

**Figure 5:** Diagram showing working of Li-Fi

A VLC light source could comprise of a fluorescent or light emitting diode (LED) bulb. Since a robust Li-Fi system requires extremely high rates of light output, LED bulbs are most ideal for implementing Li-Fi. LED is a semiconductor light source, which implies that LED light bulbs can amplify light intensity and switch rapidly. Therefore, LED cells can modulate thousands of signals without the human eye ever noticing. In turn, the changes in light intensity from the LED light source are interpreted and converted as electrical current by the receiving photodiode device. Once the electronic signal is demodulated, it is converted into a continuous stream of binary data comprising of audio, video, web, and application information to be consumed by any Internet-enabled device.

There is ample room for growing innovation in Li-Fi technology. Like conventional broadband and Wi-Fi, Li-Fi can also function as a bidirectional communication system. By interchanging visible light and infrared light from a photo detector, a mobile device connected to that photo detector can send data back to the light source for uplink. Also, multi-colored RGB (Red/Green/Blue) LED's at retina size could be engineered to send and receive a wider range of signals than single-colored phosphor-coated white LED's.

Few applications of Li-Fi are:

**RF Spectrum Relief:** Excess capacity demands of cellular networks can be off-loaded to Li-Fi networks where available. This is especially effective on the downlink where bottlenecks tend to occur.

**Smart Lighting:** Any private or public lighting including street lamps can be used to provide Li-Fi hotspots and the same communications and sensor infrastructure can be used to monitor and control lighting and data.

**Mobile Connectivity:** Laptops, smart phones, tablets and other mobile devices can interconnect directly using Li-Fi. Short range links give very high data rates and also provides security.

**Hazardous Environments:** Li-Fi provides a safe alternative to electromagnetic interference from radio frequency communications in environments such as mines and petrochemical plants.

**Hospital & Healthcare:** Li-Fi emits no electromagnetic interference and so does not interfere with medical instruments, nor is it interfered with by MRI scanners.

**Aviation:** Li-Fi can be used to reduce weight and cabling and add flexibility to seating layouts in aircraft passenger cabins where LED lights are already deployed. In-flight entertainment (IFE) systems can also be supported and integrated with passengers' own mobile devices.

**Underwater Communications:** Due to strong signal absorption in water, RF use is impractical. Acoustic waves have extremely low bandwidth and disturb marine life. Li-Fi provides a solution for short-range communications.

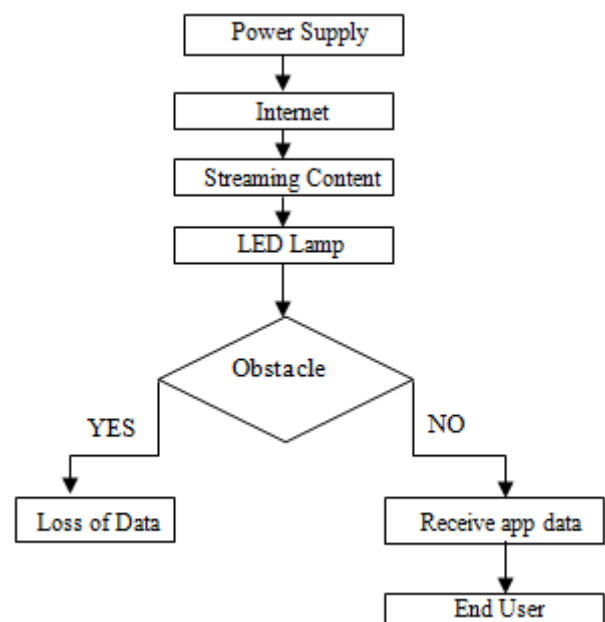
**Vehicles & Transportation:** LED headlights and tail-lights are being introduced. Street lamps, signage and traffic signals are also moving to LED. This can be used for vehicle-to-vehicle and vehicle-to-roadside communications. This can be applied for road safety and traffic management.

**RF Avoidance:** Some people claim they are hypersensitive to radio frequencies and are looking for an alternative. Li-Fi is a good solution to this problem.

