JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AUTOMATIC VENTILATOR MONITORING SYSTEM

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Abstract : Monitor patient-ventilator interactions at bed including assessing patient breathing patterns in ventilator settings. One of the goals of mechanical ventilation is to match the ventilator rate to the patient's breathing rate. The goal of this goal is to ensure that the patient's initiation of breathing results in the activation of the ventilator without the patient over-exerting themselves, matching the provision of assisted breathing with the patient's breathing effort. Patient and stop assisted breathing when the patient completes inspiration, thus avoiding ventilator assistance during patient exhalation.

Index Terms **- LCD, Heartbeat Sensor, Buzzer, DC Motor, NodeMCU**

I. INTRODUCTION

This proposed system is based on the Internet of Things (IoT). Monitor patient-ventilator interactions at the bedside including assessing the patient's breathing pattern when the ventilator is set up. One of the goals of mechanical ventilation is to match the ventilator rate to the patient's breathing rate. The purpose of this goal is to affirm that the patient's initiation of breathing leads to the activation of the ventilator without the patient being overexerted, by combining the delivery of a supportive breath with respiratory effort. of the patient. patient and stop assisted breathing when the patient completes inspiration, thus avoiding ventricular assistance during patient exhalation. During mechanical ventilation, gas pressure, volume, and flow in the ventilator system fluctuate. We cannot see the pneumatic signals directly with our eyes, but we can observe them with special monitoring devices. It is important that clinicians do not assume that the settings for the ventilator are absolute. Instead, the clinician should monitor the patient and react to the ventilator settings before concluding the patient is on ventilator connection is synchronous. The patient is at the focal point and the clinical practician must adapt the mechanical ventilator to satisfy the patient's ventilator needs. Modern ventilators display real-time statistics in the form of waveforms. Common waveforms are pressure-time, flow-time, and volume-time. Ventilator-assisted breathing can be divided into various parts: breath initiation, breath delivery, breathing termination, and mechanical exhalation. Mechanical exhalation refers to the time period when the patient is not accepting ventilator-assisted inspiration. The goal of patient-ventilator synchrony is to have the multiple parts of ventilator-assisted breathing coincide with the patient's intrinsic breathing pattern.

II. LITERATURE SURVEY

Freely available ventilators for COVID-19 and future pandemics-2019 In this study, after providing a history of respirators, the scientific literature is screened to find currently available or already published approved ventilator designs. Coronavirus pestilence threatens to overwhelm our medical infrastructure regionally, leading to an increase in mortality due to the lack of important equipment such as ventilators. Fortunately, with the latest developments and widespread use of small-scale manufacturing technologies such as RepRap-class 3D printers and open-source microcontrollers, the mass production of fans has the potential to overcome supply shortages in the medical field[1].

Assisted mechanical ventilation: the future is now! - 2015 Jul 29 In this article, Assisted ventilation is a very complex process that requires close interaction between the ventilator and the patient. The complexity of this form of ventilation is often underestimated by healthcare professionals. With assisted mechanical ventilation, the ventilator's gas supply pattern and the patient's breathing pattern must match almost perfectly, regardless of the specific position, otherwise, synchronization occurs between the patient and the ventilator[2].

This article presents a flow signal-based AutoPEEP detection platform available for the latest mechanical fans. The detection algorithms are based on nonparametric hypothesis testing that doesn't require any prior knowledge of the signal distribution. Two detectors are presented in particular: one based on SNT (Signal Norm Testing) and the other a sequential frame extension of SNT. Ex-vivo on several retrospectively recorded patient curves and on an analog of the respiratory system were used to evaluate

performance.[3].

Monitoring patient-ventilator-bedside interactions involve evaluating the patient's breathing patterns in ventilator settings. One of the goals of mechanical ventilation is to match the ventilator support to the patient's breathing. The goal of this goal is to ensure that the ventilator is triggered without unnecessary patient effort when the patient starts breathing, to match assisted breathing delivery to the patient's inhalation effort, and to interrupt assisted breathing when the patient stops breathing inhalation, avoiding ventilator-assisted inspiration during patient exhalation.[4].

