IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 3, Issue 7, July 2016

Detection and Monitoring of Asthma Trigger Factor using Zigbee

Miss. Anumeha Lal [1], **Mr. Girish A. Kulkarni**[2]

ME 2nd Year, North Maharashtra University, SSGB Engineering & Technology, Bhusawal, Maharashtra[1]

HOD of E&TC, North Maharashtra University, SSGB Engineering & Technology, Bhusawal, Maharashtra[2]

Abstract: Asthma is one of the widespread chronic diseases. Firstly, the medical background of asthma is given. Pathology and symptoms are presented. Asthma is a chronic condition that mostly affects adolescents. It is a condition that requires continuous monitoring of the symptoms in order to provide an effective course of treatment. It also requires a strict adherence to medication prescribed by the physician. However, the aim of this study is to develop a system, which is based on a periodical data collected by the different sensors. There is no cure for asthma. Symptoms can be prevented by monitoring factors which can trigger asthma attack. So it is very much needed that there should be a system which can monitor air parameter on regular basis and warn the patient when these factor can trigger their asthma attack.

Keywords: wireless sensors networks, air quality, asthma assessment, ZigBee.

I. INTRODUCTION

The primary objective of this project work is to develop a flexible system characterized by low-cost sensing nodes that assures robust and continuous monitoring of air conditions in order to analyse the asthma trigger factors. Asthma is a chronic condition that mostly affects adolescents. It is a condition that requires continuous monitoring of the symptoms in order to provide an effective course of treatment. It also requires a strict adherence to medication prescribed by the physician.

However, the aim of this study is to develop a system, which is based on a periodical data collected by the different sensors. For the proposed system is designed around a PIC microcontroller and different sensors, Temperature, Humidity & gas sensor for gathering, sending and receiving information from different sensors and external servers. The aim of the architecture design is to provide an easier access to information and services, better patient healthcare services, transparent and efficient use of healthcare resources, and a fast response by the hospital side in case of Asthma attack.

This system permits to establish correlations between the air quality parameters and the appearance of respiratory diseases such as asthma as part of environment medicine approach**.** After being processed the information and, depending of the results obtained, the system will display the messages if their range is beyond the required limit.

In this way a self management system is designed for asthmatic patient. So the system is very efficient for patient as they can monitor their asthma level at their residential place. People in villages having their financial problem then for them the system can be installed to their central clinic which can help them to diagnose their asthma at local place.

II. PROBLEM STATEMENT

Asthma, a chronic health condition prevalent in children can be characterized by breathlessness, chest tightness and coughing. An asthma attack can be triggered by a variety of factors including environmental conditions, intense physical activity, humidity and dust1. In the United States, as of February 2010, 7 million children (10%) were reported to be suffering from asthma2. This condition is generally more prevalent among adolescents in the age group of 11-17. Due to the high prevalence of asthma in children and the difficulty involved in diagnosing the condition it becomes imperative to come up with technological solutions for continuous care and management of patients with this chronic disease.

III. OBJECTIVE

The objective of this project is to develop a system to analyse the trigger factor of asthma and a device that can use by asthma patients, which can perform multiple functions that enable a physician to monitor the patient's condition and to provide continuous care. The different functionalities in a point of care device that are considered vital in caring for patients with asthma are discussed below. The idea behind this work is to develop a point of care device which can ideally be integrated with an alarm to remind the patients to take their medication and also a memory which stores all the test results, patients' perception of their condition and the regularity with which the inhaler is used so that the physicians can later use these data to accurately assess the condition of the patient.

IV. NEED

Asthma is one of the widespread chronic diseases. Rising prevalence increases the burden of personal disease

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 3, Issue 7, July 2016

management, financial expenditures and workload, both on sides of patients and healthcare systems. According to the World Health Organization asthma is a serious public health problem with over 100 million sufferers worldwide. Between 100 and 150 million people around the globe suffer from asthma and this number is rising. World-wide, deaths from this condition have reached over 180,000 annually. India has an estimated 15-20 million asthmatics. In 2013, 242 million people globally had asthma up from 183 million in 1990. It caused about 489,000 deaths in 2013. Asthma is not just a public health problem for developed countries. In developing countries, however, the incidence of the disease varies greatly. There is no cure for asthma. Symptoms can be prevented by monitoring factors which can trigger asthma attack. So it is very much needed that there should be a system which can monitor air parameter on regular basis and warn the patient when these factor can trigger their asthma attack.

