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Design and build an underwater fishing light based on internet of thing

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ABSTRACT

The utilization of fishing gear has been growing until now. One of these tools is an underwater fishing light that has been used by fishermen. However, until now this device still works conventionally and only provides one color. Based on these problems and the rapid development of the internet of things (IoT), an underwater fishing light was created and designed that can work with the IoT system and provide various colors of light according to the needs of fishermen. The design of this tool uses several tools and materials, such as generators, power adapters, controller modules, generators, and the Magic Home Pro application. This tool operates at 12 V DC and consumes 144 W of electric power. Utilization of this tool can also indirectly reduce the consumption of electrical and fuel energy on board and support the blue economy. The results of testing the device show that the IoT system can work well, provide light colors according to orders, is waterproof, and provides a fairly good light intensity with an average of 6.89 Lux (0-8 Lux).

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1. INTRODUCTION

Light is a fundamental part of determining the behavior of fish in the water. Light stimulation on fish behavior is very complex which includes intensity, angle of light distribution, polarization, spectral composition, and duration of irradiation. A review of vision and reception of light by fish found that most marine fish eyes have a very high sensitivity to light. However, not all light can be received by fish eyes [1]. Light that can be received by fish eyes has a wavelength in the interval 400 to 750 mm, 0.01 to 0.001 lux (affected by the adaptability of fish), but is more attracted to light with an intensity of 0.001 to 10 lux. The attraction of fish to light is called phototaxis. Due to the phototactic nature of some economically important fish, they can be lured by man-made lights at night [2]–[8]. Fish's interest in light is not solely due to light, but also other motives. For fish, light can indicate the presence of food. Hungry fish are more easily attracted to light than well-fed fish. The balance of certain light intensity limits is also different for each fish [6], [9]–[12]. The penetration of light in water is closely related to the wavelength emitted by the light. The greater the wavelength of light, the less penetrating power it has into water [2], [7], [8], [10], [13]–[19]. The length of each color of light varies greatly, such as purple with a wavelength of 3,900 to 4,550 A, blue with a wavelength of 4550 to 4920 A, green with a wavelength of 4,920 to 5,770 A, yellow with a wavelength of 5,770 to 5,970 A, orange with a wavelength of 5,970 to 6,220 A, and red with a wavelength of 6,220 to 7,700 A.

Apart from being caused by the wavelength, other factors that affect the penetration of light into the water are light absorption by water particles, brightness, light reflection by the sea surface, season, and geographical trajectory. The illumination value of a light source will decrease as the distance from the light source increases, and the value will decrease if the light enters the water due to fading. The light that enters the waters will be received by the fish's eye, which will then function to collect light and focus the image received, then be analyzed by the retina of the fish's eye [10], [19]–[26]. The amount of light entering a body of water varies depending on factors such as the time of day the sun or moon shines, meteorological conditions, season, and latitude. On a full moon, the illumination on the water surface is 0.01 $\mu w/cm^2$ and in the dark it is about 0.00010.01 $\mu w/cm^2$.

Indonesia is a country with large fishing opportunities, but exploitation is still low. In 2021, fishery products in Indonesian territory reach 21,872,810.30 tons [27]. This result decreased by 5.67% compared to 2017 and increased by 0.18% compared to 2020. Catches in Indonesian waters are very diverse, with types of fishing gear in the form of using fish aggregating devices (FADs) and lights [5], [28]–[32]. The use of lights as fishing aids is used to lure fish to congregate. The use of this lamp has been used since 1950 but is still done conventionally. The success of fishing with light aids is determined by the number of lights, light intensity, brightness, sea waves, wind and currents, moonlight, and predators. One form of fishing aid with this lamp is a dipping lamp in the water.

Underwater fishing light is a solution to the problems faced by fishermen in Indonesia by using lights above the water level. The use of underwater fishing light can result in higher catches compared to the use of surface water lamps [31], [33]–[36]. This technology has long been used in several regions in Indonesia, but its use in the field is still underdeveloped. The reason for the problem is that fishermen are not familiar with this technology and still use traditional methods, and consider this technique difficult and when damage occurs it is difficult for fishermen to make repairs.

Based on these problems and the development of wireless technology, an underwater fishing light with light emitting diode (LED) based on internet of things (IoT) was designed. The designed underwater fishing light can be adjusted from the user's smartphone, and the user can choose the color according to the needs when fishing activities in the sea. The choice of using LED lamps has better specifications than incandescent, fluorescent, and petromax lamps. Underwater fishing light with an LED light when fishing saves fuel by 15% to 17%. The light output emitted is also equivalent to a high-power incandescent lamp, for example, a 6-watt LED is comparable to a 40-watt incandescent lamp. The use of electrical energy with LEDs also allows for maximum conversion of light energy compared to incandescent lamps, because in incandescent lamps the energy conversion is divided into light and heat. Utilization of IoT as a wireless communication technology in underwater fishing light has several advantages, such as efficient use of resources, minimizing human effort, saving time, wide-coverage, sending data and information quickly, and having an easy and practical system because it can be used directly from the user's smartphone [37]–[40].

