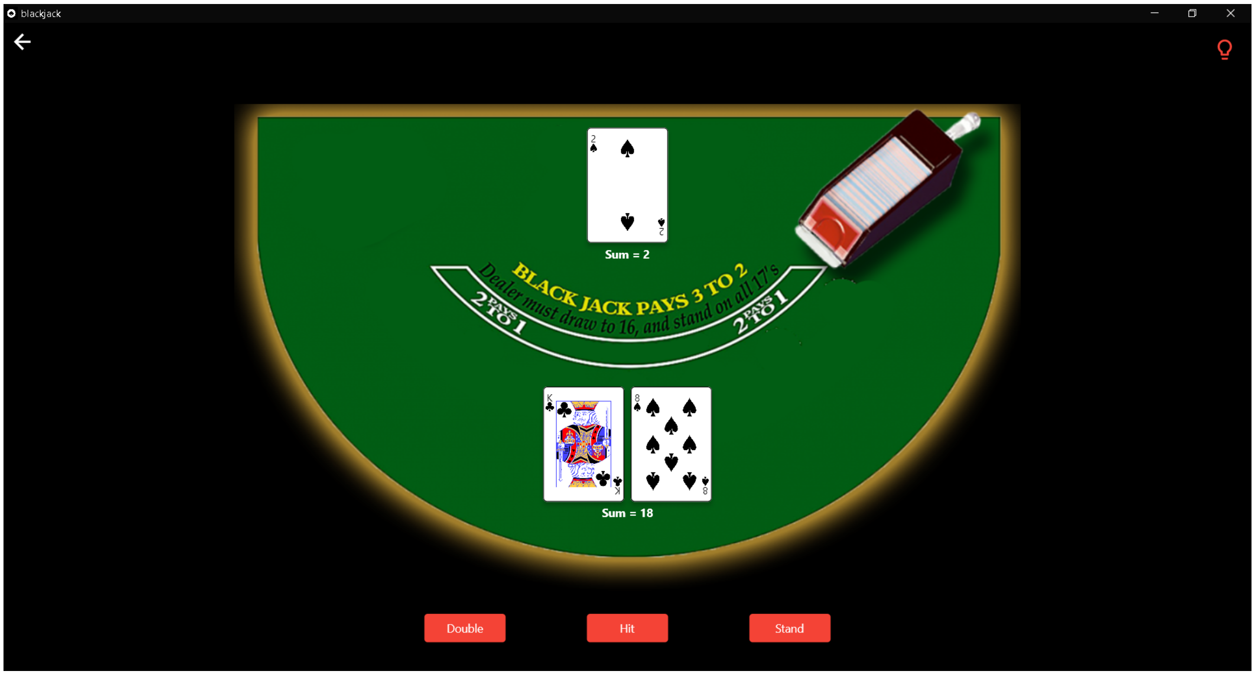


BlackJack

AI and OSC Project

Team Members

Priyanka Avhad - 191071009

Mahek Nakhua - 191071048

Vedanti Kshirsagar - 191071039

Aim

To implement a Blackjack game

Rules

1. The rules of Blackjack are fairly simple. The dealer and the player both are dealt two cards. The player sees both of their cards (they are usually dealt face up), and one of the dealer's cards is dealt face up.
2. Each card has a value - for cards between 2 and 10, the value is the same as the card's rank (so an Eight of Spades counts as 8, for example). All face cards count as 10, and an Ace can either be 1 or 11 (it counts as 11 only when that does not result in a hand that exceeds 21). The suit of a card does not matter.
3. After the cards are dealt, if the player has Blackjack (a total of 21) and the dealer does not, the player is immediately paid 1.5 times their original bet, and a new hand is dealt. If the player has 21 and the dealer does also, then it's a tie and the player gets their original bet back, and a new hand is dealt.
4. If the player wasn't dealt a Blackjack, then play continues with the player deciding whether to Stand (not get any more cards), Hit (receive an additional card), Double-down (place an additional bet, and receive one and only one more card), or, in the case of holding a pair, splitting the hand, which means placing an additional bet and receiving two new cards, so the end result is that the player is now playing two (or, in the case of multiple splits, more than two) hands simultaneously.
5. If the player hits or double-downs and has a resulting hand that exceeds 21, then they lose, and play continues with the next hand. If not, then the dealer draws until their hand totals at least 17. If the dealer exceeds 21 at this point, the player receives a payment equal to twice their original bet. If the dealer doesn't exceed 21, then the hands are compared and the player with the highest total that doesn't exceed 21 wins.

