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RESEARCH ARTICLE

INVESTIGATION OF DATA TRANSMISSION THROUGH VISIBLE SPECTRUM

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Li-Fi : Light Fidelity, OWC :
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VLC: Visible Light
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ABSTRACT

Data communication, which is the transmission of digital data through a network or to a device external to the sending device, is the cornerstone of modern telecommunications. Telephones, Computers, the Internet and Wireless technology have transformed society in virtually every way from the personal to the business realms; without it contemporary society would be vastly different. Many new models of transmission of data are coming into existence in everyday life in order to increase the speed of transmission of data at minimum amount of time and as well as at an increased amount of bandwidth. Another important factor that seriously affects the data transmission model is the transmission of data at reduced amount of losses. This can be achieved by using optical fibres for the transmission of data which leads to a reduced amount of losses.

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INTRODUCTION

Data transmission, digital transmission or digital communication is a digital transfer of data from point to point or point to multipoint communication channel. The main types of such data transmission include copper wires, optical fibres, wireless communication channels, storage media and computer buses. The data is represented as an electromagnetic signal such as an electrical voltage, radio wave, microwave or infrared signal. The transmission of data through light is popularly known as Li-fi technology. OWC is a kind of Optical Communication done with the help of visible, infrared, ultraviolet signals used to carry information. OWC generally works in the bandwidth of visible region (390-790 nm). Therefore, it can also be referred to as Visible Light Communication (VLC).

Implementation

The phenomenon of transmission of data with the help of light primarily requires the collection of data in analog form from different information sources. The information which is collected from different sources is then sent to the signal conditioning circuit which includes the process of Amplification, Filtering, Converting, Range matching,

Isolation and other processes which are required to make the sensor output suitable for processing after conditioning.

Op-amps, which are generally designed on large geometric processes to withstand the higher internal voltages, are generally employed in this Signal Conditioning Circuit. The analog form of data which is collected from the Signal Conditioning circuit is thereby sent to the analog to Digital converter in order to transform the analog form of data into Digital form.

According to the Fig 1.0 provided below, we can infer that the transmitter part of this system consist mainly Time Division Multiplexer, Controller circuit, Clock and Optical device. The digital information which is collected from the analog to Digital converter is thereby sent to the Time Division Multiplexer. The Time Division Multiplexer is supervised by the functioning of the Controller and the Clock circuits. The main theme of this process is to increase the bandwidth. Here the visible spectrum has wide range of frequencies, as soon as the user sends a request to the hotspot the controller circuit assigns a particular frequency for the user, in this way each and every user is assigned to one unique frequency assigned by the controller circuit. As soon as the user gets disconnected then the particular frequency is left empty and controller circuit

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waits till the new user gets connected to assign the frequency that is free.

Once the device get connected controller circuit from the transmitter section sends a signal saying this frequency is assigned to this device then the receiving device adjusts the LDR to that particular frequency.

LDR circuits generally sense the wavelength of the light and responds accordingly to it, while our main aim is to sense the frequency of the light which is proportional to frequency and controller circuit converts the received frequency to the respective wavelength and assigns LDR a particular value to sense the light falling on it.

The peak sensitivity range of a CdS (Cadmium Sulphide) LDR is in the range of 500-600 nm while the visible spectrum ranges from 390nm to 700nm. By this LDR circuit would easily detect the signals and decode them.

Once the information is ready to leave from TDM then controller circuit gives the number of users to TDM so that it activates required number of channels to optical device. So, a channel will be associated to a particular user and the information will be sent sequentially to a particular user while to all the users data is transmitted parallel in their respective channels.

The controller circuit which is present in the transmitter part of the Data transmission system controls the bits of information of a particular source through which the data is transmitted over the optical fibres. The clock circuit which is present ensures there is a certain timing difference between two successive bits of information, two successive words of information and as well as between two successive users.

The data from the TDM is thereby sent to the optical device which acts as a transducer for converting the electronic form of data into light form. The data is then passed through the source to fibre interface and thereby through the optical fibres. We can also use signal regenerators for the efficient transfer of the optical form of information.

