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Early Chronic Pulmonary Diseases Prediction System

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Abstract: *Smart breath analyzers are developed as sensing terminals of a telemedicine architecture devoted to remote monitoring of patients suffering from Chronic Obstructive Pulmonary Disease (COPD). The devices based on different sensors CO2, smoke sensor and Volatile Organic Compounds (VOCs), relative humidity and temperature (R.H. & T) and heart rate, respiration sensors) monitor the breath air exhaled into the expiratory line of the bi-tube patient breathing circuit. The sensor raw signals are transmitted to national health service units / Doctor by TCP/IP communication through a cloud remote platform using IoT module space.The work is a proof-of-concept of a sensors-based IoT system with the perspective to predict continuously the effectiveness of monitoring and/or any state of exacerbation of the disease requiring healthcare. By a gas-mixing bench towards gas, smoke in environment and acetone concentrations in exhaled breath collected in a sampling bag were carried out to test the realized prototypes. The paper reports on the longitudinal use of health tags among high- risk COPD patients in the indoor & outdoor environment using PIC16F877A microcontroller.*

Key Word: *Chronic Obstructive Pulmonary Disease (COPD); exacerbation ; Buprenorphine; Nalbuphine; Postoperative.*

I.INTRODUCTION

E-Health systems, together with smart sensor devices that allow real-time monitoring of relevant clinical parameters at home, are considered a promising approach to the prevention and treatment of respiratory diseases. Although the respiratory rate is a vital sign of special importance in the context of the monitoring and follow-up of respiratory diseases, especially to avoid dangerous situations in critically-ill patients, it is still considered as the most neglected vital sign[1]. However, it could indicate a variety of pathological conditions in respiratory diseases, like COPD or sleep apnea, but also in cardiovascular and metabolic disorders. The respiratory rate has been used to anticipate dangerous events such as cardiac arrest, to classify patients in intensive care units and to predict complications or exacerbations in patients with cardiopulmonary diseases[2]. It is an essential parameter for the monitoring of postoperative patients and for the detection of apnea or hypopnea events in pathologies related to sleep disorders. Wearable Health Devices (WHDs) are increasingly helping people to better monitor their health status both at an activity/fitness level for self-health tracking and at a medical level providing more data to clinicians with a potential for earlier diagnostic and guidance of treatment. The technology revolution in the miniaturization of electronic devices is enabling to design more reliable and adaptable wearables, contributing for a world-wide change in the health monitoring approach. In this paper we review important aspects in the WHDs area, listing the state-of-the-art of wearable vital signs sensing technologies plus their system architectures and specifications.

II.MATERIALS AND METHODS

The PIC microcontroller transmit and receive the data with respect to clock pulses, the PIC microcontroller operates with 4MHz crystal frequency. Two capacitors are connected to the crystal oscillator with range of 20pf to 40pf which is used to stabilize the clock signals. At some times, the PIC microcontroller goes to block state or missing time calculation, at that time we need to reset the microcontroller. If a microcontroller is reset for 3sec time delay, 10k resistor and 10uf capacitor are connected to the respective pins.The 5v DC supply is given to the 11 pin of the microcontroller which drives the circuit[3]. The crystal is connected to the 13 and 14 pins of the microcontroller. The reset circuit is interfaced at 1 pins of the microcontroller. In this system, we use serial communication to communicate between the PC and IOT module with PIC microcontroller using USB to UART converter[4]. The PIC microcontroller RX (RC7) pin connected with PC TX pin as well as IoTmodule RX pin with help of driver relay circuit.

Hardware Components

A. Gas sensor

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. A basic gas sensor has 6 terminals in which 4terminals (A, A, B, C) acts input or output and the remaining 2 terminals (H, H) are for heating the

coil. Of these 4 terminals, 2 terminals from each side can be used as either input or output (these terminals are reversible as shown in the circuit diagram) and vice versa. Vcc – Power supply. GND – ground supply, Digital output – This pin gives an output either in logical high or logical low (0 or 1) that means it displays the presence of any toxic or combustible gases near the sensor. the output of a gas sensor alone will be very small (in mV) so an external circuit has to be used in order to get a digital high low output from the sensor[5].

B. Heartbeat sensor

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat[6]. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate and heart beat is interfaced with RB3. Connect regulated DC power supply of 5 Volts to sesnor. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply. These wires are also marked on PCB. To test sensor you only need power the sensor by connect two wires +5V and GND. You can leave the output wire as it[7]. When Beat LED is off the output is at 0V. Put finger on the marked position, and you can view the beat LED blinking on each heart beat. The output is active high for each beat and can be given directly to microcontroller for interfacing applications.

C. Respiratory Sensor

First Sensor develops and manufactures highly reliable sensors and customized sensor systems as a strategic partner to medical product manufacturers in the area of breathing and respiration. The first step in this process is breathing in air, or inhaling[8]. The taking in of air rich in oxygen into the body is called inhalation and giving out of air rich in carbon dioxide from the body is called exhalation. The second step is gas exchange in the lungs where oxygen is diffused into the blood and the carbon dioxide diffuses out of the blood. The third process is cellular respiration, which produces the chemical energy that the cells in the body need, and carbon dioxide. Finally, the carbon dioxide from cellular respiration is breathed out of body from the lungs[9].

