Design Presentation

Heart Bytes

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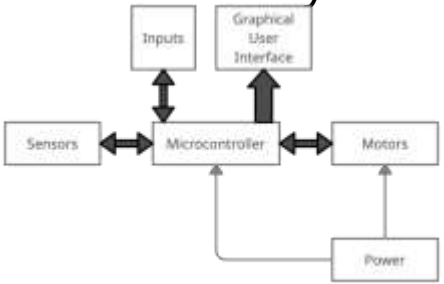
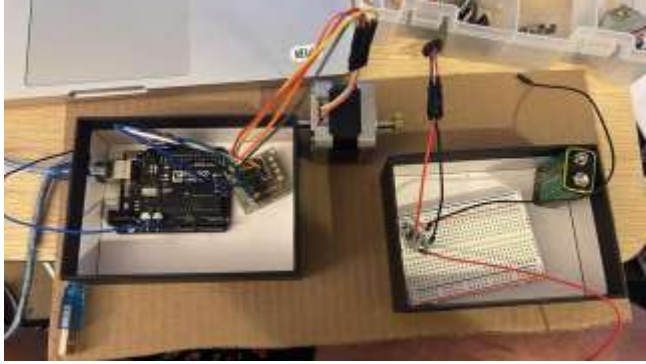
Overview

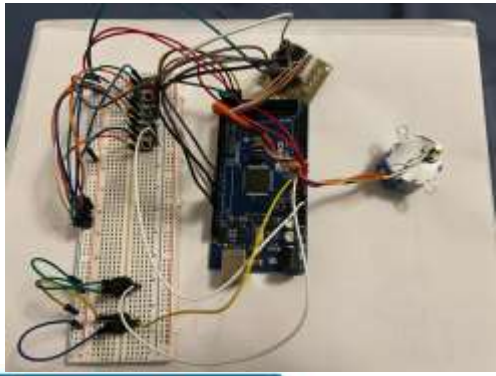
- The Heart Bytes team is currently working alongside a mechanical engineering capstone group to create a stent crimping machine for W.L. Gore & Associates
- Stent crimping machines are devices used in the medical field that contract stents to become the correct diameter prior to a surgery
    - Stents are a medical tool made of metal that is inserted inside blood vessels to ensure blood flow
- Our team is responsible for designing the hardware and software necessary for the machine to function

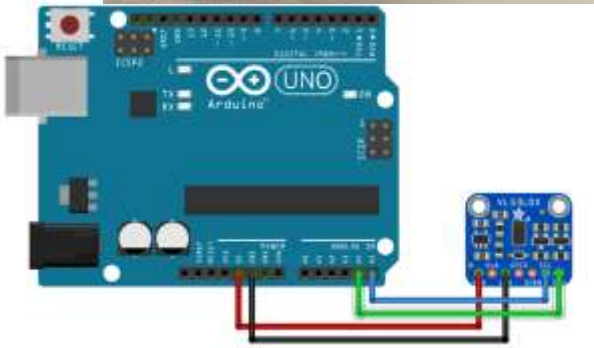


Prototypes

- Eisa prototyped the motor control system.
  - Features the control of a single stepper motor in order to increase or decrease the stent reel force, or stent aperture diameter.
- Alex prototyped the microcontroller that the team will use in the current design of the project
  - Features prototyped include user inputs, control of a stepper motor, and additional stubs for sensors and GUI
- Aziz prototyped the sensor subsystem that will be used to measure force and radius of stent crimp.
  - The sensor subsystem contains a load sensor, and laser distance sensor, which will be used to measure the stent reel force and stent aperture diameter.



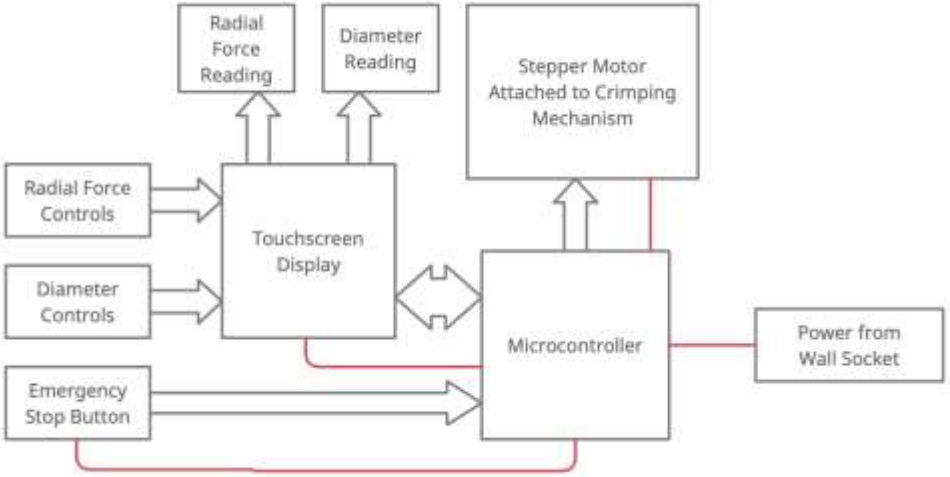




Hardware Design

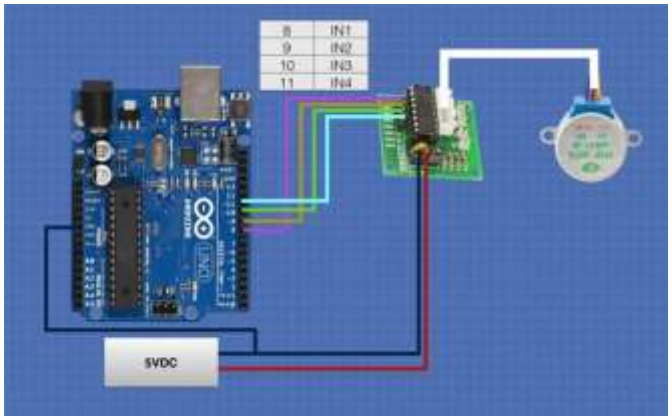
- The current design includes two sensors which read force value and diameter value. These readings will be shown in a touch screen display as the sensors read the values of the reel force and stent crimp aperture diameter. The design will also contain a stepper motor to control the radius and radial force of the stent crimp.

