No Chips? No Problem. - Poker 2.0

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1 Introduction

1.1 Objective

Everyone plays games. One of the most common games people play are card games. One of the reasons card games are so popular is due to the simplicity of the materials needed as players only need a deck of cards to play. One of the most popular card games people play is poker. Poker is not only the most popular card game in the world, but it is also the most commonly referenced card game [1]. Different variants exist for the game of poker with the most common one being Texas Hold'em [2]. Texas Hold'em consists of 2-10 players with each player being dealt two cards each laying face-down [2]. The dealer (the person controlling and handling the deck of cards) then lays three cards on the table face-up [2]. From there, players going counter clockwise from the dealer begin their turn [2]. On a player's turn, he/she has an option of either checking, calling, folding, or raising [2]. After each rotation, the dealer lays another card face-up until there is a total of 5 cards face-up [2]. The entire round of poker ends with the player having the highest hand shown or only one player is remaining if the only players have folded [2]. The winner receives the pot. Poker has slowly evolved from being a physical, in-person card game to being played online with players facing off from around the globe. Las Vegas, one of the world's biggest casino epicenters, earned up to $8 million dollars in revenue from poker rooms in a single month [3]. While the popularity and demand for poker is undeniable, it is one of the rare card games that requires more material than a deck of cards. Specifically, to play a game of poker players need plastic coins called "poker chips". These "poker chips" indicate the amount of money each player is waging based on the color and label of the chip. The plastic coins are an integral part of the game as it entices players with the chance of winning money. However, not everyone has these plastic coins already in his/her possession, and those who do, may not have enough to go around based on the number of people wanting to play. This problem causes people to rely on going to business and corporations that supply the necessary materials. It would be nice to have a solution that simulates the game of poker that does not limit the amount of players wanting to play as well as those who may or may not have poker chips. A similar problem was proposed by Team 62 in Spring 2019 with their "Electronic Betting System for Poker" [10]. While we have used their project as an influence, we present an entirely different solution that we believe offers more versatility and further resolves other issues.

The goal of our project is to develop and implement a solution that is able to simulate a game of poker without limiting the number of players wanting to play and have the game be playable with people who have poker chips as well as those without poker chips. Additionally, we want to maintain the key components of poker like face-to-face interaction because it is

important to see players' faces to see if they are bluffing or not. To solve these issues, we plan to create a main console unit which users access through mobile devices via Wifi. The main console unit allows players to insert poker chips into it, and the console senses how much each chip is worth based on color. We will utilize motors to funnel incoming inserted chips and sensors to detect them. If physical chips are used, the winner of each round collects his/her winnings from a pull-out tub located inside the control unit. Additionally, an LCD display will be mounted onto the control unit so every player can follow along together. The main console maintains its own website, and the number of devices which connect to it indicate how many players are currently playing, solving the issue of only a limited number of players being able to play the game at one time. The website will also indicate if electronic poker chips will be used or if the control unit senses no physical poker chips inserted. The interface will also provide players a display that allows them to call, check, raise, and fold as well as see the amount of money they currently have. Both components together will solve the issues previously mentioned to ensure our project solution adequately solves the proposed problem.

1.2 Background

We believe our proposed problem is worth solving as the game of poker is undeniably popular around the world, and we believe every person should be given the chance to play with as few limitations as possible. From the data shown in the previous section, we can safely say this problem is worth pursuing. Additionally, a couple of team members have had first-hand experience playing poker, so there is a personal connection to the problem itself.

Our design solution provides a more versatile and reliable product than Team 62's solution. WiFi connectivity is much more reliable than using RFID as RFID requires more readers to provide better accuracy [4]. More readers results in higher costs for the RFID infrastructure. Additionally, RFID can easily be interfered with by other RF signals as well as WiFi access points and since most households have a WiFi system in place it seems redundant to have a product require a completely different system to be installed. Within their final report, Team 62 did note how RFID was easily interferrable and unreliable suggesting in future designs a more reliable should be implemented [10]. Our design offers more versatility by allowing consumers to use our product if they have poker chips and if they do not have poker chips. Team 62's project, on the other hand, is not designed with the use of physical chips in mind. Furthermore, their solution also incorporates remotes for players to use to play, which limits the number of players to the number of remotes available. Using a website that can be connectable through mobile devices and/or laptops removes that limitation as players will only need to have a smartphone which, in today's society, most people already have.

