



UNIVERSITY OF  
**ILLINOIS**  
URBANA-CHAMPAIGN

# AUTONOMOUS CARD DEALER

Electrical & Computer Engineering

Adam Naboulsi, Rohit Chalamala, Ralph Balita

MAY 1<sup>ST</sup> 2023

# The Team

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Rohit Chalamala  
Computer Engineering



Adam Naboulsi  
Electrical Engineering



Ralph Balita  
Computer Engineering



# Introduction

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## Problems / Objectives

- Players in casual games are subject to cheating.
- Sometimes players are not in the mood to deal or shuffle.

## Solution

- Automate shuffling and dealing without human intervention.
- Design a smart device, capable of facilitating card games.

## Features

### 1. Game Modes

- Poker
- Rummy
- Uno
- Literature
- Even Deal

### 2. Max # of Players: 8

### 3. Automated Shuffling and Dealing

### 4. Button Control & Real Time Feedback





# Design

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## Subsystems

### Power:

- Regulate 9V battery down to a stable 6V, 5V, and 3.3V.

### Motor:

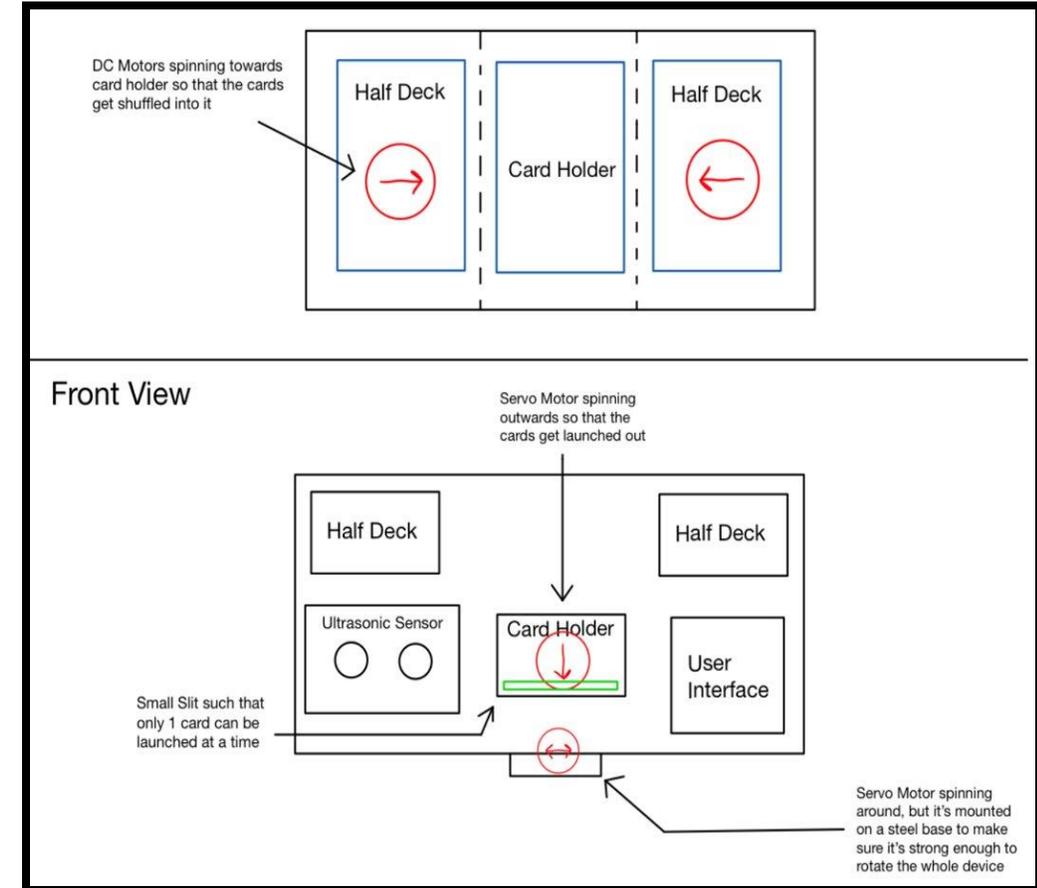
- Two servos for dealing and rotating device.
- Two DC shuffling motors One motor driver to control.

