Midway Design Review

DuelReality

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Team Members

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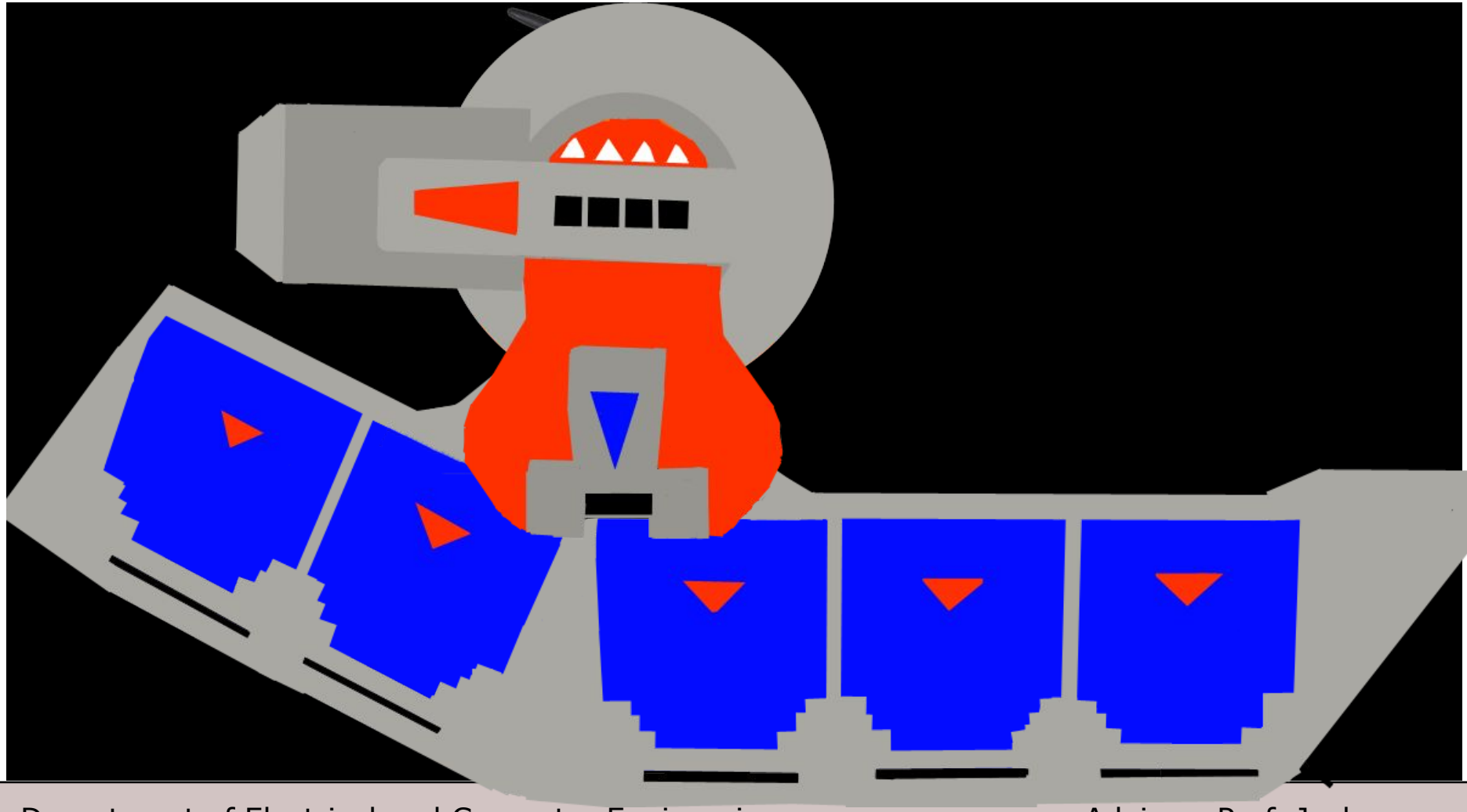
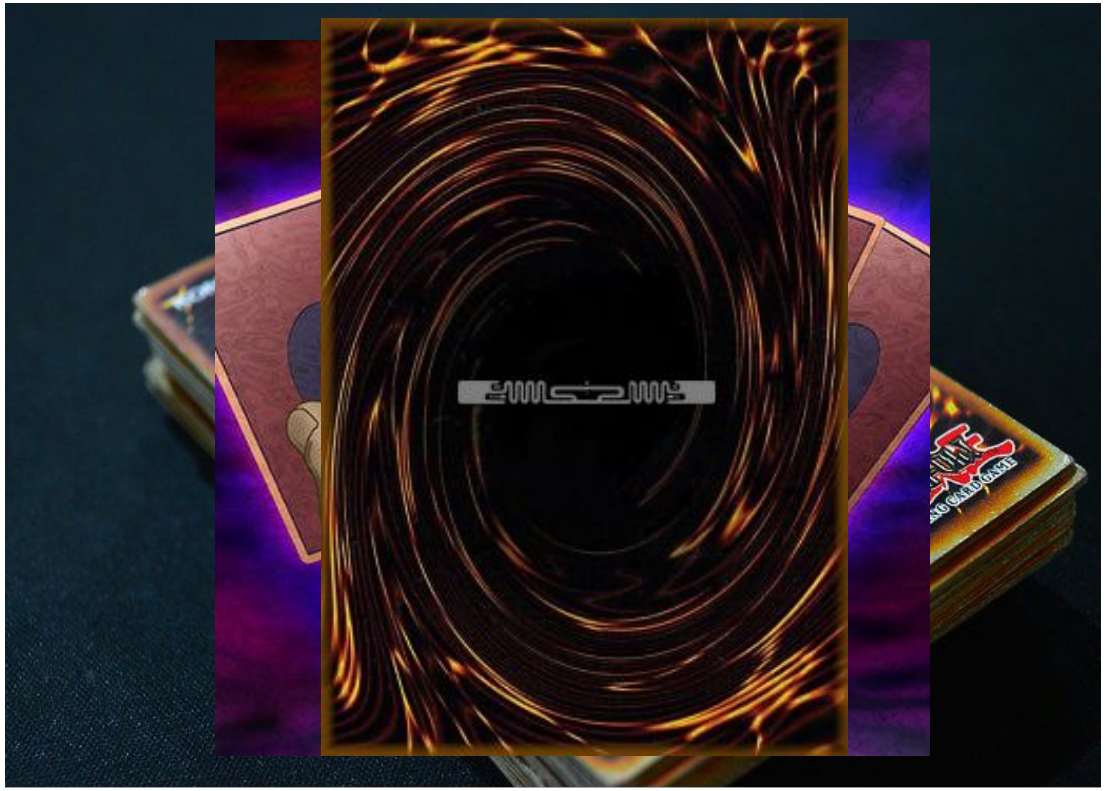
Review of Project