Basic Objective

Winning tactics in Blackjack require that the player play each hand in an optimum way, and such strategy always takes into account what the dealer's upcard is. When the dealer's upcard is a good one, a 7, 8, 9, 10-card, or ace, for example, the player should not stop drawing until a total of 17 or more is reached. When the dealer's upcard is a poor one, 4, 5, or 6, the player should stop drawing as soon as he gets a total of 12 or higher. The strategy here is never to take a card if there is any chance of going bust. The desire with this poor holding is to let the dealer hit and hopefully go over 21. Finally, when the dealer's upcard is a fair one, 2 or 3, the player should stop with a total of 13 or higher.

With a soft hand, the general strategy is to keep hitting until a total of at least 18 is reached. Thus, with an ace and a six (7 or 17), the player would not stop at 17 but would hit.

The basic strategy for doubling down is as follows: With a total of 11, the player should always double down. With a total of 10, he should double down unless the dealer shows a ten-card or an ace. With a total of 9, the player should double down only if the dealer's card is fair or poor (2 through 6).

For splitting, the player should always split a pair of aces or 8s; identical ten-cards should not be split, and neither should a pair of 5s since two 5s are a total of 10, which can be used more effectively in doubling down. A pair of 4s should not be split either, as a total of 8 is a good number to draw to. Generally, 2s, 3s, or 7s can be split unless the dealer has an 8, 9, ten-card, or ace. Finally, 6s should not be split unless the dealer's card is poor (2 through 6).

Techstack used

- Flutter
- Dart

Flutter

What is flutter?

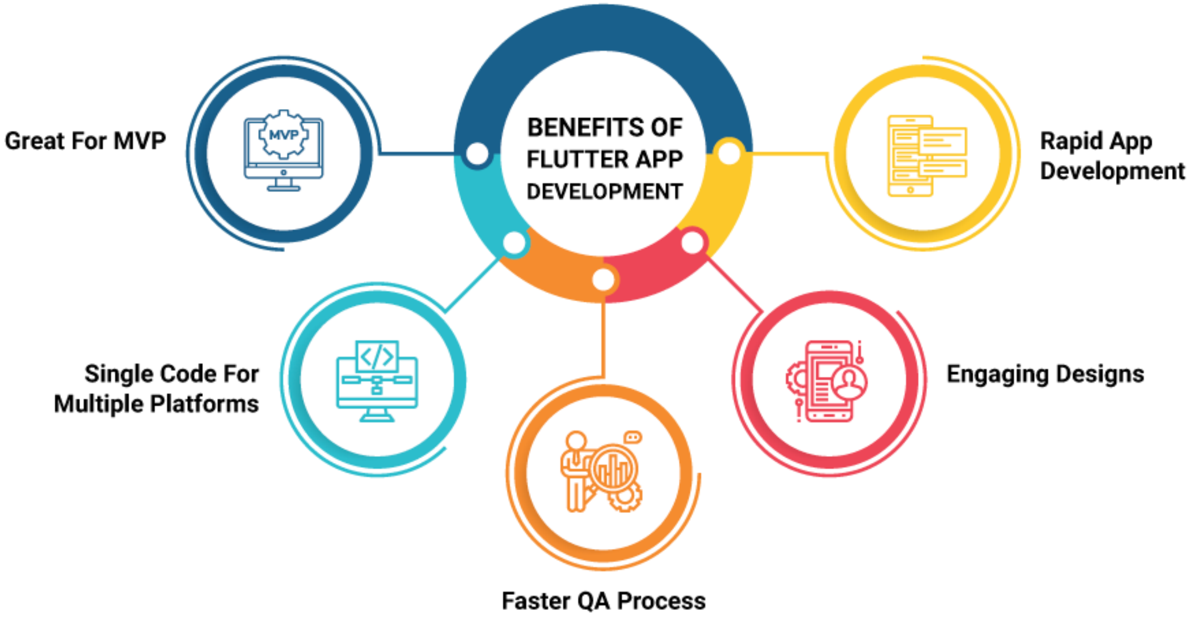
Flutter is Google's mobile app SDK, complete with a framework, widgets, and tools, that give developers an easy way to build and deploy visually attractive, fast mobile apps on both Android and iOS platforms.

Flutter enables smooth and easy cross-platform mobile app development. You don't need to develop an iOS and Android app separately. All you need is one codebase for both platforms.

