Li-Fi, a Cleaner and Greener Communication Technology of Tomorrow in the Perspective of Developing Country

Mrs Rakhi Sharma, Dr. Y.P. Singh
1Research Scholar, Mewar University, Rajasthan, India 2Supervisor & Director, SITM, Rewari, Haryana, India

Abstract
With the advent of the information communication technology, world have become a town, the demand of the technology is uprising vertically and horizontally in terms of development of the nation and its economy. Today if we look on the retail market or any other traditional and professional business or service, we find the integrated role of the communication technology, and its proportionate relationship with the business development. Service sector with the use of ICT are more profitable and tangible benefits in terms of the returns and the sustainability. To prototype the frame work of national communication channel to meet the demand of the service of ICT by the society and the requirement of Energy to meet and sustain the frame work of communication Technology, LI-Fi may play an important and vital role. The national mission of digital India may bring the fruits with the development of the LI-Fi Communication Technology. Present paper enlight the issues and solution to prove the LI-Fi as one of the pioneer technology which is clean and green.

Keywords
Microwave, Li-Fi, BTS, OFC, Electro Magnetic Interference, Spectrum, Pioneer, ICT, Framework

I. Introduction
Nowadays communication is an essential part of our life, it has been spread in each and every part of world. It is not only needed for entertainment but also in all important field like education, business, air traffic control etc. It’s not possible to run this world without communication even for one day. We have started communication with cables, then OFC and ultimately switched to wireless communication with microwaves. Microwaves have several advantages on other type of communication mode but due to increasing demand of data the spectral becomes so dense that if it will continue for some more year there is a chance of such Electro Magnetic Interference that all communication system will crashed. Furthermore electromagnetic waves has hazardous effect on human body. By taking all these issues in account we are trying to use this new mode of communication called Li-Fi. Li-Wi which is a wireless communication same as present with only difference of wavelength, here we are using visible light spectrum in place of microwave which will overcome all issues mentioned above.

II. Literature Review and Study
A. Issues with Microwave
1. Issues in Terms of Communication
Wireless communication using microwave was a best option till now. But as we can see in fig. 1 it has a limited bandwidth which cannot fulfill the increasing demand of data. Furthermore it is more expensive and less secure if we compare with visible light spectrum.

The most important issue in electronics is power consumption. Many research is going on in many field to reduce power consumption as at this point we need to save energy wherever and however possible . Microwave communication has high power consumption which is the major drawback of the same. This issue encourage us to search for a better alternative and it ends to LI-Fi. Apart from these major issues microwave communication has comparatively less speed , limited range and less security.

Fig. 1: Electro-Magnetic Spectrum

2. Health Issues with Microwave
After a research it is found that microwave has negative effect on human body. Fig. 2 shows a case where a too much lower frequency of radio wave is irradiated to the permanent dipole of water. In this case, the permanent dipole will immediately follow the directions of electric field. So in this case, water doesn’t generate heat.

Fig. 2: At Too Lower Frequency of Radio Wave

On the other hand, Fig. 3 shows a case where a too much higher frequency of EM wave is irradiated to the permanent dipole. In this case, since electric field changes its direction too fast, dipole
won't be able to follow. Then, water does not generate heat in this case also.

In contrast to these, Fig. 4 shows a case where moderate frequency of radio wave is irradiated to the permanent dipole. In this case, the permanent dipole changes a little behind the electric field. During the time delay, water is absorbing energy from radio wave and generate heat. And, this moderate frequency is the microwave.

When a human body is exposed to the electromagnetic radiation, it absorbs radiation, because human body consists of 70% liquid. Microwave absorption effect is much more significant by the body parts which contain more fluid (water, blood, etc.), like the brain which consists of about 90% water. Effect is more pronounced where the movement of the fluid is less, for example, eyes, brain, joints, heart, abdomen, etc.

- Irreversible infertility
- Risk to Children and Pregnant Women
- Increase in Cancer risk
- Sleep Disorders
- Salivary gland tumor

Adverse effect on birds, animals and environment and many more

B. Li-Fi a Cleaner and Greener Solution

As we have seen many issues in microwave a Li-Fi is a better solution. In Li-Fi we are using light waves so we need light source to emit light which consume enormous less power as compared to transmitter used in microwave communication. Following are some light sources and their features we use in Li-Fi.

III. Comparative Study

This study has been carried out with important parameters and some of the characteristics are listed as follows.

