ECE445
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Project #62: Casinova

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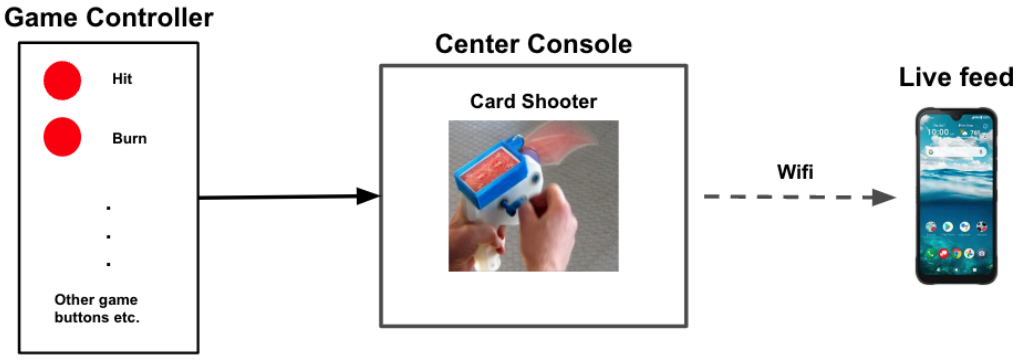
1. Introduction

Problem: Part of the fun of watching poker tournaments or cash games online is knowing what each player has and seeing their winning percentage. However, unless you have a specific type of deck with additional markings for machine-readable card tracking, you can't emulate the professional experience at home with a regular deck of cards. We want to bring that professional live experience to home games so that the everyday person can feel like an expert. In casinos, efficient dealers are the heart of every card game imaginable. Cards must be dealt out specifically at the beginning and throughout the game. Humans are the ones who have been dealing cards for centuries, however, untrained humans cause many errors. Misdeals slow down setups, mess up gameplay, and ruin the card game experience for players.

Solution: To remove errors from the dealing process and add to the professional experience, we propose an automatic card dealing machine that can act just as a human dealer. The machine would contain programmed knowledge of multiple different games and rules and would update a live feed for spectators to view the games.

There are many card dealers online that accomplish the basic task. There are a few features that we want to implement that make our design unique from the rest. Like a human dealer, our machine would be able to detect players who have either sat down or gotten up from the table with a front-facing camera. With the front-facing camera, our dealer would be able to eject the cards at varying speeds and degrees to emulate more of a human. Casinos use fresh decks of cards daily to avoid any errors of losing cards. Our dealer would be able to detect when you are playing with a faulty deck with a camera inside the console. The dealer would be able to keep track of what cards each player has to project into a live feed for spectators watching the game.

Visual Aid:

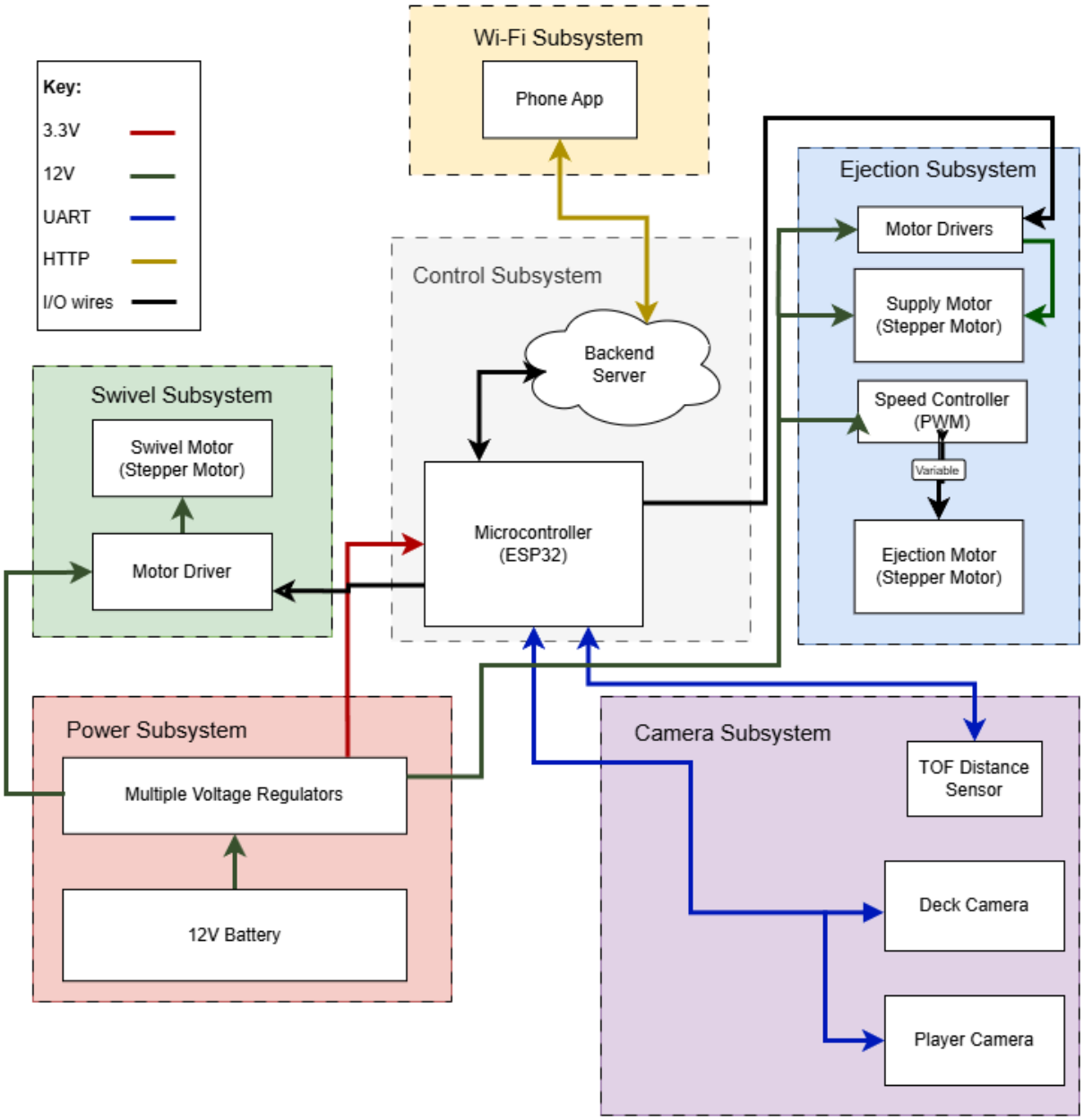


High-level requirements list:

- The dealer can deal an entire table of 8 players in under 45 seconds with high accuracy to eliminate misdeals.
- Provide validation for players that the dealt cards are fair and the playing field is level.
- Offer “human dealer” actions, such as player identification and responses to player action (such as dealing more cards, or moving on to the next player).
- Improve the spectating experience by adding statistics (odds, card reveals, and outs) to an outside feed.

2. Design

Block Diagram:



Subsystem Overview:

Control Subsystem: The control subsystem is the brains of the whole operation, computing and analyzing the I/O when it comes to data for the system.

It includes the ESP32 microcontroller and will handle the logic I/O for all the other subsystems. These calculations range from image processing on the camera output to determining card values and player positions, as well as calculating the speeds and orientations of multiple motors. It will also run a backend server (on the ESP32) to handle the HTTP requests with the phone app.

Swivel Subsystem: The swivel system is in charge of the rotational movement of the dealer.

Its whole goal is to be able to accurately rotate the dealer to the correct orientations to deal with players. Its main component is a stepper motor which will be able to keep track of the orientation of the machine as well as rotate the dealer itself.

Ejection Subsystem: The ejection system ejects cards out of the dealer using two motors.

One motor called the supply motor, queues up a single card to be ejected whenever asked. The second motor is the ejection motor, which ejects the queued card at a variable speed based on what the control subsystem tells it the speed should be.

Power Subsystem: The power system is responsible for providing electrical power to the rest of the subsystems

The power subsystem provides power specifically for the main microcontroller as well as the swivel and ejection subsystems. The power system requires the use of a 12V battery, as well as multiple voltage regulators which alter the voltage to that of the requirements of the multiple components which it services.

Camera Subsystem: The camera subsystem is in charge of providing visual images of the environment both outside and inside the dealer.

The camera subsystem consists of two cameras, one camera for looking at the queued card, and one camera for looking ahead outside at the players. The camera subsystem also includes the TOF Distance Sensor, which is a laser-based sensor that detects the distance between the dealer and the object/player directly in front of the sensor. All these components feed their sensor data to the ESP32 microcontroller, which computes what card is currently queued up if there is a player in front of the dealer, and how far the player is from the dealer.

Wifi Subsystem: The Wi-Fi subsystem is in charge of communicating with the browser and providing I/O information for players.

It consists of the phone app which is accessible by any mobile or computer-based browser. Once the user connects to the Wi-Fi network hosted by the ESP32, they will be able to communicate with the dealer over Wi-Fi to enable player action and input.

Tolerance Analysis: When it comes to the Camera Subsystem, processing power will be a bottleneck to our chances of success. Originally, the plan was to run image processing analysis on a Raspberry Pi, which has a quad-core processor with a gigabyte of RAM. However, learning that this was not an option, we are planning to resort to using the ESP32 as our main processor. However, the ESP32 only has a dual-core and 520-kilobyte RAM setup. Therefore, we have half as many cores, and about a two-thousandth amount of RAM to make image processing work. The task is still feasible as long as we figure out how to implement efficient and accurate code when it comes to processing images.

Ethics and Safety: The ethical and safety issues relevant to our project mainly consist of trust issues with a machine able to know which cards it's dealing with. Although the machine's purpose is to create a fair game, the knowledge that the machine has knowledge none of the other players have can leave a distaste for those who truly want to ensure a fair game. In the player's eyes, the machine may be rigging the deck against them to create an unfair game environment. To combat the issue of trust, we believe that if we were to make the machinations visible to every player, it would provide a level of transparency that even human dealers cannot provide. The idea is to create the casing out of a transparent material such as acrylic to display every movement and deal in plain view, with no inner workings from a black box to worry about.