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SMART WEARABLE AND MONITORING SYSTEM FOR ASTHMA PATIENTS

Sharanu[1], Vasureddy[2], Thanuja G[3], Tejaswini V[4], Smt. Vrunda Kusanur[5]

[1, 2, 3, 4]*Department of Electronics and Communication, BNMIT College of Engineering, Bangalore.*
[5] *Assistance Professor BNMIT College of Engineering, Bangalore.*

Abstract - *Internet of Things (IoT) which could be a network supported the physical systems within which it may be exhibited within the type of a typical embedded system including electronic devices like sensors. The connectivity of the network which may be enabled by these objects for exchanging and collecting data. Asthma may be a lifetime chronic disease initiating to abnormal viscus functions and problem in breathing. Regarding 350 million individuals, that's similar to one in every twelve adults, suffer from respiratory disease worldwide. Self-monitoring is that the preliminary course of action to observe, treat and manage the chronic un-wellness. Self-monitoring together helps physicians and patients to possess management over real-time observance and to provide on-time treatment. Classical spirometer take a glance at is presently the best because of diagnosing the severity of internal organ functions and their response to treatment, however, it needs superintendence. To help the people that are affected we had designed a tool to perform their regular activities. With the assistance of the sensors like dust, temperature, humidity and barometer, the info has been collected so it's uploaded to the cloud for further analysis. The information uploaded within the cloud are going to be received by a concerned doctor or the caretaker of the patient.*

***Key Words*: Ardunio, asthma, sensors, load cell, zig-bee, Wi-Fi-module, IOT-communicator.**

1. INTRODUCTION

Asthma could be a chronic condition or disease that causes inflammation and narrowing of the bronchial tubes, the passageways that allow air to enter and leave the lungs, making it harder to breathe. If people with asthma are exposed to a substance to which they're sensitive or a situation that changes their regular breathing patterns, the symptoms can become more severe. In line with the newest World Health Organization (WHO) estimates, approximately 250 million people suffer from asthma worldwide, and almost 25 million Americans are affected by this disease in line with AAFA, This disease may be a public ill health in both rich and poor countries. Although there's no cure for asthma, effective treatments are available. The most effective thanks to manage asthma is to avoid triggers, take medications to stop symptoms.

Asthma is characterized by episodic respiratory symptoms and intermittent exacerbations. The symptoms, airflow obstruction, and exacerbations in asthma vary greatly in both frequency of occurrence and severity. Monitoring these events is crucial to the care of patients with asthma and is directed at the first detection of exacerbations and monitoring of the day-to-day control of asthma. Monitoring can even be extended to analyze reasons for poor control and reasons for exacerbations, like noncompliance and exposure to triggers. It's important to spot who will perform the monitoring because this has implications for the sort of information that are collected, their validity, and their accuracy. Asthma may be monitored by the subsequent people:

• The patient with asthma because self-monitoring allows the first detection of exacerbations;

• The treating physician to assess control of asthma and investigate reasons for poor control; and

• Health care managers to assess the standard and price of take care of patients with asthma

2. PROPOSED SYSTEM

The Asthma Monitoring System is intended around a microcontroller for gathering, sending and receiving information from different sensors and external servers. The aim of the architecture design is to supply a neater access to information and services, better patient healthcare services, transparent and efficient use of healthcare resources, and a quick response by the hospital side just in case of respiratory illness. Symptoms may be prevented by monitoring factors which might trigger bronchial asthma. So it's pretty much needed that there should be a system which might monitor air parameter on regular basis and warn the patient when these factor can trigger their respiratory illness.

A conveyable system for non-invasive diagnosis of Broncho pulmonary diseases and continuous monitoring of the patient's condition may be a combination of two compact modules radiating and receiving, located on the side of the

chest and back, respectively. The position of every module is fixed and doesn't change over time. The fixation point of the modules is decided supported the individual characteristics of the patient's body.

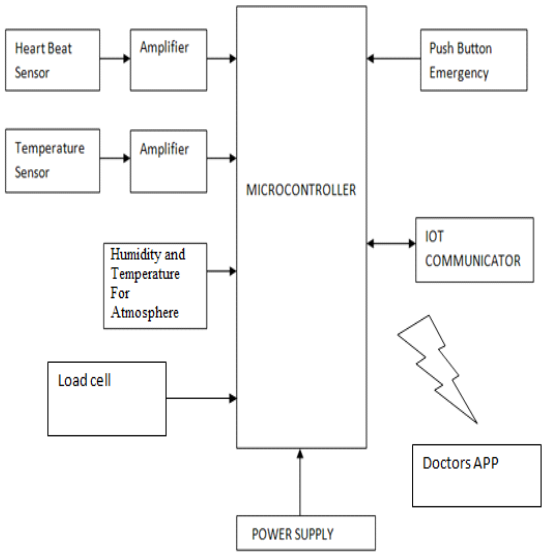

Fig -1: Block diagram

2.1 METHDOLOGY

The described individual system can be useful for continuous express monitoring of the condition of a person suffering from bronchial asthma during the day and warning him about the need to take medicine. In addition, it can be useful in medical institutions for monitoring the condition of a patient in hospital, and monitoring the effects of drugs. Overall, there are 2 devices that comprise the model.

