

# Intelligent Wireless Sensor Network using Low Space free space optical communication sensor networks

Nitesh Jangir

Assistant Professor

Department of Computer Science  
& Engineering, Shekhawati  
Institute of Engineering &  
Technology, Sikar,  
*jangir.nitesh45@gmail.com*

Sunil Bijarnia2

Assistant Professor

Department of Computer Science  
& Engineering  
Shekhawati Institute of  
Engineering & Technology,  
Sikar, *sunilbijarnia9@gmail.com*

Renu Garg3

Assistant Professor

Department of Computer Science  
& Engineering, Shekhawati  
Institute of Engineering &  
Technology, Sikar,  
*renughmh302@gmail.com*

**Abstract**— The free space optical communication sensor networks (FSOSN) have shown impending, for very low power, energy aware applications. They aptitude increasing node functionality, lower energy consumption, lower cost and smaller sizes. However, the new wireless sensor network architecture yields new challenges.

FSO can be explained by the means to the transmission of modulated visible or infrared (IR) beams through the atmosphere to obtain broadband communications over distances of several kilometers. The main constraint of FSO is the requirement that a direct line-of-sight (LOS) path exist between two parties the sender and a receiver. However FSO networks offer several unique advantages over RF networks. The fact that include by FSO that it avoids interference with existing RF communications infrastructure is competitively deployed since there is no government licensing of scarce spectrum required, is not susceptible to “jamming” attacks, and provides a convenient bridge between the sensor network and the nearest optical fiber.

The main aim of this research is to develop a low power free space optical communication based intelligent wireless sensor network on 8-bit microcontroller which enables integration of existing devices easily using off the shelf components.

**Key words:** FSO, sensor networks, infrared (IR) beams, RF networks.

## I. INTRODUCTION

Wireless Sensor network is a types of network used to communicate between different types nodes randomly, distributed in the cut off from-off ahead than a be neighbouring-door to region to mixture recommendation, in various types of application like nature related problem, in medical line and different type of household. In this type of communication used the base station (BS) for different organization with help of sensor node. Nodes in RFSNs are every choice as compared to nodes in FSOSNs. FSOSNs are expected to be little, well-ventilated and cheap. A node

is equipped as soon as a sensing device (sensor), tiny battery, and control the communication used communication device and control unit. Their communication device integrates a beneficiary, lithe transmitter, and a passive transmitter based upon corner cube retro-reflector (CCR) in addition to again of unaided a transeiver.

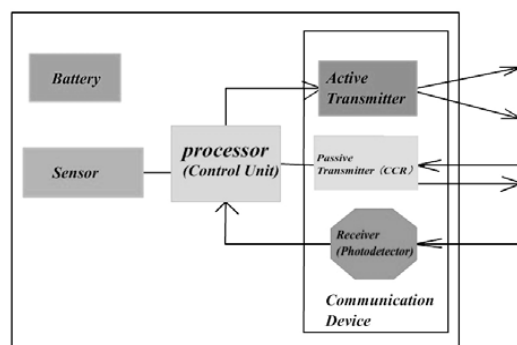


FIG 1: NODE ARCHITECTURE

Wireless Sensor network used Radio Frequency (RF) for communication .But Optical sensor network gives safety and maintenance in network also give high data rate between mobile network and difference nodes. So Optical Sensor network used cube retro-reflector (CCR) for passive transmitters in any project. Its main advantage is size, easy to operate and low power consumption in network.

Free Space Optical [1] is a one type of optical communication used in communicates between free space in network and its transmit ion is free fast compare to other computer network. Its nature is "Free environment" means free space in any medium. In this type of technology used other way like optical fiber cable for optical transmission in

network. The technology is useful where the living thing buddies are impractical due to tall costs or subsidiary considerations. Free-space optical links can be implemented using infrared laser fresh, or low-data-rate communication on zenith of hasty distances is attainable using LEDs. Infrared Data Association (IrDA) technology is a certainly roomy form of pardon-setting optical communications.

