THE REPUBLIC OF TURKEY
BAHÇEŞEHİR UNIVERSITY

THE EFFECTS OF DIGITAL COMPANIONS ON TABLETOP ROLE-PLAYING EXPERIENCE

Master's Thesis

ARDA ÇEVİK

ISTANBUL, 2017

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This is to certify that we have read this thesis and that we find it full adequate in scope, quality and content, as a thesis for the degree of Master of Arts.

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August 2017 Arda ÇEVİK

ABSTRACT

THE EFFECTS OF DIGITAL COMPANIONS ON TABLETOP ROLE-PLAYING EXPERIENCE

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Game Design Graduate Program

Thesis Supervisor: Assoc. Prof. Barbaros Bostan

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Players have been having great experiences with tabletop role-playing games. With the trend of digitalization, a variety of digital applications has been developed to enhance tabletop role-playing experience. Developers have produced digital companions which aim to streamline and automate some aspects of gameplay, enhance immersion by providing audio and visual elements, help game masters and players to keep track of game statistics, and provide generated content. However, in order to use these companion applications, special and expensive devices are required. This makes integration of digital companions with tabletop role-playing games inefficient in most cases.

In the scope of this thesis, a mobile tabletop role-playing companion application, *myFRP*, is introduced. *myFRP* runs on mobile devices of game masters and players. *myFRP* was designed to enhance gameplay experience by providing an in-game communication system and a digitalized miniatures and maps system. To examine the effects of *myFRP* on tabletop role-playing experience and to obtain new insights into usability for producing digital companion applications; a research with user tests was conducted. This research was conducted with seven tabletop role-playing game groups of a total of 30 participants, and they were asked to play short Dungeons & Dragons combat scenarios while using *myFRP* during their game sessions. After the game sessions, participants were asked to fill SUS, UMUX and LTR questionnaires. Following that, think aloud sessions were held with each group to obtain their opinions about *myFRP*. Additionally, an online survey about Roll20 application was done with 31 participants. In the light of these findings, it is revealed that participants find *myFRP* and Roll20 usable and practical. It is also revealed that game masters find both *myFRP* and Roll20 harder to use than players do.

Keywords: Tabletop Role-Playing, Role-Playing Games, Digital Companions, Computer-Supported Gameplay Tools

ÖZET

DİJİTAL YARDIMCILARIN MASAÜSTÜ ROL-YAPMA DENEYİMİ ÜZERİNDEKİ ETKİLERİ

Arda Çevik

Oyun Tasarımı Yüksek Lisans Programı

Tez Danışmanı: Doç. Dr. Barbaros Bostan

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Oyuncular, masaüstü rol-yapma oyunları ile harika deneyimler elde ediyorlar. Dijitalleştirme trendi ile, masaüstü rol-yapma deneyimini zenginleştirmek için çeşitli dijital uygulamalar geliştirilmiştir. Bu yardımcı uygulamalar; oyunun bazı yönlerini düzene sokmak ve otomatikleştirmek, sesli ve görsel öğeler sağlayarak gerçekçiliği artırmak, oyun yöneticileri ve oyuncuların oyun istatistiklerini takip etmelerine yardımcı olmak ve rastgele üretilen içerikler sunmak gibi bazı özellikler sağlamayı amaçlamıştır. Ancak geliştirilen bu uygulamaların bir kısmını kullanabilmek için hem pahalı ve özel ekipmanlar gerektiğinden, hem de bazı oyunlar için özelleşmiş olduklarından ulaşılabilir ve kullanılabilir olanların sayısı azdır. Bu da dijital yardımcı uygulamaların masaüstü rol-yapma oyunlarıyla entegrasyonunu pek çok durumda verimsiz hale getirir.

Bu tez çalışması kapsamında, mobil bir masaüstü rol-yapma yardımcı uygulaması olan *myFRP* tanıtılıyor. *myFRP*, oyun yöneticileri ve oyuncuların mobil cihazlarında çalışır. *myFRP*, oyun-içi iletişim sistemi ve dijitalleştirilmiş minyatürler ve haritalar sistemi sağlayarak oyun deneyimini arttırmak amacıyla tasarlandı. *myFRP*'nin masaüstü rol-yapma deneyimi üzerindeki etkilerini incelemek, ve dijital yardımcı uygulamalar üretmek için kullanılabilirlik konusunda yeni fikirler edinmek amacıyla kullanıcı testleri ile yapılan bir araştırma yapıldı. Bu araştırma, toplam 30 katılımcıdan oluşan yedi masaüstü rol-yapma oyun grubuyla gerçekleştirildi. Grupların oyun oturumlarında *myFRP*'yi kullanarak kısa birer Dungeons & Dragons savaş senaryosu oynaması istendi. Oyun oturumlarının ardından katılımcılardan SUS, UMUX ve LTR anketlerini doldurmaları istendi. Bunu takiben, her grup ile birlikte *myFRP* hakkındaki görüşlerini almak için think aloud oturumları düzenlendi. Ayrıca, 31 katılımcıyla Roll20 uygulaması hakkında çevrimiçi bir anket yapıldı. Bu bulgular ışığında, katılımcıların *myFRP* ve Roll20'yi kullanışlı ve pratik buldukları ortaya çıkmıştır. Ayrıca, oyun yöneticilerinin oyunculara göre *myFRP* ve Roll20'nin kullanımını daha zor buldukları sonucuna ulaşılmıştır.

Anahtar Kelimeler: Masaüstü rol yapma oyunları, Rol Yapma Oyunları, Dijital Yardımcılar, Bilgisayar-Destekli Oyun Araçları

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ABBREVIATIONS

DM	:	Dungeon Master
GM	:	Game Master
NPC	:	Non-Player Character
PC	:	Player Character
RPG	:	Role Playing Game
TRPG	:	Tabletop Role-Playing Game

1. INTRODUCTION

People have been playing tabletop role-playing games (TRPG) since the concept was first introduced with Dungeons & Dragons in 1974. A TRPG is a form of role-playing game (RPG), in which players describe their characters' actions through speech. Actions succeed or fail according to a formal system of rules and guidelines, conducted by a player with the role of game master (GM). In Dungeons & Dragons, GM tailors and narrates the world of a medieval fantasy setting, and players take the role of their characters in the given world. Players describe their actions based on their characterizations. Successes and failures are determined by rolling dice and comparing the outcome with a certain number which GM sees fit.

Some problems with traditional TRPGs arise when the complexity of a game system makes it hard for players to focus on the enjoyable parts of the game. While playing tabletop role-playing games, players and game masters face the difficulty of dealing with lots of physical components to represent the in-game elements including characters, monsters, items, and props. Keeping track of character statistics and having to change variables at short intervals makes it hard for the players to keep up with the flow of the game. When the players are engaged in battles which include a large amount of different monsters with distinct statistics, the cognitive load of the GMs also increases. This makes the overall game experience suffer. Given this, one can wonder if these problems can be solved with the use of computers.

As technology has advanced, TRPGs have evolved as well. Traditional ways of using pen, paper, and dice have been changed by the usage of digital components including mobile devices, projectors, and interactive tables. Researchers have proposed a number of systems to enhance the TRPG experience. With Undercurrents (Bergström et al., 2010) researchers have proposed a computer-based gameplay tool for providing additional communication and media streams during TRPG sessions with the usage of laptop computers. With the latest research WEARPG (Buruk et al., 2016) researchers have introduced a new movement-based play style by integrating wearable devices.

Many commercial digital companion applications have been produced to create content, automate calculations, provide audio-visual media streaming, replace physical

components (dice, reference books, maps, and miniatures), create characters and track in-game variables. However, it is possible to argue that applications aiming to solve these issues work inefficiently in most cases; thus affecting the game experience badly. Designers of such applications should provide usable, efficient, effective, learnable, useful and satisfactory applications in order to improve TRPG experience; and this is discussed within the scope of this thesis.

Definitions of user experience and usability should be distinguished (Albert et al., 2013). Usability can be defined as the ability of the user to use the system to carry out the task successfully. User experience is defined as looking at the user's entire interactions with the system, as well as the thoughts, feelings and perceptions that result from that interaction. It is proposed that when evaluating technology, there are three primary elements to be concidered; the system, the interaction between the user and the system, and the experience of using the system (McNamara et al., 2006). Each of these elements respectively represents functionality, usability and user experience. These elements are not independent. As stated in the research, usability influences user experience. As a result, it can be said that the usability of a companion application will affect the overall gaming experience.

This thesis introduces *myFRP*, a mobile TRPG companion application which works as a digital assistant. This thesis is concerned with the effects of digital companions on the gaming experience, and usability of digital companions. Therefore *myFRP*, which aims to replace physical miniatures on combat maps and allow players to share hidden information among the party by providing a distributed system for both GMs and players to use, is tested with 30 participants. In order to measure usability; SUS, UMUX and LTR questionnaires were given to the participants. Think aloud sessions were done with the participants to have their opinions on *myFRP*. Results of the user tests are reviewed to have an understanding of usability of *myFRP* and the effects of *myFRP* on the users. Also, an online survey about Roll20 was conducted. The findings of these researches are aimed to help application developers to expand their knowledge regarding designing usable and practical applications. Additionally, the findings are aimed to fill the gap in the literature for the usability of tabletop role-playing companion applications.

In the following chapters, an overview of RPGs and integration of digital companions are given. Related research is provided, followed by a pre-study in which the use cases and features of an example set of commercial companion applications are examined. *myFRP* mobile tabletop role-playing companion application is presented, with a detailed explanation of its design and architecture. Conducted researches on *myFRP* and Roll20 are given. These chapters are followed by an analysis of the user test and questionnaire results. The thesis is concluded with proposed future work and reflections upon *myFRP*.

2. BACKGROUND AND RELATED WORK

This chapter provides an overview of the literature relevant to TRPGs in general, and computer supported role-playing activity. This chapter concludes with an overview of four example commercial applications that share similar features with *myFRP*.

2.1. TABLETOP ROLE-PLAYING

This section provides an overview of TRPGs and games derived from traditional TRPGs.

The term "role-playing" can be defined as any game in which a player controls a character in a game world and develops him or her throughout the course of play (Hindmarch, 2007, p.47). RPGs consist of a set of rules to engage players in a role-playing activity. TRPGs grew out of wargames in the 1970s starting with the most well-known Dungeons & Dragons. Most of the combat system related aspects of war games were carried onto TRPGs, but the biggest change was that players controlling only one character instead of controlling a squad or an army of combatants. Another change was the emphasis on one person, the game master (GM), facilitating the game world in which players put themselves into their characters' shoes and make decisions as if they were those characters.

In Figure 2.1, a TRPG group can be seen. An example Dungeons & Dragons game can be described as follows: The GM creates a world with its own history, pantheon, continent map, villains and heroes. Players prepare their characters by choosing their race and class combination among a set of combinations, including half-elf mage, human fighter, half-orc sorcerer and halfling rogue. Players roll dice and determine their characters' ability scores: Strength, dexterity, intelligence, wisdom, and charisma. When the gaming session starts, players and the GM gather around a table and act out their characters. The GM describes the environment the characters are in, such as "You are in a dungeon. The light is dim, walls are sticky and there is a breeze coming from the corridor that lies ahead of you. What do you do?" One of the players, whose character is an elf rogue responds with "I will search for the traps before I go further." The GM asks the player to roll a search skill check, to determine if that character can detect the hidden trap. The player rolls a 20-sided die, and the result is 18. The GM decides that the

character detects the hidden trap, and explains the situation: “You notice a loose stone, which will trigger a deadly trap if you step on it.” The players then decide to go through the corridor by avoiding that loose stone. Later on, the characters encounter with a skeleton. The GM rolls a six-sided die and decides that the skeleton hits the human ranger character. The character loses 4 hit points and is severely wounded. Other characters deal damage to the skeleton and beat it. The characters earn experience points and they loot gold, thus enabling their characters to face with stronger enemies later on. The game goes on as the story unfolds.

Figure 2.1: Role-Players at the Convention Burg-Con in Berlin 2009

Source: By Sargoth - Own work, CC BY-SA 3.0,
https://commons.wikimedia.org/w/index.php?curid=6071881

Mostly used materials to play TRPGs are polyhedral dice, sheets to take notes, rule books, and miniatures. A polyhedral dice set (Figure 2.2) mostly consists of a four sided tetrahedron, a six sided cube, an eight sided octahedron, a 10 sided pentagonal trapezohedron, a 12 sided dodecahedron and a 20 sided icosahedron. Players keep their

character's scores on their character sheet. Character sheets record a character's statistics including their description, ability scores, skill bonuses and penalties, equipment list and spell book with a list of usable and memorized spells. Rule books cover a system's rules about narration, combat system and description of the setting. Miniatures are usually small figures that represent characters or monsters. Miniatures placed on battle maps are often used to show the relative position of characters to one another. As stated by Cover (2010), miniatures exist more for showing spatial relationship than for immersing players visually. According to Wizards of the Coast's market survey results (Dancey, 2000), 56 percent of TRPG groups used miniatures in their games.

Figure 2.2: Polyhedral dice

Source: By Diacritica - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=12225034

The idea of playing around a table and role-playing the characters led to the development of live action role-playing games (LARP). In this type of RPGs, players play out their characters instead of describing their actions. Players dress up and carry props such as

swords, shields, and bows as their characters do. LARPs can be played with small groups to large groups of hundreds of players. LARP events are held in secluded places and usually take a day or two. Combat systems are simpler than in TRPGs; and usually, a rock-paper-scissors match resolves the randomizations instead of using dice.

Another type of RPGs is computer role-playing games (CRPG), in which players take the role of characters in digital environments. CRPGs, in general, are designed to mediate many aspects of the role-playing activity, such as storytelling, rules enforcement, and randomization. Single player CRPGs work as the basis for the experience and they handle character representation, narrative and combat; resulting in the experience being directed by the system, and a loss of freedom to the players. The first CRPGs were heavily influenced by TRPGs. They have been the adaptations of existing TRPGs, including Dungeons (Daleske et al., 1975) Ultima (Origin Systems, Inc., 1981) series, Might and Magic (New World Computing, 1986) series and Eye of the Beholder (SSI, 1991) series. CRPGs adopt the rules sets from their tabletop counterparts. These games differ from their tabletop counterparts by eliminating the need of the GM, automating character progression and narration. There are also other genres of CRPGs including massively multiplayer online role-playing games (MMORPG), action role-playing games (ARPG) and multi-user dungeons (MUD). Multiplayer CRPGs such as MMORPGs or MUDs are not specifically designed to be played in close proximity and therefore lack the degree of sociality found in TRPGs.

