DEVELOPMENT OF IOT BASED CONTINOUS AIR WAY PRESSURE (CPAP) SYSTEM

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Abstract---Constant Positive Aviation route Strain (CPAP) treatment is a typical treatment for people with obstructive rest apnea (OSA). However, traditional CPAP machines lack features like the ability to monitor and track patients in real time. To resolve these issues, this study proposes the improvement of an IOT-based CPAP framework that consolidates sensors and remote availability to give continuous checking and following of patient information. A CPAP machine that can be controlled remotely via a mobile application is included in the proposed system, making therapy management more individualized and convenient. The framework is intended to work on quiet results by giving convenient intercession, further developing adherence to treatment, and lessening the gamble of unfavorable occasions. The proposed IOT-based CPAP system and its potential advantages for OSA patients are discussed in detail in this paper.Keywords: visual phone recognition (vpr) and lip reading

KEYWORDS: Continuous Positive Airway Pressure (CPAP)obstructive sleep apnea (OSA),, visual phone recognition(vpr)

I. INTRODUCTION (ARTIFICIAL INTELLIGENCE)

Sleep apnea is a condition that has parallel connections to the human brain and respiratory system. It indicates breathing difficulties and sleep-related breathing obstructions. Sleep apnea can be divided into two types: obstructive rest apnea (OSA) and focal rest apnea (CSA). Sometimes they occur simultaneously with one another. That is referred to as complex sleep apnea, but it is too uncommon to be classified as a type of apnea. Obstructive rest apnea (OSA) is essentially upper aviation route blockage. It happens because of unwinding of our throat muscles and absence of oxygen going through our nasal-throat entry that causes aggravation in breathing and at times brings about serious difficulties. Although less common, central sleep apnea is more serious than OSA. Every organ and system relies on the directed signal or instruction provided by the human brain, making the central sleep apnea of the brain the primary maintenance center of the body. When the brain fails to send the necessary signals or instructions to the system that controls our sleep, we get central sleep apnea.

Breathing and taking in air. Here, neurons neglect to send signs to the breathing muscle, which stops the breath for a lot of time, perhaps close to 10 seconds . Furthermore, in uncommon cases, the two of them can occur, which is in excess of a crisis clinical treatment issue, and disturbing moreover.

Persistent positive aviation route pressure (CPAP) is the highest quality level of care for gentle to outrageous OSA patients. The airway is opened up by a CPAP machine by increasing air pressure in the throat.

does not collapse when a person breathes in. Good pressure stability and pressure reduction of CPAP therapy are required for easy sleeping. During an obstructive sleep apnea episode, the diaphragm and chest muscles work harder to open the obstructed airway and pull air into the lungs. Breathing usually resumes with a loud gasp, snort, or body jerk. These episodes can interfere with sound sleep. They can also reduce the flow of oxygen to vital organs and cause irregular heart rhythms. Here, experimental CPAP machine

Using an application, a CPAP blower (motor) assembly and microcontroller are designed with the goal of making the device affordable and user-friendly for patients. The breath condition, heart rate, and blood oxygen saturation level are all measured and monitored in the proposed work. Every one of the boundaries are checked by the microcontroller, when it identifies any troubles in breathing circumstances it'll naturally turn on the strong framework for the patient. Patients would be able to breathe steadily with the proposed supportive system. In order to determine the recovery, the data are continuously monitored and stored on the cloud platform.

Obstructive rest apnea (OSA) is a typical rest problem that influences a large number of individuals around the world. During sleep, it is characterized by frequent episodes of partial or complete upper airway obstruction, resulting in intermittent hypoxia, sleep fragmentation, and other negative health effects. A common treatment for OSA is Continuous Positive Airway Pressure (CPAP), which uses a machine to deliver a constant stream of air pressure to keep the airway open while you sleep.

Poor adherence, a lack of real-time monitoring and tracking capabilities, and patient discomfort are just a few of the CPAP therapy's drawbacks. Poor patient outcomes, such as treatment failure, rising healthcare costs, and diminished quality of life, may result from these limitations.

Innovative technologies like the Internet of Things (IOT) have been the focus of recent research to address these limitations and enhance CPAP therapy. IOT alludes to an organization of interconnected gadgets that can speak with one another and trade information through remote network. IOT-based CPAP frameworks consolidate sensors, remote availability, and versatile applications to give ongoing checking and following of patient information, which can prompt more customized and advantageous treatment the executive.

