A Smart Detection of Asthmatic Environment with Alert System

Ms. R. Ramya Devi[1], Ms. V. Preetha[2], Ms. S. Revathi[3], Mr. S. Cammillus[4]

[1,2,3]Department of Electronics and Communication Engineering, National Engineering College, Kovilpatti.
[4]Assistant Professor (Senior Grade), Department of Electronics and Communication Engineering, National Engineering College, Kovilpatti.

Abstract - Asthma is a widespread chronic disease, which requires perpetual monitoring to evade nasal congestion. However, aims to develop a system that alerts the asthmatic patient when they enter into an unconditional environment. So, to monitor and detect the asthma trigger factor, temperature sensor, Humidity sensor, and CO sensor are used. The microcontroller ATMEGA 328 interface with LCD, Buzzer, a temperature, humidity, and CO sensor does the above requisites. If the concentration levels are deemed to be inimical, the user is alerted via a buzzer and to exhibit the data, LCD and an android app (Bluetooth Terminal HC05). It is necessary to intimate asthmatic patients about their surroundings when they are in. This would facilitate them to take the required precautions to avoid asthmatic quandaries. In the older system, the monitored results are provided to health care stations and the patients are unaware of their surroundings that stimulate asthmatic criteria. At the same time, the device should provide the results under the mobility conditions of the patients. Nasal congestion can be averted by monitoring factors that can trigger asthma. This is done on a conventional substructure and admonishes the patient to evade such an environment.

1. INTRODUCTION

Asthma is a condition where airways thin and swell and produces additional mucus. This can make breathing troublesome and trigger coughing, wheezing and brevity of breath. For certain individuals, asthma is a minor aggravation. For other people, it may be a significant issue that interferes with everyday exercises and may prompt a dangerous asthma assault. Asthma can't be relieved, however, its side effects can be controlled. Since asthma regularly changes over time, it's significant that you work with the primary care physician to follow the signs and side effects and alter treatment as needed. Asthma signs and indications include:

- Shortness of breath.
- Chest tightness.
- Trouble dozing brought about by brevity of breath, coughing or wheezing.
- A whistling or wheezing sound when breathing out (wheezing is a typical indication of asthma in kids).
- Coughing or wheezing assaults that are exacerbated by a respiratory infection, for example, a cold or season's flu virus.

Signs that your asthma is likely intensifying include:

- Asthma signs and side effects are frequent and vexatious.
- Increases trouble breathing (quantifiable with peak flow meter).
- The need to utilize a quick-relief inhaler is often.

In India, 3-38% of children and around 2-12% of the adult population are affected by it, with a national burden of this disease estimated to be at 18 million (Cavkaytar & Sekerel 2014; Jindal et al. 2012). In India, it is found more prevalent in females as compared to the male population. The condition is known to increase with age in rural areas because of the use of wood and coal as a fuel for cooking (Salvi et al. 2014). Another reason attributed to asthma is the family history of smoking habits. In India, 3-38% of kids and around 2-12% of the adult population are influenced by it, with a national abundance of this illness evaluated to be at 18 million (Cavkaytar and Sekerel 2014; Jindal et al. 2012). In India, it is discovered increasingly common in females when contrasted with the male population. The condition is known to be increment with age in provincial regions on account of the utilization of wood and coal as a fuel for cooking (Salvi et al. 2014). The other part of the population gets affected due to the increase in pollution. Another explanation credited to asthma is the family ancestry of smoking propensities. Traditional systems of asthma management include adherence to the intake of recommended drugs including both preventive and emergency prescription, avoidance of analyzed triggers in the surroundings, periodical pneumonic function self-appraisal and periodical check at the medical specialist for assessment of the level of control. The important purpose of this challenge work is to build up an adaptable system portrayed with low-cost sensing nodes that assure robust and continuous monitoring of bronchial asthma motive components. Hypersensitive reaction is an incessant situation that affects most of the teenagers. It is a circumstance that requires an interminable

checking of the side outcomes for you to deliver a useful course of remedy. It moreover requires thorough adherence to the drugs as recommended by the physician. However, these studies expect to build up a framework, which is based on periodical statistics gathered through the numerous sensors. The proposed work is hooked up with an ATmega328 microcontroller and numerous sensors, Temperature, humidity, and the gas sensor for gathering, sending and accepting information from the sensors to the external servers. The architectural configuration expects to offer an increasing number of convenient accesses to information and services, higher patient healthcare services, and fast response by the use of the scientific medical institution if there arises an occurrence of an asthma attack. These framework authorizations to build up connections among air quality parameters and the presence of respiration ailments, such as bronchial asthma as a phase of the ecological prescription technique. After being treated the statistics and depending upon the outcomes received, the messages will be displayed if their range is beyond the required limit. In this way, the self-control system is meant for the asthmatic affected person. So it is highly effective for the patient as they can monitor their asthma trigger factor level at their residential place. Individuals in towns having their financial problem then for them the framework may be installed to the central clinic that can profit them to research their asthma trigger factors on the community region.