2.2. COMPUTER SUPPORTED TABLETOP ROLE-PLAYING

This section provides a brief overview of technical approaches for integrating digital components with TRPGs, as well as some notable work on digital tabletop games.

Extensive research has been conducted on computer supported TRPGs. The use of computers or computer assisted devices such as mobile devices, digital tabletop devices, head mounted devices and wearable devices are intended to incorporate and enhance the gaming experience in various ways, such as by decreasing downtime, increasing immersion, increasing physicality of games and replacing representations of the in-game characters or processes such as rolling the dice. According to Wizard of the Coast's market survey results, 52 percent of gaming groups want to buy software to help manage

the game and speed up combat. 42 percent of gaming groups currently play with computer assistance. This reveals that demand for software that assists TRPGs is high among TRPG groups.

One of the first notable examples of research on digital tabletop games is False Prophets (Mandryk et al., 2002). False Prophets was developed with the motivation of exploring the space between board games and video games, and leveraging the advantages of both. A custom sensor interface promoting physical interaction around a shared public display which encourages players to focus on each other rather than on the interface of the game was implemented. False Prophets allows players to move tangible playing pieces, such as pawns or pucks, around a shared map. For private information sharing, handheld computers are used. Players are separated into two hidden teams, and their goal is to discover which team each player belongs to by gathering clues and making observations.

One of the other notable examples of research on digital tabletop games is STARS platform (Magerkurth et al., 2003). This platform was designed specifically as a basis for integrating tabletop games in a digital environment which is supported by an interactive game table, a wall display, personal digital assistants (PDA) and audio devices. STARS platform was designed to be adaptive to a variety of games. It lets designers investigate the adaptations of traditional tabletop games to digital platform. Two games were developed for STARS platform. One of them is the adaptation of a board game with role playing elements called KnightMage in which players explore a dungeon filled with monsters and treasures. The game provides both cooperative and competitive gameplay. Players need to compete with each other for treasure, and at the same time they need to work together to survive against the monsters in the dungeon. An underlying motivation of adapting KnightMage was to show the features of the STARS platform, including its interactive game board and sound system. Player interactions and communications were sustained by using PDAs so that team communication could also be examined. These PDAs were used to show the character information to the players and to support player interaction by letting players send private messages to each other during gameplay.

Another example of research is Undercurrents (Bergström et al., 2010) which focuses on providing additional communication and media streaming during TRPG sessions. Undercurrents achieves this by providing a computer-based gameplay tool based upon a

client-server architecture. In Undercurrents, both real-time documentation and secret communication within the player group are handled by the software running on the notebook computers of players. Both visual presentations of game events and timing of audio are conducted by the GM. Undercurrents works as a support tool for any TRPG, and it is system independent. It helps by facilitating role-playing activity without actively controlling any parts of it, thus making Undercurrents different from the previously mentioned computer augmented tabletop game systems. However, one problem with Undercurrents is that players need to use notebook computers to interact with the system. Since notebook computers have become less popular and less accessible than mobile devices, using a mobile application with the same features as Undercurrents will be more accessible for users.

In another study, Bergström and Björk investigated 6 different computer augmented tabletop games (Bergström & Björk, 2014). One of the games, Wizard's Apprentice (Peitz & Björk, 2006), was designed to explore how computer technology could support two distinctly different target audiences in playing a board game together. Wizard's Apprentice was designed in order to explore different player interaction styles based on their level and frequency of participation in an unfolding game. Cards, miniatures, and dice are used as the sole input devices for computer-controlled multiplayer board games. The sensing technology was custom designed using RFID technology to detect tangible playing pieces at specific locations on the board. Players work together to defend a kingdom against evil forces. Another game, M.I.G., replaces the original tabletop game M.I.G. with a mobile application, thus automating bookkeeping in the game. While some advantages were found, there were many notable disadvantages. These include the fact that the game was vulnerable to unintentional interactions and that it was difficult to correct the ensuing mistakes, that the game took place between the user and the device instead of between user and user.

Tisch (Björk, 2012) is another project that augments tabletop board and role-playing games by providing an application running on Microsoft Surface. Tisch was developed to explore how technology can support and enhance tabletop gaming activities without becoming an obstacle or removing the players' agency over the rules. In Tisch, players can use an interactive map simultaneously with touch control and special tokens. Main

goal of Tisch is to reduce excessive effort. However, Tisch was not intended for immediate commercial resale, or even usage, but rather as a proof of concept.

TViews Table Role Playing Game (Mazalek et al., 2006) and STARS (Magerkurth et al., 2003) use interactive tabletops that embed support for rule mechanics. They both are designed to be able to make use of PDAs and provide ambient sound output for the specific games implemented on them. However, since PDAs are not as common and practical as modern mobile devices anymore, practicality of STARS and TViews falls below *myFRP*.

Focusing on card games, the TARBoard (Lee et al., 2005) makes use of cameras tracking markers to provide a tangible augmented reality game.

Prosopopeia (Jonsson et al., 2006) and Momentum (Jonsson et al., 2007) show how live-action role playing games can be computer-supported through the use of web-based applications and custom-built devices.

WEARPG (Buruk et al., 2016) integrates a wearable device to augment tabletop role-playing games and introduce new play styles.

Alongside the above mentioned projects which focus on augmenting tabletop games, it is worth noting that Trans-Reality Role-Playing Games (Lindley, 2005) have been proposed as a combination of tabletop, live action, and computer role playing games to form a single game form.

Examples given above contain the vital aspects of the activity within the computer system. This forces players to be restricted with the activity provided by these systems. Using these systems, players are unable to change the system to their needs and customize the content provided by system as they wish. One possible solution would be to use systems which can be integrated in and opted-out of gaming. Computer supported tools which are not the underlying basis for the gaming activity, but supporting the gaming activity can be considered. Instead of using hardwares and softwares to interpret and conduct the game rules, and update the game state; players use computer supported tools and control the game flow and update the game state. Players can consider

integrating computer supported gameplay tools to their activity if needed, instead of being dependent on them for the activity.

2.3. COMMERCIAL APPLICATIONS

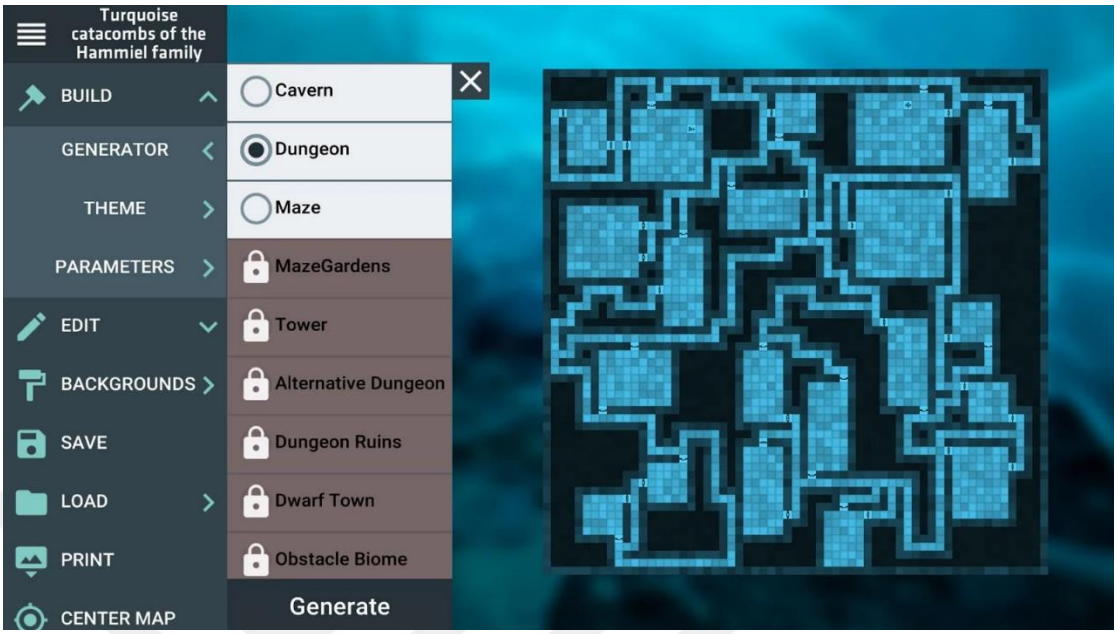
In this section, four commercial companion applications; including ProD&D Dungeon Generator (Gray Lake Studios, 2014), DM Minion for 5th Edition (Goathead Software, 2014), 3D Virtual Tabletop (Tap on Fire, 2012), and Roll20 (The Orr Group, 2012) are reviewed.

There are commercial examples for computer supported TRPG tools. Hero Lab **(**Lone Wolf Development, 2006**)** helps players create characters and keep track of their statistics. Campaign Cartographer (ProFantasy Software Ltd., 1993) and ProD&D Dungeon Generator are tools that helps GMs to create maps of various scales. Fantasy Ground (SmiteWorks USA, 2004) and Roll20 are tools that provide all-round solutions such as 3D dice, name randomization, map sharing, keeping track of the items; and they can be used on personal computers. Syrinscape Fantasy Player (Syrinscape, 2013) is a mobile application that is designed to play sound effects to increase immersion during gameplay. In the following sections, a set of example applications available for various platforms are reviewed in detail.

2.3.1. ProD&D Dungeon Generator

Developed by Gray Lake Studios, ProD&D Dungeon Generator (Figure 2.3) is an application for generating random maps for TRPGs, and is available on Google Play Store and Apple App Store. In ProD&D Dungeon Generator, users can change the parameters for random map generation and generate dungeons, mazes, castles and taverns. Users can place custom events including traps, ambushes and treasures. Users can share their maps with the community, and examine maps made by other users. ProD&D Dungeon Generator allows users to customize the background and apply themes on tiles to match with their desired map environment.

Figure 2.3: ProD&D Dungeon Generator



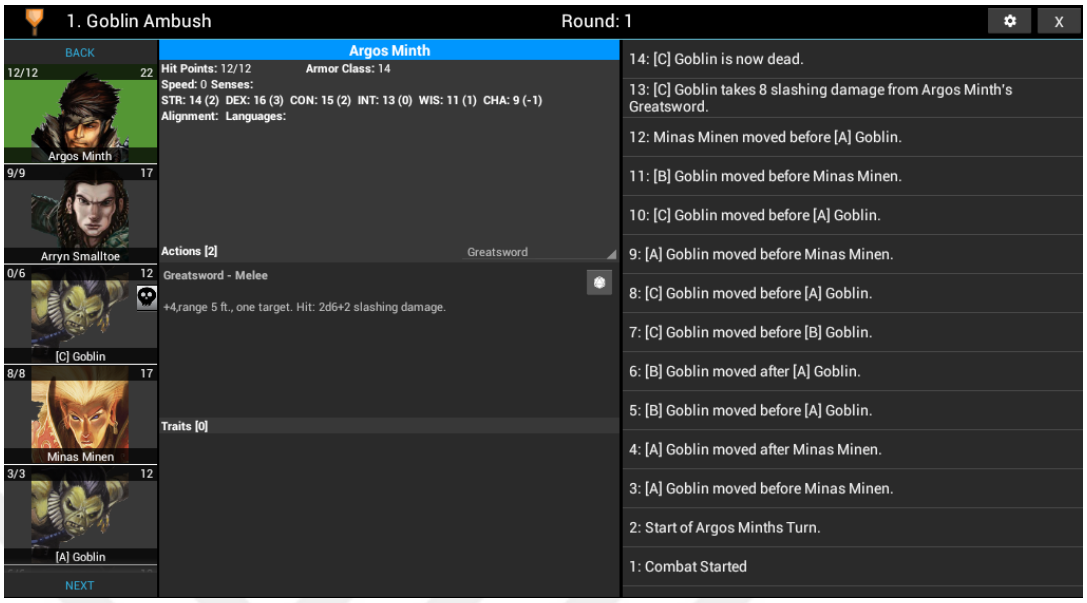
Source: https://play.google.com/store/apps/details?id=com.GrayLake.ProDnD_1

ProD&D Dungeon Generator has over 1600 reviews with 3.6/5 score on Google Play Store.

2.3.2. DM Minion for 5th Edition

DM Minion for 5th Edition is an application that features D&D 5th Edition monster database reference, virtual dice rolling, managing combat by automating initiative tracking, hp, action, conditions tracking and managing encounters. DM Minion for 5th Edition is available on Google Play Store. This is an application designed to be used by DMs.

Figure 2.4: DM Minion for 5th Edition



Source: https://play.google.com/store/apps/details?id=air.com.goatheadsoftware.dm5e

DM Minion for 5th Edition has over 300 reviews and 4.3/5 score on Google Play Store.

2.3.3. 3D Virtual Tabletop

3D Virtual Tabletop is an application that aims to replace the battle mat and miniatures by letting the users move game tokens and counters on a virtual map. Users can switch between top-down view and 3D view, zoom-in and zoom-out views, enable/disable fog of war, save encounters and scenario, customize miniatures by changing their names and visuals, and add their own maps. 3D Virtual Tabletop is released on Google Play Store, Apple App Store and is available as an online app that runs on browsers.

Figure 2.5: 3D Virtual Tabletop

Source:
https://play.google.com/store/apps/details?id=com.taponfire.threedvirtualtabletop

In 3D Virtual Tabletop, users need to be in close proximity to look at the mobile device the app is running on. Another option is that the visuals can be sent to a bigger screen via Android Cast feature.

