ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 6 November 2017

International Manuscript ID : 23482001V5I6112017-10

(Approved and Registered with Govt. of India)

Integration of Laser Based Technology for Security and Catastrophe Management

Sanehaa

Research Scholar

Department of Physics

Sri Venkateshwara University

Uttar Pradesh, India

Dr. Motiram

Research Supervisor

Department of Physics

Sri Venkateshwara University

Uttar Pradesh, India

Abstract

A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation". The first laser was built in 1960 by Theodore H. Maiman at Hughes Research Laboratories, based on theoretical work by Charles Hard Townes and Arthur Leonard Schawlow. A laser differs from other sources of light in that it emits light coherently. Spatial coherence allows a laser to be focused to a tight spot, enabling applications such as laser cutting and lithography. Spatial coherence also allows a laser beam to stay narrow over great distances (collimation), enabling applications such as laser pointers and lidar. Lasers can also have high temporal coherence, which allows them to emit light with a very narrow spectrum, i.e., they can emit a single color of light. Alternatively, temporal coherence can be used to produce pulses of light with a broad spectrum but durations as short as a femtosecond ("ultrashort pulses").

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 6 November 2017

International Manuscript ID : 23482001V5I6112017-10

(Approved and Registered with Govt. of India)

Keyword: Laser Technology, Laser based Clustering, Laser based Disaster Management

Introduction

Lasers are used in optical disk drives, laser printers, barcode scanners, DNA sequencing instruments, fiber-optic and free-space optical communication, laser surgery and skin treatments, cutting and welding materials, military and law enforcement devices for marking targets and measuring range and speed, and in laser lighting displays for entertainment.

A laser consists of a gain medium, a mechanism to energize it, and something to provide optical feedback. The gain medium is a material with properties that allow it to amplify light by way of stimulated emission. Light of a specific wavelength that passes through the gain medium is amplified (increases in power).

For the gain medium to amplify light, it needs to be supplied with energy in a process called pumping. The energy is typically supplied as an electric current or as light at a different wavelength. Pump light may be provided by a flash lamp or by another laser.

The most common type of laser uses feedback from an optical cavity—a pair of mirrors on either end of the gain medium. Light bounces back and forth between the mirrors, passing through the gain medium and being amplified each time. Typically one of the two mirrors, the output coupler, is partially transparent. Some of the light escapes through this mirror. Depending on the design of the cavity (whether the mirrors are flat or curved), the light coming out of the laser may spread out or form a narrow beam. In analogy to electronic oscillators, this device is sometimes called a laser oscillator. Most practical lasers contain additional elements that affect properties of the emitted light, such as the polarization, wavelength, and shape of the beam.

Laser and IoT

Laser Technology can be integrated with Internet of Things (IoT) that is one of key domain of research with the increase in the communication based devices. Huge amount of information and datasets are stored using wireless technologies and that forms the basis of Internet of Things in which all the objects are interconnected with each other forming the smart set of smart objects in distributed as well as shared environment with higher degree of security and privacy.

In the recent years, the machine to machine communication is in use and Internet of Things (IoT) is becoming illustrious. The problem of congestion control is very common in a traffic system and can be easily handled by the global positioning systems used by the drivers as well as traffic administrative authorities. But as the traffic density is increasing day by day, it is becoming difficult to handle and view all the possibilities in the prospective traffic area where the driver is eager to move. Moreover, the problem of security and integrity is also increasing rapidly as there are number of attacks in being used by the crackers by sending the malicious code or fake packets. Ubiquitous computing is one of the new technologies that still is in the implementation phase under Internet of Things (IoT).

The term Internet of Things was conferred by Kevin Ashton in year 1999. The implementations of IoT is common today as the high performance wireless technologies are freely available. Radio Frequency Identification (RFID) tags and Sensors are base elements in the implementation of IoT. The RFID tags can be embedded in real world devices and objects which can be monitored remotely using software based applications. The RFID readers can be used to locate, read and sense the RFID implanted objects. Very small micro sized transmitting and receiving chips are integrated with RFID which can communicate at distant point.