An IOT-based CPAP system that aims to improve patient outcomes by providing real-time monitoring and tracking of patient data, increasing therapy adherence, and decreasing the risk of adverse events is presented in this paper. A CPAP machine that can be controlled remotely via a mobile app, a sensor module that collects vital signs and sleep quality information, and a cloud-based platform that stores and analyzes patient data make up the proposed system.

There are a number of advantages that the IOT-based CPAP system has over traditional CPAP therapy. First, the system monitors and tracks patient data in real time, allowing for prompt therapy settings adjustments and intervention to improve patient outcomes. Vital signs like heart rate, respiratory rate, and oxygen saturation, as well as sleep quality parameters like stages and events caused by sleep apnea, are gathered by the sensor module. This data is sent wirelessly to the cloud-based platform, where it can be analyzed to learn more about the health of the patient and the effectiveness of their therapy.

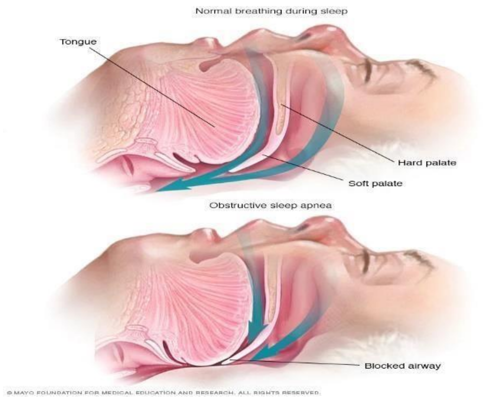

Fig 1. Obstructive sleep apnea

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Innovative technologies like the Internet of Things (IOT) have been the focus of recent research to address these limitations and enhance CPAP therapy. A network of interconnected devices that are able to communicate with one another and exchange data via wireless connectivity is referred to as IOT. In order to provide real-time monitoring and tracking of patient data, IOT-based CPAP systems incorporate sensors, wireless connectivity, and mobile applications. This can lead to therapy management that is more individualized and convenient.

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There are a number of advantages that the IOT-based CPAP system has over traditional CPAP therapy. Right off the bat, the situation gives constant checking and following of patient information, empowering convenient mediation and change of treatment settings to upgrade patient results. The sensor module gathers information on tolerant fundamental signs, for example, pulse, respiratory rate, and oxygen immersion, as well as rest quality boundaries, for example, rest stages and rest apnea occasions. This data is sent wirelessly to the cloud-based platform, where it can be analyzed to learn more about the health of the patient and the effectiveness of their therapy.

II . Framework Examination

A. Method

An Arduino Microcontroller behaves like mind of the undertaking where all sensors and the engine by means of hand-off are incorporated to give the answer for OSA patients . The specified operations are carried out by the Arduino UNO, and the data transfer to the cloud via the wi-fi protocol is carried out by the Node MCU. The step down transformer receives 230V from this power supply, and the regulators receive 5V from the microcontroller. It is used to monitor up to 30100 connected sensors, including a respiratory sensor. The subject's heart rate and blood oxygen saturation level are tracked by MAX30100. Respiratory sensor it is set inside the cover and it screens the breath condition. The values of the heart rate, Spo2, snoring events, and the status of the compressor when it is changed are displayed on the Liquid Crystal Display (LCD).

The compressor motor in the driver unit is used to supply pressurized air to the airflow unit. The mask is part of the air flow unit. The covers interface with a hose , providing air through the nasal entry of the patients. The relay is used to switch between Auto mode and Manual mode using the two pushbuttons. When the compressor is in manual mode, the motor is turned ON and OFF as needed. The supporting system is activated in auto mode in accordance with the monitored snoring events. The supporting system automatically activates to assist patients in maintaining stable breathing if the number of snoring episodes exceeds 2. The information is gotten continuously through a pre-customized Arduino board; For real-time monitoring and understanding of the recovery, the results are sent back to the Thing Speak cloud.

The sound sensor module typically detects sound intensity and provides a simple method for doing so. This module can be utilized for security, switch, and observing applications. Its accuracy can be easily changed to make it easier to use. Using a microphone, it feeds an amplifier, peak detector, and buffer from the input. The MAX30100 is an incorporated heartbeat oximetry and pulse screen sensor arrangement . To detect heart-rate and pulse oximetry signals, it combines two LEDs, a photodetector, improved optics, and analog signal processing with low noise.

The MAX30100 is powered by 1.8V or 3.3V power supplies and can be shut down via software with very little standby current, allowing the power supply to always be connected.