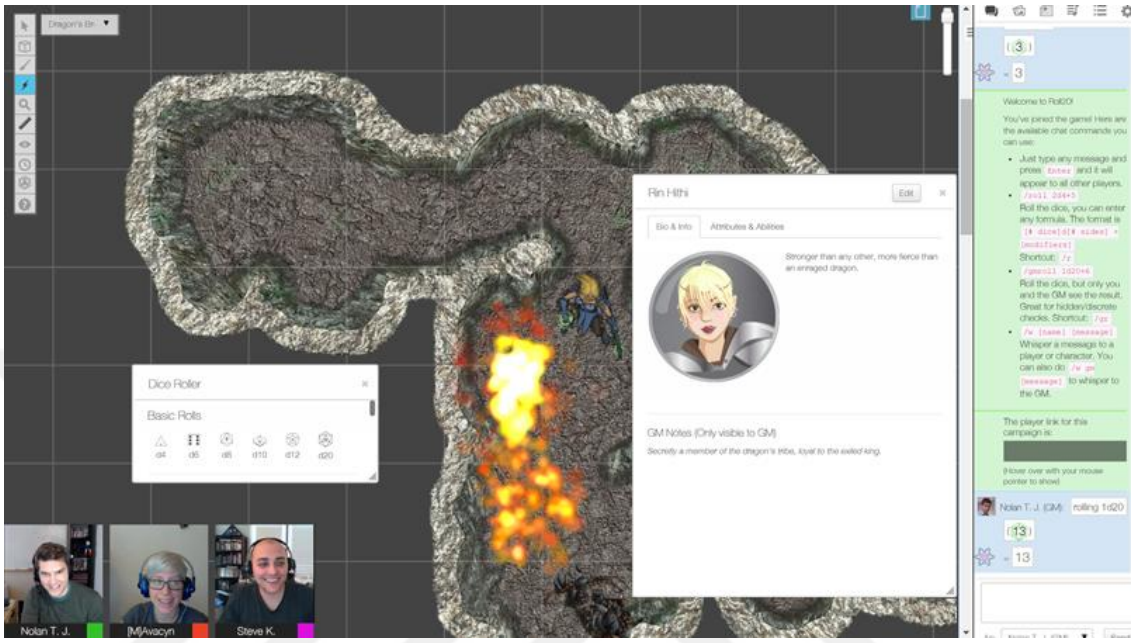
3D Virtual Tabletop has over 2500 reviews and 4.0/5 score on Google Play Store.

2.3.4. Roll20

Roll20 is a multi-platform application that provides all-round TRPG solutions including a variety of community-contributed character sheets for most popular gaming systems, a map and token system with dynamic lighting and wall drawing, voice and video chat features to help users see and hear their group members, and digital dice system. Roll20 is available as an online application that runs on browsers and as a mobile application that can be installed on Google Play Store and Apple App Store. Features of the mobile applications are limited with player-centric features; which includes digital dice, character sheets, handouts, and rules (compendium). Mobile versions also provide text

chat feature. Browser version not only provides all the features of the mobile version, but it also provides tokens, maps, voice chat, video chat, and other tabletop functionality.

Figure 2.6: Roll20



Source: https://wiki.roll20.net

In Roll20, users don't need to be in close proximity to look at a central mobile device or PC that the application is running on. Mobile users and browser users can join the same hosted campaign.

Roll20 is among the most popular digital TRPG companion applications. As stated in a blog post (The Orr Group, 2017), Roll20 has hit 2 million users in January 2017. Most popular game played on Roll20 is Dungeons & Dragons 5th Edition. As shown in The Orr Group Industry Report: Q2 2017 (The Orr Group, 2017) 52% of all games on Roll20 are Dungeons & Dragons 5th Edition games, and 62% of Roll20 users actively joined in a Dungeons & Dragons 5th Edition game in Q2 2017.

3. METHODOLOGY

In this chapter, the proposed research is explained in detail. This chapter starts with the detailed explanation of the research domain. Following that, *myFRP*, the application produced in scope of this research is explained in detail. Application production of *myFRP* is covered, giving insights about the design procedure and development details. Following that, the methods used to measure usability are given. The questionnaire given to the participants of the user test and the online survey, use case scenarios, detailed information about the participants, and data collection methods are given. Additionally, this chapter explains each research (*myFRP* and Roll20) in detail, by explaining the research setup, participants and data collection methods.

3.1. RESEARCH DOMAIN

To have an insight on the definition and usability of digital tabletop role-playing companions, the broad definition of digital companions in the context of usability were needed to be narrowed down to cover only mobile applications. As a pre-study, mobile applications on Google Play Store are searched with the given keywords: “tabletop role playing”, “tabletop rpg”, “rpg tools”, “rpg companion”. Due to work load, the search results were pruned to exclude the applications which are unpopular. Only the applications which had 50+ reviews are included in this research. Features of top 97 applications are sorted into the following seven categories:

- Dice
- Audio
- Reference
- Character Sheet
- Map / Miniature
- Tracker
- Content Generator

Applications with the **Dice** feature handle randomization of parameters, or acting as real dice. They either simulate a rolling die with physics, or just provide numerical output of a die result. Most frequent dice options are as follows: d4, d6, d8, d10, d12, d20.

Audio applications allow GMs play music or sound effects to create an immersive gameplay experience. Background ambient music of a tavern environment or forest environment can be played as suits. When a GM describes a fire spell being cast, a flame sound effect can be played.

Reference applications replace the rule books by providing digital version of books and references of rules systems. Most reference applications are bookmarked and provide an easy way to search the content.

Character sheet applications record a character's statistics. Most character sheet applications guide players through character creation process by providing calculations of the character's statistics. Not limited to that, character sheet applications also let players store and modify their character's numerical values.

Map / Miniature applications replace physical miniatures, battle grids and visual representations. Players and NPCs are represented with 2D/3D tokens on grid-based maps.

Tracker applications track initiative, hit points or experience points of characters. Some tracker applications aim to reduce the GM's cognitive load during combat. Some tracker apps are for tracking the persistent data between sessions (like journals, quest logs, etc.)

Content Generator applications generate random names, characters, narrative plots, city names, encounters, campaign ideas, maps, insults, dramatic effects, etc.

As seen in Table 3.1, the pre-study revealed that dice feature is the most commonly found feature in mobile applications. Following that, content generation feature and reference feature share the second place. Tracker feature takes the third place. It is worth to note that popular features do not necessarily reflect the demand on them. Features that can be developed with less resources are likely to be included in projects more. Common features like dice rolling, content generation and reference are easier to develop rather

than implementing map/miniature systems. In order to develop an application that offers dice rolling feature, a simple randomization and calculation logic needs to be implemented. However, in order to provide a map/miniature system; a complex grid system with movement logic and token visualization logic need to be implemented. Including a good amount of content such as a variety of audio effects and music tracks to played or token/miniature visuals to be displayed require more resources to include in an application.

Table 3.1: Tabletop role-playing application research on Google Play Store

Dice	32
Audio	4
Reference	23
Character Sheet	15
Map / Miniature	9
Tracker	16
Content Generator	23

Source:
*h*ttps://docs.google.com/spreadsheets/d/1f0Ogk_gCP4SiTYfP1s8jzuybC9Mp7b1rVfuH00m23fg/edit

3.2. myFRP APPLICATION

myFRP was developed in scope of this thesis to understand the effects of certain design decisions on the usability of a digital tabletop role-playing companion.

myFRP is an application produced by a single person; who happens to be the researcher, designer of the application and also the developer of the application. Total duration of designing and developing the application was 5 months.

In the following two sub-sections, the design decisions and the development processes are explained in detail.

3.2.1. Design

The starting point for myFRP was to explore how an accessible and easy to use mobile application could improve the tabletop role-playing activity by providing good user experience. To decide on what features myFRP should have, insights from the pre-study were used. In addition to the pre-study's results, the researcher's prior experience in TRPGs revealed that players need a solution for the problem of using physical miniatures and maps. Additionally, a need to solve the problem of not having a chance to make in-game hidden communication was also considered. Therefore, myFRP was decided to be designed to provide a map/miniature system and an in-game communication system.

Tabletop role-playing gaming groups play a wide variety of tabletop role-playing games, ranging from products like Dungeons & Dragons, Pathfinder Roleplaying Game (Paizo Publishing, 2009), Numenera (Monte Cook Games, 2013), Mutants & Masterminds (Green Ronin Publishing, 2002), Star Wars Roleplaying Game (Wizards of the Coast, 2000) and Dungeon World (Sage Kobold Productions, 2013). Each of these products have their own rule systems and settings. Stories take place in various environments; including medieval fantasy worlds, modern vampire worlds and outer space. Contrary to Stars and TViews, choosing a specific rule system and setting seemed to limit the accesibility of myFRP.

TRPG groups usually see the extra peripherals as cumbersome and limiting the gameplay experience, drawing the focus away from the gaming activity. One lesson learned from other applications is that myFRP should require the minimum attention and focus to not affect the gameplay experience by slowing down the gaming activity.

Not bringing the required materials to the gaming session is a common problem among most tabletop role-playing gaming groups, and it usually results in delaying or canceling the gaming session. myFRP users needed to be independent on the application for tabletop role-playing gaming activity. myFRP could be added or removed as fits to any gaming session.

According to a research (Carter et al., 2014), the physicality of dice played an important role in improving the gameplay experience compared to the digital counterpart. As

myFRP was designed, leaving randomization and dice rolling to physical domain by letting players roll their physical dice was concidered.

As stated in Wallace's study (Wallace et al., 2012), game automation can negatively impact enjoyment, game state awareness, and flexibility in gameplay. It was considered to not enforce any rules on the play style or automate any rules systems in map/miniature and in-game communication systems for *myFRP*.

With the above in mind, four essential design goals were set. These design goals worked as constraints for taking the design decisions. The design goals are listed below:

- myFRP should be easy to use before and in the course of a game session.
- myFRP should not demand the users' undivided attention.
- The users should not depend on myFRP to run their gaming session.
- myFRP should work in a distributed fashion by catering to a multitude of devices a group owns.

myFRP was initially designed to accomodate multiple use cases and features. Listed below is the first draft of the main features that myFRP was planned to provide:

- **Map / Miniature** system, which players can move their character tokens on the map which the GM has created before the game session.
- **Character sheet** system, with which the players can keep the record of their character's statistics.
- **Tracker** system that keeps track of hit points, initiative scores, turn indicator of each character and non-player character in a combat.
- **Communication** system that provides a structure in which the players and the GM can communicate with each other.

After considering the time limitation and the design goals, the most useful features were chosen and those that do not correlate with the design goals were removed or modified.

Map / Miniature system was considered as the most essential feature of myFRP. The GM needs to prepare maps before the game session. It was planned to be used in a way that the GM could create their own maps by either generating, or drawing. Maps could

be generated using certain parameters such as width of rooms, number of rooms, corridor length and number of buildings. Map drawing could be done by drawing on blank canvases using a set of building blocks including wooden walls, stone walls, stone floors, and lava floors. However, map generation and drawing features were removed due to the development overhead. Remaining features included players having a visual representation of their character as a form of a token; GMs managing existing map pictures and placing encounters of non-player characters on them. As a result, GMs could use the map / miniature feature before the game session to manage the maps and encounters, during the game session to provide a ground for the players to move their tokens on and reveal / hide the prepared encounters. Additionally, players could use this feature to create their characters before the game session and move their characters on the map during the game session.

Character sheet feature targeted physical character sheets to become obsolete. Character sheets existing only in the digital domain could be easy to manage. However, myFRP was aimed to be system independent. Character sheets vary from system to system, and this feature was opted out to decrease the complexity of design and development of the application.

Tracker feature was planned to be included in myFRP to keep track of the characters' and NPCs' combat related scores such as initiative score, hit points and combat effects. Combat related scores happen to be system dependent. In Dungeons & Dragons, each character has an initiative score to determine who goes first in a round, but Cypher system (Numenera, The Strange) provides a simple initiative system to determine which group (players or NPCs) goes first in a round. Since myFRP was planned to be used without much effort, asking the players to give input often was not adhering by the design guidelines. As a result, Tracker feature was excluded from myFRP.

Communication feature was intended to solve the problem of hidden information sharing between the players and the GM during a game session. Usually, GMs use impractical methods to share hidden information with a player. These methods include whispering into the player's ear, going to another room to talk, or writing on a paper and passing it to the player. These methods reveal the recipient, if not the message itself. In

order to provide a medium where a GM can reach out to a player about a message only that player should know, a simple chat system was planned to be included in myFRP.

As a result, myFRP was designed to be an application that would be used by the GM and the players using their mobile devices. Before the game session, the GM can arrange the encounters by chosing a map from a set of maps, naming the encounters, attaching NPCs to these encounters and placing those on the map. Players can create their character token before the game session. During the game session, the GM can host a networked session for the players to join in, and show/hide maps, encounters and move NPC tokens on the map. The players can move their character tokens on the board during the game session. Both the players and the GM can use myFRP to send private messages by using the in-game chat system.

3.2.2. Development

myFRP was developed with Unity game engine, using C# programming language. *myFRP* is not a video game, but an application which relies heavily on making use of a game engine's user interface (UI) and networked communication systems. Unity provides many technical possibilities, including an easy workflow for UI design and development, easy data loading/saving, frameworks for handling networked communication within peers and exporting for multiple mobile platforms with ease. Regarding the developer's prior experience with Unity and the technical possibilities Unity provides; Unity was chosen as the main development environment.

myFRP can be divided into three sub-systems. These sub-systems are:

- User interface
- Persistence
- Networking

User interface implementation of *myFRP* was based on the Model-View-Controller software architecture pattern.

A custom persistence service was implemented to make persisted data accesible anywhere within the project. Persistence handles data storing and retrieving on the disk.

GM module's saved encounters and characters are stored on the disk and are retrieved upon request.

To implement the networked communication feature, several third party solutions were surveyed and tested beforehand. First tested networking solution was Henry Smith's highly anticipated local multiplayer framework for Unity, Captain's Mess. Captain's Mess provides a local multiplayer infrastructure in which players can create and join games in the local network, thus eliminating the necessity of being connected to the internet. However, Captain's Mess was still under development and it was lacking proper documentation. The following package considered was GameSparks. GameSparks is a backend as a service platform. With GameSparks, developers can work on the client side without deploying any backend applications on the servers side. Features such as matchmaking, lobby system, social authentication, achievement system and database access are provided to the users. The reason why GameSparks was not used is that it had a steep learning curve.

