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Electronic Stethoscope with Pulse Monitoring On Online Server

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Abstract:-

A stethoscope is a medical device for listening to the sound of heart and breathing in our body. The commonly used stethoscope is an acoustic stethoscope. The disadvantage of acoustic stethoscope is that the sound level is very low and this stethoscope is not very suitable to use in noisy environment as well as to detect internal sounds of babies as they are very low. However, acoustic stethoscope is commonly used because it is cheaper than electronic stethoscope. Electronic stethoscope electronically amplifies body sounds. As the sound signals are transmitted electronically it can be wired or wireless and provide noise reduction. In this paper the design of an electronic stethoscope and pulse rate on online server with the functions of wireless transmission is proposed. The electronic stethoscope is based on embedded processor. The design consists of a integrated chest piece module for captured acoustic sound transmission and a microcontroller based head piece receiver module for decoding the data. The digital stethoscope proposed here for heart sound monitoring consists of a diaphragm, microphone, operational amplifier ,pulse sensor, arduino module, wireless module and speaker. The proposed design is successful in patient/subject beat per minute monitoring on online web server with wired amplifying sound of patient heart using stethoscope.

Index Terms- digital stethoscope, microphone,operational amplifier, arduino microcontroller, heart sound.

1.INTRODUCTION

History of stethoscope to 460 -377 BC during which Hippocrates provided the foundation for auscultation when he put his ear against the chest of a patient and described the sounds he could hear from the heart. The next research was made by Robert Hooke 1635 -1703 who realized the cardiac auscultation. Then in 1816 Rene Laennec invented the stethoscope[10].

In 1851, Arthur Leared invented a binaural stethoscope, and in 1852 George Cammann perfected the design of the instrument for commercial production. By 1873 there were descriptions of a differential stethoscope that could connect to slightly different locations to create a slight stereo effect, though this did not become a standard tool in a clinical practice[12]. Rappaport and Sprague designed a new stethoscope in the 1940 which became the standard by which other stethoscopes are measured consisting of two sides, one of which is used for the cardiovascular system[11]. In 1999, Richard Deslauriers, patented the first external noise reducing stethoscope, the DRG pure tone. In 2004, Philips came out with an electronic stethoscope model. Heart auscultation is one of the most fundamental process of interpreting the sounds produced by heart to diagnose various cardiac diseases[12]. Detecting the heart sound or murmurisng the traditional stethoscope is key problem that always arise for doctors medical physicians and at the hospitals. Generally heart murmurs get unnoticed during routine checkups since detection relies on the training or expertise of the physicians, the quality of the equipments used, and the severity of the condition[2]. That is why some form of digital stethoscope needs to be developed to replace the existing acoustic stethoscope, A digital stethoscope allow physician to analyze cardiac signals in real time as well as record patients heart sound and pulse rate instantly on to their laptop or computers for further examination and visualization. With a conventional stethoscope which is currently available in the

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market, distinguishing between innocent murmur and suspicious murmur is very difficult.

2 LITERATURE REVIEW

2.1 ACOUSTIC STETHOSCOPE

Stethoscopes are used for auscultation of heart, lung and murmurs for over two centuries. The stethoscope is an acoustic medical device for auscultation, or listening to the internal sounds of an animal or human body. It typically has a small disc-shaped resonator that is placed against the chest, and two tubes connected to earpieces. Conventional acoustic stethoscopes sound levels are extremely low and there are some shortcomings for use in telemedicine and telecardiology. Improvements in performance are targeted to increase the performance of the stethoscope and the diagnostic capability in telemedicine environment[13].

2.2 ELECTRONIC STETHOSCOPE FOR FUTURE DIAGNOSIS

Work carried out in this paper, uses a electronic stethoscope designed with the help of arduino microcontroller board, that records human organ signals and beat per minute values, stored in memory, which is transmitted to the authorized center where qualified doctors analyze signal receive from the particular public health center (PHC). Qualified doctors analyze signal and if any illness present in signal then necessary medicine is prescribe to patients through local doctors. Conventional electronic stethoscope is not used for real time monitoring and also any data is not uploaded on online server as a delay is come in diagnosis of patient[14].

