ACKNOWLEDGEMENT

It is indeed a great pleasure to express my thanks and gratitude to all those who helped me during this period. This project would not have been materialized without the help from many quarters. I sincerely thank to all the persons who ever played a vital role in the successful completion of my project.

I sincerely thank all the people who co-operate and encourage me throughout the semester and make my project work successful.

I am thankful to Dr. Dileep Kumar Singh (Project Supervisor, Department of BCA, SOET) who has constantly remained helpful in suggesting directions and providing me guidance throughout the project.

I also thank Mrs. Akrati Sharma (Project Coordinator, Department of BCA, SOET) for providing me the confidence and helping me in the project.

I would like to extend my heartfelt gratitude to the program leader for continuous help and support. Thank you to Dr. Dileep Kumar Singh (Head, School of Engineering and Technology, JLU Bhopal) for providing this platform which helped in the development of my technical skills. It is good fortune that I had support and well wishes of many. I thank all those, whose means have not appeared here but the contributions have not gone unnoticed.

Signature of Student(s)

Amisha Das (2019BCA003)

CERTIFICATE

I hereby certify that the work which is being presented in the BCA Major Project Report entitled "Gametrax: Android Application Using Flutter/Dart and Firebase", in the partial fulfilment of the requirements for the award of the Bachelor of Computer Application is an authentic record of my own work carried out during session Jan-Jun 2022(6^{th} semester) under the supervision of Dr. Dileep Kumar Singh, Head- School of Engineering and Technology, Jagran Lakecity University.

The matter presented in this Project Report has not been submitted by me/us for the award of any other degree/diploma elsewhere.

Signature of Student(s)

Amisha Das (2019BCA003)

This is to certify that the above statement made by the student(s) is correct to the best of my knowledge.

Date:

Dr. Dileep Kumar Singh
Project Supervisor, Head
JLU-SOET

Mrs. Akrati Sharma
Project Coordinator
Department of CSE,
JLU-SOET

Table of Contents

ABSTRACT

The proposed application is called “Gametrax” which is used for gaming related querying, recording, tracking and saving information related to all games released. This will be achieved through the means of an APIs. Users can use this application to stay up to date with gaming news, find games that they may have lost track of, find upcoming games, put them all into lists and access their information at any time.

User will be able to find detailed information about the game that they have queried from the API like platforms the game was released on, the prices, the genre, date released etc. On top of this, the user will also be able to search the game directly through ‘google’ to find additional information.

The software will make use of a backend where the user information and details can be stored and accessed at any time to make use of the features the application offers.

LIST OF FIGURES

LIST OF ABBREVIATIONS

SRS	Software Requirement Specification
UI	User interface
OS	Operating System
DBMS	Database Management System/Systems
URL	Uniform Resource Locator
ER Diagram	Entity Relationship Diagram
DFD Diagram	Data Flow Diagram
API	Application Programming Interface

CHAPTER-1

INTRODUCTION

1.1 Problem Definition

Today's gamers have many different dilemmas to go through. There are many different platforms and consoles, many different games, many genres of games, publishers, many different websites to buy games on, different DRMs to store and access their purchases. All of these options creates choice fatigue and thus the idea of 'Gametrax' was born.
Gametrax solves the problem of having information scattered all around us. Using this app an average gamer can search and save the information they find interesting about the game they look for.

1.2 Project Overview/Specifications

My project is called 'Gametrax'. This is an android mobile app which will allow the following features and facilities to the user:

- User will be able to stay up to date on the latest news on the homepage which updates each day, this way they are on edge with the latest happenings in the gaming world.

- User can search for games that they are interested in and find detailed information upon the game selected such as- genre, date released, platforms released on.

- From there on, the user would be able to add the game to their lists such as favourites and bookmarks or a user created list for example, user can create a list called 'to-buy'.

- User can also check the prices of selected game on ebay and amazon.

- User can make a direct google search for the game through the same window

- A trending page will also be a offered wherein the user can see the top 10 games currently in the market according to the API.

The software will implement a front-end, database and use API technologies.
The app will be a standalone application using Flutter[1] framework for UI with the database based on Firebase Firestore by Google.

1.3 Hardware Specification

User would require a mobile smartphone or smartphone tablet to access and use Gametrax. The app requires about 40 MB of RAM to run and takes about 30 MB of space on either and internal drive or external.

1.3.1 Logical Database Specification:

The app will use an online API based database by Google called 'Firebase/Firestore'.

1.3.1 Firebase/Firestore:

Google Firebase would be used as a remote database for the application. It is one of the most secure and trusted DBMS for mobile applications. The server is hosted in various locations provided by Google Inc. The User Base of the app would be easily operated within the limits of the database.[6]

Firebase offers a number of services, such as:

- Analytics – Google Analytics for Firebase offers free, unlimited reporting on as many as 500 separate occasions. Analytics affords records about consumer conduct in iOS and Android apps, permitting better choice-making about enhancing performance and app marketing.

- Authentication – Firebase Authentication makes it clean for developers to build relaxed authentication systems and enhances the sign-in and onboarding enjoy for customers. this selection gives a complete identification answer, helping e mail and password debts, cellphone auth, in addition to Google, fb, GitHub, Twitter login and greater.

- Cloud messaging – Firebase Cloud Messaging (FCM) is a cross-platform messaging device that shall we agencies reliably obtain and supply messages on iOS, Android and the internet for free of charge.

- Realtime database – the Firebase Realtime Database is a cloud-hosted NoSQL database that allows facts to be saved and synced between users in actual time. The records is synced across all clients in real time and is still to be had whilst an app goes offline.

- Crashlytics – Firebase Crashlytics is a real-time crash reporter that allows developers music, prioritize and fix stability troubles that lessen the excellent in their apps. With crashlytics, developers spend much less time organizing and troubleshooting crashes and more time building features for his or her apps.

- Performance – Firebase overall performance monitoring service offers builders perception into the performance traits of their iOS and Android apps to assist them decide where and whilst the overall performance of their apps may be improved.

The data stored will consist of:

1. User's email
2. User's entered name
3. Games they favourite and select
4. The lists they create

As this data is stored online, it will not be accessible without an internet connection.

1.4 Software Specification

The user would be required to use android version Lollipop (6.0) and up as google does not support android versions before that anymore.

CHAPTER-2

LITERATURE SURVEY

2.1 Existing System:

2.1.1 API:

An application programming interface (API) is a link between two computers or programmes. It's a form of software interface that provides a service to other programmes. An API specification is a document or standard that explains how to create or use a connection or interface. [5]

There are several gaming APIs that give a lot of detailed information but this information can be muddled and difficult to find for a layman.

Gamers are not necessarily tech savvy or have the coding knowledge required to find the vast information that is required for the querying, saving and collecting of API database and information.

2.1.2 DRMs:

Digital Rights Management (DRM) is a term used in the PC gaming industry to describe copy protection and/or technical protection mechanisms used by corporations to limit end-user manipulation and copying of game data and content after the purchase, download, and/or installation of the product.

To check the prices of games, one needs to install several DRMs because sometimes a game might not be available on a certain platform or store.
For example: Steam is immensely popular with PC gamers but not so much with console players like the Switch or Playstation.

Through Gametrax many stores will be added so the user can check the price of the same game on different websites and stores to make the best choice and find the cheapest product.

2.1.3. Websites for Gaming News:

There are several websites for gaming news that keep the gamer updated but the problem is that that the news is only available through the websites which is not always easy to access as there are many different websites and many different headlines that the information just gets scattered.

2.2 Proposed System

Gametrax will be an android application which, as the name suggests, will be a toolkit for the tools a student needs while preparing for their studies.

Gametrax will have the following features:

2.2.1. Gaming News:

The homepage will contain tiles that will have news retrieved using APIs. News headlines will be related to gaming and game industry related news which will be updated on the homepage.

2.2.2. API Search:

An open API, also called public API, is an application programming interface made publicly available to software developers. Open APIs are published on the internet and shared freely, allowing the owner of a network-accessible service to give a universal access to consumers.

Gamers are not necessarily tech savvy or have the coding knowledge required to find the vast information that is required for the querying, saving and collecting of API database and information.

There are several gaming APIs that give a lot of detailed information but this information can be muddled and difficult to find for a layman, hence Gametrax makes it easier to access and use this database and save its information.

2.2.3. Detailed Game Information:

Gametrax will reply with a list of games that relate to the search query the user has entered from the API, from here the user will be able to press on the game's list tile which will direct them to the selected game's information page.

This page will consist of information regarding the game, namely:

- Title of game
- Date released
- Genre
- Platforms the game is released on

It will also have option for the user to:

- Add the game to their 'to-buy' list
- Search for the game on google
- Compare the game's prices on eBay, Steam and Amazon

2.2.4. List maker and Default Lists:

I came across many apps and websites during our research, as mentioned above, and they all had something lacking. The biggest concern was that the apps either only gave one facility and not another or extra features were hidden behind monetary transactions or some apps were exclusive only to iOS.

