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ZigBee Technology for Remote monitoring of Crop Field in WSN

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ABSTRACT: In this paper we studied about WSN (Wireless Sensor Network) technology used for one of the precise agriculture system from last few decades related to agriculture parameters and climate conditions. Also we gave the review on various wireless protocols which are used lastly. The protocols like ZigBee, Bluetooth have limitation of short range. So there is requirement of to develop a system which is more precise one i.e. long range wireless protocol like WiMAX, Wi-Fi and GSM protocols. Over a year, many more techniques are developed related to agriculture based practices. But importantly there is need have to develop a system with a device having flexibility, more decision power and local intelligences. In India, for agriculture based hand held devices used in various task related to crops.

KEYWORDS: ZigBee, WSN (Wireless Sensor Network), Precision Agriculture, Wi-Fi, Wi-MAX

I. INTRODUCTION

Today whole over the world, agriculture is one which has required different number of tools and technologies to improve the quality and efficiency of the production, which in turn to reduce environmental impact on crop. Wireless Sensors Network (WSN) is one of them shows a wide range of applications related to different sectors, as it combines computation, sensing and also one of the vast one i.e. communication. The WSN is the one brings out more contribution towards the precise agriculture. Precise agriculture clears that at the right time at right location the right input is provided to improve quality and enhance the production by protecting environmental conditions [1].
As the advancement in Internet of things comes; so e of them is the wireless sensor networks becomes the core of networking. In WSN (Wireless Sensors Network), collections of different nodes are present which are deployed in ad-hoc manner to communicate wirelessly. The figure 1 shows Wireless Sensor Network is as below,

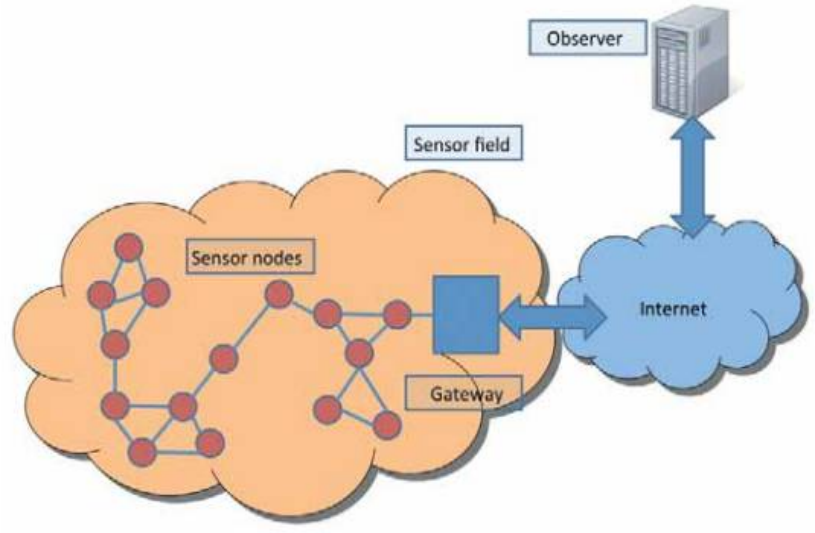

Fig. 1. Wireless Sensor Network

With the emerging growth in research, many more of the researchers investigated and develop systems related to environmental conditions to control and monitor. As shown in figure 1, each sensor node is capable to send data which

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is sensed with separate battery and it consumes very low power. To overcome the drawback of high power requirement of wired sensor network. Presently, mainly two types of technologies used i.e. ZigBee and Bluetooth.

II. RELATED WORK

In this we are given reviews on various research paper related to this theme with advancement in technologies. For this with the assumption of in agriculture system the rate of yield is not improve yet. So with different aspects, different researches given various systems to monitored which help to increase farmers yield. The below Table shows some of them are summarized as,

Sr. No.	Publication Year	Author's Name	Paper Title	Abstract
1	2014 **(IJCSIT)**	Prof. Mrs. S. S. Patil Prof. V. M. Davande, Prof. J. J. Mulani	Smart Wireless Sensor Network for Monitoring an Agricultural Environment	In this paper, for monitoring environmental parameters a ZigBee based platform is designed and developed. The station consists of microcontroller based measurement units; like temperature, humidity, soil moisture, water level which in turn sends and store data into database. Also the provision of to add sensors and stations has been provided.
2	**May-2014 (IJAIS)**	Ganiyu R. A., Arulogun O. T., Okediran O.O.,	Development of a Wireless Sensor Network for Monitoring Environmental Condition on a Farmland	In this paper author proposed a system to monitor environmental conditions and reduce the environmental parameters like temperature, relative humidity and light intensity with the use of WSN with sensor nodes and microcontroller (PI16F648A) with a PC. Also the DHT11 sensor is used to sense and provide digital outputs to measure temperature & relative humidity while a caliber light dependent resistor (LDR). Finally the outputs from these sensors are processed by the microcontroller and sent wirelessly, using low-power radio frequency.
3	July-2014 **(IJMER)**	Omveer, Dr. H. K. Singh, Rishikesh Patankar, Sandeep Bansal, Gaurav Kant Yadav	A Survey on Wireless Sensor Network based Technologies for Precision Agriculture System	This paper presents work related to communication technologies as a limitation of short range in ZigBee and Bluetooth. So in this research work for agricultural practices a device with flexibility, local intelligences and decision power has been proposed with the help of protocols like WiMAX, GSM and medium range Wi-Fi.
4	Jan-2015 **(IJAERD)**	Ms. Ragini D. khadse, Prof. Gauri borkhade	A Review: - Implementation of Wireless Sensor Network for Real Time Monitoring of Agriculture Parameter	In this paper author review on monitoring system with the use of different parameters like wind speed, water level, wind direction, Soil Moisture ,humidity detection & controlling, Flood Monitoring,, Soil Temperature etc as the technology is changed rapidly. In this paper also use of TCP/IP with microcontroller to get higher error rate, high speed and also simplicity which support to expand the farm field of a farmer.
5	May-2015	Pratibha	A Review on	To develop a smart application related to

