**Li-Fi based Text Transfer System**

A Proof of Concept for Infrastructure-Independent Data Transfer Using In-built Mobile Hardware

**Abstract**

This paper presents a Li-Fi based text transfer application developed as a proof of concept to demonstrate that direct device-to-device data transfer can be achieved without reliance on external networks like the internet or Wi-Fi. The primary objective is to validate the use of in-built mobile hardware, specifically the LED torch and camera as a viable communication channel. The system employs Li-Fi (Light Fidelity) technology to transmit text data securely and efficiently using visible light. While the current implementation is focused on text sharing, it successfully proves the core principle of infrastructure-independent data exchange, highlighting Li-Fi's potential for enhanced security and energy efficiency compared to conventional wireless methods. This work establishes a foundational step, proving that much more complex data transmission can be developed over the course of time.

**Introduction**

In an increasingly connected world, most data transfer methods rely on external infrastructure such as Wi-Fi routers or cellular networks. This dependency can be a limitation in offline environments and introduces security vulnerabilities inherent to radio-frequency (RF) technologies like Wi-Fi and Bluetooth. This project was conceived to prove a fundamental alternative: that secure, direct device-to-device communication is possible using only the hardware integrated into a standard mobile phone.

The project leverages Li-Fi, a wireless communication technology that utilizes light-emitting diodes (LEDs) to transmit data. The core goal is to demonstrate that a phone's LED torch can act as a transmitter and its camera as a receiver, creating a self-contained communication channel independent of any external network. By successfully implementing text sharing, this project serves as the initial proof of concept, validating the transfer mechanism and laying the groundwork for more advanced applications. The system addresses the need for a universally compatible solution that works across different platforms, offering a more secure and energy-efficient method for short-range data exchange.

**The Li-Fi Proof of Concept**

The application successfully demonstrates the viability of Li-Fi for mobile communication by implementing text sharing as the initial validation case. The system functions by converting text data into binary, which is then transmitted by modulating the LED torch's light at a frequency invisible to the human eye. The receiving device's camera captures these light signals, and a software algorithm decodes them back into text.

This proof of concept achieves the following core objectives:

* **Infrastructure-Independent Transfer:** The system operates without needing a Wi-Fi or internet connection, proving that direct data transfer is achievable using only the devices themselves.
* **Use of In-built Hardware:** It exclusively uses the phone's standard LED flash as a transmitter and the camera as a receiver, requiring no additional hardware.
* **Inherent Security:** By using a line-of-sight, light-based medium, the system eliminates risks associated with RF-based hacking and sniffing, making it highly secure for short-range transfers.
* **Universal Platform Potential:** The underlying Li-Fi methodology is not proprietary, establishing a foundation for an application that can work across all major operating systems like Android, iOS, and Windows.

**Technical Foundation**

The project's design addresses the key technical challenges associated with visible light communication. The primary hurdles identified were the need for a direct line-of-sight, the limitation to short-range transmission, and the potential for data corruption from ambient light interference.

The methodology developed to overcome these challenges includes:

* **Data Encoding and Decoding:** The system implements a Manchester Encoding scheme to ensure efficient and less error-prone data transmission.
* **Ambient Light Filtering:** A critical software role involves noise filtering and adjusting for ambient light. The system establishes a baseline reference signal to accurately distinguish the transmitted data from environmental light noise.
* **Software and Signal Processing:** A dedicated signal processing algorithm manages the data transmission. The mobile application provides a user-friendly interface for the transfer process and incorporates data encryption for an added layer of security.

**Conclusion and Future Scope**

This project successfully achieves its primary goal: it proves, through the functional implementation of text sharing, that direct, infrastructure-independent data transfer is viable using only the in-built camera and torch of a mobile device. By validating this core principle, the project establishes a strong foundation for future development.

The successful text transfer is a critical first milestone. The ultimate vision is to expand upon this proof of concept, scaling the technology to handle larger and more complex data payloads, such as files. With the communication channel now validated, future work can focus on optimizing data rates and developing the framework into a full-featured, universally compatible, and highly secure file-sharing application. This project confirms that Li-Fi holds significant potential to evolve into a smarter, safer mobility solution for device-to-device communication.