# Video shooting script

1. Introduction (video shoot of rendered robot + group members photos)
2. Explain why we chose that game (ppt slide)
3. Turtlebot approaching to table (gazebo)
4. How would a game be playing with the robot:
   * Robot starts (explain shuffle function) (flowchart + inventor + tinkercad)
   * Players turn (explain twist and stick) (flowchart + inventor + tinkercad)
   * Robots turn (flowchart)
   * Compare results (flowchart + tinkercad + inventor) + restart button (mention Arduino reset button)
5. Conclusion + future development and improvements (video shoot of rendered robot)

# Who says what

1. Introduction + game selection + turtlebot approaching to table – Ainhoa
2. Robot starts + shuffle function - Kieran
3. Players turn + twist function - Seun
4. Stick function + robots turn - Mark
5. Compare results - Iain
6. Conclusion + future development and improvements - Callum

# Video talking script

## Ainhoa

Hi, everyone. We are ….and today we will talk about our last project, the blackjack robot player.

We were contracted by Solo Games to design and implement a game of our choice which could be played by the elderly community in a care home. The robot, once started, will run without any other inputs from the operator. But, due to the current pandemic, this video will only contain simulations of our work and not physical output.

Based on the given specifications and the people this interactive system is geared towards, we came up with several ideas (Countdown, Connect4, Battleship, Card Game, Basketball).

But, as the game is going to be played by the elderly community, we decided the game needed to be simple, well known and physically effortless (as we want everyone to be able to play it). However, most of them meet these requirements. So, we also took into account the effort that each of them would take us implementing and the possibilities of future development.

That’s why, we decided our robot would play a card game. Once you have created an interface that is able to play a card game, more card games can be easily implemented making minor changes in the hardware or none.

However, there are hundreds of card games out there. We picked one based, as mentioned before, in the complexity level and versatility of it: The Blackjack. This game does not require complex mathematics or strategy, and almost everyone has played it at least once. For this reason, our robot is prepared to act like a casino dealer for anyone wanting to play Blackjack.

For does who don’t know about Blackjack, here is a link for a quick introduction to the game.

Now, let’s begin with the simulations.

Our robot, which will be placed on top of a turtlebot, starts by approaching the table coordinates where the person is seated. This simulation in Gazebo shows how this would work. In addition, the robot has collision avoidance system to prevent it from any undesired crash against humans or objects.

Kieran

(show complete render video)

Once the robot has reached the table, the game of Blackjack starts with the shuffling system which uses two servo motors that push the cards into the collection or dealing area where they alternately land on top of each other resulting in a shuffled deck of cards.

To begin the shuffling process the player will need to place the cards they want to shuffle into the two sides of the machine, a more even number of cards on each side will result in a more effective shuffle as a heavily stacked side will result in the same sequence of cards at the end of the deck.

(show shuffle function tinkercad)

The system is controlled by a button which is pressed and held at the start of the game by the player. While the button is held down the microcontroller will supply power to the motors which will continuously rotate each pusher arm up and down on a circular trajectory pushing the cards that will slide into the middle compartment. The arms start in opposite positions so that no two cards will be pushed into the middle at the same time and potentially This ensures smooth operation of the shuffle function. The motors will stop once the player has observed the cards shuffled and releases the button.

(show inventor shuffle mechanism)

This shuffle function is important as it means that the game can be played fairly and without predictable results ensuring that the game is not repetitive or tedious.

Seun

Show players flowchart

After the robot has dealt out everyone’s cards, the player can begin the game of blackjack. This means that the user must use his intuition based on the cards that he was originally dealt with from the robot to win the game by achieving a score of 21 or a score as close to 21 as possible. The way the player approaches their turn can be explained through the flowchart shown here.

Notice how the robot first helps the player by displaying the score of the two cards that were already detected when the robot dealt the cards to player. This helps the player make a judgement on whether to play it safe and press the stick button or take a risk and press twist button. During this, the robot is always monitoring the player’s score by determining whether the player has 21 or below to allow the player to keep on playing. Therefore, once the twist button is pressed the algorithm checks whether the new score is above 21. This would assign the player as Bust and immediately pass over to the robots.

