Research Paper

Engineering

Detection and Establishment of A Free-Space-Optical Communication

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ABSTRACT

Free-Space-Optical (FSO) communication has the potential to deliver wireless communication links at optical-level speeds as well as solve the wireless capacity problem that the traditional RF based technologies are facing. Despite its advantages, FSO communication is prone to mobility. The highly directional FSO transceivers require establishment and maintenance of line-of-sight (LOS) between them. Facilitating continuous alignment requirements has been a major concentration of mobile FSO research to date.We propose a novel scheme that deals with the problem of automatic detection and establishment of LOS alignment between the two nodes.

KEYWORDS

Introduction

As a wireless technology, free-space-optical (FSO),

optical wireless, communication has recently attracted significant interest from telecommunication research and industry, mainly due to the increasing capacity crunch faced by the RF wireless technologies . The RF bandwidth is heavily saturated and becoming more scarce as cellular capacity has mostly hit its limits. FSO communication (FSOC) has the potential to complement the traditional radio frequency (RF) networks. It uses the unlicensed optical spectrum and mostly uses the same technology as the fiber optic communications. FSOC can provide a higher bandwidth channel for transferring large volumes of data. It has shown the ability to reach modulation speeds up to 10 Gbps easily. It can also provide connectivity in conditions that are unfavorable for RF communication and has low probability of interception and detection . Furthermore, FSOC is advantageous in terms of cost efficiency as its propagation medium is free space and does not necessitate costly fiber cable deployments. While FSOC has been mainly useful for stationary nodes in a fixed network, there are also several scenarios involving mobile nodes that can benefit from the various advantages offered by FSOC. Secure command and control of mobile units in combat, sharing of high-resolution imagery and guidance data in next-generation air-traffic control, airborne internet. and rapid communication deployment in disaster recovery are a few examples of these scenarios . Application of FSOC in

mobile settings has been considered for indoor environments, within a single room, including multi-element transmitter and receiver based antennas. Due to limited power of a single source that is being diffused to spread in all directions, these techniques are suitable for small distances only. For outdoors, fixed FSOC techniques have been studied to remedy small vibrations , swaying of the buildings using mechanical auto-tracking or beam steering , and interference and noise. Line-of- sight (LOS) scanning, tracking and alignment have also been studied for years in satellite FSOCs . Again, these works considered long-range links that utilize very narrow beam widths and typically use slow, bulky beam-scanning devices such as gimballed telescopes driven by servo motors.

MODEL DIAGRAM
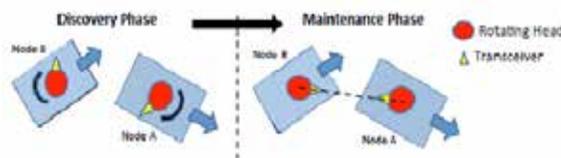
Here we take two nodes which are having line of sight propagation mechanism.if there is slight change in the position of the nodes,the line of sight will break down.So we are trying to develop a mechanism through which the two nodes can adjust their position for maintaining the LOS.
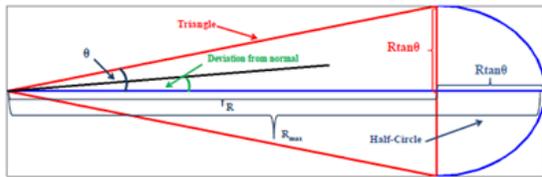
Simulink diagram-
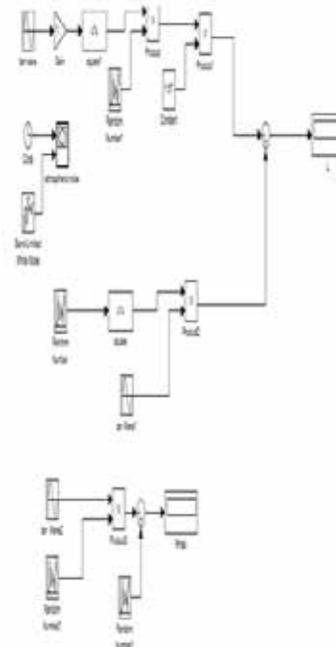
Fig. 6. Coverage Area of an FSO Transceiver as "Triangle+Half Circle"