On the market, there are a few existing solutions that attempt to solve our problem, but none that directly eliminate the problem entirely. One of these solutions that is commonly

found is simulated poker online through mobile applications. There are a ton of online poker applications scattered throughout the app store. However, most of these online poker mobile applications remove the element of face-to-face interaction, which is a key component many players use to tell if other players are bluffing or not. There is one mobile application called Bold Poker that still gives players face-to-face interaction. Bold Poker simulates the table, dealer, cards, and poker chips on an iPad, while players can join in together through their mobile devices [4]. While this product does eliminate the issue of limiting the number of people wanting to play, it does not take into account those consumers who have poker chips already in their possession. Additionally, Bold Poker requires a 5 minute delay every 30 minutes calling it a "cigarette break" which can be very annoying and cumbersome [5]. To remove this "cigarette break" players have the option of paying $4.99 to unlock "uninterrupted" mode [5]. Bold Poker also requires players to have an iPad to simulate the poker table. No Android or other tablet can be used. This requirement severely limits the audience scope of this product as an iPad is not cheap and has a price tag northward of $300. Other solutions aimed to solve our design problem consist of building entire apparatuses to mimic a casino poker table or electronic slot machine. It should be noted that both these designs are currently patented, but have yet to reach the public as an eligible product. The casino poker table suggests the solution should consist of a full embodiment of a poker table with an electronic dealing system [6]. This solution still contains a limit on the number of players able to play with only six seats available. Additionally, this solution is only feasible for businesses and corporations who have the space and money to purchase such a product. The electronic slot machine has the same issues. The size of the machine makes it only feasible to business and corporations [7]. This slot machine also does not take into account physical poker chips, but rather makes everything electronic [7]. While there are solutions existing in the market or making their way to it, none of them provide direct solutions to the problem we are trying to directly solve. Problems like setting a limit on the numbers of players capable of playing and giving players the option of still playing poker despite not having physical poker chips are just some of the issues that still linger today. Our project solution aims to tackle and solve each of those issues as well as make it feasible to everyone.

1.3 High-Level Requirements List

- The entire system, main unit and website, correctly performs all functions of a poker game, specifically Texas Hold'em, without the use of physical poker chips.
- The poker chip detector must have greater than 95% accuracy in correctly determining the quantity and color (blue, black, green, red, or white) of chips inserted into the console during a person's turn.
- The console must be able to successfully handle requests from external devices for the "game dashboard" (an HTML file displaying players' money totals, whose turn it is, and options to buy in, check, call, raise, and fold) 70% of the time.

2 Design

The overall functionality of the entire system depends largely on one machine: the main console. Inside this machine, there are six subsystems: a power supply circuit, a motor driving circuit, a poker chip detector, a microcontroller unit, a Wifi module, and a user interface module. The console needs the power supply circuit to supply electrical power to all necessary electrical components. The motor driving circuit sends poker chips through the console, and the poker chip detector determines the quantity and color of chips passing by. During gameplay, the user interface module takes in input from buttons and outputs visual cues and feedback to an LCD display. As the game progresses, the Wifi module communicates with external devices, taking in gameplay actions (folding, raising, etc.) and sending out game information as requested. And finally, the microcontroller manages game state data, sensor readings from the poker chip detector, communication via the Wifi module, and I/O to/from the user interface module.

2.1 Block Diagram

Figure 1 shows how all of these modules physically connect with one another as well as how the console communicates with other devices on the wireless network (that is, through a router).

