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Li-Fi Based Video Compression and Transmission for Biomedical Application

Mrs. R. Aarthi¹, Radha B²., Pushpalatha M²., and Priyadharshini V²

Assistant Professor, Department of Electronics and Communication Engineering, R.M.D Engineering College,
Chennai, Tamil Nadu, India¹

Student, Department of Electronics and Communication Engineering, R.M.D Engineering College, Chennai,
Tamil Nadu, India²

ABSTRACT: The Li-Fi technology was invented by Professor Harald Hass of University of Edinburgh. Li-Fi or Light Fidelity refers to 5G Visible Light Communication systems using light-emitting diodes as a medium to high-speed communication in a similar manner as Wi-Fi. Li-Fi has thousand times greater speed than Wi-Fi and provides security as the visible light is unable to penetrate through the walls, which propose a new era of wireless communication. The concept of Li-Fi is data communication on fast flickering of light which is not detected by human eye but it is focused on photo detector which converts the on-off state into binary digital data. It has gained a huge popularity in two years of its invention. Such technology has brought not only greener but safer and cheaper future of communication. In the days where internet has become a major demand, people are in a search for Wi-Fi hotspots. Li-Fi or New Life of data communication is a better alternative to Wi-Fi in wireless communication. Li-Fi has more capacity in terms of bandwidth in visible region therefore it does not poke its nose in other communications which uses radio frequency range, without taking its frequency bands.

KEYWORDS: Li-Fi, Video Compression, Medical Application.

I. INTRODUCTION

Li-Fi is a revolutionary solution for the high speed data network, proposed by a German physicist Harold Haas. Li-Fi networks support the transmission of data through illumination of LED bulb, thereby it is also termed as visible light communications. In the epoch of internet, there is a continuous urge for faster, secure, and reliable wire-wireless connectivity in all fields, while wireless networks are more preferable in all domestic application in general and health-care application in particular. The reason for depending on wireless network in hospital is the cables which are running over the patient's body interconnecting the devices may cause contamination. Dependency on the wireless internet increases the burden on wireless fidelity (Wi-Fi) technology which, in turn, creates a huge demand for bandwidth and radio spectrum. To reduce the load on Wi-Fi, an alternate mean of wireless internet is Li-Fi finds which find its applications in almost every field, even in vehicle technology. For a long time, medical technology has lagged behind the rest. The scope for wireless communication in the medical field is set on the rise; there are many devices which work on Wi-Fi such as infusion pumps, defibrillators, lung ventilators, and anesthesia machine. When a doctor is supposed to use magnetic resonance imaging scanners along with infusion pumps, which work on Wi-Fi there results a frequency overlapping problem. With more and more number of wireless medical devices coming up, utilizing the RF spectrum increases which lead an electromagnetic interference that results in potentially hazardous events related to medical equipment operations. Apart from the interference with medical equipment, an EMI affects human body also in the form of diseases, immune dysfunction, electromagnetic hypersensitivity, etc., and in worst case, it may lead to cancer. Another limitation of Wi-Fi in hospital system is its security issue. Patient information must be private and secure but remain accessible to authorized persons. Hospitals are places where both EMI sensitivity and security of medical details are issues with the uses of Wi-Fi. To combat the above limitations of Wi-Fi in health monitoring

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system, Li-Fi is used, which is a novel technology for high density wireless data coverage relieving radio interferences in confined areas.

Visible light communication has definite scope in many areas such as smart stores, consumer electronics, defense and security, vehicle and transportation, aviation, hospital, underwater communication, and hazardous environment. Massive bandwidth owing to the growing RF spectrum crunch, together with a high degree of security and energy efficiency are expected to bolster the global Li-Fi market. Since the technology involves visible light wavelength and not radio waves, it is less likely to have a negative effect on human health. Experts often compare Li-Fi to free space optics as it also utilizes light to transfer data but it cannot be used in the places where it is difficult to lay the optical fiber like hospitals. Parallel working with various EMI devices is feasible with Li-Fi and is also beneficial for robotic surgeries and automated procedures. During surgery, Li-Fi system along with various sensors is needed to get immediate guidance from experts in the therapy by sharing data, videos/live details about the patient for the best results. Thus, a Li-Fi-based health-care monitoring hospital system secure patient's body from attack of many types of disease, as the resistance power of patients, is very low. Not only improving the patient's health conditions but also communications among the physicians and clinicians. Wireless technology with Li-Fi system enables clinicians to monitor patients remotely and give them timely health information, reminders, and support. Li-Fi technology ameliorates medical field to the next level and has a plethora of merits when installed and used beneficially.