What's more, Flutter:

- Is free and open source,
- Is based on Dart – a fast, object-oriented programming language that is in itself easy to learn,
- Provide its own widgets, drawn with its own high-performance rendering engine. They are fast, pretty, and customizable,
- Thanks to the rich widgets, Flutter apps look and feel great (you can create your own custom app design, but also use readily available UI elements following specific platforms' guidelines). Check out the article about Top Apps Made with Flutter
- The architecture of Flutter is based on the very popular reactive programming of today (the same that React has been made from)

Advantages of Flutter



The reason we chose flutter is highlighted in these advantages of flutter. Flutter is an open-source code software development toolkit from Google. It provides easy posting of issues and access to documentation from open developer forums.
it is a cross-platform framework, it allows programmers to write code once and they can use it on multiple platforms. It also comes with advantages of Native App Like Performance, Hot reload custom widgets and a huge tech community.

1. Faster code writing

For developers, Flutter means faster & more dynamic mobile app development. We can make changes in the code and see them straight away in the app! This is the so-called Hot reload, which usually only takes milli-seconds and helps teams add features, fix bugs, and experiment faster. It is one of the things about Flutter loved by every top

2. One code for 2 platforms

Developers write just one codebase for your 2 apps – covering both Android and iOS platforms. Flutter doesn’t depend on the platform, because it has its own widgets and designs. This means that you have the same app on two platforms. Yet what’s important is that, if you want to differentiate your apps – it’s possible.

3. Less testing

If you have the same app for 2 platforms, it means less testing! The Quality Assurance process can be faster. Because of one codebase, the developers write automatic tests only once. What's more, Quality Assurance specialists have less work to do, because they have only one app to check. Of course, if your apps have some differences, they need to be tested on both platforms.

4. Faster apps

Flutter apps work in a smooth and fast way, without hanging and cutting while scrolling. If you want to understand why and how it works from a technical point of view, read this article. Also, check out this amazing page in the Flutter documentation that talks about best practices for app performance.