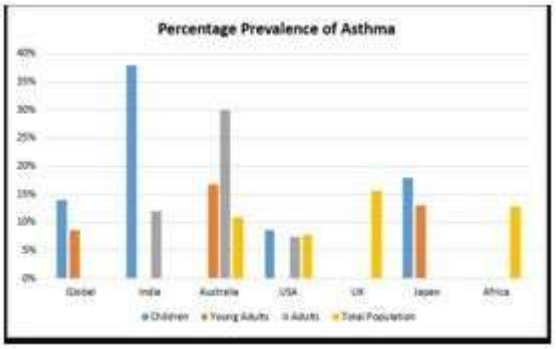

Fig – 1: Percentage Prevalence of Asthma

2. RELATED WORK

Anza (1997) discusses using the Holter system for recording the cardio activities of cardiovascular sufferers. Those structures cannot be used out of hospitals additionally. Those structures are not able to transmit records robotically to medical doctors under strange situations. Jimena Rodfguez (2005) designs the tracking machine that performs an entire ECG evaluation close to the affected person. The steps observed to build an ECG beat and rhythm classifier for PDA are given. The consequences obtained are proven relatively better than the previous methods. Chen (2007) offers a system for non-stop monitoring of sufferers with cardiovascular disease even when these sufferers are out of hospitals. The machine permits instant reaction and takes care of the affected person as information is transmitted with the cell telephone. The mobile telephone is embedded with the ECG processing algorithms that hit upon an irregular coronary heart rhythm in actual-time. Sing-Hui Toh (2008) describes a strong healthcare monitoring and control system with ECG, blood pressure and blood glucose sensors. The structure helps a cell health care system. Kho (2005) proposes a Wi-Fi affected person tracking device with the use of the Bluetooth era. The work discusses lead ECG sensors and transmission of records obtained through a Bluetooth wireless hyperlink. Shenoy (2005) proposes a portable tele monitoring gadget, which captures the air pleasant situations from the school districts the use of low value, low power, wearable electronics to a computer or a transportable laptop. The author targets to observe the readings obtained from the sensors, system the facts, and raise an alarm if the amount of bronchial asthma triggers rises beyond the taken into consideration protection region. Tae-Jung Yun, Hee Rin Lee Rosa, Hee Young Jeong, I. Arriaga Gregory, D. Abowd (2010), suggest that the severity of asthma impacts the way that technologies are utilized. Thus, pervasive computing applications can assist families and pediatric patients by bridging gaps between user's needs and their practices based on the severity of asthma and other contextual factors. Preeti Chandra, D. M. (2013, May), The indoor air quality is measured by the environment to provide a continuous stream of information for control of building automation systems. This low power sensor network design provides vital AQI(Air Quality Index) information and hazardous conditions even without grid power for a time interval. Then the results are revealed to the domestic indoor air quality may be extremely different compared.Teixeira, A. F., & Postolache.O (2014, May), It presents a web information system and a wireless sensor network for indoor or alfresco air quality monitoring with application in asthma trigger factors assessment. The major aim of the project to target has mentioned the development of an adjustable of the system characterized by low-cost sensing nodes that assure robust and perpetual monitoring of air conditions to obviate the asthma attacks. Chinazunwa Uwaoma and Gunjan Mansingh(2015), presented the application situation where a cell phone is utilized to identify and quantitatively list early indications of an asthma assault activated by exercise. The microphone in the cell phone records the client's breath sound while movement sensors-accelerometer, gyroscope, and advanced compass give estimations on the degree of force of action and stance changes. The structure and

fundamental outcomes show that utilizing just implicit sensors in smartphones, mobile phones can adequately screen the health status of patients with long term respiratory conditions, especially in asthma.