List making in Gametrax is very simple as it happens simply on the tap of a button. When the user likes a game, they can add it to one of the following lists:

- Favourites List
- Bookmark List
- To-buy List

Gametrax also has complimentary modules such as:

- **Onboarding Screens**

  An onboarding screen is like a walkthrough, aimed to introduce what an app does to a user and of course how to use it. The onboarding process is essentially a series of screens which direct users through an app interface. These onboarding screens have three purposes:

  1. Educate the user about the functions and benefits of the app,
  2. Allow the user to register their login details, and
  3. Collect profile information

  App onboarding allows businesses to optimise a user's first interaction with an app. Creating an engaging first-time and positive user experience is fundamental to app success and fostering ongoing user engagement. Users quite often lose interest when an app is confusing and difficult to navigate. Utilising app onboarding helps make the first-time user transition as seamless as possible, minimising potential pain points.

- **Login and Sign up Pages**

  Login and sign up pages are what is used for the registering and entering of the user into the database. It connects the user and the app on a digital level, creating their own repository.

  This page is beautiful and invites the user in immediately with gaming graphics. Through these pages the user can sign up and use the app through their account, this is used to store user information, such as their username, their lists, etc.

- **Splash Screen**

  Splash Screen is the screen show at the starting of the app, when the app loads at background. We use our applications' logo along with its name and version number on the splash screen with animation of our logo and a loading circle to show the user that the app is loading in background and is not stuck.

- **Home Page**

  The page also greets the user using the name provided by the user on the first use of app which is saved in the shared preference of the app. This greeting is to make the app more user friendly as studies show that when a person is called by his/her name, they feel more connected to the application.

  The top part of the homepage aims to navigate user to different pages so they can use the functionality intended to.
  The search icon takes the user to the trending games page which is the top 10 games in the meta currently, from there they can search the games they want to search for, from the top search bar. The other icon is for the lists page, which shows the users their saved lists.

2.3 Feasibility Study

2.3.1 Cost Feasibility:

The app uses almost zero development costs and only has production and running costs.

Gametrax uses Firestore for its database and as such the database costs can go from free to 10 dollars a month if we need to use more than 1GB of data. [7]

The spark plan of the Firebase console is free and limits the database usage up to a certain amount as mentioned below in table 2.3.1:-

Simultaneous connections	100
GB Stored	1 GB
GB Downloaded	10 GB/month

Figure 2.3.1 Firebase's Spark Plan Offers

Running costs of the app can be counted in the internet requirements as the app requires a consistent internet connection to run and communicate with APIs and the database.

Production costs require us to pay 2500 indian rupees for Google Playstore licensing to publish the app on Google's Playstore.

Concluding from this, the app can be considered very feasible to produce financially.

2.3.2 Social and Legal Feasibility

Gametrax uses news channels that might be or might not be agreeable with certain third parties with their opinions and reportage.

The app does not use any unethical means or products that might harm its reputation in the eyes of the general public.

2.3.3 Technical Feasibility

Gametrax uses the following technologies to develop and function:

- Flutter
- Dart
- Firestore for database storage
- Firebase for authentication
- RAWG API for gaming database, search and query [8]
- NewsAPI for fetching latest news articles
- PriceAPI to find latest prices for the game searched

For the development of this app the developer will need to know the working and know-how of all of these technologies.

The hardware required is:

- A windows, macintosh or linux based computer system for development
- (optional) a hardware device i.e smartphone for debugging.

CHAPTER-3

SYSTEM ANALYSIS & DESIGN

3.1 Requirement Specification

The user will be required to use a mobile smartphone or tablet to use Gametrax.
The app will be launched with 3 on-boarding screens and the user will then be able to navigate to the sign in or sign up page, then the homepage and then navigate to the following modules from there on.
The application will work on Android platforms only.

3.2 Flowcharts / DFDs / STDs

3.2.1 Sequence Diagram:

The sequential diagram shows the flow of every module and consecutive sub-modules.

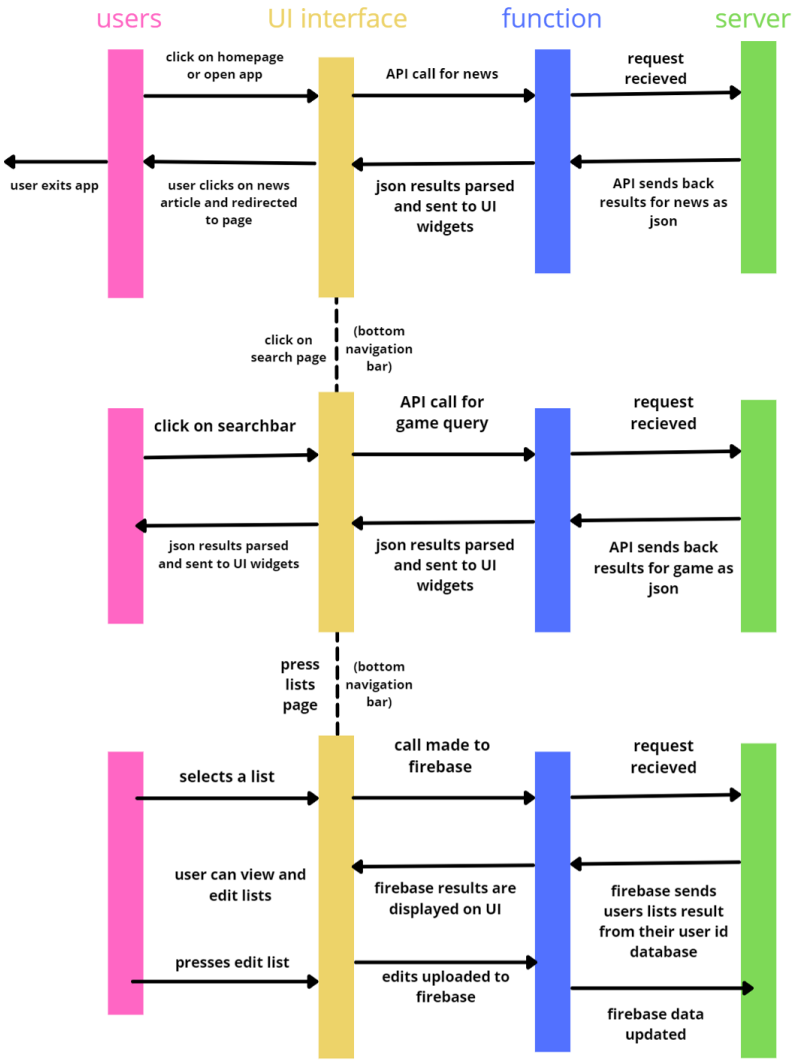


Figure 3.2.1. Sequence Diagram

3.2.2 State Transition Diagram (STD):

There is a separate STD for each function/screen as follows:

3.2.2.1 Searching a game

The state change in the process of searching for a game can be seen in figure 3.2.2.1. below:-

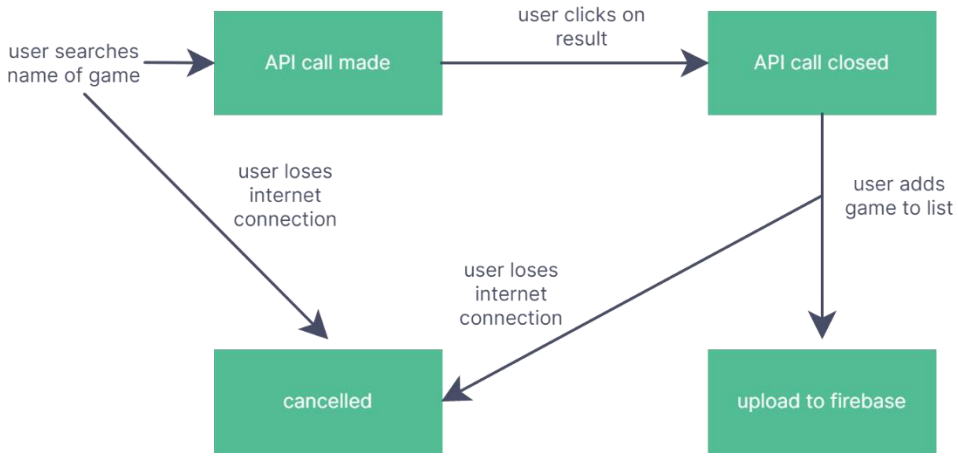


Figure 3.2.2.1. STD for searching a game

3.2.2.2 Homepage

The state change in the process for the homepage can be seen in figure 3.2.2.2. below:-

