SDP22: Team 20

JACKBLACK

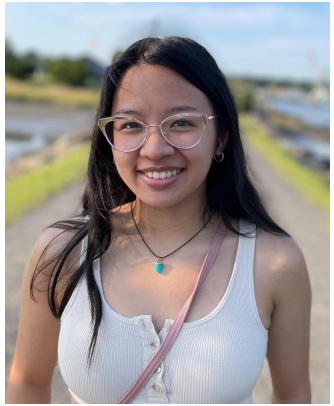
Ray Castillo, Alina Daraphet,
Marvin Nguyen, Lamisa Sheikh

Advisor: Bill Leonard

Meet the Team

Professor Leonard
Advisor

Ray Castillo
Computer Engineer



Alina Daraphet
Computer Engineer

Lamisa Sheikh
Electrical Engineer

Marvin Nguyen
Computer Engineer

Problem Statement

When playing Blackjack among friends, the issue of who will be the dealer always arises. The job of the dealer includes:

- Dealing and shuffling cards
- Collecting and counting chips

These are tedious tasks that most players do not want to take on.

Our Solution

We are proposing an automated Blackjack system that has the following features:

- Automated shuffling and dispensing system
  - Users input the deck into the dispenser and the cards will shuffle and dispense themselves to each player/dealing system
- No chips (non-physical betting; using play chips in system)
  - Incorporate the betting system in a virtual environment

Notes From MDR

Multiple touch displays

- Notes for MDR advised against multiple touch displays to simplify system and cost.
- Progress: We continued with attempting multiple touch displays, however we found that the hardware connections for this don't exist. (there is no HDMI connection and there is only one DSI port of the raspberry Pi).
  - Having multiple displays is not an issue having multiple touch displays is an issue. There is specialized hardware that we found that could be used for this, but it is not available/out of stock/extremely back ordered (our research indicates this is an industry problem).
- Solution: Recently decided on using non-touch displays with button-GUI functionality
  - 4 Buttons: Hit (Increment Value), Stand (Enter), Double (Decrement Value), Exit Game

Notes From MDR

- What computational platform will host the game algorithm and what will host the shuffling and dealing?
  - Raspberry Pi

Notes From MDR

- Flipping One card
  - We decided that the accuracy of shooting a card forward to a very specific location would be too difficult to accomplish. In revisiting the game rules, we have found that all cards are dealt face up except for the one dealer card. We will replicate this and deal all cards face up and print a box that will enclose the dealer card.
- Moving RFID Reader
  - Move RFID reader to the central component. This will reduce costs as there will be one card reader rather than one for each player.
- Refine the mechanical component - Gear towards table top design
  - 3D printed rotational board. We have models for other stacking components.
  - Distributing one card at a time

Current State

Completed:

- Pi -> ATmega328P -> dealer (motor, shuffler, dispenser)
- Game -> Pi
- Buttons -> Game
- RFID -> Pi

In progress:

- Everything is on the Pi, and we need to put everything into the game. (Connect Game to all components) After that a game can be played: Estimated Completion Date 4/2 (two weeks post spring break to have a playable game)

User Interface:

- Completely integrated with game
- Playable up to 1 player (plus dealer)

Integration of Components

- ATmega328PU -> SPI -> ATmel Ice
- Pi -> UART -> RFID
- ATmega -> 16MHz Clock
- ATmega -> Motor Driver -> Motor
- ATmega -> Transistors -> (Dispenser + Shuffler)
- ATmega325PU -> binary connection -> pi
    - (001) - Shuffle
    - (111) - Deal player 5

System Specifications [pt.1]