2. METHOD

2.1. Hardware design

Manufacture of underwater fishing lights based on IoT using several hardware devices. This hardware is then assembled to become an underwater fishing light Figure 1. Table 1 is the hardware used.

Figure 1. The operating system of underwater fishing light based on IoT

2.2. IoT system design

The network system used for underwater fishing light uses an application from magic home pro. This application is available in the app store and play store so it is easy to install. The display of the applications used in this equipment can be seen in Figure 2.

Table 1. Specifications of underwater fishing light

Hardware	Description	Quantity
light emitting diode (LED) red, green, blue (RGB)	SMD5050; IP65; 60 LEDs/ m; DC 12 DC; -20 to 60 °C; Color mode: red, green, blue, white, purple and yellow; 5 m; 144 W; visible distance 30 m	1
Power adapter	Input: AC 100 to 240 V, 50/60 Hz Output: DC12 V, 2 A	1
Wi-Fi controller	2.4 GHz	1
Connector	Socket cable JST SM 4p 4pin	2
Acrylic Tube	Length 65 cm, OD 50 x ID 46	1
Cable power and rope	15 m	1
Bullet sinker	1 kg of lead	1

Figure 2. Application of underwater fishing light based on IoT

2.3. Testing of underwater fishing light

Device testing is carried out in several ways, namely by testing the color of the light, measuring the intensity of the light produced, testing the device for leaks when immersed in water, and testing the device's IoT. Color testing is done by changing the color of the dipping lamp in water with several predefined colors. The light intensity test was carried out by measuring the light intensity of the light immersed in water using a lux meter with a measuring radius of 1 meter around the lamp. This measurement is carried out in dark conditions so that the light produced is not distorted by outside light. Leakage testing is carried out by immersing the dipstick in water in a fish tank for 1 hour. Testing the IoT device is done by testing the application from the smartphone to the device. This test is also carried out by making changes to all modes contained in existing applications. This test is not up to what kind of fish will be attracted to each color of the light. This test will be carried out in further studies when fishing.

3. RESULTS AND DISCUSSION

The use of IoT for underwater fishing light is a form of developing the use of technology for fishing aids Figure 3. This tool uses LED lights with a power of 144 W and can be supplied from a power source on board. This tool can provide a variety of colors according to the needs of fishermen when fishing activities in the sea.

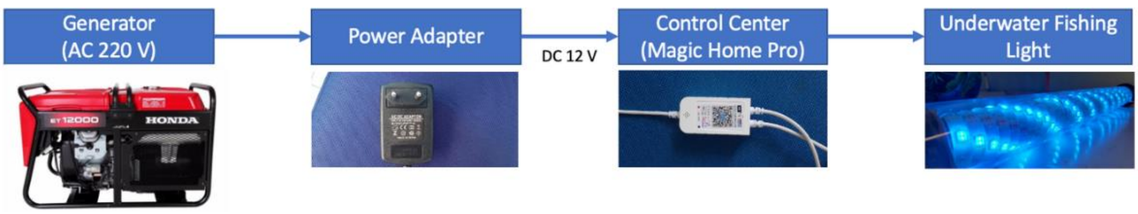


Figure 3. Underwater fishing light based on IoT

3.1. Underwater fishing light testing

IoT testing and changing the color of the light from underwater fishing light is carried out by utilizing the Magic Home Pro application that has been installed on a smartphone. Device testing is carried out by making a connection between a smartphone and an underwater fishing light. After the device is detected in the application, the IoT system is tested by testing the color change. Color testing is done by giving orders through the application by selecting red, green, blue, yellow, cyan, purple, and white. This test was carried out in fish ponds. During the test, it was found that there was an attraction for fish to the light from the lamp. The display of the application used and the commands given can be seen in Figure 4. Table 2 is the result of the underwater fishing light test that was carried out. In testing the green, yellow, and white colors produced by underwater fishing light in fish ponds, they appear to be the same color. This is because there is a distortion of the color of the fish pond container which has a blue color, so that the appearance from the outside air gives slightly the same color.

