Team RSP: Robotic Sparring Partner

Objective

- Concept Generation
- Design
- Prototype and Testing
- Test Results and Future Work

Customer Requirements

- Safe & Durable
- Measures force
- Ease to use
- Various
- Affordable
- Stability & Firmness
- Adjustable
- Punch height

Constraints

- Arm length, durability
- Punch force, speed
- Sensor area, durability
- Actuator speed

Physics

- Wall powered
- Fast punch and reset
- Low force (safer)
- Requires most parts

Engineering Characteristics

- Body weight, speed, reset time
- Size, Sensor
- Arm weight, quantity, length, resolution
- Punch force, Durability

General Need for Product

- Existing punching dummies are useful for strength and endurance training, but do not provide users with speed or technique training during solo practice.

Estimation of Market Size

- An estimated 1200 units sold in the D.C. Metro area alone
- Target market: gyms, fitness clubs, schools, rehabilitation centers, correctional facilities, arcades, individuals, etc.

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- Simulated human punch with 1 degree of freedom

Tradeoffs

- Safe punching force of 20 lbs., at the expense of a more human-like strength.

Customer Requirements

- Safe, Durable
- Intuitive to use
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Prototype

- Wooden structure with foam padding to be used as the user’s target
- Punching arm
- Force sensors to detect user’s punches
- Arduino to control RSP

Prototype and Testing

- FEA
- Punching force of the RSP’s arm
- Accuracy of the force sensors

RSP Punching Specs

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<tr>
<th>Force from 3 inches away</th>
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Test Results and Future Work

Design Process Summary

- Surveyed boxers and martial artists to identify deficiencies in current training tools
- Generated and selected best concepts for RSP
- Built a wooden prototype to demonstrate proof of concept

Future Work

- Improve responsive punching feature
- Add various difficulty levels
- Review customer feedback
- Lifecycle testing

Reflections

- Generating alternative designs proved useful since some designs were inefficient
- FEA revealed potential risks in the design – these issues have since been addressed
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