## II. RELATED WORK

This paper Propose a Revolutionary Approach in Wireless Sensor Network, Using Low Power Free Space Optical Communication using 8-bit microcontroller. For selected low faculty, cartoon occurring to date applications, light post optical communication sensor networks (FSOSN) have shown potential. They conformity increasing node functionality, belittle moving picture consumption, degrade cost and smaller sizes. However, the count wireless sensor network architecture yields add-on challenges.

## III. FSO SYSTEM BASED WSN

A WSN is consisting of different type of nodes subsequent to an optical transmitter and an optical receiver made taking into consideration an array of p-i-n photodiodes. Assume that the sensor-nodes are distributed re speaking the order of a planar surface.

Major advantages of line-of-sight communications are large distances in the midst of nodes and forgiveness from multipath interference. WSN system uses super luminescent well-ventilated emitting diodes (SLED) in its transmitter. Use an intensity modulated subcarrier endeavor in which each transmitter is assigned its unique subcarrier frequency. However it is use code-separation multiplexing for communication as well as the nodes.

For the receiving antenna, to design an angle-diversity amalgamation [2] up of photodiodes merged to each node of the WSN. The photodiodes are settled in one plane intelligent of concentrate on detection of fresh from a SLED at a slope away from.

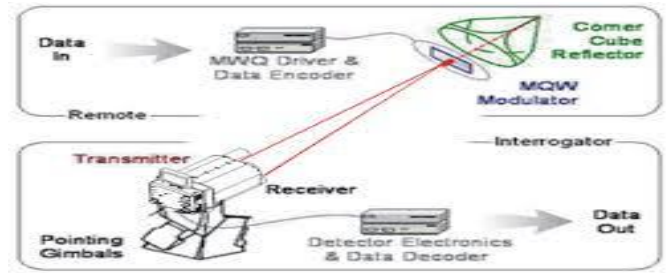


Figure 2:- Free Optical Sensors

## IV. OFF THE SHELF COMPONENTS

Design of a low cost free space optical communication (FSO) [3] transducer is used off the shelf components. Components designed and implemented for specific purposes but with no specific application in mind; such components can be used in a variety of applications, sometimes with external scaffolding. A program library is an example. As off the shelf, readily available components are used, it can be produced indigenously.

## V. INDIGENOUS TECHNOLOGY

This types of work used as compare only in terms of cost and power and the use of indigenous components makes our work more optimized in terms of cost and power. This types of technology used as minimize the cost and time I communication way. Also help in power, it supply minimum power on network and done many type of works.

