

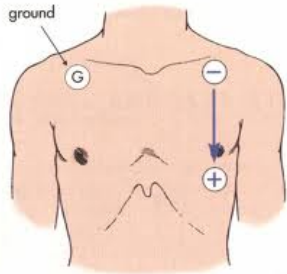
2. Ease of Use

While the conventional ECG monitor is an excellent heart monitoring device, it has certain challenges associated with it. In recent times, healthcare wireless systems are being developed. In an ECG monitoring system, when patients are tethered to their bedside ECG monitor, their movement is naturally restricted. Patient safety is compromised during ambulation. Another limitation of conventional ECG is improper acquisition of data due to the lead wires rubbing against each other. There may be poor transmission signal in lead wires. Tangling of lead wires may pose a problem and considerable time maybe spent in attaching and detaching lead wires.

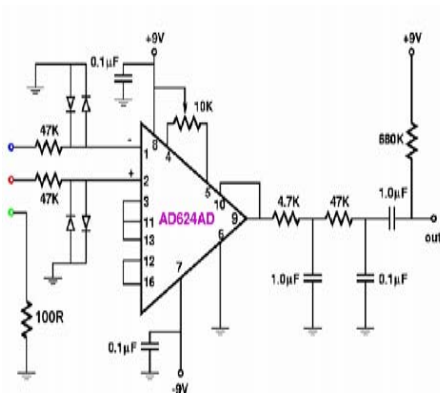
A wireless ECG monitoring system, on the other hand, would do away with the use of wired communication. It will allow mobility of the patient and provides reliable data through wireless communication. Monitoring of other medical parameters is also done, from a remote place, to allow the patient to move freely. This ensures that medical monitoring is possible whenever required.

3. Design and Operation

This system is designed to remotely monitor medical parameters, temperature and electrocardiograph, by transmitting the required data through Bluetooth.



The instrumentation amplifier AD624 circuitry provides a pin programmable gain of 1000. This is obtained by connecting Pin 3 to Pin 11. Pins 13 and 11 are shorted. Pins 16 and 12 are shorted. Since AD624 provides a high CMRR (130 dB minimum for gain= 500 to 1000), noise rejection is sufficient for this application.



The diodes are used for overvoltage protection. A high voltage may appear at the input because of shorting it to the

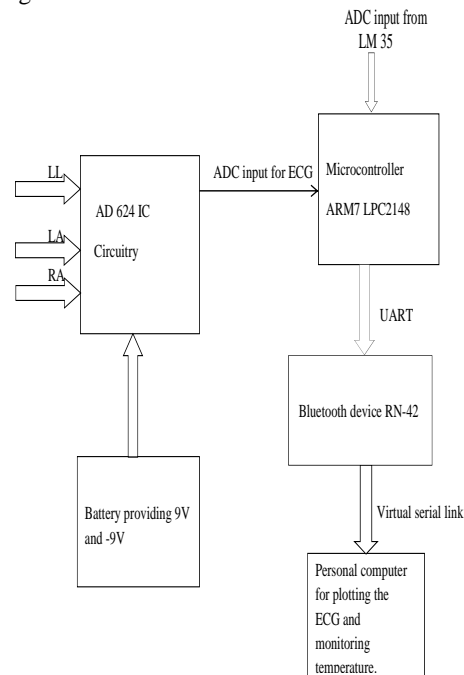
supply voltage. Any high voltage picked up at the inputs may cause damage to the circuit. This high voltage maybe transient, in the form of a spike or it may last over a longer period. To provide protection from such voltages, the diodes are connected, to shunt the current, on application of a large voltage. 100R indicates a resistance between the terminal and ground. Low pass filters are used at the output to filter the higher frequency signals in the output.

At the output of the AD624 circuitry, we get differential amplified signal which maybe fed as the ADC input to the processor ARM7LPC2148. This signal is found to be in the range of 900mV-1200mV. Hence it is suitable to be processed by the ADC of the ARM processor. It is connected to the pin 28 of port 0.

The TXD pin (Pin 0 of Port 0) is connected to the RX of the RN42 and RXD pin (Pin 1 of Port 0) is connected to TX of RN-42. UART transmission functions are defined. On transmission through UART, data reaches Bluetooth. The Bluetooth device RN-42 is added on the computer. A virtual serial link is established on port COM3. Data from COM3 is used for plotting the ECG waveform. Microsoft Visual Studio is used, here, to check the ECG data in the form of a waveform.

The two pins of LM35 are connected to supply voltage and ground terminals. Its third pin, which gives output voltage, is connected as the ADC input of the processor. The change in digitized value is observed for a unit rise in temperature. Accordingly, calibration is achieved. It is then possible to display temperature.

A detailed layout of the system is as shown in the block diagram.



Block Diagram.

After ECG data is transmitted to the computer, it is plotted in Microsoft Visual Studio.



4 Applications and Future Scope

Wireless monitoring of temperature keeps a check on the patient and helps the doctor know when the patient is ill. ECG monitoring finds applications in professional healthcare sector and consumer sector. Professional health care sector involves applications like defibrillators, automatic external defibrillators, holter monitor etc. Consumer sector includes commercial fitness equipment, home products etc.

This system can be upgraded so that it is used in applications to monitor patients located in remote places using wireless devices such as GPRS depending upon how far the patient is located. According to the requirements of the patients, unique systems can be designed to measure only the required biomedical parameters such as blood pressure, blood sugar, temperature, heartbeat, ECG. Scaling down the system ensures that it is portable and the patient can carry it with him wherever he goes.

5. Safety Protocols

It is necessary that anyone who wishes to implement or use this application should pay heed to safety protocols. When you connect your body to any electronic device, you must be much more careful than you usually are with your standard home electronics, because it can be extremely easy to cause a serious and even fatal electric shock. Placement of the electrodes on the body provides an excellent path for current flow — the measured impedance between leads L1 and L2 is approximately 50 k ohms. Professionally built medical devices are built with significant overvoltage protection so that line power glitches do not represent a hazard to patients — for this application diodes are used to provide limited over-voltage protection. To further increase safety an opt isolator integrated circuit could be added to the existing circuit so that the subject is completely isolated from the power supply. It is not recommended that you use this ECG device during an

electric storm. You should not attempt to use such a setup as that described here unless you are knowledgeable about and comfortable with using electricity in a safe and controlled manner.

6. Conclusion

This paper illustrates the system for Bluetooth based remote monitoring of medical condition in terms of Electrocardiograph and temperature of patients. The system provides medics with information about potential diseases or threatening cardiovascular conditions. Getting accurate measures is of the utmost importance in such instances, especially if the patient has history of heart disease. The doctor can monitor the medical condition of a multiple number of patients at a time, from the convenience of his cabin.

7. Acknowledgment

The authors would like to thank Prof. Amutha Jeyakumar, Electrical Engineering Department, Veermata Jijabai Technological Institute for her valuable guidance and support.

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