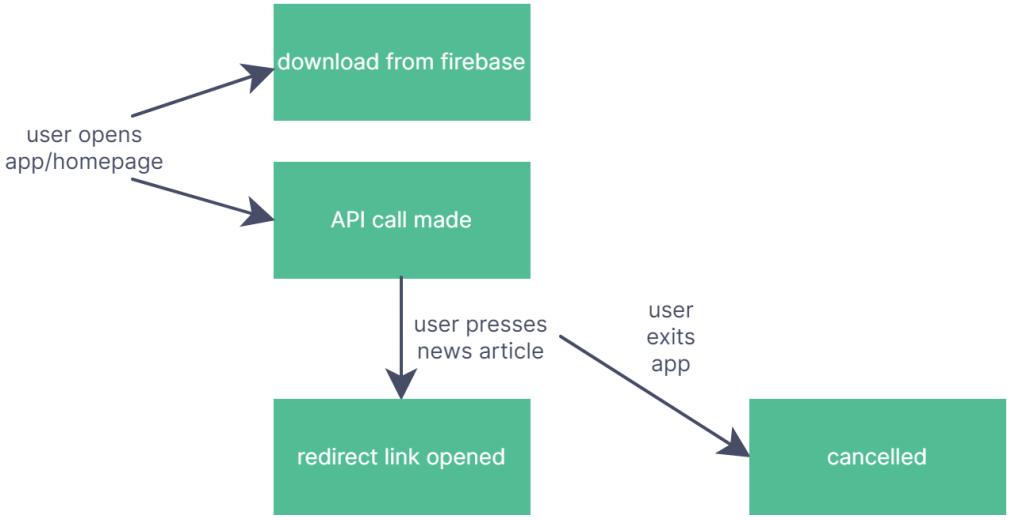


Figure 3.2.2.2. STD for homepage and news

3.2.2.3 Adding list items and loading on list page

The state change in the process of user adding list items can be seen in figure 3.2.2.3. below:-

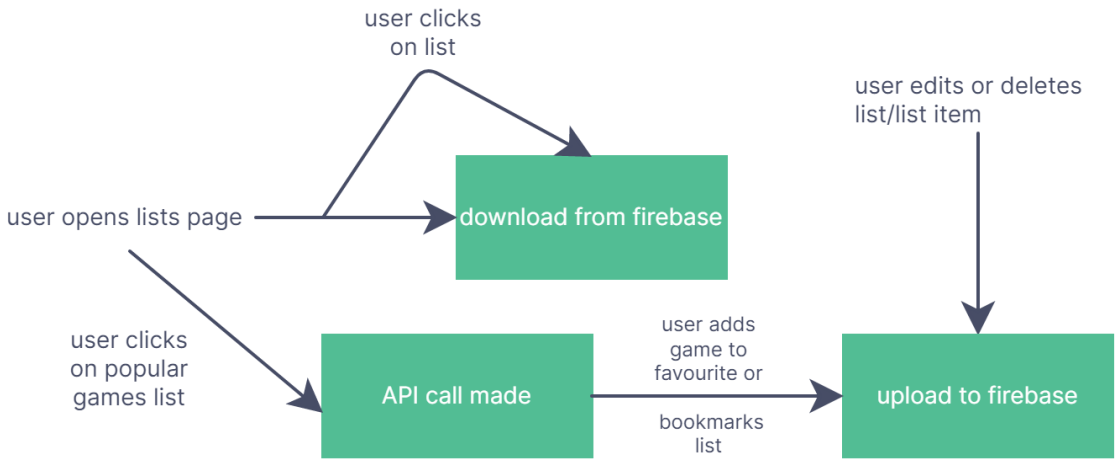


Figure 3.2.2.3. STD lists page

3.2.3 DFD:

DFD or data flow diagram maps out the flow of information for any process or system. Following is a level 2 Data Flow Diagram.

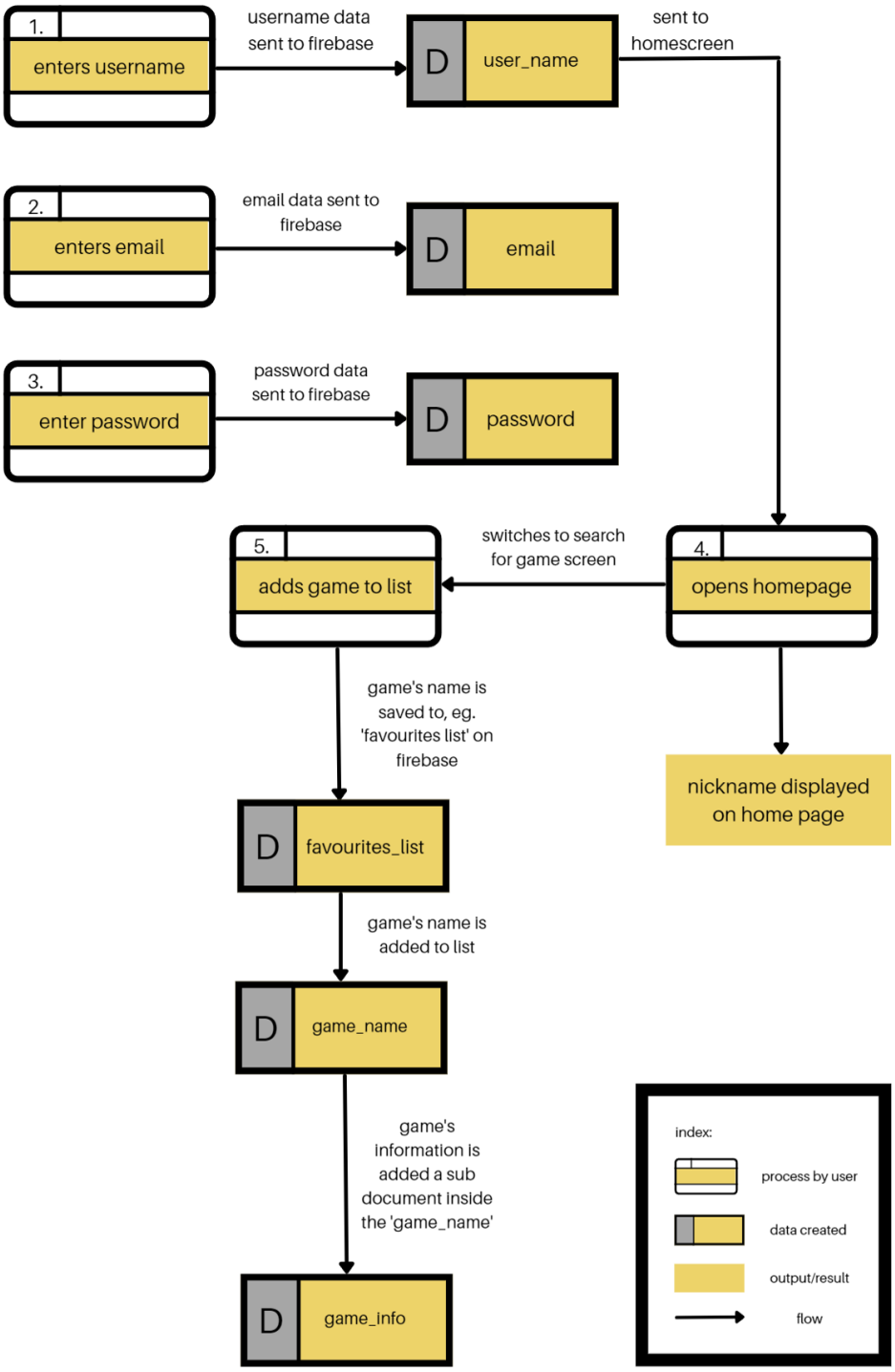


Figure 3.2.3. DF Diagram

3.3 Algorithm

1. Start
2. Add scaffold
3. Make list maker to add information of newsAPI.
4. Add the newslist builder to a ctream builder to allow reloading if connection is lost or widget isn't built
5. Add a DateTime.now() function for clock and add it to a timer to keep it updated
6. Add an app bar to the top for navigation as therre are only 2 main pages and their subpages can be navigated from the main pages themselves.
7. The first icon is a search icon to direct to trending page using navigator.
8. The second icon will use the navigator to navigate to the lists page.
9. For the trending page we will add container to the scaffold for the trending games and their information
10. Create a function for fetching treding games and add it to the initstate() of the widget.
11. Parse the json response and put it into the containers
12. Add an app bar for searching the API.
13. For this another function needs to be made to put user entered value into the search URL and query the API
14. The results then need to be parsed into the listbuilder.
15. From here the lis titem needs an inkwell so the user can press it and be directed to the subpage for game's information.
16. Create a class model to do this with necessary information passing
17. Information page should follow the UI created and add 4 more functions
18. To add the game to the 'to-buy' list which will use the user's firestore credentials and store it in a collection as an array appending with each entry
19. To search game on google we will need to add a url_launcher** package, set a URL for querying google search and set it to launch on the browser which the package does itself.