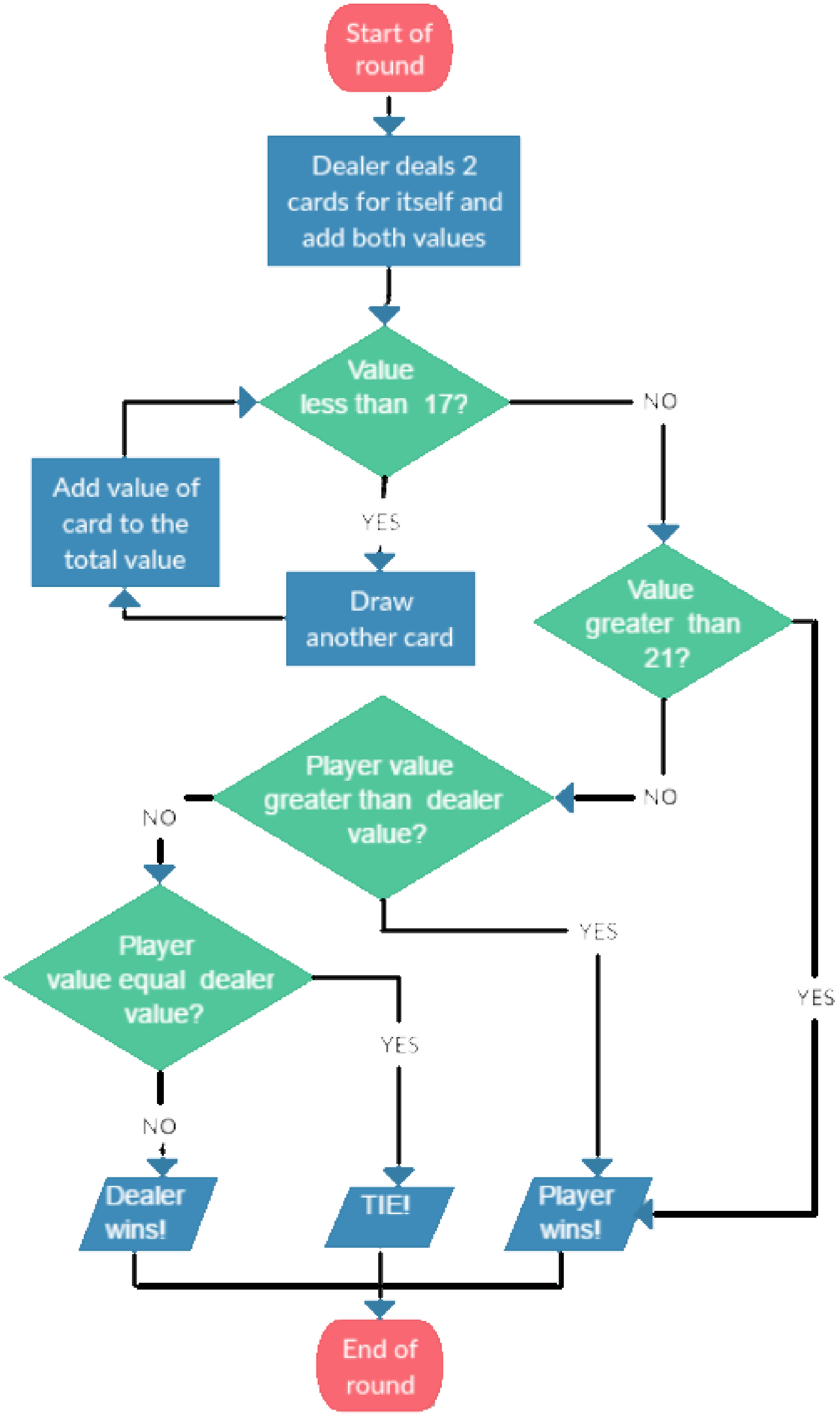
5. Designs which your users will love

Flutter is designed to make it easy to create your own widgets or customize the existing widgets. Here you can browse a catalog of Flutter's widgets and view, for example, Material Design widgets and Cupertino widgets.

6. The same app UI on older devices

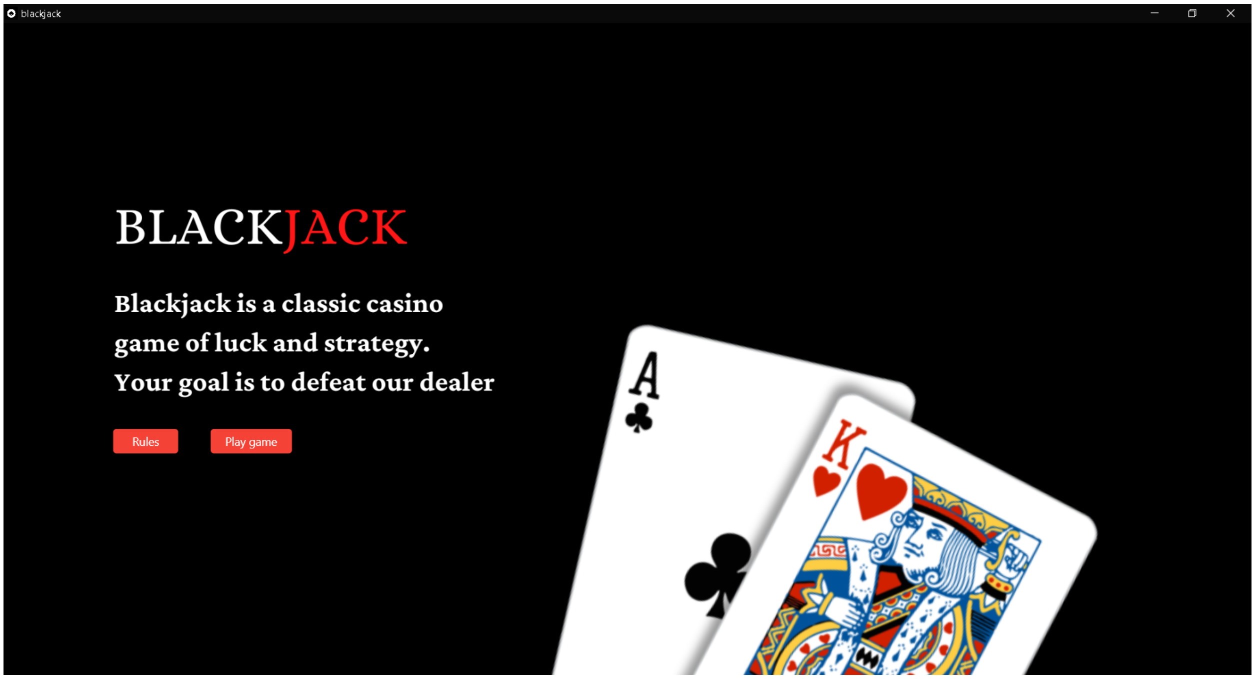
Your new app will look the same, even on old versions of Android and iOS systems. There are no additional costs for supporting older devices. Flutter runs on Android Jelly Bean or newer, as well as iOS 8 or newer.

