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Underwater Human Monitoring System using Visible Light Communication

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Abstract: Our paper a method for underwater monitoring and analysing body parameters using visible light technique of Things. Visible Light Communications VLC have been studied thoroughly in recent years an alternative or complementary technology to radio frequency communication. The reliability of VLC channels highly depends on availability & alignment of line sight links. In this work we study the effect of random receiver orientation for mobile users over VLC downlink channels which affects existence and quality of line sight links. Based on the statistics of the receiver location and relative orientation with respect to the transmitter LED, we develop a analytical framework to characterize the statistical distribution of VLC downlink channels, which is then utilized to obtain the outage probability & the bit error rate. The analysis is generalized for arbitrary distributions of relative orientation and location for a single transmitter & extended to multiple transmitter case for some certain scenarios. Extensive Monte Carlo simulations show an perfect match between analytical & simulation data in terms of both the statistical channel distribution & the resulting bit error rate. Our results characterized channel attenuation due to random receiver orientation & location for various scenarios of interest.
Keywords: Light-emitting diodes, light-fidelity (Li-Fi), probability, random variables, optical communication

I. INTRODUCTION

Visible light communication (VLC) is an emerging technology that can achieve illumination and communication simultaneously, hence improving energy efficiency by using existing lighting infrastructure. Along with the wide-scale deployment of energy efficient light emitting diodes (LEDs) as the primary luminary, next-generation wireless networks leveraging VLC techniques appear to be even more promising .As recent experiments have revealed, VLC networks can provide data rates as large as multiple Gigabits per second making it a powerful alternative or a complementary technology to conventional radio-frequency (RF) counterparts.

The propagation through VLC channels can be highly directional and communication mainly relies on the availability of line-of-sight (LOS) links. In practice, how ever,the field-of-view (FOV) of VLC receiver is usually limited ,which in turn appears as a barrier in providing seamless network connectivity.

The hybrid RF/VLC networks and relay-assisted cooperative VLC systems are two main research directions to circumvent FOV constraints and extend the network coverage as desired. Then the density & mobility of VLC receiver increase along with the use of wearable sensors and Internet of Things -IOT devices sophisticated dynamics are emerging with FOV constraints and LOS reliability.

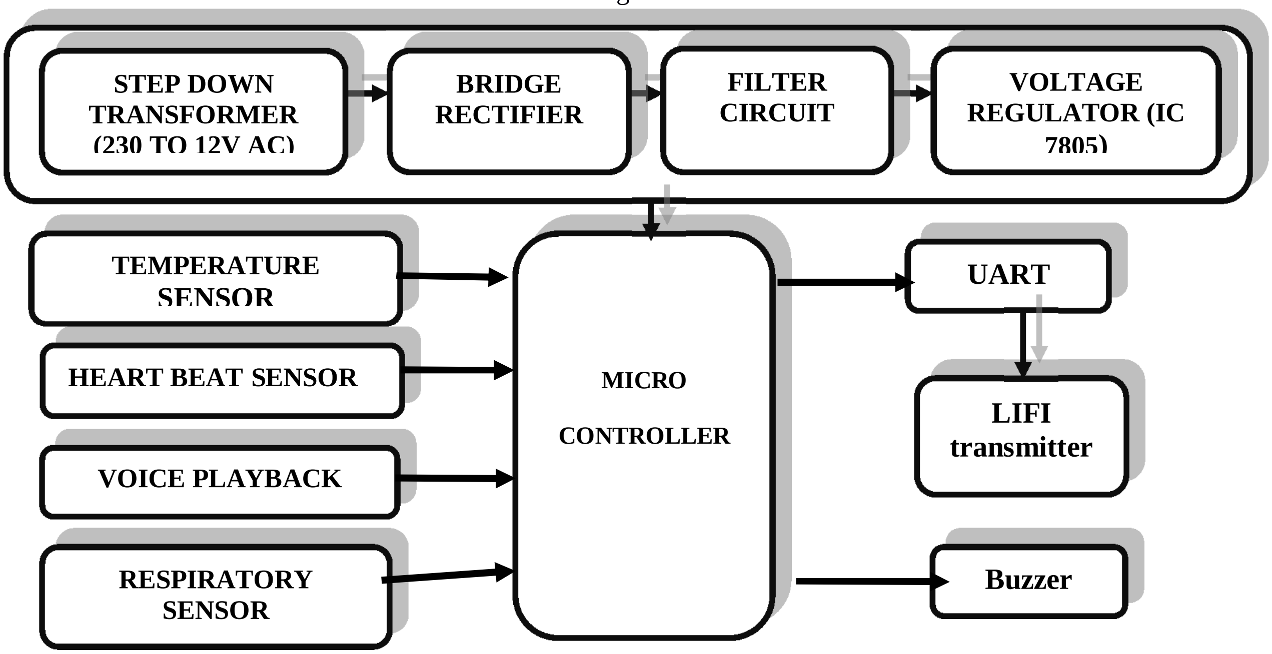
The receiver orientation & mobility are two major obstacles affecting the availability of LOS link in VLC networks .Their direct influence on the existence of LOS links & signal quality become even more significant especially when both these feature are varying randomly.