II. LITERATURE SURVEY

To keep systems affordable, there is a trend towards using open standard and commercial off the shelf (COTS) components in the development of dependable real-time systems. However, the use of COTS also introduces the vendor-driven upgrade problem that is relatively new to the dependable real-time computing community. If we refuse to accept the "new and improved" hardware and software components provided by vendors, then the hope that using COTS components will help keep the system modern via market forces will be dashed. If we decide to keep our systems modern, then we have to develop approaches that can introduce new hardware and software components into deployed systems safely, reliably and easily, in spite of the inevitable bugs in some of the new COTS components. An informal review of the Simplex Architecture, which has been developed to support safe and reliable online upgrade of dependable computing systems. This is a revision of the SEI technical report: A Software Architecture for Dependable and Evolvable Industrial Computing Systems [8].

General-purpose processors are expected to be increasingly employed for multimedia workloads on systems where reducing energy consumption is an important goal. Researchers have proposed the use of two forms of hardware adaptation - architectural adaptation and dynamic voltage (and frequency) scaling or DVS - to reduce energy. This develops and evaluates an integrated algorithm to control both architectural adaptation and DVS targeted to multimedia applications. It also examines the interaction between the two forms of adaptation, identifying when each will perform better in isolation and when the addition of architectural adaptation will benefit DVS. Our adaptation control algorithm is effective in saving energy and exploits most of the available potential. For the applications and systems studied, DVS is consistently better than architectural adaptation in isolation. The addition of architectural adaptation to DVS benefits some applications, but not all. Finally, in a seemingly counter-intuitive result, we find that while less aggressive architectures reduce energy for fixed frequency hardware, with DVS, more aggressive architectures are often more energy efficient [9].

There is still much performance to be gained by out-of-order processors with wider issue widths. However, traditional methods of increasing issue width do not scale; that is, they drastically increase design complexity and power requirements. This introduces the braid, a compile-time identified entity that enables the execution core to scale to wider widths by exploiting the small fanout and short lifetime of values produced by the program. Braid processing requires identification by the compiler, minor extensions to the ISA, and support by the microarchitecture. The result from processing braids is performance within 9% of a very aggressive conventional out-of-order microarchitecture with almost the complexity of an in-order implementation [10].

Multiprocessor SoC systems have led to the increasing use of parallel hardware along with the associated software. These approaches have included coprocessor, homogeneous processor (e.g. SMP) and application specific architectures (i.e. DSP, ASIC). ASIPs have emerged as a viable alternative to conventional processing entities (PEs) due to its

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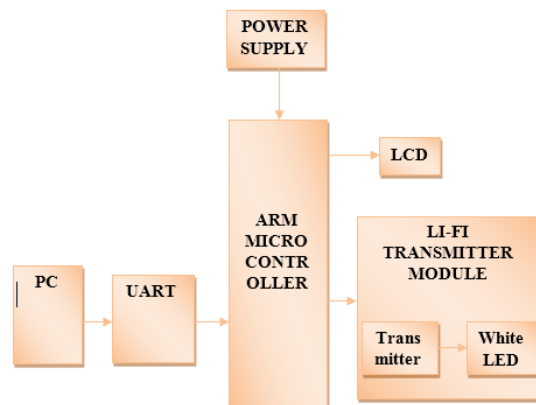
configurability and programmability. In this work, we introduce a heterogeneous multi-processor system using ASIPs as processing entities in a pipeline configuration. A streaming application is taken and manually broken into a series of algorithmic stages (each of which make up a stage in a pipeline). We formulate the problem of mapping each algorithmic stage in the system to an ASIP configuration, and propose a heuristic to efficiently search the design space for a pipeline-based multi ASIP system. We have implemented the proposed heterogeneous multiprocessor methodology using a commercial extensible processor (Xtensa LX from Tensilica Inc.). We have evaluated our system by creating two benchmarks (MP3 and JPEG encoders) which are mapped to our proposed design platform. Our multiprocessor design provided a performance improvement of at least 4.1 IX (JPEG) and 3.36X (MP3) compared to the single processor design. The minimum cost obtained through our heuristic was within 5.47% and 5.74% of the best possible values for JPEG and MP3 benchmarks respectively [11].