Game flow


Start of round
Dealer deals 2 cards for itself and add both values
Value less than 17?
NO
YES
Add value of card to the total value
Draw another card
Value greater than 21?
NO
YES
Player value greater than dealer value?
NO
YES
Player value equal dealer value?
YES
NO
Dealer wins!
TIE!
Player wins!
End of round

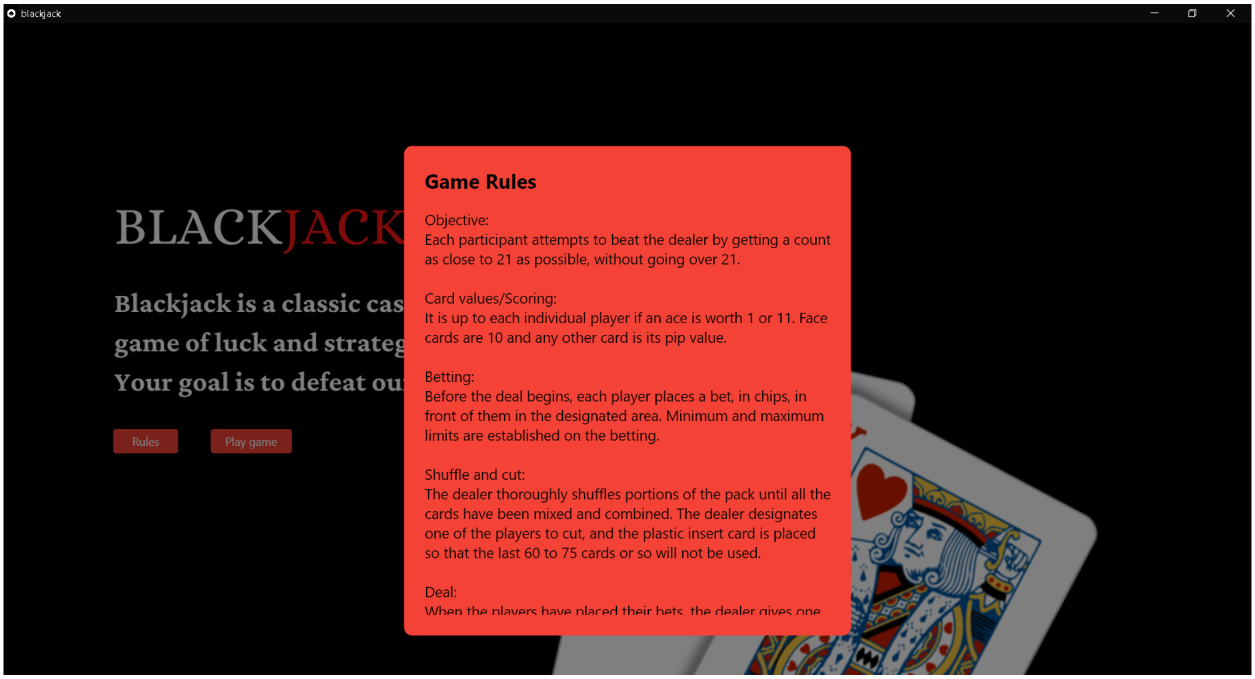
Implementation

To begin with we design classes for cards, hands, and moves. We then add the rules of the game. The UI is developed using flutter and dart and is responsive.



BLACKJACK

Blackjack is a classic casino game of luck and strategy. Your goal is to defeat our dealer