Our Card Game mechanism



Our Card Game mechanism

System Requirement

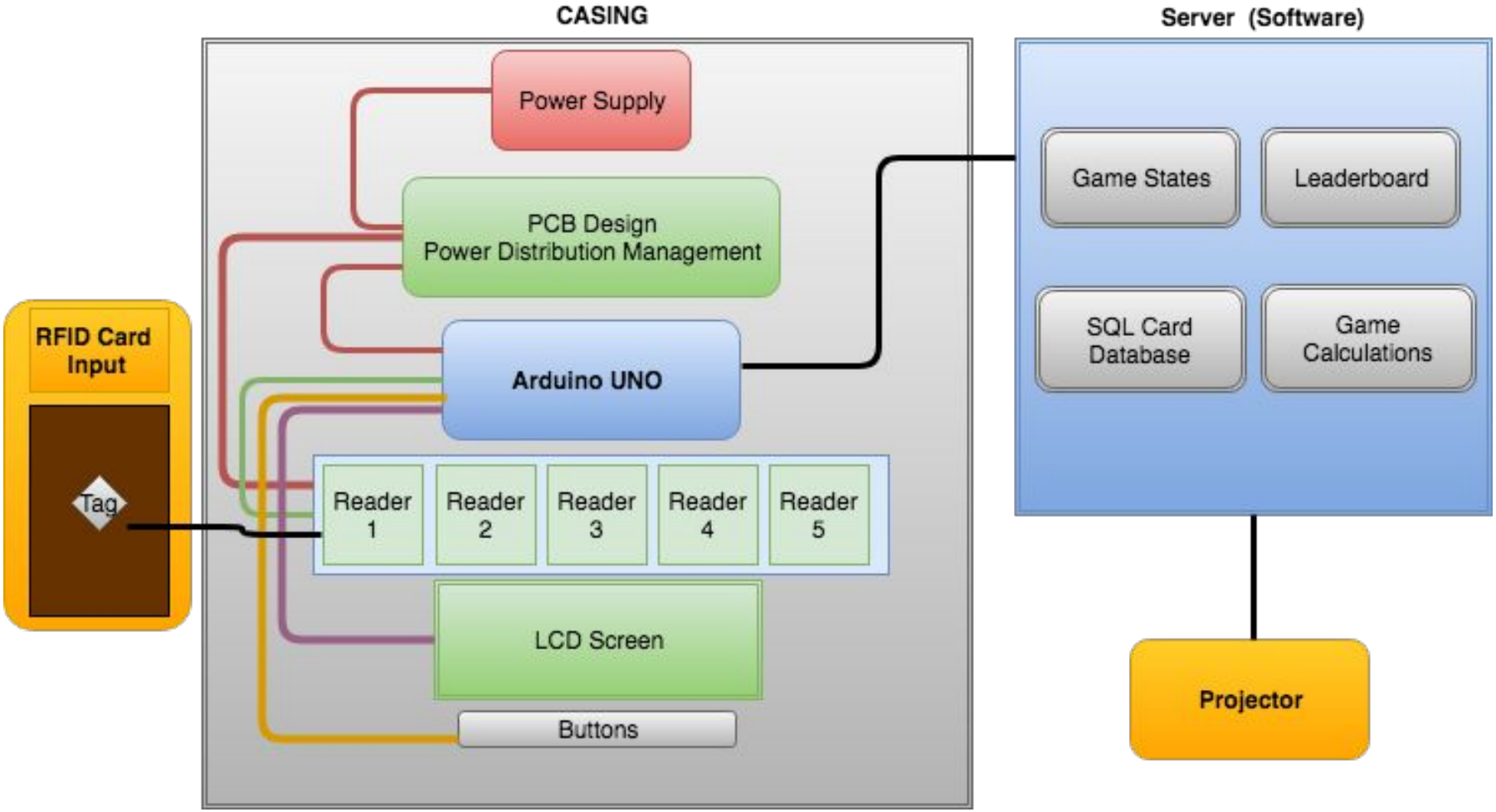
1. Minimum of 20 cards needed for each player,RFID Tags attached to each card
2. Wristband device is light enough to wear and hold still
3. Support 2 Player Mode (need 2 wristband devices)

1. Not satisfied. Need online database to hold information of 40 cards
2. Satisfied. Total weight per system: Approx.1.0kg(2.2 pounds)
3. Not satisfied. Need another wristband device.