As per the reports from Forbes.com, the market of Internet of Things will reach around 267 billion dollars by year 2020. The analysis from Gartner underlines that around 8.4 billion objects with investment of 273 billion dollars will be interconnected with each other in current year 2017. This figure of 8.4 billion objects is 31% more than the implementation figures of previous year 2016.

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 6 November 2017

International Manuscript ID : 23482001V5I6112017-10

(Approved and Registered with Govt. of India)

Some of the key applications of IoT are

- Smart Cities
- Smart Retail Points
- Smart Grid
- Smart Agriculture and Farming
- Internet of Vehicles (IoV)
- Connected Cars
- Connected Railways Infrastructure
- Wearable Devices
- Smart Home
- Smart Offices
- Software Defined Networking
- Smart Supply Chain
- Smart Healthcare and Smart Ambulances
- Industrial Internet
- Energy Management
- and many others

Following are some of the applications and real world implementations of Intelligent Transportation System throughout the globe

- Smart Traffic Control Lights with projection and display of varying speed limit
- Auto-Detection of Number Plate System disobeying the traffic signals and messages
- Speed Detection Cameras
- Collision Avoidance and Detection Systems
- Vehicle Notification Systems for Critical and Emergency Points

Interconnectivity is the basic trait for IoT as the whole concept is built upon the idea of being able to interconnect everything (despite the traffic going through different networks).

Different types of attacks are used to control and damage the VANET at different layers. The key points and components in VANET are vehicular nodes and associated infrastructure. The vehicular network may be damaged and controlled by attackers by the way of sending the malicious packets and signals, consequently whole infrastructure can be virtually destroyed. Such attacks are ranked high as these attacks affect the entire network. A number of attacks are frequent for controlling and damaging the vehicular networks.

Denial of service (DOS) Attack - Using DoS attack, the network availability is clogged by the attacker node or malicious packet. Figure 1.2 depicts the legitimate/authentic users are not able to access the network services. DoS is one of the prevalent attacks that works on the network layer of VANET.

Distributed Denial of service (DDOS) Attack - DDOS attack is more dangerous in VANET because the mechanism involved is distributed in nature. In this attack, the malicious node or attacker perform the attack from multiple and different locations. Figure 1.3 shows the multidirectional clogging or blocking occurs in the network and legitimate/authentic systems cannot communicate.

Sybil Attack-Sybil attack affects the network layer of vehicular network a lot. In this attack, the identity of source is manipulated. The malicious node attempts to fabricate and manipulate the original identity and imitate to be a registered or original source node. In Sybil attack, the attacker node creates various vehicles or nodes of same identity by replication and forces other nodes to leave or move fast from the road. These attacks can be detected by using resource testing which works on the assumption that vehicles have limited resources. This problem of Sybil attack can be solved using public key cryptography where public keys are used to authenticate vehicles.

ISSN (Online) : 2348 - 2001
International Refereed Journal of Reviews and Research
Volume 5 Issue 6 November 2017
International Manuscript ID : 23482001V5I6112017-10
(Approved and Registered with Govt. of India)

Node Imitation Attack - In this type of attack, the transmission of messages takes place by the imitated node of other identity. Therefore the attacker can send the malicious or wrong messages to any node hiding or changing its own identity.

Application Level Attack - In this type of attack, the manipulation is done in the message received and then retransmitted to different nearby nodes or vehicles. In this manner the network infrastructure and traffic can be damaged. For example, the message like ‘High Traffic Ahead’ can be changed to ‘Road Free Ahead, Move Fast’ and then retransmitted to the nearby vehicles. By this approach, the network congestion can be increased at the upcoming point and may lead to an accident.

