REAL-TIME MEASUREMENT AND MONITORING SYSTEM USING ZIGBEE AND LABVIEW

MUHAMMAD HAIRUL BIN YAHAYA

This report is written as a partial fulfillment of terms in achieving the awards for Bachelor of Electronic Engineering (Wireless Communication)

Faculty of Electronic and Computer Engineering

Universiti Teknikal Malaysia Melaka

JUNE 2015

Tajuk Projek : REAL-TIME MEASUREMENT AND MONITORING SYSTEM USING ZIGBEE AND LABVIEW

Sesi Pengajian :

1	4	/	1	5

Saya MUHAMMAD HAIRUL BIN YAHAYA

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.

2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.

3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.

4. Sila tandakan (√) :

☐ SULIT* *(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

☐ TERHAD** **(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

☑ TIDAK TERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

(COP DAN TANDATANGAN PENYELIA)

KHAIRUN NISA KHAMIL
PENSYARAH
Fakulti Kejuruteraan Elektronik Dan Komputer
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya
76100 Durian Tunggal Melaka

Tarikh: 8 JUNE 2015

Tarikh: 8 JUNE 2015

"I admit that this report is from my own work and idea except for the summary and a few sections which were extracted from other resources as being mention".

Signature :

Writer's Name : MUHAMMAD HAIRUL BIN YAHAYA

Date : 8 JUNE 2015

"I admit that I have read this report and it has followed the scope and quality in partial fulfillment of requirement for the degree of Bachelor of Electronic Engineering (Wireless Communication) With Honours.

Signature : ....

Supervisor's Name : PN. KHAIRUN NISA BINTI KHAMIL

Date : 8 JUNE 2015 ....

To my lovely parents, my brother and sister who give me encouragement to success in my studies and not to forget special thanks to all my lecturers and friends that give me guideline and support during my study in

UTeM

ACKNOWLEDGEMENT

This project would not have been possible without considerable guidance and support. I would like to acknowledge those who have enabled me to complete this project.

In particular, I wish to express my sincere appreciation to my supervisor, Puan Khairun Nisa Binti Khamil and my co. supervisor, Puan Norshahida Binti Saba from MARA Japan Industrial Institute for encouragement, guidance, critics and friendship towards me to finish up the entire requirement needed in completing the project.

Secondly, I would like to thank for all other Universiti Teknikal Malaysia Melaka staff members that I may have called upon for assistance since the genesis of this project. Their opinions and suggestions have helped me in realizing this project. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. To my friend, especially Muhajir Bin Mustafar, my friend back in UTeM for his idea, critic, and support.

Finally, I would like to thank to my big family for their understanding, encouragement and support towards the completion of my project.

ABSTRAK

Teknologi komunikasi tanpa wayar menjadi kesukaan ramai dalam persekitaran perindustrian masa nyata. Projek ini menerangkan kerja asas system pengukuran dan pemantauan masa sebenar dengan Arduino, ZigBee, dan Grafik Bahasa Pengaturcaraan (LabVIEW). Ketebalan item itu diambil sebagai parameter yang akan diubah kepada bilangan item. Dengan memperoleh data analog dari sensor ultrasonik, isyarat yang sesuai bersyarat disalurkan ke Arduino. Ia disambungkan kepada modul pemancar ZigBee, yang menghantar data kepada penerima ZigBee itu. Akhirnya, data yang diterima akan dilihat pada PC melalui LabVIEW. Metodologi yang menggambarkan dalam kerja-kerja yang dicadangkan itu adalah berguna untuk mereka bentuk system rangkaian sensor tanpa wayar (WSN) dalam penggunaan perindustrian seperti penyimpanan barangan sebenar. Percubaan rangkaian penghantaran dan pemerhatian data yang diperlukan dalam LabVIEW dilaporkan. Gabungan pengukuran, penghantaran tanpa wayar dan sistem pemantauan boleh diperbaiki ketepatan pengukuran, terutama bagi kemampanan tempat kerja yang lebih baik.

