General need for the product
The current method for cleaning a golf club during a round of golf is labor intensive and time-consuming.

Estimation of market size
- 60 million golfers worldwide
- $30 billion spent annually on golf-related commodities
- After 5 years, 5 million units sold target

CTQ Customer requirements
- Transportability
- Quick Part Replacement
- Aesthetically Pleasing
- Clean Time
- Size
- Weight
- Motor Speed
- Angle of Rotation
- Force Applied to Club
- Battery Life
- # of Operations

Constraints
- Size/Weight
- Automated
- Short Clean Time
- Cost
- Material Strength

Tradeoffs
- Dry system only
- Golf ball attachment and polish not designed due to customer disinterest

Product Operation
1. Club run over scraper
2. Club is inserted into enclosure
3. Device actuated by the switch
4. Battery powers motor
5. Motor turns gears assembly
6. Brushes clean club face
6b. Club is rotated in enclosure

Key Innovations
- Scraper removes large clumps
- DC motor automates process
- Rechargeable Battery Pack
- Portability
- Fit Inside Golf Bag
- Easily Serviceable Parts
- Quick Clean Time

Prototype and Testing

Customer Testing
- Cleaning Rating
- Ease of Use
- Overall Quality Rating
- Time to Clean

Mechanical Testing
- Brush Forces and Moments
- Angle of Cleaning - 360°
- Thermal Analysis
- Vibrations

Finite Element Analysis

Results and Future Work

Product Development Process (PDP)
- Problem Definition – Surveyed golfers to assess need for product.
- Concept Generation – Proposed 5 functional design ideas.
- Concept Selection – Determined part geometry, material selection, and manufacturing processes for selected design.
- Prototype and Testing – Purchased motor and gearing assembly; manufactured remaining parts; tested key functionalities.

Recommendation for Future Design
Upgrade to wet system
Decrease size
Golf ball Compartment
Sensor actuation
Improve brush efficiency

Process Reflection
- Concept Generation – Innovative ideas from various perspectives.
- Concept Selection – Ideal design chosen by analytical means.
- Prototyping – Built the physical device to test functionalities.