

#### University of Idaho

College of Engineering

# SMOOTH ARTHROSCOPIC SHAVER

The \$1500 Shave Club

#### **TEAM INFORMATION** THE \$1500 DOLLAR SHAVE CLUB

#### Jett Murray



- Biological Engineering
- Preston, ID
- Client Contact, Recorder

#### Lucas Dibelius



- Mechanical Engineering
- Boise, ID
- I Purchasing Liaison, Wiki

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#### Maclean Landis



- Mechanical Engineering
- Boise, ID
- Portfolio

#### Ryan Crowell



- Mechanical Engineering
- Davis, CA
- Financial Advisor



# **PRODUCT REQUIREMENTS**

For this project, the client specifically requested that the product met several criteria:

- Variable speed output with 900-6000 RPM oscillation settings
- Random orbital sanding action within a pistol-grip device
- Maximum output shaft diameter of 4mm
  - Output shaft should be able to withstand corrosion in saline-rich environments
- Compatibility with 100-400 grit shaver heads/burs
  - ~300 grit shaver heads/burs have been previously noted to work the best
- Reliable two-hour battery life
- Compatibility with existing surgical suction pumps
  - Debris removal during shaving (condyle, menisci cartilage, bone fragments)
- The device should be reusable, and compatible with different shaver heads
  - Autoclaving (60kPa, 150 degrees Celsius)









## **CRITICAL CONSIDERATIONS**

Last year's prototype incorporated a Sonicare toothbrush motor into the handle to power the bone shaver. After examining the prototype in detail, we identified several considerations to account for with the intent of designing a robust, reliable prototype.

- Designing a tool capable of interfacing with a vacuum pump
  - Removal of bone debris post-shaving
- Designing an orbital shaving mechanism that can shave bone under load
  - Rotary motor with linear actuator, 4mm diameter output shaft
- Creating a slim handle for the device to help it feel more ergonomic
  - Autoclavability, comfortable use of device, claps for easier disassembly
- Improving the microcontroller design to create a more reliable tool
  - Adafruit trinket, move away from Arduino IDE
- Quality of life improvements for the device
  - Toggle switch, variable speed adjustments







## **DESIGN PLANS**

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Push - Pull Solenoid for linear Actuator Circuit - Off rod is pushed in. Off Circuit-On relectro-magnet pulls On VIIII







## **RESEARCH AND DEVELOPMENT OLD PROTOTYPE**

- Bulky, unreliable, complicated to disassemble
- Held together by hot glue and tape
- Motor could not function under load
  - No vacuum or speed variability for output

#### **ACTUATOR/SANDER PLANS**

- Utilizing high-power RC-aircraft motor with electronic speed controller
  - Introduce speed variability, high RPM capability, necessary torque to function under load
- Combining rotary motion with linear actuation
  - Random orbital sanding approximation
  - Motor would actuate forward and back while running inside of handle





## **PROJECT LEARNING** CONVERSATIONS WITH PAST GROUP

- Past group created prototype using vibration Sonicare toothbrush motor
  - Very little manipulative control considering non compatible motor with Arduino microcontroller
- Experimented with concave, convex, round heads with varying sandpaper grits
  - We will use their designs and 300 grit sandpaper
- No variable speed, no suction, non-detachable heads
  - Client asked for these, last group didn't touch on them, but we plan to work on variable speed
- Exterior battery casing
  - Dangling battery unit in past design, ours will be housed within handle





## SCHEDULE

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**I** This is a brief look at our preliminary schedule for the Capstone course







## BUDGET

## This is a look at our preliminary budget before prototyping

#### **Capstone Project Budget Tem**

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Prototypes	Γ
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Travel:	
Trip to hospital	
Supplies / Parts / Services:	
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**QUESTIONS?** 