3. PRESENT WORK

To eliminate extremely low sound levels and diagnosis based on past observations of patient with a large time delay. We propose the design of electronic stethoscope with amplified sound and real time monitoring of bpm on online server.

3.1 ELECTRONIC OR EMBEDDED STETHOSCOPE WITH REAL TIME PULSE RATE MONITORING

Portable device includes microphone embedded with stethoscope, the pre and post amplification circuit, low pass filter , arduino, speaker, LCD display and pulse sensor. The microphone embedded in the chest piece of stethoscope is to capture heart sounds and convert it in electrical signals or digital signals by using amplifier which are processed by front end pick up circuitry that playing heart sound signal in real time using speaker.

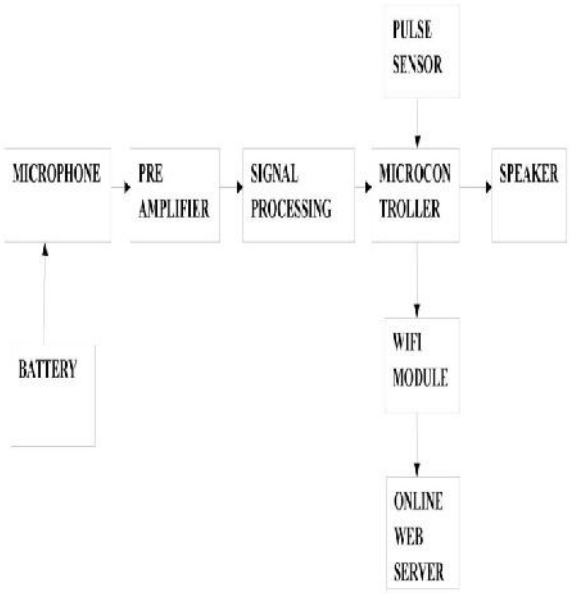

Figure1. Block Diagram of Proposed System .

The components of the design are discussed as below:-

3.1PULSE SENSOR

In this proposed design, the pulse sensor used that works on the principle of Photo plethysmography and is utilized to detect pulse. This technique is a noninvasive technique of measuring the cardiovascular pulse wave by detecting blood volume changes in the blood vessels close to the skin. It can be detected by using IRLED and Photo Detector. Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at

each pulse. It uses light source to illuminate the finger on one side and photo detector another side measures the small variation in transmitted light intensity. The sensor unit consists of an infrared light-emitting-diode (IR LED) and a photo diode. The IR LED transmits an infrared light into the fingertip, a part of which is reflected back from the blood inside the finger arteries. The photo diode senses the portion of the light that is reflected back. The intensity of reflected light depends upon the blood volume inside the fingertip. So, every time the heart beats the amount of reflected infrared light changes, which can be detected by the photo diode. With a high gain amplifier, this little alteration in the amplitude of the reflected light can be converted into a pulse. The output is digital level at 5V supply. The duration between pulses are used to calculate the heartbeat..The portable device consist of an built in microphone in a chest piece to capture heart sounds, front end pick up circuitry, head phone amplifier, .

3.3 ARDUINO UNO BOARD

Arduino is an open source hardware. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains. A minimal Arduino C/C++ sketch, as seen by the Arduino IDE programmer, consist of only two functions:

- *setup()*: This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.
- *loop()*: After *setup()* has been called, function *loop()* is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

Most Arduino boards contain a light-emitting diode(LED) and a load resistor connected between pin 13 and ground, which is a convenient feature for many tests and program functions. A typical program for a beginning Arduino programmer blinks a LED repeatedly.

