

Secure Data transfer of Li-Fi – By RC4 and JWSED Algorithm

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Abstract: Li-Fi is the technology which supports transmission of data through light. Various techniques are used for encryption and decryption to support highly secure data transmission. In this paper, procedure for communication is used which supports secured data transmission using RC4 algorithm along with JWSED technique at the sender's side. JWSED is Jumbled Word String Encryption Decryption mechanism. Data is sent through Li-Fi from sender to receiver after performing its encryption. JWSED algorithm provides security while data is transmitted among Li-Fi devices. Data is input from the user. It is encrypted using RC4 algorithm. After this, JWSED algorithm is applied which provides more security to encrypted text. Then, data is sent through the channel via Li-Fi means. On the other system at receiver side, plain data is reproduced by applying techniques for decryption i.e. reverse of techniques applied for encryption at transmitter end. Data security is primary concern in today's world which is addressed beautifully using technique described in paper.

Keywords: Light Fidelity, Wireless Fidelity, Security Key, Encryption and Decryption Technique, Virtual Light Communication.

1. INTRODUCTION

Li-Fi stands for Light Fidelity. Li-Fi enables transmission of data at very high speeds. The technology is similar to the Wi-Fi. Light rays are used by Li-Fi for information transmission which is 100 times speedier than Wi-Fi. This is on the grounds that light has the ability to exchange immensely more measure of information in a less time in comparison with radio waves. The newly invented technology Li-Fi consists of highly intensified light source which brings out highly energy efficient solutions. The technology is better than conventional technologies.

The technology was invented by Harald Hass. He explained that transmission of binary value 1 if LED is on and transmission of binary value 0 if LED is off takes place. Fast switching of LED enables transmission of data and the blinking of LED cannot be observed by human eye[1]. The paper focuses on secure transmission of data using RC4 algorithm and JWSED algorithm for encryption using Li-Fi technology[2].

This paper utilizes RC4 algorithm for encryption of data to be transmitted. JWSED algorithm is also used for making data more secure. After encryption is done, data is transmitted

between Li-Fi devices and decryption algorithm is used with a specific decryption key at receiver.

1. RELATED WORK

In the present era, the smart phones are used and are available in everywhere. The today's scenario of using mobile phones, data is exchanged between two or more devices by having the connectivity through Wireless Fidelity (Wi-Fi), Bluetooth and hotspot. In future of Li-Fi technology, the data would be made and expected to exchange between the phones using light. This provides a very high speed communication. Today, the demand for high data rate keeps on increasing.

Data transfer through light by using RC4 algorithm in encrypted and decrypted form. LED bulbs are switched on and off in very less time of order of nanoseconds which can't be identified by human eye.

This can be obtained by fitting a Li-Fi chip, to turn the light bulb into a high speed broadband communications device. LEDs are utilized as light hotspot for transmission of information by means of web in Li-Fi correspondence. In this day and age, Li-Fi is the new innovation which utilizes LED as light source for data transmission in wireless manner.

Li-Fi requires line of sight to be present for transmission or reception of data, without of which communication may be obstructed. Data transmission at high rates is one of the most crucial requirements of today's world. The technology uses visible light spectrum for communication which does not have major bad effect on human life. Light has more density, 10000 times wider bandwidth than radiowaves[3].

According to Professor Haas, the light which has been alluded by him as D-Light, it can be utilized to deliver information rates is higher than 10 megabits for each second which is substantially quicker than our normal broadband connection[4].

Haas has set up a turn off firm to offer a customer VLC transmitter which is because of dispatch by one year from now. It is fit for transmitting information at 100MB/s - is significantly quicker than most UK broadband associations[5].

Harald Haas has been presented the novel approach Li-Fi

(Light Fidelity), to transmit the data through light illumination devices such as televisions, lamps, road signs, commercial adboxes to smart phones [6].

3. DATA TRANSMISSION THROUGH LI-FI

Cloud computing and Wi-Fi advancements increase the reliability of signal day by day, where speed and security of signals are major concern. Here, data can be transmitted through Li-Fi. This technology involves sending the data through a light source i.e. LED light bulb, whose illumination's intensity vary faster than being detected by human eye. In not so distant future, it is normal that information would be send and get through a light in a room among workstations, keen cell phones and tablets. It relies upon the innovation that depends on visible light communication (VLC), which makes Li-Fi quick and modest optical type of Wi-Fi.

Optical wireless technologies also known as Visible light communication (VLC)[7], and referred as Li-Fi(Light Fidelity) technology. It offers advance model in wireless technologies with respect to the flexibility, communication speed and usability [8].