3. PROPOSEDWORK

A suitable method for the detection of asthma triggers has been proposed to help identify the factors that cause asthma in a particular person. To Attribute asthma as indicated by creating a serious impact of asthma, in various cases like carbon dioxide to find the dust induced asthma in humans as the air quality.in major cities are critical person consuming such low air quality index subject toward peak flow meter is noted asthma. Hence the harmful level of AQI needs to be monitored. Concentrations of various gases like carbon monoxide and smoke have been recorded and with the standard Air Quality Index (AQI) as a reference, harmful levels are obtained. If the recorded concentration levels are deemed to be harmful, the user is alerted via an android app to display data. In this system, we monitor and detect the asthma trigger factor, through sensor and microcontroller. Initially, the power supply gets converted from 230v AC to 12V DC. After that, the microcontroller ATMEGA 328 needs a 5 voltage DC power supply, so 7805 regulators regulate the 12V to 5V. The microcontroller ATMEGA 328 interface with LCD, Buzzer, temperature, humidity and CO sensor. The analog sensor gets connected at C0, C1, and C2 Pins of the microcontroller. LCD interface with port D pins. The Bluetooth is connected to the TTL port of the ATMEGA 328.

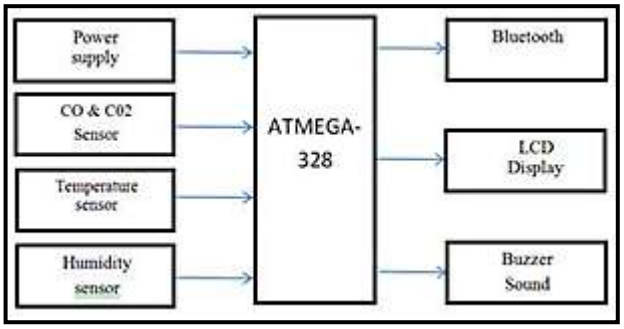

Fig -2: Block Diagram of Proposed Work

The system work focused on two cases:

Case 1: The system tracks the temperature of the surrounding area when it becomes subjected. If the temperature comes to the critical value, the water vapor level in the air also varies. The system identifies the critical value of the temperature sensor and the humidity sensor indicates the asthmatic conditions to the person commonly.
Case 2: The availability of CO and CO2 gases are estimated by these sensors. The algorithm to trigger within the case(1) and case(2) is to be tracked by this sensor. The alerting message is sent to the patient through the Bluetooth device that helps the asthma patient to move away from the place.

In the purpose of Zigbee and Bluetooth: Zigbee is used in a much-embedded application, requiring low data rates. Though Zigbee provides a larger coverage area, it fails in terms of reliability but specifically Bluetooth connecting the devices such as mobile phones, etc. In the case of Bluetooth, they provide a short coverage area, they are reliable and cost-effective. The result obtained is shown in figure 2, where the connections of the components are made.

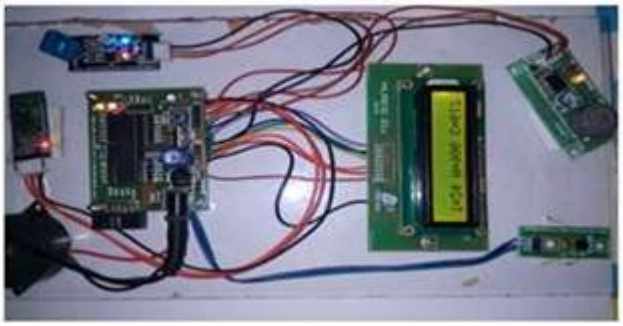

Fig -3: Circuit Diagram

In the older system, the monitored results are provided to health care stations where they used the Zigbee module for long-distance communication. In our system, the Bluetooth module is helpful to send the monitored data to the smartphones w here it maintains the records for future purposes. The development of this system is characterized by the sensor nodes that ensure accurate and reliable measurement. The device is compact, user-friendly and can be powered by a power bank.

4. RESULT

This is one of the efficient strategies to monitor the air first-rate parameters which can trigger an asthma attack. As the principle goal of this system is to monitor the air high-quality parameter, this has been applied to monitor temperature, humidity, and gas molecule particles present within the air.

Table -1

Temperature sensor (degree)	Humidity sensor (%)	Alert
28	73	√
29	69	X
29	65	x

Table -2

Co(ppm)	Co2(ppm)	Alert
183	280	√
246	328	√

Table -3

Temperature	Humidity	Co	Co2	Alert
28	73	183	280	√
29	69	328	328	√
29	65	100	110	x

In this, the result is obtained by checking the first two sensors, one is a temperature sensor and the other is a humidity sensor. If the two sensor values seemed to be high (following table 1) at that time buzzer sound will be produced. In this case, if any of the sensor values are low then the alert will not be present. The carbon monoxide and carbon dioxide gas sensor values are checked (following table 2) and if any one of these values is deemed to be high the buzzer sound will be produced for alerting. Thus the microcontroller works (following table 3) with these sensors and alerts the users via buzzer sound.