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	(IJETT)	Gangurde, Manisha Bhende	Precision agriculture using Wireless Sensor Networks	agriculture environment number of observations related to it like temperature, soil moisture, humidity etc. in this paper author used a agriculture monitoring system with wireless communication to collect data, send data to server at center position and also perform analysis on it, to display on mobile present at client side

III. ZIGBEE TECHNOLOGY

ZigBee is one of the technologies used now a days, is a heart of wireless node. ZigBee was established in 2001 but officially named as ZigBee 2007. It is based on 802.15.4 protocol, which allows communication between nodes. Data may be transfer to separate node i.e. point-to-point or to all different nodes which are in range i.e. point-to-multipoint. In any industry it is used to connect number of devices using point-to-point or point-to-multipoint. The ZigBee technology with different elements is depicted in below figure 2, which categorized into mainly three parts as applications, logical and physical.

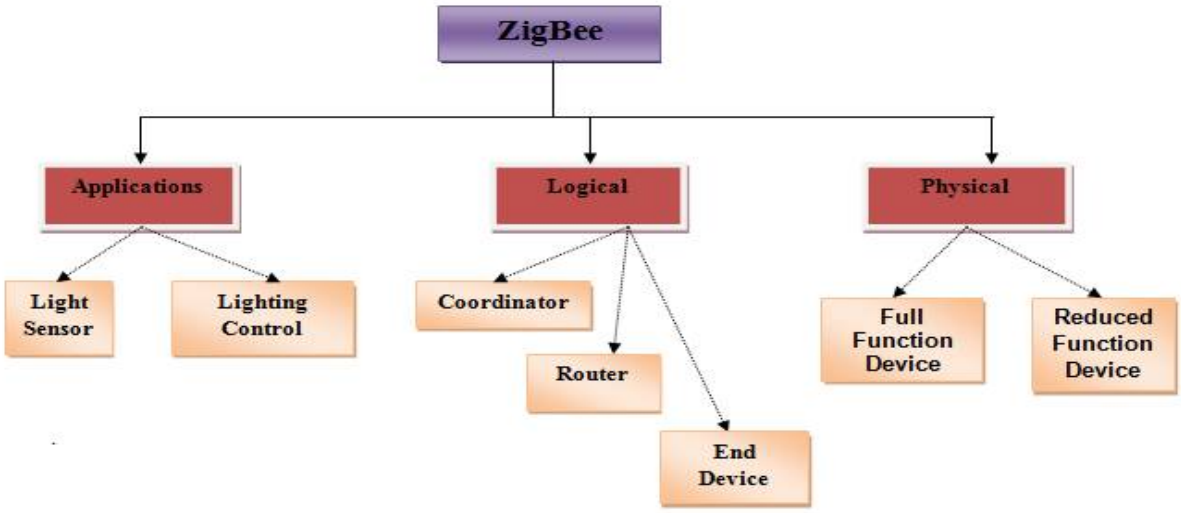

Fig. 2. ZigBee Technology

A. *Characteristics of ZigBee*:

With the advancement in use of various technologies in WSN, then there are some of the characteristics of ZigBee technology are given in below Table 1 as,

Table 1: ZigBee Characteristics

Characteristics	Explanation
Radio Frequency data rate	250 Kbps
Operating frequency	2.4 GHz
Interface data rate	Up to 115.2 Kbps
Receiver sensitivity for all variants	100 dBm
Global operation	2.4GHz frequency band
industry standard	AES-128 security scheme

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B. ZigBee device types:

As shown in below figure 3 there are mainly three types of devices are present in ZigBee system are coordinator, Router and End devices etc. The function and characteristics of each of the device is as described below.