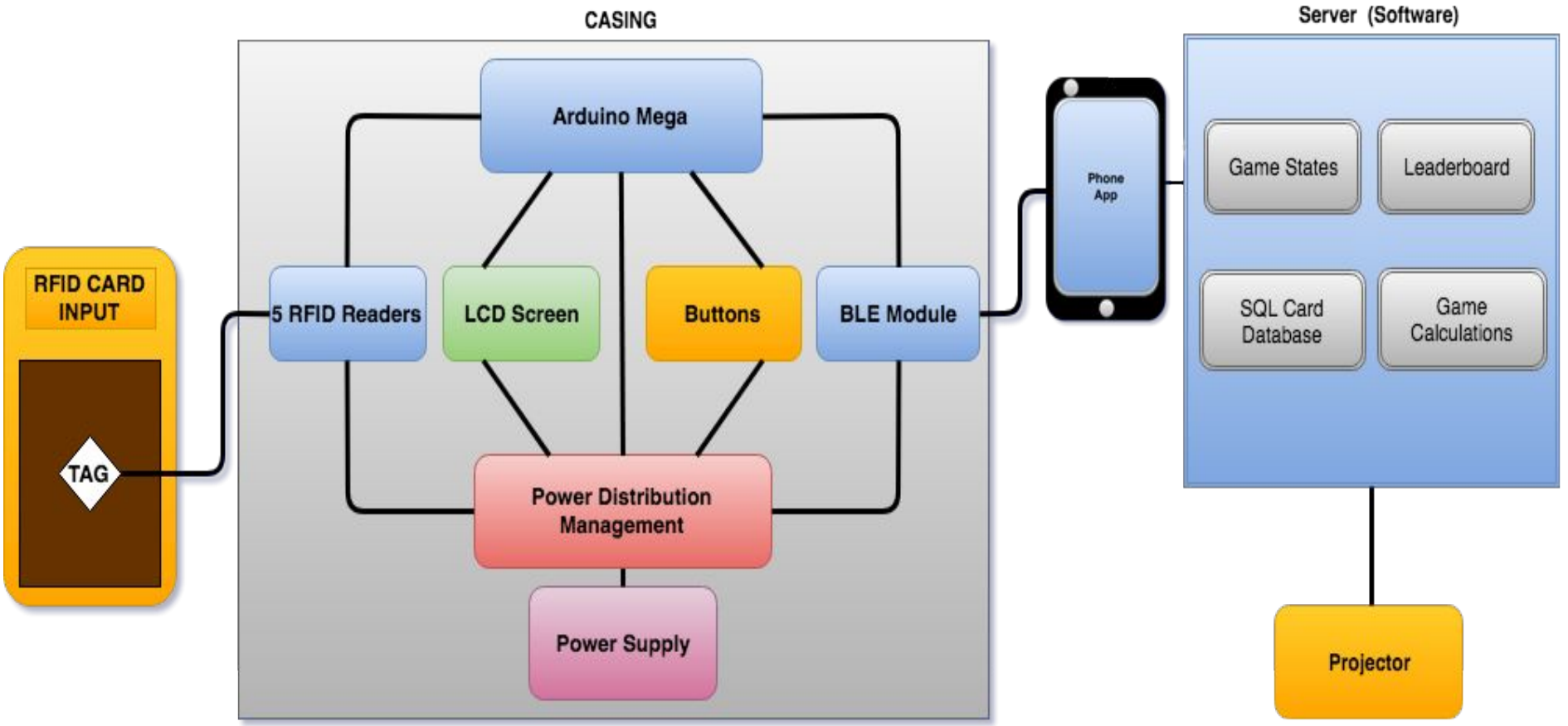
System Requirement

4. Meet Safety Standards	4. Satisfied. The original Yu-Gi-Oh! Duel Disk without electronic parts satisfy the safety standards.
5. 4+ hours battery life	5. Satisfied. The device can work for 8+ hour even in peak power dissipation.
6. Inexpensive	6. Satisfied. The cost per device can be reduced to approx. $60
7. Bluetooth as midway communication	7. Satisfied.