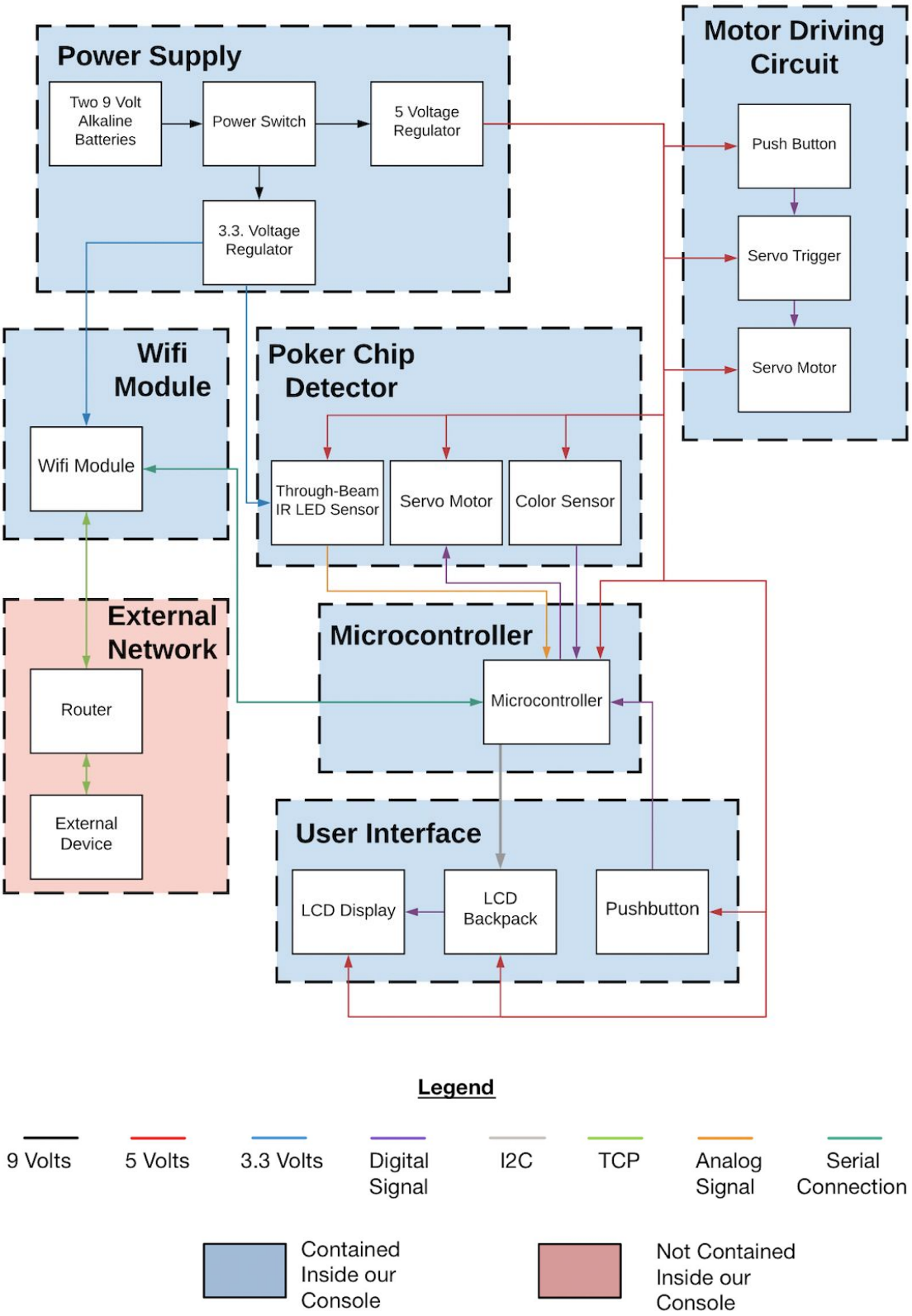

Figure 1. Block Diagram

2.2 Physical Diagram

Figure 2 shows a top view of what the spinning drum (powered by the motor driving circuit) looks like as well as the layout of the user interface.