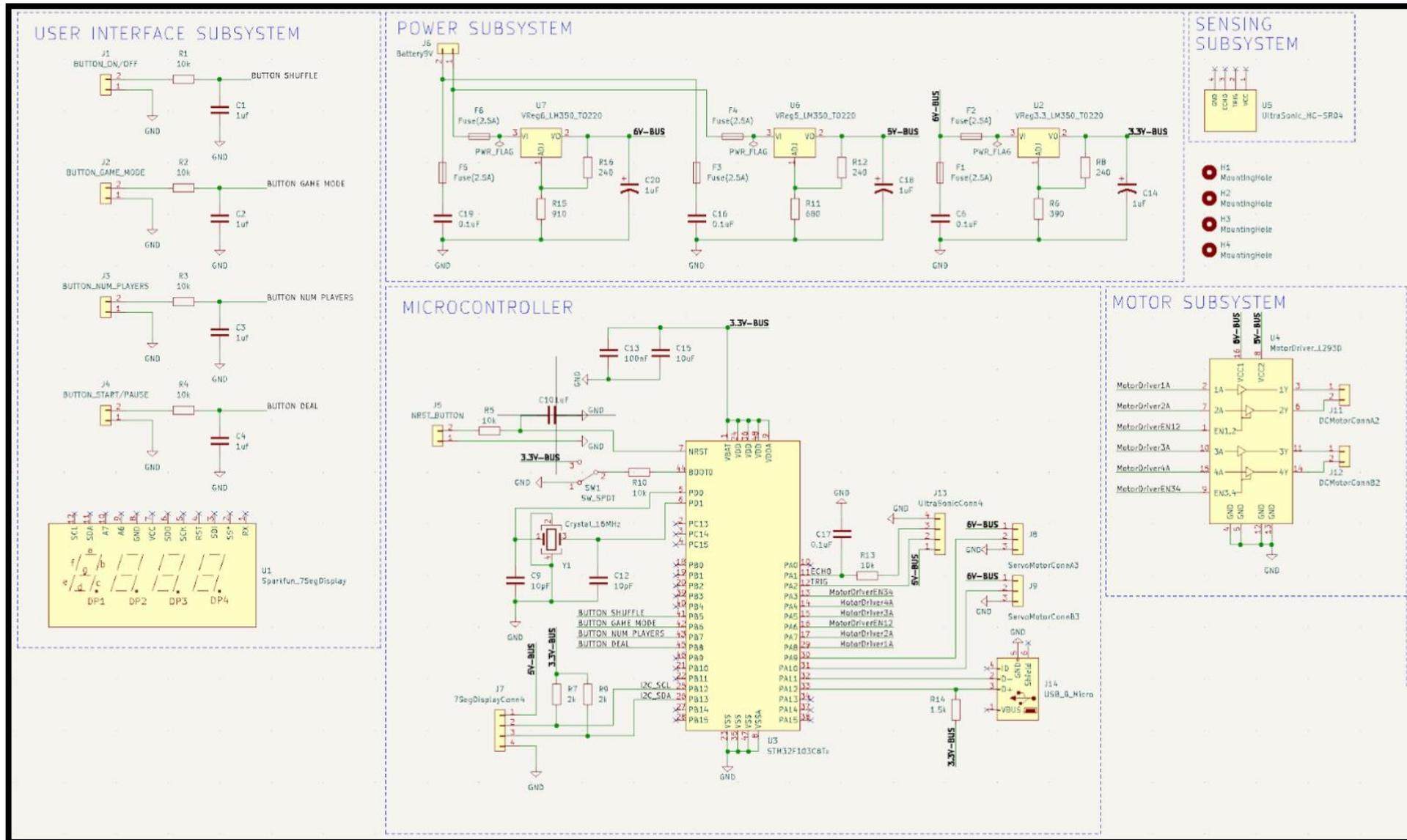
### User Interface:

- Hex (7Seg) Display to show status of game.
- 4 buttons for user control.

### Sensing:

- Ultrasonic Sensor to determine distance from user.





# Changes Made by Subsystem



## **Power Subsystem**

Added an extra Voltage Regulator.  
Regulated down from 18V instead of 9V.

## **Motor Subsystem**

Replaced Dealing Servo motor with a DC motor.

## **User Interface Subsystem**

Changed the 7-Segment Display to an LCD.