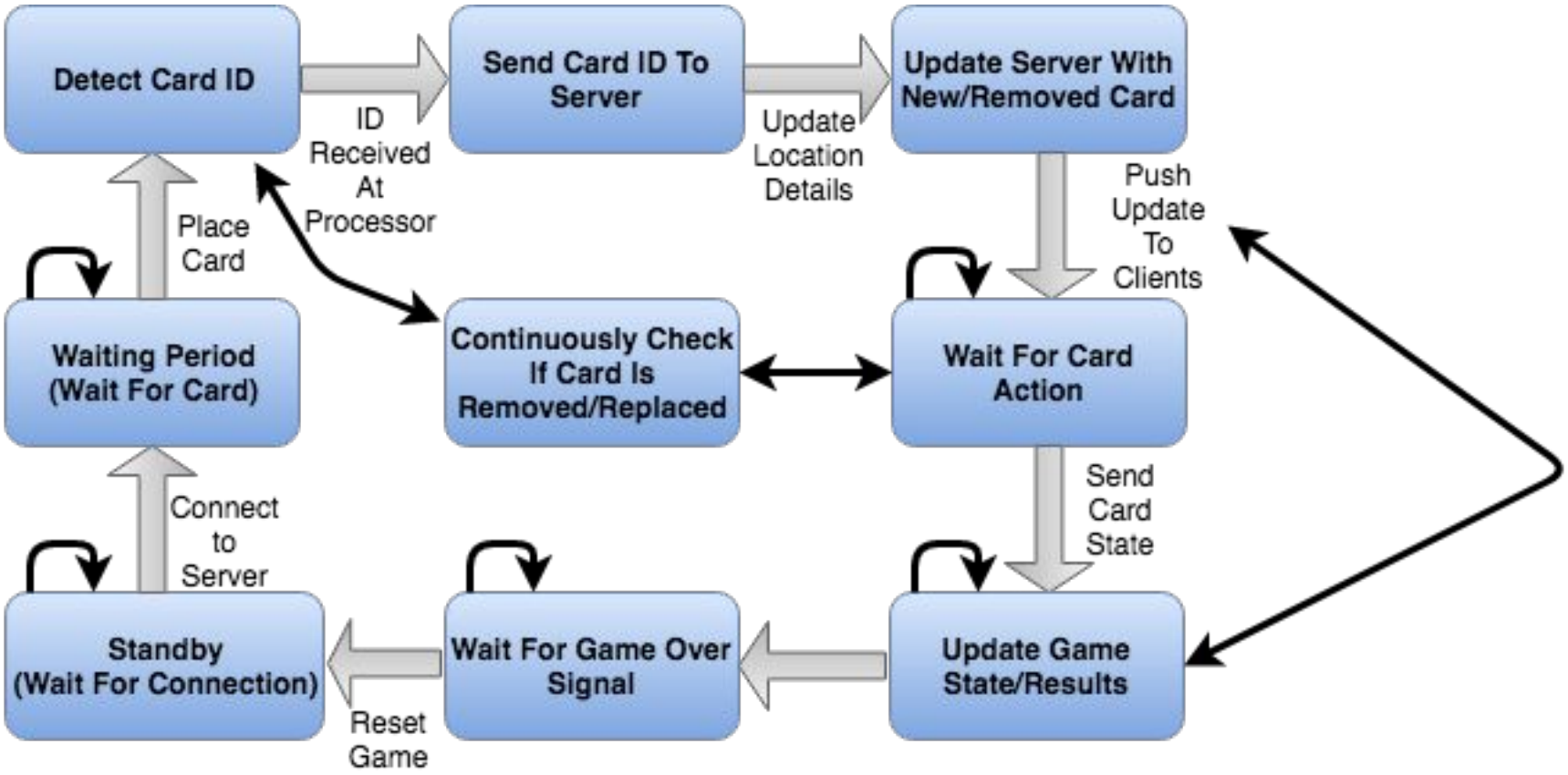
Previous System Block Diagram



Updated System Block Diagram



State Machine



Proposed MDR Deliverables

- Communication between 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, and perform basic power consumption analysis.

Met MDR deliverables

- Communication between one RFID reader and microprocessor ready.
- Provide steady power to readers,microprocessor, and Bluetooth module.
- Server set up.

Proposed MDR Individual Responsibilities

- Jerry: Communication between smartphone and Arduino through Bluetooth module, Bluetooth module configuration for pairing with smartphones.

- Hadi: Communication between readers and microcontroller. Online server implementation to be used for app.

- Xiaobin: Custom circuit board for power distribution, circuit setup and power consumption analysis.

Jerry: Bluetooth LE App

- App to connect device to smartphone.

Reads data from BLE module.

sdp18.Duel Reality

Tools used to build the app

- IDE
  - Visual Studio (C#)

- Libraries
  - Xamrin Forms
  - BluetoothLE.Core developed from MIT Monkey Robotics project.