Photon Unity Networking solution was used in *myFRP*. Photon is well documented and is easy to use. All features which GameSparks provides are also available in Photon. Easy to follow tutorials, example projects and chat UI features were the main reasons why Photon was used in *myFRP*.

For networked connection, one of the methods of connecting mobile devices in a networked session is to use a host/client architecture. In this type of architecture, one of the clients acts as a host, and other clients can join the session of this host. Host can create a room with a name where players can join in *myFRP*.

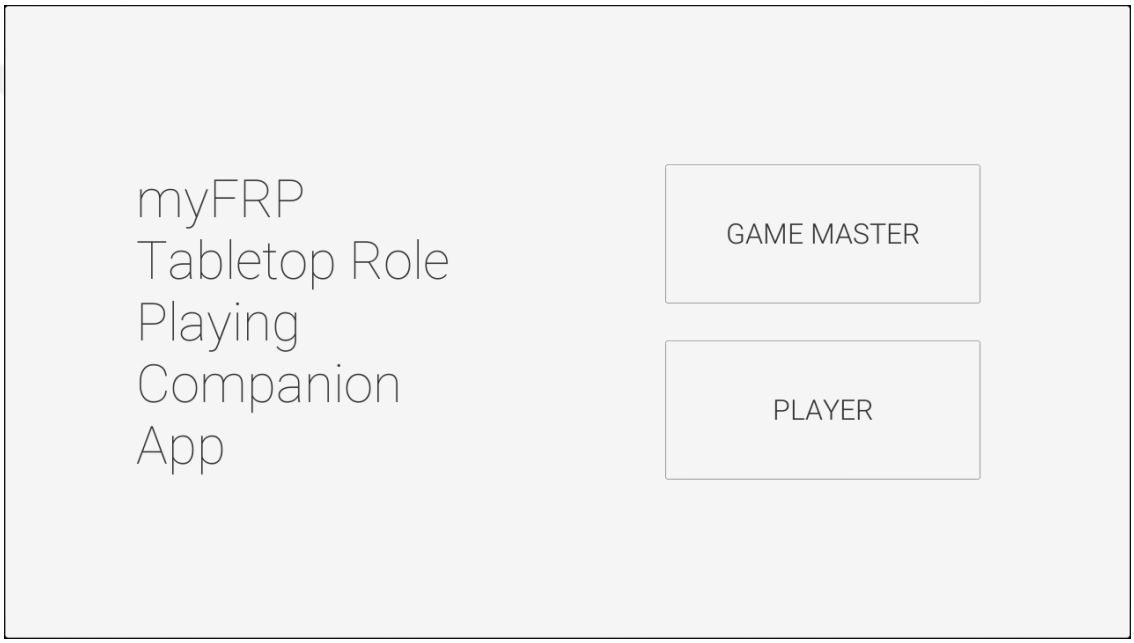
Chat system in myFRP was implemented using Photon Chat UI Kit. Photon provides a messaging functionality in its core SDK, but a UI solution is not available for free. Photon Chat UI Kit is an add-on to Photon, and can be purchased on Unity Asset Store. Photon Chat UI Kit provides a chat panel, in which users can send messages to other users in the same room. Users can type in any text message or use emojis to send to other users.

Unity can export project for platforms such as Android, iOS and Windows. *myFRP* was designed and implemented in a way that can run on both Android and iOS platforms. For this purpose, none of the platform dependent features or SDKs were used.

3.2.3. UI Flow

After launching *myFRP*, users see the main view shown in Figure 3.1. Game Master button navigates to the Game master view. Player button navigates to the join view.

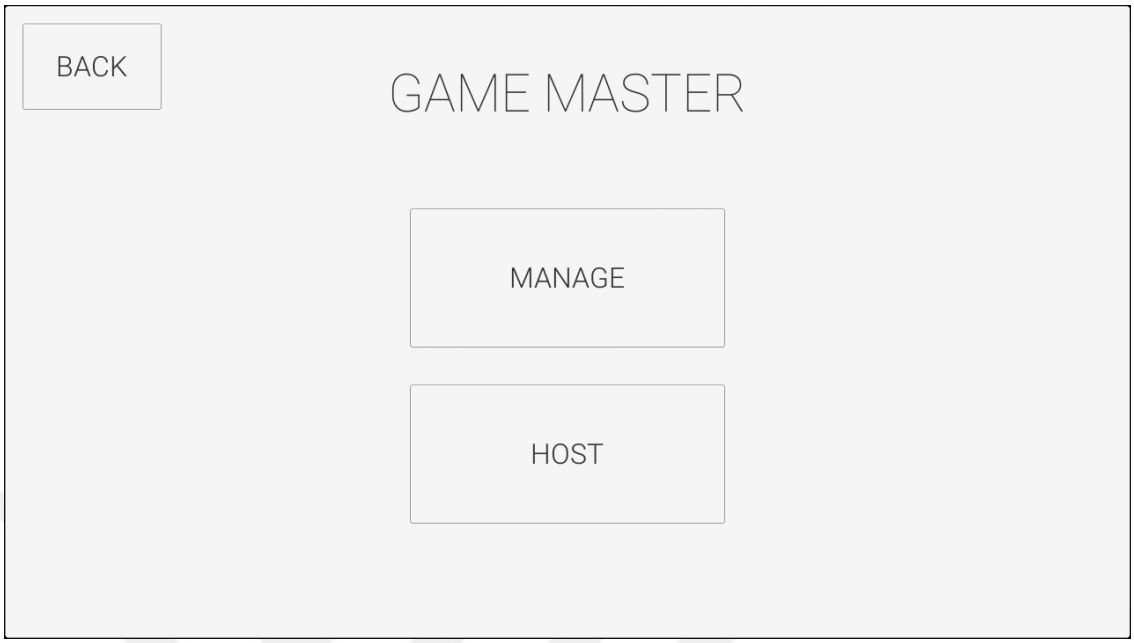
Figure 3.1: myFRP main view



Source: myFRP application

In the Game master view (Figure 3.2), there are two buttons. Manage button navigates to the map management view and puts users into map, encounter and NPC management flow. Host button navigates to the host view.

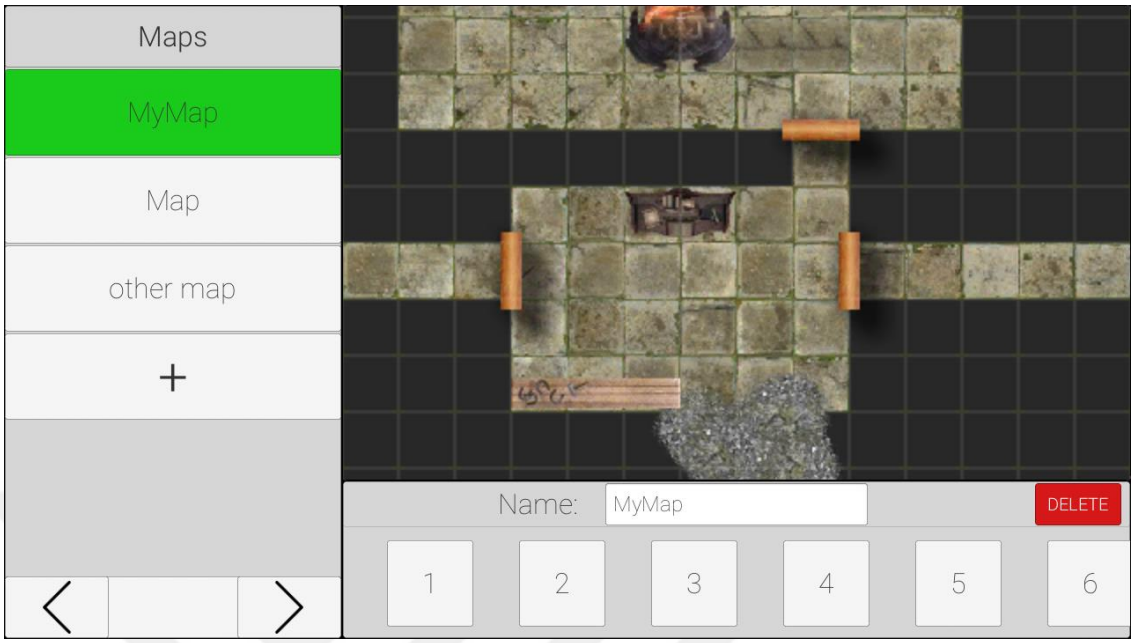
Figure 3.2: myFRP game master view



Source: myFRP application

Map management view (Figure 3.3) has a left panel, a bottom panel and a map panel. On the left panel, a list of maps is visible. Plus button at the bottom of the list adds a new map into the list. Left button at the bottom of the left panel navigates back to the game master view. Right button at the bottom of the left panel navigates to the encounter management view, but is tappable only if a map is selected from the list. At the bottom panel, there is a scrollable list of numbered buttons. When the user taps on a numbered button, currently selected map's picture changes. Name input field changes the name of the selected map. Delete button deletes the selected map. Map panel can be dragged around and map picture can be zoomed in/out with pinch gestures.

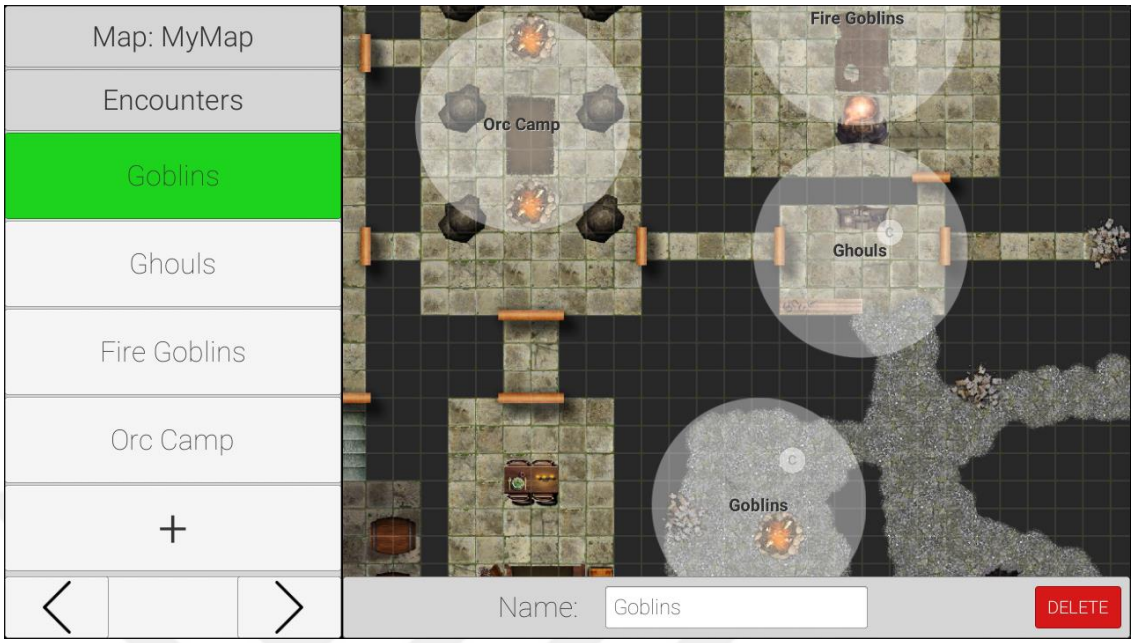
Figure 3.3: myFRP map management view



Source: myFRP application

Encounter management view (Figure 3.4) has a left panel, a bottom panel and a map panel. On the left panel, a list of encounters is visible. Current map's name is visible at the top of the list. Plus button at the bottom of the list adds a new encounter to the current map. Left button at the bottom of the list navigates back to the map management view. Right button at the bottom of the list navigates to the character management view, but is tappable only if an encounter is selected from the list. At the bottom panel, name input field changes the name of the selected encounter. Delete button at the right side of the bottom panel deletes the selected encounter. Map panel can be dragged around and map picture can be zoomed in/out with pinch gestures. Encounters are represented as semi-transparent circles on the map, with their names on the circles. Encounters can be dragged around the map.

Figure 3.4: myFRP encounter management view



Source: myFRP application

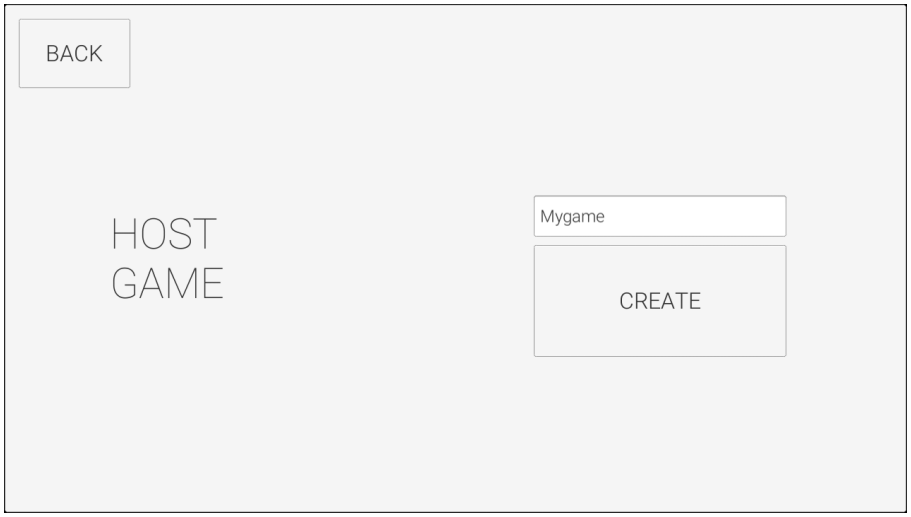
Character management view (Figure 3.5) has a left panel, a bottom panel and a map panel. On the left panel, a list of characters is visible. Current map's and current encounter's names are visible at the top of the list. Plus button at the bottom of the list adds a new character to the current map. Left button at the bottom of the list navigates back to the encounter management view. At the bottom panel, name input field changes the name of the selected character. Delete button at the right side of the bottom panel deletes the selected character. Initial input field changes the character's text visible on the token. Color button opens a pop-up panel with R, G and B sliders. R, G and B sliders change the character token's color by adjusting red, green and blue values. Size slider at the bottom panel was designed to adjust the character token's size, but this feature was not implemented due to time constraint. Map panel can be dragged around and map picture can be zoomed in/out with pinch gestures. Current encounter is represented as a semi-transparent circle on the map, with its name on it. Character tokens are represented and can be dragged around the map.