- First device is the "**Asthma Inhaler**", it has the following features:
- **Medicine monitoring**: When the medicine in the Inhaler comes down to a certain 'threshold' it warns the patient and sends a warning through the app.

- **Smoke/Gas/humidity/temperature detection:** Breathing CO, methane and hydrogen are dangerous for the asthmatic patients. Alcohol is also on the list.

- **Total usage tracking**: The inhaler not only keeps a track of no. Of times the device was used, it also updates the doctor through the mobile application.
- The second device is the "**Portable device**". It has the following features:

1. **Temperature and pulse rate detection of the patient:** If there are any abnormalities in factors then a warning is sent to the family members and the doctor through the app.
2. **An emergency push button**: In case of any emergency, this push button can be used to notify all the app users and the location of the patient is sent through the inbuilt GPS module.

Fig -2: Portable wearable device model

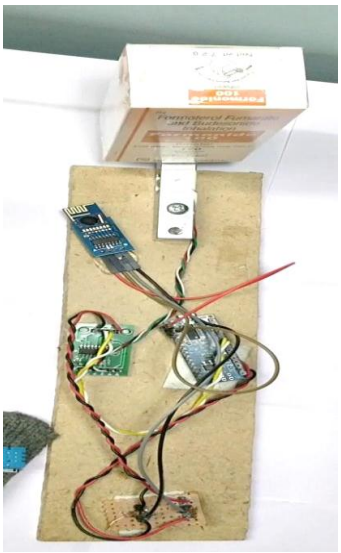

Fig -3: Load cell device

3. HARDWARE REQUIRMENTS

3.1 Ardunio Nano –Microcontroller

The Arduino NANO is an open-source microcontroller board supported the Microchip ATmega328P microcontroller and

developed by Arduino. The board is provided with sets of digital and analog input/output (I/O) pins which will be interfaced to numerous expansion boards and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a sort B USB cable. It are often powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts.

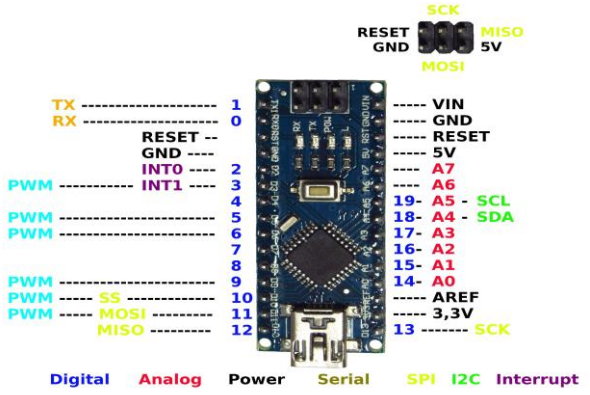

Fig -4: Ardunio Nano-Microcontroller

3.2 Temperature sensor (LM35)

LM35 temperature sensor could be a temperature measuring system having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases. The range is about -55 °C to 150 °C.

3.3 Humidity sensor (DHT11)

The DHT11 could be a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to live the encircling air, and spits out a digital signal on the information pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data.

Dry and humid air can cause bad flare-ups (coughing, vomiting, etc.). It's necessary to avoid air below 40% humidity. Air as humid as 55% is troublesome, with 60% becoming dangerous for the asthmatic patients. Humidity is a vital contributor, therefore the patient should be very cautious from these conditions.

3.3 Smoke sensor

A smoke detector could be a sensor that detects smoke as a primary indication of fireplace. We want to passively and unobtrusively monitor the asthma patient's environment to detect the presence of two asthma-exacerbating activities: smoking and cooking using the Foobot sensor. We propose a data-driven approach to develop an eternal monitoring-activity detection system aimed toward understanding and improving indoor air quality in asthma management. It's accustomed detect a high concentration of stuff, volatile organic compounds, and greenhouse gas during cooking and smoking activities. Breathing CO, methane and hydrogen are dangerous for the asthmatic patients. Alcohol is additionally on the list.

3.4 Pulse sensor

The sensor employed in this project is TCRT1000, which may be a reflective optical sensor with both the infrared radiation emitter and phototransistor placed side by side and are enclosed inside a leaded package so there's minimum effect of surrounding actinic radiation. During this project the heart beat sensor is employed to observe the guts beat rate of the patient and it'll be updated continuously.