The modernization of transport is presently an important aspect in the in the development of a country. Developments in communication techniques and networking, together with vehicle location methods have become the key enablers of innovative transport systems. These three principal techniques for automatic location-sensing which are widely used for road transport of dangerous goods, logistics, armored car and other particular fields

- Triangulation
- Scene Analysis
- Proximity

The Internet of Things can logically be divided into a perception layer, a network layer, a service layer and an application layer. The perception layer senses, gathers information, and the network layer enables the connectivity between the different items making use of Internet technology, while the service layer offers services to the application or to the end user for further intelligent processing.

This strong vision of Internet of Things can add new dimensions to Intelligent Transportation Systems and certainly have a high impact on applications and services. However, there are many challenges such as real-time traffic management, seamless connectivity, vehicle location prediction, security and privacy, interoperability, communications, associated with Internet of Things which needs to be resolved. Next generation transportation systems based Internet of Things and sensors technologies :

- The intelligent transportation, connected vehicles and Internet of Things
- Intelligent vehicle monitoring system based on Internet of Things
- Distributed intelligent transportation system based Internet of Things architecture
- Internet of Things applications and services for real-time traffic management.
- Embedded systems and sensors for intelligent transportation systems.
- Wireless sensor devices in intelligent transportation systems.
- Vehicle location prediction based advanced sensor technologies.
- Peer-to-Peer data sharing for fleet management and safety purposes.
- Integrated transportation and sensors for location based services.

Laser based sensor networks are used to exchange information between an application platform and one or more sensor nodes. This exchange takes place in a wireless fashion.

There are number of specific purposes of sensors, such as measuring temperature, humidity, vibrations, motion, light, pressure and altitude. Companies will need to develop new applications to take advantage of all the big data that the sensors are generating. The lower costs and more advanced capabilities of RFID tags are starting to enable wider and more effective use. The cost of RFID, which has come down dramatically, is in more than just the tag itself. To determine the true cost per use it is required to include the software applications and deployment costs. The combination of lowered costs for tags and improved capabilities means that their value proposition has changed, and represents an opportunity for enterprises to rethink RFID.

Y.2221 characterizes the USN as a theoretical system fabricated over existing physical systems which makes utilization of sensed information and gives learning administrations to

ISSN (Online) : 2348 - 2001
International Refereed Journal of Reviews and Research
Volume 5 Issue 6 November 2017
International Manuscript ID : 23482001V5I6112017-10
(Approved and Registered with Govt. of India)

anybody, anyplace and at whatever time and where the data is created by utilizing setting mindfulness.

In this definition "physical systems" implies different sorts of WSNs, as well as wired sensor systems and RFID.

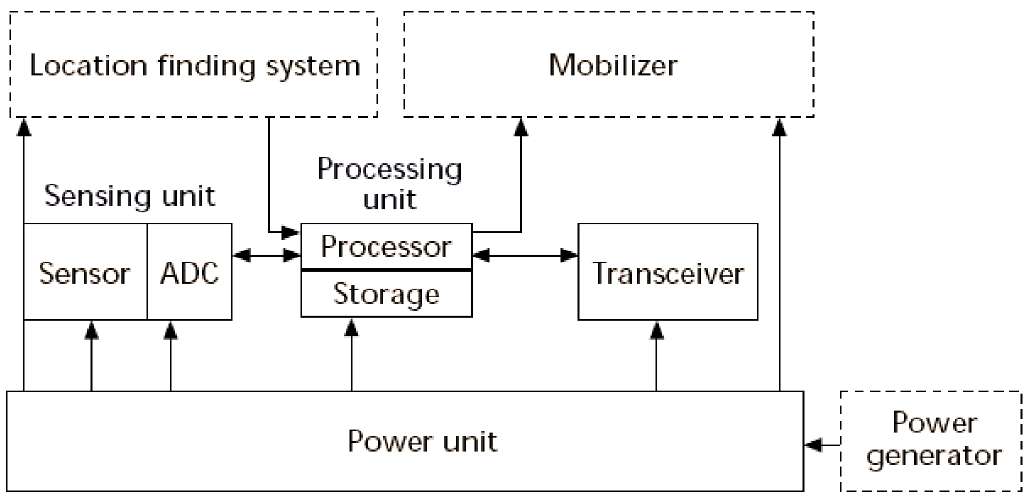

Figure 1. Segments of Laser Integrated IoT

Figure shows the components in the sensors used in Internet of Things (IoT). This architecture of the sensor is having multiple modules with transmitter and receiver to communicate with other devices and technologies.

