UNDERWATER COMMUNICATION USING LIFI

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***Abstract*- Communication is a vital component of submarine operations. In underwater environments, conventional radio communication is often challenging due to the attenuation of radio waves in water. To overcome this, we propose a Li-Fi based communication system for submarines that uses an Arduino and water leak detector sensor to detect water leaks in the submarine and transmit signals to the shore via a Li-Fi transmitter. The shore-side Li-Fi receiver will capture the data from the Li-Fi transmitter and display the message on the serial terminal. This paper discusses the working principle of the proposed system, the unique LIFI transmitter and Receiver hardware is used to establish the output for this project.**

INTRODUCTION

Submarines operate in an underwater environment where traditional radio communication is challenging due to the attenuation of radio waves in water. Thus, submarine communication systems rely on acoustic and optical communication technologies. Acoustic communication is the most common method, but it has several limitations, such as slow data rates, susceptibility to interference, and limited range. Li-Fi (Light-Fidelity) technology, on the other hand, has emerged as a promising alternative to acoustic communication in underwater environments due to its high bandwidth, low latency, and immunity to electromagnetic interference.

EXISTING SYSTEM

The primary drawback of the existing communication systems that use radio signals in submarines is that radio waves are heavily attenuated when they pass through water. This attenuation limits the range and data rate of the communication system and makes it susceptible to interference from other radio sources. Additionally, radio signals can also be intercepted by unauthorized parties, posing a security risk to submarine operations. Therefore, in underwater environments, traditional radio communication is not a reliable method of communication and can compromise the safety and security of the submarine crew. In contrast, Li-Fi technology offers high data rates, low latency, and immunity to electromagnetic interference, making it a promising alternative to traditional radio communication in submarines.

PROPOSED SYSTEM

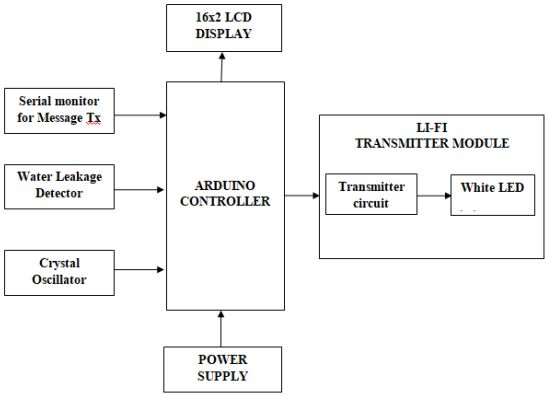

Figure 1: Block Diagram Transmitter Section

The block diagram consists of several components that are used in the proposed Li-Fi based communication system for submarines.

The power supply unit provides the necessary power to run the entire system. The Arduino is the microcontroller board used to control the system and receive inputs from the water leak sensor. The water leak sensor detects the presence of water in the submarine and sends a signal to the Arduino when it detects a leak.

The Li-Fi transmitter is responsible for transmitting data to the shore-side Li-Fi receiver using light. The transmitter uses an LED that is modulated at a high frequency to encode the data, which is then transmitted through the water using light. The crystal oscillator provides a stable reference frequency for the Li-Fi transmitter to modulate the LED.

The 16x2 LCD display is used to display important system information such as the status of the water leak sensor and the data being transmitted to the shore. The display can also be used to input data manually into the system.

In summary, the proposed Li-Fi based communication system for submarines uses a water leak sensor, an Arduino microcontroller, a Li-Fi transmitter, a crystal oscillator, and a 16x2 LCD display to detect water leaks in the submarine and transmit signals to the shore via light. The LCD display can also be used to input data manually into the system for transmission to the shore.

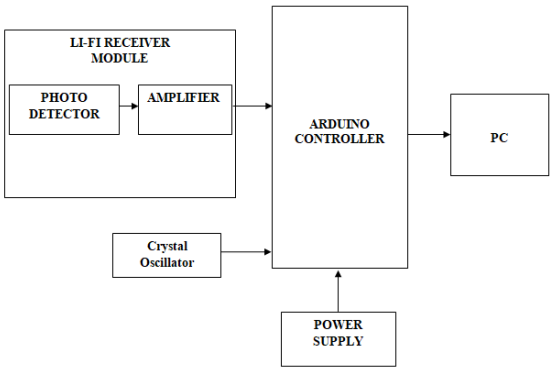

Figure 2: Block Diagram Receiver Section

The block diagram for the receiver section includes an Arduino microcontroller, a Li-Fi receiver, a crystal oscillator, and a PC. The Li-Fi receiver is responsible for receiving the light signal transmitted from the submarine using the Li-Fi transmitter. The receiver converts the modulated light signal into a digital signal that is compatible with the Arduino microcontroller.