III. SYSTEM DESIGN

In the existing system, audio transmission is only obtained. This fails to transmit video using Li-Fi technique. To overcome this method, we propose this system. Video compression algorithms have a large number of applications ranging from video conferencing to video on demand to video phones. Video compression standards (such as the MPEG -1, 2, 4, 7) and Teleconferencing standards (such as the H.2XX) are vital algorithms used in these and other multimedia applications, whose performance is very critical given the high data rates that are common for video applications. The timing constraints with such high data rates can be challenging enough even for custom video-codecs and overwhelming for some of the state-of-the-art superscalar processors. Performing these operations real-time isn't easy on most platforms if image resolutions of acceptable quality are desired. Two basic steps used in video compression. The video compression algorithm utilized in numerous standards (such as MPEG 1, 2 H.263) usually consists of the following steps:

- Motion Estimation
- Motion Compensation and Image Subtraction
- Discrete Cosine Transform
- Quantization
- Run Length Encoding
- Entropy Coding – Huffman Coding

Li-Fi Transmitter



In this proposed system, we overcome the drawbacks in the existing system. Here the video to be transmitted is selected. The video is provided to the Li-Fi module using controller through software. Now data is provided to the Li-Fi module. It transmits a light signal. This signal is received by the receiver module. The receiver module transmits the data to the PC using UART. Now the received video can be viewed using PC. The application of this system is the video streaming using light. The hardware requirements for this system are microcontroller, Li-Fi module, PC and LCD

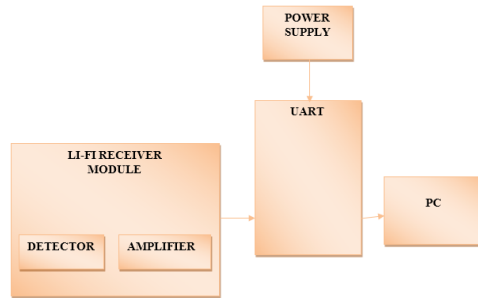
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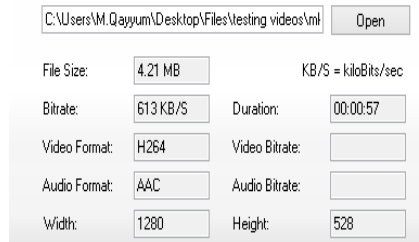
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Li-Fi Receiver

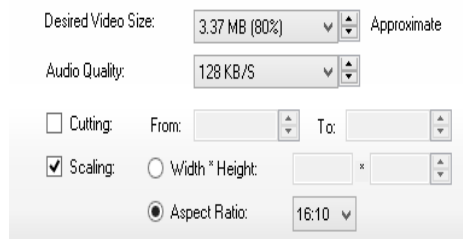


IV. RESULTS AND DISCUSSION

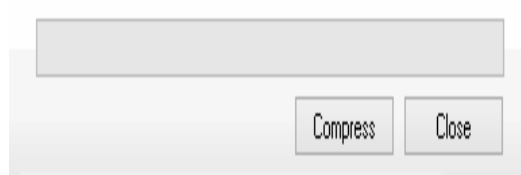
The following are the output screen shots of the implemented system.



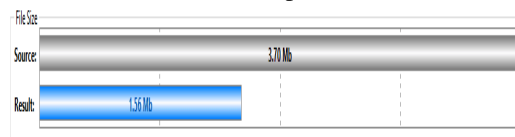
Video Select



Options



Video Compression



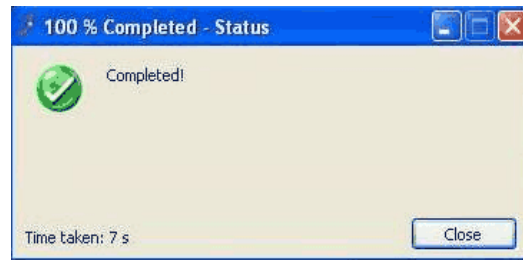
Processing

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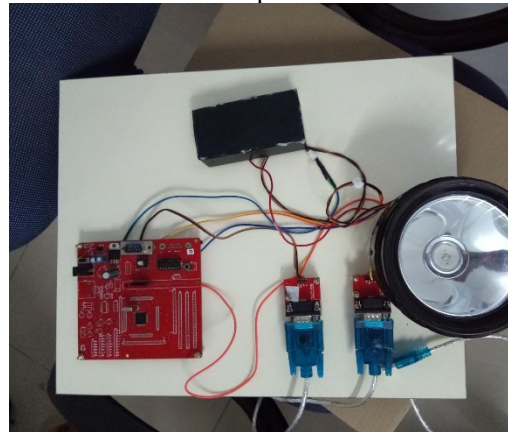
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Completed



Hardware

V. CONCLUSION AND FUTURE ENHANCEMENT

Thus the problem of transmitting video in hospital using Wi-Fi has been overcome by using Li-Fi means of transmission. The proposed model could be developed to transfer a video of longer duration with high speed. The compression rate would be increased from KBs to MBs.

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