20. To get game prices, we create another function that queries the PriceAPI and parses the required information and sends it back to the dialgoue box that opens and send the prices into the widget.

21. We will also add a redirect to lists button at the bototm which will enable to user to go to the lists page directly from this page itself.

22. The lists page will have the options for the user to access their favourites, to-buy, bookmarks, logout and trending games page.

23. For the user lists the function to fetch user's lists from firestore needs to be created which will query firestore and fetch and store the data into variables. For ease, the data should be made into a Map.

24. The trending page button will redirect the user to the trending page in the previous module.

25. Logout option will be to sign the user out using firebase_firestore authentication functions which need to be created as a model in a separate file along with the login and sign up functions.

26. Stop.

3.4 Testing Process

3.4.1 Alpha Testing

Alpha testing is a type of testing that is done on an application towards the end of a development process when the product is almost in a usable state. The first phase consists of testing by the developers. The software used is either hardware-assisted debuggers or debugger software.[2]

3.4.1.1 Manual Testing

- The app's ".apk" file will be deployed to several people who will have different smartphones and android versions.

- The bugs reported will then compiled and worked on and retested.

3.4.2 Beta Testing

Once the app is tested in-house, we will release the beta version of the application to market.

1. **Compatibility Testing**

Mobile devices vary between platforms, models, and operating system versions. It's essential to select a subset of devices relevant to your application.

2. **User Interface Testing**

User experience is key for apps to be accepted by end users. Check usability issues, navigation, and content. Test menus, options, buttons, bookmarks, history, settings, and navigation flow of the application.

3. **Interface Testing**

Testing of menu options, buttons, bookmarks, history, settings, and navigation flow of the application.

4. **External Factors Testing**

Mobile device applications must also contend with interactions and interruptions from other device features like various network connection types, SD cards, phone calls, and assorted device settings.

5. **Accessibility Testing**

Mobile devices have a diverse demographic of users so it is important to ensure that your application is widely accessible.

CHAPTER-4

RESULTS/OUTPUTS

4.1 Splash Screen:

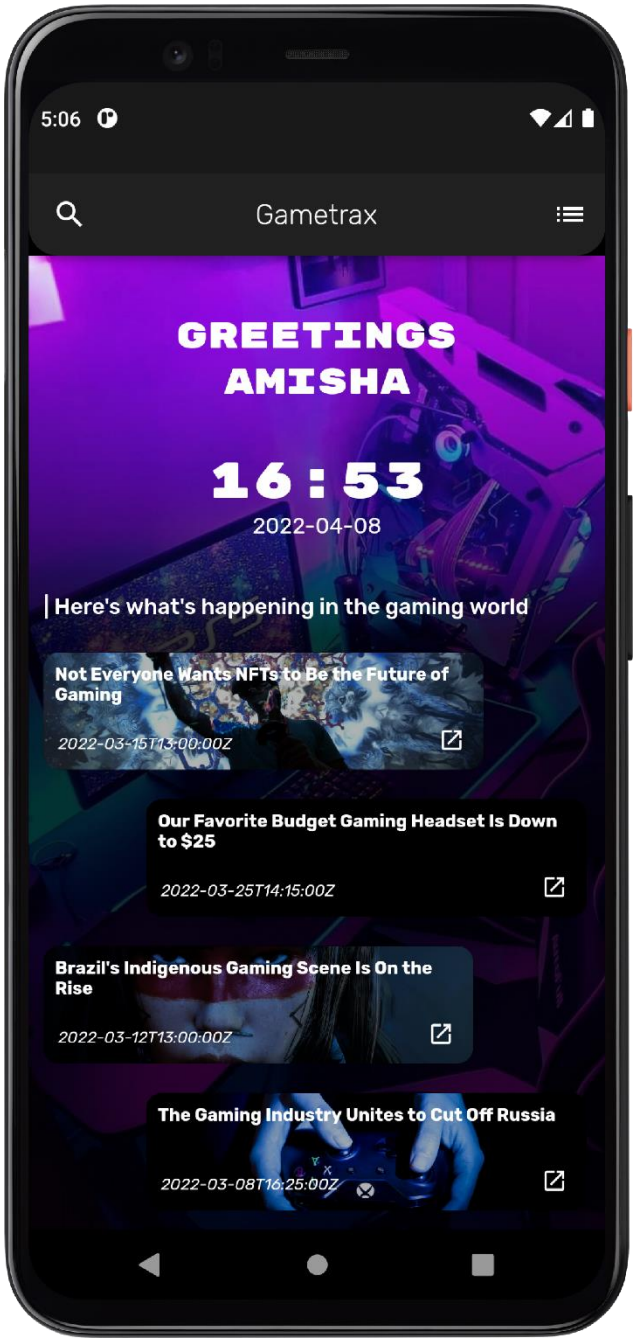
Splash Screen is the screen show at the starting of the app, when the app loads at background.

Gametrax's logo is simple, modern and minimalistic. It has the gaming appeal with sharp colours and contrasts. This is the screen that shows when the app is loading for the first time in the state tree.

4.1 Splash screen

4.2 Home Screen:

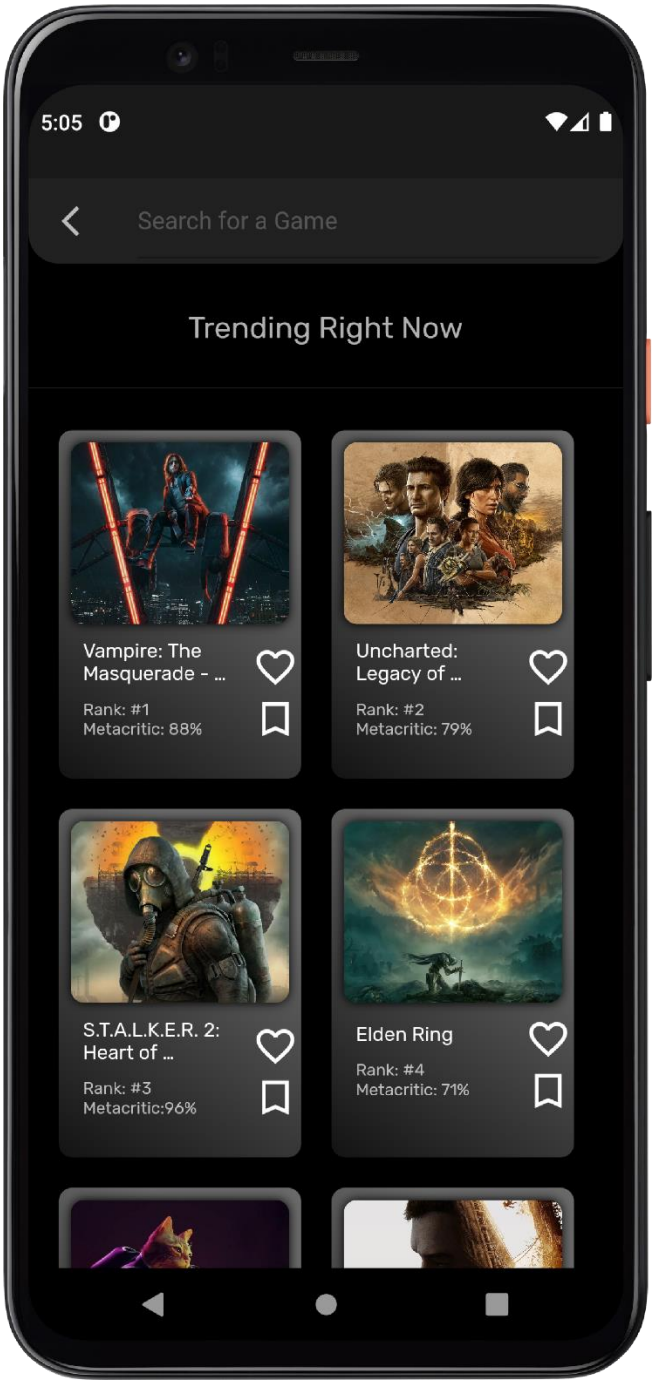
Homepage is the main page of the app, this is the page which connects all other pages of the app and opens first when the user uses the app. The homepage of Gametrax shows the time and date of the current day along with dynamic news updates which use an API for the calling and receiving of the news articles. This way the user can stay up to date with the latest happenings in the game world.



4.2. Homepage

4.3 Trending Page

This page will show the top 10 games trending in the gaming world at the moment, this list is dynamic and will change according to the API response.