### 5. Issues of the Existing System

The following are some of the issues of the existing system:

- 1) High installation charges of Visible Light Communication (VLC) devices.
- 2) Interference from external light sources like sun-light, normal bulbs, opaque materials.
- 3) Light cannot penetrate through objects such as walls and the exact explanation is described below:
  - a) If there is no obstacle between LED lamp and receiver, the data is received normally on the receiver end.
  - b) But if there is some kind of obstacle like wall in between the LED Lamp and receiver then there is loss of data which is explained in the diagram below



**Figure 6:** Flow Chart showing Issue of the Existing System

## 6. Proposed System

### 6.1 Components

**Power supply:** Provides the necessary electrical power to operate the transmitter.

**Internet:** Internet is a global system of interconnected computer networks that interchange data by packet switching using the standardized Internet Protocol Suite (TCP/IP).

**Streaming Content:** Streaming Content which refers to content delivered live over the Internet, requires a form of source media (e.g. a video camera, an audio interface, and screen capture software) an encoder to digitize the content, a media publisher, and a content delivery network to distribute and deliver the content.

**LED Lamp:** It is defines as semiconductor light source which means that LED light bulbs can amplify light intensity and switch from it rapidly.

**Sensor:** A sensor is a transducer whose purpose is to sense (that is, to detect) some characteristic of its environs. It detects events or changes in quantities and provides a corresponding output, generally as an electrical or optical signal.

**Oscillator:** Creates alternating current at the frequency on which the transmitter will transmit. The oscillator usually generates a sine wave, which is referred to as a *carrier wave*.

**Modulator:** Adds useful information to the carrier wave. There are two main ways to add this information. The first, called amplitude modulation or AM, makes slight increases or decreases to the intensity of the carrier wave. The second, called frequency modulation or FM, makes slight increases or decreases the frequency of the carrier wave.

**Amplifier:** Amplifies the modulated carrier wave to increase its power. The more powerful the amplifier, the more powerful will be the broadcast.

**Antenna:** Converts the amplified signal to radio waves.

**Wireless Adaptors:** A high-speed wireless network card that is used to access a network that is pre-installed in most of the computers, laptops and mobiles.

**End User:** End User can be any number of user using laptop, computer and mobile.

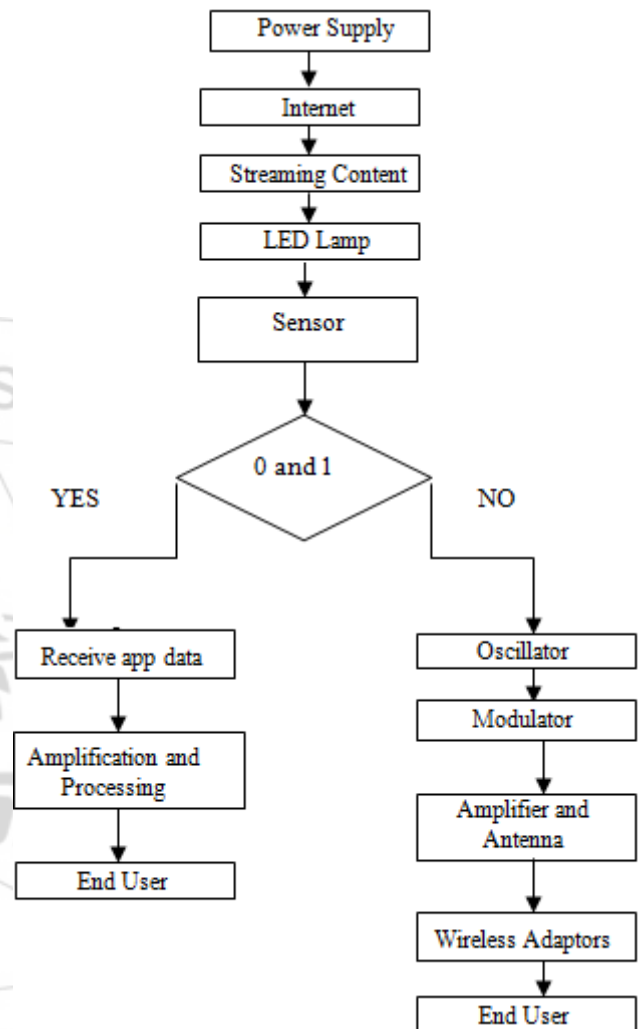
### 6.2 Working of the Proposed System

The following are the steps designed for Proposed System:

- 1)The first and most important thing needed for the system to work is Power Supply.
- 2)Internet connection is made and streaming of the content is done accordingly.
- 3)LED Lamp glows with the help of power supply and there is continuous transfer of 0 and 1 and when there is no

obstacle the sensor receives 0 and 1. But if there is an obstacle the sensor receives only 0 signal.