- The arrows represent the flow of data and they point in the direction of the data flow, while the red lines are the power connections



Motor control design

- The motor design Involves the control of a single stepper motor to control the radial force exerted by the stent crimping process and the radius of the stent aperture.
- The motor will be attached to a gear on the crimping aperture that will allow the device to contract the stent
- When the motor turns clockwise, the iris will contract and when the motor turns counter clockwise the iris will expand



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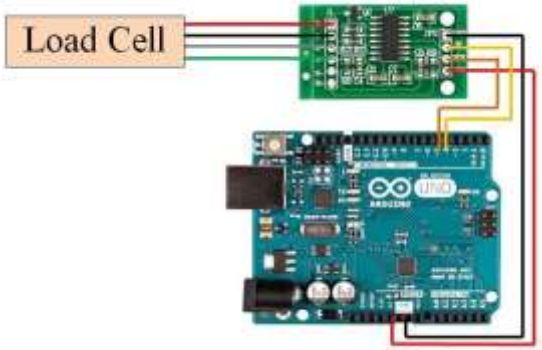
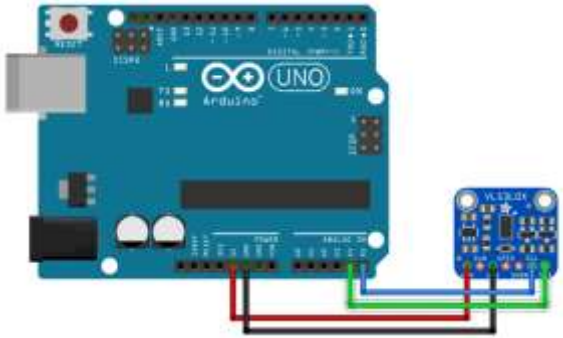
Sensor design

- The load sensor is a digital sensor that will be used to measure the radial force exerted by the stent crimper
  - In order to get measurable data out of the load sensor, a hx711 chip is needed.
- The distance sensor is an analog sensor that will be used to detect the change in diameter of the aperture of the stent crimp
  - The sensor is a laser operated distance sensor and planned to be placed outside the walls of the aperture in order to read a diameter value as can be seen in the image to the far right. The sensor readings will then be displayed in the graphical user interface.





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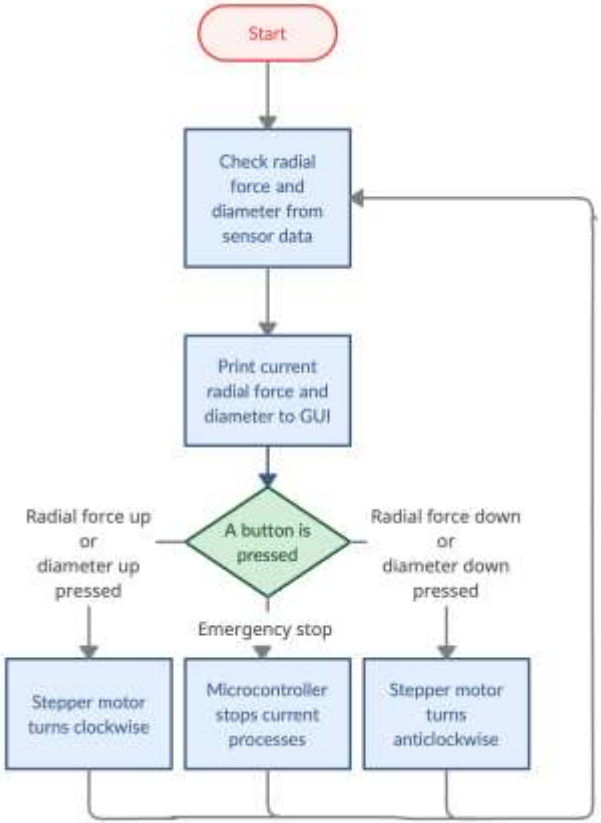
Software Design



- The software running the stent crimping machine is being written in the Arduino programming language
- The software loop the device runs through needs to
    1) Check radial force and diameter sensors
    2) Store both of the sensors' data as variables
    3) Print both of the variables on the GUI
    4) The device will wait for a button to be pressed
        1. If radial force or diameter up buttons pressed, the stepper motor will turn clockwise
        2. If radial force or diameter down buttons pressed the motor will turn anticlockwise
        3. If the emergency stop button is pressed, the device stops all current operations
    5) The software loops back to the start

Plans moving forward

- The mechanical engineering team and our team will combine prototypes to create a fully functional prototype
  - Following this, the sensors can be properly implemented and control of the motor can be tested
- Additional research on user experience and safety elements to ensure the final product is up to all necessary standards
- Over summer break, the team the team will research how to implement a touchscreen display on Arduino
  - Prototypes with the touchscreen display are planned to be implemented over the summer or early fall of 2022

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