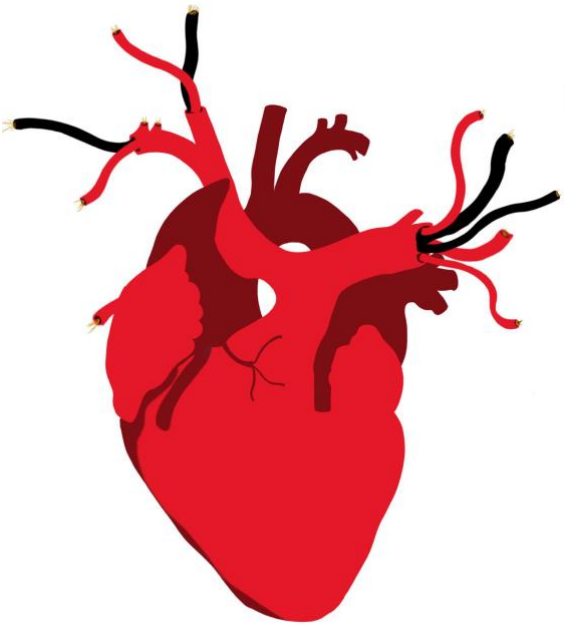
NORTHERN ARIZONA UNIVERSITY
School of Informatics, Computing, and Cyber Systems

Heart Bytes



Requirements Document

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The Heart Bytes team is working with a mechanical engineering team to produce a stent crimping machine for W.L. Gore & Associates. The Heart Bytes team is responsible for developing and testing all of the electrical components of the stent crimper.

1. General Requirements
    - 1.1. The device must use an iris crusher mechanism
    - 1.2. The device must have a graphical user interface to display information
    - 1.3. The device will draw power from the wall for general usage
        - 1.3.1. The device will also be able to accept power from a battery
    - 1.4. Safety Standards Requirements
        - 1.4.1. Warning labels in accordance with OSHA 1915.16
        - 1.4.2. Electric shock warning in accordance with OSHA 1910.137
        - 1.4.3. Emergency stop button in accordance with ISO 13850:2016
        - 1.4.4. Pinch point guard in accordance with OSHA 1910.212
2. Microcontroller Requirements
    - 2.1. Must have a minimum of 5 input pins that can be used for user inputs
        - 2.1.1. 2 input pins are required to adjust the diameter
        - 2.1.2. 2 input pins are required to adjust the radial force
        - 2.1.3. 1 input pin is required for the emergency stop button
    - 2.2. Must have a minimum of 4 input pins that can be used for sensors
        - 2.2.1. 2 pins are required for a distance sensor to tell the diameter
        - 2.2.2. 2 pins are required for a radial force sensor
    - 2.3. Must be able to drive at least 2 different motors
        - 2.3.1. 1 connection is required for use of a servo motor
        - 2.3.2. 4 connection required for use of a stepper motor
    - 2.4. Must be able to run a graphical user interface
        - 2.4.1. A set of seven-segment displays to display the diameter
        - 2.4.2. A set of seven-segment displays to display radial force
    - 2.5. Must have memory to store project files
    - 2.6. Must be able to supply the power needed to run all of the above components
3. User Input Requirements
    - 3.1. There must be two buttons to control the diameter of the stent
        - 3.1.1. One button should be used to increase the diameter
        - 3.1.2. One button should be used to decrease the diameter
    - 3.2. There must be two buttons to control the radial force of the stent
        - 3.2.1. One button should be used to increase the radial force
        - 3.2.2. One button should be used to decrease the radial force

3.3. There must be an additional button for emergency stops

4. Sensor Requirements
   4.1. Length Sensor
      4.1.1. Must be able to measure distances between 1 to 100 mm
      4.1.2. Must be accurate up to 1%
   4.2. Radial Force Sensor
      4.2.1. Must be able to read forces around 132.94 Newtons or 28.9 N/cm
      4.2.2. Must be accurate up to 1%
5. Graphical User Interface Requirements
   5.1. The GUI must be several seven-segment displays, one to display radial force, one for diameter
      5.1.1. One set of seven-segment displays should be able to display radial force
      5.1.2. One set of seven-segment displays should be able to display diameter
6. Motor Requirements
   6.1. Servo Motor
      6.1.1. It will be used in helping insert stents into the machine
   6.2. Stepper Motor
      6.2.1. It will be used to change the diameter of the iris crusher