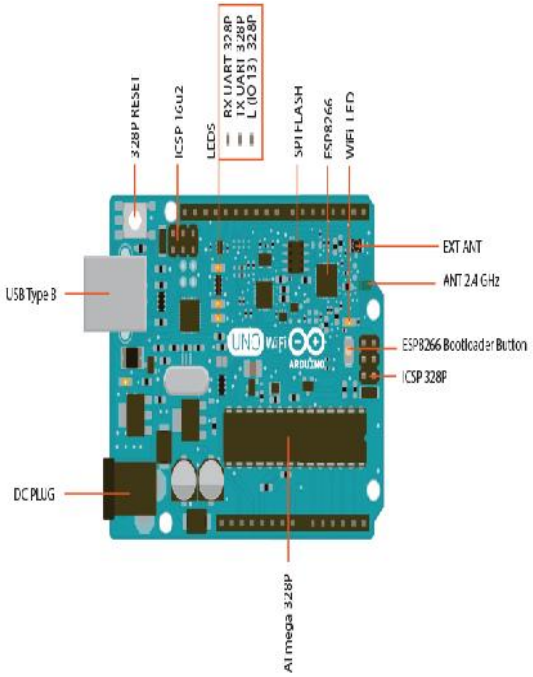

Figure 2. Arduino Board

3.4 LM386 AUDIO AMPLIFIER

The **LM386** is an integrated circuit containing a low voltage audio power amplifier. It is suitable for battery-powered devices such as radios, guitar amplifiers, and hobby electronics projects. The IC consists of an 8 pin dual in-line package (DIP-8) and can output 0.25 to 1 watts of power depending on the model using a 9-volt power supply.

Figure3. Diagram of amplifier module

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3.5 Electret Condenser Microphone

The microphone used in this device is of great importance with consideration of size, sensitivity, frequency response and cost, electret condenser microphone (WM-61A) has been used to capture the acoustic signal which gives high sensitivity and high S/N ratio. Broad and flat frequency response curve enables perfect heart and lung sound acquisition. Small dimension is also significant that allows the microphone to be embedded in to the latex tube with a chest piece, which reduces ambient noise and extract the acoustic signal from the thoracic cavity. Then microphone is connected to amplifier circuitry which is already connected to the speaker and battery with charger.

Figure 4. Electret Condenser Microphonone
Figure 5. Amplification Module .

3.6 WIFI ESP8266 Module

The **ESP8266** is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit). This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume, The **ESP8285** is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

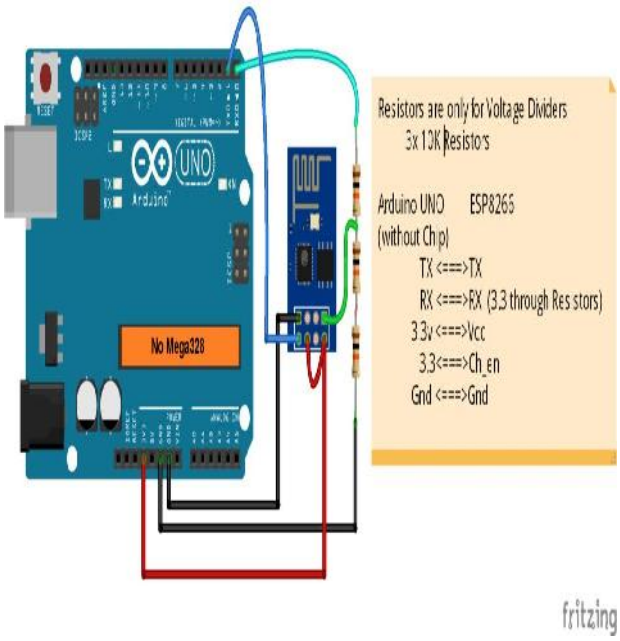

Figure 6. WIFI Module with arduino uno

RESULT

The result shown in fig 7., describes a channel on thingspeak which shows a graph of beat per minute ,field1 shows bpm on x-axis and time zone with day and date on y-axis.Red dots of graph shows bpm like 96,104,73etc.The channel access is private, author –sandhupriyanka. This is a private view of the channel. Channel status includes creation, updation and last entry with date. The channel works on the API key of the hardware which is generated by programming of arduino.