The comparative study of incandescent Bulb, Fluorescent lamp. Solid-state light emitting diode (LED) and result thereof has been listed as Under:

1. Incandescent Bulb
   - First industrial light source
   - 5% light, 95% heat
   - Few thousand hours of life

2. Fluorescent Lamp
   - White light
   - 25% light
   - 10,000s hours

3. Solid-state Light Emitting Diode (LED)
   - Compact
   - 50% light
   - More than 50,000 hours life span

A 1800 band BTS power need is nearly 3 KW out of which only 4% energy is transmitted as data. Rest is wasted in radio equipment’s and cooling system. The tariff rates become cheaper as light waves are cheaply available. 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. Moreover Li-Fi is faster and more secure as light cannot penetrate through walls. Also there is no interference problem we can use this system in hospitals, aero plane, underwater communication and mines and petrochemical plants.

IV. Results and Conclusion

LI-FI will be able to transfer the power as an efficient energy saving alternative of Wi-Fi with more secure, reliable, compact transmitter and receiver, faster data transfer and wider bandwidth. This may also solve issues such as the shortage of radio-frequency bandwidth and allow internet where traditional radio based wireless isn’t allowed such as aircraft or hospitals. Table.1 shows comparison of microwave and Li-Fi technology.

<table>
<thead>
<tr>
<th>Property</th>
<th>VLC</th>
<th>RF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>Unlimited, 400nm–700nm</td>
<td>Regulatory, BW Limited</td>
</tr>
<tr>
<td>EMI Line of Sight Standard</td>
<td>No</td>
<td>High</td>
</tr>
<tr>
<td>Standard Hazard</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Visibility (Security)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Power Consumption Distance</td>
<td>Relatively low</td>
<td>Medium</td>
</tr>
<tr>
<td>Visibility (Security)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Mobility Coverage</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Capacity</td>
<td>Narrow</td>
<td>Wide</td>
</tr>
</tbody>
</table>

With the help of comparative study on the above certain parameters and characteristics, it is worth to note the followings results.
1. Li-Fi in very cost effective technology.
2. Cleaner and green Technology.
3. May save a lot of energy to make country self-dependent.
4. With Li-Fi technology may achieve the dream of digital India.
5. Less harmful and energy efficient technology.
6. Alternative mode of highway communication technology.

**V. Future Research Work**

Li-Fi technology and its application can be further extended an entire wireless architecture and investigate time factors, type of traffic affected, various reliability and maintainability growth, constancy and deterioration. Simulation modeling can be further extended for different network topologies such as WIB star and WIB rings to evaluate the performance for different network topologies. Cost functions can be developed and simulation can be designed for an optimal set of dependability and cost of WIB. This analysis can be further applied for 3G and 5G wireless technology. Effectiveness of neural network modeling can be evaluated for an entire PCS architecture and different network topologies and variable sized WIBs. Reverse engineering can be carried out for neural networks to find the optimal set of inputs (component MTTF and MTR values). NN modeling can also be implemented with empirical data, provided by wireless carriers for more accurate perspectives of ARMS. Besides above some issues related to light propagative properties may come in way but, that can also be solved out with the help of simulations and some other tools.

**References**


Prof. Y.P. Singh, currently working as Director, Somany (P.G.) Institute of Technology and Management, Rewari, Haryana. He has also worked about 27 years as Lecturer, Dean of academics & Principal in many Engineering institutions and organization. He has also served with Training and Technical Deptt. Govt. Of Delhi, almost for 17 years. He has about 76 research paper published in National and 164 papers published in international journals in his credit. He has been selected and awarded by Govt. of Delhi as “Best Technical Teacher- 2004”. He has been conferred Outstanding Teacher Award 2012 and 2013 respectively. His Research work has been adjudged as outstanding work. He has submitted his 2 patents and are in process. He has also has been awarded as “Star of Asia Award “ an international award, by Global achievers foundation. He has been awarded the Best Technical Director (Research) in Haryana in 2014, and Best Technical Director (Research) in Delhi 2015. He is also an expert and Master Trainer for the Teachers, empanelled by SCERT/NCERT. He is also the guide of research scholar for almost dozen of Universities.

Mrs. Rakhi Sharma a research scholar is post graduate in Electronics & Communication Engineering, working as Asstt. Professor in Chennai, She is pursuing her research in the Innovative and front line research in Energy efficient communication system (a future wireless internet communication), from the Faculty of Electronics and communication Engineering, Mewar University, Chittour, Rajasthan. She had already published one paper on the topics.