Therefore vital to investigate the effect of the receiver orientation & mobility over VLC network with practical FOV constraints. Especially ,orientation of the receiver directly affects the LOS incidence angle, the angle between the signal arrival direction and the receiver normal, which affects the received signal strength. In this work, we investigate the effect of random receiver orientation and location on the statistics of VLC downlink channels in single and multiple LED scenario.

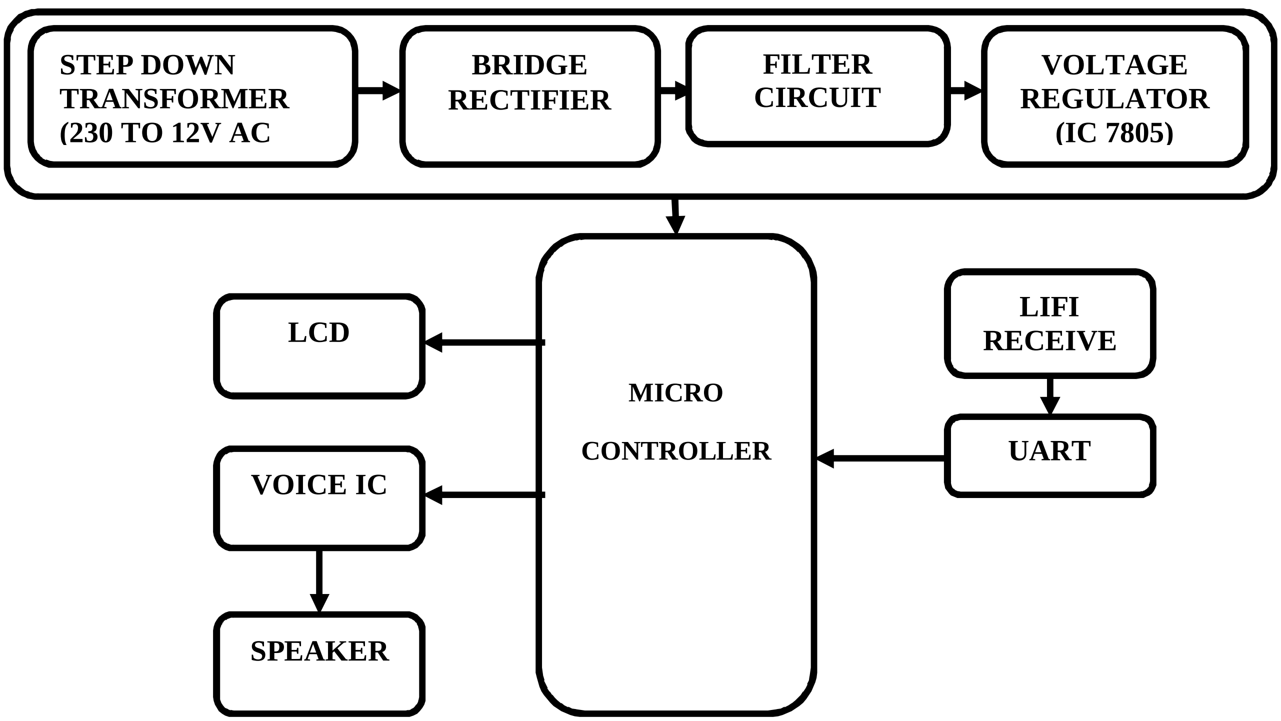
II. PROPOSED METHOD

In the proposed system, we are going to propose underwater (sea) parameters monitoring between the two ships, placed in under water, using LIFI (Light Fidelity). Here the temperature is measured using their corresponding Sensor and the data are captured in the microcontroller and it is transmitted via VLC and it is received in the receiving side using Photo Detector. The microcontroller received data will be transfer into the LCD. So here present situation monitoring can be advanced and more effectiveness for to take immediate actions .Communication happens between those two person with the help of LIFI technology

