FeedRite Feeding Tube

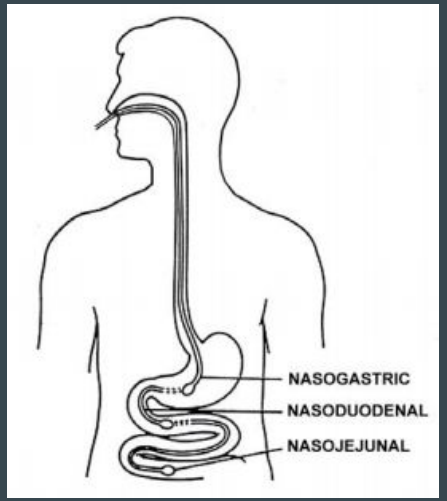
Alex Heilman, Graham Husband,
Kate Jones, Ying Lin

Problem

Gastric bypass is an invasive procedure that requires up to 5 days of hospitalization and has a narrow patient population (those with a BMI greater than 40 or greater than 35 with obesity-related conditions; roughly 18 million Americans) in comparison with the rate of obesity in America (78.6 million Americans; defined as BMI > 30). In addition, gastric bypass can cost ~$25,000 (depending on state of residence), reducing the number of patients who receive the procedure to 1% of those who qualify. Current analogs to gastric bypass use naso-duodenal feeding tubes that rely on repeated fluoroscopic procedures and several hours for proper tube placement.

Background

- Problems: Obesity, Type II Diabetes
- Solution: Gastric Bypass Surgery
  - Lose weight, may reverse diabetes
  - Invasive, risky and expensive
- Alternative Solution: Naso-duodenal Feeding Tube
  - Existing device - Cortrak EAS
  - Our design - less expensive, confident placement



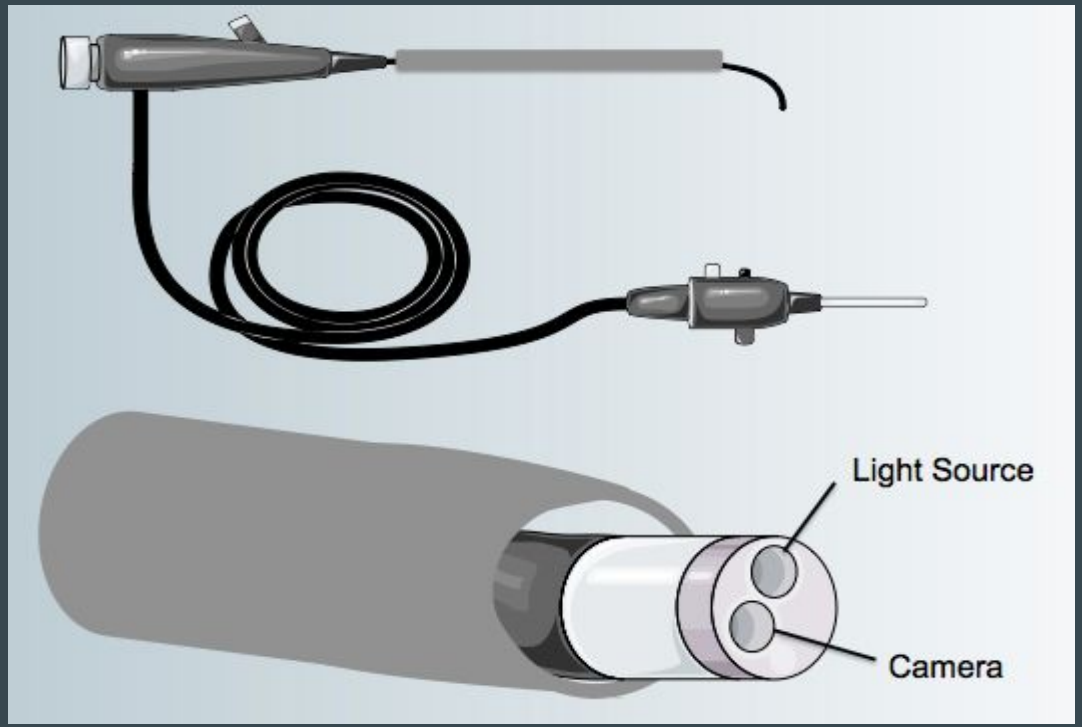
Potential Market

- Obesity and Type II Diabetes - 9 % of American adults
- Gastric Bypass Procedures - 180,000 per year
- Marketing:
  - Medical professionals at hospitals
  - Individual patients at home

