IR sensor based measurement system for continuous blood pressure monitoring .

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Design Objective

Based on the last team's limitations we suggested the following improvements:
1)Reduce power supply of circuit
2)Reduce overall size of PCB
3)Increase overall circuit performance by reducing DC offset
4)Increase overall gain to a more visual output
5)Provide the best IR sensor with detailed explanations – Compare their detected signals and analyze the difference

Procedure and Proposed Solutions

1) Eliminate the Potentiometer tests– Inserted a high pass filter (Cut off frequency with 0.1 Hz) to obtain a stable gain factor(100 times).

2) Replace digital filter tests- Replaced the A/D Converter and digital filter with the analog filters to save cost.

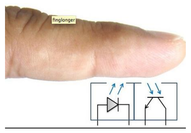
3) Design voltage follower tests- Two op amp followers were installed before the filters to separate each stage in this circuit, minimizing the sudden noise interruption from the input port.

4) Reduce DC power supply tests- This design successfully lowered down 8V(previous) to 6V(current) by adjusting the sensor without losing signal quality.

Introduction

The Twin Cities IEEE Phoenix Project is seeking to produce a blood pressure system that can be easily worn 24 hours a day for a week or more and record systolic and diastolic blood pressure readings every 1/2 hour. The last team prototyped a circuit that converted a weak pulse signal into a digital signal. This project aims to simplify the process and obtain a clear analog signal.

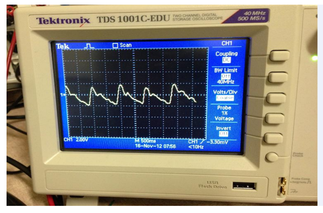
Block Diagram Blood Pressure Device



Reference citation: http://embedded-lab.com

→ 1st Voltage follower → High-pass filter (Cutoff Freq:0.1HZ) → Amplifier 100 X (time) gain ↓

2nd Voltage follower → Band pass filter (0.1 Hz – 10 Hz) →



Conclusion & Recommendation

The primary objective of the project was to modify a portable blood pressure system in a way to collect accurate analog signals and display them on the monitor. The design prototype met the client's primary demand**.**

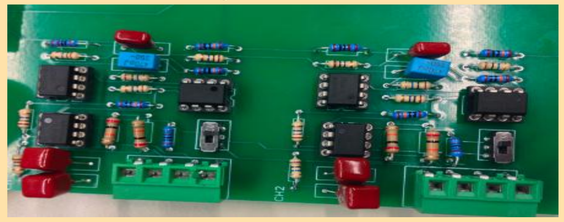
Testing the circuit by operating the two potentiometers was a very hard and unstable way to generate the analog signals. Our tests revealed that capacitor sizes in the Sallen-Key band pass filter did not directly solve the DC offset drifting.

The team recommends that the Twin Cities IEEE Phoenix Project pursue further testing of the prototype that uses (1) instrumental operation amplifiers for complete elimination of DC drift and (2) multi-pole filters in order to obtain a noise-free signal.

Our Products

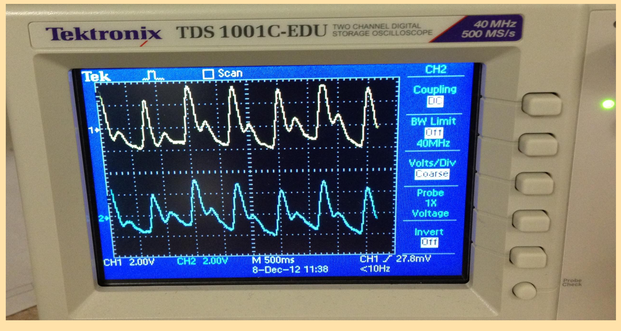
✓Eliminates the Potentiometers
 Uses Analog filter only
✓ Operates with 6V battery power
✓ Reduces DC offset of the output signal
 Operates with four input channels

PCB Board Layout



Analysis and Consideration

Test result



Analysis and Conclusion

The two signals above were detected from the index and middle fingers at the same time. In future work, this test result can serve as a reference to calculate blood pressure even if the signals still exhibit DC drift.

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