Smart Aeterial Blood Gas Analyzer

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ABSTRACT

The Patient's blood sample records are all not able to get properly as more no of samples are used daily in that machine. More samples, transportation and storage that are lead to loss of data or it will become some technical issues. So it is important to get data securely to doctor's hands. We have taken ABG machine's database to store and retrieve information whenever it is necessary. Blood gas analysis is used to measure oxygenation level, partial pressure, electrolytes and other parameters. We are using Arduino and cloud network that offers proven solution for backing databases to the storage. The readings can be view by the mobile application.

KEYWORDS: Blood sample, patient's database, ABG machine, Arduino, Wi-Fi module, Cloud Network

1. INTRODUCTION

Blood gas analyzer is used to measure blood gas, pH, electrolytes, and some metabolites in whole specimens [3]. They can measure pH, partial pressure of carbon dioxide and oxygen, and concentration of ions. They are also used to determine abnormal metabolite level in blood and patient's acid-base balance and levels of oxygen/carbon dioxide exchange [7]. Blood gas and PH measurements combined with a knowledge of the temperature and haemoglobin [2]. Electronic health records that make information available instantly and securely to authorized users. While an EHR does contain the medical and histories of the patient. Modern blood gas analyzers are measuring various forms by recording parameters in different forms. This is used in hospitals for measuring the blood gas parameters for the patients in daily life. The design of the project is to record the patient's database securely [11]. This device is overcome from the loss of patient's data when transferring the device and also depends on the users. This device will save the patient's data by backing up and restore the data. Unsafe, unhealthy, uncomfortable or inefficient situations at work. Backup and recovery is one of the most critical operations performed in the data centre, requiring organizations to maintain current, flexible, secure and speedy solutions to keep their data accessible at all times.

2. Blood gas analyzer

Blood gases are a measurement of how much oxygen and carbon dioxide are in your blood. They also determine the acidity (pH) of your blood. Blood gas measurements are used to evaluate a person's lung function and acid/base balance.

Blood gases are used to detect an acid-base imbalance, such as can occur with kidney failure, heart failure, uncontrolled diabetes, severe infections, and drug overdose [3].

ABG results provide information on the acid base status, oxygenation (pO2 and haemoglobin saturation) and CO2 elimination. A utilisation survey of a large tertiary hospital showed that the reasons for requesting ABG tests included change in ventilator setting, respiratory event, part of clinical routine, metabolic episode, pre- and post-intubation, pre- and post-extubation, confirmation of pulse oximetry results and abnormal results, altered mental state, to establish brain death and cardiac event.

ABG Parameter	Reference Ranges
pH	7.35-7.45
Pco2(mmHg)	35.0-45.0
pO2(mmHg)	75.0-100.0
Na+	140.0 – 170.0
K+	4.0 -8.0
Cl-	1.25 -2.50

2.1. pH

The pH is a measurement of the acidity of the blood, indicating the number of hydrogen Ions [H+] present. Most of the body's hydrogen ions are the result of carbohydrate and protein metabolism. The hydrogen ion concentration is maintained within a tight range of 7.35–7.45 by 3 mechanisms working in concert at different time frames and at different levels [1].

2.2. Partial Pressure of carbon Dioxide (pCO2)

The normal pCO2 range reflects the amount of CO2 dissolved in the blood [1]. Carbon dioxide is produced by the internal respiration of tissue cells and excreted from the body by external respiration via the lungs.

2.3. Partial Pressure of Oxygen (pO2)

The partial pressure of oxygen (pO2) reflects the amount of oxygen gas dissolved in the blood [1].

2.4. O2 saturation

Oxygen saturation measures the percentage of haemoglobin that is fully combined with oxygen as represented by the oxygen-haemoglobin dissociation (saturation) curve. The plateau of the haemoglobin dissociation curve shows that there is a substantial reserve for oxygen, and haemoglobin saturation remains high at about 75–80% at pO2 greater than 40mmHg [1].

3. Components

3.1. Arduino

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features an ATmega16U2 programmed as a USB-to-serial converter. This auxiliary microcontroller has its own USB boot loader, which allows advanced users to reprogram it.

The Arduino has a large support community and an extensive set of support libraries and hardware add-on "shields" (e.g. you can easily make your Arduino wireless with our Wixel shield), making it a great introductory platform for embedded electronics.
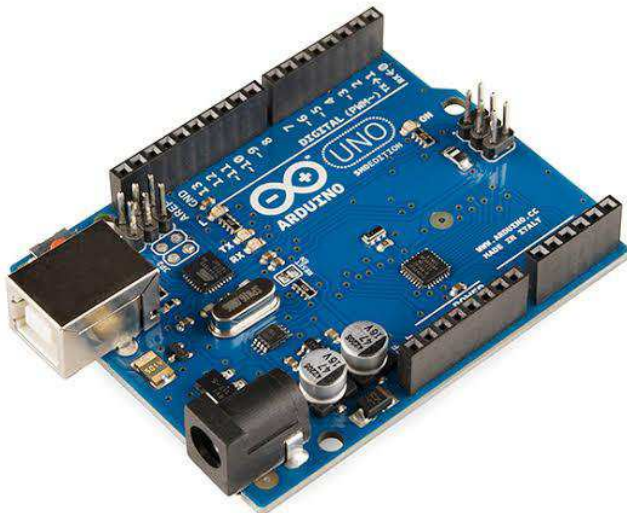

3.2. Wi-Fi module

The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands.