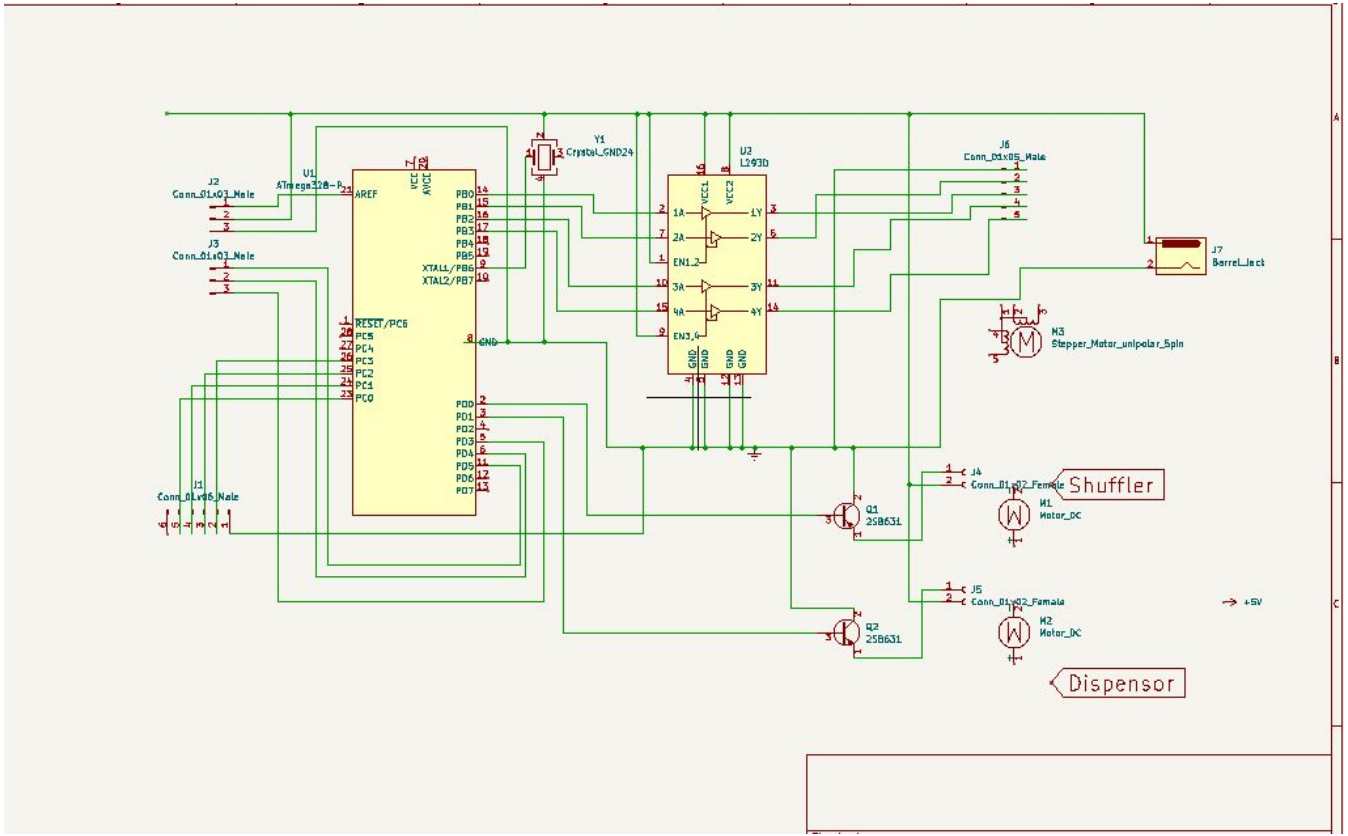
1. Shuffle all cards loaded into the system when prompted by the game.
2. Transfer cards from shuffling system to dispenser without dropping any cards.
3. Dispense cards to community/dealer as well as dispensing cards across the table to the player's designated section (within reach of the player's screen/designated area, without having cards fall off the table, and allocating the correct number of cards to each player).
4. System will stop once an "end" state is reached.
    a. "End" state can be reached by:
        i. A button press (Exit Button), where players can choose to leave the game
        ii. When a player's total winnings reaches the "winning amount"
        iii. After a certain amount of games (player inputs number of games)
        iv. Players can input duration of play before end game (e.g. 1 hour of playtime)
    b. On game end, display on UI: Total winnings, "play again", "exit"

continued....

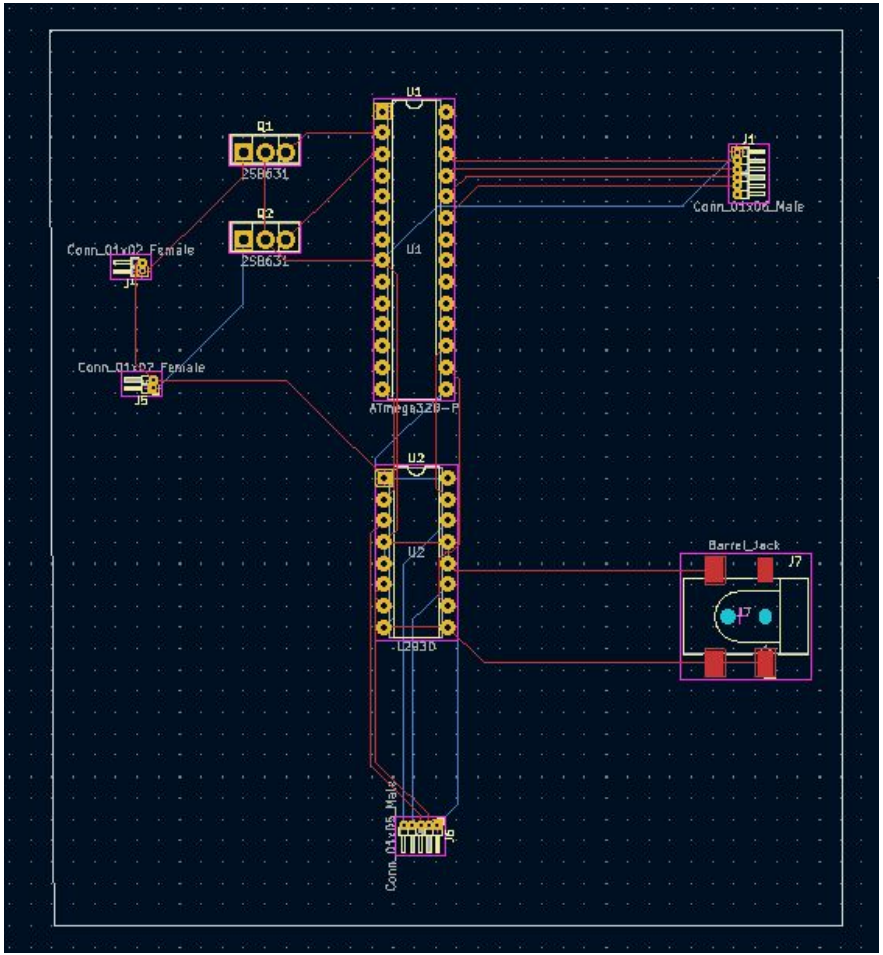
System Specifications [pt.2]