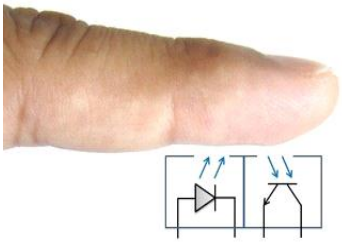

Fig -5: Basic reflectance PPG probe to extract the pulse signal from the fingurestrip

3.5 Load cell

A load cell may be a transducer that measures force, and outputs this force as an electrical signal. Most load cells use a strain gage to detect measurements, but hydraulic and pneumatic load cells also are available. In this project the load cell is used to measure the weight of the medicine.

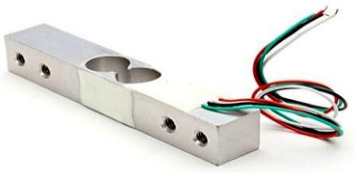

Fig -6: Load cell

3.6 Push button

A push-button could be a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is typically flat or shaped to accommodate the human finger or hand, so on be easily depressed or pushed. In this project the push button acts as emergency button. If the patient is in abnormal condition then that time

he can use the push button, once he pressed the button a message will be sent like the "patient is abnormal" to the doctors and family members.

4. COMMUNICATION MODULES

4.1 Zig-bee Module

Zig-bee communication is specially built for control and sensor networks on IEEE 802.15.4 standard for wireless personal area networks (WPANs), and it's the merchandise from Zigbee alliance. This communication standard defines physical and Media Access Control (MAC) layers to handle many devices at low-data rates. These ZigBee's WPANs operate at 868 MHz, 902-928MHz and a pair of.4 GHz frequencies. ZigBee is low-cost and low-powered mesh network widely deployed for controlling and monitoring applications where it covers 10-100 meters within the range. This communication system is a smaller amount expensive and simpler than the opposite proprietary short-range wireless sensor networks as Bluetooth and Wi-Fi.

In this project there are two parts one is hand gloves part and another one is load cell part , in the both the parts we are using zigbee module to communicate and share data between these two parts.

4.2 Wi-Fi-Module (ESP8266)

The ESP8266 WiFi Module may be a self-contained SOC with integrated TCP/IP protocol stack which will give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. This module incorporates a powerful enough on-board processing and storage capability that permits it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

5. EXPERIMENTAL RESULTS

The portable wearable device is used for following:

- Detect the surrounding humidity and temperature.
- Detect the patient's heat pulse.
- Detect the patient's body temperature.
- Detect Surrounding air parameters.
- Communication with doctors and clinicians to correlate potential asthma symptoms and exacerbation reports from patients with environmental factors without having to personally be present using zig-bee and Wi-Fi module.
- Push button acts as alarm button to notify the doctor and the emergency contact of the patient.

The load cell device is used for following:

- Calculate the weight of the inhaler.
- Communicates with the wearable device to correlate potential asthma symptoms and exacerbation reports from the patient's inhaler.
- Calculates how often the patients consume the medicine.

We interfaced both the parts using the communication module Zig-bee, for both the parts we can obtain the result in the serial monitor. We can also see the output in the Blink and the telegram application for the doctor, patient and family purpose.

