SPIROMETER BASED SMART DIAGNOSE OF WHEEZING AND TREATMENT USING NEBULIZER

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Abstract: Chronic respiratory diseases are airway and other lung structure diseases, typically causing breathing difficulty and other symptoms. Chronic obstructive pulmonary disease (COPD) is regarded as one of the most prevalent of respiratory diseases. Spirometer is still the gold standard for diagnosing and staging COPD today. By keeping in mind the fact that this disease may become worse with the passage of time and adversely affect the life of a patient, the patients should perform routine spirometer tests at healthcare facilities or purchase costly and portable equipment to check and control the disease. COPD spirometer is expensive in terms of both money and time. In this paper and owing to the omnipresence and sophistication of Smartphones, we try to leverage their embedded sensors and continually growing computational powers to offer patients a spirometer for diagnosing and treating COPD in a low-cost and reliable way. Typically, the majority of the drug is wasted during the exhalation stage and the patients have to breathe in accordance with the medicine flow which may lead to suffocation. Here the mediate care instead of nebulizer system will get automatically triggered for patient's welfare. Here LDR and LED are utilized to determine the level.

Keywords: *Spirometer, Nebulizer ,Microcontroller(PIC 16F877A),motor unit, Solenoid valve, LCD display, IR sensor, Gas Analyser*

I. INTRODUCTION

Chronic respiratory diseases (CRDs) are a global leading cause of mortality, and among the most common are Chronic Obstructive Pulmonary Disease (COPD). COPD is an irreversible lung disease with airflow limitation, breathlessness, and impaired lung function. Prompt diagnosis and early treatment of COPD are of utmost importance for successful disease control and enhanced patient quality of life. Conventional spirometry is still the gold standard for leveling and diagnosing COPD, wherein the patients have to go to medical centers or spend money on costly portable spirometers in order to get monitored regularly. Such procedures are generally found to be inconvenient, time-consuming, and costly for the patients.With the accelerated pace at which smartphone technology advances, coupling integrated sensors with processing power is a more attractive option to developing cost-effective and practical health solutions. In this study, we outline a smartphone spirometer system through exploiting the ubiquity of mobile phones as a means of presenting a credible and simple COPD monitoring solution. Since the standard nebulizer setups, in which medicine is wasted during exhale, our system provides an auto mediate care feature for maximum drug delivery and patient comfort. The use of Light Dependent Resistors (LDR) and LED sensors also accelerates precise monitoring of medication levels, leading to enhanced COPD control.

These Chronic Obstructive Pulmonary Disease (COPD) involves 12–16 million Americans and is the third highest cause of death. The incidence and mortality from COPD is projected to rise in the decades ahead. COPD is defined by wheeze, breathlessness and cough symptoms. Besides, recurrent flare-ups of illness tend to alter the direction of disease path, resulting in diminished health associated quality of life, accelerated impairment in lung function, decreased capacity to perform functioning and enhanced chances of mortality. It is approximated by World Health Organization that in 2012 ambient air pollution caused a global total of 3.7 million premature mortality and that 14% of these mortality occurrences were linked with COPD or acute lower respiratory infections.

COPD is primarily caused by smoking-induced damage, whereas asthma is caused by an inflammatory response.COPD is a progressive condition, whereas allergic responses of asthma are reversible.Early signs may be indistinguishable in the two conditions, such as shortness of breath, tightness in the chest, wheezing, and cough, which may cause confusion or misinterpretation.Both diseases may present with serious, life-threatening signs and symptoms, for instance, bluish coloration of the skin, and shortness of breath. Death can even ensue.Primary treatments of COPD are bronchodilators, whereas primary treatments of asthma are inhaled corticosteroids whereas primary treatments.

COPD typically occurs after the age of 40 and tends to become a chronic lung function disease. But some of the copd like wheezing can be caused during any age groups.

II. PROPOSED SYSTEM

A. Objectives

- To create a low-cost system that checks lung problems using a smartphone
- To build a device that gives medicine only when the patient inhales, to avoid waste.
- To send health data to doctors in real-time for quick and remote check-ups.
- To help people get treatment in places where they can't easily see a doctor.

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III. COMPONENTS DESCRIPTION

A. MICRO CONTROLLER PIC16F877A

The below given details are general description of PIC16F877A controller. The controller is known as the heart of the entire system which will check for the input and operate the output accordingly.

