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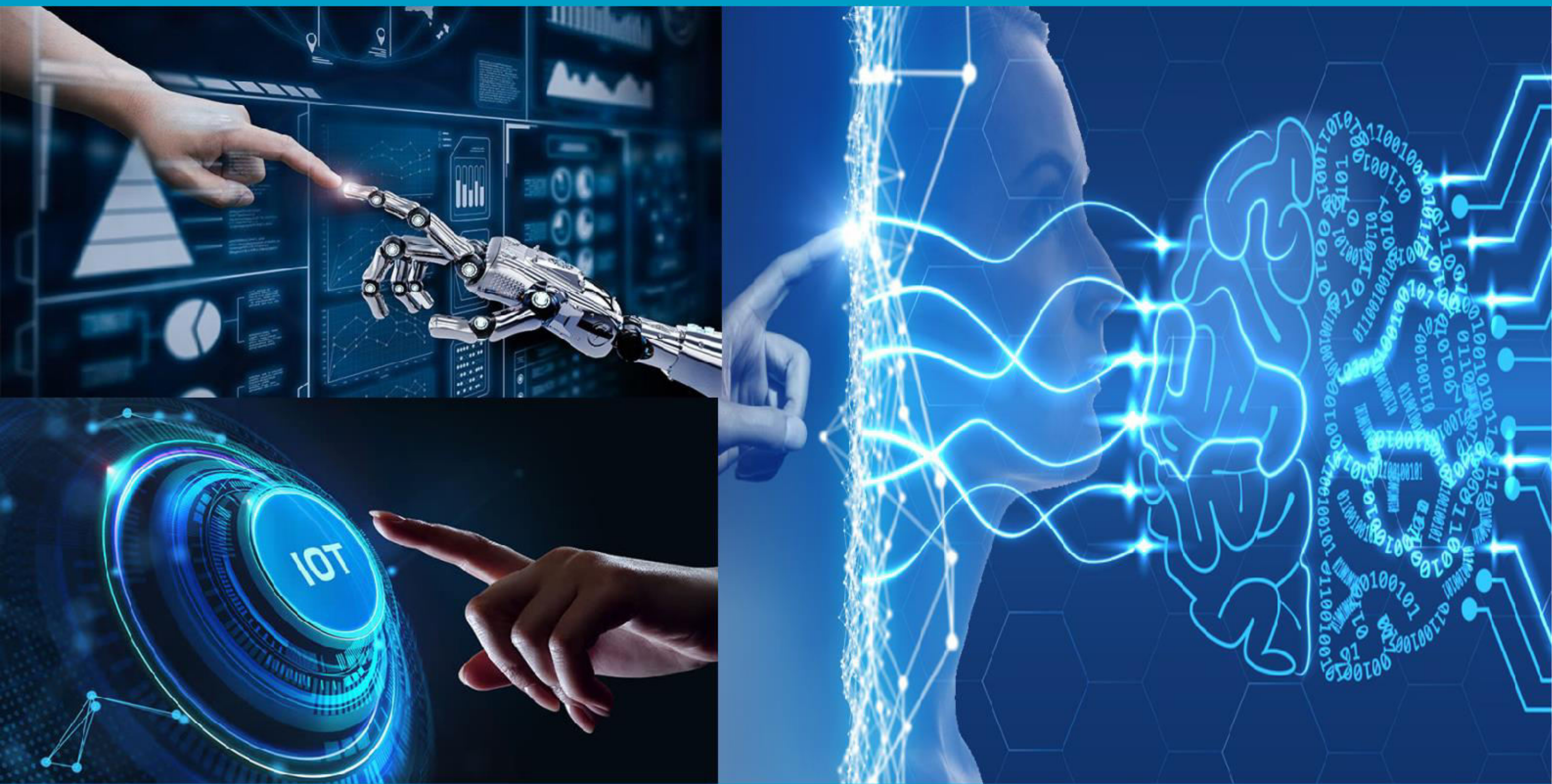

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Smart BPM Monitoring System Using Raspberry Pi

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ABSTRACT: This project shows an outline of many studies that have been conducted. Humans take breaths using their lungs. The Smart BPM ventilator that we are configuring here is meant to assist people during the Covid epidemic. It is incredibly moderate and modest. This component can be carried out while breathing and heartbeat levels are low. The breathing and heartbeat rates are displayed on the LCD panel. It regularly checks on the patient's basic health and any breathing problems. In addition to the ventilator, we constantly keep an eye on blood oxygen levels. The Raspberry Pi CPU is required to handle the entire workload.