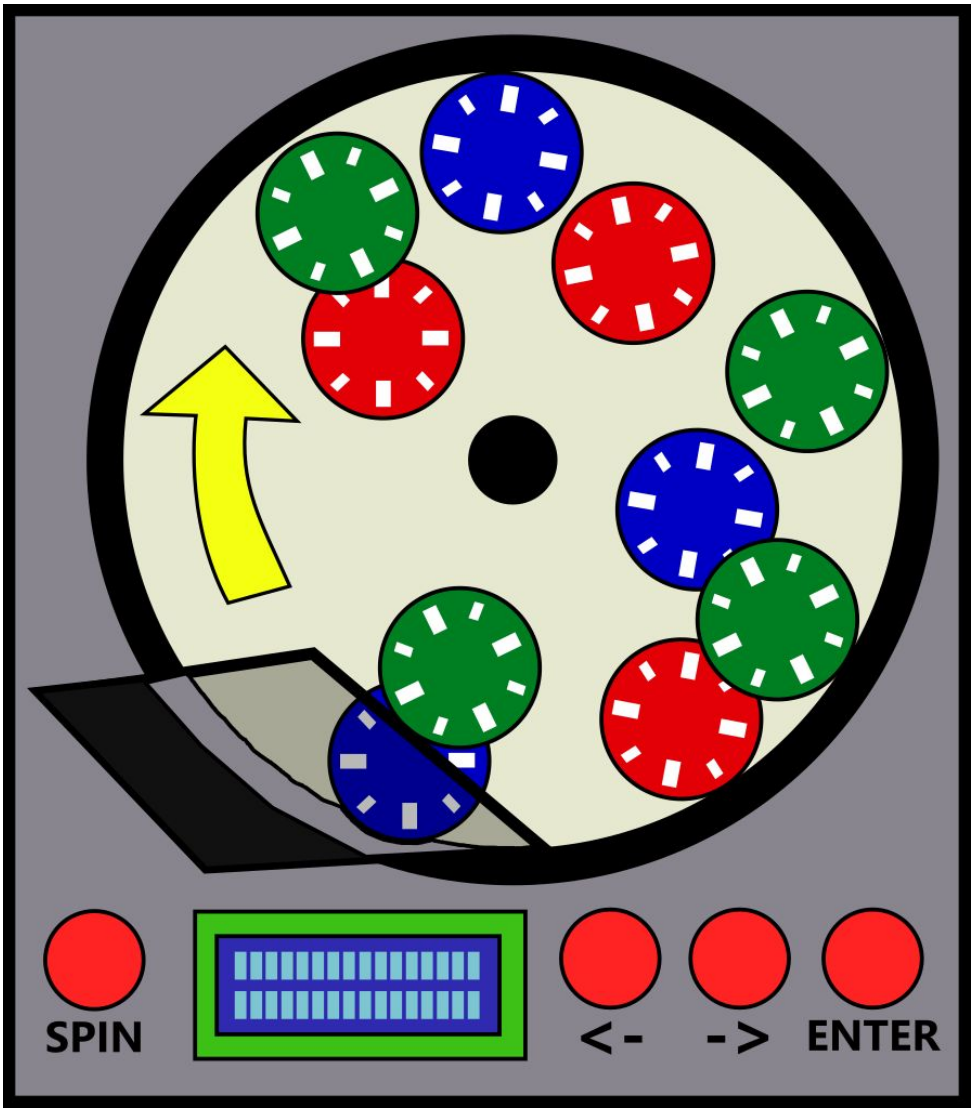

Figure 2. Top View of Console: Spinning Drum and User Interface

2.3 Power Supply

Every single component in Figure 1 needs some kind of electrical power to operate. With this being said, in order for the console to function correctly, it needs a steady, reliable power supply. The components used in the power supply for this machine are a 5 V switching regulator, a 3.3 V switching regulator, two 9 V alkaline batteries connected in parallel, and a power switch.

2.3.1 5 V Switching Regulator

The microcontroller, servos, servo trigger, color sensor, IR sensor (part of the "Through-Beam IR LED Sensor"), pushbuttons, LCD display, and LCD backpack all use 5 V inputs. Therefore, there needs to be a regulator which ensures this voltage is available at all times. It must also be capable of outputting enough current for all of these components.

Requirement 1: The voltage regulator must continuously supply an acceptable input voltage level for all of the following components: microcontroller (2.7 V to 5.5 V), servos (4.8 V to 6 V), servo trigger (1.8 V to 5.5 V), color sensor (2.7 V to 5.5 V), IR sensor (2.5 V to 5.5 V), pushbuttons (3 V to 5.7 V) LCD display (4.8 V to 5.2 V), and LCD backpack (2.0 V to 5.5 V). In this case, the acceptable output voltage range for the regulator is 4.8 V to 5.2 V.

Requirement 2: The voltage regulator must be able to handle the sum of the currents coming from these same components. In this case, the current rating must be greater than 2.5 A.

2.3.2 3.3 V Switching Regulator

Devices which use 3.3 V sources include an IR LED (part of the "Through-Beam IR LED Sensor") and the Wifi module. Just like the 5 V regulator, the 3.3 V regulator must supply enough current for both of these components.

Requirement 1: The voltage regulator must continuously supply an acceptable input voltage level for all of the following components: IR LED (minimum of 1.3 V) and Wifi module (2.5 V to 3.6 V). In this case, the acceptable voltage range is 2.5 V to 3.6 V.

Requirement 2: The voltage regulator must be able to handle the sum of the currents coming from these same components. In this case, the current rating must be greater than 420 mA.

2.3.3 Two 9 V Alkaline Batteries

In order for the two voltage regulators to function correctly, they, too, must have acceptable voltage inputs. Voltage magnitude is not the only characteristic which matters for the choice of batteries, however. Other considerations include how long the batteries need to

last and the maximum instantaneous current drawn from the battery. By using multiple batteries, these additional considerations are more easily satisfied which is why this design implements two 9 V batteries hooked up in parallel (instead of just one battery).

Requirement 1: The batteries, together, must meet the voltage input requirements for the two voltage regulators: the 5 V regulator (4.5 V to 42 V) and the 3.3 V regulator (8 V to 40 V). In this case, the acceptable output voltage range for the batteries is 8.1 V to 40 V (8.1 V is chosen to account for the potential voltage drop across the power switch).

Requirement 2: The batteries, together, must be able to supply an instantaneous current greater than or equal to the maximum current draw of all of the downstream components during normal operating conditions. In this case, the batteries must be able to supply a steady current value of 3 A.

2.3.4 Power Switch

Because this system uses batteries to power itself, consumers will want to turn off the machine after they are done using it—if they do not do this, the batteries will die. One way of preserving battery life is to remove the batteries from the machine after each game finishes. This, however, is a pain for the consumer. Instead, turning on and off the machine should be as easy as flipping a switch. This is the purpose of the power switch: to disconnect the batteries from the circuit when the console is not in use. Additionally, when the switch is closed, the voltage drop across it should not noticeably impact the voltage seen at each of the voltage regulators. If this is not the case, the voltage observed at the regulators may not meet the input requirements needed for them to work.

Requirement 1: When the power switch is open, it must provide isolation (less than 1 mA of current) between the batteries and the rest of the components.

Requirement 2: When the power switch is closed, the voltage drop across the switch must be less than 0.1 V.

2.4 Motor Driving Circuit

At the top of the console, there is a drum that players put poker chips into which automatically directs the chips into the machine. The drum consists of a spinning disk located at the bottom of the drum which slides the chips into a slot in the console. To electrically control the spinning of the disk, the console uses a servo motor to physically rotate the disk and a servo trigger to drive the servo. A pushbutton is used with the servo trigger to turn the servo on and off.