5. System will identify cards by their number/letter and suit with 99% accuracy of recognition.
6. System will engage with the user by the following (through use of physical buttons):
    a. Display wins/player money
    b. Player input (Betting / Player Moves)
    c. Asking the number of players (1-4 players)
    d. Asking for house rules
7. Players will not be able to substitute cards from another deck into the system deck.
8. System will organize betting virtually and display values through UI: All players' cards and scores will be shared on one display

PCB Design (Schematic)



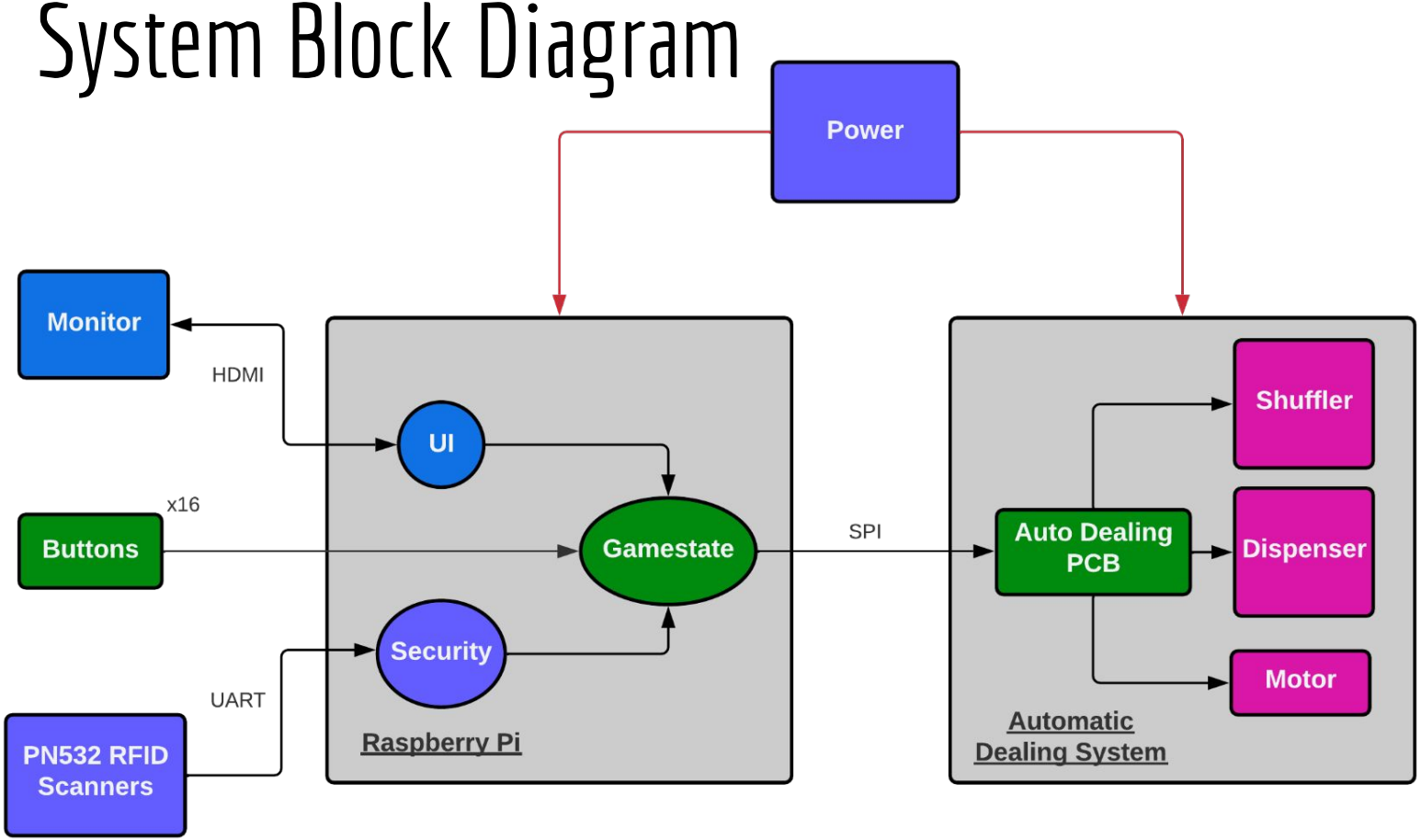
PCB


U1
Q1
2SB631
Q2
2SB631
J1
Conn_01x04_Male
Conn_01x02_Female
J4
Conn_01x02_Female
J5
U1
ATmega328-P
U2
U2
L293D
Barrel_Jack
J7
J7
Conn_01x05_Male
J6

Testing

- This system will primarily be tested by playing the game multiple times
- We will also test it by pushing the system in unusual ways - showing fail safes
  - What happens when external card is used
  - Betting variations
  - Different number of players
  - Players pressing buttons simultaneously
  - Players not pressing buttons for extended periods of time
  - etc.

System Block Diagram



Alina

Lamisa

Marvin

Ray

Proposed CDR Deliverables (Checklist)

- Completely functional GUI embedded with gaming algorithm and RFIDs.
  - Completely functional GUI defined as having all necessity features included, as well as the game play and RFIDs working together.
- GUI is functional with game play for up to 1 player; not embedded with RFID
- An integrated table top unit
  - Physical unit will be assembled combining the motor and dealing components
- Integration of RFID, Game algorithm, and Dealing Unit
  - All components are integrated and on Pi. Last step is Game integration: in progress 4/2

Hardware Components/Justification

- ~~4 Raspberry Pi's~~ 1 Raspberry Pi
- ~~4 Touch Displays~~ 1 Display
- ATmega 328P
- Atmel-ICE
- Adafruit PN532 (RFID Scanning)
- Stepper motor
