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A Short Range under Water Data Transmission Using Li-Fi and PWM Techniques

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ABSTRACT
In recent days, the under-water vehicles are implemented for various applications like military application, ocean mapping etc. In this regards, the data communication between Vehicle to Vehicle or Vehicle to Infra-structure is very essential for critical informative wirelessly. In this proposed research article data transmission from one vehicle to another vehicle is obtain using Li-Fi and PWM Techniques for under water application. The Li-Fi Technology is constructed to build the wireless data transmission for the various application proposed in this research article. The PWM Technique is additionally programmed in the proposed model to decode the various numerical values. These techniques are framed to communicate wirelessly between two devices through the water medium.

Keywords - under-water vehicles, data communication, Li-Fi, PWM Techniques, wirelessly

I. INTRODUCTION

In future, the underwater communication system is going to play a vital role in the various applications highlighted in this research paper.

The outline of [1], reveals the review on the propagation up to certain MHz frequency range in under sea water. In [2] proposed system utilizes the ultra-low power MSP430F449 MCU and an infrared wireless communication, to obtain a simple underwater communication in the wireless form. In [3] research article proposes 433MHz bow-tie antenna is suitable for use in Underwater. The research article [4] presents existing UWC techniques for the future directions on the next generation underwater wireless communication systems. The research paper [5] reveals a study on UWA communication corresponding to the multicarrier communication particularly Orthogonal Frequency Division Multiplexing -OFDM.

In [6] paper, a new OFDM-based scheme is proposed for underwater transmission in order reduces the combat with asynchronous problem in cooperative UWA systems without adding a long CP at the transmitter antenna. The research articles [7], [8], [9], [10], propose an acoustic modelling of underwater communication. The foresaid research articles propose underwater communications with different techniques are highlighted with suitable contents. In this research article executes with more suitable Li-Fi and PWM techniques to provide accurate data communication for the underwater applications.

II. SOFTWARE

The proposed methodology is programmed using Arduino software. The two section coding, one for transmitter section and another for receiver section is programmed uniquely and dumped into the microcontrollers in both transmitter and receiver sections.

III. HARDWARE IMPLEMENTATION

In this research proposes underwater wireless data transmission enlisting two sections namely, transmitter section and receiver section.

A. Functional Block Diagram

In the transmission section, the list of components like LED, Arduino Uno, Keypad are interfaced to communicate a data to receiving section. In the receiver section, the list of components like LDR, Arduino Uno, LCD are interfaced to receive a data from transmitter section. The complete architecture of underwater data communication wirelessly is shown in Figure 1 combining with both sections.

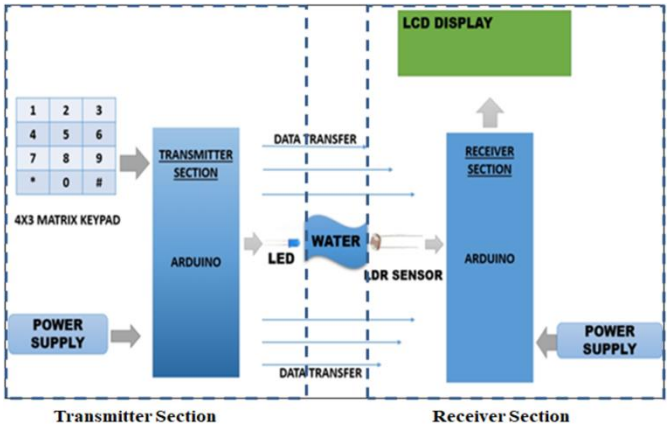

Fig 1. Function Block Diagram of underwater communication system

1) Transmitter Section

In this section, the list of hardware components like LED, Arduino Uno and Keypad are interfaced to transfer the valid data to the receiver section. In this research paper, the keypad acts as input device in the transmitter section, the character on the keypad is received to Arduino Uno upon the specific key press. Arduino Uno is a microcontroller board, which has lot of peripherals likes PWM, ADC, Serial communication peripherals (UART, SPI, I2C), etc. Arduino Uno fetches a character from keypad and converts equivalent electrical signal in the form of the pulse using PWM techniques. The equivalent converted electrical pulse signal is applied to the LED to glow for certain period in the transmitter section. The emitted light from the LED is transmitted to the receiving section through the medium called water.

2) Receiver Section

In this section, the list of hardware components like LDR (Light Dependent Resistor, Arduino Uno and LCD are interfaced to receive the valid data from the transmitter section. In the receiver section, LDR acts a receiver to fetch a light signal and convert into the equivalent electrical pulse signal. The converted electrical pulse signal is given to Arduino Uno microcontroller board to converted electrical pulse into equivalent character using the suitable control logic algorithm. The converted character is observed on the LCD by sequence programming of character to display. Here, LDR plays a vital role in sensing the character in the form of electric signal. On the whole, the data is communicated wirelessly through the water medium.