4.3 Trending page shows the top 10 games currently

4.4 Search Games

This is the search page which returns search query results from the user using the RAWG API. From here the user can click on the game and be redirected to the game's information page.

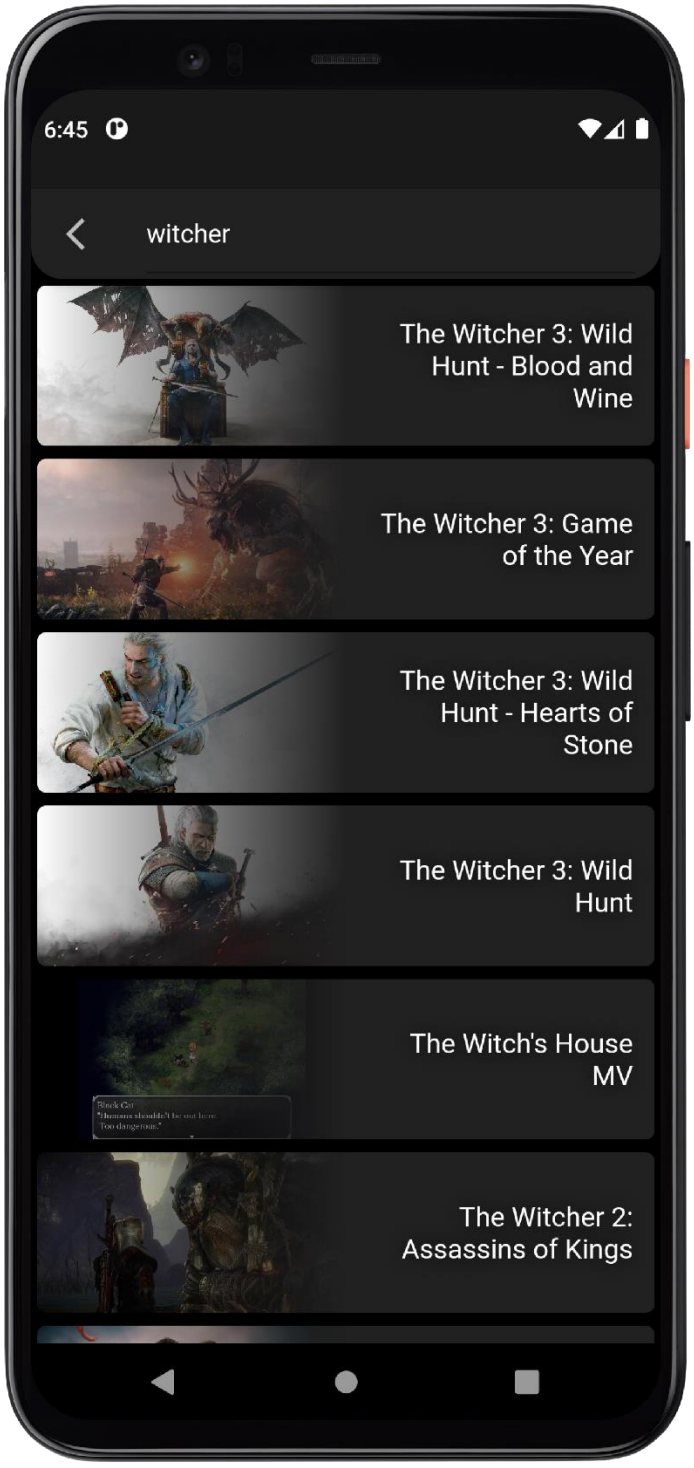
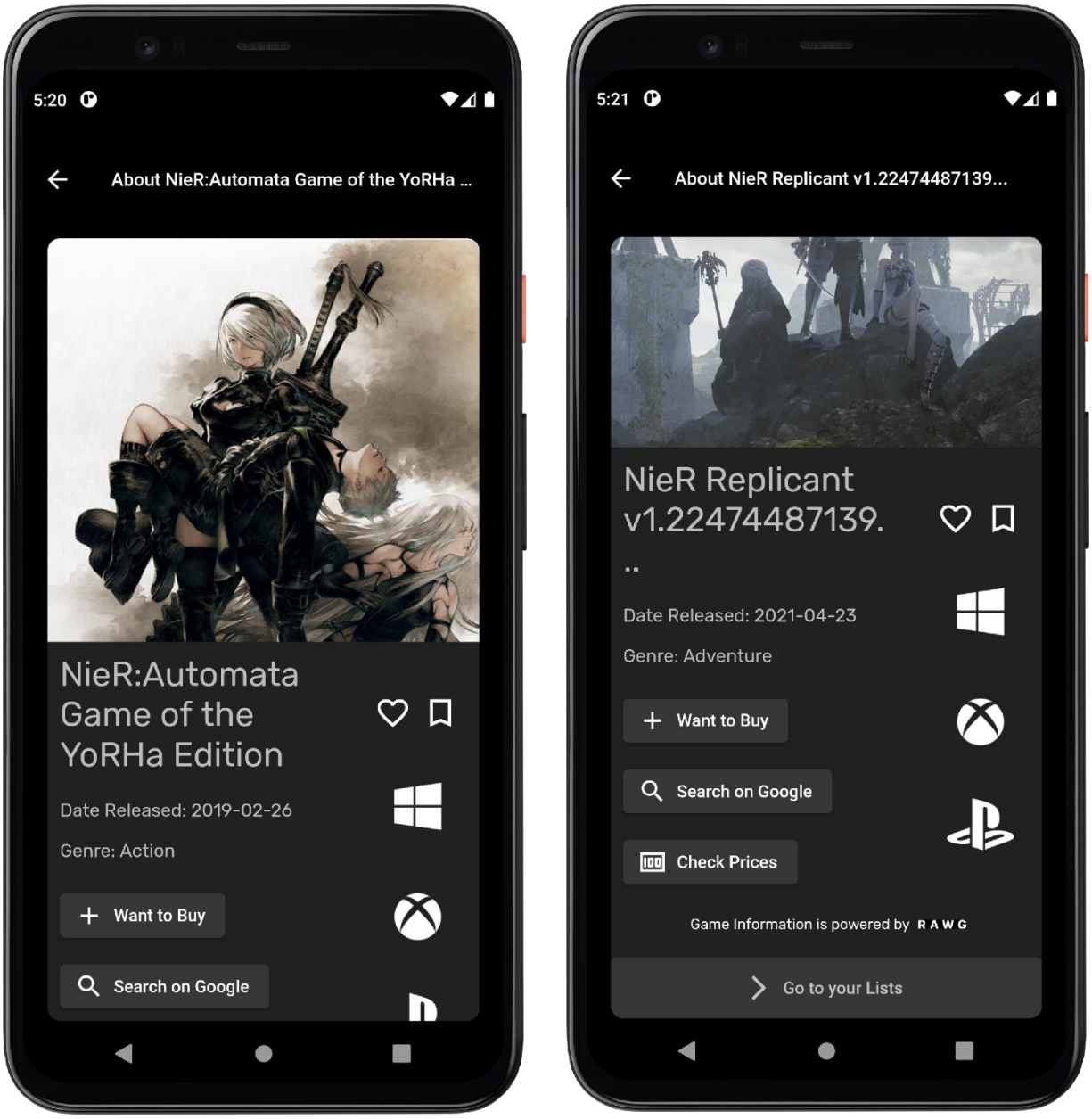


Figure 4.4 Search Results Screen

4.5 Game Info Page

Gametrax will reply with a list of games that relate to the search query the user has entered from the API, from here the user will be able to press on the game's list tile which will direct them to the selected game's information page.



4.5 Game Information Page

4.6 Google Search Page

This page is a redirect from the page that lets the users make direct google search for the game they want to look up on in case the information they searched for and received is not enough.