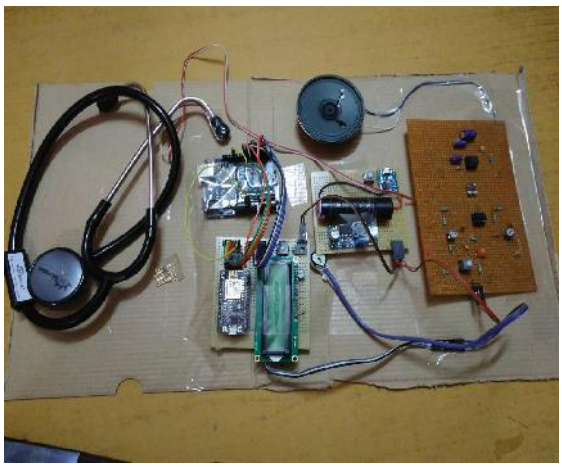

Figure 8. image of proposed system

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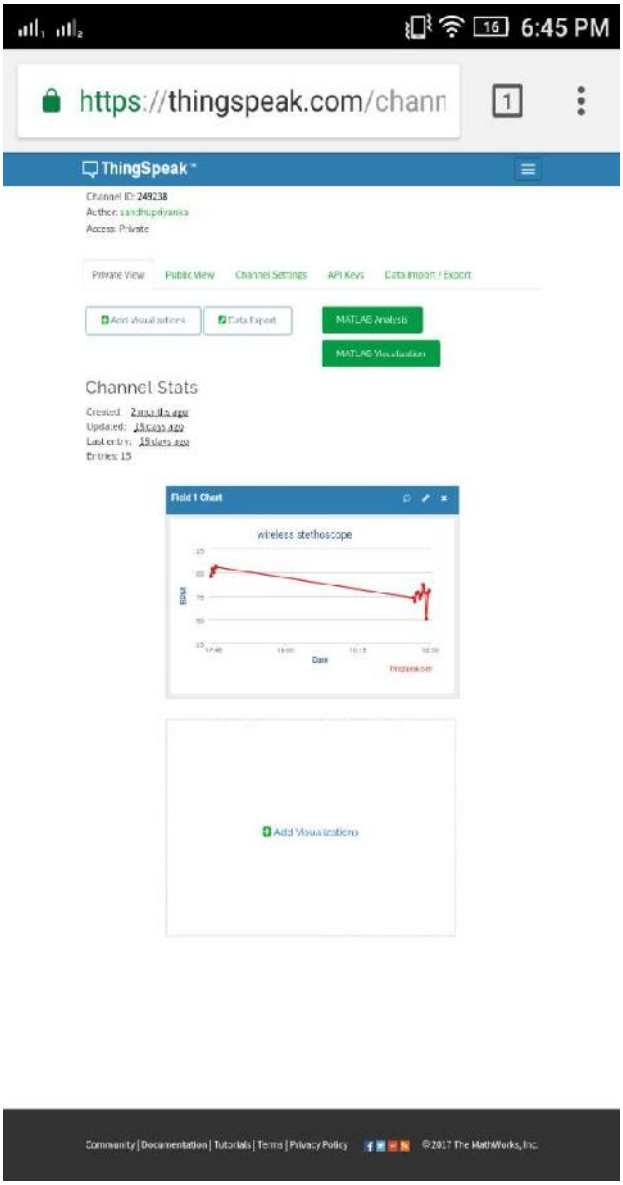

Figure 7. result

4 CONCLUSION AND FUTURE SCOPE

Electronic stethoscope found that sound is pick up by chest piece and then amplify by using an amplifier as a result we can hear it only a louder sound of heart and lungs it is not wireless as well as data cannot be saved for future purpose ,its good only for real time. Also pulse rate monitored using Arduino IDE software is used to program the microcontroller (Arduino Uno) so that the signal from the pulse sensor can be represented in digital form. The pulse is measured in beats per minute. Thing speak is an open source internet of things application and is used to store and receive data from things using HTTP protocol over the internet or via a LAN. In our proposed and implemented system, we focussed on monitoring the health care parameters like heart rate and also amplification of heart sound using amplifier and filters to remove noise. The system can be further improved by transmitting sound signal from chest piece of stethoscope to arduino which converts it into digital form and the sound transmit wirelessly using wireless modules like zigbee.

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