ABSTRACT

Wireless communication technologies become popular in real-time industrial environments. This project describes the fundamental work of real time measurement and monitoring system with Arduino, ZigBee, and Graphical Programming language (LabVIEW). Thickness of the item is taken as a parameter that will convert into the number of item. By acquiring the analog data from the ultrasonic sensor, the suitable signal conditional is fed to Arduino. It is connected to the ZigBee transmitter module, which transmits the data to the ZigBee receiver. As a result, the data received will be viewed on a PC via LabVIEW. The methodology describe in the proposed work is useful for designing Wireless Sensor Network (WSN) system in the industrial application such as real leveling storage. The experimental of transmission range and observation of data required in LabVIEW was reported. The combination of measurement, wireless transmission and monitoring system can be improved of accuracy of measurement, especially for sustainability of better working place.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATION

AC   -   Alternative Current

DC   -   Direct Current

ECG   -   Electrocardiogram

GPRS   -   General Packet Radio Service

ISM   -   Industrial, scientific and medical radio bands

LabVIEW   -   Laboratory Virtual Instrument Engineering Workbench

LED   -   Light-Emitting Diode

MAC   -   Media Access Control

PC   -   Personal Computer

PWM   -   Pulse Width Modulation

SSID   -   Service Set Identifier

UWB   -   Ultra wideband

WSN   -   Wireless Sensor Network

WPAN   -   Wireless Personal Area Network

WLAN   -   Wireless Local Area Network

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

1.1   Project background

The Wireless Sensor Networks or WSN could be a wide space of analysis in recent years. Wireless sensor network consists of distributed autonomous sensors to observe physical or conditions environmental like distance, pressure, sound, temperature and to hand and glove pass their knowledge through the network to a main location. The wireless sensor network will be used with ease within the surroundings wherever wired system cannot be used or if used, can measure to be treated with caution, as an example, in industrial surroundings.

One advantage is in independent device monitoring system for measuring in leveling storage. The storage racks can install a ZigBee device that interfaces with the device and knowledge will be wirelessly transmitted in PC and it'll store an information with LabVIEW. WSN is constructed like Bluetooth, sensing transducers, PAN, WI-Fi and ZigBee can measure differing kinds of Wireless sensor Network. ZigBee operates within the scientific, industrial, and medical (ISM) radio bands. During this 868 MHz in Europe, 915 MHz within the USA and a 2.4 GHz use in worldwide. The IEEE helped the assembly of ZigBee protocol and devices that support this protocol. The disadvantage of victimization ancient systems is that it will increase the price where as digital systems scale back the price of the system. ZigBee is low price, wireless network common place and low power usage. It permits longer life with

a smaller battery. ZigBee supports hybrid, star, mesh, and tree topologies. The development of ZigBee is to fulfill the low power devices for demand for capable wireless networking. Its wide used for dominant and watching application. The ZigBee commonplace is showing thanks to its potential for low cost, low power, quick response and easy implementation compare to ancient new wired network. Its easy installation used for automation industrial.

The ZigBee basic structure primarily based parameter monitoring and controlling system consists of Arduino, and ZigBee device. These can measure connected with inaudible device and also acts as the transmitter for the other end ZigBee device that is close to the PC wherever the parameters can measure showed on computer victimisation package application for display identical output display which might be shown in PC. Additionally to numerous alternative sensors can measure by ZigBee device used for activity totally different parameters. Wireless sensor network system can measure autonomous and operate unattended conjointly adaptation to the surroundings.

It is a very interesting application. An integrated with wireless solution allows one to exploit the positive aspects of many technologies by improving performances and productivity. Various network topologies that have to be implemented depend on the requirement of the application. The entire assembly storage can be monitored by WSN, implemented based on the requirement of the industrial application. Each leveling rack will be assembling with the ultrasonic sensors, and Arduino for microcontroller. They are connected with each other by wireless systems. The sensors are used to measure and monitor the information about the item of the storage like quantity and also saving the information data for recorded by using LabVIEW.