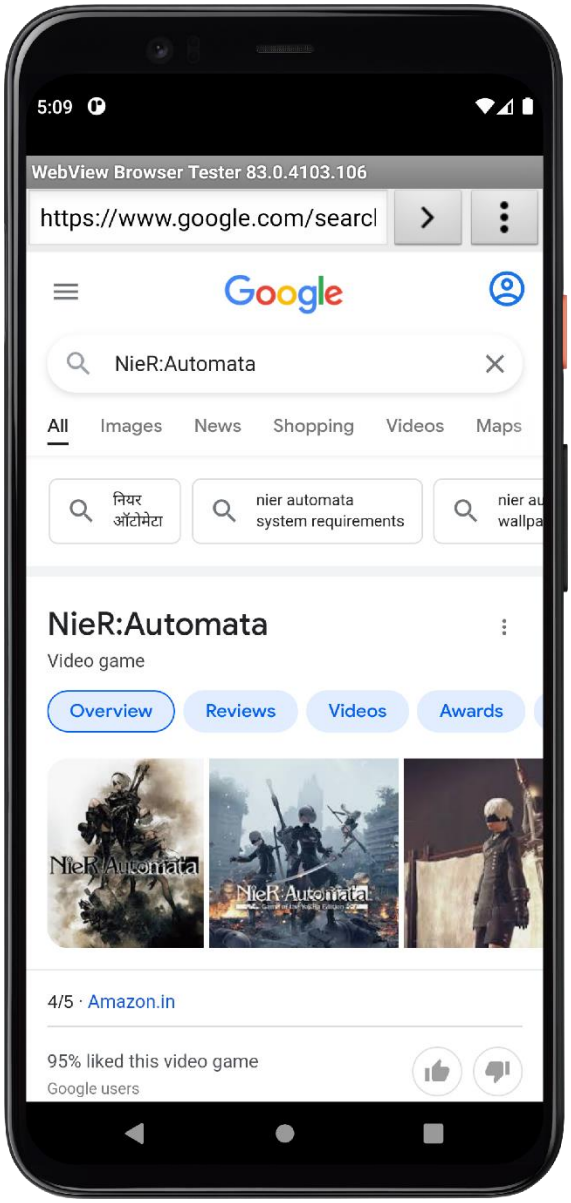
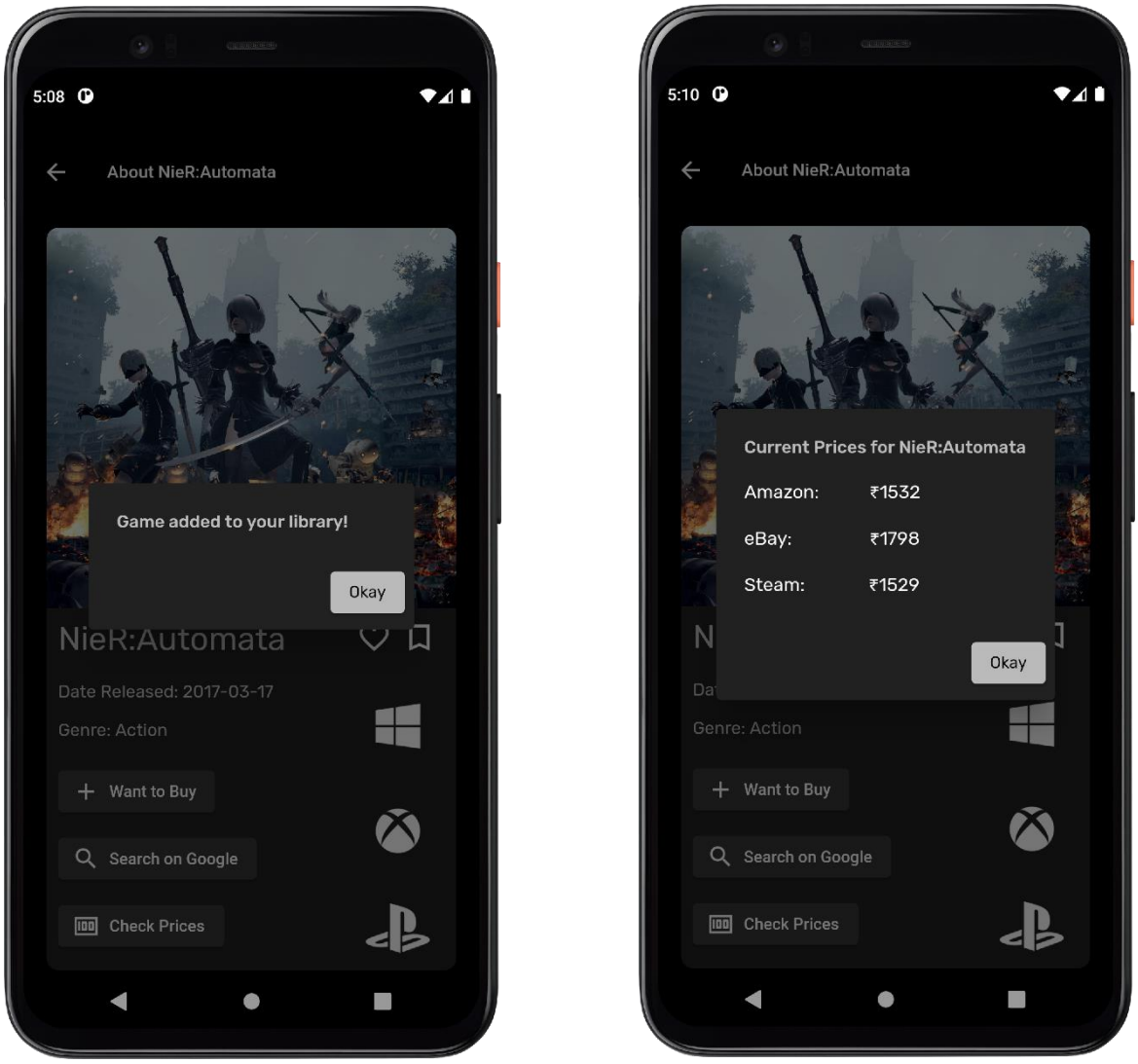


Figure 4.6 Direct Google Search redirect

4.7 Prices and Add to ‘To-Buy’ list

These are the two functions that allow the user to make financial decisions to let them decide whether ot buy the game or not and if yes, where to buy it from.
The to-buy button lets the user wishlist an item to their list which they can access later on and the ‘prices’ search button tells the user the current prices of the game from eBay, Amazon and Steam.

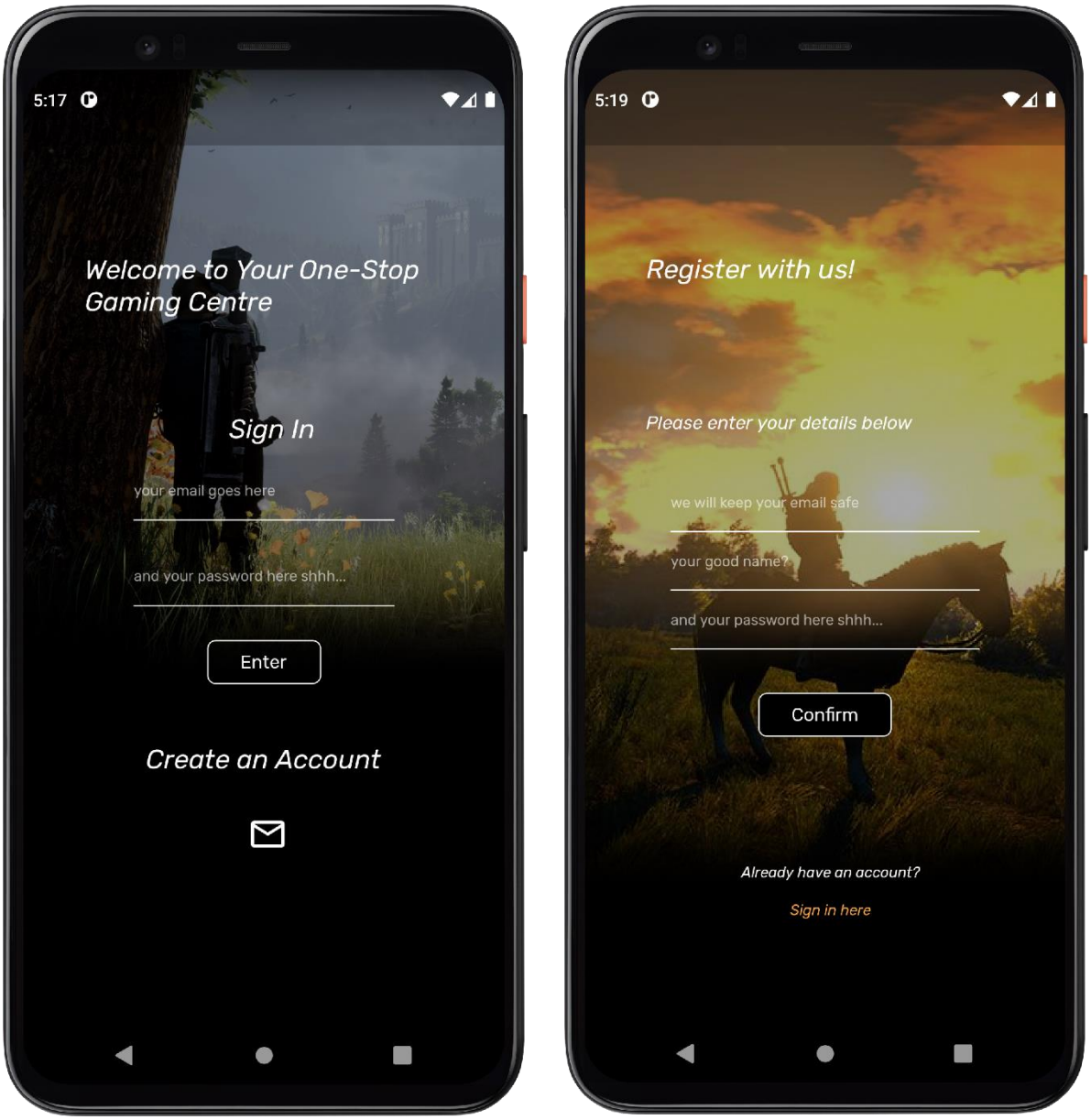


4.7 Prices Search and add game to library features

4.8 Login and Sign-up Pages

Login and sign up pages are what is used for the registering and entering of the user into the database. It connects the user and the app on a digital level, creating their own repository.