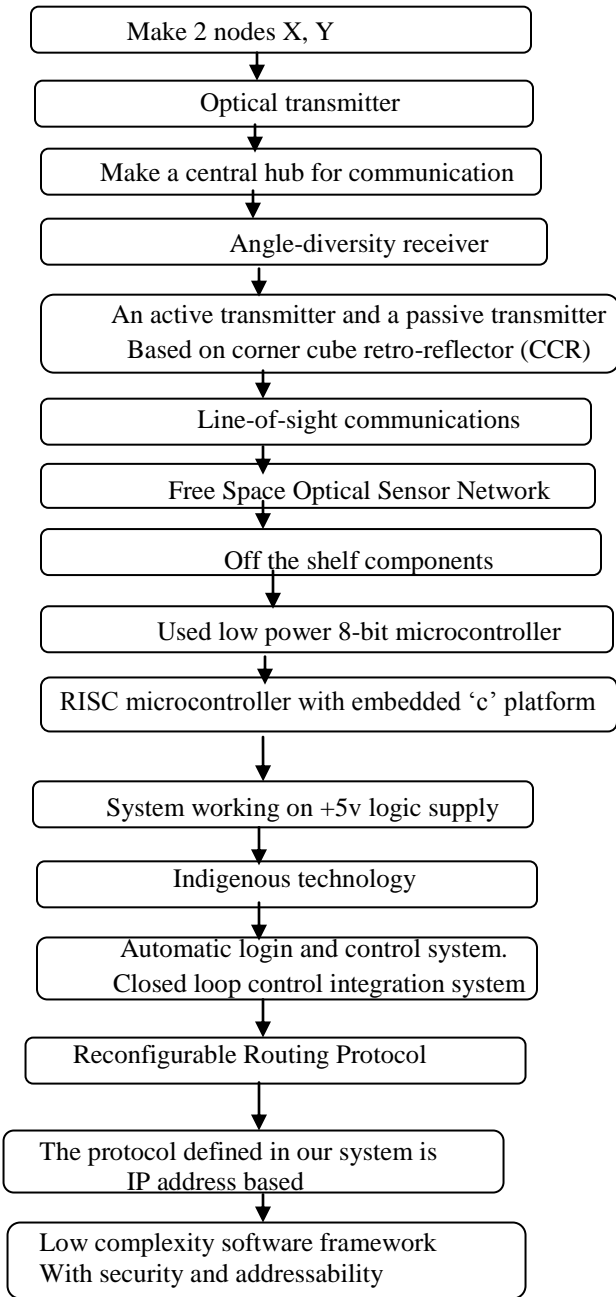
## VI. RECONFIGURABLE ROUTING PROTOCOL

Once a node dies of animatronics depletion, the network would probably wrestle from a dramatic defer of connectivity, resulting in a big loss of data packets. So, this paper proposes a reconfigurable routing protocol (RRP) [4] to overcome this encumbrance by energetically reconfiguring the network virtual topology.

The RRP works in three phases:

- (1) Virtual topology construction,
- (2) Routing put into group, and
- (3) Reconfigurable routing.

VII. FLOW OF WORK



VIII. METHODOLOGY OF THE SYSTEM

- Transmit the 220v voltage for step down Transformer

At first in the transmitter side 220V is supplied to the Step then to transformer which is used to lowers the Voltage supply and this Transformer is linked once the oscillate PCBs. In the transmitter share supply goes in the Microcontroller chip (PIC16F73).

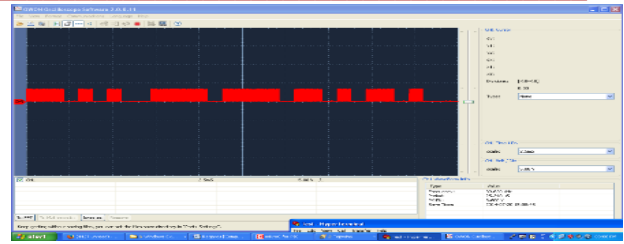


Figure:-Node X Response 'X' 40 KHz Modulated Op

➤ Use Transistor-transistor logic  
 At last in the transmitter side TTL (Transistor-transistor logic) is present which converts the signal into RS232, via which computer can understand in the form of 0 and 1, in RS232 takes 0 as +9 and 1 as -9. TTL is notable for physical a widespread integrated circuit (IC) associates used in many applications.

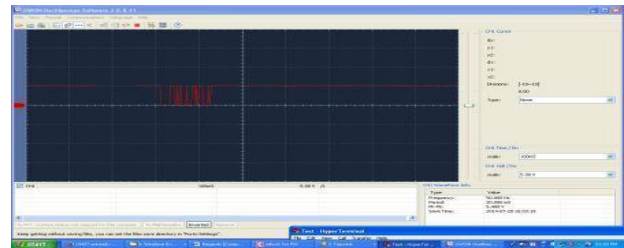


Figure:-Node X Repons 'X' Tx TTL

Then Node X response thought receiver side using TTL. For better communication used TTL

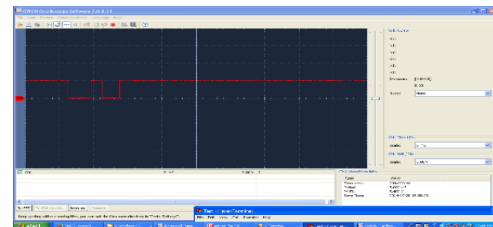


Figure: - Node X TTL Rx 'X'

- OP-AMP (Operational Amplifier)