KEYWORDS: Ventilator, Raspberry Pi, Health monitoring

I. INTRODUCTION

Human lungs use the opposing pressure created by the stomach's compression process to draw air in for relaxation. A ventilator uses an unnatural action, akin to siphoning, to reach the lungs. A ventilator component should be able to deliver between 10 and 30 breaths per minute, with the flexibility to handle increasing augmentations in sets of two. In addition, the ventilator component should be able to control the amount of air driven into the lungs with each breath. The option that regulates the ratio of the length of the inhalation to the exhalation is last but not least for now.In addition, the ventilator should have the capability of monitoring the patient's blood oxygen level and lung strain as they are exhaled in order to prevent over/under gas tension at the same time.The ventilator we here develop using Arduino envelops all requirements to produce a reliable yet affordable BPM ventilator to support pandemic seasons. Here, we push the ventilator sack using a silicon ventilator pack linked with DC engines and a two-side push mechanism. We use an electric switch for switching and a variable pot to control the breath length and, as a result, the patient's BPM. Our system uses a blood oxygen sensor and a sensitive tension sensor to monitor the patient's essential vitals and display them on a small screen. Moreover, a crisis ringer alarm is included into the structure to sound a ready when an anomaly is discovered.An Arduino controls the entire structure in order to recognize desired outcomes and assist patients during the COVID pandemic and other emergency situations. Medical clinics and medical services offices are displaying serious equipment shortcomings in the middle of the global emergency caused by the COVID pandemic. It is our responsibility as creators to address the shortage by developing makeshift open-source replacement tools.Our country might be on absolute lockdown, but not our inventiveness! Ventilators for patients who require assistance with breathing are one prominent device whose demand has increased as a result of COVID19's respiratory effects. A ventilator, in its simplest form, could be a device that supplies breathable air into and out of the lungs, to give a patient who is actually unable to breathe for themselves or who is not breathing enough breaths. Homemade ventilators are likely to be less effective than professional ones. clinical quality ventilator, but it can serve as a decent substitute if it has control over the aforementioned crucial parameter.

II. METHODOLOGY

The system has sensors MAX30102 that can measure three separate parameters, including temperature, SPO2, andheart rate. The data will be provided to Raspberry Pi, and when certain conditions are met, the motor will turn on. The MAX30102 sensor communicates with Raspberry Pi via the I2C protocol (inter-IC communication).By

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regulating the lung sizes and necessary vital capacity, the ventilator will mimic how the respiratory system moves oxygen through tubes into our lungs, where it diffuses into the bloodstream, while carbon dioxide travels in the opposite direction. Children and newborns can primarily use this ventilator.

FLOW CHAT OF PROPOSED SYSTEM:

The flow chart of the proposed system is shown in the following Fig.2.