Important classes in the app source code

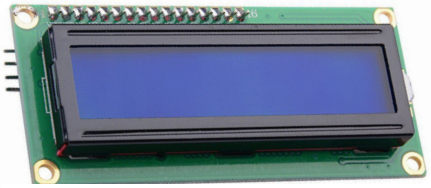
- Adapter
  - Provides objects that allow bluetooth LE device detection.
- DeviceListPage
  - Allows to display detected devices.
- DevicePage
  - Displays messages received from bluetooth LE module.

How BLE module and app meet system specs

- Allows 2-team mode
  - Each player connects to a wristband by installing the app on its smartphone.
- Allows to play for many hours
  - The current consumption of the BLE Module is only 10 to 30 mA.

Hadi: Reader-Microcontroller Communication

- Hardware:
  - Arduino Mega2560
  - MFRC522 RFID Reader
  - LCD Display
- Software:
  - Arduino IDE - C
- Process:
  - RFID Reader detects new card ID
  - RFID reports ID details to Microcontroller
  - Microcontroller prints contents to LCD Display



Client-Server Implementation

- Eclipse IDE:
  - Main Classes: Client.java, Server.java
- Client Class:
  - Make connection with Temp Local Server (localhost)
  - Send and receive messages to/from server for testing
- Server Class:
  - Listen and accept new connections
  - Send and receive messages to/from client(s) for testing

Server Hosting

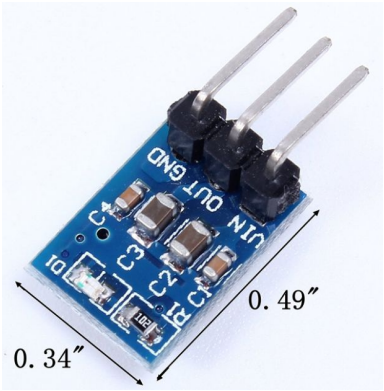
- Google Cloud Platform:
  - Establishes an online client-connectable server running Server.java
  - Bulk of the game states, calculations, databases, and leaderboards.
- Security:
  - Uses RSA algorithm for Public-Key Encryption
  - Uses MD5 hashing for additional security

Google Cloud Platform

Xiaobin: Power distribution

- 5V 4000mAh Li-polymer Powerbank
  - Battery Capacity:4000mAh / 3.7V 14.8Wh
  - Rated Capacity: 2600 mAh / 5.0V (TPY 1A)
  - Input voltage: 5V
  - Output Voltage: 5V

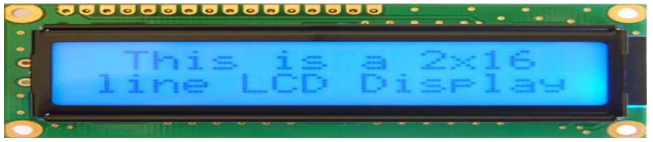
- AMS 1117 Linear Regulator
  - Convert 5V to 3.3V
  - Efficiency: approx. 70%
  - 1A Output
  - Small and cheap



Power Consumption

- BLE Module @ 5V
  - Standby Mode: 2~7 mW
  - Transmission Mode: 43 mW

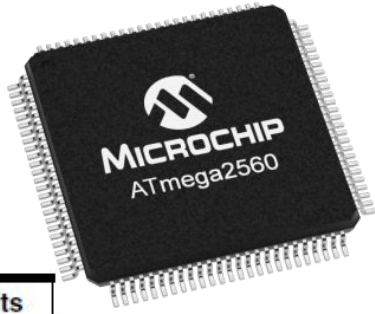
- LCD 16x2 @ 5V
  - No Backlight: < 5mW
  - Backlight Enabled: 600~800 mW



- (RFID Reader @ 3.3V) * 5
  - Standby Mode: 170~210 mW
  - Peak: <480 mW

Power Consumption

Arduino Mega contains one ATmega2560 microprocessor.