The Arduino microcontroller is used to process the digital signal received from the Li-Fi receiver and extract the data that was transmitted from the submarine. The crystal oscillator provides a stable reference frequency for the Li-Fi receiver to demodulate the received signal.

Once the data is extracted from the signal, the Arduino microcontroller sends the data to a PC using a serial connection. The PC is used to display the data received from the submarine in a user-friendly format, such as a text message displayed on the screen. The PC can also be used to store and analyze the data received from the submarine for further processing or to trigger appropriate responses.

In summary, the block diagram for the receiver section includes an Arduino microcontroller, a Li-Fi receiver, a crystal oscillator, and a PC. The Li-Fi receiver detects the light signal transmitted from the submarine, and the Arduino processes the signal to extract the data. The PC receives and displays the data received from the submarine.

WORKING PRINCIPLE

The proposed Li-Fi based communication system for submarines uses an Arduino and water leak detector sensor to detect water leaks in the submarine. The Arduino is programmed to detect the presence of water using the water leak detector sensor. When the sensor detects water, it sends a signal to the Li-Fi transmitter. The Li-Fi transmitter then uses light to transmit the signal to the shore-side Li-Fi receiver.

The Li-Fi transmitter uses an LED light source to transmit data. The LED is modulated at a high frequency to encode the data. The modulated signal is then transmitted through the water using light. At the shore, the Li-Fi receiver captures the modulated signal and demodulates it to extract the data. The demodulated data is then displayed on the serial terminal.

SIMULATION RESULTS

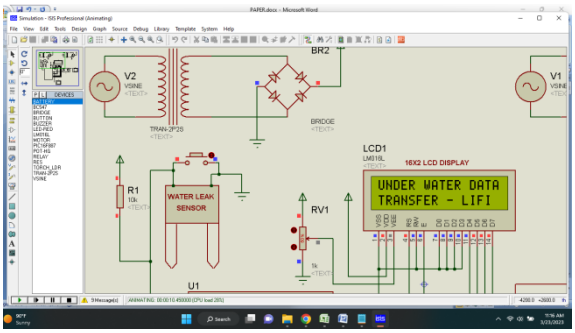

Figure 2: Simulation Result 1

By the figure represents the working of our project and displaying the project title “UNDER WATER COMMUNICATION SYSTEM USING LIFI” in the 16X2 LCD Display unit.

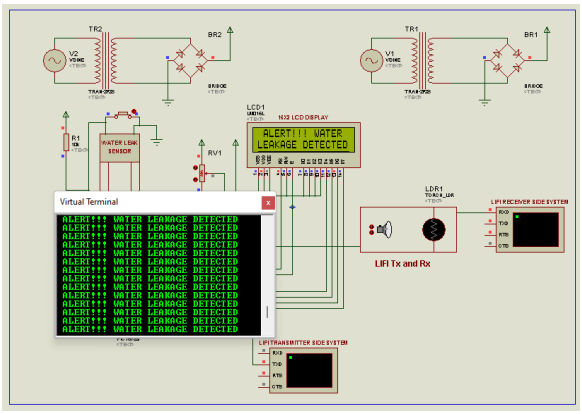

Figure 3: Water Leak Alert

The above figure represents the water leakage alert in the LIFI receiver PC and the status of water leak is displayed in the 16X2 LCD Display also.

CONCLUSION

In conclusion, we propose a Li-Fi based communication system for submarines that uses an Arduino and water leak detector sensor to detect water leaks in the submarine and transmit signals to the shore via a Li-Fi transmitter. The shore-side Li-Fi receiver captures the data from the Li-Fi transmitter and displays the message on the serial terminal. The proposed system offers several advantages over traditional acoustic communication, such as high bandwidth, low latency, and immunity to electromagnetic interference. Further research is needed to optimize the system for practical use in submarines.

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