Here, temperature sensor, dust sensor and 2 motor unit is connected with the controller's analog and digital pins

The collected data of the system will be sent to IOT module through the controller's TX pin

These parameters are transferred over the cloud with the help of node MCU Esp8266

The motor unit will be controlled using digital pins of the controller in order to spray and cleans the panel

Thus, this will improve the efficiency of the panel and produces more voltage

LCD interfaced will be connected with the digital pins of the controller

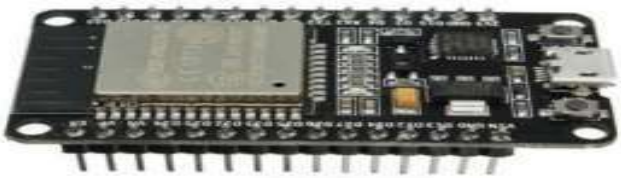

Fig. 2. ESP32 Microcontroller

B. Liquid Crystal Display (LCD)

The This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power

Fig.3. 2x16 Liquid Crystal Display

C. SOLENOID VALVE

The sensor senses the process towards the outlet side of the solenoid valve. When it senses that certain quantity of the flow of the fluid is required, it allows the current to pass through the solenoid valve. Due to this the valve gets energized and the magnetic field is generated which triggers the movement of the plunger against the action of the spring

Fig.4. Solenoid valve

LDR SENSOR The t Light dependent resistors or LDRs are often used in circuits where it is necessary to detect the presence or the level of light. Depending upon the black and white lines drawn on the railway station the LDR sensor will give the different output

Fig. 5. LDR sensor

E. Nebulizer

Nebulizer is a medical device that is most often utilized to administer the medication directly into the lungs of patients suffering from chronic respiratory disease like asthma and COPD

The nebulizer is a device that breaks down liquid medication into a mist or aerosol that is inhaled from a mouthpiece or mask.

Fig. 6. Nebulizer

IV. SOFTWARE DESCRIPTION

a. EMBEDDED C

Embedded C language is used to develop micro-controller based applications.Embedded C is an extension to the C programming language including different features such as addressing I/O, fixed-point arithmetic, multiple-memory addressing, etc. In embedded C language, specific compilers are used.

b. ARDUINO IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Fig. 8. Arduino ide

c. BYLNK APP

Blynk is a cloud platform and an iOS and Android application that allows you to control Arduino, Raspberry Pi and other such boards on the Internet. It's an electronic dashboard where you can build a graphical user interface for your project by a simple drag 'n' drop of widgets. It's Extremely simple to add all this and you'll start hacking within a time span less than 5 mins. Blynk has no connection to any specific board or shield. Instead, it's your preferred hardware to enable it. Whether your Raspberry Pi or Arduino is online through Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready to tackle the Internet Of Your Things.

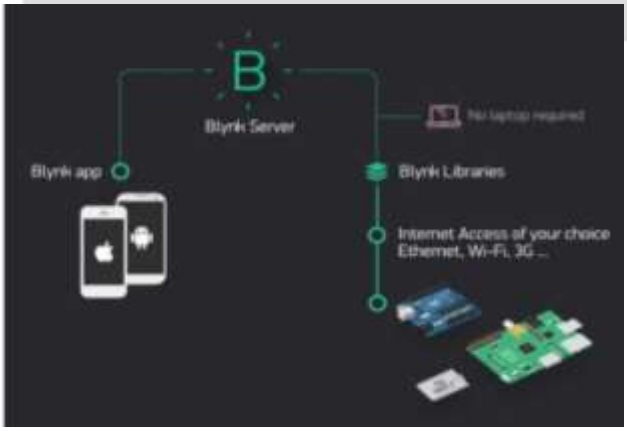

Fig. 9.IOT Signal Processing

V. RESULT:

The output of the various sensors used in this project is received at the control room followed by message indication. successfully wheezing iis diagnosed and the iot based smart therapy using nebulizer is given

VI. OUTPUT

Fig. 10. IOT Output

VII. CONCLUSION

The suggested system was implemented and tested successfully to track COPD symptoms and administer medication in accordance with the patient's respiratory pattern. Through the smartphone's internal sensors combined with an LDR and LED mechanism, the system effectively sensed inhalation and exhalation stages. It was noted that drug delivery was triggered only during the inhalation phase, which resulted in a significant decrease in drug wastage in comparison to standard nebulizer systems.Patients who employed the system reported increased comfort because of the coordination of drug release with their inherent breathing.

VIII. REFERENCES

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