II. EXPLAINATION OF OUR PROJECT

The objective of this project is to clear the subject's throat and nasal passages in order to eliminate long-term issues like sleep apnea and snoring. Moreover, we execute continuous observing and putting away of the boundaries checked. If an individual suffers from obstructive sleep apnea (OSA), continuous positive airway pressure therapy (CPAP) is a treatment option that can help them breathe more easily while they sleep. A CPAP machine increments gaseous tension in the throat so the aviation route doesn't fall when an individual takes in. One of the most underdiagnosed

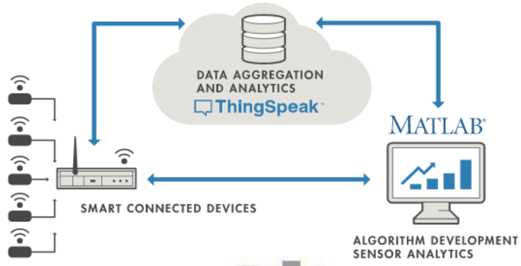

Fig 2. Connection diagram

sleep disorders is obstructive sleep apnea (OSA), in

which the upper airways collapse periodically during sleep, resulting in breathing stops. It is a disturbing element for a number of serious heart diseases, including stroke.

A lot of people die while sleeping because their bodies change in different ways when they sleep. The majority of sleep apnea treatments are clinical in nature and unsuitable for everyday use. In this task, we carry out a smaller, compact and financially savvy miniature regulator based rest apnea screen with Breath sensor for observing the breath condition, SPO2 and Heartbeat Sensor for checking the pulse and blood oxygen immersion level. The microcontroller keeps track of all the parameters, and if the patient is having trouble breathing, it automatically activates the supportive system to help the patient breathe normally. To determine the recovery, the data are continuously monitored and stored on the Thing Speak platform using IOT.

A. Imagination

B: components • Power LED Indicator: The LED's ON status indicates that power has been turned on. The LED will not turn on when the power is turned off.

The digital I/O pins have the values HIGH and LOW. Digital pins can be found on the pins D0 through D13.

TX and RX LEDs: The illumination of these LEDs indicates that the data flow was successful.

AREF-The Simple Reference (AREF) pin is utilized to take care of a reference voltage to the Arduino UNO board from the outer power supply.

Reset button-Adding a Reset button to the connection is utilized.

The board can be connected to the computer using USB. It is necessary for the Arduino UNO board's programming.

Gem Oscillator-The Gem oscillator has a recurrence of 16MHz, which makes the Arduino UNO a strong board.

Voltage Controller The voltage controller changes the information voltage over completely to 5V.

GND-Ground pins. The ground pin goes about as a pin with zero voltage. o Vin is the voltage at the input.

Simple Pins-The pins numbered from A0 to A5 are simple pins. The analog sensor that is being connected is read by analog pins. It can likewise go about as GPIO (Broadly useful Information Result) pins.

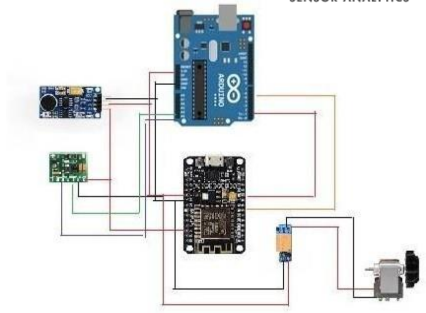

Fig 3. Schematic diagram

D: programming language As depicted in Fig.6.3, the open-source Arduino Software (IDE) makes it simple to write code and upload it to the board. Any Arduino board can be used with this software. It has different features than a notepad and functions as a text editor. It is utilized for composing code, incorporating the code to check in the event that any mistakes are there and transferring the code to the Arduino.

Arduino loads up are modified in "C." C is a famous framework programming language that has negligible execution time on equipment in contrast with other undeniable level programming dialects. AVR microcontrollers housed in Arduino boards are programmed in a subset of C, which is referred to as "Embedded C" because it applies to programming embedded controllers. This is the reason that the majority of operating systems and several programming languages are built on C. Like other microcontrollers, the AVR microcontrollers housed in Arduino boards are programmed in a subset of C.

The Arduino programming language is a subset of C and only includes the standard C features supported by the Arduino IDE.The term "Internet of things" (IOT) refers to physical objects—or groups of such objects—equipped with software, processing power, sensors, and other technologies for communicating with other systems and devices via the Internet or other communications networks and exchanging data. Since devices do not need to be connected to the public internet but rather to a network and be individually addressable, the term "internet of things" has been deemed misleading.

