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LIFI BASED UNDER WATER COMMUNICATION

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ABSTRACT

Nowadays, there is extensive ongoing research activity relating to underwater communications and underwater sensor networks. On one hand, the main research lines are based on increasing the distance and bandwidth, and, on the other hand, the attempt to reduce the energy consumption of underwater devices, with the aim of increasing the network lifetime. The proposed system underwater communication system using Li-Fi technology which provides protection against ship collisions on the sea. Li Fi (Light Fidelity) is an emerging technology which uses the visible light spectrum for communication. This project focuses on the safety on sea in which the headlights, which consists of LEDs acting as transmitter, communicate with photo sensors acting as receiver. White LEDs used in the head and tail lights can effectively be used for short range communication with the photo detectors. The application is cost effective as LEDs are cheap and simple algorithms are proposed for signal generation and transmission.

INTRODUCTION

The term Li-Fi was coined by Professor Harald Haas, and refers to light based communications technology that delivers a high-speed, bidirectional networked, mobile communications in a similar manner as Wi-Fi. Although Li-Fi can be used to off-load data from existing Wi-Fi networks, implementations may be used to provide capacity for the greater downlink demand such that existing wireless or wired network infrastructure may be used in a complementary fashion.

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LITERATURE SURVEY

W.-L. Jin, "SPIVC: A Smartphonebased inter-vehicle communication system," Proceedings of Transportation Research Board Annual Meeting, 2012.

Vehicular communications are a need in future smart scenarios, since people can spend hours on a variety of transport means in daily activities. However, most of the current research deals with the integration of telematics in light vehicles, while twowheelers (or equivalent) present especial conditions that reveal a need for new communication units that allow integrating bikes and mopeds (among others) into vehicular networks. In this paper, this gap is solved with a new embedded design provided with IEEE 802.11p and cellular communications, which can work as a mobile router and presents a simple but effective interface for warning services. A key point of the proposal is the bet for IPv6 as the base network protocol, which will be the essential in all-connected environments following the IoT paradigm. The communication unit has been tested in a real driving scenario, and one-hop results using the 802.11p channel reveal communication delays bellow 2 ms, packet delivery rates above 50% within a road stretch of 400 meters, and a maximum throughput of 4 Mbps. These performance values are adequate for a number of safety, infotainment and exploitation services. Cooperative Intelligent Transportation Systems (C-ITS) are demonstrating to improve safety and mobility of common vehicles, as it has been reported in results of European projects like Drive C2X [1] or FOTsis [2]. These systems stretch the range of isolated systems powered with sensors to better maintain contextual information about the surrounding traffic, thanks to wireless communication technologies. Vehicular networks have reached a standardization stage and vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communications are considered to save lives and improve travel experience in the near future. The USA government has stated its deployment strategy in this line [3], for instance. However, the work in this area focused on two-wheelers is still limited in the ITS context, even though European studies remarked the need for further research in the area of vulnerable road users (VRU) [4]. Bikes, mopeds and motorbikes have special constraints that make them a different vehicle group to be integrated in the Future Internet. Power source, mobility patterns, vehicle dimensions, communication range, positioning capability, human-machine interface (HMI) or electronics integration are some of these particular features. The potential of C-ITS in the two-wheel segment is clear, but a proper technological platform is needed to provide effective safety and mobility services. For C-ITS to happen, a network that interconnects all the different elements of the road is necessary. In this field, different standardization bodies have defined its own reference communication architecture. IEEE have bet on Wireless Access in Vehicular Environments (WAVE), whose most relevant technology in the last years has been 802.11p, also called Vehicular WiFi, which provides the physical and access layers of the stack. ETSI and ISO propose an architecture with an exchangeable access technology, and propose different routing protocols. What is remarkable in these three proposals is the presence of the IPv6 protocol, although it has received a marginal interest and it is mainly considered by these organizations as a complementary network protocol mainly for infotainment applications. However, we understand IPv6 as an essential piece of a vehicular communication stack to integrate vehicular networks in the Future Internet. The work described in this paper follows the objective of providing a communication unit adapted to the special needs of two-wheelers by also using IPv6 as a reference interconnection protocol. For this, the proposal raises from the synergy between current ITS standards (ISO/ETSI), Internet protocols (IETF) and IEEE technologies. The solution is an embedded communication unit for two-wheel vehicles integrating IEEE 802.11p and 3G wireless technologies in a small-factor computer, and running a communication middleware based on IPv6. Apart from the design, the work is especially focused on the prototype of the platform and the real communication performance tests.