Show twist cad drawing

Let’s focus more on how the twist function works, by pressing the twist button this retrieves a random card from the shuffled deck. that will added to their score already. This random card is drawn from the robot a conveyer belt system shown here. When the button is pressed the motor of the conveyer belt performs a single rotation that delivers a single card from the deck to give the requested player. However, these rotations require precise movements to deliver a card, and this is possible through a servo motor.

Show twist tinkercad simulation

This Arduino breadboard circuit shows how the conveyer belt signified as the servo motor would naturally respond to the twist button on robot. So, through demonstrating the simulation, it is evident that the button inputs create an output as the servo motor to spin. This suggests that the conveyer belt successfully responds with rotational movement when the twist button is pressed. Now I am going to pass it over to Mark to further explain the stick function.

Mark

(Show Dealer tinkecad simulation + code)

Once a player chooses to stick, they press the stick button and aren’t dealt any more cards. The system will store their score and rotate to the next player or the dealer if there are no players remaining. The robot takes the place of the blackjack dealer and will take its turn after all the players have chosen to stick.

(robot’s turn flowchart)

The dealer follows a simple set of rules and so doesn’t have to actually apply any game AI. Dealers in blackjack must draw until they reach a minimum hand value (17) and stick on a soft maximum value that is lower than 21. This is to allows players to gauge the relative value of their own non-bust hands before the dealer has taken their turn.

The dealer reads the value of the cards it is dealt using the RFID reader and stores them in an array to be used by the ‘handValue’ functions. To deal with the fact that the Ace card can either be played with a value of 11 or 1, The robot treats its hand as though Aces have a value of 11 until it has passed either its soft maximum value or gone bust. The robot then checks if it could continue play by playing its Ace cards as 1s, and continues if possible. Once it has reached either its soft maximum value or gone bust, the robot stores its score to be compared to the players.

Once the dealer has finished its turn, The system moves on to compare results and declare who won the round.

Iain

(Show cad drawing of exploded view of cards)

In order to compare the results on the Arduino and have physical cards that would be easy to use we decided to fit the cards with RFID chips and have a RFID reader imbedded into the table. This means when the cards are placed down in front of the player they can be read automatically and the Arduino can start to compare the results to find the winner.

(Show flowchart)

The aim of blackjack is to get the closest to 21 without going bust (over 21). The Arduino finds this by adding the players and the dealers cards up to get there total if their total is over 21 then it eliminates them. With the remaining players it finds who has the closest to 21 and they are the winner of that round.

(Show tinkercad)

We have a simulation of this process using Tinker cad unfortunately tinker cad doesn’t have RFID chips so instead we are using buttons and we must input the cards manually. If I select an ace and a king for the player which adds up to 21 and then I select a 10 and an 8 for the dealer you can see that the player wins.

(Show inventor)

This is a rendering of what our game will look like it has a twist, stick, reset and shuffle buttons once everyone is happy with their cards and as pressed the stick button the Arduino starts calculating the winner.

The reset button on the Arduino then starts the simulation again for tinker cad we were just tuning it on and off again.

Callum

(Display the final render of the board game for outro)

As a group we all believe that the project has been an overall success, even though that the circumstances for it has not been in our favour. However, taking from this, we have all learned new skills, such as creating simulations and animations, which I don’t think we would have learned, if it been a physical project. We set out with a goal in mind of creating blackjack using motors, sensors and microcontrollers which could replicate a dealer. After breaking down each element into individual components, as a group effort, we successfully managed to replicate a dealer shuffling a deck of cards, a dealer dealing cards, and finally computing the end results all at the touch of a button.

To make sure that our game continues to be fun and exciting, constantly developing it is key. One of the things we would like to introduce is a multiplayer mode where the elderly can play with one and other. We would like to develop the system, so it can move from one player to the next, whilst keeping track of the scores and determining who the winners and losers are, in the hope of adding that extra competitive edge to our game.

As mentioned by Ainhoa in the introduction, the fundamental building blocks to support other card games in the future have already been established. By using the RFID technology, already built into the board, the Arduino code can be easily developed to introduce more cards games which the elderly community can play, such as snap or poker. This ultimately will increase the replay ability of our product.

(Contact info of team members)

Each member of the teams contact information will be displayed on the screen if you require further information regarding the games design. On behalf of the team, Thank you very much.