BLACKJACK

Blackjack is a classic cas
game of luck and strateg
Your goal is to defeat ou

Game Rules

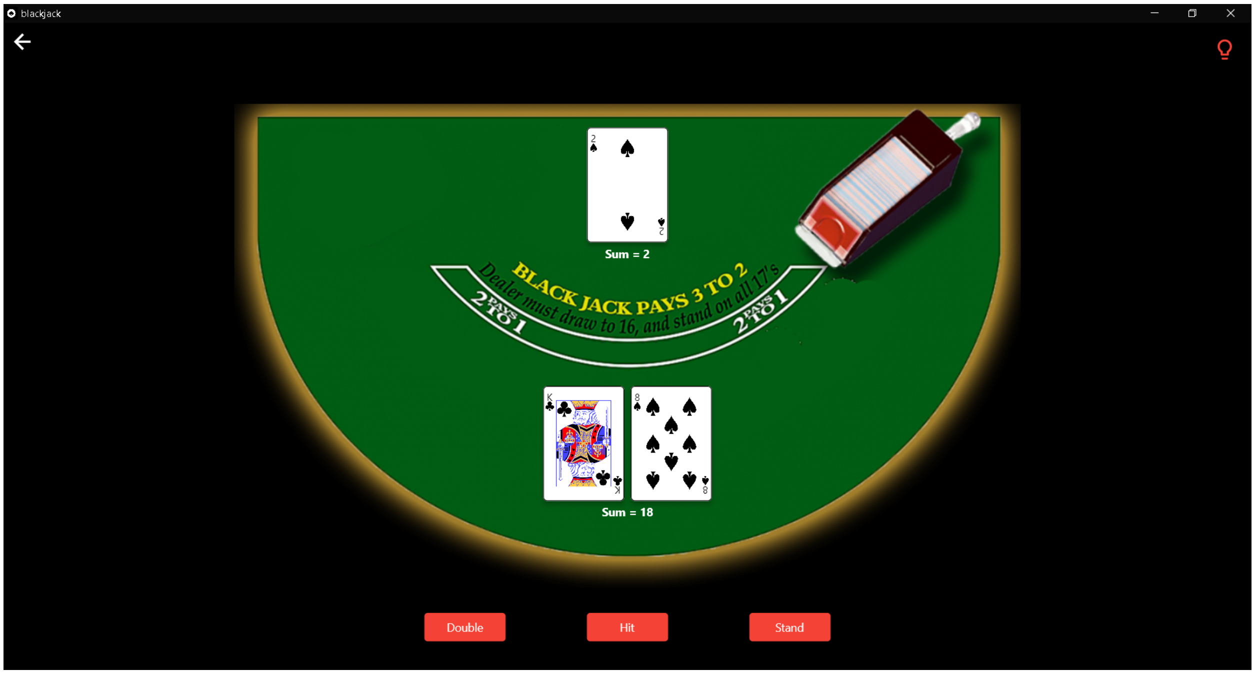
Objective:
Each participant attempts to beat the dealer by getting a count as close to 21 as possible, without going over 21.

Card values/Scoring:
It is up to each individual player if an ace is worth 1 or 11. Face cards are 10 and any other card is its pip value.

Betting:
Before the deal begins, each player places a bet, in chips, in front of them in the designated area. Minimum and maximum limits are established on the betting.

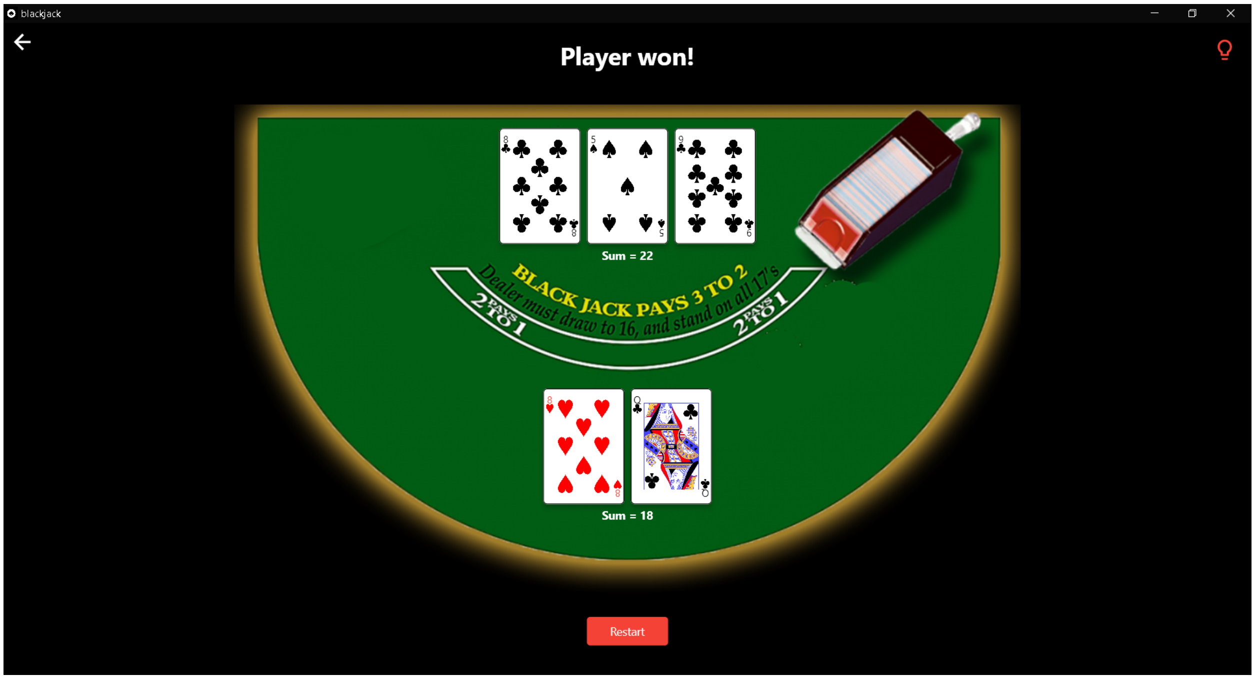
Shuffle and cut:
The dealer thoroughly shuffles portions of the pack until all the cards have been mixed and combined. The dealer designates one of the players to cut, and the plastic insert card is placed so that the last 60 to 75 cards or so will not be used.