## **Sensing Subsystem**

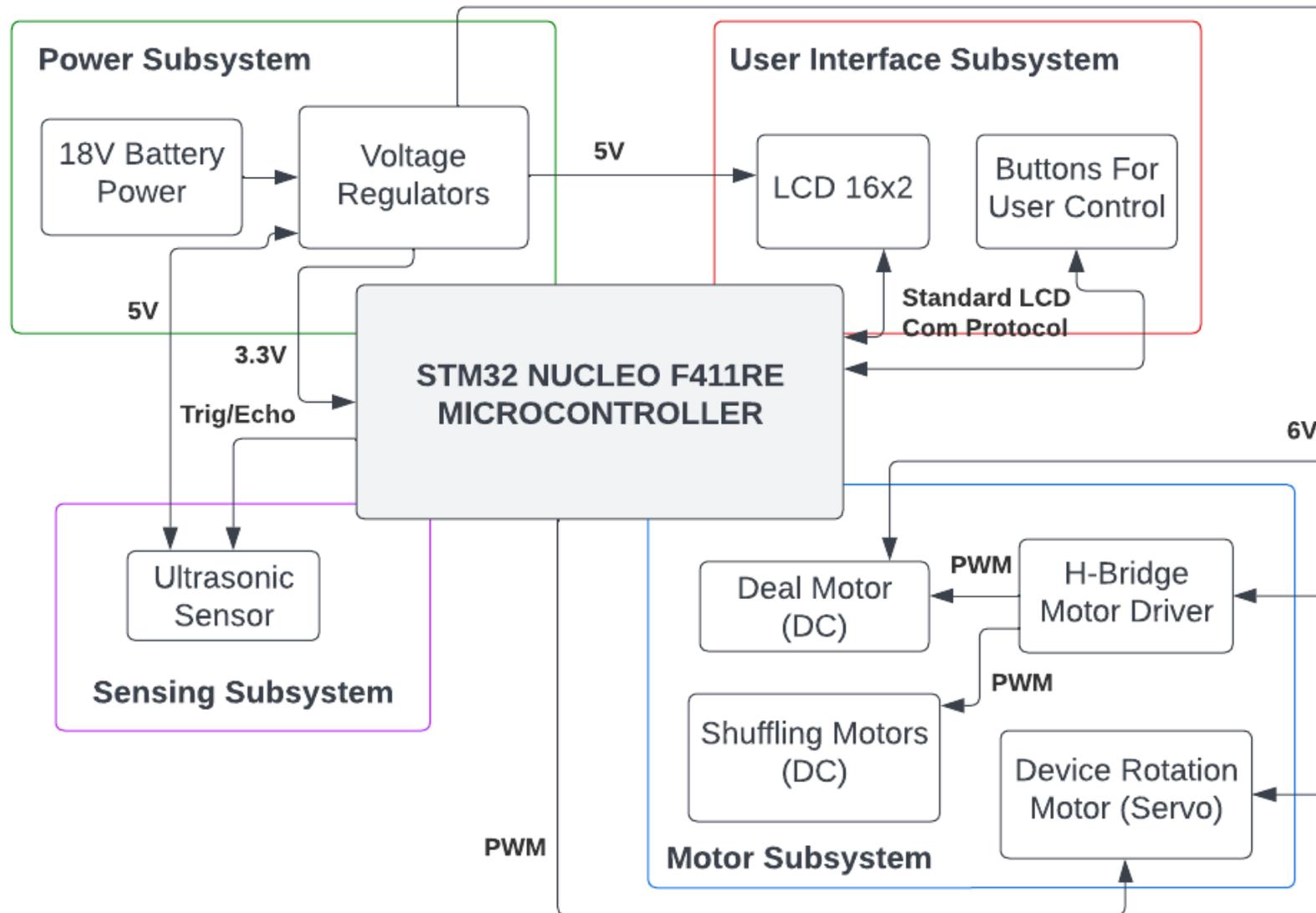
No changes made.