V. SYSTEM DESIGN

A. System Architecture

The Asthma Monitoring System is designed around a PIC microcontroller for gathering, sending and receiving information from different sensors and external servers. The aim of the architecture design is to provide an easier access to information and services, better patient healthcare services, transparent and efficient use of healthcare resources, and a fast response by the hospital side in case of Asthma attack. The most relevant features and application scenarios will be accurately described in the following sections.

B. Hardware Architecture

The proposed system is designed by integrating the following hardware modules shown in Fig. 3.1. As the figure shows, the system consists of a PIC184520 microcontroller integrated with a sensor array (Temperature sensor, Humidity sensor & Gas sensor) using analog ports. The hardware unit is also connected to a ZigBee-Modem using the RS-232 interface

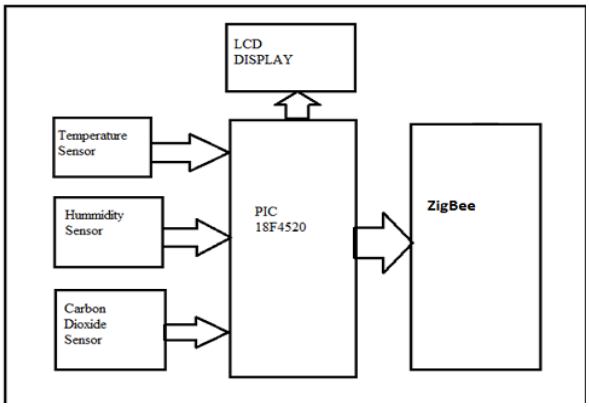

Fig 1 Block Diagram of Proposed System

C. PIC18F4520 Microcontroller

PIC microcontrollers (Programmable Interface Controllers) are electronic circuits that can be programmed to carry out a vast range of tasks. They can be programmed to be timers or to control a production line and much more. They are found in most electronic devices such as alarm systems, computer control systems, phones, in fact almost any electronic device. Many types of PIC microcontrollers exist, although the best are probably found in the GENIE range of programmable microcontrollers. These are programmed and simulated by Circuit Wizard software. PIC Microcontrollers are relatively cheap and can be bought as pre-built circuits or as kits that can be assembled by the user.

D. Temperature Sensor

A temperature sensor is a device that gathers data concerning the temperature from a source and converts it to a form that can be understood either by an observer or another device. These sensors come in many different forms and are used for a wide variety of purposes, from simple home use to extremely accurate and precise scientific use. The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C) The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ˚ Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies.

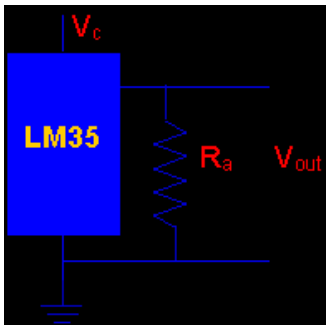

Fig 2 Circuit diagram of LM35

E. Gas Sensor

Semiconductor sensors detect gases by a chemical reaction that takes place when the gas comes in direct contact with the sensor. Tin dioxide is the most common material used in semiconductor sensors, and the electrical resistance in the sensor is decreased when it comes in contact with the monitored gas. Semiconductor sensors are commonly used to detect hydrogen, oxygen, alcohol vapor, and harmful gases such as carbon monoxide. One of the most common uses for semiconductor sensors is in carbon monoxide sensors. They are also used in breathalyzers. Because the

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 3, Issue 7, July 2016

sensor must come in contact with the gas to detect it, semiconductor sensors work over a smaller distance than infrared point or ultrasonic detectors. MQ2 flammable gas and smoke sensor detects the concentrations of combustible gas in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm. The sensor can operate at temperatures from -20 to 50°C and consumes less than 150 mA at 5 V. Connecting five volts across the heating (H) pins keeps the sensor hot enough to function correctly. Connecting five volts at either the A or B pins causes the sensor to emit an analog voltage on the other pins. A resistive load between the output pins and ground sets the sensitivity of the detector. Both configurations have the same pin out consistent with the bottom configuration. The resistive load should be calibrated for your particular application using the equations in the datasheet, but a good starting value for the resistor is 20 kΩ.