2.4.1 Continuous Rotation Servo Motor

The servo is the driving mechanism which rotates the spinning disk. Ultimately, the servo must have enough torque to spin the disk with poker chips laid on top of it. It must also spin fast enough to push the chips to the outside of the disk where they fall through a slot but not fast enough where chips can be launched out of the drum by accident. Also, since the drum needs to continuously spin in a clockwise direction, it cannot have a limited range of rotational motion.

Requirement: The servo must spin at speeds faster than 0.5 rev/s under no-load conditions.

2.4.2 Servo Trigger

The continuous-rotation servo takes in a pulse train as input which tells the servo which direction to spin; without this pulse train, the servo does nothing. The microcontroller inside the console is capable of sending these pulses. The issue with this, however, is sending these pulses takes away valuable computation cycles from the microcontroller. Therefore, by using a servo trigger, the microcontroller no longer has to supply these pulses. Plus, it frees up a digital pin on the microcontroller to be used by other components.

Requirement: The servo trigger must be able to supply pulses to the servo motor ranging from 500 µs to 2500 µs.

2.4.3 Pushbutton

Out of all of the components needed in this project, the servo motors consume the most power (when they are running). Therefore, in an effort to save power and extend battery life, the amount of time the servos run should be kept to a minimum. This is done via the use of a pushbutton. The servo trigger contains logic inside of it to toggle an internal state for controlling the motor. Each time the button is pressed, the servo trigger switches between two states: in the case of this project, those two states are on and off.

Requirement 1: When one presses the pushbutton, the measured resistance between its two terminals must be less than 1 k Ω.

Requirement 2: When one is not pressing the pushbutton, the measured resistance between its two terminals must be greater than 10 k Ω.

2.3 Poker Chip Detector

In order for people to use poker chips with the console, somehow, the console must keep track of the quantity of chips inserted into it as well as the color—that is, the value—of

each chip. Ultimately, there are three pieces of hardware which indirectly work together to accomplish these two objectives: a through-beam IR LED sensor, a color sensor, and a servo. As players insert chips into the spinning drum, chips fall one-by-one through the console. As each chip falls, the servo arm momentarily catches one chip at a time. Meanwhile a mechanical link attached to the servo arm positions a separate arm in a way which prevents other chips from falling down at the same time. Now, with the servo arm holding the poker chip steady, the through-beam IR LED sensor detects the presence of the chip and informs the microcontroller. Then, the microcontroller takes a reading from the color sensor and performs a sweep of the servo arm to let the chip drop into the bin as well as bring in another chip for the next reading. This process repeats until there are no longer any chips which need to be read.

2.3.1 Through-Beam IR LED Sensor

The through-beam IR LED sensor is responsible for sensing the presence of a poker chip as it falls through the console. The sensor is set up in a way where an IR LED (supplied by the 3.3 V source) sits on one side of the channel the chips falls through, and an IR sensor (supplied by the 5 V source) detects the light on the other side. When no chip is present, the IR LED emits light from one side of the channel to the other. The sensor detects this light, and therefore, the microcontroller knows no poker chip is present. When a poker chip falls down into the channel, however, the servo arm catches the chip, and the chip blocks the light coming from the IR LED going to the IR sensor. When the microcontroller reads from the IR sensor during this situation, it observes a low light reading and, thus, it knows a poker chip is present. Therefore, in order for this system to work effectively, it must be able to correctly differentiate when a chip is present and when it is not.

Requirement: The difference in voltage between the scenario when there is a poker chip present and when there is not a poker chip present must be greater than 1 V (so the two scenarios are easily distinguishable).

2.3.2 Color Sensor

In the game of poker, different chips have different values. Thankfully, unlike values of coins or dollar bills which are sometimes difficult to identify without looking at text or shapes, values of poker chips are easily distinguishable by color. To determine how much money each person puts into the pot each round, the console uses a color sensor to detect the color of the center of each chip as it passes through the machine. Ultimately, for this project, the color sensor must be able to distinguish between the colors red, green, blue, white, and black.

Requirement: The color sensor must distinguish between the colors red, green, blue, white, and black, and it must do this correctly at least 95% of the time.

2.3.3 Positional Rotation Servo Motor

One of the challenges associated with trying to count and determine colors of chips passing through the console is the speed with which the chips move. If the poker chips move too quickly, the IR sensor and/or the color sensor may not sense them as they make their way through the machine. Therefore, to ensure all poker chips are accounted for, the console uses a servo motor to stop the motion of each chip—conveniently stopped in the same spot as the sensors—so the console can count and observe color for every chip passing by. Then, after the sensors take their readings, the motor performs a sweeping motion which allows the next chip to fall through.

Requirement 1: The positional rotation servo motor must have a high enough torque to overcome the gravitational force of two poker chips stacked on top of each other. In this case, the torque must be greater than 0.1 kg-cm.

Requirement 2: The positional rotation servo motor must rotate fast enough to allow throughput of at least 30 chips a minute when operating at its quickest capacity.