This page is beautiful and invites the user in immediately with gaming graphics. Through these pages the user can sign up and use the app through their account, this is used to store user information, such as their username, their lists, etc.



4.8 Login and Sign-up

4.9 Lists Page

This page allows the user to access their lists like to-buy, favourites, bookmarks and top 10 trending games. It also has the option for the user to log out of the app instance.

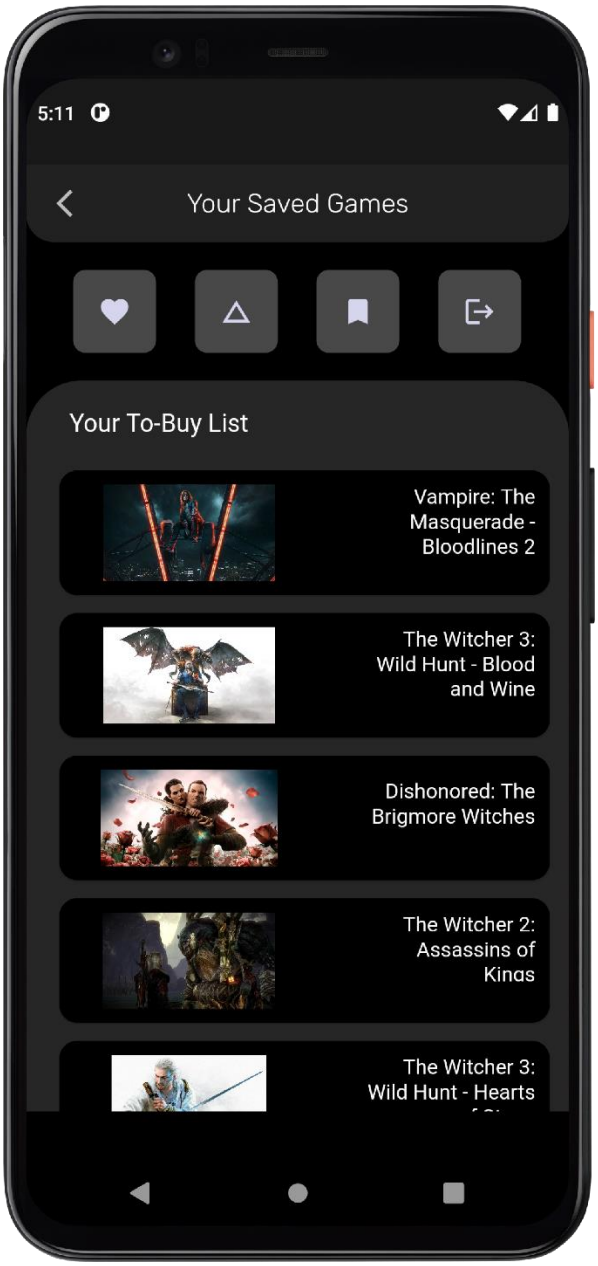


Figure 4.9 Lists Page

CHAPTER-5

CONCLUSIONS/RECOMMENDATIONS

5.1 Lessons Learnt

I have learnt many things throughout the process of creating and completing this project. I learnt API handling, calling and saving the data. Caching API requests and app scaffold states. I learnt to build and access API information efficiently through maps and models. Before working on this application I used to be extremely intimidated by the daunting task of having to use APIs for information access and querying, let alone the idea of saving the information and using it for my own use.

I have gained confidence in my capabilities and skills as a programmer and thus this proved to be a very enriching experience.

5.2 Conclusions

Gametrax is an enriching and useful place for people who want to utilise their time efficiently and we hope it can provide users usefulness and ease of access.

Gametrax has turned out to be a very comprehensive and tidy place for people to find a comprehensive user experience and ease of access for the everyday gamer in today's world where there are a hundred different options and several places to get a single thing from. The number of games and vast and constantly building place of the gaming world is confusing and through Gametrax users will be able to find a neater and cleaner way, to comprehensively navigate this maze of and ever expanding gaming industry which will only grow more as the years pass. Through Gametrax I hope to provide a service that will prove convenient to hundreds of people in need.

CHAPTER-6

REFERENCES

6.1 Report References:

[1] Development in Flutter (2021) '*Flutter – Beautiful Native Apps in Record Time*' - https://flutter.dev/, (website)

[2] Your Step-by-Step Mobile Application Testing Process https://dzone.com/articles/your-step-by-step-mobile-application-testing-proce (website)

[3] Biessek, Alessandro (2019) '*Flutter for Beginners: An Introductory Guide to Building Cross-platform Mobile Applications with Flutter and Dart 2*', pg 345, 347, (book)

[4] Build apps for any screen (2020) - https://flutter.dev/, (website)

[5] MuleSoft LLC, a Salesforce company (2022) *'What is an API? (Application Programming Interface)'*- https://www.mulesoft.com/resources/api/what-is-an-api, (website)

[6] FlutterFire, (2021) *'FlutterFire Overview'*- https://firebase.flutter.dev/docs/overview (website)

[7] Firestore Pricing (2022) 'Firestore pricing'- https://cloud.google.com/firestore/pricing (website)

[8] RAWG API (2022), 'Explore RAWG Video Games Database API'- *https://rawg.io/apidocs* (website)

CHAPTER-7

APPENDICES

7.1 Architecture of Flutter

7.1.1 Architectural Layers[1]

Flutter is designed as an extensible, layered system. It exists as a series of independent libraries that each depend on the underlying layer.

No layer has privileged access to the layer below, and every part of the framework level is designed to be optional and replaceable.

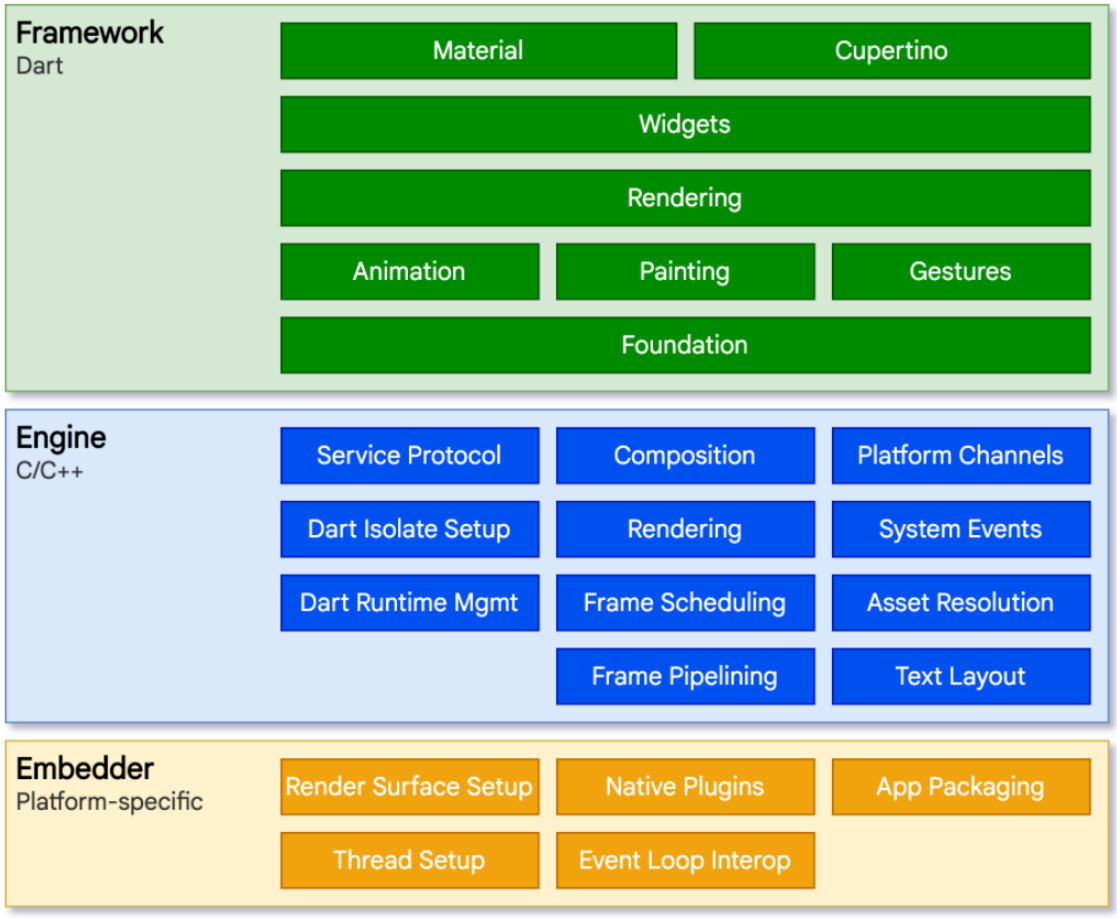


Fig 7.1.1 Architecture of Flutter and Dart

[1] Source: *Architectural Layers in Flutter* https://flutter.dev/docs/resources/architectural-overview

7.2 Appendix 1: Gaming Demographic of Today (USA)

The gaming demographic of today is as follows:

7.2.1 Gamers thoughts on how gaming affects their lives:

"The real-world gamer demographic is more complex than the stereotypical gamer persona of a 30-something man-child living in his mother's basement. In fact, video gaming had ceased to be merely a hobby.