- Motor driver L293D
- 16 Buttons (4 Buttons/player)

Software Components/Justification

- ~~GUI:~~
  - ~~PyQt/Qt Designer~~
  - ~~Python~~
- Gaming Algorithm:
  - Python
- RFID code:
  - C programming language
- Dealing System
  - C programming language

Cost Estimates

Item	Quantity	Cost/item	Total
Table	1	$50	$50
RFID Cards	1	$118	$118
RFID Scanners	2 (Backup)	$40	$80
Card Shuffling	1	$11	$11
Card Dealing	1	$25	$25
RaspberryPi	2 (Backup)	35	70
PCB	1	$100	$100
Total			454

FPR Plan

- Buttons with UI/game complete
- Game integrated with all other components
- Demonstration of a game from start to finish
    - Multiple games with multiple outcomes
- 3D printed parts (PCB enclosure, possible dealer card holder, refined rotation and stacking components as needed)
- PCB printed, populated, functioning
- Construction of final product
- Testing multiple edge cases

Technical Responsibilities

Ray

- Budget Lead
- RFID Systems/ Testing
- Assembly of final components

Lamisa

- Team Coordinator
- 3D Printing Designs
- Dealing unit final construction

Marvin

- PCB Lead
- Event Handlings
- Integration (algorithm/dealing system)

Alina

- GUI Interface/ Buttons
  - Improve GUI visuals
  - Additional GUI features
  - Adding buttons to GUI
- Project Website
- Integration (GUI/algorithm)

Gantt Chart						
Overarching category	**Task**	**Team Member**	**3/20 - 3/26**	**3/27 - 4/2**	**4/3 - 4/9**	**4/10 - 4/16**
Communication	Button/Game Integration	**Marvin/Alina**		x		
User Interface	Button UI implementation	**Alina**	x		x	
Displays	Connecting UI/Game to Multiple Displays	**Alina**	x	x	x	
Software	Project Website	**Alina**		x		
Construction	Final table top components	**Ray/Lamisa**	x			
Hardware	Changes to PCB and order	**Lamisa**	x			
Hardware	Add Multiple Shuffles to System	**Ray/Lamisa**		x		
Integration	Integrate RFID into Game	**Ray/Marvin**	x	x		
Design/Hardware	PCB Incorporation	**ALL**		x	x	
Formal Report	SDP Report	**ALL**			x	x

Demo

Questions?

THE END!