2.6 Microcontroller

At the heart of the console lies the microcontroller. Nearly every subsystem (with the exception of the motor driving circuit and the external network) directly interacts with the microcontroller, and as such, it is responsible for many different things. First of all, it is the device which houses game state data. It keeps a record of how much money each player has, how much money is in the pot, whose turn it is, and what round it is. Next, it is responsible for reading input from the “select” button on the user interface and printing values and instructions on the LCD screen. Additionally, it interprets the quantity and color of poker chips read by the poker chip detection subsystem and pulses the position rotation servo motor to let chips fall through the console. And finally, given all of the information it stores about the game, it interacts with the Wifi module which, in turn, interacts with the external network so people can access this data via a browser on their phone or laptop.

Requirement 1: The microcontroller must have enough digital and analog pins to allow each of the aforementioned components to connect to it. More specifically, it needs at least 13 digital I/O pins (1 with PWM capability) and 1 analog input pin.

Requirement 2: The microcontroller must communicate with external hardware via TTL-serial and I2C protocols.

Requirement 3: The microcontroller must be fast enough to respond to HTTP requests coming from the Wifi module in under 25 seconds.

Requirement 4: The microcontroller must check for the presence of poker chips (as well as color) at least every 5 seconds.

2.7 Wifi Module

Section 2.6 mentions the microcontroller is the component which maintains a record of information regarding the poker game. This data contained inside the microcontroller is not very useful by itself—somehow, this information needs to be shared with people playing the game. This project design uses a Wifi module connected to the microcontroller which allows users to request game information via a web browser. Going into the details of how this works, the microcontroller uses the Wifi module to connect to a wireless network provided from something such as a wireless router found in one's home. Once connected, players use an internet browser on their phones and/or laptops (assuming they are also part of the wireless network) to connect to the IP address of the console. Each time a user connects to the console through a browser, it sends an HTTP request to the Wifi module, and the Wifi module passes this request onto the microcontroller. From there, the microcontroller handles the request and sends an HTTP response through Wifi back to the external device (phone, laptop, etc.).

Requirement: The Wifi module must successfully connect to a pre-defined wireless network upon startup of the machine (that is, when someone turns on the power switch) at least 80% of the time.

2.8 User Interface

When people use the console to play poker in the absence of poker chips, most of the user input throughout the game comes in the form of HTTP requests over Wifi. When chips are used, however, it makes sense to transfer functionality from people's phones to the physical console (since players are already using the console at that point to keep track of money totals via poker chips throughout the game). With this being said, the console needs a simple way to take input from users and display new game data based on these inputs. This is done through a 16x2 LCD screen connected to an LCD backpack, and 3 pushbuttons.

2.8.1 LCD Display

In order for users to connect to the microcontroller via Wifi, they must, first, know the console's IP address on the network. This is one of the applications which makes the LCD useful for this project: displaying the IP address. Once the game begins—and thus, no more connections to the console need to be made—the LCD can, instead, display game data such as players' money totals, how much money is currently in the pot, and how much more money a player must put in to stay in the game.

Requirement: The LCD screen must be large enough to display one player's name (limited to 7 characters), his/her money total (limited to 8 digits), the amount of money needed to keep playing in a given round (limited to 7 digits), and the total amount of money currently in the pot (limited to 8 digits), all on one screen.

2.8.2 LCD Display Backpack

One issue with 16x2 LCD displays is, without the use of external hardware, they use up many digital pins on the microcontroller. In a project like this, many other components also need to use these pins, and therefore, the best practice in this situation is to reduce device footprints when possible. To reduce the number of pins needed to interact with an LCD display, LCD backpacks convert the parallel data signals used by the LCD display to serial I2C signals used by a microcontroller. This project implements this strategy to reduce the number of pins needed for the LCD display down to two pins.

Requirement: The LCD display backpack must use the same parallel communication protocol as the LCD display which is chosen (that is, four data lines, one enable line, and one register select line).

2.8.3 Pushbuttons

The console uses three pushbuttons for user input. When a player wants to display a different player's money total on the LCD, he/she uses the two buttons marked "<-" and "->" to cycle between the players. In regard to the other button marked "ENTER," players use this to lock in their bets after each turn. For example, if a group of people are playing poker using chips with the console and it is Player 3's turn, if he/she wants to make a bet, Player 3 puts the desired number of chips into the machine and presses enter. If other players want to call or raise, they put their chips in and press enter when it is their turn. And finally, if players want to fold, they simply abstain from putting in any chips and press enter, and the machine will know they are trying to fold.

Requirement 1: When one presses the pushbutton, the measured resistance between its two terminals must be less than 1 k Ω.

Requirement 2: When one is not pressing the pushbutton, the measured resistance between its two terminals must be greater than 10 k Ω.