Figure 3.5: myFRP character management view

Source: myFRP application

Host view (Figure 3.6) has an input field, a Create button and a Back button. Input field sets the game session's name. Players can join the game session by entering this name in the join view. Create button creates a game with the given name, and navigates to the game view – GM mode when the connection is established. Back button navigates back to the game master view.

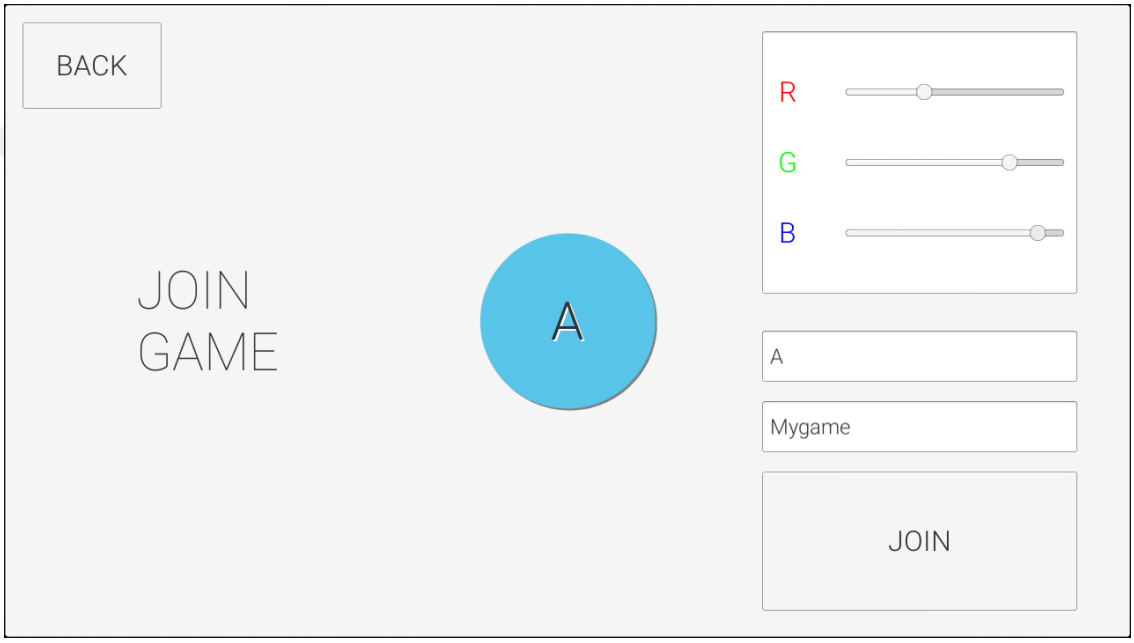
Figure 3.6: myFRP host view



Source: myFRP application

In Join view (Figure 3.7), players can adjust the look of their character token and type in the game session name they will join. Back button navigates back to the main view. R, G and B sliders change the red, green and blue color values of the character token. Initial input field changes the letters visible on the token. Game name input field declares which game session player will join. Join button navigates to the game view – player mode when the connection is established.

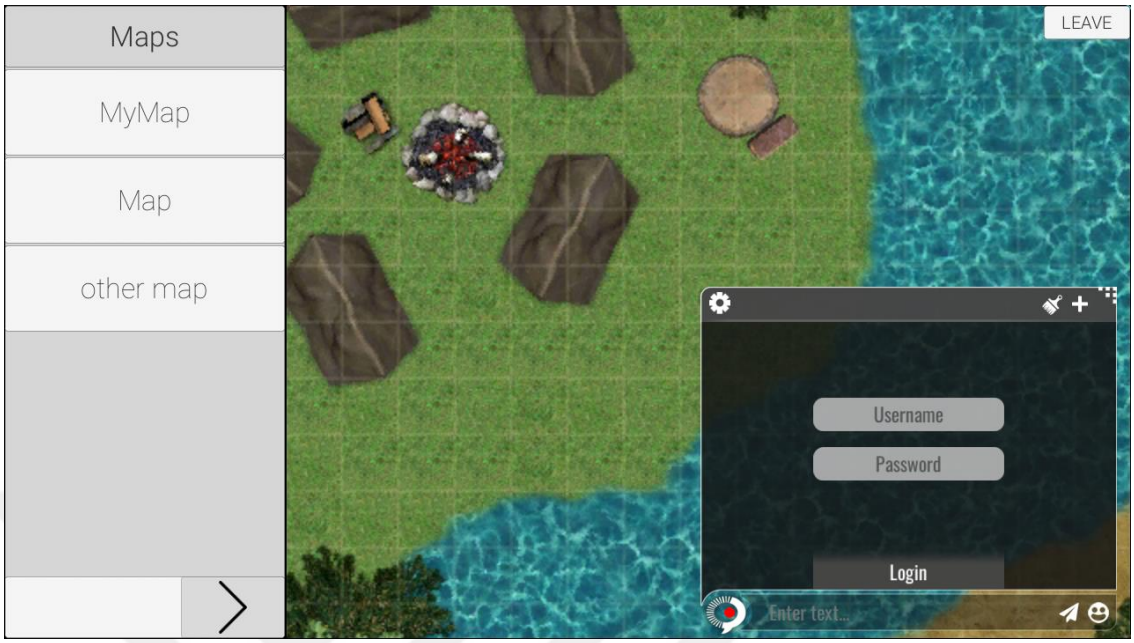
Figure 3.7: myFRP join view



Source: myFRP application

Game view – GM module – map management (Figure 3.8) has a left panel, chat panel, map panel and a Leave button. On the left panel, a list of previously managed maps is visible. Right arrow button at the bottom of the list navigates to the game view – GM mode – encounter management, but is tappable only if a map is selected from the list. Map panel can be dragged around. Leave button closes the current game session and navigates back to the Host view.

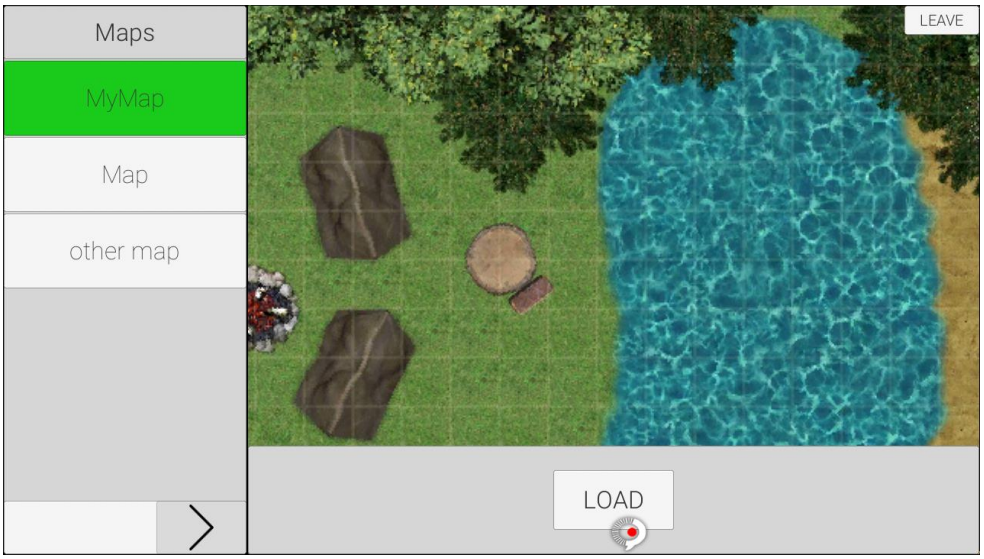
Figure 3.8: myFRP game view – GM mode – map management



Source: myFRP application

As seen in Figure 3.9; when the user taps on a map name in the list, a panel with a Load button appears at the bottom. Load button loads the map, changing the map picture on all clients connected to the current game session.

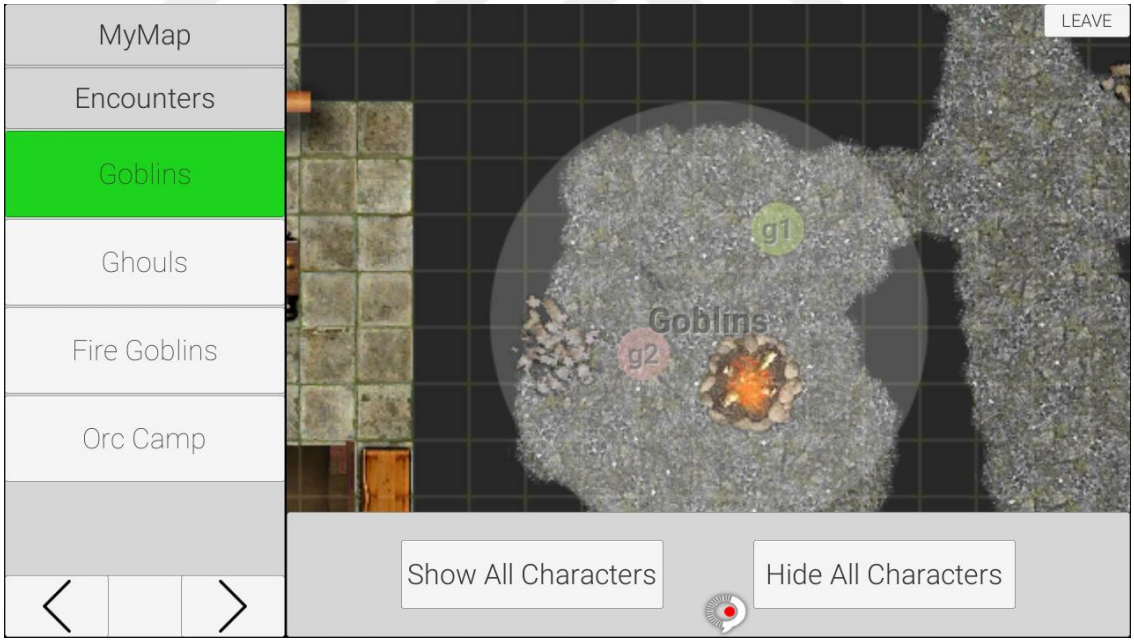
Figure 3.9: myFRP game view – GM mode – map management, load button visible



Source: myFRP application

Game view – GM module – encounter management (Figure 3.10) has a left panel, bottom panel, chat panel, map panel and a Leave button. On the left panel, a list of previously managed encounters is visible. Current map's name is visible at the top of the list. Left arrow button at the bottom of the list navigates back to the Game view – GM mode – map management. Right arrow button at the bottom of the list navigates to the Game view – GM mode – character management, but is tappable only if an encounter is selected from the list. A semi-transparent encounter circle and semi-transparent character tokens are visible on the map. Map panel can be dragged around. Leave button closes the current game session and navigates back to the host view. At the bottom panel, there are two buttons as Show All Characters and Hide All Characters. Show All Characters button reveals the characters in the current encounter to all clients. Semi-transparent character tokens become opaque and can be moved around the map. Hide All Characters button hides the characters in the selected encounter.

Figure 3.10: myFRP Game view – GM mode – encounter management

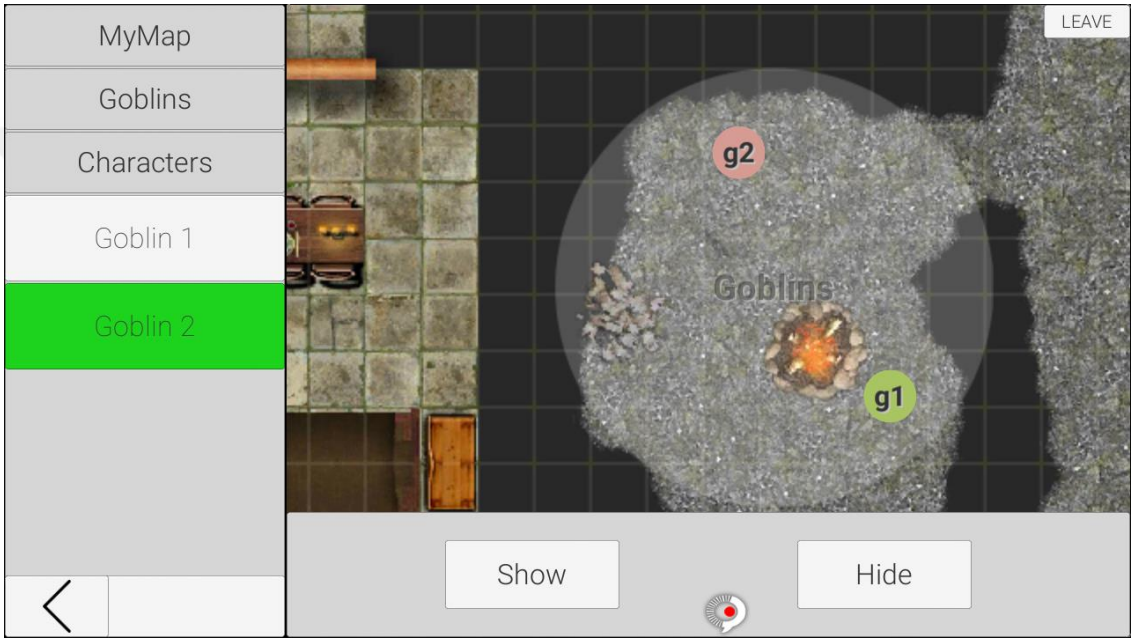


Source: myFRP application

In the game view – GM module – character management (Figure 3.11), there is a left panel, a bottom panel, a chat panel, a map panel and a Leave button. On the left panel, a list of previously managed characters is visible. Current map's and encounter's names are visible at the top of the list. Left arrow button at the bottom of the list navigates back

to the myFRP game view – GM mode – encounter management. A semi-transparent encounter circle and semi-transparent character tokens are visible on the map. Map panel can be dragged around. Leave button closes the current game session and navigates back to Host view. At the bottom panel, there are two buttons as Show and Hide. Show button reveals the selected character to all clients. Semi-transparent character token becomes opaque and can be moved around the map. Hide button hides the selected character.