T_A = -40°C to 85°C, V_{CC} = 1.8V to 5.5V (unless otherwise noted) (Continued)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
I_{CC}	Power Supply Current[5]	Active 1MHz, V_{CC} = 2V (ATmega640/1280/2560/1V)		0.5	0.8	mA
		Active 4MHz, V_{CC} = 3V (ATmega640/1280/2560/1L)		3.2	5	
		Active 8MHz, V_{CC} = 5V (ATmega640/1280/1281/2560/2561)		10	14	
		Idle 1MHz, V_{CC} = 2V (ATmega640/1280/2560/1V)		0.14	0.22	
		Idle 4MHz, V_{CC} = 3V (ATmega640/1280/2560/1L)		0.7	1.1	
		Idle 8MHz, V_{CC} = 5V (ATmega640/1280/1281/2560/2561)		2.7	4	
	Power-down mode	WDT enabled, V_{CC} = 3V		<5	15	µA
		WDT disabled, V_{CC} = 3V		<1	7.5	

Max output current from arduino 3.3v pin: 50mA

Power Consumption

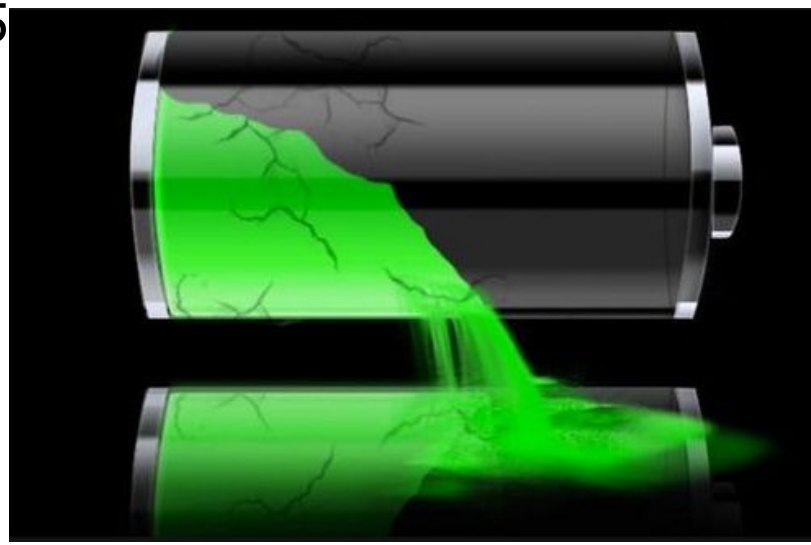
Worst condition:

Total current =BLE+LCD+5RF reader+arduino

=8.5+160+130+15

≈320 mA

2600/320 ≈ 8.2 h



Wristband device can work for 8+ hours at worst condition.

The system specification is satisfied.