Closed-loop mechanical ventilation has the potential to provide patients with more effective and straightforward respiratory support than traditional ventilation. The purpose of this study was to see how effective automatic mechanical ventilation is.[5].

This article gives an idea of the origin of the modern mechanical fan. Based on the reviewed literature, a simple, easy-to-use, and easy to fabricate design of a low-cost portable ventilator is proposed in this paper. The proposed prototype fan is said to have better performance than those already on the market at a very low cost. This ventilator will help in a situation like COVID19 when the whole world has difficulty with the ventilator[6].

This article describes Panic among medical, information, and device administrators about resolving some of the high-profile attacks on healthcare facilities. This hostile situation will lead the medical informatics industry to medical data hoarding, flow control, and web administration[7].

ECSTASY is designed to provide a common software base that facilitates the rapid transfer of CAD tools between different academic groups. It serves as a means of industrial transfer of scientifically developed control system design tools within a consistent framework, providing a common software foundation for the development and testing of new algorithms and design equipment.[8].

III. PROPOSED METHODOLOGY

The proposed system`s design consists of NodeMCU ESP8266 which acts as the main controller. Thingspeak helps in monitoring the entire system. The system will check heartbeats, if heartbeats go down then the ventilator will start automatically. And the graph will be continuously displayed on Thingspeak.

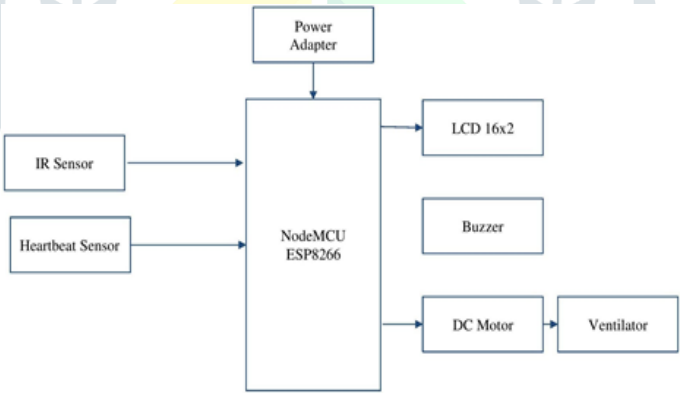

Fig 1: Block Diagram of System Architecture

The functional requirements of the system are as follows:

(i). Relay

A relay can be an electrically controlled switch. The device is made up of a set of input terminals for one or more control signals and a set of operating contact terminals. Switches can have any number of contacts in any manner, such as create, detach, or a mix of the two. He always had the feeling that something was going on. You could organize a relay race where each member of the team carries the baton halfway and then crosses it. A new working group is a relay that, like an electrical switch, can activate the second circuit.

Fig (i): Relay

(ii). Buzzer

A whistle or beep is a device that emits a mechanical, electromechanical, or piezoelectric (called a piezo) acoustic signal. Alarm clocks, timers, and confirmation of human intervention such as a mouse or keyboard clicks are all common uses for whistles and beeps. Electromechanical, piezoelectric, or mechanical devices that emit audible signals such as beeps or whistles are examples. Its primary purpose is to transform audio signals into audio. It is commonly used in timers, alarm devices, printers, alarm devices, computers, and other devices that are powered by DC voltage. It can produce a variety of sounds, including alarms, music, bells, and sirens, depending on the design. The buzzer pin configuration is shown below. It consists of two pins, positive and negative.

Fig (ii): Buzzer

(iii). LCD

A liquid clear display (LCD) is a flat committee display that uses the light-modulating characteristics of liquid crystal. It accepted excessively long to move from liquid clear incident to a lot of LCD uses. When he melted a substance like cholesterol benzoate, he observed that it first turned into a cloudy liquid and then melted as the temperature rose. After cooling, the liquid then turns blue before crystallizing. After that, LCD manufacturers gradually devised differences and developed ingenuity in by technologies introducing. This display device has a wide range of applications. As a result, the development of LCD was accelerated.