D. Humidity Sensor

A humidity sensor also called a hygrometer, measures and regularly reports the relative humidity in the air. They may be used in homes for people with illnesses affected by humidity as part of home heating, ventilating, and air conditioning (HVAC) systems; and in humidors or wine cellars. Humidity sensors can also be used in cars, office and industrial HVAC systems, and in meteorology stations to report and predict weather A humidity sensor senses relative humidity. This means that it measures both air temperature and moisture[10]. Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold. The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature.

E. IOT Module

The In this system, we use serial communication to communicate between the PC. The PIC microcontroller TX (RC7) pin connected with PC RX pin as well as IOT module RX pin with help of driver relay circuit. we present the experimental results obtained from the implemented device prototype. The heart pulse sensor, temperature sensor, respiration sensor,humidity sensor,rate are transmits data to the PIC (16F877A) microcontroller[11]. The microcontroller processed the data and sends it to the LCD screen for display. The data are then transmitted to the ESP8622 WiFi module and from there it is then transmitted to the cayenne IoT platform through a well-established internet connection and which is further designed in a way that physicians can view patient's vital sign reading in real-time irrespective of their geographical location.**ESP-12E** is a miniature **Wi-Fi module** present in the market and is used for establishing a wireless network connection for microcontroller or processor[12]. The core of ESP-12E is **ESP8266EX,** which is a high integration wireless SoC (System on Chip). It features ability to embed Wi-Fi capabilities to systems or to function as a standalone application.

III.RESULT

This study focuses on the factors that characterize the classifying of asthma, COPD and healthy control with PIC16F877A controller for early prediction and diagnosis of pulmonary diseases. Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disease that affects the lung function of an individual. It is characterized by symptoms such as shortness of breath, coughing, wheezing, and chest tightness. In recent years, there has been a growing interest in using sensor technology and the Internet of Things (IoT) to monitor and predict the occurrence of COPD exacerbations. A respiration sensor can be used to monitor the breathing rate and pattern of the patient. A heart rate sensor can be used to monitor the heart rate of the patient. Changes in the heart rate may be indicative of an impending exacerbation. A humidity sensor can be used to monitor the humidity level in the patient's environment. Changes in humidity levels can affect the respiratory function of the patient high humidity levels may increase the risk of exacerbations.The data collected from the sensors can be transmitted to a cloud-based platform using the technology.

Fig 1 Copod Kit

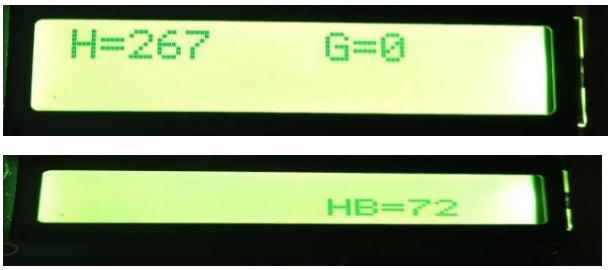
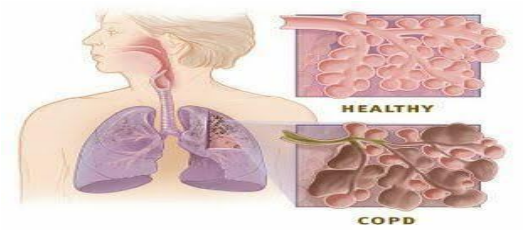
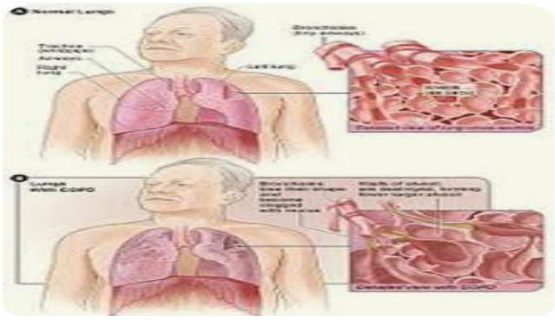


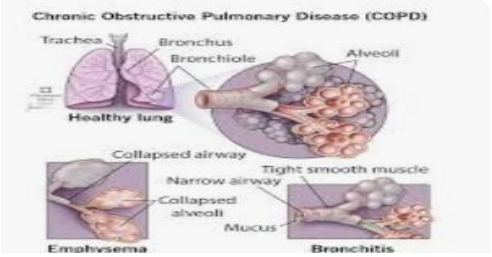
Fig 2 LCD Display Output

IV.CONCLUSION

Lung Diseases as Chronic Obstructive Pulmonary Disease (COPD), lung cancer, pneumonia, and asthma are considered as genuine well being difficulties and one noteworthy reason for death in both developed and developing nations. Specialists affirmthat the prior an illness is analyzed and classified, the higher is the chances of patient cure. In this situation, using a combination of respiration sensors, heart beat sensors, humidity sensors and IoT technology can be an effective way to predict the occurrence of COPD exacerbations. By collecting and analyzing data in real-time, healthcare providers can detect changes in a patient's respiratory rate, heart rate, and environment that may be indicative of an impending exacerbation. This early warning can allow for timely intervention and treatment, improving patient outcomes and reducing the burden on healthcare systems.However, it is important to note that this approach requires a reliable and secure IoT infrastructure, as well as machine learning algorithms that can accurately analyze the data collected from the sensors. It is also important to ensure that patient privacy is protected and that patients have control over their data.the use of sensor technology and IoT in COPD prediction is a promising area of research, with the potential to significantly improve the lives of COPD patients and reduce healthcare costs.







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