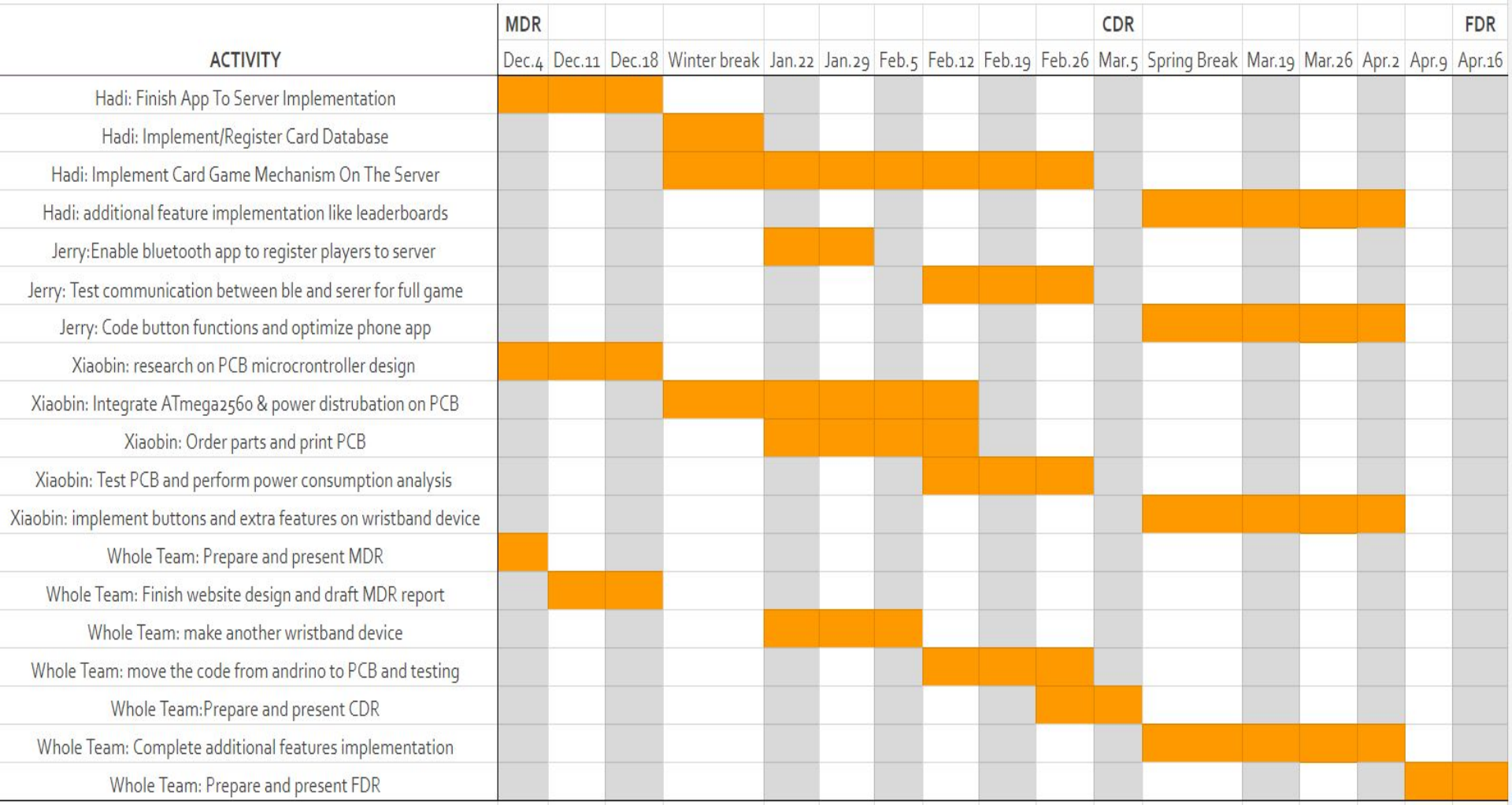
CDR Deliverables

- Allow user recognition and connection between two Bluetooth-enabled devices
- Be able to begin, play, and end a fully functional game between two systems.
- Complete PCB design that integrates an ATMega2560 Processor with power distribution functionalities.

CDR Individual Responsibilities

- Jerry:
  - Write code to implement the game communication
  - Enable bluetooth app to register players and login to server at game start.
- Hadi:
  - Design online web server that handles game implementation, functionalities, and databases.
- Xiaobin:
  - PCB microcontroller Design that integrates an ATMega2560 Processor with power distribution functionalities.

Gantt Chart


MDR
CDR
FDR
ACTIVITY
Dec.4
Dec.11
Dec.18
Winter break
Jan.22
Jan.29
Feb.5
Feb.12
Feb.19
Feb.26
Mar.5
Spring Break
Mar.19
Mar.26
Apr.2
Apr.9
Apr.16
Hadi: Finish App To Server Implementation
Hadi: Implement/Register Card Database
Hadi: Implement Card Game Mechanism On The Server
Hadi: additional feature implementation like leaderboards
Jerry:Enable bluetooth app to register players to server
Jerry: Test communication between ble and serer for full game
Jerry: Code button functions and optimize phone app
Xiaobin: research on PCB microcrontroller design
Xiaobin: Integrate ATmega2560 & power distrubation on PCB
Xiaobin: Order parts and print PCB
Xiaobin: Test PCB and perform power consumption analysis
Xiaobin: implement buttons and extra features on wristband device
Whole Team: Prepare and present MDR
Whole Team: Finish website design and draft MDR report
Whole Team: make another wristband device
Whole Team: move the code from andrino to PCB and testing
Whole Team:Prepare and present CDR
Whole Team: Complete additional features implementation
Whole Team: Prepare and present FDR

Demo

Thank You!

Questions?