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Emergency Smart Ventilator with Health Monitoring System

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Abstract: ***Internet has been an important part of our life, it has enabled many machines and devices we use in everyday life to be monitored and controlled remotely. Most monitoring systems that are in use in today's world works in offline mode but our system is designed such that a patient can be monitored remotely in real time. The proposed approach consists of sensors which measures heartbeat and body temperature of a patient which is controlled by the microcontroller with smart ventilator. The readings are displayed in LCD monitor. The measuring system, which consists of sensors, constantly measures patient signs. If the predetermined critical values for the patient are exceeded, the Sensor values and also the alert system is turned on (Buzzer). By using this prototype, it can provide artificial ventilation to a person who cannot breathe independently and various health parameter readings can be accessed and monitored by a medical professional remotely.***

I. INTRODUCTION

A ventilator is a machine that provides artificial ventilation to a patient who is physically unable to breathe or breathing insufficiently. Ventilators can cost around Rs.5 lakh to 12 lakh and it requires external oxygen cylinder which can cost around 10 thousand rupees each.

One of the most pressing shortages faced by hospitals during the Covid-19 emergency is lack of ventilators. Acquiring medical assistance in these conditions can also be a concern. The primary goal of the project is to provide medical assistance to a patient independently without any human contact.

The function of this project is to assist in respiration and measure various health parameters such as heart rate, oxygen rate and body temperature and report it. In addition to that it also reminds the medication prescribed to that condition. We intend to achieve these applications in a safe and an inexpensive alternative.

II. LITERATURE SURVEY

A. Title: "The internet of things for health care: A Comprehensive survey"

Year: 2015 Author: S. M. RIAZUL ISLAM1, DAEHAN KWAK, MD. HUMAUN KABIR

The IoT revolution is redesigning modern health care with promising technological, economic, and social prospects. This paper surveys advances in IoT based health care technologies and reviews the state-of-the-art network architectures/platforms, applications, and industrial trends in IoT based health care solutions. It also discusses how different innovations such as big data, ambient intelligence, and wearables can be leveraged in a health care context.

B. Title: "The Smartphone as a Medical Device"

Year: 2013 Author: Emmanuel Agu, Peder Pedersen, Diane Strong, Bengisu Tulu

Smartphone sensors can be processed to diagnose a wide variety of medical conditions including cough detection, irregular heartbeat detection, and lung function analysis. The ability to diagnose ailments's on smartphones could lead to early detection, which could ultimately reduce healthcare costs

C. Title: "A Non-Invasive Method for Calculating Calories Burned during Exercise using Heartbeat"

Year: 2017 Author: Justin Turner, Chase Zellner, Tareq Khan, and Kumar Yelamarthi

In this project, heart rate is measured using Heartbeat sensor . Our proposed IR sensor is economical and user friendly and uses optical technology to detect the flow of blood through index finger. In this project, Arduino is used in which microcontroller ATmega328 is embedded into it, suitable codes have been written to detect and count the heartbeat and also to calculate the calories burnt.

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III.PROPOSED METHOD

Arduino Microcontroller is used to implement this project. We will write code for Arduino using Embedded C programming. Sensors are used to measure the physical parameters of the human body. The data collected by the sensor is uploaded to a cloud platform called "Thingspeak". This uses a technology known as internet of things. Internet connectivity to the microcontroller is established using ESP8266 Wi-Fi module. When the system senses lack of oxygen, the smart ventilator is initialized automatically and robotic paddles are actuated to pump the oxygen out of an ambu bag , which is driven by DC motor.

