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Collage of Post - Graduate

**A thesis Submitted as Partial Fulfillments of the
Requirements for the Degree of Msc in
Telecommunication Engineering**

FREE SPACE OPTICAL COMMUNICATION SYSTEM

نظام الاتصالات الضوئية اللاسلكية

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ABSTRACT

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The thesis (free space optical communication system) describes two methods for optical wireless system (indoor and outdoor system),Also this thesis make a combination to a different types of all possible topologies that can be used , and it determined the suitable to each type of the optical wireless system .

Also it introduce all elements that FSO system composed of it , where we have optical sources ,driver and modulator in the transmitter side , and at the other side we have lens to improve the collection area ,optical filters which are used to reject out unwanted wavelengths, and photodetector in addition to an amplification stage.

Integration of transmitter and receiver in one unit provide a full duplex transmission ,there are two methods of integration in the first one (electric) the optical source in transmitter and photodetector in the receiver are discrete. The other method of integration is opto-electric here the optical source and photodetector are join with the other parts .

In the practical side the thesis contain an experiment that we have done by designing a transmitter an receiver circuit and test some samples to notice the challenges that may face the optical signal while it propagate in the free space .

تجريد

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هذا البحث (الإتصالات الضوئية اللاسلكيه) يصف طرق إرسال الإشارة الضوئية لاسلكيا داخل المباني اوعارجها داخل المدن لمسافات طويله نسبيا . كما يوفر هذا البحث شرحا وافيا للمكونات الأساسية لنظام الاتصال اللاسلكي الذي يتكون من مرسل ومستقبل ويتكون جهاز الإرسال من مصدر ضوئي وتستخدم الثنائيات المشعه LEDs او مصدر ليزر بالإضافة الى دائرة تعديل .

في الجانب الآخر يتكون المستقبل من ثنائي ضوئي يقوم بتحويل الاشارة الضوئية المستقبلة الى إشارة كهربيه، بالإضافة الى العدسات التي تزيد مساحه جمع الاشعه والمرشحات الضوئية لازالة الاطوال الموجيه الغير مرغوب بها، يمكن دمج المستقبل والمرسل بوحده واحده للحصول على وحده ارسال واستقبال واحده ويستخدم نوعان من الدمج احدهما يكون فيه المصدر الضوئي ودايود كشف الاشارة منفصلين عن الأجزاء الأخرى ، اما الطريقه الأخرى فيتم فيها دمجهما بالاجزاء الأخرى.

تعرض هذا البحث للمعوقات التي تواجه الاشارة اثناء انتقالها لاسلكيا وللأثار التي قد يسببها الضوء المرسل لعين الانسان .

في الجانب العملي من هذا البحث فإنه يوضح تصميم دائرة إرسال واستقبال لدراسه التغير الناتج في الإشارة الضوئية نتيجة لمرورها خلال اوساط مختلفه .

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FSO	Free Space Optic
LOS	Line Of Sight
RVR	Runway Visual Range
GHz	Giga Hertz
THz	Tetra Hertz
FOV	Field Of View
RF	Radio Frequency
IR	Infrared
LED	Light Emitting Diode
LASER	Light Amplification Stimulated Emission of Radiation.
LDs	Laser Diodes
MQW	Multi Quantum Well
EAM	Electro –Absorption Modulator
EML	Electro-absorption Modulated Laser
OOK	On Of Key
NRZ	None Return to Zero
CPC	Compound Parabolic Concentrator
DTIRC	Dielectric Totally Internally Reflections Concentrators
PD	Photo Diode
APD	Avalanche Photo Diode
RMA	Receiver Main Amplifier
VCSEL	Vertical Cavity Surface Emitting Laser
LPF	Low Pass Filter
IOEC	Integrated Opto – Electric
XI	
AGC	Automatic Gain Control

VPN	Vertical Private Network
WDMA	Wavelength Division Multiple Access
SDMA	Space Division Multiple Access
TDMA	Time Division Multiple Access
MAC	Medium Access Control protocol
A/r	Advanced infrared protocol

Chapter One

Introduction

Chapter Two

Definitions & Topology

Chapter Three

FSO basic elements

Chapter Four

Experiment

Chapter Five

Discussions & Conclusion