# 1. Problem Statement:

Poker and other card games require shuffling and dealing after every hand. It takes seven riffle shuffles to completely shuffle and randomize a deck. The game needs to be paused and a player will need to take time to complete a task that is simple and can be automated. For games like poker this shuffling and dealing process can often make games feel tedious and a burden to play. For many recreational players there is no way to analyze their play in a long term GTO manner as data isn't kept for casual games. Currently RFID options for card tracking and hand results are expensive and impractical for a casual player. Many players want to keep track of their data over time as they want to improve their poker theory and experience but lack the data to do so.

2. Solution

We want to make a table/machine that will be able to deal accurately and efficiently while tracking card data. In order to ensure a seamless transition between hands it should be able to load two decks and automatically start dealing once the next hand is initiated. The robot will identify the number of players at the table, shuffle a deck of cards and deal cards face down to players present at the table. The robot should be able to deal to a circle of max 8 players and smoothly run a poker game with minimal human intervention (collecting cards and replacing the deck). Our solution should work for a variety of different tables supporting a variety of player distances and deal appropriately for 3-8 players. As the robot deals, it will send card data to be stored in a database as well as displayed using a simple mobile GUI allowing players to track data and data quickly and easily.

3. Visual Aid
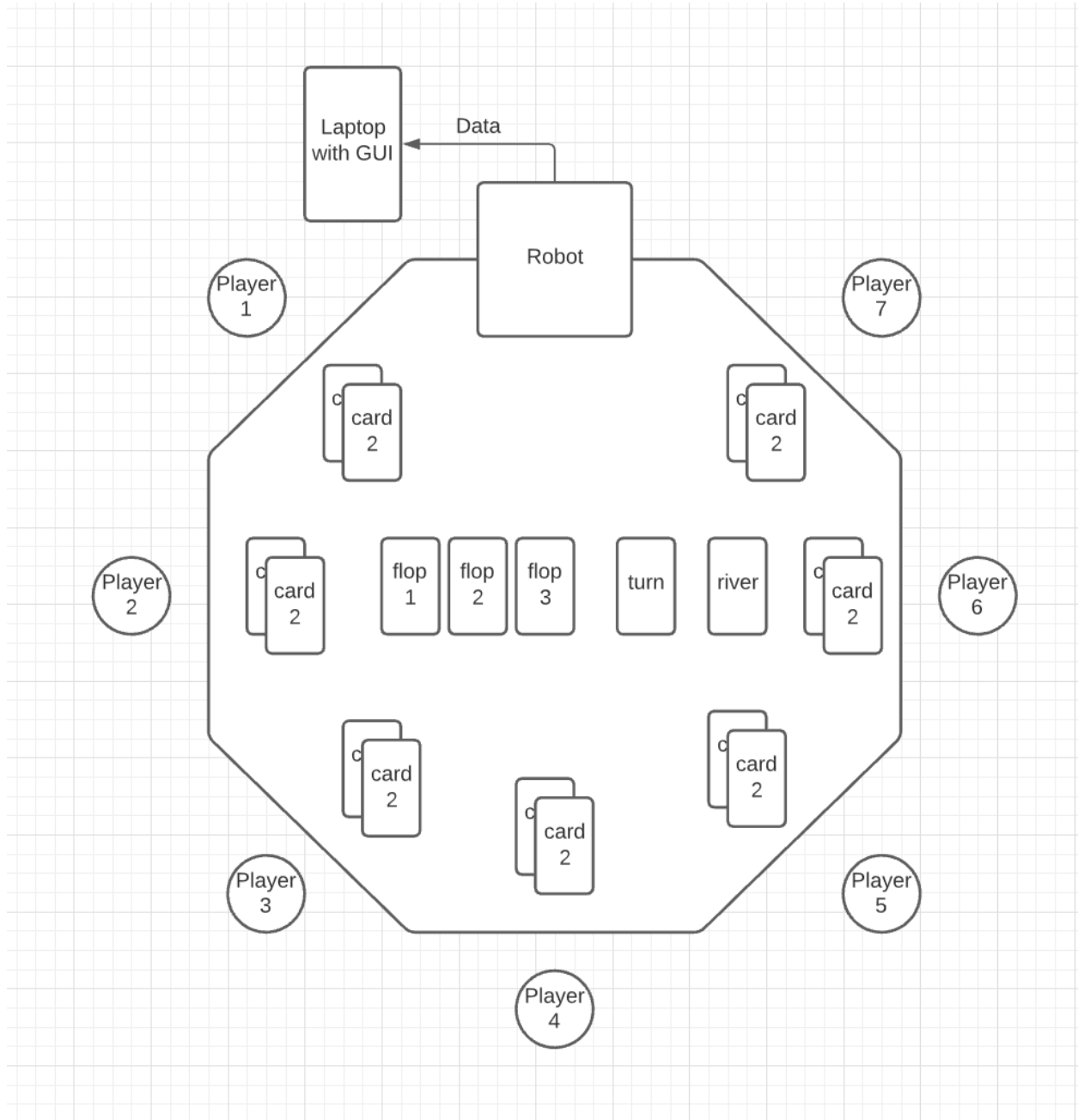
4. High-Level Requirements

i. The dealer must improve efficiency of the game by facilitating dealing, shuffling, and data collection by a margin of 30%. The dealer should eliminate the need for a player or designated dealer to shuffle and deal as well as improve upon the efficiency and accuracy of a human dealer.

ii. The dealer should accurately track hand data and community cards dealt for players over a 100 hand period. The card data should be 95% accurate and stored in an external database.

iii. The device should be suitable for recreational users. The device should not be excessively bulky, require additional power beyond a wall outlet, nor difficult to debug and reset if issues occur. It shouldn't require human programming to deal with Texas hold'em for a table of suitable size and players.