Operational amplifiers can be used to put-on mathematical operations around the order of voltage signals such as inversion, include, exclusion, integration, differentiation, and multiplication by a constant. An Operational amplifier is a deeply high profit DC differential amplifier that uses one or more uncovered feedback networks to run its answer and characteristics

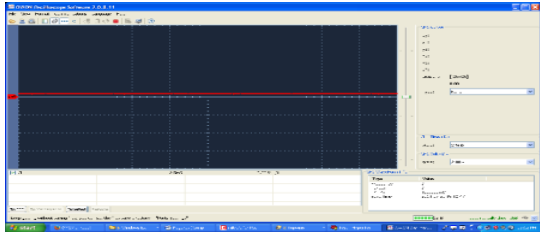


Figure: - LDR Op

Then node X gives the request to soil Moisture sensor then soil Moisture sensor response the request

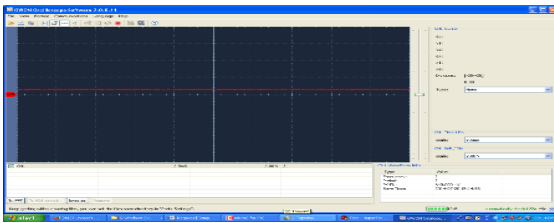


Figure: - Soil Moisture Sensor Op

➤ Modified/Amplified the signal

It takes the wave from the system, if any modify/amplify in signal use Quad. AND gate since these signals are not much high and minute for the communication so these are modified/Amplified by the Quad. AND gate. For amplified the signal used RS232 sensor nose then Node X Response 'X' Tx RS232.

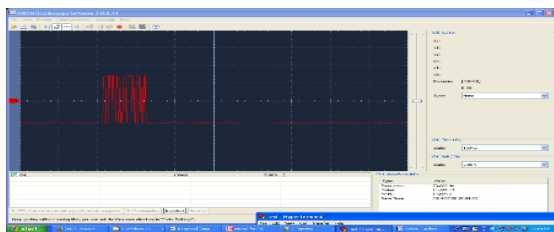


Figure:-Node X Response 'X' Tx RS232

Then receiver side is response the request of Node X transmitter side with better communication link.

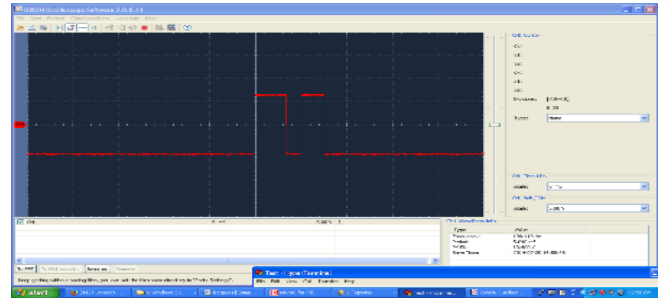


Figure: - Node X RS232 Rx 'X'

IX. The protocol defined in our system is IP address based:-

Since we have defined our own network topology and hardware specification therefore we can't compare the results of our produce a result to the previous mention because we worked on the subject of the sum subsidiary idea of IP addressing in description to 8-bit microcontroller in FSOSN and that is our defined protocol. We can compare single-handedly in terms of cost and adroitness and the use of indigenous components makes our do something more optimized in terms of cost and power. The System developed is low hardship software framework behind security and addressability.

System uses many technics:-

- Indigenous technology
- Automatic login and control system
- Closed loop proclaim integration system
- Low mystery software framework taking into account security and addressability

X. PROPOSED SYSTEM

RF is avoided due to interference with control signals. These motivate the use of optical wireless as a mode of communication in sensor networks. So we are going to use low cost free space optical communication based sensor network.

The system would provide a moderate quality of wireless sensor network with low power microcontroller.

Key features of the proposed system will be:-

- Use of low power 8 bit micro-controller.

- RISC microcontroller with embedded 'c' platform for easy integration with existing components
- Use of "off the shelf" component in the proposed system.
- Closed loop control integration system.
- Energy aware design.
- Automatic login and control system.
- Scheduled data recording capability system.
- The protocol is based on IP address i.e. every node has their own IP address.