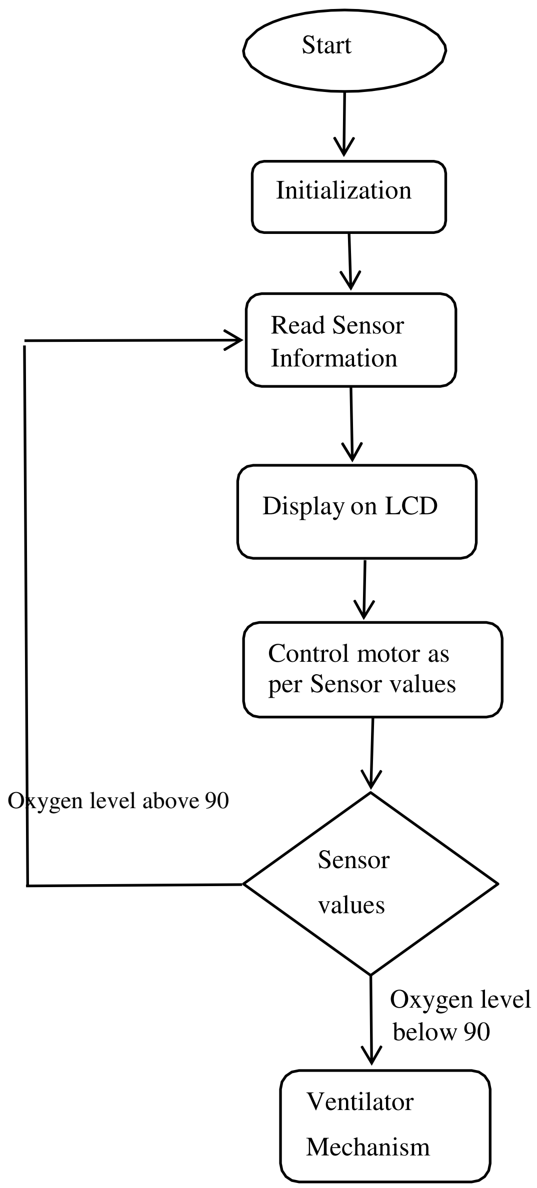

Fig.1. Flow Chart of Proposed System

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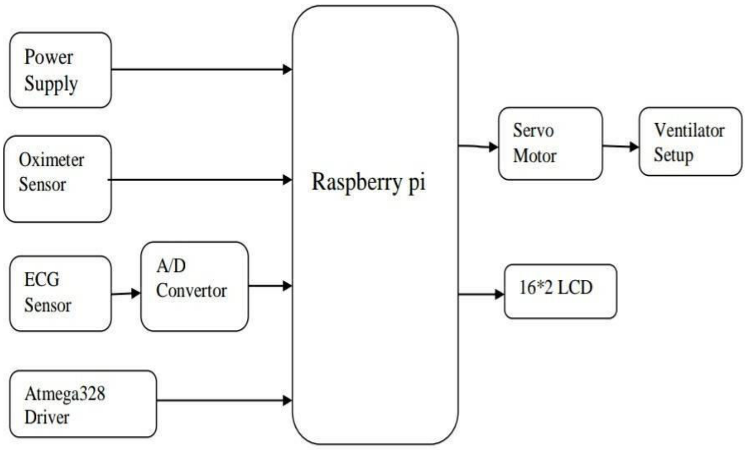

Fig.2:Block Diagram of Proposed system

III. HARDWARE REQUIREMENTS

RASPBERRY PI 3B:

As seen in Fig.3, Raspberry Pi is a line of miniature single-board computers (SBCs) created by the Raspberry Pi foundation. An SBC is a complete computer built on a single circuit board, with microprocessors, memory, input/output, and other characteristics necessary for a functional computer. A wide com system on chip (SOC) with an integrated ARM-compatible CPU and on-chip graphics processing unit is present in all variants (GPU). The foundation offers third-party Windows 10 IOT core, RISC OS, and specialized media centre distributions for download, in additionto the Raspbian (OS for Raspberry pi) based Linux distribution.

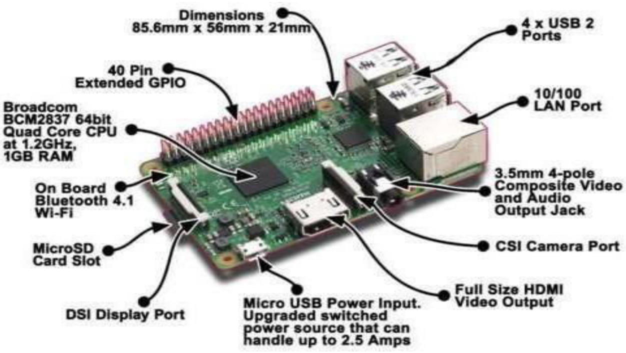

Fig.3 Raspberry Pi 3B+

OXIMETER SENSOR:

The MAX30102 is a very flexible sensor that, in addition to measuring blood oxygen levels and heart rate, can also monitor body temperature. An Analog Devices-made sensor can detect the pulse oximetry (SpO2) and heart rate (HR) signals thanks to two LEDs (one infrared and one red), a photo detector, optics, and a low-noise signal processing unit. The main concept is to shine one LED at a time and measure how much light is reflected back to the sensor. You can calculate the heart rate and blood oxygen saturation from the reflection.

