

Automatic Blood Pressure Measurement, or Multidisciplinary Action Hero Team Saves Little Betty Sue

Objectives: Student teams will develop automatic blood pressure measurement devices. In doing so, they will experience the general engineering design and development process, and consider how this process relates to situations commonly eluded to in life.

Background: Most people are familiar with having their blood pressure measured manually by a health care clinician. This measurement approach uses a manually inflated/deflated arm cuff, a pressure gauge and a stethoscope. Sound from the stethoscope is used to determine when to read the pressure.



An automatic blood pressure measurement device is a less accurate but often more convenient alternative. Typically, only pressure information is used. (The added cost of acquiring and processing a stethoscope signal is considered cost ineffective.)

In addition to blood pressure and stethoscope signals, finger pulse and so called oscillometric signals can be processed to automatically derive blood pressure measurements.

Multi-disciplinary content: To engineer an effective automatic blood pressure measurement device, a design team should have expertise in the following areas: human cardiac physiology, fluid dynamics, health care, electronics engineering, and computer engineering.



Course structure: Students will first participate in laboratory and classroom investigations aimed at understanding the health care, human cardiac physiology and fluid dynamics aspects of required background expertise. Student design teams will then be formed. By lottery, each team will select its own sensor types and digital processor type to be used to develop an automatic device. Paralleling the engineering design process, each team will first analyze signals from their sensor types, then learn to acquire & process signals from their sensors, then use electronics to interface their sensors to their digital processor. In culmination, each team will implement the signal processing required to automatically derive blood pressure measurements from their sensors.

Action heroes do engineering – sort of: Have you ever heard of MacGyver? How about MacGruber? Have you ever seen an action hero in a movie develop a required device out of “resources or opportunity”? Did it seem realistic? How would an engineer realistically build an automatic blood pressure device, needed to save little Betty Sue, using a digital processor scavenged from a Blackberry, or a PlayStation 3, or a washing machine?



As an engineer, you might question the plausibility of an action hero development scenario. You may view a produce advertisement skeptically if claims are made which don't make sense from an engineering point of view. As part of this project, we will consider these issues. Each student team will develop a short video spoofing an unrealistic action hero scenario or advertisement, while highlighting its own more realistic engineering development.

For more information, feel free to contact Professors Kevin Buckley (kevin.buckley@villanova.edu) and Lunal Khuon (lunal.khuon@villanova.edu).