A. Boukerche et al., “Vehicular Ad Hoc Networks: a new challenge for localizationbased systems,” Computer Communications, Science Direct, 2008, pp. 1-12.

A new kind of ad hoc network is hitting the streets: Vehicular Ad Hoc Networks (VANets). In these networks, vehicles communicate with each other and possibly with a roadside infrastructure to provide a long list of applications varying from transit safety to driver assistance and Internet access. In these networks, knowledge of the real-time position of nodes is an assumption made by most protocols, algorithms, and applications. This is a very reasonable assumption, since GPS receivers can be installed easily in vehicles, a number of which already comes with this technology. But as VANets advance into critical areas and become more dependent on localization systems, GPS is starting to show some undesired problems such as not always being available or not being robust enough for some applications. For this reason, a number of other localization techniques such as Dead Reckoning, Cellular Localization, and Image/Video Localization has been used in VANets to overcome GPS limitations. A common procedure in all these cases is to use Data Fusion techniques to compute the accurate position of vehicles, creating a new paradigm for localization in which several known localization techniques are combined into a single solution that is more robust and precise than the individual approaches. In this paper, we further discuss this subject by studying and analyzing the localization requirements of the main VANet applications. We then survey each of the localization techniques that can be used to localize vehicles and, finally, examine how these localization techniques can be combined using Data Fusion techniques to provide the robust localization system required by most critical safety applications in VANets.

A number of interesting and desired applications of Intelligent Transportation Systems (ITS) have been stimulating the development of a new kind of ad hoc network: Vehicular Ad Hoc Networks (VANets) [1], [2], [3], [4], [5]. In these networks, vehicles are equipped with communication equipment that allows them to exchange messages with each other in Vehicle-to-Vehicle communication (V2V) and also to exchange messages with a roadside network infrastructure (Vehicle-to-Roadside Communication – V2R).

All of these applications require, or can take advantage of, some sort of localization technique [6], [7], [8], [9], [10], [11]. In the localization problem, the definition of a reference system among nodes is performed by identifying their physical location (e.g., latitude, longitude, and altitude) or their relative spatial distribution in relation to each other. For instance, Map Location is usually done using Global Positioning System (GPS) receivers with a Geographic Information System, while Vehicle Collision Warning Systems can be implemented by comparing distances between nodes' locations combined with geographic information dissemination.

As ITS and VANets technology advances toward more critical applications such as

Vehicle Collision Warning Systems (CWS) and Driverless Vehicles, it is likely that a robust and highly available localization system will be required. Unfortunately, GPS receivers are not the best solution in these cases, since their accuracy range from up to 20 or 30 m and since they cannot work in indoor or dense urban areas where there is no direct visibility to satellites. For these reasons and, of course, for security reasons, GPS information is likely to be combined with other localization techniques such as Dead Reckoning, Cellular Localization, and Image/Video Localization, to cite a few. This combination of localization information from different sources can be done using such Data Fusion techniques as Kalman Filter and Particle Filter.

N. M. Husain Fidvi, "Car to Car Communication System," source: car communication system.

This Essay discusses the most recent technology, known as LI-FI, which has seen significant growth over the years. With the use of transmitter and receiver circuits and LED bulbs, two vehicles can communicate using the LI-FI idea. This technology makes it possible to control traffic accidents and save a great number of lives. The two cars only communicate when they come into touch within a certain range, which is desired for the ultrasonic detector, which is a real-life chip device used to assess distance. Data are exchanged from one vehicle to another via tis LI-FI Any type of data can be transferred with LI-FI. Almost 5 billion mobile phones are connected to approximately 1.4 million cell, poll radio waves base stations. On a regular basis and regularly. Cell phones send more than 600TB of data. Nowadays, radio waves are used form remote correspondence. Yet there are limitations, accessibility, security and efficiency issues with radio waves. For remote correspondence, range is a crucial need. With advances in technology and an increases in the number of customers, the problem is addressed by the current radio wave range, which leads to came up with the idea of transmitting information remotely through the light using LEDs or LI-FI. LI-FI is a relatively new invention that makes use of LED lights to speed up the transmission of information technology. Another technique for remote correspondence that makes use of observable light is obvious light correspondence (VLC). Clear light LEDs are frequently used as transmitters for visible light communication, and photodiodes and image sensors are frequently used as recipients. India is highly popular country with significant traffic problems, thus there is always problem with human traffic management if any emergency vehicle appears along a particular, in effective route. The suggested system proposes to use LI-FI for data transmission between two vehicles via led lights, which reduces traffic accidents and encourages safe driving