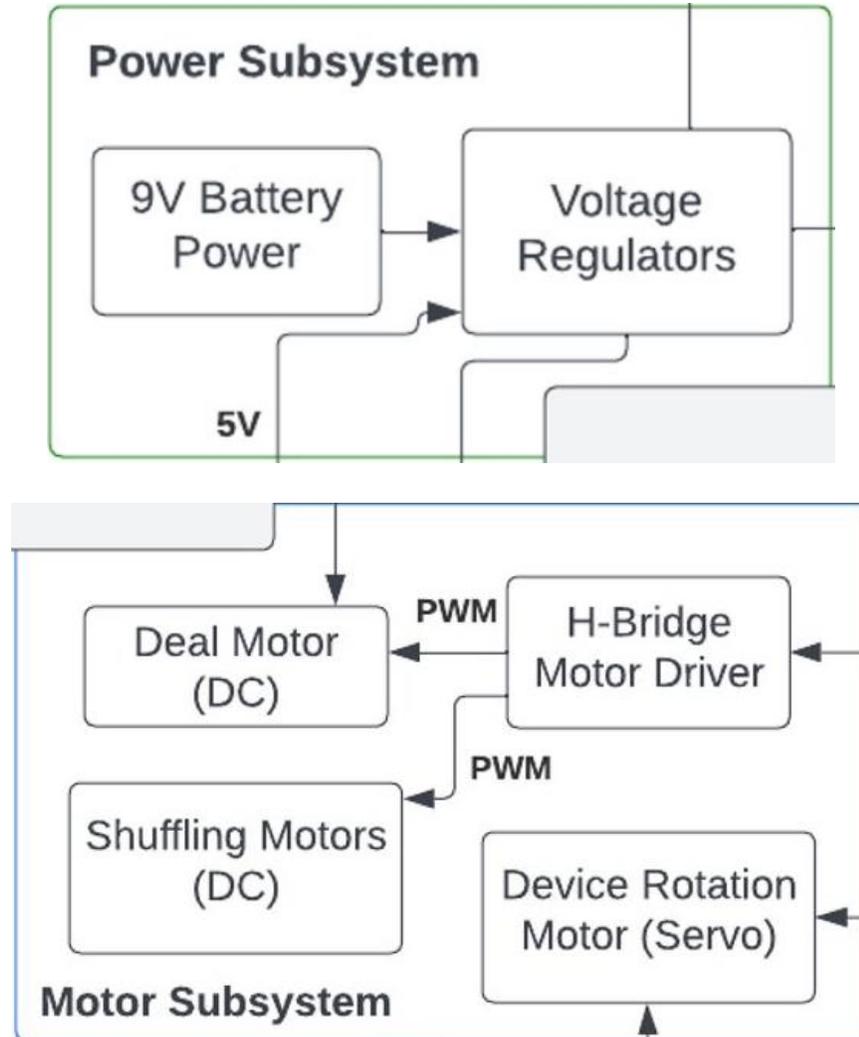
## **Microcontroller Subsystem**

Used a NUCLEO-F411RE Development Board.  
Breadboarded the PCB components.



# Updated Block Diagram and Physical Design





## Power Subsystem

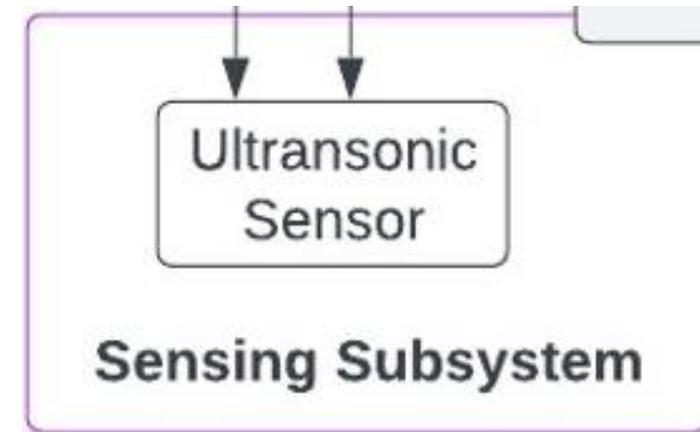
- Stable, regulated voltage from 18V to  $13.5 \pm 0.5V$ ,  $6.5 \pm 0.5V$ ,  $5.5 \pm 0.5V$ ,  $3.8 \pm 0.5V$ .
- Support up to 2.5A of current; Short-circuit protection.

## Motor Subsystem

- Shuffle cards in riffle fashion
- Shuffling motors output  $>40\text{oz-in}$  of torque.
- Deal servo motor outputs  $>55.54\text{ oz-in}$  of torque.
- Rotation Servo motor outputs  $>60\text{ oz-in}$  of torque.
- Rotation Servo motor rotates at least 180 degrees in various increments.