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements.

Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface. ESP8266 on-board processing and storage capabilities allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.
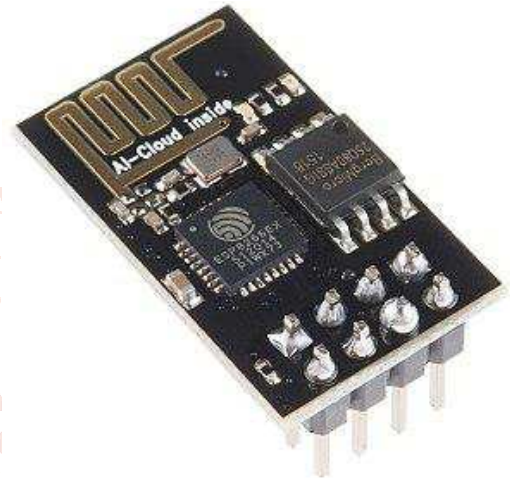
3.3. Cloud networking

Cloud networking is a type of infrastructure where network capabilities and resources are available on demand through a third-party service provider that hosts them on a cloud platform. The network resources can include virtual routers, firewalls, and bandwidth and network management software, with other tools and functions becoming available as required. Companies can either use cloud networking resources to manage an in-house network or use the resources completely in the cloud.

Cloud networking describes a software-defined computer network that is within a cloud computing infrastructure. Internal and external computing resources and users can use the network to connect and communicate with each other.
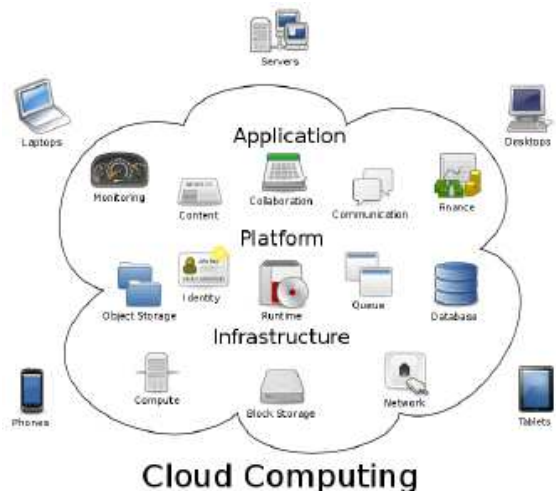
To understand the workings of a cloud system, it is easier to divide it into two sections: the front end and the back end. They are connected to each other through a network, usually the Internet. The front end is the side of the computer user or client. The back end is 'the cloud' section of the system. The front end consists of the client's computer or computer network. Also the application essential to access the cloud computing system. It is not necessary that all cloud computing systems have the same user interface.

On the back end of the cloud technology system, there are various computers, servers and data storage systems that make up the cloud. A cloud computing system could potentially include any computer program, from data processing to video games. Generally, each application will have its own dedicated server.

4. Block diagram
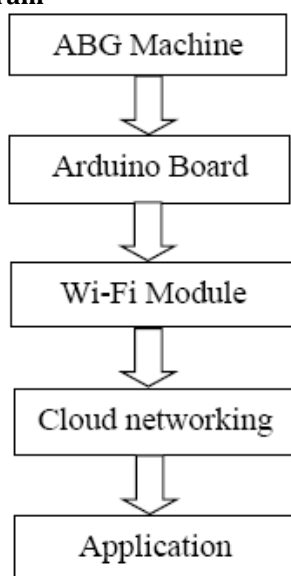
5. Construction and working
The Arterial blood gas analysis is measures the amount of oxygen and carbon dioxide present inside it. It is the most important test to measure the level of pH which helps to balance when you are healthy and also results other blood parameters. There are many ways to interpret the blood gas in a crucial way. The output samples are taken from the machine is transferred to the arduino through RS232. RS232 is originally designed for serial communication transmission of data. As it obtains the voltage for the path used for exchanging the data between the devices. The digital signals from the arduino to Wi-Fi module ESP8266. ESP 8266 maximum working Voltage is 3.6V and it is very important to note. The data will be transfer to the EPS 8266 serial Wi-Fi module. That Wi-Fi module for using the wireless data transferring to the cloud computing network. Cloud computing, in turn, refers to sharing patient data an information via a network, in this case the Internet. By using cloud storage, you don't have to store the information on your own hard drive. Instead, you can access it from any location and download it onto any device of your choice, including laptops. This method for exact and secure the data will transfer to the doctors so they can be view at any time.

6. Conclusion
Software defined computer network describes and reduces the management devices that helps to respond faster for the medical needs and deployed quickly to the doctor's hand.

The output can be viewed through mobile application. The main advantage of cloud networking is the consumption of less storage space so, as more no of data can be stored and it does not require continuous internet connection.

7. Result
In this article, it explained about the blood gas analysis test that extracting patient's data from the machine that can be send to the cloud network through Wi-Fi module that can be stored and retrieve at any time.

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