Fig (iii):LCD

(iv).IR Sensor

Here are the Arduino connectors for the IR sensor: Connect the negative wire of the IR sensor to the GND of the Arduino. Infrared technology is utilized for a variety of reasons in everyday life and in industry. Low power consumption, a simple design, and useful functionality are the key advantages of IR sensors. The human eye cannot perceive infrared signals. Infrared radiation is found in the visible and microwave ranges of the electromagnetic spectrum. The IR spectrum can be divided into three regions near infrared, medium infrared, and far infrared.

Fig (iv): IR Sensor

(v). Heartbeat Sensor

Knowing heart rate information is useful for exercise, study, etc. But heart rate could be complicated to calculate. A pulse sensor or a heart rate sensor is used to solve this problem. This is a plug-and-play sensor for Arduino boards that may be used by makers, students, developers, and artists who want to include heart rate data in new projects. their judgment. The circuit for this sensor is made up of a simple optical pulse sensor with amplification and noise reduction. We can get quick and accurate heart rate measurements with this circuit. This circuit can be used in portable applications with a current of mA and a voltage of 5 V.

Fig (v):Heartbeat Sensor

(vi). NodeMCU ESP8266

NodeMCU (Node MicroController Unit) is an open-source hardware and software development environment built around an inexpensive SystemonaChip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the vital elements of a computer: CPU, RAM, network (WiFi), and even a modern operating system and SDK. This makes it a great choice for Internet of Things (IoT) projects.

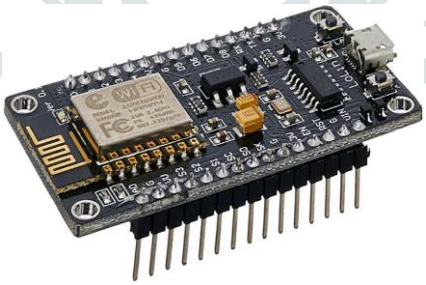

Fig (vi):NodeMCU ESP8266

(vii). DC Motor

The direction of rotation of this motor is given by Fleming's left-hand rule, which states that if the index, middle, and thumb fingers of your left hand are extended perpendicular to each other and the index represents the direction of the magnetic field, the middle finger indicates the direction of the current, the thumb indicates the direction in which the force acts on the shaft of the DC motor.

Fig (vii): DC Motor

IV. IMPLEMENTATION

The following steps are involved in the implementation of the project:

Step 1:Hardware Setup:

Put the heart rate on the finger, then the infrared sensor will check if there is a finger, then the heart rate will show on the LCD screen. If the current heart rate is low, the ventilator will start automatically.

Step 2 :Software Setup:

Users who want to use it will receive a username and password for authentication. After logging into the system, they will come to a screen where they can see the heart rate and the status of the panton. And it can see the IR indicator which means they know if the IR sensor is indicating it or not.

Step 3: Operation:

First, boot the recommended system. Then put the heart rate on your finger. If the heart rate is low, the system will automatically start the ventilator, and the heart rate will show on the LCD screen, and the heart rate will show on ThingSpeak.

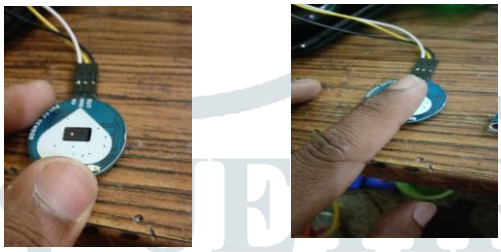

Figure 1.HeartBeat Sensor

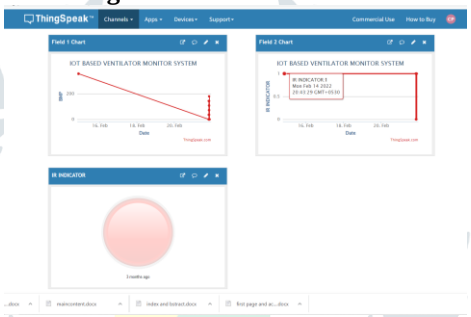

Figure 2.ThingSpeak Graph

Figure 3. LCD Display

V. CONCLUSION

The proposed system is able to turn on the ventilator automatically when the oxygen levels go down. It saves the time for the doctor to come and start the ventilator. Many lives are saved by using this technology. The proposed system is very useful in hospitals.

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