Deal:
When the players have placed their bets, the dealer gives one



Sum = 2

Sum = 18

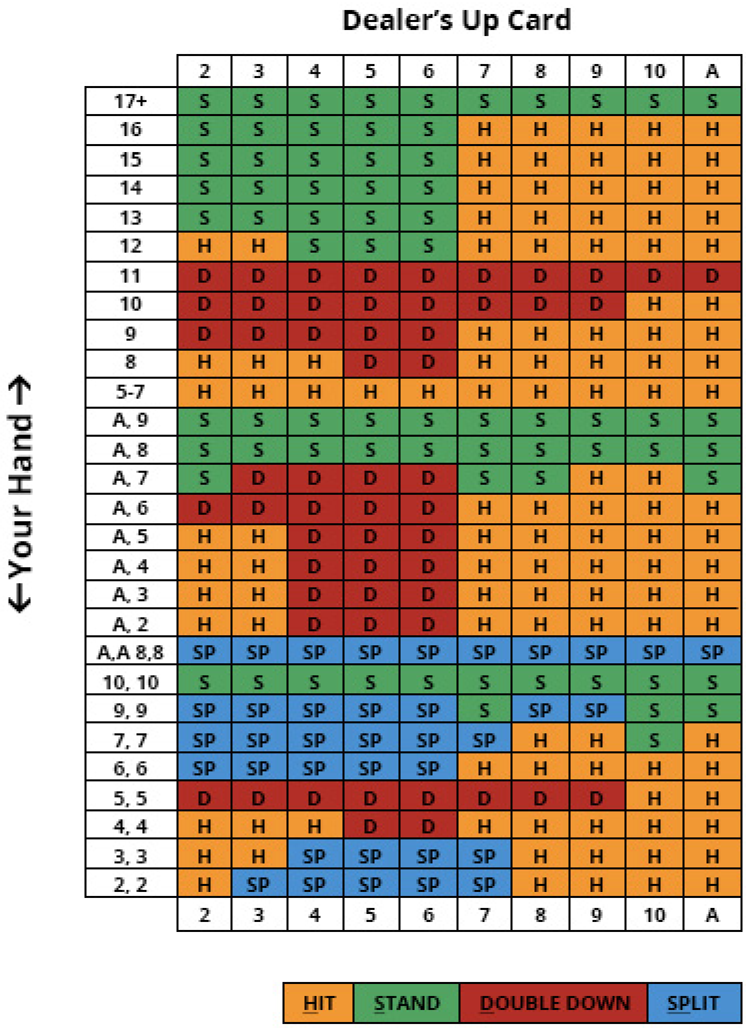


Player won!

Sum = 22

Sum = 18

The table generated in the AI project will be used for suggesting the player's moves during the game. We add the strategy table generated by the AI and store it in a dictionary which works like a hash map to give **O(1) time complexity**.



