Design A Low Cost Ventilator Using Cam Shaft Mechanism

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Abstract: **Ventilator is a life- redeemer in the development of ultramodern ICU. This paper provides an idea of the origin of ultramodern ventilators. Grounded on reviewed literature, A simple easy-to-use and easy-to-figure design of low-cost cam shaft ventilator is proposed in this paper. Cam shaft ventilator are compact bias designed to give ventilation. This extremity performing from the COVID-19 epidemic has generated an adverse situation in which thousands of people failed due to the lack of artificial ventilation bias. Low cost cam shaft ventilator is substantially used to keep cases breathing by using atmospheric air. It's a tool tackle used in an emergency situation in first-aid purposes. This system encases the pump with a motor and controls to take the place of contraction process. A feasible option to achieve low-cost, low-power cam shaft ventilator technology that also detects a Blood oxygen and Pressure position. This prototype also features an alarm to indicate over pressurization of the system. The proposed ventilator is assumed to have better working performance than formerly available in the request at a veritably low cost. This ventilator will help in the situation like COVID-19 when the whole world is facing the difficulties related to ventilators**.

***Keywords*— Cam shaft Mechanism, Ventilator bag, Blood oxygen sensor and Pressure sensor.**

I .INTRODUCTION

Failure of respiratory system and respiratory conditions caused by different kind of injuries is a source of great stress in both the worlds of advanced and technologically extemporized countries as well as backward and semi advanced countries. Bone of contention in the form of Asthma, habitual obstructive pulmonary complaint are a nonstop source of pain and stress for the representatives of these countries. It's the general perception that these catastrophes are wide because of the reproduction of bank, operation of dangerous feasts on massive position and consecutive use of natural coffers for the sake of mending energy requirements [7]. The conditions mentioned above requires mechanical ventilation in case of failure lungs. This prototype will help a case to gobble and exhale so the exchange of carbon dioxide and oxygen could be possible and the case have the artificial respiration to survive (6).
Ventilator those are formerly in use in utmost of privileged hospitals are high in cost. Poor countries are seen unfit to render similar services and reason is veritably important clear the high costs of acquiring and exercising them. Therefore their conservation is also expensive affair of business. Another dilemma related to similar kind of developing countries is achromatised of introductory coffers to civic areas only. In distant and deprived areas similar kind of installations are still missing and as a result there's pause of similar ventilators [12]. One result of similar deficit was seen in Lahore where eight babies failed of pneumonia due to attainability of ventilators in the sanatorium [10]. As bandied before major reason of this deficit is the high cost of presently available ventilator in the request. In the epidemic situation there's demand for ventilator. the ventilator cost is also high. to overcome the problem, in this paper proposed a low cost ventilator using cam shaft.

A cam shaft is a shaft that contains a row of pointed cams in order to convert rotational motion into reciprocating motion .Cam shaft operates the intake and exhaust valves .cam shaft control electric motor speed. In ventilator, a cam shaft used to compress the ventilator bag with motor speed control.
our machine is truly helpful in the epidemic situations like covid-19 which shocked humankind with a swell of unanticipated health heads in a multitudinous times and continues to persecute humankind in some regions or the other. As we all know it affects the lungs while limiting lung capacity and causing breathing problems, ventilator development and exploration have gained particular significance. The lungs of humans

use the hamper pressure generated by the compression stir of the diaphragm to stink in air for breathing. A ventilator recreates the process of breathing by pumping air into the lungs. A medium called a ventilator must be suitable to deliver in the range of 10 – 30 breaths per nanosecond and with the capability to acclimate rising supplements in sets of two. The ventilator must also have the capability to acclimate the air volume pushed into the lungs of humans with each breath. It must fulfill the setting to acclimate the time duration for inhalation to exhalation rate. Our medium fulfill these conditions. Monitoring the case's blood oxygen position and exhaled lung pressure to avoid over/ under pressure is also an important work of the ventilator.