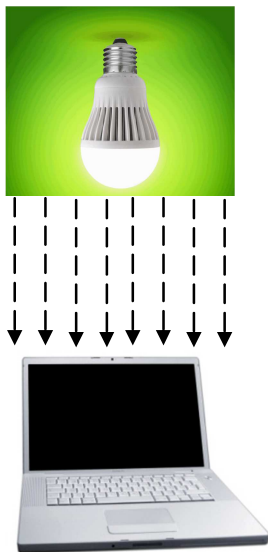


Figure 1: Data Transmission in Li-Fi

Li-Fi is a bidirectional technology. VLC is a medium in data communication. It utilizes light as optical carrier that lies in the scope of 400THz(780nm)- 800THz (35nm) for transmission of data. Also, fast pulses of light is utilized for transmission of data in a wireless manner.

Here the main components are source and receiver of the light. White LED is used as a source because of its high brightness. Whereas a silicon photodiode serves as a receiver's element, as it shows good response to visible region of electromagnetic spectrum. By switching the LED on & off digital strings of 1's and 0's can be generated. Flashing rate of LED is differed with a specific end goal to

create another data stream which comprises of data signal encoded with light. In actual, by modulation of LED light with data signal, illumination of LED can be utilized as a source. LED output appears to be constant as flickering rate is too fast to be resolved by the human eye. When LED is in ON state, a digital 1 is being transmitted otherwise a digital 0. A human eye can't detect the on-off switching of LED [9].

Various means of RF communications allow its users to utilize the high data rates available at cheap rates. As the number of people utilizing the technology increases, then number of waves travelling through air also increases, thus results in increase in congestion traffic and also it become quite difficult to extract high speed signals accurately [10]. In this way, there are distinctive foundations based on which we can judge the working of Li-Fi and Wi-Fi that is capacity, efficiency, accessibility and security[11]. The LED (Light Emitting Diode) intensity regulated so quickly that human eyes can't see, with the goal that yield shows up constant[11].

By using suitable multiplexing techniques with high speed LEDs, we can achieve data rate of more than 100 Mbps. LED arrays increase the VLC data rate by applying parallel data transmission technique, where different data stream is transmitted by different LED. We can use several other illumination devices like incandescent bulb, fluorescent lamp, etc. But we prefer LED. It is just because of the reason i.e. binary signals quickly develop by LED and this lead to an advantage of manipulating the signals by small changing in their respective amplitude.

A thousands of data stream can be send, if we use large LED array instead of IR LED [12].

4. SYSTEM DESIGN IMPLEMENTATIONS

4.1 Encryption Method:

Data security is the crucial issue while data transmission. So to provide a security level while data transmission procedure, used encryption method. In the encryption method different encryption algorithm are uses to encrypt the data. In the encryption algorithm ASCII character or string is converting in the cipher text. Then on one cannot detect the original ASCII character or string data.

4.2 Li-Fi

Li-Fi is bi-directional wireless enabled network technology used to transmit data. The data is transmitted in the form of visible light using the LED light source. The principle of Li-Fi is quite easy, when LED is on then it transmit '1' and when LED is OFF it transmit the bit '0'.

4.3 Software design Implementation

Encryption is done at software end using the tools mentioned as under:

a. Microsoft Visual studio

To design the proposed system application software used C# programming language. C# allows to users to develop GUI application using their powerful tools. Different kinds of tool have the different type functionality. We can create secure and user friendly application in C# with ease.

b. Proteus

Proteus ISIS professional combine ease of use with powerful features to help us to design, testing and layout of electronic circuits and microcontrollers design. It is capable for supporting both schematic capture simulation and PCB design. And we can make changes easily in the circuit design by using the schematic rewiring, changing in component value for components and easily add or delete new component according to our requirement in the designing phase.

c. Serial Port Communication

RS232 is communication protocol used for data exchange between the computer and devices. For connection of peripheral devices to computer, standard feature used is a RS232 serial port. This standard defines the signals association between DTE (Data Terminal Equipment) and DCE (Data Communication Equipment). Computer act like as a DTE device and modem as a DCE device.

We face a major problem of how the data will transmit back from receiver side to transmitter. And pathway of LED light can simply block by someone standing in front of source. [13]. Computer act like as a DTE device and modem as a DCE device.

D. Hardware Design Implementation

Proposed system hardware comprises of Transmitter and Receiver setup.

- A. Transmitter Part : In transmitter part the data is said to be transmitted by transmitting user’s data from Li-Fi Device and this data is converted to digital signal form of zero’s and one’s. Once the data transmitted it reaches receiver side via visible light communication procedure.
- B. Receiver Part: The use of receiving part is to input user data that is transmitted successfully from the transmitting side.