Fig 3 Gas Sensor

F. Humidity Sensor

Humidity is the presence of water in air. The amount of water vapour in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapour also influences various physical, chemical, and biological processes. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort. Controlling or monitoring humidity is of paramount importance in many industrial & domestic applications. In semiconductor industry, humidity or moisture levels needs to be properly controlled & monitored during wafer processing. In medical applications, humidity control is required for respiratory equipments, sterilizers, incubators, pharmaceutical processing, and biological products. Humidity control is also necessary in chemical gas purification, dryers, ovens, film desiccation, paper and textile production, and food processing. In agriculture, measurement of humidity is important for plantation protection (dew prevention), soil moisture monitoring, etc. For domestic applications, humidity control is required for living environment in buildings, cooking control for microwave ovens, etc. In all such applications and many others, humidity sensors are employed to provide an indication of the moisture levels in the environment.

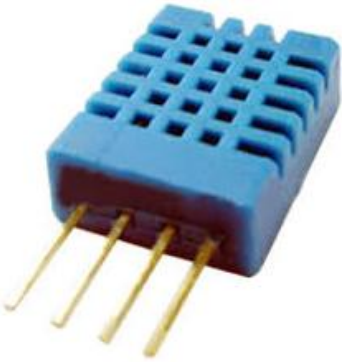

Fig 4 Humidity Sensor

G. ZigBee

ZigBee is the wireless language that everyday devices use to connect to one another ZigBee is a wireless networking standard that is aimed at remote control and sensor applications which is suitable for operation in harsh radio environments and in isolated locations. ZigBee technology builds on IEEE standard 802.15.4 which defines the physical and MAC layers. Above this, ZigBee defines the application and security layer specifications enabling interoperability between products from different manufacturers. In this way ZigBee is a superset of the 802.15.4 specification. With the applications for remote wireless sensing and control growing rapidly it is estimated that the market size could reach hundreds of millions of dollars as early as 2007. This makes ZigBee technology a very attractive proposition for many applications. The distances that can be achieved transmitting from one station to the next extend up to about 70 metres, although very much greater distances may be reached by relaying data from one node to the next in a network. The main applications for 802.15.4 are aimed at control and monitoring applications where relatively low levels of data throughput are needed, and with the possibility of remote, battery powered sensors, low power consumption is a key requirement. Sensors, lighting controls, security and many more applications are all candidates for the new technology.

The data is transferred in packets. These have a maximum size of 128 bytes, allowing for a maximum payload of 104 bytes. Although this may appear low when compared to other systems, the applications in which 802.15.4 and ZigBee are likely to be used should not require very high data rates.

Fig.5 ZigBee

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 3, Issue 7, July 2016

H. Algorithm
-Initialize ADC,LCD
-Initialize Zigbee,Serial COM port
-Initialize sensor module
-Monitor the sensor data using pulling
- Read the ADC value for corresponding sensor
-Convert the read ADC value to ASCII code to display on LCD
-Display on LCD
-Send through serial Zigbee Module
-on Receiver side Initialize Zigbee
-Receive data through Zigbee
-Set the Hyperterminal/Flash
-Set the COM port
-Display data on HyperTerminal/Flash

VI. RESULT

This is one of the efficient methods to monitor the air quality parameters which can trigger asthma attack. As the main objective of this project is to monitoring the air quality parameter, this has been implemented to monitor temperature, humidity and gas molecule particles present in the air.

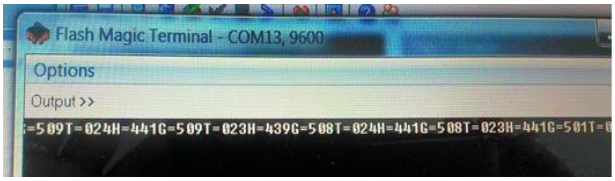

Fig 6 Output

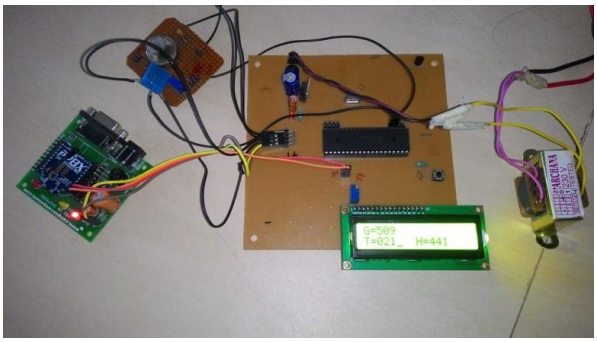

Fig 7 Snapshot of Project

VII. APPLICATIONS

- Green House Parameter monitoring & Control System
- Remote weather monitoring System
- Industrial Parameter monitoring
- Indoor & outdoor air quality monitoring & control
- In Chemical Plant.