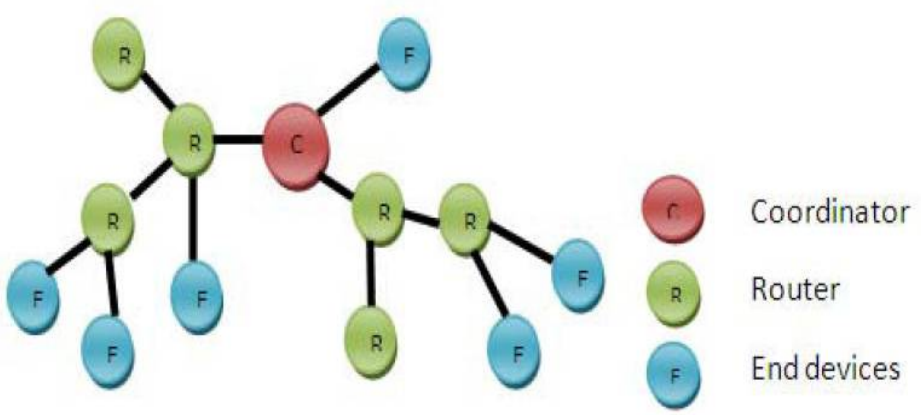

Fig.3. ZigBee Network

[i] Coordinator: In each network one coordinator is present which is responsible to initiate network and also parameter selection like network identifier, RF channel etc. it stores the information related to network security keys. Therefore it is generally formed the root of network and bridge to different networks.

[ii] Router: It acts as an intermediate node in network which relays data from other kinds of devices. To enhance the network there is a use of ZigBee routers. It also accepts connection from other devices and also re-transmission is also available.

[iii] End devices: These are powered based devices. These devices collect the information from different switches and sensors present in a network. They perform functionality to talk with coordinator or may be with router. But they cannot relay data from other types of devices.

Advantages: This functionality supports the various advantages like,

a) Reduce cost,
b) Support of low power models
c) Each end device has 240 end nodes for sharing purpose.

C. ZigBee topologies:

In network system, computer is connects different nodes in some logical manner. The arrangement of such kind referred as topology. ZigBee provides different kinds of topologies like star, Mesh and cluster tree. The overall performance of each of topologies is as shown in below figure 4,

[i] Star: In this topology, each node is connected to coordinator node and the communication is taken out through ZigBee coordinator. It is not reliable in nature as if the route is failed then the communication between different nodes is also failed.

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[ii] Mesh topology: In mesh, each device is communicated with other device which is in radio range and also with the help of multi-hop. It is flexible in nature. In this topology message can be transferred between different nodes through multiple path from source to destination.

[iii] Cluster topology: It is one of the topology of ZigBee in which there is only one path between any devices.

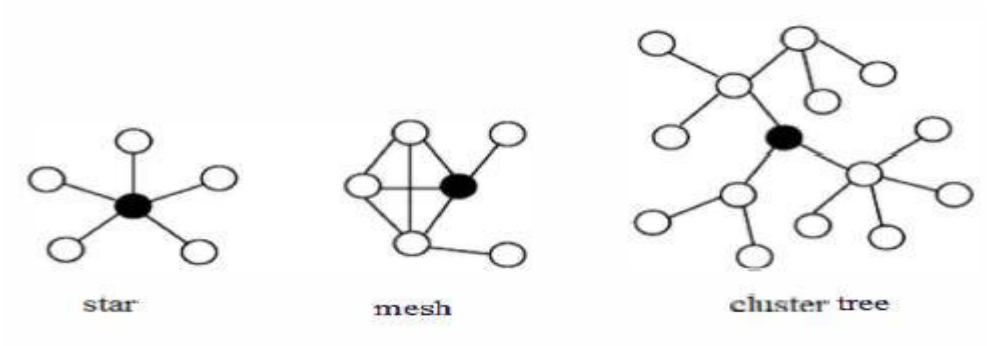

Fig. 4. Topologies in ZigBee

IV. COMPARATIVE RESULTS

But with the advancement in technologies, as per advanced in characteristics the number of protocols are defined in earliest have some of the limitations are overcome with now a day's various wireless protocols are used related to increase processing capacity, the appearance, hardware-software platforms. The below table gives comparison between various early used technologies. As per limitations the below Table 2 shows the use of ZigBee technology related to Bluetooth technology shows advancement with respect to different terms.

Table 2: Comparison between various Technologies

Category	Bluetooth	ZigBee	Observation (As Compared to Bluetooth)
Protocol used	IEEE 802.15.1	IEEE 802.15.4	Advanced protocol.
Stack size of Protocol	250k byte	28k byte	Low size suitable one.
Network speed	1M bit/sec	250kbits/sec	High speed of Bluetooth
Network range	1-10 meter	10-100 meter	Long range
Modulation Technique used	Frequency Hopping Spread Spectrum (FHSS)	Direct Sequence Spread Spectrum (DSSS)	DSSS has low power
Network join time	3 s	30ms	High selectivity
Path to way	more oriented toward user mobility	aims more for grand-scale automation and remote control	Remote control

V. CONCLUSION AND FUTURE WORK

The comparative results show that the ZigBee technology performance is better than the earliest used Bluetooth technology in different metrics. Also the system with ZigBee technology in agriculture system provides advantages of

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Low power consumption, provides Reliable, open and Global standard and Simple network configuration. In future there is requirement of to develop a system which is more precise one i.e. to used long range wireless protocol like WiMAX, Wi-Fi and GSM protocols.

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BIOGRAPHY

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