A 2020 study found that as video games become a typical element of a typical American's life, the average gamer's age also goes up. The evidence: while 38% of gamers still belong to the 18-34 age group, 6% are from the 65 years old and above demographic (ESA, 2020).

Likewise, the study found that the average age range of an American gamer is 35-44 years, while 70% of those below 18 years and 64% of US adults play video games on a regular basis. Also, most gamers play video games because they help them relax (79%) and offer mental stimulation (80%). Moreover, 61% of American gamers play using their smartphones, and around 75% of US households have at least one gamer in their fold."

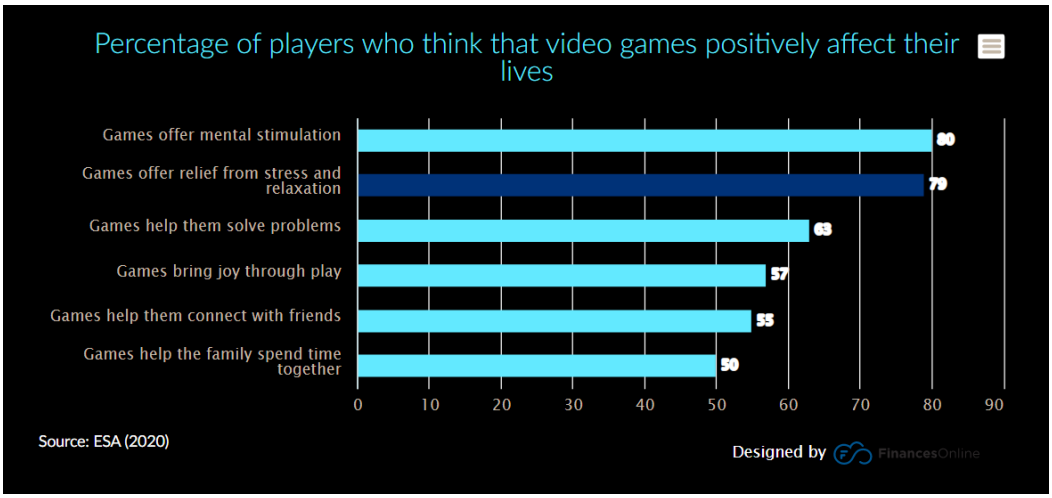


Figure A.1.1. gamers' thoughts on how gaming affects their lives

A.1.2. Gamers Range and Gender Split:

"Gamers range in age from children under 18 to post-Boomers 70 and up. 68% of American adults (163.3 million) are gamers, while 70% of American kids aged 18 and below (or 51.1 million) are gamers, too (ESA, 2020).

As most people stayed in their homes out of necessity during the pandemic, many Americans turned to video games to pass the time. A survey found that 37% of respondents said that they will likely spend more on video games because of the pandemic (MorningConsult, 2020)."

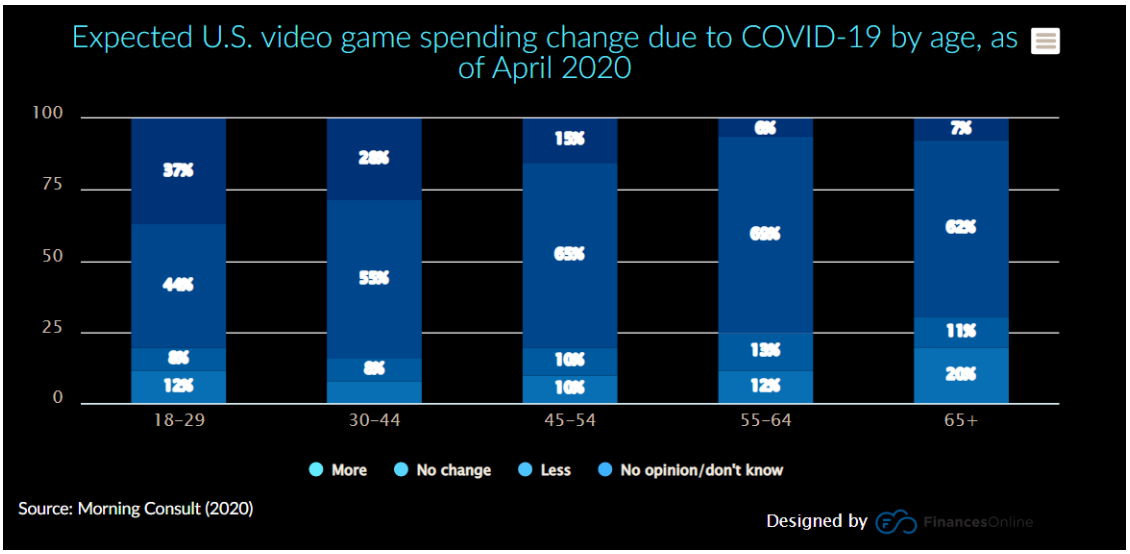


Figure A.1.2.1 Age Range of an average gamer in the USA

"The Gender Divide Gets Blurred
The gender split has a slight skew in favor of male gamers at a 59% to 41% ratio in the US (ESA, 2020). The average gamer age is 34 years for men and 36 years for women. Likewise, there are likely more females among older American gamers (Visual Capitalist, 2020)."[2]

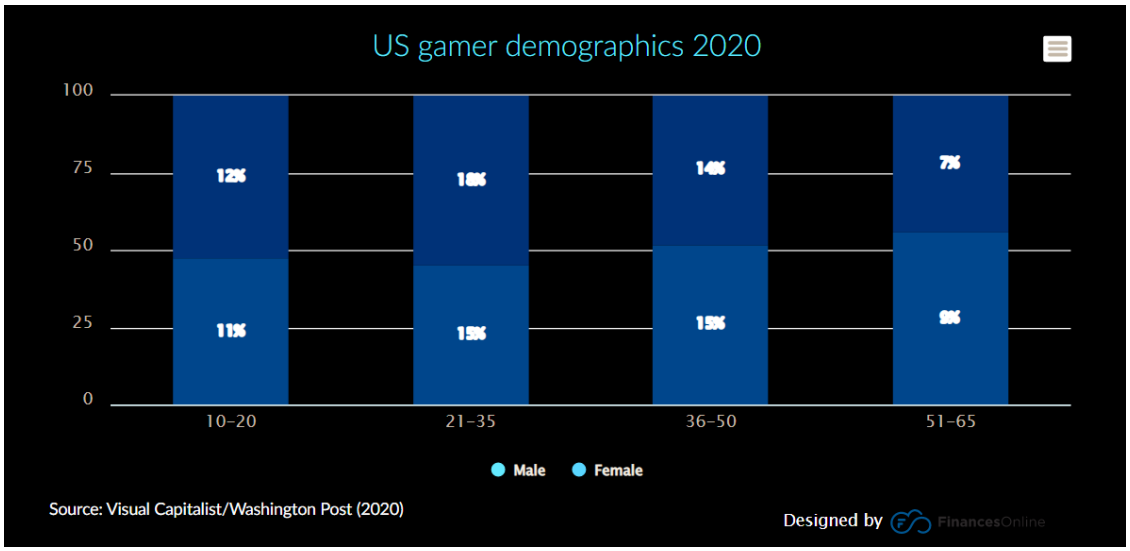


Figure A.1.2.2 Gender ratio of an average gamer in the USA

[2] Source: *Number of Gamers Worldwide (2020)* https://financesonline.com/number-of-gamers-worldwide/#:~:text=The%20average%20gamer%20age%20is,and%2036%20years%20for%20women.