0 -2	0 -2	3-10	3-5	-	-
0-250 PWM	0 -2	0 -2	3-9	3-4	-	-

4. Conclusions

Hasil penelitian di atas dapat disimpulkan sebagai berikut:

- This tool can be used to adjust the intensity of light and produce the color spectrum by combining three basic colors (red, green and blue).
- HPL color spectrum were tested by using ILT5000 Research Radiometer owned by the Bogor Agricultural University laboratory.
- Color setting of each lamp can be easily programmed, resulting to a smooth color transition.
- Smooth color spectrum transition did not scare the fish, making the fish to keep staying in catchable area.

- By using this tool, when the color changes, the fish were not surprised during the transition.

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