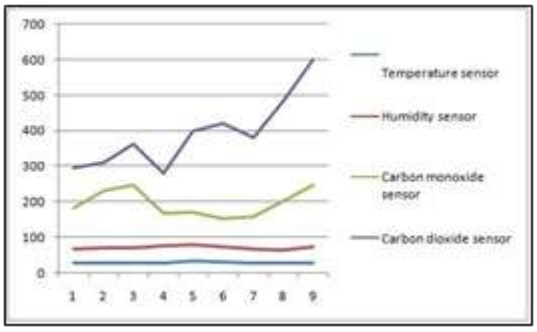

Fig -4

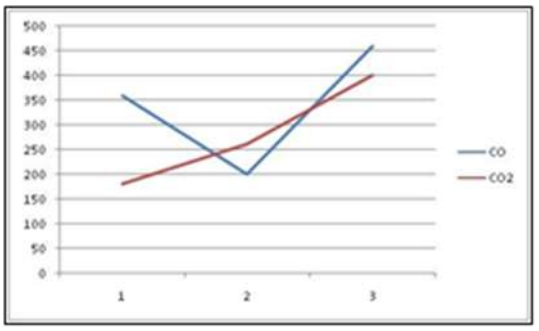

Fig -5

This graph is represented by the sensor's values (figure 4) .If both the temperature and humidity sensor values are true or the gases Carbon monoxide and carbon dioxide values are true. It will be compared with the other two sensor values. It will generate an alert message to display an LCD Board and the buzzer sound rings.

5. CONCLUSION

Asthma has been perceived as one of the most common assiduous diseases with an elevating occurrence. The key to prosperous control of asthma is preserving it in the diagnosed state. Traditional strategies of home control by utilizing peak flow meter and paper-diaries depend upon user participation and are failing to offer objective data in instances of asthmatic assaults. An opportunity technique of perpetual tracking of the affected person's surroundings and physiological functions has been reviewed. The sensor detects the environmental condition and sends the records to the AT-mega controller where based on the values it intimates the people regarding the environmental situation. If the extortionate-value of CO and moisture levels are detected then it provides a buzzer sound thereby show off the values in LCD and provide facts in the android app. The transformation of the data takes place through Bluetooth.

REFERENCES

[1] J Postolache, O. A., Pereira, J. D., & Girao, P. S. (2009). Smart sensors network for air quality monitoring applications. IEEE Transactions on Instrumentation and Measurement, 58(9), 3253-3262.
[2] Postolache, O., Girao, P., Pereira, M. D., Ferraria, G., Barroso, N., & Postolache, G. (2009, May). Indoor monitoring of respiratory distress triggering factors using a wireless sensing network and a smart phone. In 2009 IEEE Instrumentation and Measurement Technology Conference (pp. 451-456). IEEE.
[3] Masoli, M., Fabian, D., Holt, S., & Beasley, R. (2010). Global burden of asthma, medical research institute of New Zeland. New Zeland: Wellington. OpenURL.
[4] Lee, J. S., Su, Y. W., & Shen, C. C. (2007, November). A comparative study of wireless protocols: Bluetooth, UWB, ZigBee, and Wi-Fi. In IECON 2007-33rd Annual Conference of the IEEE Industrial Electronics Society (pp. 46-51). IEEE.
[5] Preethichandra, D. M. (2013, May). Design of a smart indoor air quality monitoring wireless sensor network for assisted living. In 2013 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) (pp. 1306-1310). IEEE.
[6] Teixeira, A. F., & Postolache, O. (2014, May). Wireless sensor network and web based information system for asthma trigger factors monitoring. In 2014 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings (pp. 1388-1393). IEEE.
[7] Venkataramanan, R., Thirunarayan, K., Jaimini, U., Kadariya, D., Yip, H. Y., Kalra, M., &Sheth, A. (2019). Determination of Personalized Asthma Triggers From Multimodal Sensing and a Mobile App: Observational Study. JMIR pediatrics and parenting, 2(1), e14300.
[8] Morrison, D., Mair, F. S., Yardley, L., Kirby, S., & Thomas, M. (2017). Living with asthma and chronic obstructive airways disease: Using technology to support self-management–An overview. Chronic respiratory disease, 14(4), 407-419.
[9] Tinschert, P., Jakob, R., Barata, F., Kramer, J. N., &Kowatsch, T. (2017). The potential of mobile apps for improving asthma self-management: a review of publicly available and well-adopted asthma apps. JMIR mHealth and uHealth, 5(8), e113.
[10] Chu, H. T., Huang, C. C., Lian, Z. H., & Tsai, J. J. (2006, June). A ubiquitous warning system for asthma-inducement. In IEEE International Conference on Sensor Networks, Ubiquitous, and Trustworthy Computing (SUTC'06) (Vol. 2, pp. 186-191). IEEE.