PROJECT ABSTRACT

Li-Fi Based Audio Transmission System

Radio spectrum is congested and RF communication suffers interference in hospitals, aircraft and industrial zones.

01 Title

Li-Fi Based Audio Transmission System

02 Introduction / Background

Radio spectrum is congested and RF communication suffers interference in hospitals, aircraft and industrial zones. Li-Fi — communication through visible light — offers a complementary optical channel: LEDs are already everywhere, light cannot pass through walls (a natural security boundary), and it causes no electromagnetic interference. A Li-Fi audio link is the perfect final-year demonstration of the principle: an audible, visible, measurable system the student can build and defend.

03 Problem Statement

Students understand Wi-Fi intuitively but rarely work with optical wireless links, and most Li-Fi demos are abstract. This project builds a complete, working audio-over-light system — LED modulation, free-space optical channel, photodiode/solar-cell receiver and audio reconstruction — with measured range and ambient-light performance, proving Li-Fi is real engineering, not just a buzzword.

04 Objectives

- Transmit real-time audio through modulated visible light.
- Build transmitter (audio modulator + LED driver) and receiver (optical sensor + amplifier) circuits.
- Compare solar-cell vs photodiode receivers on range and fidelity.
- Measure and tabulate performance vs distance and ambient light.
- Demonstrate zero-latency analog audio reconstruction on a speaker.
- Present Li-Fi vs Wi-Fi trade-offs with experimental backing.

05 Proposed System / Working

The transmitter takes an AUX audio signal through an op-amp pre-amplifier into a MOSFET constant-current LED driver, amplitude-modulating the LED's intensity with the audio waveform at frequencies far above visible flicker. The receiver uses either a solar-cell panel (large-area, simple) or a photodiode feeding an op-amp transimpedance amplifier, followed by DC-blocking and filtering stages and an LM386-class audio power amplifier driving a speaker. The link is characterized with an oscilloscope at each stage: modulation waveform, photocurrent, and recovered audio. Range tests (0.5–3 m) and ambient-light tests (indoor vs sunlight) are tabulated, comparing the two receiver types on audible quality and measurable signal level.

The system reproduces speech and music live over 1–3 metres indoors with clearly audible quality; the photodiode receiver measurably outperforms the solar cell at range. Ambient indoor lighting causes negligible degradation, while direct sunlight reduces usable range — all tabulated in the report. The live demo is striking: block the beam with your hand and the audio stops; remove it and the audio returns instantly, making the optical link tangible.

06 Technologies / Components Used

high-brightness LED + driver · **audio modulator circuit** · **solar cell/photodiode receiver** · **amplifier** · **speaker**

07 Key Features

- Real-time audio transmission via amplitude-modulated visible light.
- MOSFET constant-current LED driver for linear modulation.
- Dual receivers: solar cell (simple) and photodiode + transimpedance amp (sensitive).
- Zero-latency analog path with live speaker output.
- Measured range and ambient-light performance tables.
- Any AUX audio source: phone, laptop or MP3 player.
- Full schematics with test-point voltages.

08 Applications / Use Cases

- Hospitals and aircraft (RF-restricted zones), underwater optical links, secure room-level communication, industrial plants with RF interference, and smart-lighting data overlays.
- The audio link itself is a teaching platform for optical communication courses.

10 Conclusion

This Li-Fi audio system turns an abstract concept into hardware: a working optical wireless link with measured performance, dual receiver designs, and a demo that makes the physics visible. It gives the student circuit design, modulation theory and honest experimental results to defend in the viva.