2.9 External Network

One of the key advantages of this system's design as opposed to the past group's solution is one does not need to buy a remote for each person who wants to play. Instead, players use their own phones. Section 2.7 mentions the microcontroller used in this project interfaces with a Wifi module so it can wirelessly communicate with devices such as phones and laptops. More specifically, the Wifi module connects to a wireless network (likely provided by a wireless router), and as phones join the network, they send client requests to the console (which, essentially, acts as a server) through the router. The console then responds to the requests and sends back game information to those devices in the form of HTML web pages.

2.9.1 Wireless Router

The wireless router's job is to direct communication from players' phones to the console and vice versa. It does this by creating its own wireless network and having devices join the network before the game begins.

Requirement: The number of IP addresses available for use on the router's WLAN must be greater than or equal to the number of people wanting to play, plus one (for the console itself).

2.9.2 External Devices

Because the console uses Wifi as the communication method for sending and receiving information, any device with 2.4GHz Wifi capabilities can connect to the console. With this being said, however, the application protocol used by the microcontroller is HTTP. So in order to send valid requests and properly read data coming from the microcontroller, the receiving device must use an application that uses HTTP and can display HTML files. An internet browser, for example, satisfies these requirements.

Requirement: Each external device must run an application which sends/receives HTTP requests/messages and is able to display HTML files.

2.10 Risk Analysis

The implementation of the poker chip detector subsystem provides the greatest risk in our design solution. Without this subsystem functioning properly, our project fails to address and solve the issue of allowing players that do have physical poker chips to still play a fully operational game of poker with our design. Not solving this issue renders our design solution to only purely provide an electronic simulated version of poker. There already exists various solutions allowing people to play poker electronically through mobile and web applications. Additionally, our design solution will function very similarly with the Bold Poker product that was discussed in the Background section of this document. It is critical for the poker chip reading subsystem to be implemented properly as it makes our design solution unique and effective.

One area of concern within the poker chip reading subsystem is the ability to correctly read the incoming poker chip using the IR and color sensor. It is critical to correctly read the poker chip or the entire subsystem becomes useless. We need to ensure all the incoming poker chips are effectively caught by the servo arm as it falls through the channel chute. The servo arm has to be able to catch the falling poker chip at the speed the chip is falling. Additionally, the mechanical link attached to the servo arm that positions a separate arm needs to be sturdy enough to not allow the poker chip's weight from overtaking it. This separate arm is in charge of not allowing multiple poker chips falling through the channel chute at the same time. It is important that every inserted poker chip is caught and read in order for the game to be properly updated. If just one chip is failed to be read, misinformation will be displayed and users will not want to utilize this attribute of our design solution. Therefore, the servo arm must be able to catch the falling poker at the speed at which it falls, while the other arm needs to prevent other chips from falling through at the same time.

Another concern is the effectiveness of the IR and color sensor. Both these sensors are used to determine the quantity and color of the incoming poker chips that are being fed by the user. The color sensor must be able to distinguish between the various poker chip colors being used by the user. There are a variety of poker chip sets a user may have, therefore the color sensor must be robust enough to be viable for varying colors. The IR beam sensor will be required to detect the quantity of poker chips being passed through from the user. It is significant the sensor determines the correct quantity of chips because if it does not then incorrect information will be shown to the users. Both the IR and color sensor have to be effective and robust for a variety of situations in order for the poker chip reading subsystem to correctly function.

The final concern for the poker chip reading subsystem is the data transfer rate being read from the IR and color sensors. The data transfer rates are critical as the poker reading chip

subsystem will be relied upon to carry the new data that will be necessary to update the game. The chip reading subsystem is connected to the microcontroller subsystem with the former being the central hub for maintaining and routing game data. Both sensors will need to be able to pass their respective data at a rate where players will not be waiting long amounts of time to see their game be updated. If the time to update the game takes too long, users will undoubtedly move away from playing the game with physical poker chips leaving the poker chip reading subsystem useless. Therefore, the data transfer rates from the IR and color sensors needs to be both fast and effective to update the game in a timely manner.

3 Safety and Ethics

There are a few safety and ethical concerns that reside with our project. One of the main safety concerns comes from the batteries that will be used to power the chip reading system and LCD monitor within the main unit. These batteries can explode if they become overcharged or reach an extreme heat temperature [8]. Additionally, these batteries should not be charged in extreme cold temperatures either as they can deteriorate and leak chemical acid [8]. To ensure safety, we will adequately test and monitor the battery cell temperature to ensure its overall quality and performance.

With our project design containing electronics like the IR and the color sensor, the safety issue of exposed wires arises. Exposed wires can cause detrimental damage to both the other electronics surrounding it and the users with burns and shocks being the common injuries. To safely and effectively avoid the safety concern, we plan to insulate the wires through the use of electrical or thermal insulating tape. Additionally, we will also verify our electronic components are being supplied with the correct amount of voltage and current going through each of them by testing each individual part and seeing if it meets the necessary requirements/limits. To ensure our wires are safely insulated, we will test them and ensure they do not conduct any electricity as well as not heat up to dangerous temperatures.

