Infrared Blood Pressure Sensor

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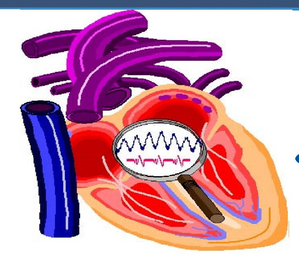
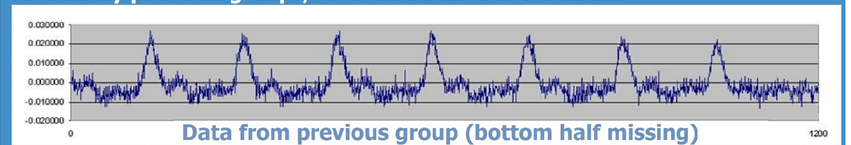


Phoenix Project

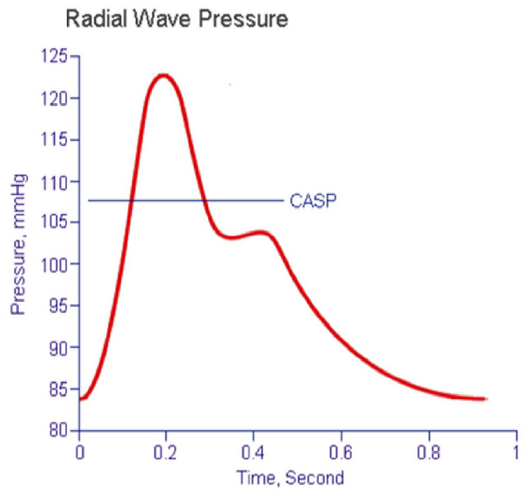
Introduction

The Twin Cities IEEE Phoenix Project seeks to design and build a blood pressure monitor that is non-intrusive, inexpensive, and can be worn twenty-four hours a day for a week or more. Currently, the central challenge in building this blood pressure monitor is the sensor itself, which must obtain an accurate electrical signal that represents the full pulse waveform. The Senior Design Group is now working specifically on this task.

The major challenge is to obtain a complete waveform of the blood pulse. Previous groups have failed to do so by getting only the upper half of the pulses. In order to measure the two blood pressures (diastolic and systolic), the full waveform must be obtained. After investigation into a variety of sensors by previous groups, infrared sensors are chosen.



Data from previous group (bottom half missing)

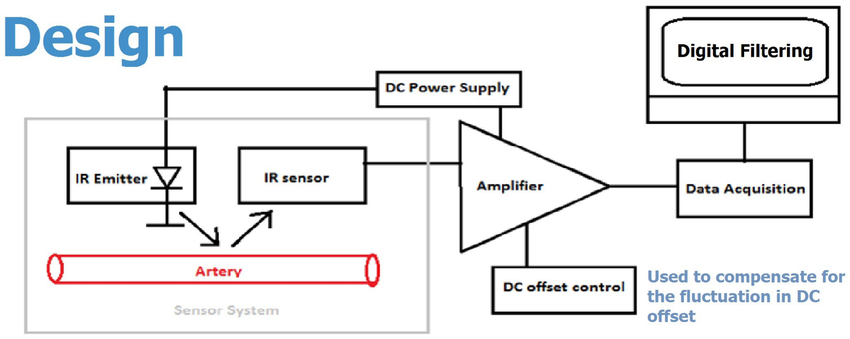


Goals

We are to build infrared sensor prototype that:

- can obtain a complete blood pulse waveform
- has basic amplification and filtering to process the raw data
- can be easily attached to human body
- has multiple channels so it can take readings from different places of the body simultaneously. Also the multiple channels can be implemented as sensor arrays so that it will be easier for the user to locate the optimal position to secure the sensors.
- is inexpensive
- doesn't take up much space
- relatively low power
- battery powered