1.2 Objectives

The aim of this paper is to designing the wireless sensor network system that will measure and monitor in real-time by using Arduino, Zigbee and LabVIEW. The main functions of this system is:

- • To monitor storage continuously
- • To receive and store the real time data acquisation on the PC

1.3 Problem Statement

Nowadays, the increasing numbers of factories are created as a result of industrial development. However, issues of safety have additionally increased, and work is less economical for many examples is that the instrumentality malfunction, human error and natural disaster. Which will cause the error in measuring and storing information. The damage and injury caused by these factors is additionally usually increasing, therefore lack of safety and potency has become an enormous issue of today. On this downside, the observation management won't be unendingly owing to manually measure on industrial currents. Apart from that, the standard measuring system is a high cost of the system as a result of the abundant files of paper and if it uses wired system, the high price and consumption are occurring with their installation. From that, the protection and work efficiency can less on some factories.

Another issue that has been a concern is the management of monitoring the storing item in the storage area. Some of factories that was unperiodictly monitor their item and the time to analyze the quantity item, it will more risk on their worker such as racks collide, and miss conduct the measurement.

By victimization the WSN, the system can operate swimmingly with real time observation and unendingly. From that, it has rather more efficient on this technique like low price installation and maintenance, low energy usage, long lasting equipment, measure and monitor in real time, ease to storing data acquisition, and straightforward implementation and installment comparable to ancient new wired network.

1.4   Scope of project

The scope of this project is:-

Focus on factory storage location such as storage racks that may more difficulty and dangerous for worker or personnel to manage and work in because of crowded and limitation space.

This project will use Arduino UNO 1.0.4 as the controller, Xbee Pro Zigbee devices for wireless network, and HC-SR04 ultrasonic sensor for the distance measurement. The design will required of 3 sensors; HC-SR04 ultrasonic sensor. This sensor has task to detect the presence of an item in the storage rack. Since the project covered the three levels of the rack, the range for each sensor detection is from 2cm to 450 cm detection of surface distance to measuring the quantity of an item. Each sensor will be set for each level of storing rack space. Average of standard leveling racks is about 200 cm per level. Each sensor will be set for each level of storing rack space.

Arduino UNO 1.0.4 will use on Xbee Zigbee transmitter device (figure 1.4.1). A fundamental kind of Arduino that have 6 simple inputs and 14 digital input/output pins (can be utilized as PWM outputs). It is a microcontroller board focused around ATmega328 and also contains lots of everything expected to help the microcontroller, essentially unite it to machine with USB cable or force it with AC-to-DC connector or battery to source the power. Arduino board will be the controller to the sensors that integrated with the WSN by code program commands. The output will through the Xbee Pro Zigbee receiver and by using the Labview. Finally the data acquisition will shown on PC and stored for recording data.
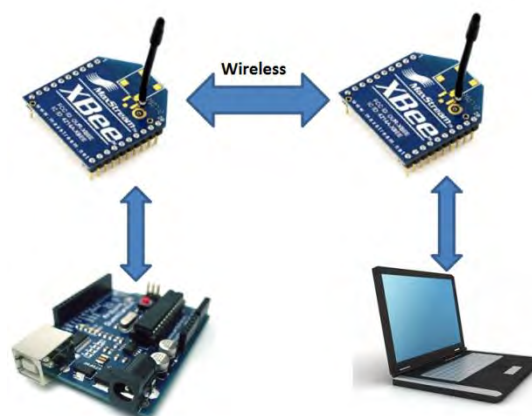

Figure 1.4.1 Zigbee is use to receive data wirelessly

CHAPTER II

LITERATURE REVIEW

In completing this project, some literature reviews are done on certain resources. The theoritical and outline details concerning the project has taken as guidence to complete this project. In this chapter, a overview of several application will been overviewed that almost like the project and related project design was presented.

2.1   Previous journals/paper works/projects

2.1.1   Design and Development of ZigBee Based Instantaneous Flat-plate Collector Efficiency Measurement System by K.Vairamani, K. A. Venkatesh and N. Mathivanan[1].