Optical device should be capable of sending many frequencies at the same time. It generates a particular frequency to the user to say the data transmitted is logical 1 and if no pulse is generated then it is said to be logical 0.

An optical device should be designed in such a way that it is capable of emitting any required frequencies required with the information assigned to it. Waiting for future technologies to develop such an optical device.

On the receiving end a fibre to light source interface is present. The optical detector which is present in the receiving part is used to detect the optical form of information. The output from the optical detector which is converted back to the electronic form is thereby sent to the De-multiplexer.

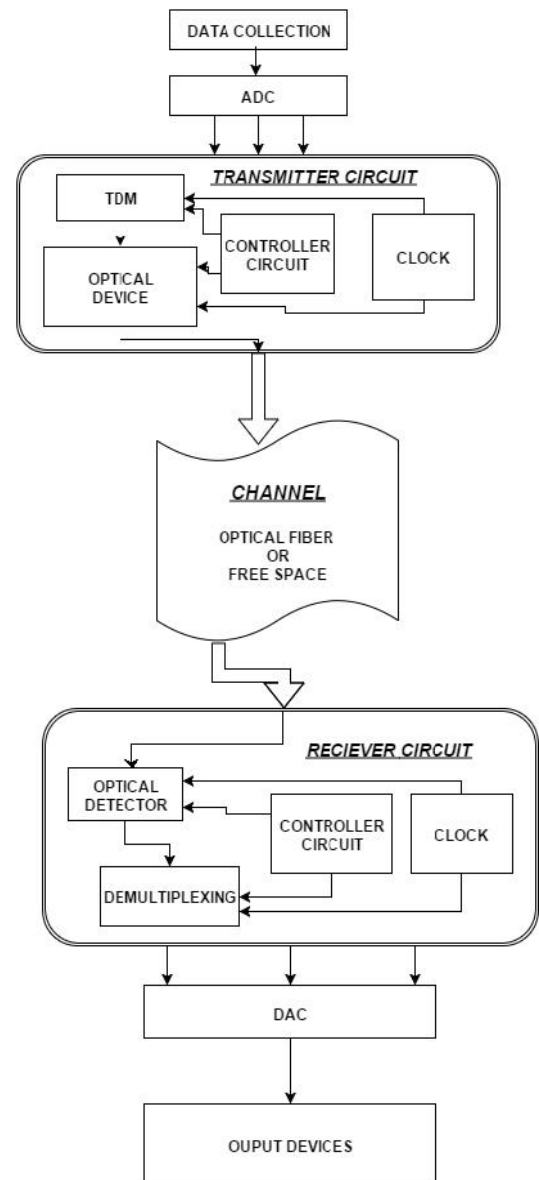


Fig 1 Flowchart describing the process of data transmission through light

The De-multiplexer is again supervised by a controller and as well as a clock circuit. The information which the De-multiplexer gets is further divided into the user channels respectively. This division of the accumulated information in a single channel into the various user channels is thereby controlled by the controller circuit in the receiver part of the data transmission system.

The digital information from the De-multiplexer is then sent to the Digital to analog convertor. Here the digital form of information is converted back into the analog form of information. This analog form of information is thereby sent to its respective destinations. As a result the information is transferred from the source to the destination.

Advantages

- It helps in transmission of data at improved amount of speeds.
- It leads to less time consumption for the transmission of data.

- It leads to improved amount of bandwidth for the transmission of bits of information.
- It also leads to transmission of data at a minimum amount of cost hence making it more economic.
- It helps in securing the data that is being transmitted and actions like hacking of information can be overcome.
- The loss of information could also be minimised due to the use of optical fibres for transmission of data.

Due to the growing needs of internet and other requirements in every nook and corner of the world, transmission of data through light would be more economical to a common man. Yet another striking feature of the proposed idea is that it has increased amount of Bandwidth which would open up a Pandora's Box of related issues. In the further investigations we can make this even more reliable to replace the present day Wi-Fi routers in terms of speed.

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CONCLUSION

The transmission of data at increased amount of speeds and reduced amount of losses is the utmost thing which is important that needs to be kept in mind while designing a system for transmission of data.

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