BUILDING WIRELESS MESH SENSOR NETWORKS USING XBEE AND ARDUINO

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Abstract – Wireless Sensor Networks(WSNs) have used for many applications. Mesh networks are one of the wireless communication process for long indoor and outdoor areas. The goal of this study is to use advantages of the mesh networks in long areas and to observe instant sensor data via the Internet. Arduino and DigiMesh 868 MHz transceivers were used for this experiment. Finally, the results of the each sensor values were viewed from the webpage.

Keywords – wireless communication, mesh network, arduino, sensors, Digimesh.

I. Introduction

A wireless sensor network (WSN) is a special ad-hoc, multi-hop and self-organizing network that consists of a huge number of nodes deployed in a wide area in order to monitor the phenomena of interest [1]. WSNs are used many applications to make the life easier and faster such as environmental, logistics, industrial control, security and agriculture. The main WSNs are consist of the base and remove sensor nodes. Base node is used for managing the network and collecting data from remote nodes. Remote nodes send data to the base node.

Zigbee is a low-cost, low-power consumption, low data rate, two-way, wireless communications standard based on IEEE 802.15.4 [2]. It is target market is low power applications with infrequent data transmission needs. Zigbee mesh network consist of the router, end device and coordinator. All the remote devices can be identified for building Zigbee sensor networks.

Xbee is Digi International's in house use Zigbee communication module brand. Xbee is a brand of radio that supports a variety of communication protocols. Xbee has two series, Series 1 Xbee has Digimesh feature. The main difference between Zigbee mesh network and Digimesh is that Digimesh has only one node type. All the nodes have homogeneous network. All nodes can route data. There are no parent-child relationships.

In this study, building a wireless Digimesh networks will be explained using arduino and carbon-monoxide sensor. This mesh network consist of 6 nodes to collect data from the base route. All the sensor data can be viewed from the Internet.

II. Hardware Setup

This system is a comprehensive monitoring system which is combined with software and hardware. This WSNs consist of 7 nodes. Each node has arduino, Xbee and sensor. First , hardware part is clearly examined. Arduino Board that is a microcontroller use a open source platform. This board is used for reading sensor values with UART.

In Figure 1 shows that, feature of the Digimesh network system. DigiMesh is similar to ZigBee in that both of them support mesh networking, nevertheless DigiMesh has its specific characteristics and advantages which are important to support different applications.

When the zigbee mesh network and DigiMesh network are compared, DigiMesh offers these advantages: Network is simpler, more flexibility to expand the network and increased reliability in environments where routers may come and go due to interference or damage[3}.

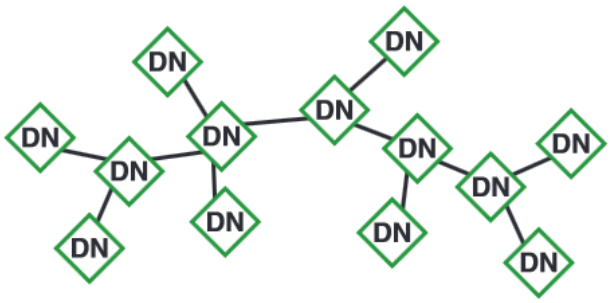

Fig. 1 Digimesh Network

Figure 2 ,shows that the connection between Arduino board and Digimesh board.