In the paper by [1], the figuring the effectiveness of level plate authority is fundamental in sunlight based heat system testing. The authors have exhibits the immediate level plate gatherer effectiveness count outline of Zigbee empowered data acquisition system. The inlet and outlet liquid temperatures, encompassing temperatures and sun oriented radiation power was includes estimation of parameters.

The composed system has a sensor node and a base station. The Zigbee remote correspondence, convention to utilized for correspondence between the sensor node

and the base station for wirelessly obtaining information. The mounted wireless sensor node which is over the authority plate incorporates the essential sensors and related signal conditioners. For information securing, transforming and analysis is executed in the base station PC, the application program have been created on Labview. Momentary level plate authority, effectiveness have been processed.

In completing this project, some literature reviews are done on many resources. The idea and outline and details concerning the project have taken as steerage in completing this project.

2.1.2 Design and Development of Ultrasonic Process Tomography by M. H. F. Rahiman, Ruzairi A. R., Herlina A. R. and Nor Muzakkir N. A.[2].

The system and principle by authors [2] consists of Ultrasonic sensors are with successed applied in flowing activity, non destructive testing, and its wide utilized in medical imaging. The tactic involves in mistreatment inaudible is through the transmission, and receiving sensors that are axially spaced on the flowing stream. The sensors don't impede the flow because the suspended solids' concentration fluctuates, the ultrasonic beam is scattered, and also received the signal fluctuates in an exceedingly random manner a few mean value. This kind of device may be used for measuring the flow speed. 2 pairs of sensors are needed so as to get the speed, employing a cross- correlation technique. The propagates waves at intervals of variance of 18 kHz to 20 MHz on ultrasonic device.

Ultrasonic wave at the interface between one substance, and another is powerfully mirrored. Nevertheless, it is tough to collimated, and issues occur attributable to reflections inside fogbound spaces, like metal pipes. Those area unit 2 styles of supersonic signals that area unit typically used. It also are the continual signal, and therefore the periodic signal. Employing a continuous signal can give continuous impact on the crystal by mistreatment pulses the interval of the reception and transmission signal may be calculable. Mistreatment the supersonic technique within the air is extremely inefficient because the mate of the sensors resistivity that compared with air's acoustic reactance. The newest types of sensor area unit regularly being

developed, however that effectiveness ones are a unit valuations. The design of that detector is essential once it must scale back the sensor's ringing.

2.1.3 Design of ultrasonic distance-measuring system using temperature compensation methods by Hong Wei Peng, Yu Jie Cheng,, Zhi Guo Hu, and Chu Chen Zhang[3].

This journal form [3] that archive exhibits the guideline of ultrasonic separation estimation is portrayed, the fundamental lapse wellsprings of ultrasonic separation estimation are examined likewise. A strategy for enhancing exactness of ultrasonic separation estimation in air, in which the transmission rate of ultrasonic wave if revised by measured air temperature what's more the forward edge of get wave can be dead set precisely by utilization of the get wave input time strategy with the product. In light of the thought, the circuit and programming of the ultrasonic separation estimation system have been intended to apply advanced sign handling engineering. Examination shows that the measuring accuracy of ultrasonic separation estimation system is higher and its circuit is easier.

2.1.4 Real-Time Monitoring of ECG using Zigbee Technology by Ramu R, A. Sukesh Kumar[4].

This journal explains about a wireless electrocardiograph monitoring system is implemented by Zigbee module for remote monitoring of cardiac patients. The ECG Acquisition system is designed and the signals are plotted in LabVIEW. The Signal from ECG acquisition module is given to Zigbee module. The transmitted signals are then received by Zigbee Transceiver. TTL output from the receiver Zigbee module is converted to RS232 using a MAX232 level converter. The serial data are then plotted in Laptop using LabVIEW. ECG Acquisition System contains cathodes, instrumentation intensifier and channels. It catches the ECG flag, opens up and channels this to an attractive reach. The simple output from the channel is given to microcontroller for simple to advanced transformation (ADC) and the serial