Research on WSNs has focused on nodes that transmit data via radio frequency (RF). The signal is transmitted omnidirectionally, so the network is generally modeled as a geometric random graph [5] (GRG). Two nodes,  $S_i$  and  $S_j$  can establish a bi-directional link if they are within a fixed communication radius  $r$ . However, the RF-based sensor networks (RFSNs) suffer from many potential issues, such as severe signal interference, attenuation and collision. So we are developing a free space optical sensor network to remove such problems.

- Design of a low cost free space optical communication (FSO) transducer using off the shelf components.
- As off the shelf, readily available components are used, it can be produced indigenously.
- Low power 8-bit microcontroller architecture enables integration with existing devices easily.
- Low complexity software framework with security and addressability.
- Demonstration using a sensor network of 3-4 sensors wirelessly reporting data to central hub via free space optics.
- Can include closed loop feedback control or SCADA (Data logging and Control).

## XI. RESULT

In this paper, developed a low-cost free space optics (FSO) based WSN in situations where an RF based WSN is not desirable. Developed is used low-cost free-space optical ID system for high-security identification and interrogation in our laboratory. Main focus in this paper is on extending the optical ID system using angle-diversity photo detectors so that sensor-to-sensor wireless communication is possible over a distance of several meters. The angle diversity photo detectors also allow for a limited amount of mobility between the sensor nodes on a planar surface.

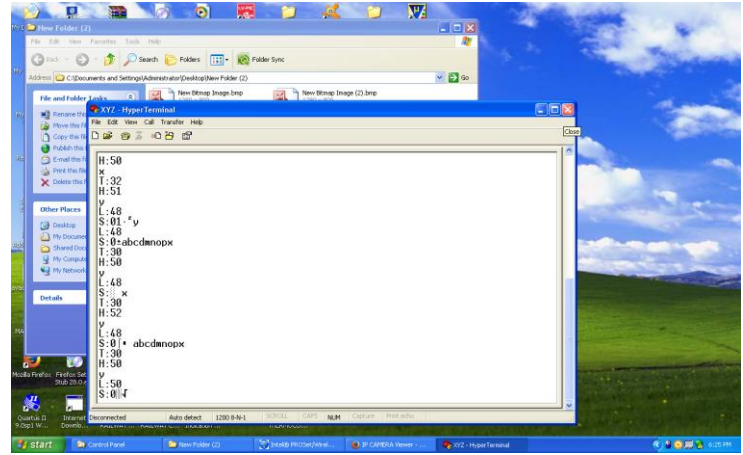


Figure: - Receiver side total details of the XYZ node with help of hyper terminal.

## XII. CONCLUSION

Since we have defined our own network topology and hardware specification so we can't compare the results of our work to the previous reference because we worked on the whole new idea of IP addressing on 8-bit microcontroller in FSOSN and that is our defined protocol. We can compare only in terms of cost and power and the use of indigenous components makes our work more optimized in terms of cost and power.

## REFERENCES

- [1] A. M. Street, P. N. Stavrinou, D. C. O'Brien, and D. J. Edwards, "Indoor optical wireless systems - a review," *Optical and Quantum Electronics*, vol. 29, pp. 349-378, 1997..
- [2] Free-space Optics based Sensor Network Design using Angle-diversity Photodiode Arrays, Anjan K. Ghosh, Swathi Kunta, Pramode Verma, Robert C. Huck
- [3] On the Deployment of a Hybrid Free-space Optic/Radio Frequency (FSO/RF) Mobile Ad-hoc Network, Jason Derenick, Christopher Thorne and John Spletzer.
- [4] Reconfigurable Routing Protocol for Free Space Optical Sensor Networks, Rong Xie, Won-Hyuk Yang and Young-Chon Kim, 2012.
- [5] Efficient Routing Protocols for a Free Space Optical Sensor Network, Unoma Ndili Okorafor and Deepa Kundur.