$$L = R^2 \tan \Theta + (1/2)(3.141)(\tan \Theta)^2$$

$$R_{max} = R + R \tan \Theta$$

The formula which gives the length between the two nodes is represented by the simulink diagram.Various values of   and R are put in the equation to get the length between the nodes and Rmax. Using the simulink we obtain the various coefficients we required to draw the table and subsequently obtain graph.
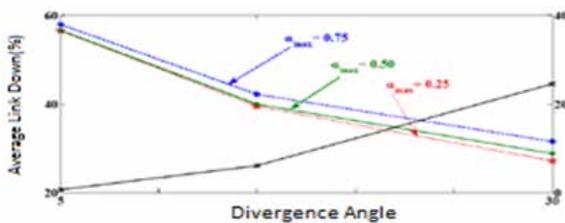
The link is dependant on the divergence angle. Lower the divergence angle, the longer the link is down. In other words, the performance of the link is inversely proportional to the divergence angles. The performance is not dependent to tx even if it reaches to 1s.Increasing alpha max degrades the performance. The performance of the algorithm is highly dependant on the divergence. The performance of the algorithm improves with larger divergence angles. In other words, the performance of the algorithm is directly proportional to the divergence angles.
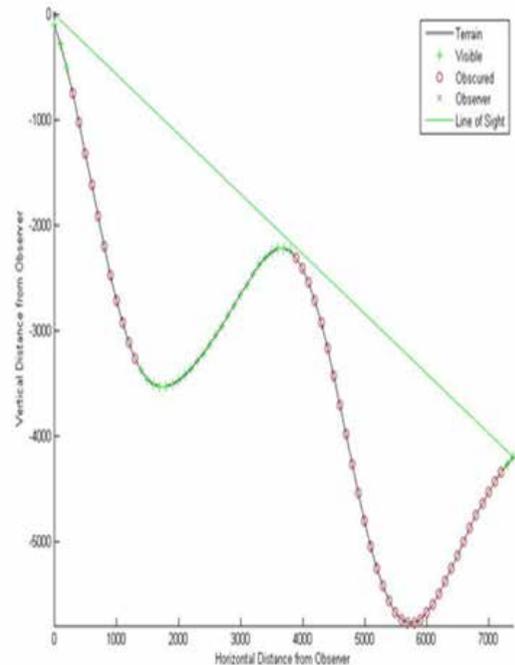
Line-of-sight propagation is a characteristic of electromagnetic radiation or acoustic wave propagation. Electromagnetic transmission includes light emissions traveling in a straight line. The rays or waves may be diffracted, refracted, reflected, or absorbed by atmosphere and obstructions with material and generally cannot travel over the horizon or behind obstacles. Thus any obstruction between the transmitting antenna (transmitter) and the receiving antenna (receiver) will block the signal, just like the light that the eye may sense.In the diagram it is shown that regardless of the terrain the two nodes must maintain Line-Of-Sight(LOS). LOS is a critical requirement for the optical communication systems.

Result-
Lower the divergence angle, the longer the link is down. The performance is not dependent to tx even if it reaches to 1s. Increasing alpha max degrades the performance. Increasing divergence angle yields better link maintenance.   increasing alpha max deteriorates the performance**.** The performance of the algorithm improves with larger divergence angles.

Using MATLAB ,we obtained the LINE OF SIGHT that should be present for proper communication between the two nodes . Irrespective of the terrain,optical communication requires node to node line-of sight for communication between the two mobiles or nodes for proper communication between them.

REFERENCES

[1] A. Sevincer, A. Bhattarai, M. Bilgi, M. Yuksel, and N. Pala, Communications Surveys & Tutorials, IEEE, pp. 1–22, 2013. | [2] D. Zhou, P. G. LoPresti, and H. H. Refai, Journal of Lightwave Technology, vol. 29, pp. 1583–1589, 2011. | [3] Internet sources | [4] Mahmudur Khan and Murat Yuksel Department of Computer Science and Engineering University of Nevada, Reno, NV 89557 mahmudurk@cse.unr.edu, yuksem@cse.unr.edu