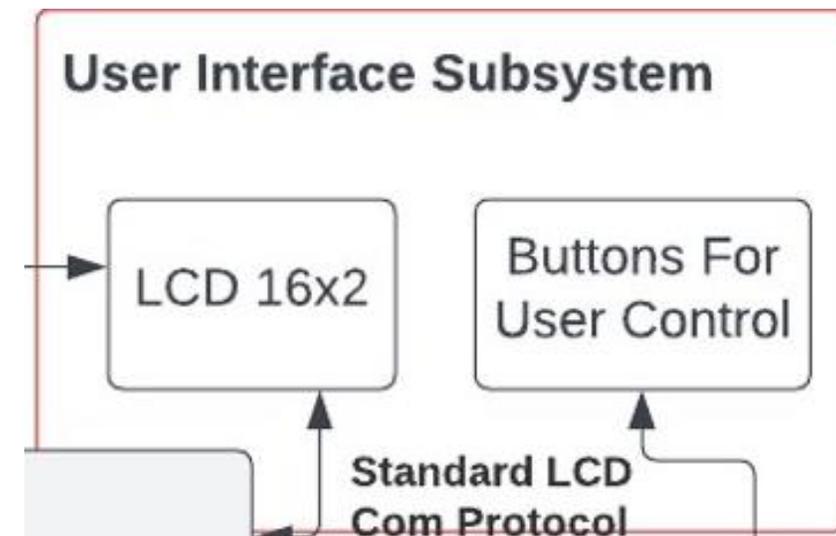
## Sensing Subsystem

- Accurate readings from ultrasonic.
- Get readings from at least 0.5 meters away.
- Ultrasonic takes distance measurements in a range of 10-15 degrees wide.
- Collect and send readings to microcontroller through trig/echo on 5V



## User Interface Subsystem

- Indicate # of players (1-8) and change game mode through button control.
- Communicate data from buttons to microcontroller and LCD.





# Results

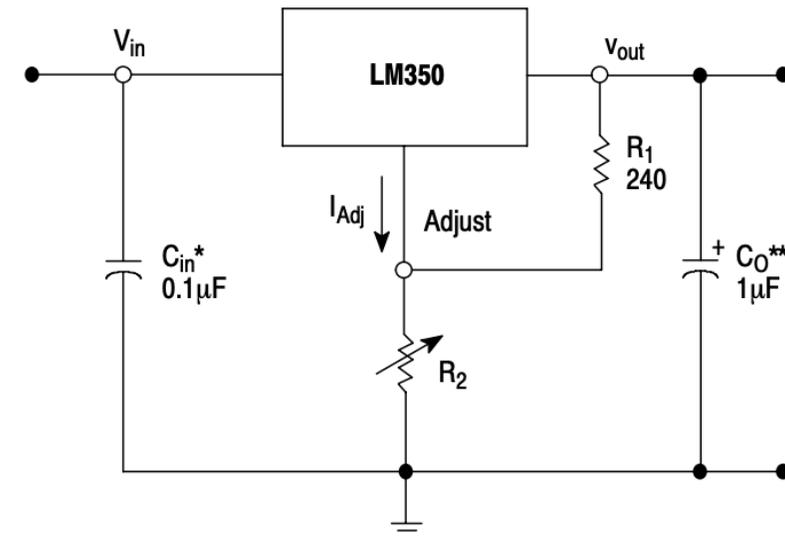
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**We want a stable and regulated voltage from 18.0V to 13.5±0.5V, 6.5±0.5V, 5.5±0.5V, 3.8±0.5V.**

Voltage Regulator Intended Output	Resistor Value Used (R2)	Output Testing
13.5±0.5V	220Ω	13.39V
6.5±0.5V	880Ω	6.14V
5.5±0.5V	760Ω	5.47V
3.8±0.5V	430Ω	3.43V

