DuelReality

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Advisor: Professor Jackson

October 7, 2017
Team Members

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## Collectible Card Game Playerbase

<table>
<thead>
<tr>
<th>Hearthstone</th>
<th>Magic: the Gathering</th>
<th>Yu-Gi-Oh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 70 million registered accounts worldwide</td>
<td>Over 20 million players worldwide</td>
<td>Over 20 million online accounts registered worldwide</td>
</tr>
</tbody>
</table>

![Hearthstone Game Screenshot](image1)

![Magic: the Gathering Game Screenshot](image2)

![Yu-Gi-Oh Game Screenshot](image3)
Problem Statement

- Physical card games:
  - No visual effects, plain and boring!
  - Cards are easy to duplicate, card game inventor gains little profit from selling cards

- Online card games:
  - Purely virtual
  - No real social interaction
  - Virtually multiplayer, Physically singleplayer
Assess Needs (Our Solution)

- Connect the virtual world with our physical world
  - Step toward hologram and mixed reality gaming
- Social benefit
  - Help making friends
  - Ease solitary game addiction
- Cards can’t be duplicated
  - Unable to replicate unique card ID’s and cheat
Our Card Game mechanism

- **Warrior Elimination**
  - *Limited Edition*
  - Destroy all face-up Warrior-Type monsters on the field.

- **Dark Magician**
  - *Spellcaster*
  - The ultimate wizard in terms of attack and defense.
  - ATK: 2500
  - DEF: 2100

- **Negate Attack**
  - *Trap Card*
  - When an opponent’s monster declares an attack, target the attacking monster. negate the attack, then end the battle phase.
Our Card Game mechanism

Round One
Our Card Game mechanism
Our Card Game mechanism

Player 1

8000 LP

Player 2

0 LP

ATK:
2500

8000 LP

8000 LP

8000 LP

Player 1

8000 LP

Player 2

8000 LP

8000 LP

8000 LP

Player 1

ATK:
1700

Player 2

7

DEF:
1000
Department of Electrical and Computer Engineering

Advisor: Prof. Jackson
System Specifications

- Minimum of 20 cards needed for each player
  - RFID Tags attached to each card
- Wristband device is light enough to wear and hold still
- Support 2 Player Mode (need 2 wristband devices)
- Meet Child Safety Standards of Consumer Product Safety Commission
- 4+ hours battery life
- Inexpensive
Hardware Components

● Wristband Structure:
  ○ Buttons and LCD screen on each case
  ○ RFID readers (5 each)
  ○ Microprocessor and Bluetooth Module
  ○ Power supply

● Additional Components:
  ○ Projector
  ○ RFID Tagged Cards
  ○ Phone App
Support Wristband Casing
Display Screen

SunFounder LCD1602 Module

- Operate Voltage: 5V
- Displays 2-lines X 16-characters
- Blue Blacklight LCD Module
- Displays lifepoints, and gameplay messages.
- Weight: approx. 45g
RFID Reader

Mifare RC522 RF Sensor Module

- Operating Frequency: 13.56MHz
- Data transfer rate: Maximum 10Mbit/s
- Operating current: 13-26mA/DC 3.3V
- Idle current: 10-13mA/DC 3.3V
- Sleep current: <80uA
- Read Range: 0 - 60mm (1 card)
- Weight: 15 g
Microprocessor

Arduino UNO

- Used for Prototyping
  - Code Transferred later to ATmega328
- ATmega328 microcontroller
- Input voltage 7-12V
- 14 Digital I/O Pins (6 PWM outputs)
- 6 Analog Inputs
- 32k Flash Memory
- 16Mhz Clock Speed

- Weight: 25 g
Bluetooth Module

DSD TECH SH-HC-08 Bluetooth 4.0 BLE Slave Module

- Working voltage: 3.3V to 6V
- Effective distance: 10 meters
- Default baud rate: 9600 bps
- Weight: 6 g
- Supports bluetooth 4.0 ble mode
- Compatible with ios7.0 or later and Android 4.3 or later
- Operating Current: 10-30 mA
Microcontroller and Power Bank

Atmega328 processor

- CPU Type: 8-bit AVR
- Max Frequency: 20 MHz
- 6.75mA @ 5V

Power Bank

- Capacity: 20000 mAh
- Output Voltage: 12V
- Output Current: 1A

Whole device Operating time:
20000 mAh/166.75mA = 120 hrs
Power Supply and Management

● Requirements
  ○ Various voltage requirements within wristbands
  ○ Readers, Microprocessor, LCD screen, Bluetooth module

● Implementation
  ○ Custom circuit board for power distribution
  ○ Amplification and attenuation of voltage as needed
DeepLee DP300 Portable LED Projector

- Input Voltage: 5V/2A
- Dimensions: 4.7 x 1.9 x 3.4 inches
- Weight: Approx 250g
- SD Card Slot, HDMI, VGA, AV, USB Port, Built in Speakers
Phone App

Provide midway connection from wristband devices to the internet (server)

Why Android?

- Open source
- Better programming experience

Optional features

- Personal game account
- Game history
- Leaderboards
- Achievement
Block Diagram

- **CASING**
  - Power Supply
  - PCB Design
    - Power Distribution Management
  - Arduino UNO
    - Reader 1
    - Reader 2
    - Reader 3
    - Reader 4
    - Reader 5
  - LCD Screen
  - Buttons

- **Server (Software)**
  - Game States
  - Leaderboard
  - SQL Card Database
  - Game Calculations

- **RFID Card Input**
  - Tag

- **Projector**
State Machine

- Detect Card ID
  - Place Card
  - ID Received At Processor
- Send Card ID To Server
  - Update Location Details
- Update Server With New/Removed Card
  - Push Update To Clients
- Waiting Period (Wait For Card)
  - Connect to Server
- Standby (Wait For Connection)
  - Reset Game
- Continuously Check If Card Is Removed/Replaced
- Wait For Card Action
  - Send Card State
- Wait For Game Over Signal
- Update Game State/Results
# Estimated Budget (Per Device)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 readers</td>
<td>$12</td>
</tr>
<tr>
<td>Microprocessor</td>
<td>$22</td>
</tr>
<tr>
<td>Bluetooth Module</td>
<td>$8</td>
</tr>
<tr>
<td>LCD Screen</td>
<td>$6</td>
</tr>
<tr>
<td>Wristband</td>
<td>$20</td>
</tr>
<tr>
<td>PCB Power Supply &amp; accessories</td>
<td>$22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$90</strong></td>
</tr>
</tbody>
</table>
Design Alternatives

ESP8266 WIFI Module

➤ Most uncertain part of the project is the internet connection.

- Integrated TCP/IP protocol
- Flash disk size from 512k to 1MB.
Design Alternatives - Home Network

Players Connect to Personal Home Network Server
MDR Deliverables

➤ Communication between at least one RFID reader and microprocessor ready. We will need to expand to other readers.

➤ Communication between the system and the internet established.

➤ Provide steady power to readers, microprocessor, and Bluetooth module.
Individual Responsibilities

➤ Jerry: Communication between readers and microprocessor. Implementation of processors tasks.

➤ Hadi: Communication with internet using Bluetooth enabled microprocessor and server implementation.

➤ Xiaobin: Custom circuit board for power distribution, circuit setup and power consumption analysis, and later on ATMega328 PCB design.
Questions ?