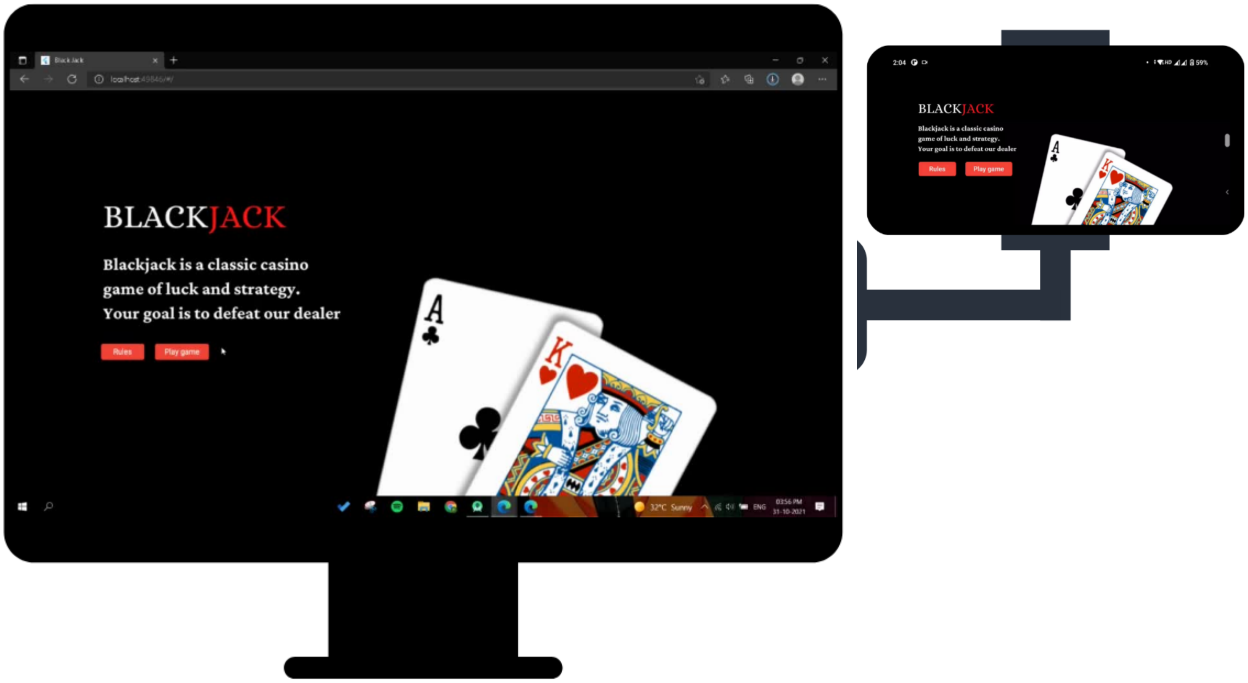
Dealer's Up Card

← Your Hand →

	2	3	4	5	6	7	8	9	10	A
17+	S	S	S	S	S	S	S	S	S	S
16	S	S	S	S	S	H	H	H	H	H
15	S	S	S	S	S	H	H	H	H	H
14	S	S	S	S	S	H	H	H	H	H
13	S	S	S	S	S	H	H	H	H	H
12	H	H	S	S	S	H	H	H	H	H
11	D	D	D	D	D	D	D	D	D	D
10	D	D	D	D	D	D	D	D	H	H
9	D	D	D	D	D	H	H	H	H	H
8	H	H	H	D	D	H	H	H	H	H
5-7	H	H	H	H	H	H	H	H	H	H
A, 9	S	S	S	S	S	S	S	S	S	S
A, 8	S	S	S	S	S	S	S	S	S	S
A, 7	S	D	D	D	D	S	S	H	H	S
A, 6	D	D	D	D	D	H	H	H	H	H
A, 5	H	H	D	D	D	H	H	H	H	H
A, 4	H	H	D	D	D	H	H	H	H	H
A, 3	H	H	D	D	D	H	H	H	H	H
A, 2	H	H	D	D	D	H	H	H	H	H
A,A 8,8	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
10, 10	S	S	S	S	S	S	S	S	S	S
9, 9	SP	SP	SP	SP	SP	S	SP	SP	S	S
7, 7	SP	SP	SP	SP	SP	SP	H	H	S	H
6, 6	SP	SP	SP	SP	SP	H	H	H	H	H
5, 5	D	D	D	D	D	D	D	D	H	H
4, 4	H	H	H	D	D	H	H	H	H	H
3, 3	H	H	SP	SP	SP	SP	H	H	H	H
2, 2	H	SP	SP	SP	SP	SP	H	H	H	H
	2	3	4	5	6	7	8	9	10	A

HIT	STAND	DOUBLE DOWN	SPLIT

This application is available to users on mobiles, windows as well as web. The demos of which are given in the video submitted along with this report.



BLACKJACK

Blackjack is a classic casino game of luck and strategy. Your goal is to defeat our dealer

CONCLUSION

Hence, we successfully implemented BlackJack in a flutter. The UI of the game is responsive. The game can be accessed using mobile, web, and windows. It is integrated with BlackJack AI, developed using Genetic Algorithms, which suggests the next move to the player.