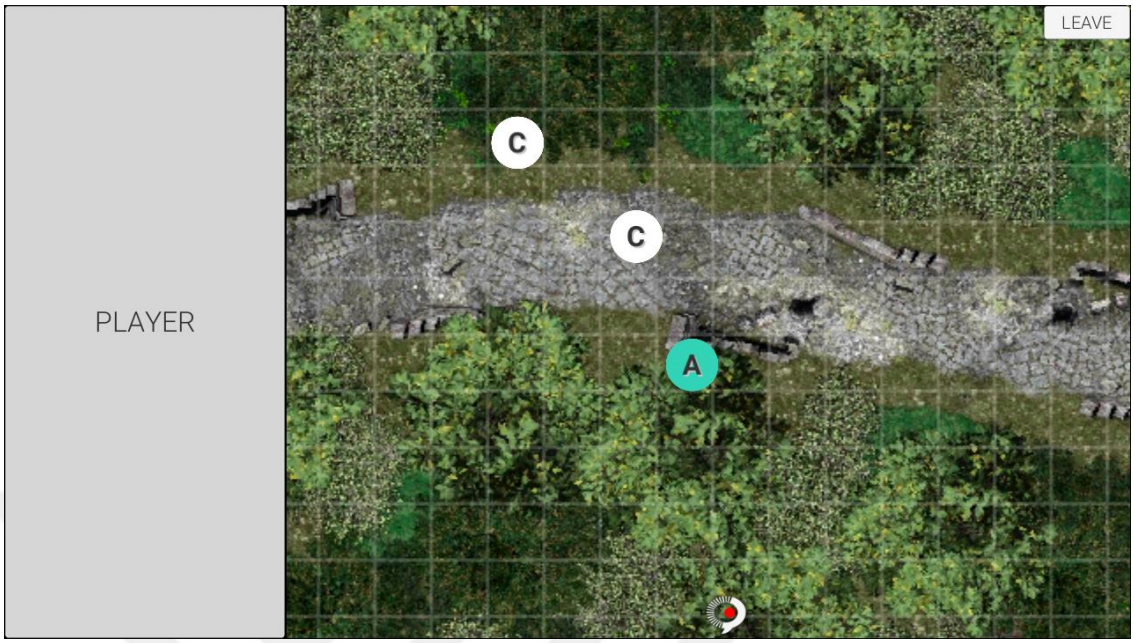
Figure 3.11: myFRP game view – GM mode – character management



Source: myFRP application

Game view – player mode (Figure 3.12) has a blank left panel, map panel and a Leave button. Left panel was planned to display the information relevant to the character, but this feature was not implemented. Map panel can be dragged around. Map's picture can change when the GM loads a map. Positions of the character tokens of other players and NPCs can change. Leave button disconnects from the game and navigates back to the join view.

Figure 3.12: myFRP game view – player mode



Source: myFRP application

As seen in Figure 3.13, the chat view has a user name and password input fields, and a login button. User can type in a user name and password to access to chat functionality. In chat view, a user can select a tab to write to a user in a private channel or write in the public channel. Chat view has the same look for all players and the GM. Chat view can be minimized by tapping on the chat icon at the bottom.

Figure 3.13: myFRP chat view

Source: myFRP application

3.3. USABILITY

To understand the usability of a system, a questionnaire was compiled with methods used by researchers to measure user satisfaction, system's effectiveness and efficiency. The questionnaire included the following questions:

- Demographics
- System Usability Scale (SUS)
- Usability Metric for User Experience (UMUX)
- Likelihood to Recommend (LTR)

The System Usability Scale (SUS), originally created by John Brooke in 1986, is a 10 item Likert scale which provides a quick and dirty, yet robust and reliable tool for measuring the usability of a system (Brooke J, 1996). SUS has become an industry standard for evaluating a wide variety of products and services. SUS was used to measure the usability of *myFRP* and Roll20.

Usability Metric for User Experience (UMUX), designed by Finstad (2010), is a four item Likert scale used for measuring perceived usability of a system. UMUX is designed to provide results similar to SUS. Participants' age, gender and mother language differences do not effect the results, as stated in Berkman's research (2016); thus making UMUX a reliable method. UMUX was used as a method for measuring the usability for both researches.

Likelihood to Recommend (LTR) is a scale to understand a user's satisfaction with a product or service. LTR was used to measure a user's likelihood to recommend *myFRP* and Roll20 to their friends.

3.4. RESEARCH DESIGN

Two researches have been conducted in scope of this thesis. Firstly, *myFRP* was tested on users to have an understanding of the system's usability. The research was conducted with 30 volunteers, who had prior experience with TRPGs. Users were asked to play a Dungeons & Dragons session of 15-45 minutes long, with the provided pre-made character sheets and dice. Secondly, an online survey with 31 participants were done to

have an understanding of Roll20's usability. In this section, details about the researches are given.

3.4.1. myFRP Research

3.4.1.1. Setup

Players were given six Dungeons & Dragons 5th Edition character sheets and were asked to choose one among them. All the pre-made characters were third level, with various race and class combinations consisting of a dwarf fighter, an elf wizard, a human cleric, a half-elf rogue, a half-orc barbarian and a gnome bard. Each GM were asked to prepare a quick combat-oriented scenario.

myFRP was installed on six Android tablets. Structure of the sessions are as follows:

- Purpose of the research was explained to the participants.
- *myFRP* was introduced to the participants.
- Players were given a few minutes to examine the pre-made character sheets and were asked to choose one among them.
- GM was introduced with the GM mode of *myFRP*. A walkthrough of the features were given.
- GMs used *myFRP* to manage the maps, encounters and NPCs before the gameplay session started.
- When GM was done with preparing a map with encounters and NPCs, Players launched *myFRP* and prepared their characters.
- GM hosted a game.
- Players joined the game hosted by GM.
- Participants played a 15-45 minutes session of Dungeons & Dragons 5th Edition.
- GMs used *myFRP* during the gameplay session to load the prepared maps and encounters, to reveal/hide the non-player characters (NPC), and to change the position of the NPCs.
- Players could used the application during the gameplay to manage their characters' position.
- At the end of play session, a questionnaire was filled by participants.

- At the end of questionnaire, a think aloud session was held.

An RPG convention (YILDIZCON) is being held at Yildiz Technical University annually. Participants volunteered among the convention audience. A table was given to the researcher at the convention area. Android tablets were being displayed on the table. To draw the attention of participants, a sign saying "*myFRP*, experiment with reward" was kept on the table. The rewards were displayed on the table.

A game jam, where participants come together and develop video games in 48 hours, was held at Bahcesehir University. A remote table, which had a similar layout with the one at YILDIZCON was used.

Pokemon cards were given to each participant at the end of the sessions as rewards for participating the research.

In this research, play sessions were recorded on video. Think aloud sessions were recorded on audio. During the think aloud sessions, participants were asked to give feedback about their experiences. Following questions are asked to the participants as prompts:

- Would you use the app in your games?
- Was the app easy to use?
- Would you prefer using the app on only one device?
- Would you prefer using paper or battle mat in the physical domain over the app?
- What kind of features would you like to see in this app?
- GM: Was the app easy to use before the game?
- Would you use this app during non-combat times or combat times?
- Would you like an addition to this app that eases the calculations?
- Would you like the dice to be in digital?
- How would the app be like if there were no bugs or technical problems, and would you use that version of the app?
- How did you find tokens not snapping onto the tiles?

- Would you like to see any other features, such as an initiative tracker, a combat stats tracker, a turn tracker, rulebooks, a life tracker in this app?
- Did you need to use chat? Would you use the chat feature, or would you rather whisper in the GM's ear?
- Did you need something on the map to show the distances and directions?
- Would you like to see special effects for fireballs, lightning, etc.?
- Would you like to see a map generation feature? Would you use it?
- Could you and your party go on with your game if you didn't have your device with you?
- Is it hard to use both physical dice, papers, sheets and the digital app? What about the cognitive load for GM?
- Would you like to change the map features on the fly? (destroy an object, burn a tent, open a door, etc.)
- Would you use this app on a mobile phone?
- Did you need any other grid options, such as hexagon grid and scalable grid structure?
- How much would you pay for this app?

3.4.1.2. Participants

30 participants volunteered to participate in the user tests. All 30 of the participants were chosen among volunteers who had prior tabletop role-playing experience. Age of the participants ranged between 18 to 45. 23 of the participants had role-playing experience over one year. Four participants were female, 24 participants were male. 10 participants had prior experience of playing tabletop role-playing games as both GM and player roles, and the rest had only player experience. At YILDIZCON, the research was held with 14 participants. 14 participants were divided into 4 different groups. At the game jam, *myFRP* was tested with 16 volunteers among the jammers. 16 participants were divided into 3 different groups.

3.4.2. Roll20 Research

3.4.2.1. Setup

An online survey was compiled with SUS, UMUX, LTR and demographic questions. With the demographic questions, it was intended to learn the participant's age, gender, role, and game experience in years. In order to detect the most popular companion application, an open question "Please write the name of a digital tabletop role-playing companion application you used." was asked to the participants. 31 participants answered with "Roll20". Therefore, any participant's result out of these 31 participant's was opted to limit the research with only Roll20.

3.4.2.2. Participants

Reddit community is known for helping out to researchers by participating online surveys. To reach many people, the online survey was posted on Reddit's r/rpg, r/tabletop and r/prodnd subreddit channels. The online survey was also posted on Facebook groups, including Role Playing Günlükleri, Magister Ludi and Tabletop Role-Playing Games.

A total of 293 unique users visited the online survey. 82 out of 293 users participated the survey. 51 participants finished the survey.

4. RESULTS

In this chapter, quantitative and qualitative research results are explained in detail. Quantitative methods cover the analysis of *myFRP* and Roll20 surveys. Qualitative methods cover the analysis of the think aloud session held after the participants used *myFRP*.

4.1. QUANTITATIVE METHODS

myFRP and Roll20 survey results were acquired and analysed. *myFRP* and Roll20 researches involved a total of 61 participants. *myFRP* research involved 26 male and four female gendered participants, whose ages range between 18 and 45. Roll20 research involved 27 male, 3 female and one other gendered participants, whose ages range between 18 and 43. Roll20 research participants had between one and 34 years of tabletop role-playing experience.

myFRP research SUS & UMUX overall descriptives are given in Table 4.1. In Table 4.1, mean scores of SUS overall (M = 73.33, SD = 16.88) and UMUX overall (M = 64.58, SD = 18.13) are given. According to the research (Sauro, 2011), the average SUS overall value from his 500 studies is 68. Any system with 68 or more UMUX overall score can considered a usable system. Compared to that, SUS overall value of myFRP is 73.33, therefore proving myFRP as a usable application.

Table 4.1: myFRP SUS & UMUX overall descriptives

			Statistic	Std. Error
SUS overall	Mean		73.3333	3.08252
	95% Confidence Interval for Mean	Lower Bound	67.0289	
		Upper Bound	79.6378	
	5% Trimmed Mean		73.9352	
	Median		80.0000	
	Variance		285.057	
	Std. Deviation		16.88365	
	Minimum		40.00	
	Maximum		97.50	
	Range		57.50	
	Interquartile Range		30.00	
	Skewness		-.674	.427
	Kurtosis		-.740	.833
UMUX overall	Mean		64.5833	3.31141
	95% Confidence Interval for Mean	Lower Bound	57.8107	
		Upper Bound	71.3559	
	5% Trimmed Mean		64.3519	
	Median		62.5000	
	Variance		328.963	
	Std. Deviation		18.13734	
	Minimum		33.33	
	Maximum		100.00	
	Range		66.67	
	Interquartile Range		23.96	
	Skewness		.001	.427
	Kurtosis		-.676	.833

According to a previous study (Berkman, 2016), results of SUS and UMUX overall values correlate. However, the calculated overall mean values of SUS and UMUX reveal that there is a remarkable difference between each other.

In table 4.2, it is revealed that the SUS overall value for participants in GM role (M = 62.85, SD = 7.89) and for participants in Player role (M = 76.52, SD = 3.03) show a remarkable difference.

Table 4.2: myFRP SUS overall descriptives by role

	Roles			Statistic	Std. Error
SUS overall	GM	Mean		62.8571	7.89493
		95% Confidence Interval for Mean	Lower Bound	43.5389	
			Upper Bound	82.1753	
		5% Trimmed Mean		62.2024	
		Median		55.0000	
		Variance		436.310	
		Std. Deviation		20.88802	
		Minimum		40.00	
		Maximum		97.50	
		Range		57.50	
		Interquartile Range		37.50	
		Skewness		.769	.794
		Kurtosis		-.547	1.587
	Player	Mean		76.5217	3.03039
		95% Confidence Interval for Mean	Lower Bound	70.2371	
			Upper Bound	82.8064	
		5% Trimmed Mean		77.6087	
		Median		80.0000	
		Variance		211.215	
		Std. Deviation		14.53325	
		Minimum		40.00	
		Maximum		92.50	
		Range		52.50	
		Interquartile Range		15.00	
		Skewness		-1.180	.481
		Kurtosis		.677	.935

In table 4.3, it is revealed that the UMUX overall value for participants in GM role (M = 65.47, SD = 7.42) and for participants in Player role (M = 64.31, SD = 3.77) do not show a remarkable difference.