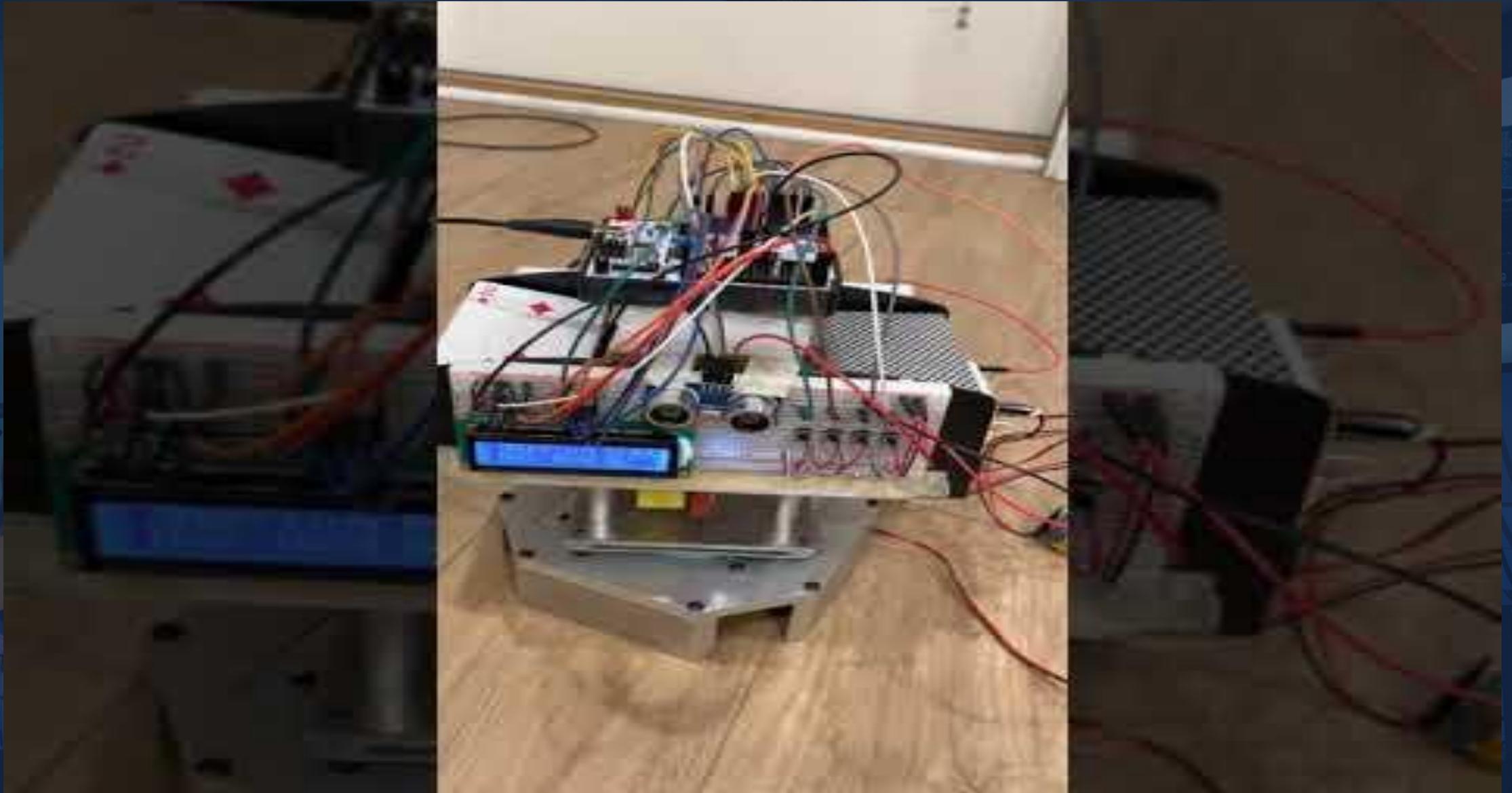
**Must have the capability to rotate at least 180 degrees in increments of 11.25, 12.9, 15, 18, 22.5, 30, 45, and 90 degrees (1-8 players) clockwise in a controlled manner.**

Expected	11.25	12.9	15.0	18.0	22.5	30.0	45.0	90.0
Observed	11.00	13.0	16.0	18.0	22.0	30.0	46.0	90.0



\* =  $C_{in}$  is required if regulator is located an appreciable distance from power supply filter.  
 \*\* =  $C_0$  is not needed for stability, however, it does improve transient response.

$$V_{out} = 1.25 \text{ V} \left( 1 + \frac{R_2}{R_1} \right) + I_{Adj} R_2$$





# Accomplishments & Challenges

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## Successes

### **Taking User Input and Display**

Buttons capable of changing the state of the machine and user input settings. Seen clearly via the Liquid Crystal Display (LCD)