RPL is an open routing protocol standardize by IETF for IoT networks based onIPv6 that is implied and concocted towards Low-Power and Lossy Networks. It is taken accepted routing layered convention for the Internet of Things (IoT). From its consistency, RPL added to the advancement of correspondences in the realm of small, inserted, organizing gadgets, by giving, alongside different measures, gauge engineering for IoT.

Routing issues are exceptionally trying for 6LoWPAN, given the low-power and lossy radio-interfaces, the battery provided hubs, the multi-bounce work topologies, and the successive topology changes because of portability. Fruitful arrangements ought to consider the particular application necessities, alongside IPv6 conduct and 6LoWPAN systems as in the Figure with its multiple segments.

A compelling arrangement was created by the IETF Routing over Low power and Lossy (ROLL) systems working gathering. It has proposed the main IPv6 Routing Protocol for Low power and Lossy Networks (LLNs), RPL, in light of an inclination based approach as shown.

The Internet of Vehicles (IoV) consists of vehicles that communicate with each other and with public networks through V2V (vehicle-to-vehicle), V2I (vehicle-to-infrastructure) and V2P (vehicle-to-pedestrian) interactions V2H (vehicles to human), which enables both the collection and the real-time sharing of critical information about the condition on the road network.

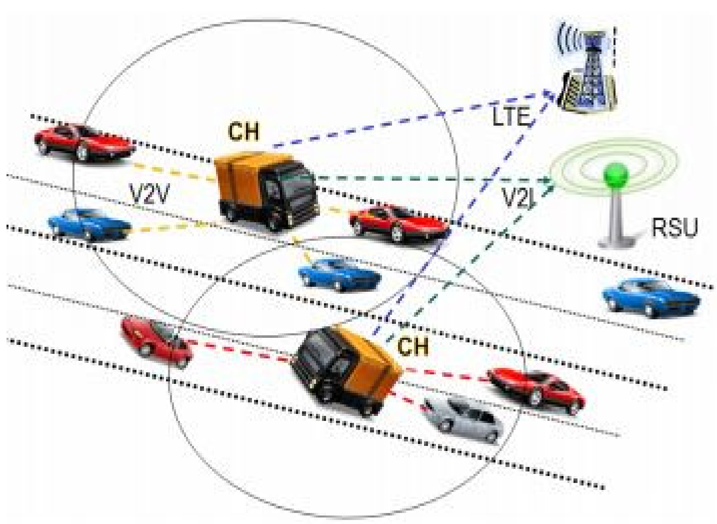

Figure 2. Laser Based Dynamic Clustering of Vehicles

The modernization level of transport is currently an important aspect to take the measure of development. Progress in communication techniques and networking, together with vehicle location methods have become the key enablers of innovative transport systems. These three techniques for automatic location-sensing which are widely used for road transport of dangerous goods, logistics, armored car and other particular fields.

- Triangulation
- Scene Analysis
- Proximity

Next generation transportation systems based Internet of Things and sensors technologies:

- The intelligent transportation, connected vehicles and Internet of Things
- Intelligent vehicle monitoring system based on Internet of Things
- Distributed intelligent transportation system based Internet of Things architecture
- Internet of Things applications and services for real-time traffic management.
- Embedded systems and sensors for intelligent transportation systems.
- Wireless sensor devices in intelligent transportation systems.
- Vehicle location prediction based advanced sensor technologies.
- Peer-to-Peer data sharing for fleet management and safety purposes.
- Integrated transportation and sensors for location based services.