VIII. CONCLUSIONS AND FUTURE SCOPE

A wireless sensing network indoor and outdoor to monitor the air quality in relation with trigger factors detection associated with asthma attacks was developed. To support data representation was developed. As important part of the system Zigbee module makes a bridge between the sensor network and the database connectivity. Data from respiratory tests, imported using the developed MPLAB application permits to analyze the relationship between asthma and air quality. The presented solution is useful to analyze and detect asthma triggering factors and other respiratory diseases factors in indoor spaces. The information can be accessed anywhere which allows the users to know elements about risk condition for their respiratory health. As the future work is mentioned and extension of the wireless sensor network using zigbee nodes can be possible. The algorithm can be modified to new capabilities to analyze more air compounds concentration measurements. Referring to the information system side, in order to provide a more efficient alert system, the warnings can be sent as a SMS to cell phone of users, or by email. The Enviogis web based information system can be improved with new technologies that permit to be accessed using mobile devices such as smart phones or tablets. In Future scope it would be possible to maintain the Database for the system we can design of Data Logger like system which store the parameter on the SD card or Hard Drive for future reference.

REFERENCES

1. Ana Filipa Teixeira, Octavian Postolache, "Wireless Sensor Network and Web based Information System for Asthma Trigger Factors Monitoring", IEEE 2014, PP.1388 – 1393
2. O. Postolache, P. Girão, M. Dias Pereira, G. Ferraria, N. Barroso, G. Postolache, "Indoor Monitoring of Respiratory Distress Triggering Factors Using a Wireless Sensing Network and a Smart Phone", International Instrumentation and Measurement Technology Conference Singapore, IEEE 5-7 May 2009, PP.451 – 456
3. Zhe Cao, Rong Zhu,, Member, IEEE, and Rui-Yi Que "A Wireless Portable System With Microsensors for Monitoring Respiratory Diseases", IEEE Transactions On Biomedical Engineering, Vol. 59, No. 11, November 2012, PP.3110 – 3116
4. Kelly L. Andrews, Sandra C. Jones, Judy Mullan, "Asthma self management in adults: A review of current literature", ELSEVIER journal, Volume 21, Issue 1, March 2014, PP.33-41
5. Antoinette Bumatay , Remy Chan , Keith Lauher , Alice M. Kwan, Tod Stoltz, Jean- Pierre Delplanque, Nicholas J. Kenyon, and Cristina E. Davis, Member, IEEE, "Coupled Mobile Phone Platform With Peak Flow Meter Enables Real-Time Lung Function Assessment", IEEE Sensors Journal, Vol. 12, No. 3, March 2012, PP.685 – 691
6. Vilas D. Ghonge, Vijay S.Gulhane, Nitin D.Shelokar, "A Real-time Ingenious System for Remote Health Assistance", International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 2, Issue 3, March 2013, PP.350-355
7. Surajit Bagchi, Dr. Madhurima Chattopadhyay, "Real-time monitoring of respiratory diseases of distantly located elderly impaired patients", IEEE 2012 Sixth International Conference on Sensing Technology (ICST), PP.146 – 150
8. B O Adeniyi and G E Erhabor, "The peak flow meter and its use in clinical practice", Journal of Respiratory Medicine, March 2011, PP.5-8
9. Liu Jen-Hao, Lin Tzu-Shiang, Lai Da-Wei, "Developed Urban Air Quality Monitoring System Based on Wireless Sensor Networks", International Conference on Sensing Technology (ICST), New Zeeland, pp. 1-5, 2011
10. Jin-Shyan Lee ; Yu-Wei Su ; Chung-Chou Shen, "A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi",Industrial Electronics Society, 2007. IECON 2007. 33rd Annual Conference of the IEEE
11. A. H. Lockwood, K. W.-Hood, M. Rauch, B. Gottlieb, "Coal's Assaulton Human Health" A Report From Physicians For SocialResponsibility, on-line at: http://www.psr.org/assets/pdfs/psr-coalfullreport.pdf, 2009