Transmitting Section



Receiving Section



1) *Microcontroller:* Microcontroller is a control device which incorporates a microprocessor. In our project ,the PIC16F877A is used. The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices .It features 200 ns instruction execution, 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bitAnalog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

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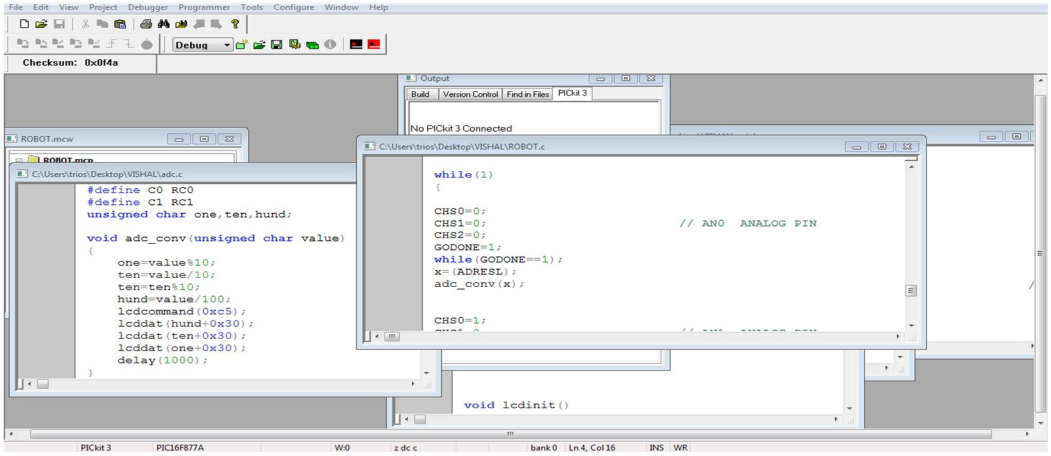
2) *Power Supply:* Here ,is a 5v power supply circuit using LM7805. LM7805 is a famous positive voltage regulator IC comes in three terminal provides fixed 5V DC output.
3) *Temperature Sensor:* The first slave connected to a temperature sensor LM35.This senses the temperature of an engine and provides the level of temperature.
4) *Voice IC-APR9600:* The APR9600 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds**.** Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier ,and AGC circuits greatly simplify system design.
5) *Speaker:* The voice recognition board is a completely assembled and easy to use programmable speech recognition circuit. The commands that you need can be programmed to recognize. It has 8 bit data out which can be interfaced with 16- bit PIC microcontroller. The audio input from the microphone can be given through the audio jack assembled in this board. The input command with their corresponding characters can be displayed in LCD.
6) *Photo Detector:* Photo detectors, also called photo sensors, are sensors of light or other electromagnetic radiation . A photo detector has a p–n junction that converts light photons into current. The absorbed photons make electron–hole pairs in the depletion region . Photodiodes and photo transistors are a few examples of photo detectors. Solar cells convert some of the light energy absorbed into electrical energy.
7) *Li-Fi Device:* Li-Fi is a technology for wireless communication between devices using light to transmit data and position. In its present state only LED lamps can be used for the transmission of visible light.
8) *Uart:* A UART(Universal Asynchronous Receiver/Transmitter)is the microchip with programming that controls a computers interface to its attached serial devices.
9) *Respiratory Sensor:* It detects chest/abdominal expansion/contraction and outputs the respiration waveform.

III. RESULT AND DISCUSSION

Hardware kit

The above picture shows the output of the transmitter section with the help of li-fi communication, temperature sensor and respiratory sensor the person normal and abnormal condition can be checked person diagnosed. The measured value of the sensor can be transmitted to the photo detector .which detects the person condition accurately.



Notification

IV. CONCLUSION

We investigated the statistics of a VLC downlink channel when the incidence angle is varying randomly due to the fluctuations of the user orientation. The mobility is also considered through the random deployment of the user which results in a random distance to the source LED. We proposed an analytical framework which successfully characterizes the channel statistics when both the incidence angle and the user location are randomly varying. The equations are derived so that any random distribution of location or incidence angle with a known PDF can be directly employed. This analytical framework helps develop strategies in dealing with the destructive effects of the random user orientation and mobility. The statistics we have derived can be used for infrared communications with OOK modulation too, which has similar channel characteristics as VLC .The simulation results show that the random fluctuations in the incidence angle can have significant adverse effects on the BER. For a receiver horizontally located 2.5 meter away from the transmitter with an incidence angle of 30◦,random deviations in the receiver orientation/location results in more than 7 dB of SNR loss at a BER of 10−3 dB for a wide FOV. The effects are even more catastrophic for an arrow FOV, where the BER quickly converges to an error floor as the transmit power increases. As a future research direction, the analysis for the incidence angle can be extended to LED-independent user orientation that can be represented using Euler angles, or the mobility model can be extended to include movement in the vertical dimension.