Wireless sensor networks are used to exchange information between an application platform and one or more sensor nodes. This exchange takes place in a wireless fashion. It consists of a transreceiver which transmits and receives the radio signal and a preprocessor. It converts the signal and then data so received in the sensor node is encrypted and then the signal is forwarded to the another node through which they can communicate with each other, Controller processes data and control the functionalities of other components in the sensor node. Sensor nodes often use ISM band which gives free radio spectrum allocation and global availability. An important aspect in the development of a wireless sensor node is ensuring that there is always adequate energy available to power the system. The sensor node consumes power for sensing, communicating and data processing. More energy is required for data communication than any other process. Power is stored either in batteries

Sensors play a major role in the IoT as sensors performs the sensing operations and communicates with the other nodes. Clusters are formed by the sensors to pass data from one cluster to another.

- Sensing Unit
- Processing Unit
- Communication Unit
- Battery

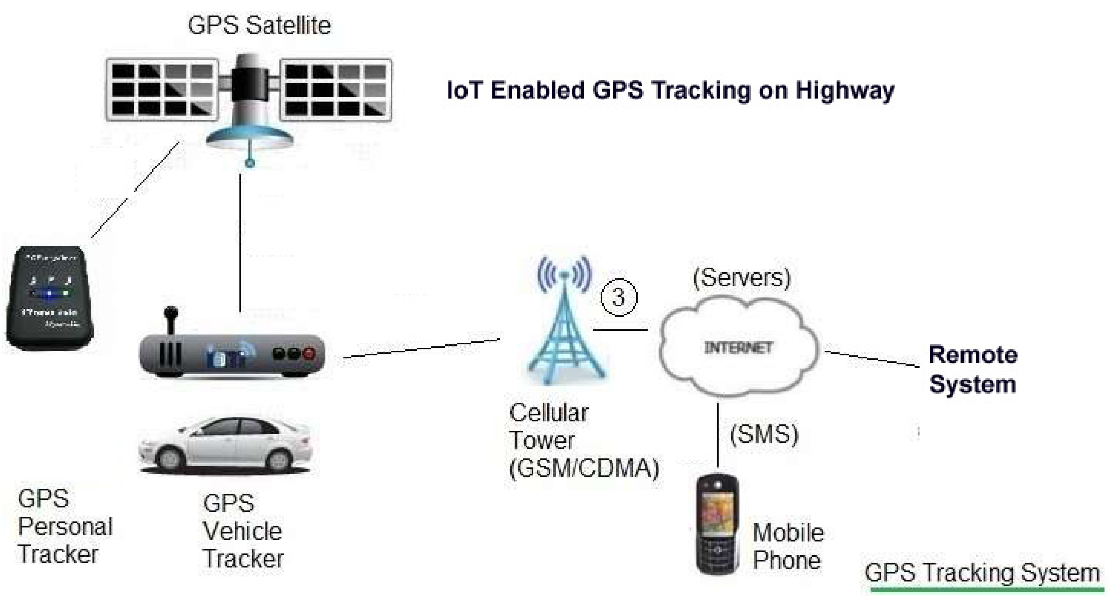

Figure 3. IoT enabled using GPS Tracking

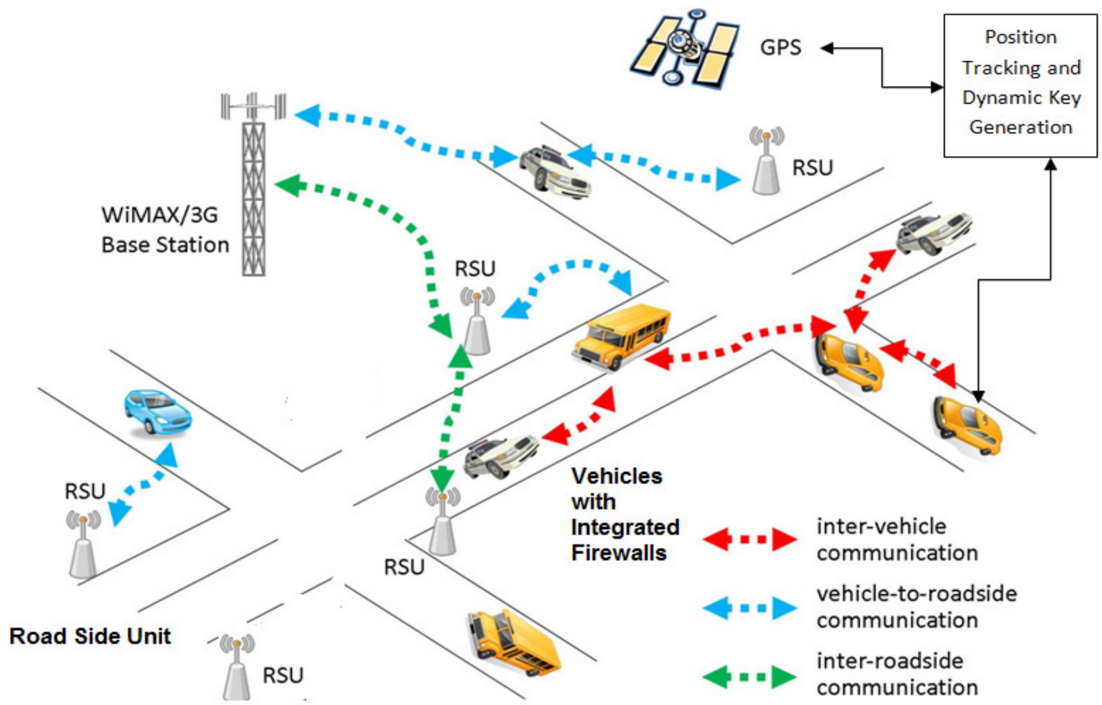

Figure 4. Dynamic Clustering based Intelligent Laser Sensor Transportation System

Conclusion

The Laser integration in Internet of Things can logically be divided into a perception layer, a network layer, a service layer and an application layer. The perception layer senses, gathers information, and the network layer enables the connectivity between the different items making use of Internet