II. METHODOLOGY

I. Theoretical overview

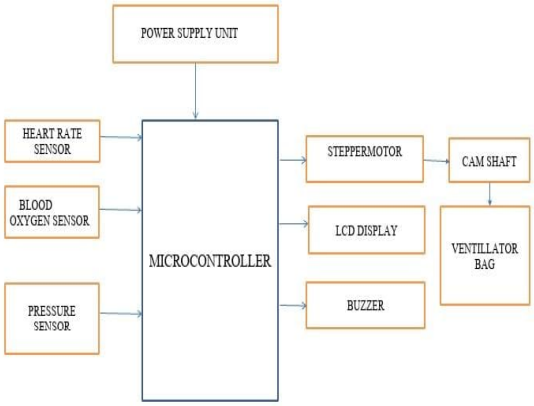

Fig.1: Block Diagram

A silicon ventilator bag is used which is driven by a stepper motor with a single- side drive medium to push the ventilator bag. To achieve affectation and deflation, the cam Shaft medium is used. The stepper motor shaft is connected to a cam to convert rotary stir into direct stir then. The cam is round and designed to push one end of the pressing arm overhead. The pressing arm is connected to the common medium and mounted on the top of the ventilator. Which creates a seesaw- suchlike medium. When the stepper motor rotates and pushes the arm overhead on one side, it presses against the bag on another end. The rate of affectation and deflation depends on the RPM of the motor. As per the settings handed to the setup, the motor RPM is varied to achieve asked BPM rate. In this system, a blood oxygen detector along with a sensitive pressure detector is used to cover the necessary vitals of the case and display in the LCD. An emergency buzzer alert is also fitted in this system to sound an alert as soon as any anomaly is detected and this entire system is driven by a regulator circuitry to achieve asked results and to help cases in extremities.

II. HARDWARE IMPLEMENTATION

A. Microcontroller

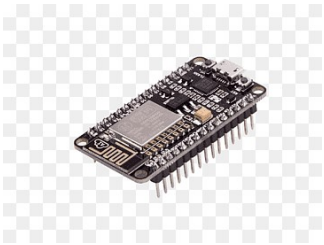

Fig 2: ESP8266 Module

The ESP8266 microcontroller is used to measure the patient biological parameter such as blood oxygen and pressure level. The ESP8266 is a self-contained with integrated TCP/IP protocol stack that can give any microcontroller access to the wife network. The ESP8266 can be used to perform the following functions in this project:

- Real-time biological parameter monitoring: The ESP8266 can be used to receive data from the sensors that measure the patient's biological parameters, such as blood oxygen and pressure level.
- Wireless communication: The ESP8266 has built-in Wi-Fi and Bluetooth connectivity, which can be used to establish a wireless connection with the computer and phone.

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B. *Biological sensors*

The use of biological sensors in this project is crucial for measuring the patient's biological parameters during ventilation .These sensors can provide feedback on the patient's physiological responses to the rehabilitation process and help clinicians monitor the patient's progress. There are several types of biological sensors that can be used in this project, including:

- Blood oxygen sensors: Blood oxygen sensors can be used to measure the patient's blood oxygen

level during breathing problem.

Fig 3 : Blood oxygen sensor

- Pressure sensors: Pressure sensors can be used to measure the patient's pressure level.

C. *STEPPER MOTOR*

The stepper motors play a major role in the prototype. These motors are used to rotate the cam shaft mechanism. Fig 4 gives an image representation of the stepper motor.

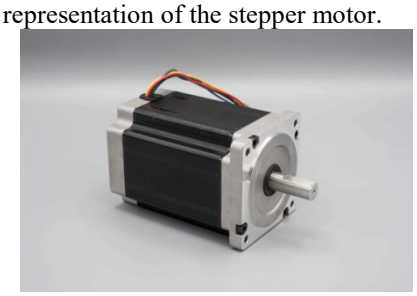

Fig 4: Stepper Motor

D. *System Design*

This system consists of: Cam shaft mechanism, relay, regulator, stepper motor, Ventilator bag, blood oxygen sensor and pressure.