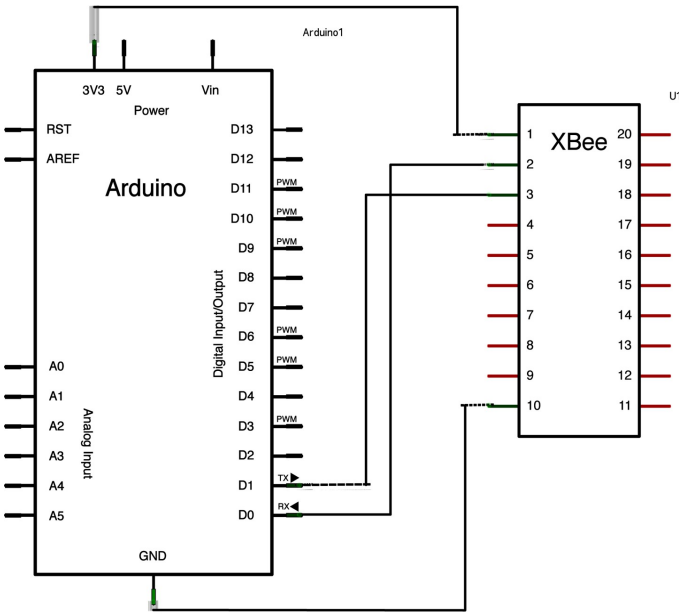

Fig.2 System function

Arduino Board and Digimesh board connected to according to the Fig 2. Then, serial communication started. Each sensor send the data to the another node. Finally, base node keeps all remove node data.

III. Software Setup

In this part, software setup of the WSNs designed and analyzed. Software setup consist of the PHP, Java scripts and also Arduino code was written for controlling the sensors. Each sensor data were transferred by the help of Digimesh 868 Mhz. 868 MHz only used in European communication protocol.

Thanks to the Digimesh, each node sent its data to the another node. In figure 3 shows that instant carbon-monoxide values graphically.

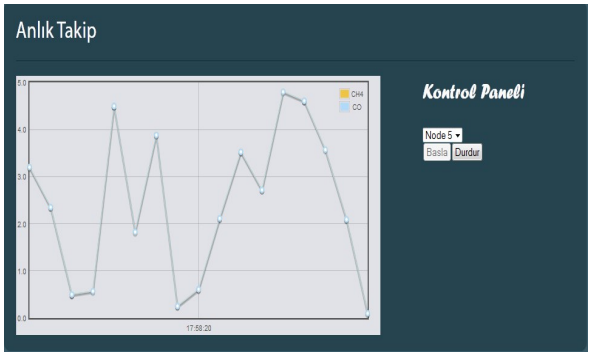

Fig 3. Control Panel of the system

Each node send its data to the base node. Base node is connected to the base computer. Base node send all the sensor data to the MySQL database. MySQL store the sensor data from the each node five columns. First column of the MySQL shows the node name. Second column says the node id. Third column says the digital of sensor values. Fourth column says the value of the sensors and fifth column says the when sensor data reached the base node.

	id	nodeid	sensorType	rawvalue	date
Düzenle Sıralı Düzenleme Kopyala Sil	2371	1	1	1.45161	1378840577
Düzenle Sıralı Düzenleme Kopyala Sil	2372	2	0	0.544739	1378840577
Düzenle Sıralı Düzenleme Kopyala Sil	2373	2	1	2.35837	1378840577
Düzenle Sıralı Düzenleme Kopyala Sil	2374	4	0	2.38511	1378840577
Düzenle Sıralı Düzenleme Kopyala Sil	2375	4	1	2.94269	1378840577
Düzenle Sıralı Düzenleme Kopyala Sil	2376	5	0	3.55442	1378840577
Düzenle Sıralı Düzenleme Kopyala Sil	2377	5	1	1.68541	1378840577
Düzenle Sıralı Düzenleme Kopyala Sil	2378	6	0	3.20646	1378840578
Düzenle Sıralı Düzenleme Kopyala Sil	2379	6	1	0.168194	1378840578
Düzenle Sıralı Düzenleme Kopyala Sil	2380	5	0	2.10366	1378840578

Fig. 4 MySQL page of the system

Figure 5 shows the sensor sets of the system. Wireless Sensor networks consist of six nodes. Each node has carbon-monoxide sensor to measure gas sensor values of the hazardous environments.

Fig. 5 Sensor System

Conclusion

As a result of the experiments, mesh sensor networks designed for hazardous environments. Carbon-monoxide sensor was used for detecting gaz. Moreover, arduino and DigiMesh boards were used for collecting sensor data. Finally, PHP and MySQL were used to monitor data from the Internet. In the future, this work will be developed for gas monitoring systems.

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