technology, while the service layer offers services to the application or to the end user for further intelligent processing. Undoubtedly, this strong vision of Internet of Things could add new dimensions to Intelligent Transportation Systems and it will have a high impact on applications and services. However, there are many challenges such as real-time traffic management, seamless connectivity, vehicle location prediction, security and privacy, interoperability, communications, associated with Internet of Things that needs to be addressed.

ISSN (Online) : 2348 - 2001

International Refereed Journal of Reviews and Research

Volume 5 Issue 6 November 2017

International Manuscript ID : 23482001V5I6112017-10

(Approved and Registered with Govt. of India)

References

[1] Gould, R. Gordon (1959). "The LASER, Light Amplification by Stimulated Emission of Radiation". In Franken, P.A.; Sands R.H. (Eds.). The Ann Arbor Conference on Optical Pumping, the University of Michigan, 15 June through 18 June 1959. p. 128. OCLC 02460155.

[2] "laser". Reference.com. Retrieved May 15, 2008.

[3] "Four Lasers Over Paranal". www.eso.org. European Southern Observatory. Retrieved 9 May 2016.

[4] Conceptual physics, Paul Hewitt, 2002

[5] "Schawlow and Townes invent the laser". Lucent Technologies. 1998. Archived from the original on October 17, 2006. Retrieved October 24, 2006.

[6] Chu, Steven; Townes, Charles (2003). "Arthur Schawlow". In Edward P. Lazear (ed.). Biographical Memoirs. vol. 83. National Academy of Sciences. p. 202. ISBN 978-0309086998.

[7] Siegman, Anthony E. (1986). Lasers. University Science Books. p. 2. ISBN 978-0935702118.

[8] "Nitrogen Laser". Light and Its Uses. Scientific American. June 1974. pp. 40–43. ISBN 978-0716711858.