Needs Assessment

- Device must be radiation-free
- Device must integrate a second method that ensures proper tube positioning
- Feeding tube must require 1 outpatient appointment for placement
- Tubing must be biocompatible
- Must be portable such that it can be used throughout a hospital
- Primary placement tool must be detachable from tube after placement
- Device must verify differences between duodenum and jejunum
- Device must provide real-time updates of tube position

Old Design

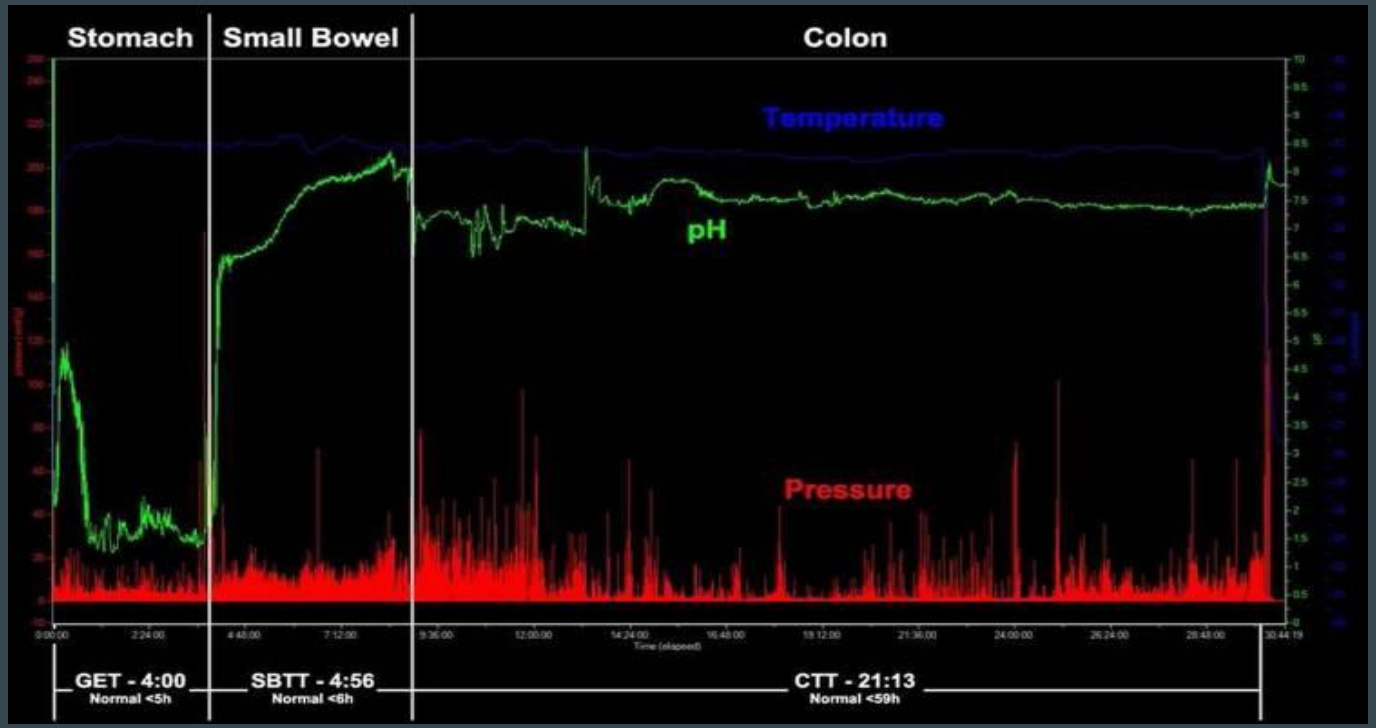


- Mimic endoscope surrounded by feeding tube
- Camera
  - Visualize current position
  - Measure gastrointestinal motility
- Strain Gages
  - Track path
- Removable insert