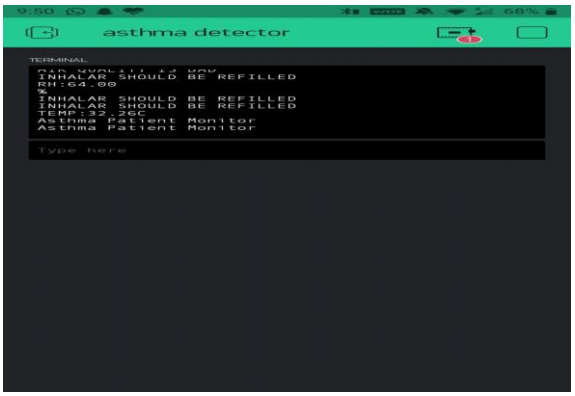

Fig -7: Result obtained on Blink Application

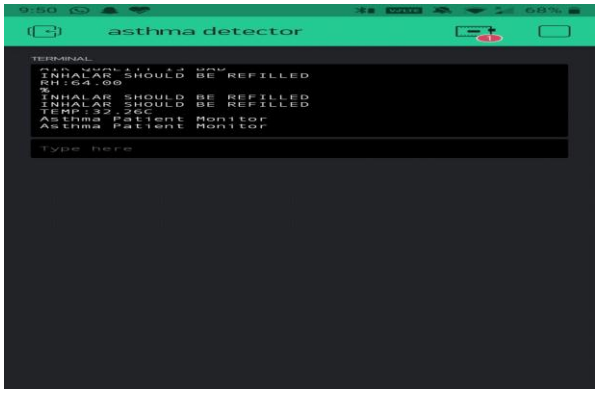

Fig -8: Result obtained on Blink Application

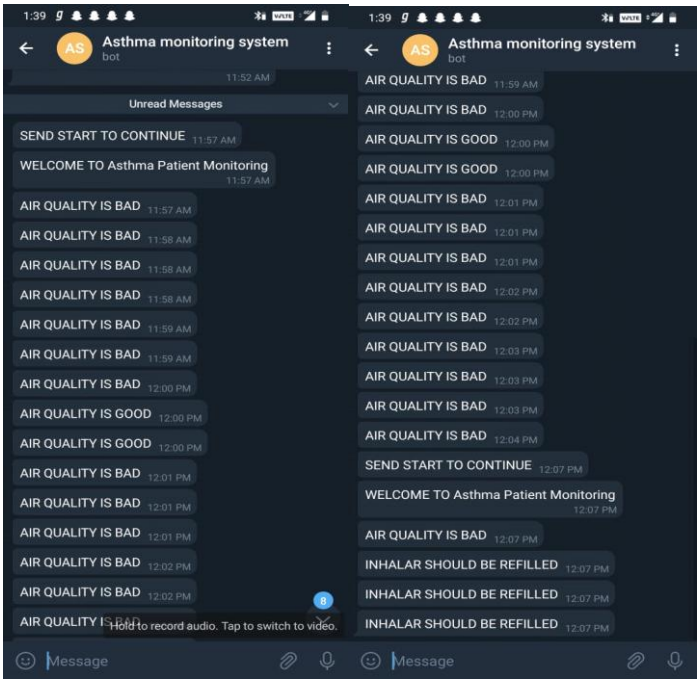

Fig -9: Results obtained on Telegram Application

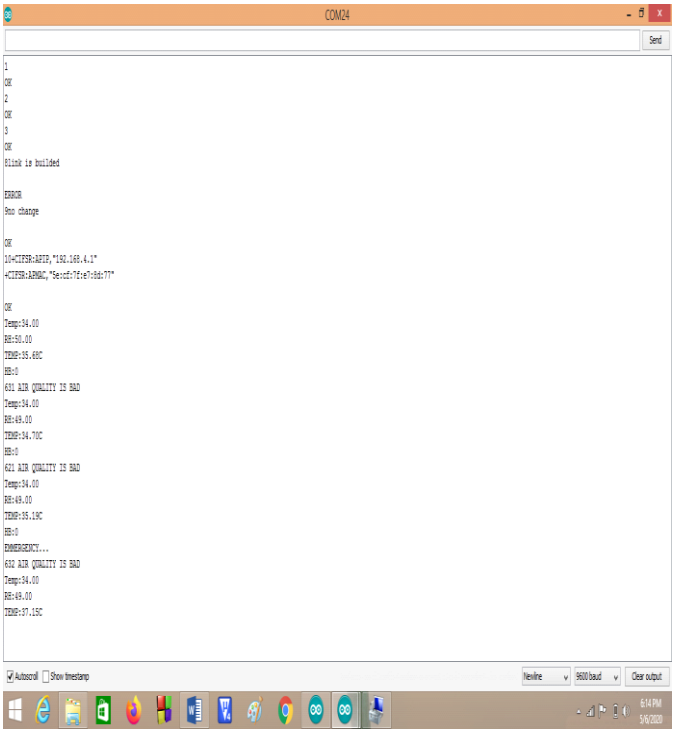

Fig -10: Result obtained on Serial Monitor in Ardunio IDE from PC

6. CONCLUSIONS

When the engineer will design a replacement product he must study everything associated with his idea to avoid its errors and he must interest to introduce top quality, low cost, high accuracy, small size and straightforward to use product, then he should take customers opinions and suggestions to enhance his skills within the next design. Thus, this paper discusses the prospects for introducing a conveyable system for diagnosing respiratory disease. A diagram of the system is presented on the idea of an inexpensive patient status sensor together with a conveyable data processor - a smartphone, tablet, etc. Such a structure will significantly reduce the value of the device, which is able to contribute to its wider distribution. Because the main method of state control, it's proposed to use the strategy of measuring the transmission coefficient of the microwave signal through the patient's chest. During this case, measurements are dispensed at one point, except for an extended time, as an example, when the device is continuously worn during the day. The benefits of using microwave technologies allow us to use the proposed structure to observe the condition of patients of all age groups, including young children. The combination of additional sensors for the patient's vital activity and therefore the state of the environment, along with the employment of contemporary IT technologies, will enable the creation of a comprehensive system for monitoring the patient's condition and informing him of the mandatory actions during a timely manner.

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