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Fig.4 Oximeter Sensor

ECG SENSOR:

A commercial board called the AD8232 ECG sensor is used to determine the electrical activity of the human heart. The result of this process is an analogue reading, which can be displayed on a chart similar to an electrocardiogram. The AD8232 chip can be used to minimize the noise in electrocardiograms because they can be highly noisy. The ECG sensor's operation works similarly to an operational amplifier to make it easier to get a clear signal from the intervals. The AD8232 sensor is utilized for bio potential measurement applications and signal conditioning in ECG. This chip's primary function is to amplify, retrieve, and filter bio potential signals that are weak innoisy environments such those created by replacing a distant electrode and motion.

Fig.5 ECG Sensor

SERVO MOTOR:

A servo motor is a kind of motor that has extremely precise rotational capabilities. This type of motor typically has a control circuit that gives feedback on the motor shaft's current position. This feedback enables the servo motors to rotate very precisely. A servo motor is used to rotate an object at predetermined angles or distances. It consists of of a straightforward motor that drives a servo mechanism. A motor is referred to as a DC servo motor if it is powered by a DC power source, and an AC servo motor if it is driven by an AC power source. We will solely talk about the operationof the DC servo motor in this lesson. There are numerous different servo motor kinds based on the type of gear arrangement and operating characteristics in addition to these primary divisions. A servo motor often has a gear configuration that enables us to produce a very high torque servo motor in tiny and light designs. These characteristics make them useful for a variety of applications, including toy cars, RC helicopters and planes, robotics, etc.

Fig. 6 Servo Motor

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ANALOG to DIGITAL CONVETOR:

With on-board sample and hold circuitry, the Microchip Technology Inc. MCP3008 devices are successive approximation 10-bit Analog-to-Digital (A/D) converters. Eight single-ended inputs or four pairs of pseudo-differential inputs can be provided by the MCP3008 depending on the programming. Differential and integral non linearity (DNL and INL) are given at 1 LSB. A straightforward serial interface that is compliant with the SPI standard is used to communicate with the devices. The devices have a 200 ksps maximum conversion rate. The MCP3008 devices function across a wide voltage range (2.7V - 5.5V). With typical standby currents of only 5 nA and active currents of 320 A, low-current designs enable operation. 16-pin PDIP and SOIC packages for the MCP3008 are both available.

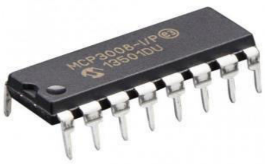

Fig.7 A/D Convertor

ATMEGA328 DRIVER CIRCUIT:

Advanced Virtual RISC (AVR) micro controller ATmega328. It supports the processing of 8-bit data. Internal flash memory of the ATmeg328 is 32KB. 1KB Electrically Erasable Programmable Read-Only Memory is available in the ATmega328 (EEPROM). This feature demonstrates that the micro controller can still store data and provide outcomes after receiving an electric source, even if the electric supply is disconnected. Moreover, the ATmega-328 features a 2KB Static Random Access Memory (SRAM). Further explanations will cover additional traits. The ATmega328 is the most widely used device on the market right now thanks to a variety of characteristics. Key characteristics include configurable Serial USART, advanced RISC architecture, good performance, low power consumption, real timer clock with separate oscillator, six PWM pins, programming lock for software security, throughput up to 20 MIPS, etc.

Fig.8 ATmega Driver

LCD DISPLAY:

The 4-bit mode and the 8-bit mode are the two operating modes for the LCD. In the 4 bit mode, we transfer the data one bit at a time, higher bit first, then lower bit. For those of you who don't know what a nibble is, it's a group of four bits made up of the lower four bits (D0-D3) of a byte and the top four bits (D4-D7) of a byte. We can convey data in 8 bits thanks to this. In contrast, since we employ all 8 data lines in the 8 bit mode, we may convey the 8-bit data in a single motion. Certainly, 8-bit mode is faster and more reliable than 4-bit mode, as you surely have figured by now and is in fig.9.