B. Working Principle

In the lab setup, the transmitter and receiver sensors i.e. LED and LDR are dipped into the water. The working operation is carried out to obtain an efficient data transmission from transmitter section to receiver section. In the transmission section, character is encoded and converted into equivalent electrical signal, thus generated electrical signal is applied to LED were electrical signal is converted into light and transfer into the water medium.

Dissimilarly, the light applied on the LDR in the receiving section converts light energy into electric signal in the form of pulse. Thus generated electrical pulse into convert equivalent character by using time logic coded in the Arduino Uno microcontroller. Finally, generated character is visualized on the display unit using LCD.

The complete hardware interfacing with both transmitter and receiver sections is shown in Figure 2.

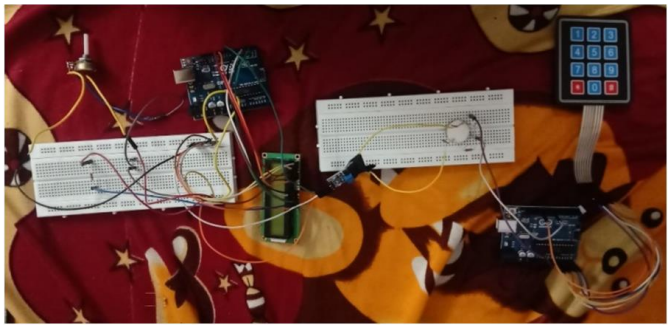

Fig 2. The complete Harware Setup with transmitter and receiver sections

The design of simple hardware prototype as complete model for underwater testing is shown in Figure 3. The sensors LED and LDR are dipped into the water to test the accurate data transmission shown in Figure 4.

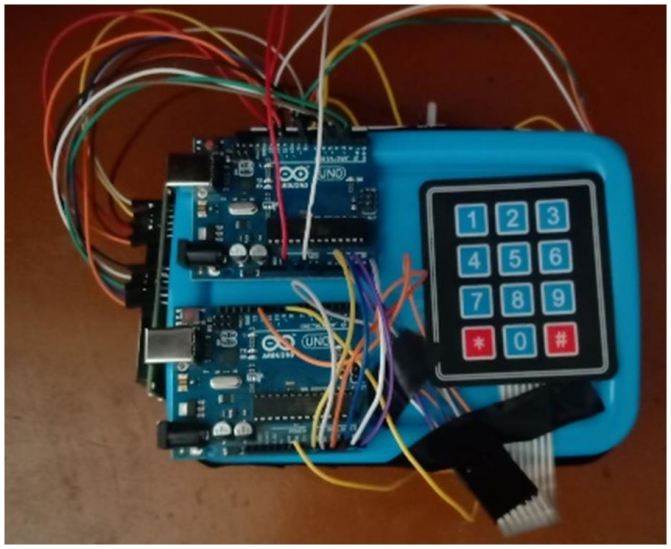

Fig 3. Compact Hardware testing module

After the complete hardware setup, the control algorithms are dumped into the transmitter and receiver microcontrollers to transmit and receive the data upon the key press on the keypad. The user presses key 4, corresponding data is displayed on the display unit in the receiver section as shown in Figure 5.

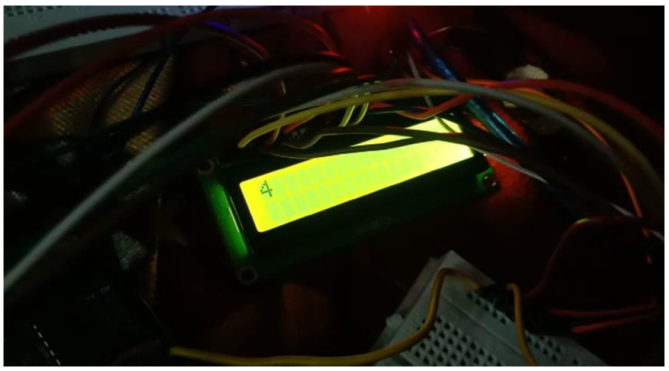

Fig 4. Data communication result on the receiver upon keypress.

IV.CONCLUSION

In this proposed research article, the underwater data communication is tested and verified with suitable hardware modules. The sensor modules are dipped into the water to identify whether there is accurate data transmission using Li-Fi technology. In future, the data communication between two vehicles or devices inside the River, ocean, etc, is easily obtained by using Li-Fi technology.

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