UNDERWATER COMMUNICATION USING LIFI

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Abstract - As far as terrestrial applications, underwater wireless communication is not a straight forward process. The objective of this wireless underwater communications can be established by Li-Fi technology along with the use of LED and photodiode. The Li-Fi module passes the message to the destination underwater. Underwater communication is required in many applications such as the transfer of messages and speech transmission between submarine ships, Scuba drivers, etc., and to track lost ships and located down planes. Since Li-Fi technology used in underwater communication can be done the data rate would be near as the terrestrial data communications. Since the transmitted signal is in encoded form, so the hacker cannot track the signals easily, so the privacy/Security of information is obtained. So that data is not last.

1. INTRODUCTION

Light Fidelity (Li-Fi) is a bidirectional high-speed, and fully networked wireless communication technology like the Wi-Fi. Visible light communication and a subset of optical wireless communications (OWC) and could be a complement to RF communication (Wi-Fi or cellular networks), or even a replacement in contexts of data broadcasting. It is wire and UV visible light communication or infrared and near ultraviolet instead of radio frequency spectrum part of optical wireless communications technology, which carries much more information, and has been proposed as a solution to the RF bandwidth limitations. Visible light communications (VLC) work by switching the current to the LEDs off and on at a very high rate, too quick to be noticed by the human eye. Although Li-Fi LEDs would have to be kept on to transmit data, they could be dimmed to below human visibility while still emitting enough light to carry data. The light waves cannot penetrate walls which makes a much shorter range, though more secure from hacking, relative to Wi-Fi Direct line of sight is not necessary for Li-Fi to transmit a signal; light reflected off the walls can achieve 70 Mbit/s.

2. PROBLEM STATEMENT

Acoustic waves move slowly taking two seconds to travel back and forth across 1.5 kilometers distance. Electromagnetic waves cannot propagate through water easily. Use of electromagnetic and acoustic waves under water is not efficient.

3. EXISTING SYSTEM

As far terrestrial application, the underwater wireless communication is not a straight forward process. In most of existing system Acoustic signal is most preferred signal used as carrier by many applications, because of its low absorption characteristic underwater.

This has a drawback, as it cannot be used for large distance communication because of signal deterioration. Some existing system use Electromagnetic waves at higher frequency and bandwidth for underwater communication. The limitation is due to high absorption/attenuation that has significant effect on the transmitted signals. Due to absorption of sea water ultrasound is not used for underwater communication.

4. HARDWARE DESCRIPTION

RP2040 microcontroller with 2MByte Flash. Micro-USB B port for power and data (and for reprogramming the Flash). 40 pins 21x51 'DIP' style 1mm thick PCB with 0.1" through-hole pins also with an edge castellations. Pico provides minimal (yet flexible) external circuitry to support the RP2040 chip (Flash, crystal, power supplies, decoupling, and USB connector). The majority of the RP2040 microcontroller pins are brought to the user IO pins on the left and right edges of the board. Four RP2040 IO are used for internal functions - driving an LED, 2 onboard Switched Mode Power Supply (SMPS) power control, and sensing the system voltages.

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. Each DHT11 element is strictly calibrated in the laboratory which is extremely accurate in humidity calibration.

The calibration coefficients are stored as programs in the OTP memory, which are used by the sensor's internal signal-detecting process. Its small size, low power consumption, and up-to-20-meter signal transmission make it the best choice for various applications, including those most demanding ones. The component is a 4-pin single-row pin package.

The normal pulse for healthy adults ranges from 60 to 100 beats per minute. The pulse rate may fluctuate and increase with exercise, illness, injury, and emotions. Females ages 12 and older, in general, tend to have faster heart rates than males. The heartbeat rate is measured by the IR transmitter and receiver. Ian infrared transmitter is one type of LED that emits infrared rays generally called an IR Transmitter.

The IR receiver is connected to the Vcc17 through the resistor which acts as a potential divider.

Pressure (symbol: p) is the force per unit area applied on a surface in a direction perpendicular to that surface. The pressure is measured by the diaphragm which is one type of transducer. When pressure is applied, the diaphragm is moving on the forward side. The diaphragm movement depends on the pressure. The important features of instrumentation amplifiers are high gain accuracy, high CMRR, and low output impedance. Here the instrumentation amplifier is constructed by TL 074 operational amplifier. The TL 074 is a dual operational amplifier that is two operational amplifiers fabricated in a single chip. Here the instrumentation amplifier acts as a differential instrumentation amplifier. The diaphragm transducer terminals are connected to the A1 and A2 amplifiers of the differential instrumentation amplifier.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD is a basic module and is commonly used in various devices and circuits. These modules are preferred over seven segments and another multi-segment led. The reasons are: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations, and so on