5. PROPOSED METHODOLOGY

5.1 Proposed Algorithm Implementations

The proposed system when data transmitted using the Li-Fi transfer device as well as encrypt the data using Wheel string manipulation algorithm. When we encrypt data using the encryption algorithms then possibility to identify actual data is less. In Wheel algorithm first we encrypt data using the RC4 algorithm and in second procedure we again encrypt data using the wheel operation that means original data is encrypted twice. RC4 algorithm is a symmetric encryption algorithm.

And the algorithm result gets in the following equations:
 Wheel String Encryption = Enc { () } (i)
 Where “Str” is indicate the final step of Encryption Procedure
 Wheel String Decryption = Dec { () } (ii)
 And here proposed algorithm explains through the flow chart.

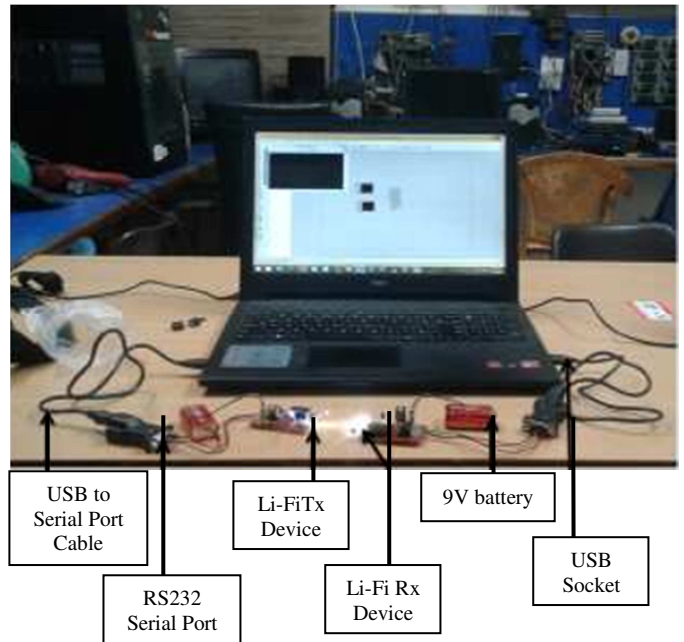


Figure 2: Proposed system Hardware Implementation

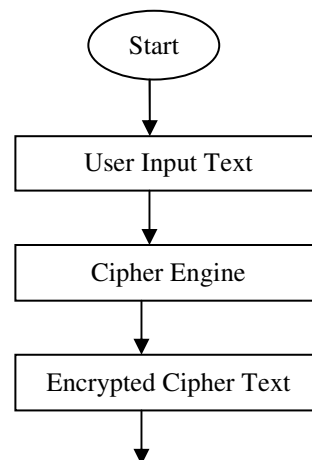
5.2 Flow chart

a. Encryption Procedure:

The process of converting plain text into cipher text. It includes encoding of message signal to protect user information on internet can be protected by it, that is being sent between a browser and a server. It can be passwords, payment information or any other private information. Two types of encryption are as follows:

- 1. Symmetric key.
- 2. Asymmetric key.

Its advantage is that protection of confidentiality of data or information can be done either stored on computer systems or transmitted via any network.



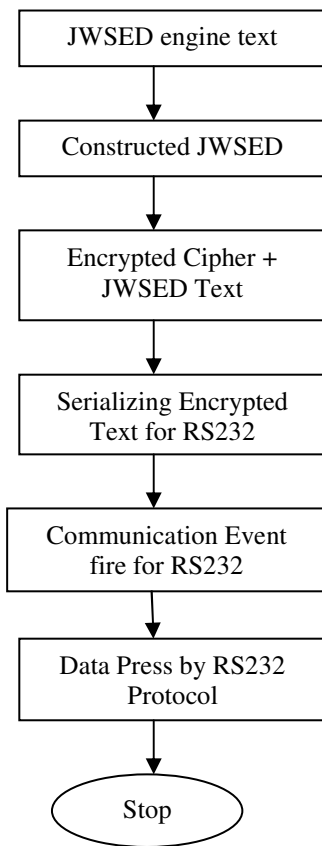


Figure 3: Encryption Procedure Part 1 Flow chart

Encryption is a process of converting plain text into ciphered text. Fig 3 represents the step by step flow chart representation for encryption process done at transmitter end.

b. Decryption Procedure:

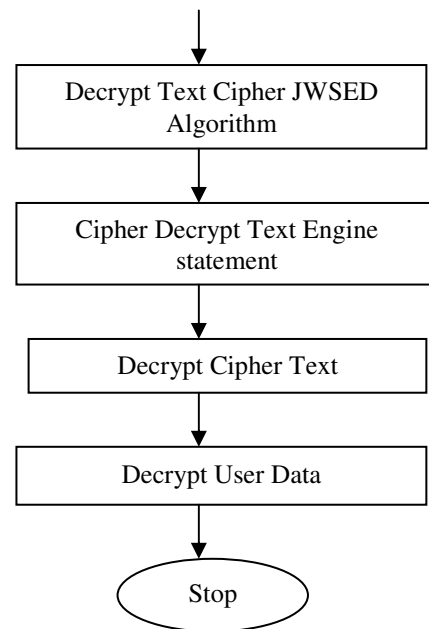
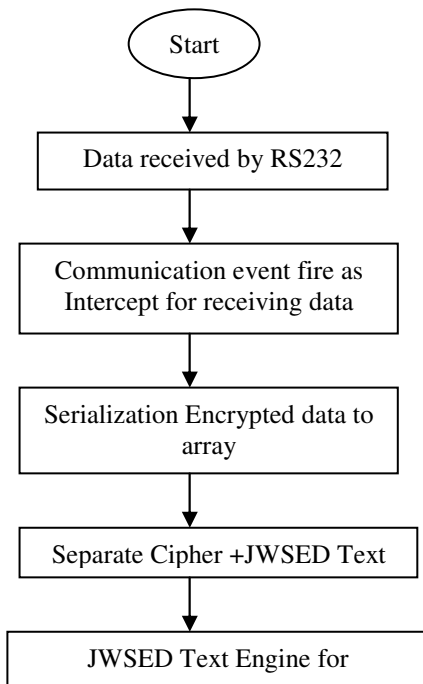


Figure 4: Decryption Procedure Part 2 Flow chart

The process of converting cipher text into plain text and process of decoding text. It is the opposite of encryption. Fig 4 represents the step by step flow chart representation for decryption process done at receiver end.

6. DIAGRAMMATIC REPRESENTATIONS

The algorithm is explained with the help of following example:

- Step 1: User types the text message to be sent. Let user types the text “TECHNOCRAT”.
- Step 2: Encryption is done for text message to be sent and JWSED algorithm is applied in a fig. 5.

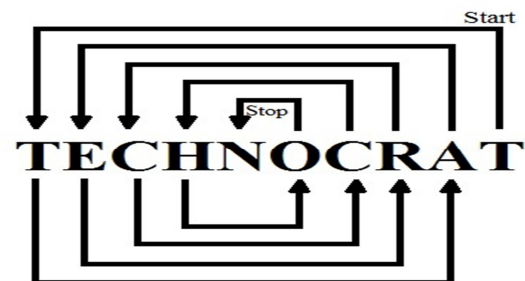


Figure 5: Apply Wheel Algorithm

After applying algorithm, the word gets de-arranged in form of “TTAERCCHON”.

- Step 3: The text after application of algorithm is sent on transmission medium.
- Step 4: The text received at receiver is rearranged back to get original word after application of decoding technique as shown in fig 6.

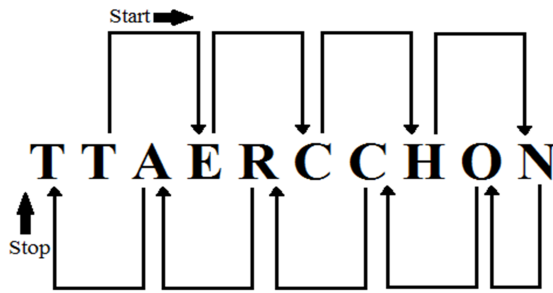


Figure 6: Apply JWSED (Wheel) Algorithm (Rearrange)

7. RESULT

The result of JWSED and wheel encrypted algorithm which is saturated in wheel string manipulation algorithm. The user details send through RC4 algorithm. The result is proceed through wheel algorithm by which data is securely transmitted through light. We have to send data through input in RC4 algorithm, one key is encrypted and other is decrypted. After apply the JWSED algorithm, Plain text is converted into cipher text in encrypted form then cipher text can shows the output in original form in decrypted process. Through RC4 algorithm, then JWSED by own their encrypted. RC4 encrypted data with their key then after JWSED algorithm then again which is produced JWSED by RC4 algorithm. On another system, Plain data is capable of carrying a data from first computer by LED then after this data is decrypted by an application. Hence, the plain data from first system is decrypted to another system. Hence successful data is transmitted from one computer to another system successful. Security increases, data bits are same with respect to other RSA, AES, DES Algorithms.

8. CONCLUSION AND FUTURE SCOPE

In the present scenario, now a days, light is available everywhere and there is great scope of its use with the evolution. This technology can be make more useful and mature in such a way that to transmit the wireless data only a light bulb can be sufficient. Wi Fi is an awesome general remote scope region inside structures and Li-Fi is perfect for high thickness remote information scope in restricted zone and for radio obstructions issues, so the two advancements can be other handling information independently and sending their discoveries occasionally back to surface. Popularity of Li-Fi technology increasing day by day, which make our communications safer, faster. And our future environment cleaner and greener.

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