- 4)Now, if there is continuous transfer of 0 and 1 signals the system works as a Li-Fi which has the following steps:
  - a)Receiving the application data coming from the LED Lamp through sensor.
  - b)Performing Amplification and Processing.
  - c)Delivering the data to the end user.



**Figure 7:** Flow Chart showing Proposed System

- 5) But, if there is only 0 signal coming from the sensor that means there is some kind of obstacle which may be wall or anything which does not allow light to transfer the system generates radio waves in the following manner:
  - a)Oscillator which oscillates the current coming from the power supply into alternating current.
  - b)Modulator which adds the information in the wave.
  - c)Amplifier which increases the power of the transferring wave.
  - d)Antenna which converts the amplified waves into radio wave.
  - e)Wireless Adaptors are the receivers which receives the radio waves.
  - f) Finally, the data is delivered to the end user.
- 6) In this way, the data can be transmitted through walls without causing any problem to the user.

## 7. Analysis of the Proposed System

### 7.1 Advantages

- 1) The Proposed System designed can easily penetrate through walls and the user can avail the services provided by the internet service provider without any interruption.
- 2) This system makes use of sensors which are not much costly and are easy to deploy.
- 3) This system also makes use of radio waves which can travel long distances and are cheap.
- 4) Radio waves can be used for almost all non written communications.
- 5) The Proposed System ensures security in the following two ways:
  - a) It is difficult to eavesdrop on Li-Fi signals since the signal is confined to a closely defined illumination area and will not travel through walls. Data may be directed from one device to another and the user can see where the data is going; there is no need for additional security such as pairing for RF interconnections such as Bluetooth.
  - b) While using radio waves we can use encryption and decryption technique where in the user can set password and change it after periodic intervals of time so that only the authenticated user is able to access the internet.

### 7.2 Disadvantages

- 1) One of the disadvantages of the system is that as it uses radio waves they cannot transmit a lot of data simultaneously because they have low frequency.
- 2) In addition, continued exposure to large amounts of radio waves can cause health disorders like leukemia and cancer.
- 3) Though the cost of sensor and generation of radio waves is not that costly but the overall cost of the system increases.

### 7.3 Future Scope

- 1) Furthermore, a system should be developed which is less costly like by using energy saver bulbs.
- 2) To develop a system that will support Li-Fi in almost all mobile devices

## 8. Conclusion

Thus radio waves can help Li-Fi technology to overcome its few shortcomings in the following 2 ways:

- 1) It allows the data to penetrate through walls.
- 2) There is no requirement of continuous line-of-sight as is required in Li-Fi.

## References

- [1] A study of visible light communication with Li-Fi Technology, IJAECs C S Patil, R B Bhamare, M I Rangrez
- [2] IEEE Journal of Lightwave Technology

- [3] reLi-Fi (Light Fidelity) Technology, International Journal in Computer Application and Robotics 2370-7345 Suganyal c, Subhalakshmi priya
- [4] Light-Fidelity: A Reconnaissance of Future Technology-Dhakane Vikas Nivrutti, Ravi Ramchandra, Nimbalkar International Journal of Advanced Research in Computer Science and Software Engineering
- [5] Li-Fi Tehnology in Wireless Communication Revathi Ganesan International Journal & Magazine of Engineering, Technology, Management and Reasearch Registrar of Newspapers of India
- [6] Original Video of Li-Fi [http://www.ted.com/talks/harald\\_haas\\_wireless\\_data\\_from\\_every\\_light\\_bulb](http://www.ted.com/talks/harald_haas_wireless_data_from_every_light_bulb) (dated July 2011)
- [7] Dr.Y.P.Singh, Critical Technical Aspect and Extensive Research Study of the Light Fidelity International Journal of IT, Engineering and Applied Sciences Research(IJITEASR), Volume 2,No. 9, September 2013.
- [8] M.Thai gavel Li-Fi Technology Wireless Communication, International Journal of Engineering Research and Technology(IJERT) ISSN: 2278-0181,Vol.2, Issue 10, October 2013,
- [9] Research Center of Li-Fi <http://www.li-fi-center.com> (dated 2013)
- [10] Definition of Li-Fi <http://whatis.techtarget.com/definition/Li-Fi> (dated November 2013)
- [11] Transmission of Radio Waves <http://www.dummies.com/how-to/content/radio-electronics-transmitters-and-receivers.html>
- [12] Comparison with Wi-Fi <http://spectrum.ieee.org/telecom/internet/lifi-gets-ready-to-complete-with-wifi> (dated 20 November 2014)