Microcontroller ESP8266 (Wi-Fi Module) was used for transmission of data to the cloud and it was extracted in the Blynk App. Adriano UNO is connected to the stepper motor to give a rotation of cam shaft.

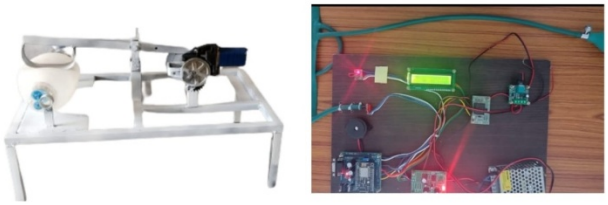

Fig 5: Ventilator bag compress with Arm using Cam shaft

Here Fig 5 shows the prototype of a ventilator bag compress with cam shaft. Fig 6 shows the Blynk IOT platform which can be connected by username and password in any mobile. It is user friendly and can be viewed anytime and anywhere.

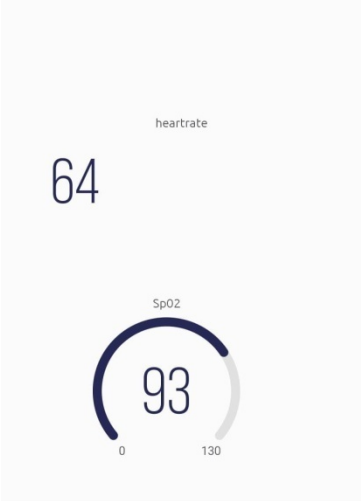

Fig 6: Blynk App

III .SOFTWARE USED AND CLOUD PLATFORM

A. *Embedded C in Adriano IDE*

Embedded C is a programming language that can be used in this project to program the microcontroller, such as the ESP8266, to control the operation of the ventilator bag, the biological sensors and cam shaft mechanism.

B. Cloud Platform

The Blink Cloud platform can be used in this project to remotely monitor and shows the blood oxygen and pressure level. The ESP8266 can be connected to the internet, and the device can be registered on the Blink Cloud platform. A dashboard can be created to display relevant data, and the communication protocol can be defined to transmit and receive data between the device and the cloud. The user can access the dashboard remotely to monitor and control the system.

III .RESULT

The result of this project is a compress the ventilator bag using cam shaft mechanism

After enforcing all setup and successful run of our ventilator to gain results. So, it delivers in the range of 15 – 30 breaths per nanosecond, with the capability to acclimate rising supplements in sets of two and tailwind for the pneumonia cases of COVID- 19 case lungs. It also monitors the case's blood oxygen position and exhaled lung pressure to avoid over/ under air pressure contemporaneously. Its exigency buzzer also makes an alert sound when an anomaly is detected.

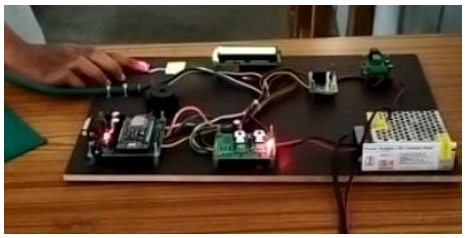

Fig 7 output images

Fig 8 compress ventilator bag

III. CONCLUSION

In this paper, a prototype device to help cases who can incompletely breathe on their own is developed .this ventilator is handed with a veritably introductory and light design and dependable structure that's fluently respectable by thecae. The main focus of this paper is to minimize the factors and increase the effectiveness of the device so that while using this device the case, should feel as comfortable as the normal ventilator .in this trial, a silicon ventilator bag is used which is driven by a stepper motor with a single side drive medium to push the ventilator bag to achieve affectation and deflation, the cam shaft medium is used. The stepper motor shaft is connected to a cam to convert rotation motion into reciprocating motion then. The cam shaft is round and designed to push one end of the pressing arm overhead. the pressing arm is connected to common medium and mounted on the top of the ventilator. Which creates a see-saw like medium. When the stepper motor rotates and pushes the arm overhead on one side, it presses against the bag on another end the rate of affectation and deflation depends on the RPM of the motor.

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