5. METHODOLOGY

Medical electronics sensors, or E-sensors, are a vital part of healthcare facilities today. One of the significant developments in the field of research is the monitoring of an individual's electronics-health (E-health). Here, we measure each person's internal body temperature underwater, pulse, and heart rate using a temperature sensor, heartbeat sensor, blood oxygen sensor, and humidity sensor, respectively. Thus, this proposed model (devices) can be used to check the person's health state underwater as first aid information to the concerned individual, much like the usage of a thermometer in the house to check body temperature before a doctor consultation. We outline the design of an advanced/high-performance integrated health portable monitoring system based on the Raspberry Pi microcontroller. The patient's heart rate, for example, is monitored by placing their index finger on an IRD (Infra-Red Device) sensor, which subsequently measures their pulse rate. The concerned person is then informed of the Heart Rate and Body Temperature. To keep track of each person's health while traveling deep underground, all the monitored data is transmitted to both the people above and below the sea.

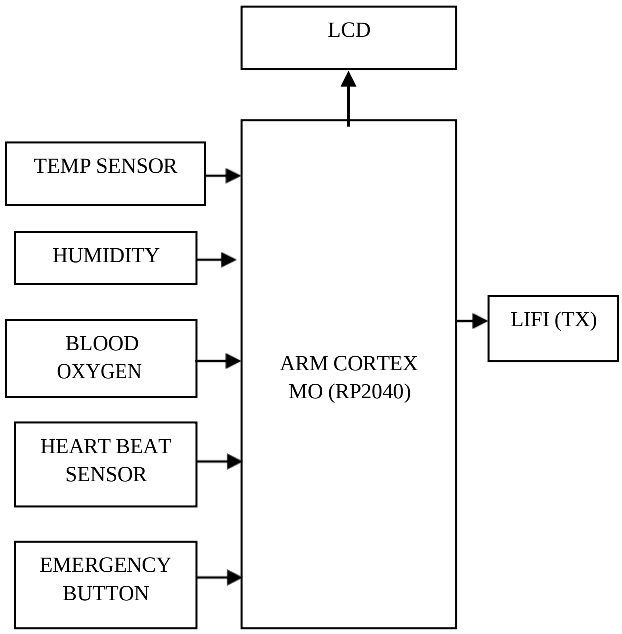

Fig 1: Block Diagram of a Transmitter

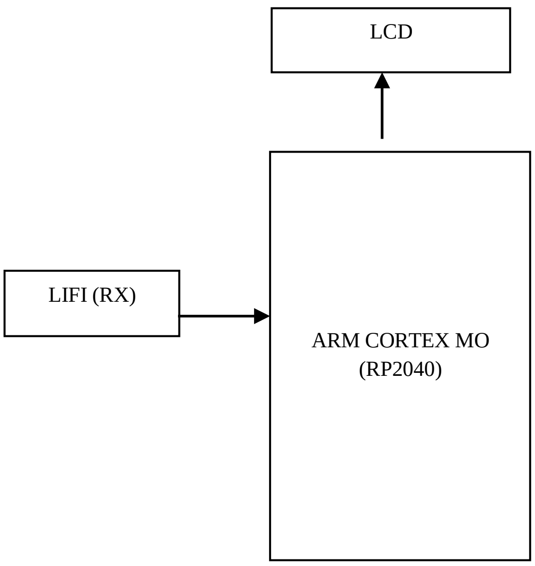

Fig 2: Block Diagram of a Receiver

6. RESULT AND DISCUSSION

We have examined underwater data communication using Li-Fi technology in this paper. Any abnormalities in a person's underwater health, including their temperature, humidity, heart rate, blood oxygen level, and pressure, can be instantly detected and communicated to them. The suggested system is straightforward, energy-efficient, and simple to comprehend. It serves as a link between an individual in the sea with someone inside the submarine. We also included an emergency button, which enables the user to notify of danger. The person underwater is monitored continuously and the data is also shared at both the transmitting and receiving ends for the person's safety.

7. CONCLUSION

We have examined how sensors connected to a Raspberry Pi compute the body's temperature and heartbeat, and then show the results on an LCD. The adoption of Li-Fi allows the recipient to access the data. The standard Wi-Fi network uses radio frequency waves, however the amount of RF spectrum that may be used is constrained. As a result, Li-Fi, a new technology, has emerged. Thus, our approach would prevent the individual from suffering a serious loss of life and assist the person on the receiving end in acting appropriately and at the correct moment. Li-Fi technology has the benefit of not using radio frequency, making it suitable for usage in areas like submarines, airplanes, and deep mines where RF waves are not desired. This project will be highly helpful for those who are in the military and the navy, as well as for underwater researchers. Li-Fi technology promises to deliver a quicker, safer, greener, better, and healthier future for wireless communication systems as the electromagnetic spectrum gets increasingly saturated. In comparison to Wi-Fi, this technology offers many more benefits including better security, increased spectrum accessibility, reduced latency efficiency, and significantly higher speed.

8. REFERENCES

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