### **Shuffling**

Pseudo-random riffle shuffling mechanism

### **Rotating Base**

Servo Motor capable of controlled 180 deg rotation

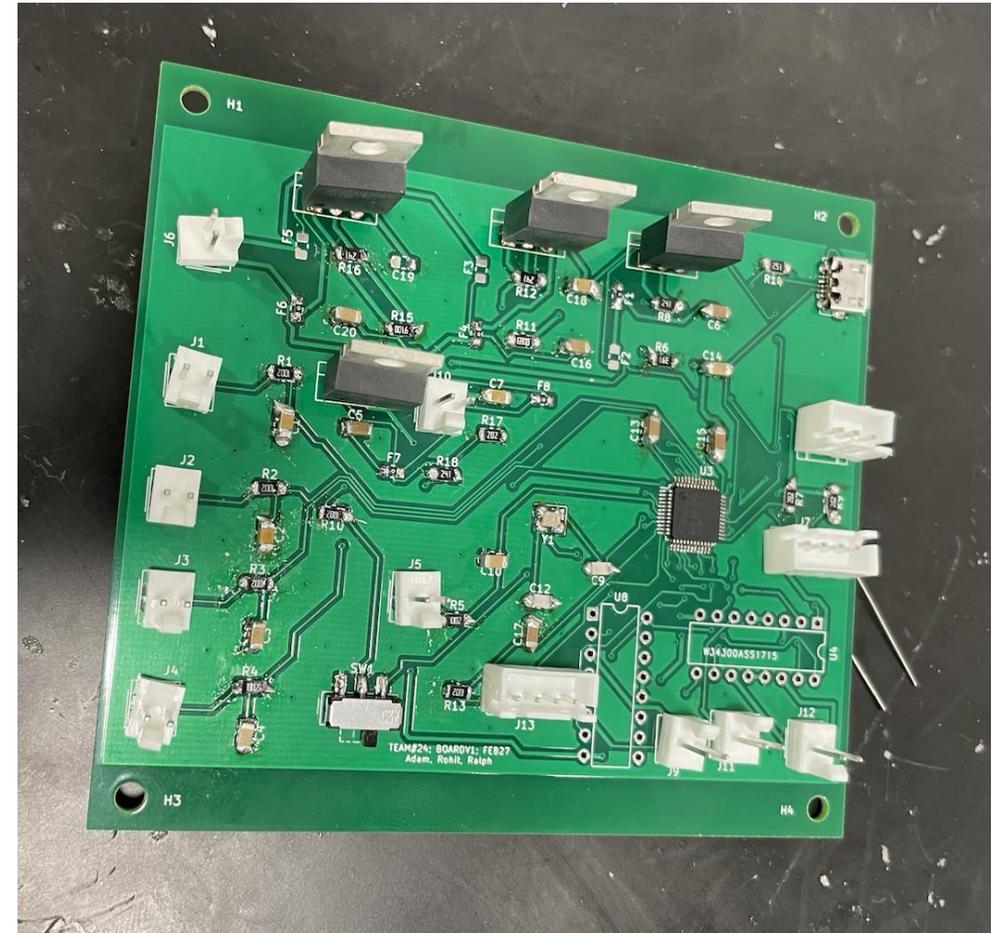
### **Dealing and Sensing**

Dealing Mechanism capable of dispensing cards when player is scanned



## Challenges & Solutions

- Unable to get the PCB working
- Power drains from the batteries very quickly
- Inaccurate readings from the Ultrasonic sensor
- Imprecise rotation from the servo motor
- Shuffling isn't as even as we want it to be
- Dealing is difficult when only a few cards remain





# Conclusions

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## Reflection

We are happy with what we have achieved, and we feel that we've all learned a lot.

## Improvements

- Moving our design onto a working PCB
- Using a Lidar sensor as opposed to an Ultrasonic
- Using a better voltage supply such as a wall plug in
- Better motors for more control of shuffling, dealing, and rotation
- Adding an arm lever or a weight on cards.