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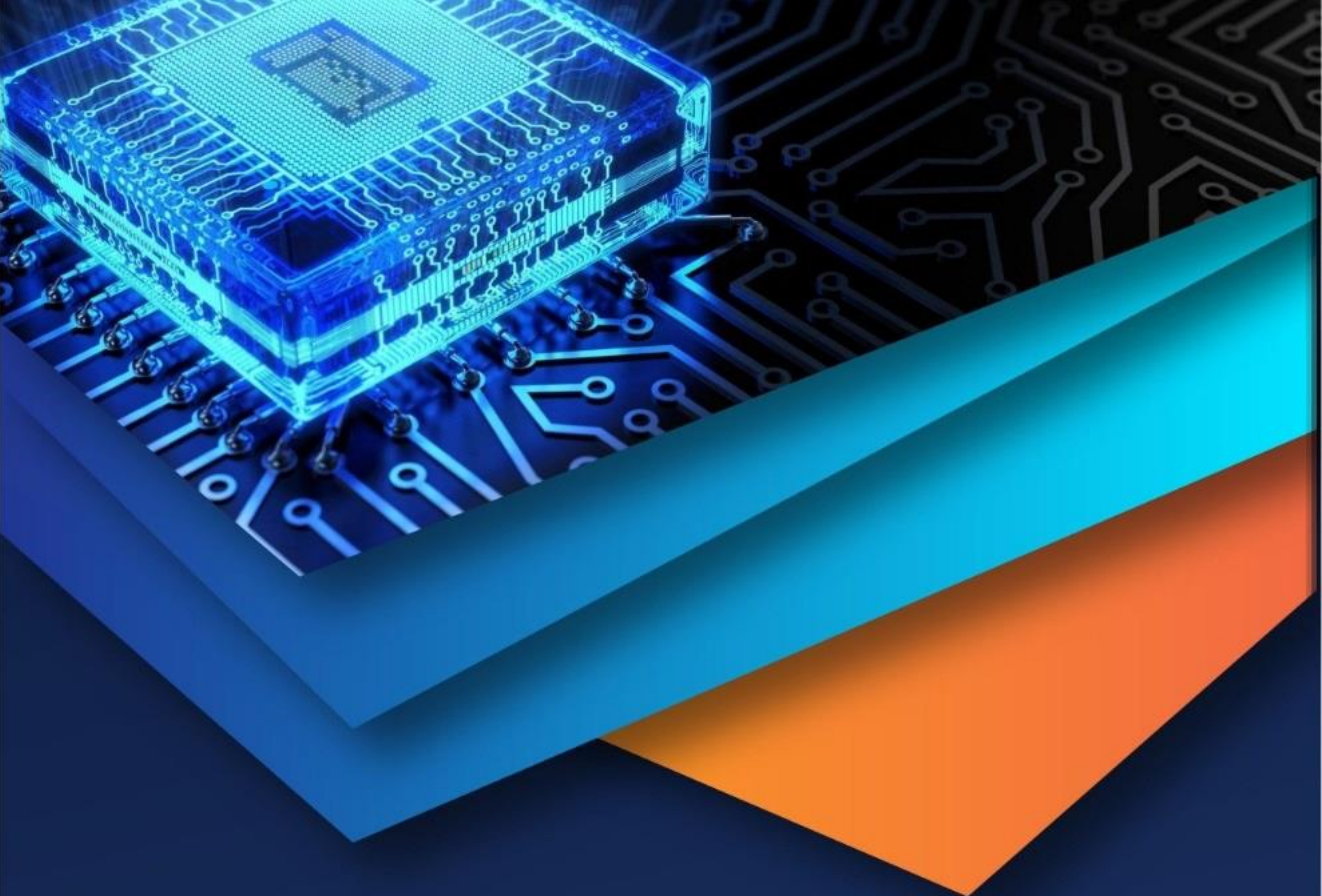

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