5. Design
a. Block Diagram
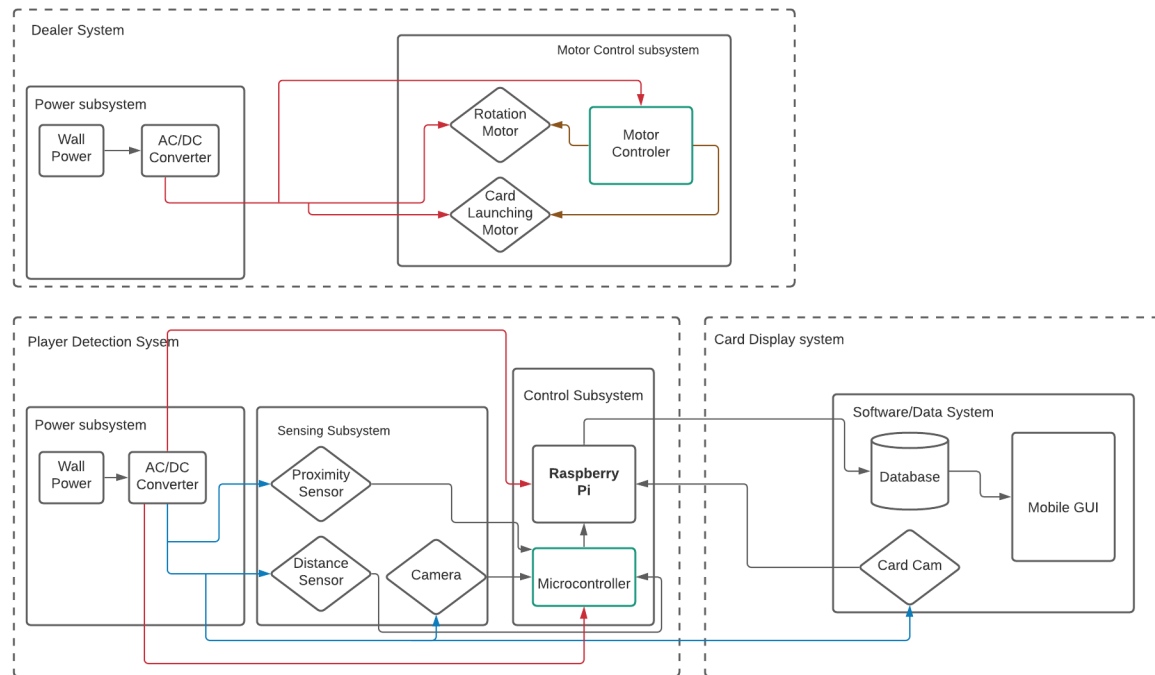
Red - 5V Power Lines
Blue - 3V Power Lines
Black - Digital Data Lines
Brown - Analogue Data Lines

b. Subsystem Overview

i. Table Scanner

This subsystem is to look around the table that the robot is mounted to, and figure out the amount of players seated and their relative positions. The robot should be able to scan the table, recognize exactly how many players are seated, and figure out their locations relative to its own position. The robot should calculate the optimal location to deal community cards if community cards are required for the game.

ii. Card Dealer

The robot should be able to consistently deal a single card to a single player sitting up to 3 feet away. This subsystem should use and process the data gathered by the table scanner in order to shoot the cards the right distance and send them to the correct position.

iii. Card Reader

This subsystem should be used before the card is dealt to the player. The robot is able to read a single card and identify its suit and type. The data should be accessible to spectators or people not in the game.

c. Subsystem Requirements

i. Table Scanner

1. The robot can identify whether a player is sitting 1, 2, or 3 feet away with an accuracy of 80% over 300 trials.
2. The robot can accurately identify player distance to +- 6 inches
3. The robot can accurately deal to players based on player presence and angle based on its origin.

ii. Card Dealer

1. The robot can deal a single card face down to a player 1 foot away 100 times with a 95% success rate.
2. The robot can deal a single card face down to a player 2 feet away 100 times with a 90% success rate.
3. The robot can deal a single card face down to a player 3 feet away 100 times with a 80% success rate.
4. The cards should be dealt to the position decided on by the table scanner subsystem.
5. The dealer must successfully deal cards to players face down into a 12 inch by 12 inch square with a success rate of over 90%

iii. Card Reader

1. The machine should recognize the correct card at least 85% of the time.
2. The data should be transmitted quickly via bluetooth or a webserver with latency of under 10 seconds.
3. The cards should be accurately displayed and easily read through a mobile GUI.

d. Tolerance Analysis

The main tolerance issue would be in the motors used to deal the cards to different players. We would have to test with different voltages and motor speeds in order to see how the trajectory of the cards would change. Unfortunately, this is something we can't work on until we have the machine built and in front of us. Additionally, since this is a card game, it would be ok if the cards were dealt a slightly shorter distance in front of the players. However, we would not want to overshoot the location.

6. Ethics and Safety

We need to make sure that when we deal cards, we aren't launching them at a speed or angle that could be dangerous for players around the table. Additionally, we don't want to endorse gambling in a non responsible manner. Our project is simply to make the game experience better for people playing, and we don't want to encourage people to gamble or spend their money on something they would regret.