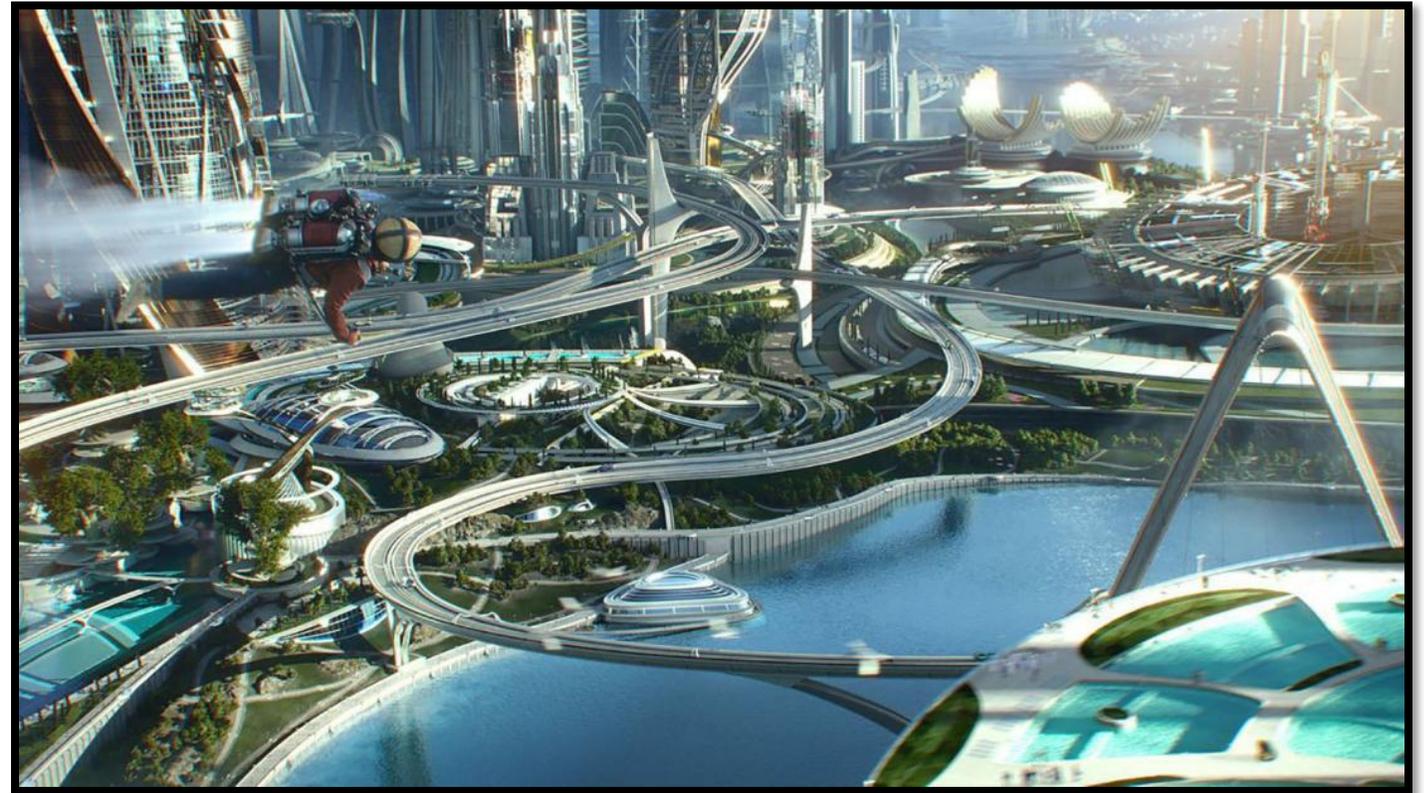
# Future Work

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## The Future of Automated Card Dealing

- Improved Player Recognition
- Card Game – Gaming Console
- Dealer Tracking
- Customize Game Modes directly onto the device

*Society with an Autonomous Card Dealer*





# Ethics

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Main purpose of this project is to prevent cheating and make card games fair.

## *IEEE Code of Ethics*

- Ensuring health and safety of our users
- Frequently met with the Machine Shop to make sure no mechanical hazards surface.
- Actively sought advice from expertise and loved constructive criticism on our project.
- Proper teamwork etiquette was in place.
- Scheduled weekly meetings during the semester to discuss any violations of the code of ethics.





**Thank you for attending our presentation!**  
**Questions?**

[rohitc2@illinois.edu](mailto:rohitc2@illinois.edu), [adamjn3@illinois.edu](mailto:adamjn3@illinois.edu), [rbalita2@illinois.edu](mailto:rbalita2@illinois.edu)