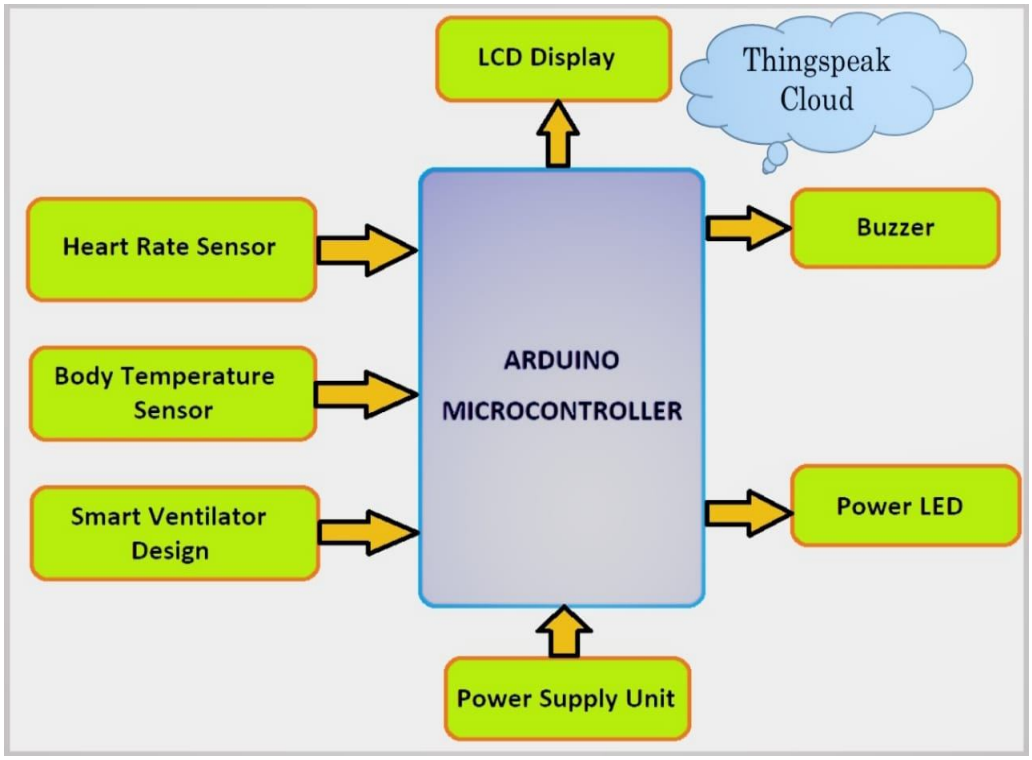

Fig 1: Block Diagram showing interfaces of various peripherals with Arduino Microcontroller

The above block diagram shows the different blocks used in our prototype and their interfaces, temperature sensor can sense temperature values from 0-100°C with a tolerance of ±0.4°C at room temperature, the heart rate sensor can sense the heart beat, the health parameters are stored in a cloud platform called thingspeak, the sensor readings are displayed on a 2×16 LCD monitor. In smart ventilator design, mechanical paddles fits around an Ambu bag , which hospitals already have on hand in abundance. These ambu bags are designed to be squeezed by hand, instead they are squeezed by mechanical paddles driven by a DC motor. This directs air through a tube which is placed in the patient's airway

IV. APPLICATIONS

A. Hospitals.

As expressed before , hospitals are facing lack of ventilators. Hence ,our prototype can be used as an alternative since they are inexpensive to implement.

B. Trekking Base Camps

These camps are usually located in high altitude regions where level of oxygen will be low, so this prototype can play a vital role.

C. Military Camps

As this device is light in weight it can be carried easily to different military camps situated in remote locations.

D. Emergency Situations.

They can be used in emergency situations such as ambulance to help a person in breathing.

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V. ADVANTAGES AND DISADVANTAGES

A. *Advantages*

1) Economical in design since minimal components and parts are used in the unit.
2) Accuracy is better when compared to manual pumping of oxygen.
3) Encourages physical distancing as patients can be monitored from different locations.
4) It is portable because it is light in weight.

B. *Disadvantages*

1) In some rare cases, it might require external oxygen supply.
2) As it involves delicate components , proper maintenance is necessary.

VI. RESULT ANALYSIS

As we mentioned earlier sensor are used to read the values of health parameters of a patient such as, heart rate sensor is used to reads the heart rate value of the patient .Similarly, body temperature sensor reads the temperature of the patient. LCD (2 X 16) will display all data of the sensor parameters as well as prescribed medication. All the sensor readings are stored in a cloud platform called Thingspeak which can be accessed and monitored by a medical professional. When the system senses lack of oxygen smart ventilator is actuated automatically and robotic paddles are actuated to pump the oxygen out of an ambu bag which can provide assistance to a patient in respiration. Pressure sensor is used to control and maintain the flow of oxygen.

VII. CONCLUSIONS AND FUTURE SCOPE

A. *Conclusion*

At the completion of this work, we have developed a device which can provide basic medical assistance independently without any human contact. This device is capable of reading the body temperature, heart rate and oxygen rate of a patient and upload it to a cloud called Thingspeak for accessing and monitoring. If the oxygen value falls below the threshold ,the smart ventilator actuates automatically to assist a person with abnormal breathing .