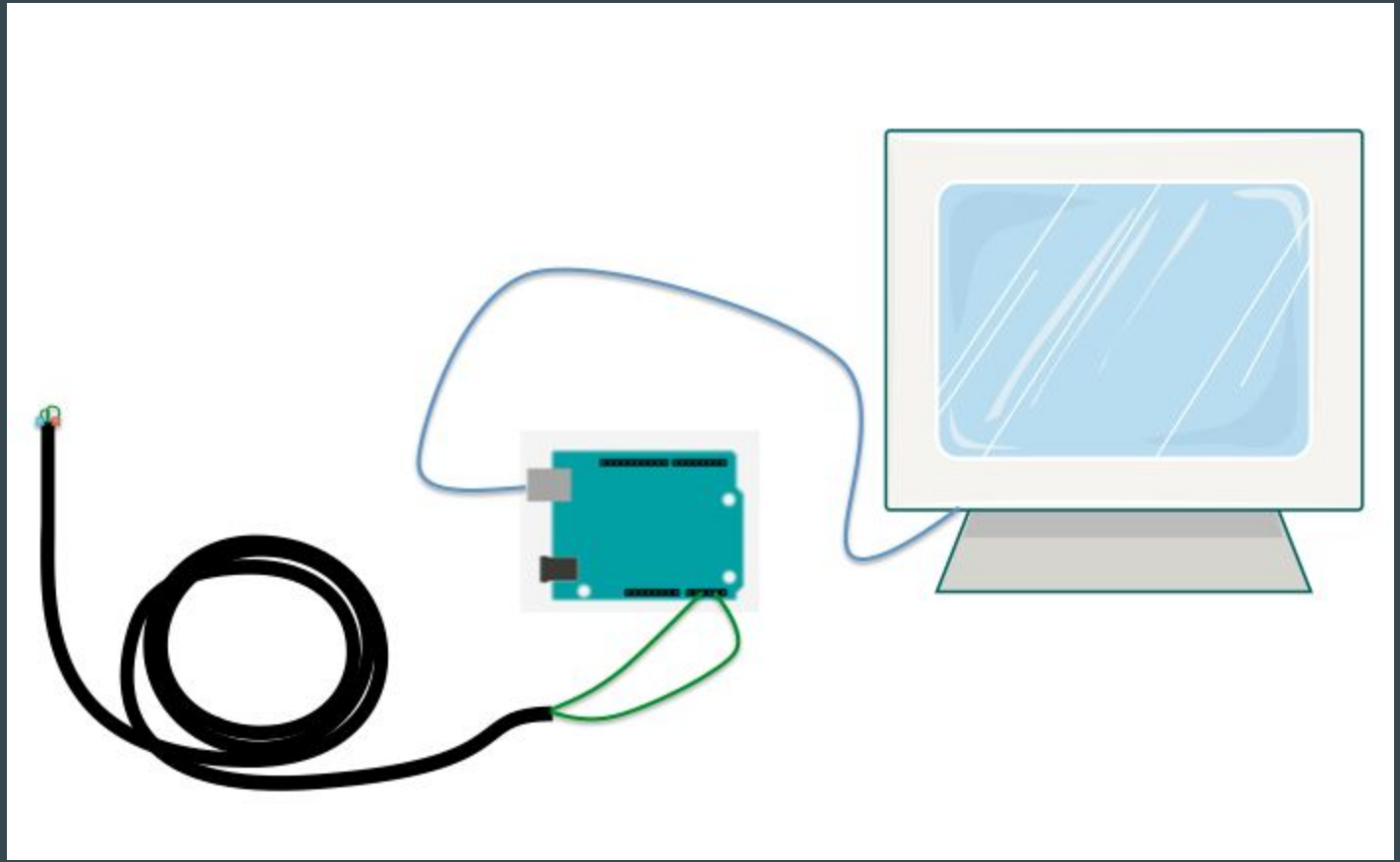
Flaws

- Cost of equipment and training
- Complex use procedure
- Sterilization process
- Potential for disease transmission
- Share device among multiple patients
- Removal mechanism
- Storage issues

Solution to the Flaws



Tran, K., Brun, R., & Kuo, B. (2012). Evaluation of regional and whole gut motility using the wireless motility capsule: relevance in clinical practice. *Therapeutic Advances in Gastroenterology*, *5*(4), 249-260.

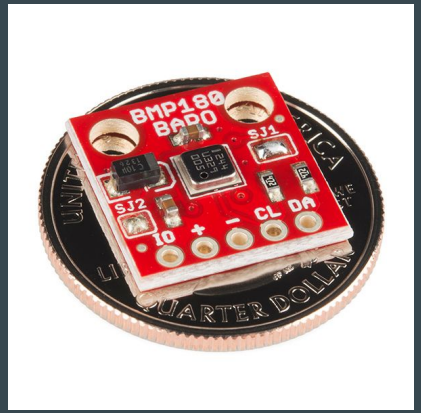


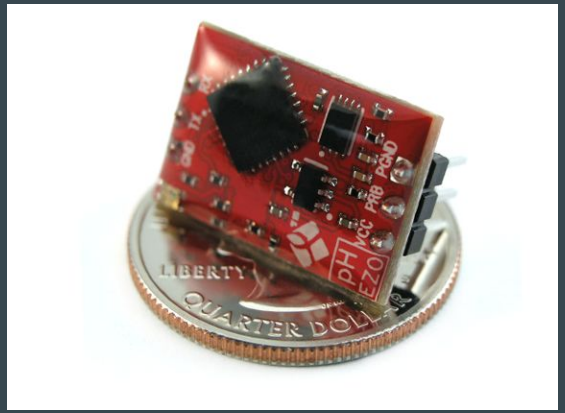
Benefits

- Minimal Cost
- Simple Components
- Scalable for testing
- Easily disposable
- Individualized for each patient
  - addresses sterilization and transmission flaws
  - dedicated device for each patient
- Minimal training
  - CorTrak