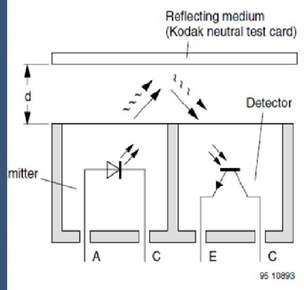
Design

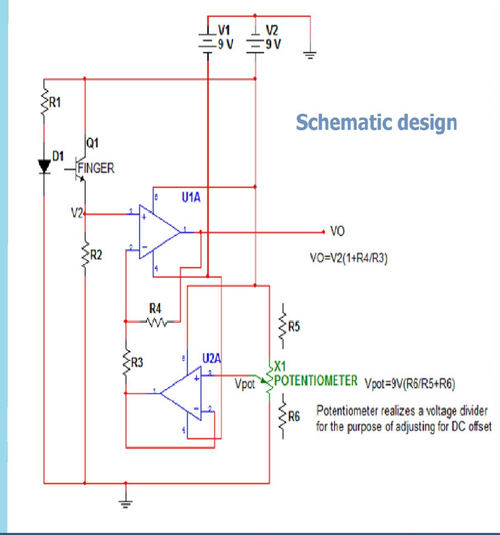


Block diagram of the prototype

IR Sensor

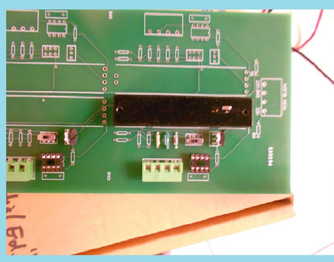
TCRT-1010

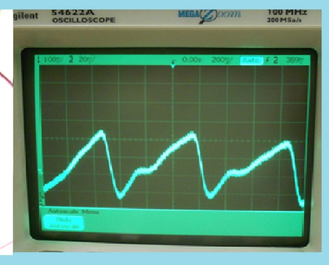




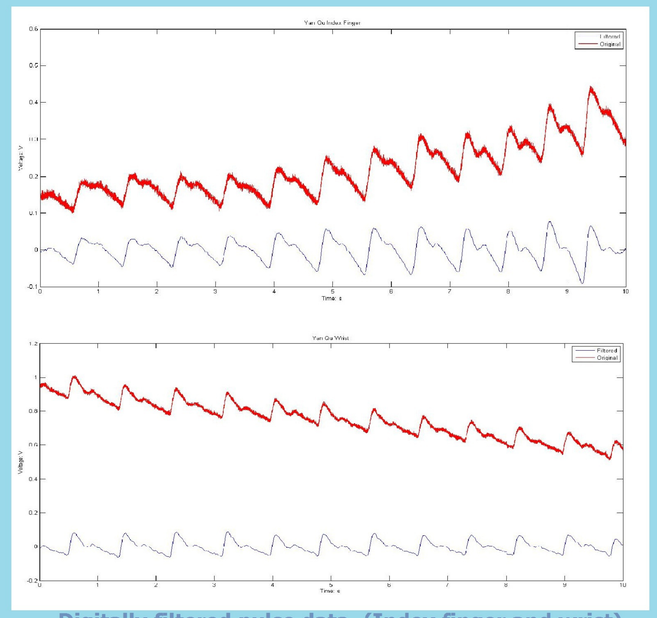
Schematic design

Results

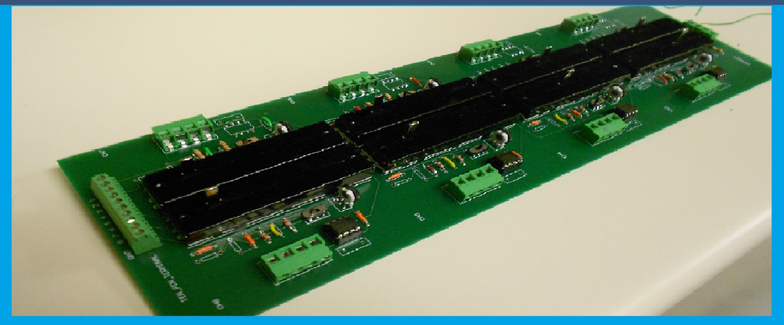




PCB prototype (one channel)



Digitally filtered pulse data, (Index finger and wrist)



PCB prototype (8 channels)

Accomplishments and Future Tasks

Our group has successfully accomplished the following:

- An 8-channel, battery powered PCB prototype
- Reading complete blood pulse waveform from various locations on human bodies, usable for blood pressure calculation.
- Digital data acquisition from analog signal
- Implementation of basic digital filtering on a PC
- Power consumption measurement

Upcoming tasks in the future include:

- More secure ways to place the sensor arrays
- Further implementation of digital filtering using microcontrollers or DSP chips
- Further lowering power consumption
- Scaling down the size

Acknowlegement and Reference

[1] "Objectives." Home Page. Web. 14 Feb. 2012.<http://www.phoenix.tc-ieee.org/000_Background/Phoenix_Objectives.htm.
[2] Chen patent for transient time and blood pressure calculation: http://www.phoenix.tc-ieee.org/023_Data_Acquisition_Prototype/InvestigateChenPatentHardware/20060629pete_Chen%27s%20Patent_US06599251%28B2%29.pdf

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