Table 4.3: myFRP UMUX overall descriptives by role

	Roles			Statistic	Std. Error
UMUX overall	GM	Mean		65.4762	7.42657
		95% Confidence Interval for Mean	Lower Bound	47.3040	
			Upper Bound	83.6484	
		5% Trimmed Mean		65.3439	
		Median		62.5000	
		Variance		386.078	
		Std. Deviation		19.64887	
		Minimum		37.50	
		Maximum		95.83	
		Range		58.33	
		Interquartile Range		29.17	
		Skewness		.277	.794
		Kurtosis		-.400	1.587
	Player	Mean		64.3116	3.77640
		95% Confidence Interval for Mean	Lower Bound	56.4798	
			Upper Bound	72.1434	
		5% Trimmed Mean		64.1103	
		Median		62.5000	
		Variance		328.008	
		Std. Deviation		18.11100	
		Minimum		33.33	
		Maximum		100.00	
		Range		66.67	
		Interquartile Range		25.00	
		Skewness		-.076	.481
		Kurtosis		-.605	.935

One-way between subjects ANOVA was conducted to compare the effect of each SUS and UMUX question in GM and Player conditions in order to examine the remarkable difference between SUS and UMUX overall mean values.

As seen in Table 4.4, there was not a significant effect of the question SUS_01 “I think that I would like to use this system frequently.” on the result at the $p < .05$ level for the two conditions [$F(1, 28) = .293$, $p = .593$].

Table 4.4: myFRP SUS_01 ANOVA

System Usability Scale (SUS): I think that I would like to use this system frequently.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.383	1	.383	.293	.593
Within Groups	36.584	28	1.307		
Total	36.967	29			

As seen in Table 4.5, there was a significant effect of the question SUS_02 “I found the system unnecessarily complex.” on the result at the $p < .05$ level for the two conditions [$F(1, 28) = 8.409$, $p = .007$].

Table 4.5: myFRP SUS_02 ANOVA

System Usability Scale (SUS): I found the system unnecessarily complex. (reversed)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.783	1	6.783	8.409	.007
Within Groups	22.584	28	.807		
Total	29.367	29			

As given in Table 4.6, post hoc comparisons using the Tukey HSD test indicated that the mean score for the GM condition ($M = 3.57$, $SD = 1.61$) was significantly different than the Player condition ($M = 4.69$, $SD = .55$) for the question “I found the system unnecessarily complex.”. These results suggest that players found *myFRP* more complex than GMs did. GMs use *myFRP* to do many tasks, including managing encounters and NPC. GMs find the complexity necessary to complete their tasks. However, players use

the app with less functionality. They find the processes including network connection, character customization and map movement unnecessarily complex.

Table 4.6: myFRP SUS_02 descriptives

System Usability Scale (SUS): I found the system unnecessarily complex. (reversed)

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
GM		7	3.5714	1.61835	.61168	2.0747	5.0682	1.00	5.00	
Player		23	4.6957	.55880	.11652	4.4540	4.9373	3.00	5.00	
Total		30	4.4333	1.00630	.18372	4.0576	4.8091	1.00	5.00	
Model	Fixed Effects			.89809	.16397	4.0975	4.7692			
	Random Effects				.62006	-3.4452	12.3119			.55679

As seen in Table 4.7, there was a significant effect of the question SUS_03 “I thought the system was easy to use.” on the result at the $p < .05$ level for the two conditions [$F(1, 28) = 16.229$, $p = .000$].

Table 4.7: myFRP SUS_03 ANOVA

System Usability Scale (SUS): I thought the system was easy to use.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.632	1	7.632	16.229	.000
Within Groups	13.168	28	.470		
Total	20.800	29			

As given in Table 4.8, post hoc comparisons using the Tukey HSD test indicated that the mean score for the GM condition ($M = 3.28$, $SD = .95$) was significantly different than the Player condition ($M = 4.47$, $SD = .59$) for the question “I thought the system was easy to use”. These results indicate that GMs use more features than players do, therefore making *myFRP* harder to use for GMs than for players.

Table 4.8: myFRP SUS_03 descriptives

System Usability Scale (SUS): I thought the system was easy to use.

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
GM		7	3.2857	.95119	.35952	2.4060	4.1654	2.00	5.00	
Player		23	4.4783	.59311	.12367	4.2218	4.7347	3.00	5.00	
Total		30	4.2000	.84690	.15462	3.8838	4.5162	2.00	5.00	
Model	Fixed Effects			.68577	.12520	3.9435	4.4565			
	Random Effects				.66649	-4.2686	12.6686			.66727

As seen in Table 4.9, there was not a significant effect of the question SUS_04 “I think that I would need the support of a technical person to be able to use this system.” on the result at the $p < .05$ level for the two conditions [$F(1, 28) = 1.582$, $p = .219$].

Table 4.9: myFRP SUS_04 ANOVA

System Usability Scale (SUS): I think that I would need the support of a technical person to be able to use this system. (reversed)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.239	1	2.239	1.582	.219
Within Groups	39.627	28	1.415		
Total	41.867	29			

As seen in Table 4.10, there was not a significant effect of the question SUS_05 “I found the various functions in this system were well integrated.” on the result at the $p < .05$ level for the two conditions [$F(1, 28) = .719$, $p = .404$].

Table 4.10: myFRP SUS_05 ANOVA

System Usability Scale (SUS): I found the various functions in this system were well integrated.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.848	1	.848	.719	.404
Within Groups	33.019	28	1.179		
Total	33.867	29			

As seen in Table 4.11, there was not a significant effect of the question SUS_06 "I thought there was too much inconsistency in this system." on the result at the $p < .05$ level for the two conditions [$F(1, 28) = 1.948$, $p = .173$].

Table 4.11: myFRP SUS_06 ANOVA

System Usability Scale (SUS): I thought there was too much inconsistency in this system. (reversed)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.908	1	1.908	1.958	.173
Within Groups	27.292	28	.975		
Total	29.200	29			

As seen in Table 4.12, there was not a significant effect of the question SUS_07 "I would imagine that most people would learn to use this system very quickly." on the result at the $p < .05$ level for the two conditions [$F(1, 28) = 1.105$, $p = .302$].

Table 4.12: myFRP SUS_07 ANOVA

System Usability Scale (SUS): I would imagine that most people would learn to use this system very quickly

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.134	1	1.134	1.105	.302
Within Groups	28.733	28	1.026		
Total	29.867	29			

As seen in Table 4.13, there was a significant effect of the question SUS_08 “I found the system very awkward to use.” on the result at the $p < .05$ level for the two conditions [$F(1, 28) = 4.764$, $p = .038$].

Table 4.13: myFRP SUS_08 ANOVA

System Usability Scale (SUS): I found the system very awkward to use. (reversed)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.339	1	3.339	4.764	.038
Within Groups	19.627	28	.701		
Total	22.967	29			

As given in Table 4.14, post hoc comparisons using the Tukey HSD test indicated that the mean score for the GM condition ($M = 3.42$, $SD = .97$) was significantly different than the Player condition ($M = 4.21$, $SD = .79$) for the question “I found the system very awkward to use.”. The reason why players found myFRP awkward to use more than GMs did should be the connectivity issues players had experienced.

Table 4.14: myFRP SUS_08 descriptives

System Usability Scale (SUS): I found the system very awkward to use. (reversed)

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
GM		7	3.4286	.97590	.36886	2.5260	4.3311	2.00	5.00	
Player		23	4.2174	.79524	.16582	3.8735	4.5613	2.00	5.00	
Total		30	4.0333	.88992	.16248	3.7010	4.3656	2.00	5.00	
Model	Fixed Effects			.83724	.15286	3.7202	4.3465			
	Random Effects				.42571	-1.3758	9.4425			.24581

As seen in Table 4.15, there was not a significant effect of the question SUS_09 “I felt very confident using the system.” on the result at the $p < .05$ level for the two conditions [$F(1, 28) = .649$, $p = .427$].

Table 4.15: myFRP SUS_09 ANOVA

System Usability Scale (SUS): I felt very confident using the system.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.822	1	.822	.649	.427
Within Groups	35.478	28	1.267		
Total	36.300	29			

As seen in Table 4.16, there was a significant effect of the question SUS_10 "I needed to learn a lot of things before I could get going with this system." on the result at the $p < .05$ level for the two conditions [$F(1, 28) = 15.863$, $p = .000$].

Table 4.16: myFRP SUS_10 ANOVA

System Usability Scale (SUS): I needed to learn a lot of things before I could get going with this system (reversed)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.474	1	7.474	15.863	.000
Within Groups	13.193	28	.471		
Total	20.667	29			

As seen in Table 4.17, post hoc comparisons using the Tukey HSD test indicated that the mean score for the GM condition ($M = 3.42$, $SD = .97$) was significantly different than the Player condition ($M = 4.60$, $SD = .58$) for the question "I needed to learn a lot of things before I could get going with this system.". The reason why players thought that they needed to learn a lot of things before they could get going with the system should be that the researcher made a quick walkthrough about using *myFRP* to only the GM participants.

Table 4.17: myFRP SUS_10 descriptives

System Usability Scale (SUS): I needed to learn a lot of things before I could get going with this system (reversed)

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
GM		7	3.4286	.97590	.36886	2.5260	4.3311	2.00	5.00	
Player		23	4.6087	.58303	.12157	4.3566	4.8608	3.00	5.00	
Total		30	4.3333	.84418	.15413	4.0181	4.6486	2.00	5.00	
Model	Fixed Effects			.68641	.12532	4.0766	4.5900			
	Random Effects				.65934	-4.0443	12.7110			.65245

As seen in Table 4.18, there was not any significant effect of the questions “This system’s capabilities meet my requirement.”, “Using this system is a frustrating experience.”, “This system is easy to use.” and “I have to spend too much time correcting things with this system.” on the results at the $p < .05$ level for the two conditions [$F(1, 28) = .210$, $p = .650$], [$F(1, 28) = .246$, $p = .624$], [$F(1, 28) = 3.577$, $p = .069$], [$F(1, 28) = .342$, $p = .564$].

Table 4.18: myFRP UMUX ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
UMUX: This system's capabilities meet my requirements.	Between Groups	.673	1	.673	.210	.650
	Within Groups	89.627	28	3.201		
	Total	90.300	29			
UMUX: Using this system is a frustrating experience. (reversed)	Between Groups	.822	1	.822	.246	.624
	Within Groups	93.478	28	3.339		
	Total	94.300	29			
UMUX: This system is easy to use.	Between Groups	3.553	1	3.553	3.577	.069
	Within Groups	27.814	28	.993		
	Total	31.367	29			
UMUX: I have to spend too much time correcting things with this system. (reversed)	Between Groups	.649	1	.649	.342	.564
	Within Groups	53.217	28	1.901		
	Total	53.867	29			

In Table 4.19, likelihood to recommend score of *myFRP* can be seen for GM (M = 6.85, SD = 1.10) and Player (M = 7.26, SD = .54) roles.

Table 4.19: myFRP likelihood to recommend descriptives

	Roles			Statistic	Std. Error
Likelihood to recommend: How likely is it that you would recommend myFRP to a friend?	GM	Mean		6.8571	1.10040
		95% Confidence Interval for Mean	Lower Bound	4.1646	
			Upper Bound	9.5497	
		5% Trimmed Mean		6.8968	
		Median		8.0000	
		Variance		8.476	
		Std. Deviation		2.91139	
		Minimum		3.00	
		Maximum		10.00	
		Range		7.00	
		Interquartile Range		6.00	
		Skewness		-.597	.794
		Kurtosis		-1.602	1.587
	Player	Mean		7.2609	.54162
		95% Confidence Interval for Mean	Lower Bound	6.1376	
			Upper Bound	8.3841	
		5% Trimmed Mean		7.3382	
		Median		8.0000	
		Variance		6.747	
		Std. Deviation		2.59751	
		Minimum		2.00	
		Maximum		11.00	
		Range		9.00	
		Interquartile Range		4.00	
		Skewness		-.450	.481
		Kurtosis		-.761	.935

Roll20 research SUS & UMUX overall descriptives are given in Table 4.20. In Table 4.20, mean scores of SUS overall (M = 66.12, SD = 17.92) and UMUX overall (M = 67.06, SD = 19.93) are given. The calculated overall mean values of SUS and UMUX reveal that they correlate as stated in Berkman's study.

Table 4.20: Roll20 SUS & UMUX overall descriptives

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
SUS Overall	31	20.00	92.50	66.1290	17.92157	321.183	.713	.821
UMUX Overall	31	16.67	100.00	67.0699	19.93493	397.401	.036	.821
Valid N (listwise)	31							

In the Roll20 research, 26 of the participants are in GM role and five of the participants are in Player role.

As seen in Table 4.21, SUS overall scores for GM (M = 64.03, SD = 3.52) and Player (M = 77.00, SD = 6.53) reveal that players find Roll20 more usable than GMs do.

Table 4.21: Roll20 SUS overall descriptives by role

	Role			Statistic	Std. Error
SUS Overall	GM	Mean		64.0385	3.52485
		95% Confidence Interval for Mean	Lower Bound	56.7789	
			Upper Bound	71.2980	
		5% Trimmed Mean		64.9786	
		Median		65.0000	
		Variance		323.038	
		Std. Deviation		17.97327	
		Minimum		20.00	
		Maximum		90.00	
		Range		70.00	
		Interquartile Range		18.75	
		Skewness		-.827	.456
		Kurtosis		.681	.887
	Player	Mean		77.0000	6.53835
		95% Confidence Interval for Mean	Lower Bound	58.8466	
			Upper Bound	95.1534	
		5% Trimmed Mean		77.3611	
		Median		77.5000	
		Variance		213.750	
		Std. Deviation		14.62019	
		Minimum		55.00	
		Maximum		92.50	
		Range		37.50	
		Interquartile Range		26.25	
		Skewness		-.781	.913
		Kurtosis		.332	2.000

As seen in Table 4.22, UMUX overall scores for GM (M = 65.86, SD = 4.06) and Player (M = 73.33, SD = 6.79) correlate with SUS overal values per role. This reveals that players find Roll20 more usable than GMs do.