EXISTING SYSTEM

In underwater communication systems, traditional methods like acoustic communication or radio frequency (RF) communication have been more common. Acoustic communication, for instance, utilizes sound waves to transmit data in underwater environments. Li-Fi underwater communication, on the other hand, has been a subject of research and development to explore its potential advantages, such as higher data rates and the absence of electromagnetic interference.

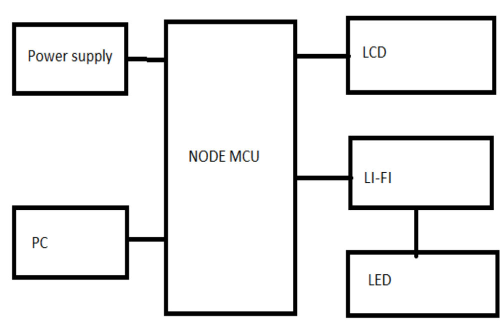
Researchers and engineers have been working on adapting Li-Fi technology for underwater scenarios by addressing issues like light absorption, scattering, and attenuation in water. Specialized optical systems and modulation techniques are being explored to enhance the performance of Li-Fi in underwater environments. The use of specific wavelengths of light that can penetrate water more effectively is also under consideration.

While Li-Fi underwater communication is an evolving area of research, it is essential to note that the deployment of such systems might still be limited, and the technology may not yet be as mature as other conventional underwater communication methods. Ongoing advancements and collaborations between researchers, engineers, and industry experts are crucial for overcoming the challenges associated with implementing Li-Fi in underwater communication systems.

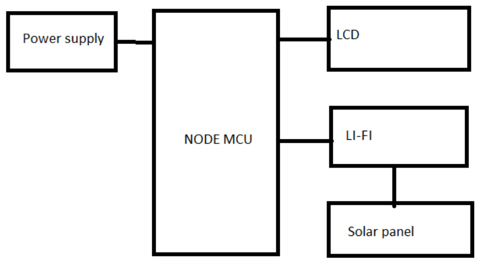
IMPLEMENTATION

BLOCK DIAGRAM

TRANSMITTER



RECEIVER



In this envisioned system, engineers are actively exploring advanced optical techniques and modulation methods tailored to the underwater environment. The aim is to optimize data transmission rates while mitigating the impact of light attenuation in water. Researchers are investigating specific wavelengths of light that can penetrate water more effectively, allowing for improved signal reliability and performance.

Moreover, the proposed Li-Fi underwater communication system considers the development of specialized hardware and underwater transceivers capable of efficiently transmitting and receiving light signals. These devices would need to be designed to withstand the unique conditions of underwater environments, such as pressure and temperature variations. Additionally, researchers are exploring strategies to minimize interference from ambient light and other sources, ensuring the reliability of data transmission.

While Li-Fi underwater communication is an evolving field, the proposed system emphasizes a multidisciplinary approach, combining optics, signal processing, and underwater engineering. Continued research and collaboration in these areas are crucial to refining and implementing Li-Fi technology for effective communication in underwater settings.

CONCLUSION

The concept of Li-Fi had been introduced along with existing techniques and classical trends used for vehicle to vehicle communications. As this project aims to propose a cost effective solution to reduce accidents in Oman, the design guidelines and details of system components were thoroughly explored. Due to unavailability of all system components, proof of concept has been illustrated in this paper by sending data through Li-Fi smallscale prototype. Both numerical simulations and experimental work were presented and results agree well.

REFERENCES

[1] W.-L. Jin, “SPIVC: A Smartphonebased inter-vehicle communication system,” Proceedings of Transportation Research Board Annual Meeting, 2012.

[2] A. Boukerche et al., “Vehicular Ad Hoc Networks: a new challenge for localizationbased systems,” Computer Communications, Science Direct, 2008, pp. 1-12.