B. *Future Scope*

In the future, this Smart Ventilator can be further improved to make it completely automated and it can be designed to have other features such as voice control which makes it capable of monitoring a patient without any professional doctor's assistance. A webcam with a screen can also be added to help patient interact by maintaining physical distance.

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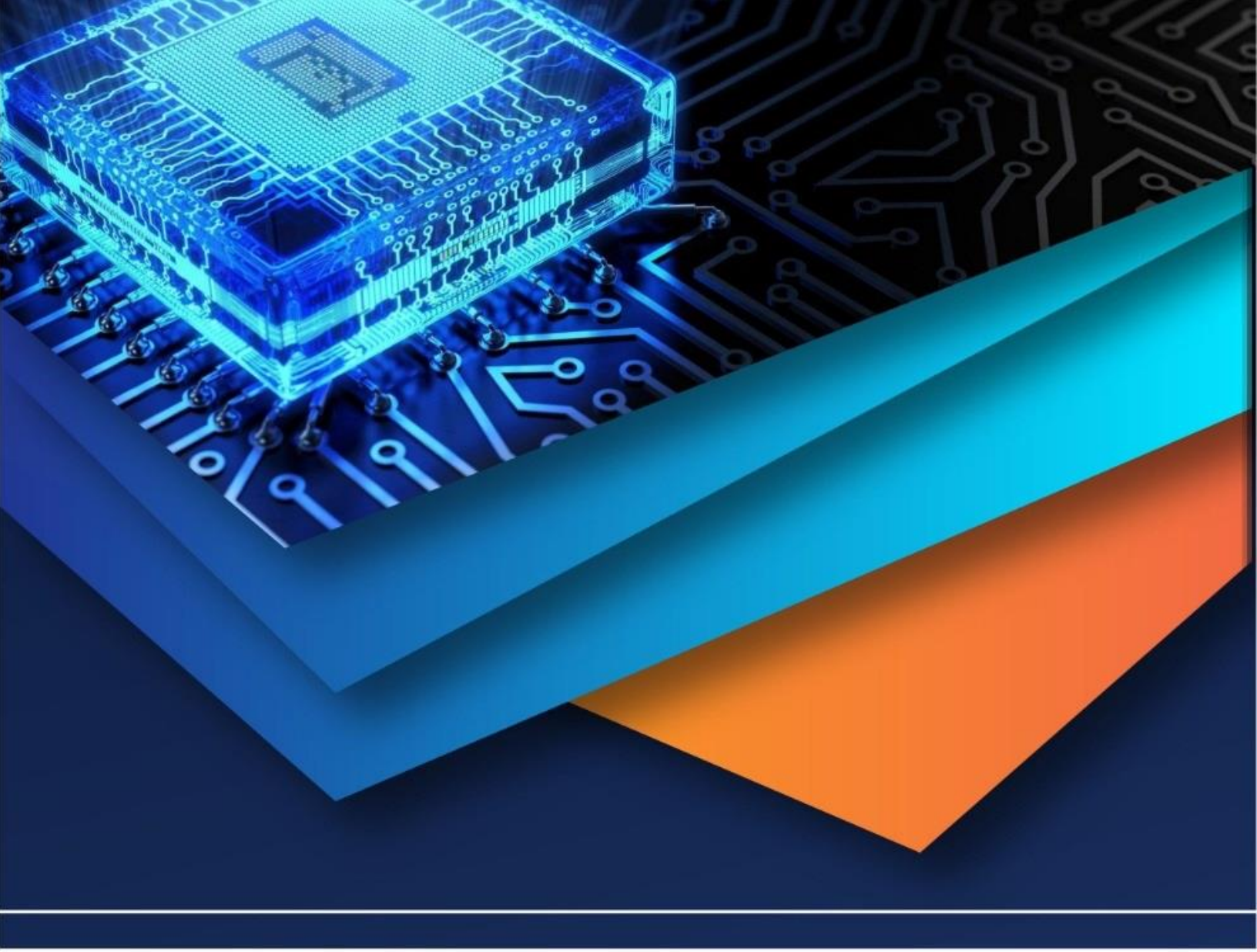

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