In Thing Talk , IOT examination stage administration that permits you to total, picture and break down live information streams in the cloud as displayed in Fig.6.2. Visualizations of data posted by your devices to Thing Speak are available right away with Thing Speak. With Thing Talk, your information is put away in channels. Data can be stored in up to eight fields per channel. Additionally, there will be a limit of four channels for free license holders. The message update interval limit remains at 15 seconds for free users. Thing Speak is Ruby-based open-source software that lets users communicate with Internet-enabled devices, as depicted in Fig. 6.1. By providing an API to social network websites and devices, it makes data access, retrieval, and logging easier. Thing Talk was initially sent off by IO Scaffold in 2010 as a help on the side of IOT applications. Thing Talk has coordinated help from the mathematical figuring programming MATLAB from Math Works, permitting Thing Talk clients to dissect and picture transferred information utilizing MATLAB without requiring the acquisition of a MATLAB permit from Math Works.

You can develop IOT algorithms with MATLAB. You can quickly and easily collect and analyze IOT data with the help of MATLAB and Thing Speak. You can develop smart connected devices with the help of MATLAB and Simulink. From small to medium-sized IOT systems to large enterprise systems, MATLAB supports cloud deployment.

IV. RESULTS

In this venture, a compelling CPAP configuration is proposed to treat the Obstructive Rest Apnea (OSA) patients. It is used to monitor up to 30100 connected sensors, including a respiratory sensor. The subject's heart rate and blood oxygen saturation level are tracked by MAX30100. The mask's respiratory sensor keeps track of how your breath is going. The values of the heart rate, Spo2, snoring events, and the status of the compressor when it is changed are displayed on the Liquid Crystal Display (LCD). The two pushbuttons are used to switch between Auto mode and Manual mode as needed. In manual mode, the caretakers or the patient themselves turn the compressor motor ON and OFF for the patient's comfort, and the status is shown on the LCD in Figs. 7.2 and 7.3. This is how doctors monitor OSA patients in hospitals.

When we press the manual mode button, automatic mode is turned off and manual mode is turned on, as shown on the LCD. Additionally, the LCD displays the airflow as Airflow as the motor pumps air into the CPAP mask through a tube.

Two seconds is the maximum amount of time you can snore. The patient is in stable condition if the snoring limit is less than two seconds. Air is not pumped by the motors. A person is not in stable condition if the snoring limit is greater than two seconds. The snoring is found. The CPAP mask is filled with air as soon as the motor starts pumping air through the motor-connected tube, and the patient is treated.

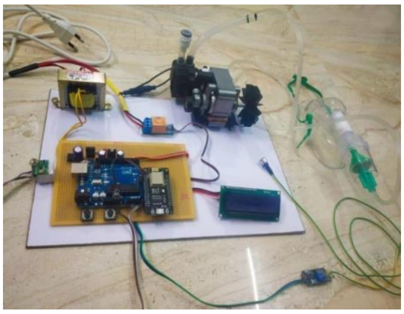

Fig 4. Circuit diagram

If the person snores for less than two seconds, their condition is stable. Air is not pumped by the motors. A person is not in stable condition if the snoring limit is greater than two seconds. The snoring is found. The CPAP mask is filled with air as soon as the motor starts pumping air through the motor-connected tube, and the patient is treated.

The Thing speak platform sends and stores the data that are displayed on the LCD at each point. Software output The software output that is displayed on the Thing speak platform is depicted in fig.7.10. It is an IOT-based platform where data are continuously monitored and stored to learn about the recovery of person A. Here the different boundaries are observed and put away. The person's heart rate is shown in the first graph. The person's SPO2 level is shown in the second graph. The compressor's state is depicted in the third graph. Every one of the subtleties are put away in the Thing talk stage to be familiar with the recuperation of the individual.

The Respiration sensor, the SPO2 sensor, and the Pulse sensor are used in Continuous Positivity Airway Pressure (CPAP) with IOT to monitor breath condition, heart rate, and blood oxygen saturation level. The microcontroller keeps track of all the parameters. If the microcontroller notices that the patient is having trouble breathing, it will automatically activate the supportive system. The information are ceaselessly observed and put away on the ThingSpeak cloud to know the recuperation. In this system, the subject receives a constant supply of pressurized air for stable sleep breathing.

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