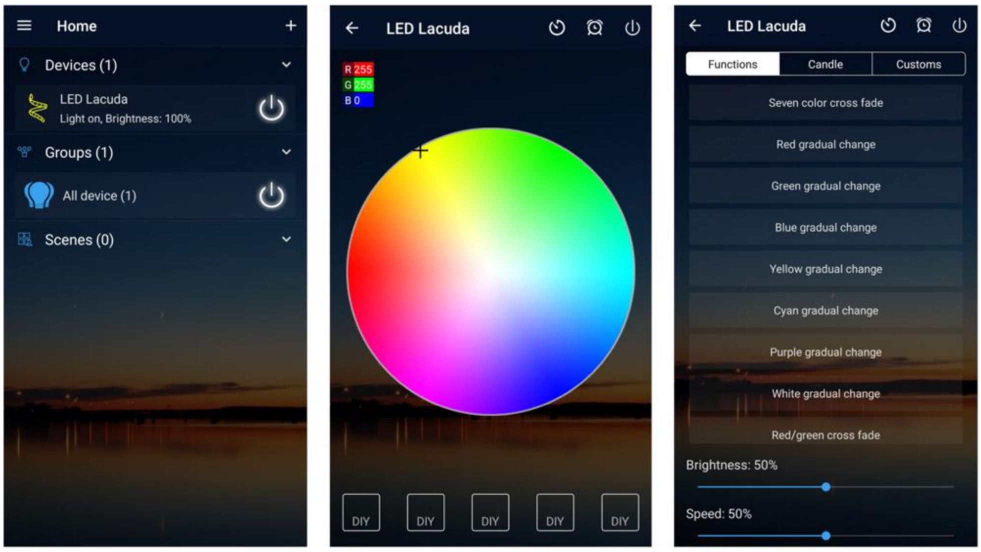
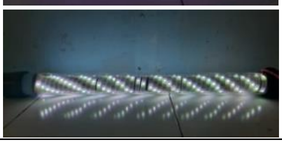


Figure 4. application display of underwater fishing light based on IoT

Table 2. Test results of underwater fishing light based on IoT

Color	IoT	Outside the water	In the water
Red	Work well		
Green	Work well		
Blue	Work well		
Yellow	Work well		
Cyan	Work well		
Purple	Work well		
White	Work well		

3.2. The spread of light from underwater fishing light

Testing the light intensity of an underwater fishing light is carried out by measuring the light intensity around the lamp at a distance of 1 meter using a lux meter. Tests are carried out every 10 degrees, with measurements starting from 0 to 350 degrees. From the measurement results, it was found that the average light intensity that can be produced from an underwater fishing light is 6.89 Lux, with a range of values from 0 to 8 Lux. The light intensity value of 0 Lux was obtained at an angle of 90 and 270 degrees. This value is due to the spread of light generated by the lamp being blocked by the bottom and top covers of the device. In more detail, the light intensity produced by underwater fishing light for all angles can be seen in Figure 5.

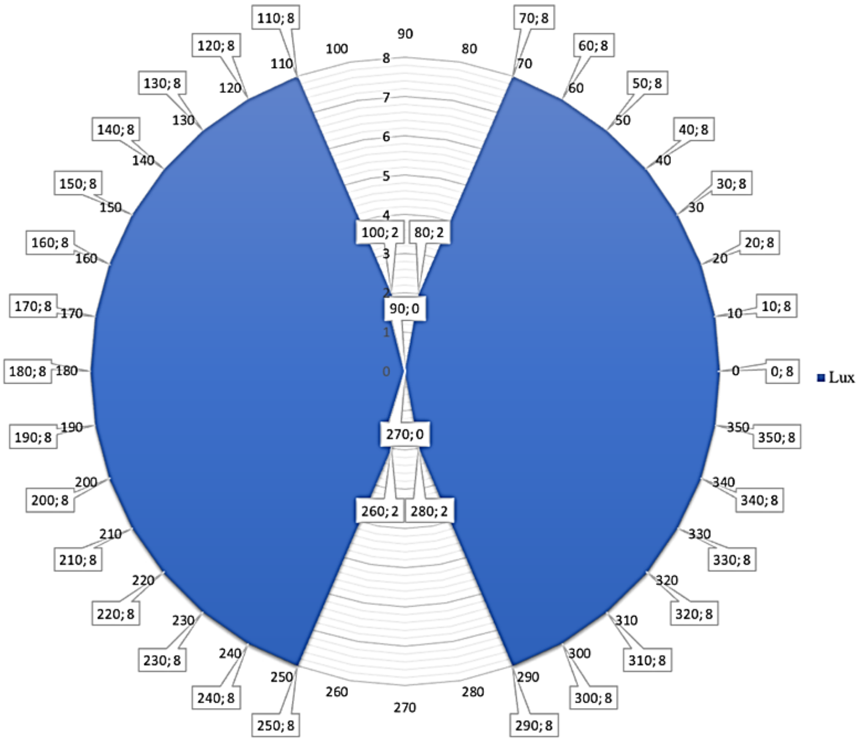


Figure 5. The spread of light from underwater fishing light

4. CONCLUSION

The utilization of IoT for underwater fishing lights works well. The test results show that underwater fishing light can be connected to the application, provide customized colors, waterproof, and provide a fairly good light intensity with an average of 6.89 Lux, with a range of values from 0 – 8 Lux. In testing this device, it is also confirmed that fish are attracted to the light produced by underwater fishing light.

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