To avoid our electronics from getting exposed to water or wet situations, we plan to enclose them within a casing. This casing will allow our solution to be played/used in a variety of different locations without the worry of damage or shorting any of the electronics. The casing will help prevent water from getting in and damaging the electronics. This casing allows us to address and mitigate yet another safety issue.

Another safety concern stems from the motor driving circuit. This mechanism will utilize servo motors that will exert force on a spinning disk to push the received chips to the outer edge of it before going down a channel chute. The concern that arises is possible injury from these motors when inserting a chip into the mechanism. To combat this safety concern, we plan on abstracting away the motor driving circuit from the user. Specifically, the unit will have a designated poker chip slot that users will only interact with and nothing else. This poker chip slot will only be wide enough to fit the size of a normal poker chip in order to ensure no fingers or nails get stuck in it.

An ethical concern our project raises involves the containment of private user data. We plan on utilizing an HTML website to maintain, distribute, and update game data for players. Some of this data includes the player's amount of money remaining and the current amount of the pot for that round. This issue raises the concern of possible data leaks or piracy that can take place through malicious software attacks focused on web application data. These issues go

against the IEEE Code of Ethics #9 - “to avoid injuring others, their property, reputation, or employment by false or malicious action” [9]. To mitigate this issue, we will implement a web application firewall that will check all incoming traffic and prevent any incoming, malicious attacks. Additionally, we plan on encrypting the game data as well for an extra layer of protection against attackers. Finally, we will provide a notification to users to remind them to check to make sure their external device currently has no malicious software embedded into it that can potentially compromise the website.

Since the game of poker involves the aspect of money, both the mobile device and LCD display should reflect the correct amount of money that each player currently has as well as the correct amount of money in the pot. Our project raises the concern these values can possibly be skewed. This concern violates the IEEE Code of Ethics #3 - “to be honest and realistic in stating claims or estimates based on available data” [9]. To avoid violation, we will accurately store the correct user inputted data as well as perform correct arithmetic on these values. Lastly, we will effectively update these now-changed values and correctly display them on the proper interfaces, so users can properly see them.

Finally, to avoid violation of IEEE Code of Ethics #1 - “hold paramount the safety, health, and welfare of the public, to strive to comply with ethical design and sustainable development practices, and to disclose promptly factors that might endanger the public or the environment” [9]; we accept responsibility for our design. Our project aims to ensure the safety of its users and while we hope to test all possible scenarios there are a billion more that may occur. Specifically, we want to ensure users are completely safe from the mechanics within the main unit like the chip reading system. Therefore, we accept responsibility for faults in our design and ensure we take appropriate action to ensure better user safety when these faults occur by updating our design.

References

[1] Gabi, “6 Most Popular Card Games in the World,” Bridge Is Cool, 25-Apr-2019. [Online]. Available: https://bridgeiscool.com/card-games-2/. [Accessed: 30-Mar-2020].

[2] “Poker Rules, How to Play Poker For Beginners,” PokerNews. [Online]. Available: https://www.pokernews.com/poker-rules. [Accessed: 30-Mar-2020].

[3] B.Pempus, Las Vegas Poker Rooms Report Strong February Revenue. [Online]. Available: https://www.cardplayer/com/poker-news/22659-las-vegas-poker-rooms-report-strong-february-revenue. [Accessed: 30-Mar-2020].

[4] B.Ray, “RFID Vs. Wifi: Comparing The Technology & Costs For Asset Location,” AirFinder, 07-Feb-2017. [Online]. Available: https://www.airfinder.com/blog/rtls-technologies/rfid-vs-wifi-comparing-technology-and-cost.[Accessed: 30-Mar-2020].

[5] “Bold Poker,” BoldPoker - Deal with it. [Online]. Available: https://www.boldpoker.net/. [Accessed: 30-Mar-2020]

[6] Casino poker game table that implements play of a casino table poker game, Feraidoon Bourbour, Troy Nelson. (2008, Mar. 8). *Patent US7341510B2*. Accessed on: Apr. 3, 2020. [Online]. Available: https://patents.google.com/patent/US7341510B2/en?inventor=Feraidoon+Bourbour

[7] Electronic video poker method and system having multiple poker hands, by Mark Angel. (2004, Feb. 24). *Patent US6695695B2*. Accessed on: Apr. 3, 2020. [Online]. Available: https://patents.google.com/patent/US6695695B2/en

[8] batteryuniversity.com,“Lithium-ion Safety Concerns,” *Lithium-ion Safety Concerns–Battery University*. [Online]. Available: https://batteryuniversity.com/learn/archive/lithium_ion_safety_concerns. [Accessed: 07-Feb-2020].

[9] Ieee.org, “IEEE IEEE Code of Ethics”, 2016. [Online]. Available: http://www.ieee.org/about/corporate/governance/p7-8.html. [Accessed: 03-Feb-2020].

[10] U. Chavan, A. Giridharan, and V. Pitta, “Electronic Betting System For Poker.”