Necessary Components

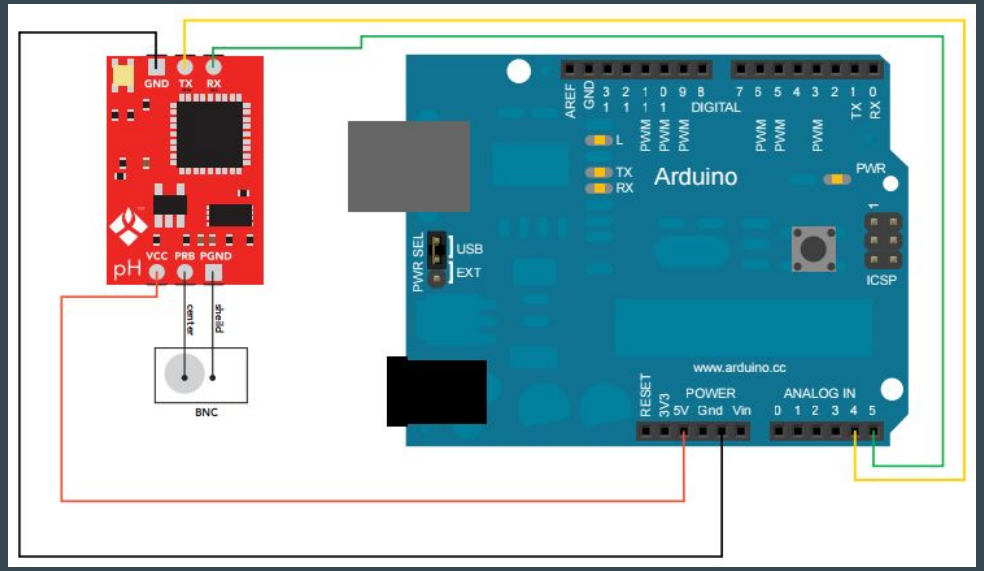
- Arduino
- Breadboard
- Wires/Solder
- EZO Class Embedded pH Circuit
- Bosch Sensortec BMP180 Digital Pressure Sensor





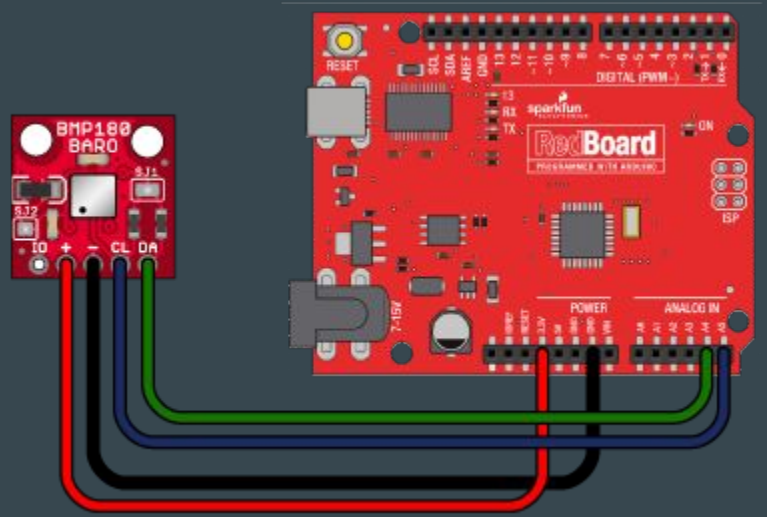
pH Sensor

- Range from 0.001 to 14.000 with resolution of 0.02 pH units
- Operational from -40° C to 85° C
- I2C connection to Arduino



Pressure Sensor

- Range from 225-825 mmHg with resolution of 4.5 mmHg
  - Sensors with correct range of 0-350 mmHg have too complicated of connection for initial prototype
- Operational from -20° C to 65° C
- I2C connection to Arduino



Future directions

- Choose the pH sensor, pressure sensor, feeding tube, and wires with appropriate testing range and physical properties
- Build the first prototype
- Discuss the testing method for first prototype (simulation, phantom...)
- Scale down the size and cost of each component

Grant Proposal Modifications

- Basic design and procedure is already approved for CorTrak EAS
- Prototype:
  - No motility sensors--pressure and pH will indicate location
  - No ultrasound or cameras to visualize location
  - May still include strain gauges to track position (fine tune)
- Approximate size and cost of components
- Initial testing methods