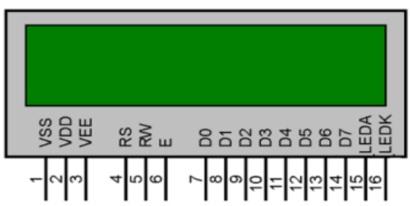

Fig.9. LCD Display

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BAGVALVEMASK:

Ventilation with a bag-valve-mask (BVM) is a crucial emergency skill. In situations where end otracheal incubation or other definitive control of the airway is not possible, this fundamental airway management approach enables oxygenation and ventilation of patients until a more definitive airway can be established. Basic BVM ventilation is frequently the only method of airway care available to the EMT. BVM might be the greatest prehospital airway support option for the pediatric population. Although the laryngeal mask airway now frequently takes its place in this environment, BVM ventilation is still suitable for elective ventilation in the operating room (OR) when incubation is not necessary.

Fig.10: Bagvalvemask

IV. RESULT & CONCLUSION

In this project, a Smart BPM monitoring system will be created using reverse engineering principles to addressthe needs of cardiopulmonary resuscitation, ventilators, and real-time patient heartbeat monitoring. There are a number of portable ventilators on the market, and each one's design takes into account the accessibility of gas and electrical sources as well as the breathing support patterns required by patients at the service area. Researchers have been working on solutions to the challenges that the COVID-19 epidemic has brought since it first emerged. Making affordable, open-source mechanical ventilators is one of the more recent concepts that has the author interested. The inspiration for the idea came from the severe lack of mechanical ventilators used to treat COVID-19 patients. Those who are severely ill are kept alive by mechanical ventilators. This essay supports that notion and provides a brief description of the design of the efficient ventilator discussed earlier. The primary goal of the writers is to address the ventilator shortage. This research presented a numerical concept that continuously tracks a patient's lung health. This numerical approach excludes the idea of using it in additional mechanical ventilators. In a nutshell, this essay offers both theory and practise. Moreover, alarms can be added to this, alerting physicians via speakers or an alarm screen during any abnormal readings.

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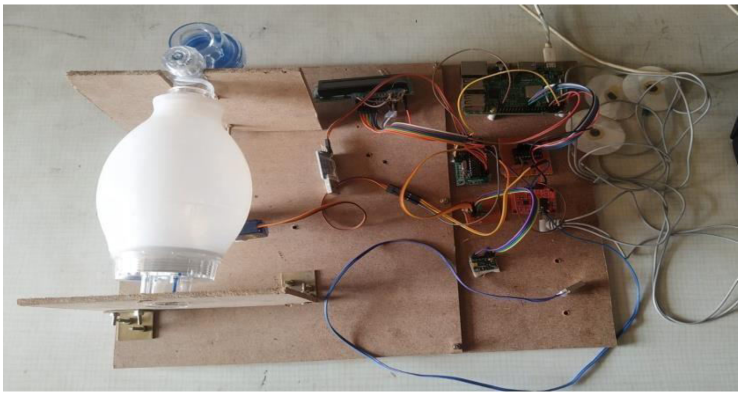

Fig.11: Experimental Set

DISPLAYING DATA ON LCD SCREEN:

Physical parameters such as temperature, SPO2, and heartbeat will be sensed by the sensor before being sent tothe Raspberry Pi for analysis and display of the results. Buzzer will turn on and the equivalent information will be shown on the LCD screen if Heartbeat and Spo2 surpass the threshold value. depicted in figure 12.

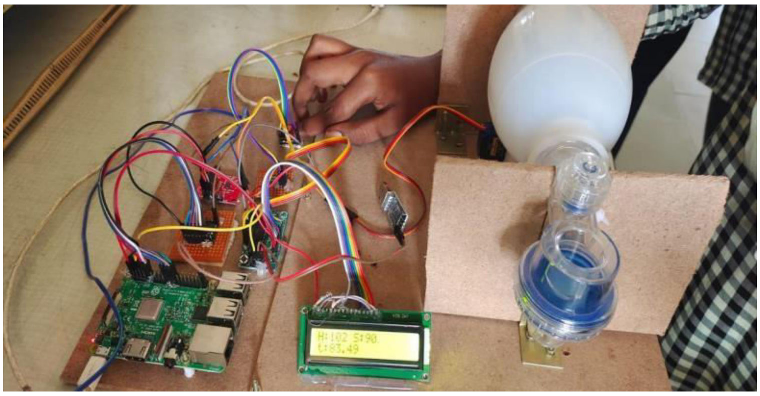

Fig.12:Oximeter Output values displayed on LCDV.

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