Table 4.22: Roll20 UMUX overall descriptives by role

	Role			Statistic	Std. Error
UMUX Overall	GM	Mean		65.8654	4.06950
		95% Confidence Interval for Mean	Lower Bound	57.4841	
			Upper Bound	74.2467	
		5% Trimmed Mean		66.4886	
		Median		66.6667	
		Variance		430.582	
		Std. Deviation		20.75048	
		Minimum		16.67	
		Maximum		100.00	
		Range		83.33	
		Interquartile Range		34.37	
		Skewness		-.320	.456
		Kurtosis		-.083	.887
	Player	Mean		73.3333	6.79563
		95% Confidence Interval for Mean	Lower Bound	54.4656	
			Upper Bound	92.2010	
		5% Trimmed Mean		73.1481	
		Median		66.6667	
		Variance		230.903	
		Std. Deviation		15.19549	
		Minimum		58.33	
		Maximum		91.67	
		Range		33.33	
		Interquartile Range		29.17	
		Skewness		.482	.913
		Kurtosis		-2.851	2.000

In Table 4.23, likelihood to recommend score of Roll20 can be seen for GM (M = 8.53, SD = .54) and Player (M = 9.80, SD = .48) roles.

Table 4.23: Roll20 likelihood to recommend descriptives

	Role			Statistic	Std. Error
Likelihood to recommend: How likely is it that you would recommend the digital tabletop role-playing companion application to a friend?	1.00	Mean		8.5385	.54697
		95% Confidence Interval for Mean	Lower Bound	7.4120	
			Upper Bound	9.6650	
		5% Trimmed Mean		8.7949	
		Median		10.0000	
		Variance		7.778	
		Std. Deviation		2.78899	
		Minimum		1.00	
		Maximum		11.00	
		Range		10.00	
		Interquartile Range		4.25	
		Skewness		-1.291	.456
		Kurtosis		.916	.887
	2.00	Mean		9.8000	.48990
		95% Confidence Interval for Mean	Lower Bound	8.4398	
			Upper Bound	11.1602	
		5% Trimmed Mean		9.8333	
		Median		10.0000	
		Variance		1.200	
		Std. Deviation		1.09545	
		Minimum		8.00	
		Maximum		11.00	
		Range		3.00	
		Interquartile Range		1.50	
		Skewness		-1.293	.913
		Kurtosis		2.917	2.000

4.1. QUALITATIVE METHODS

myFRP think aloud sessions were recorded in audio, and later transferred to text format. In this section, think aloud session results are given.

Most of GMs and players among the participants thought that *myFRP* was easy to use both before and during the gameplay sessions. It was easy to understand how to use the application when they first used *myFRP*. Navigating the menus and performing actions seemed easy to follow. They explained that it didn't make a GM's task more complicated, and it actually helped them streamline their tasks. There were technical issues, but most of the participants agreed that they would actually use a bug-free version of *myFRP* in their games.

When the participants were asked if they have found myFRP as a useful application, a player resonded in Turkish as:

> *"Özellikle bunu kendi istediği gibi özelleştiren oyun yöneticileri daha çok kullanacaktır kesinlikle. Kendi settingini oluşturduğu için çok hayali anlatıyor ve oyuncular aynı frekansta buluşamayabiliyor. Ciddi bir avantaj sağlıyor."*

Given quote can be translated to English as:

> *"In particular, it will certainly be used by GMs who customize it as they wish. GM tells a lot of imagination for his own settings and the players may not meet in the same way. It gives a serious advantage."*

Participants expressed their needs in digital companion apps in general. The participants explained the features they would like to see.

The participants discoursed the need of a customizable grid system. Most of the participants complained about characters not snapping on tiles. The participants wanted to see the tile snap feature as an optional feature, turned on and off as desired. Also, most of the participants said that it would be good if the movement of the characters were limited by their speed. A hexagon grid system was needed by a few participants, and they wanted it to be an optional feature. Map creation and map manipulation features were also wanted. Fog of war feature was high in demand. Visible and obfuscated areas on the map should be in GM's control.

A player gave a valuable feedback about the map system:

> *"Grid opsiyonel olsa iyi olur. Farklı gruplar farklı şekilde oynamayı tercih edebilir. Haritanın altıgen şeklinde olması da mümkün olursa güzel olur. Harita çizgilerinin tamamen kapanıp görünmemesi de bir çözüm."*

The quote above can be translated as:

> *"The grid should be optional. Different groups may prefer to play differently. It would be nice to have the hexagon shape of the map. It is also a solution where the map lines can be completely closed and not rendered."*

Most of the participants noted that tokens and map tiles should be customizable. They wanted to change their character's image as they liked.

Dice, map distance calculator, circle indicator, movement tracker and pinging on a map location features were among the requested. Most of the comments revealed that these features should be optional. Also, anyone without dice should use the app even if it does not feel as the real dice, they said.

When the participants were asked if a central device, instead of multiple devices as the current setup would be useful; a few participants said that a central tablet as a display system would be useful. It should be controlled by a terminal device that GM has. Most of the participants were satisfied with the current distributed setup in terms of usability and accessibility.

A participant wanted the app to save him from pen and paper altogether. His interaction should be only with the device. However, some participants were not satisfied with the system and they said that they would rather use only pen and paper instead of a digital application.

The participants agreed that this app shouldn't be system dependent, but simple score tracking like hit points, initiative score, armor class, etc. should be included.

The participants thought that it's good to use this app without being fully dependent on it. If a player doesn't have an app, the game is still playable.

There was a debate among the participants when it was asked if it would be better when they could write their character's statistics in detail. Some participants liked the idea, but some participants argued that it would be too complex for the GMs. It would be better if the system did not get involved too much with the rules system.

Some participants wanted to see eye-candy effects, including burning flames, arrows and fogs. Also, sound effects of arrows, sword fights, and explosions would be nice to have to have a more immersive experience. Ambient music was also wanted. However, some participants argued that sound and music playing could make a GM's job harder.

A few participants wanted the combat system, along with the movements system to be turn-based. Turn and initiative tracker should impose the usage of a turn based system.

Most of the participants expressed that chat feature is important. However, none of the participants used it during combat. It is best used in non-combat environments. A few participants said that the chat feature should be limited to the characters in close proximity, and GM should control who can communicate with each other. Also, an out-of-topic channel should be included.

A participant wanted to use a campaign journal. She wanted to be able to look at the notes about the previous session and keep up with her campaign easily.

When the participants were asked about the application's monetization system, they said that in-app purchases would the best way of monetizing this app. Basic features should be given for free. Content; including maps, character portraits, and eye-candy effects can be sold additionally. A GM responded as follows:

> *"Bu uygulama için grafik üretecek grafikerler kendi ürünlerini satabilmeliler. Bir komünite oluşması sağlanabilir. Şirket de bundan komisyon alabilir. Bunları satın almak isteyenler olacaktır. Kullanıcıların kendi oluşturdukları haritalar, senaryolar, görseller satılabilir."*

This can be translated as:

> *"The artists that will produce graphics for this application should be able to sell their own products. A community can be established. The company can get a commission from it. There will be demand for it. Maps, scenarios, visuals can be sold."*

5. DISCUSSION AND CONCLUSION

As the results show, TRPG players prefer using easy to use applications during their gameplay sessions. To reduce the complexity of TRPG systems, digital companions like *myFRP* and Roll20 are preferable by the users.

myFRP was developed as a prototype, resulting in not working in full extent as a final product would do. However, by analyzing the survey results, *myFRP* is revealed to be admissible as a usable companion application. *myFRP*'s overall SUS score exceeded Roll20's.

As the results show, GMs find both *myFRP* and Roll20 applications less usable than players do. GMs use *myFRP* to do many complex tasks, whereas players use *myFRP* to do less complex tasks than GMs do.

In *myFRP* research, GMs and players gave different answers to the SUS question "I found the system unnecessarily complex.". This suggests that players found *myFRP* more unnecessarily complex than GMs did. The reason should be that GMs find the complexity necessary to complete their tasks.

In *myFRP* research, GMs and players gave different answers to the SUS question "I thought the system was easy to use". GMs thought that *myFRP* was not easy to use, but players thought otherwise. This should be relevant to the fact that GMs use more complex features than players do.

In *myFRP* research, GMs and players answered the SUS question "I found the system very awkward to use." differently. This suggests that the technical problems players had; including a bug causing player tokens to stand on each other and locking character movement, connectivity problems where players were disconnecting from the host, and a bug causing character color selection slider being hard to pull. GMs used *myFRP* with less problems.

LTR results show that players are more likely to recommend both *myFRP* and Roll20 than GMs. *myFRP*'s score is significantly lower than Roll20. However, the median of

myFRP's LTR score is above %50 for both GM and player roles. *myFRP*'s low score can be explained by its being on prototyping phase and having several bugs.

In conclusion, as the development of *myFRP* and the research conducted with users revealed that digital companions are actually usable and preferred by users. Tabletop role-playing experience can be enhanced with the use of easy to use digital companions. User tests revealed that participants showed their enthusiasm about the digitally enhanced tabletop role-playing experience.

myFRP and Roll20 user tests showed that GMs and players can benefit from the companion applications. GMs find companion applications harder to use compared to players. However, both GMs and players prefer effective, efficient and satisfactory applications.

It also shows that developing companion applications is a business worth to invest in, because of the high demand from the users. However, it is crucial to produce usable applications for both GMs and players to provide good user experience.

As for future work, effects of digital companion applications on the game experience can be tested by conducting tests with a group of user using a digital companion application, and with a group of user not using any digital companion application while playing a TRPG.

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APPENDICES

APPENDIX A: SUS QUESTIONNAIRE

Based on your experience with myFRP, do you agree with the statements below?

Please answer the questions based on your experience on the test session.

	Strongly Disagree				Strongly Agree
I think that I would like to use this system frequently.					
I found the system unnecessarily complex.					
I thought the system was easy to use.					
I think that I would need the support of a technical person to be able to use this system.					
I found the various functions in this system were well integrated.					
I thought there was too much inconsistency in this system.					
I would imagine that most people would learn to use this system very quickly .					
I found the system very awkward to use.					
I felt very confident using the system.					
I needed to learn a lot of things before I could get going with this system					

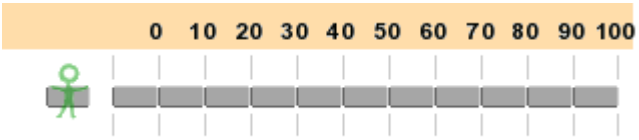
APPENDIX B: UMUX QUESTIONNAIRE

Consider your experience with the evaluated system during the test session.

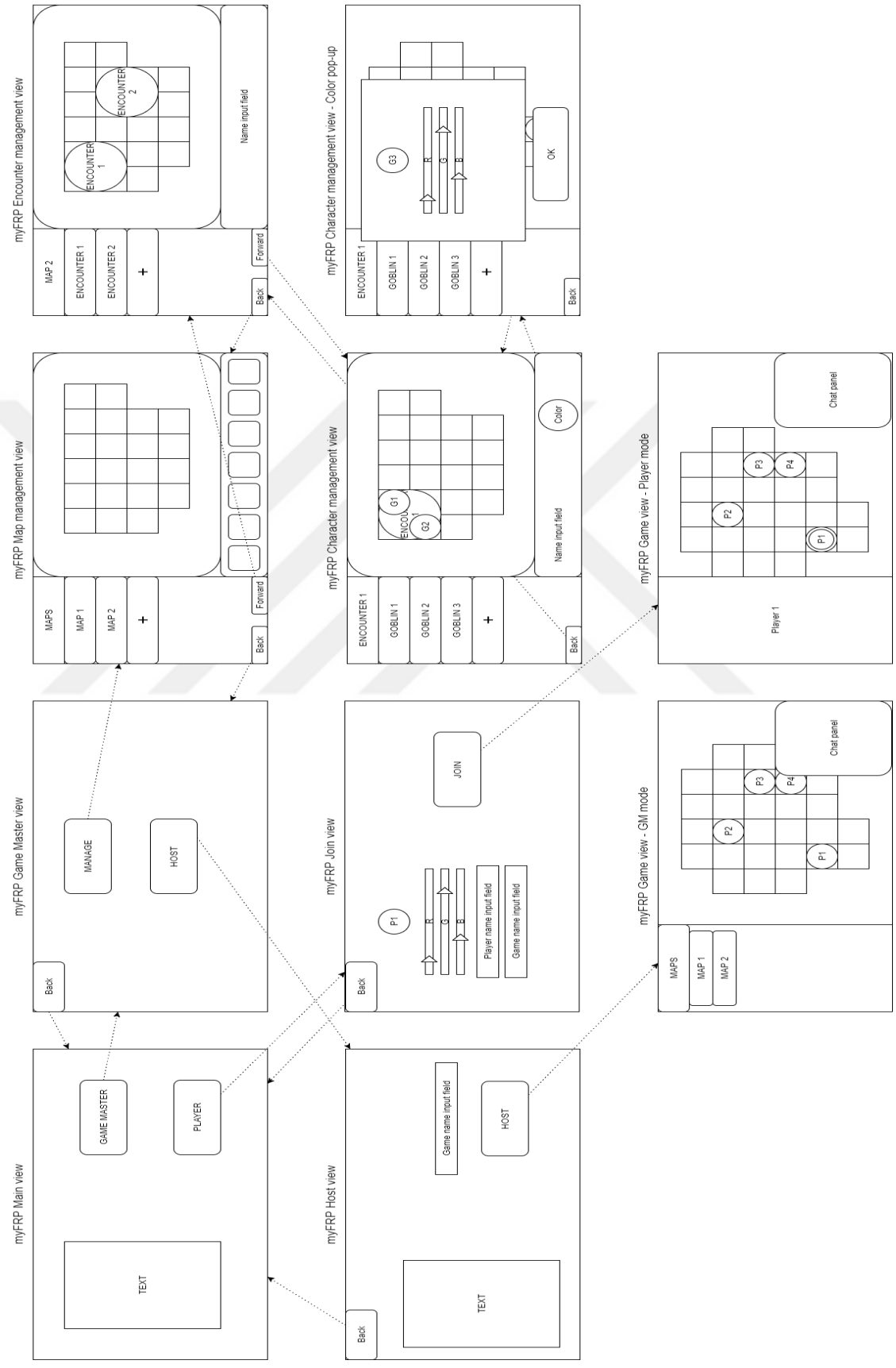
	Strongly Disagree						Strongly Agree
This system's capabilities meet my requirements.							
Using this system is a frustrating experience.							
This system is easy to use.							
I have to spend too much time correcting things with this system.							

APPENDIX C: LTR QUESTIONNAIRE

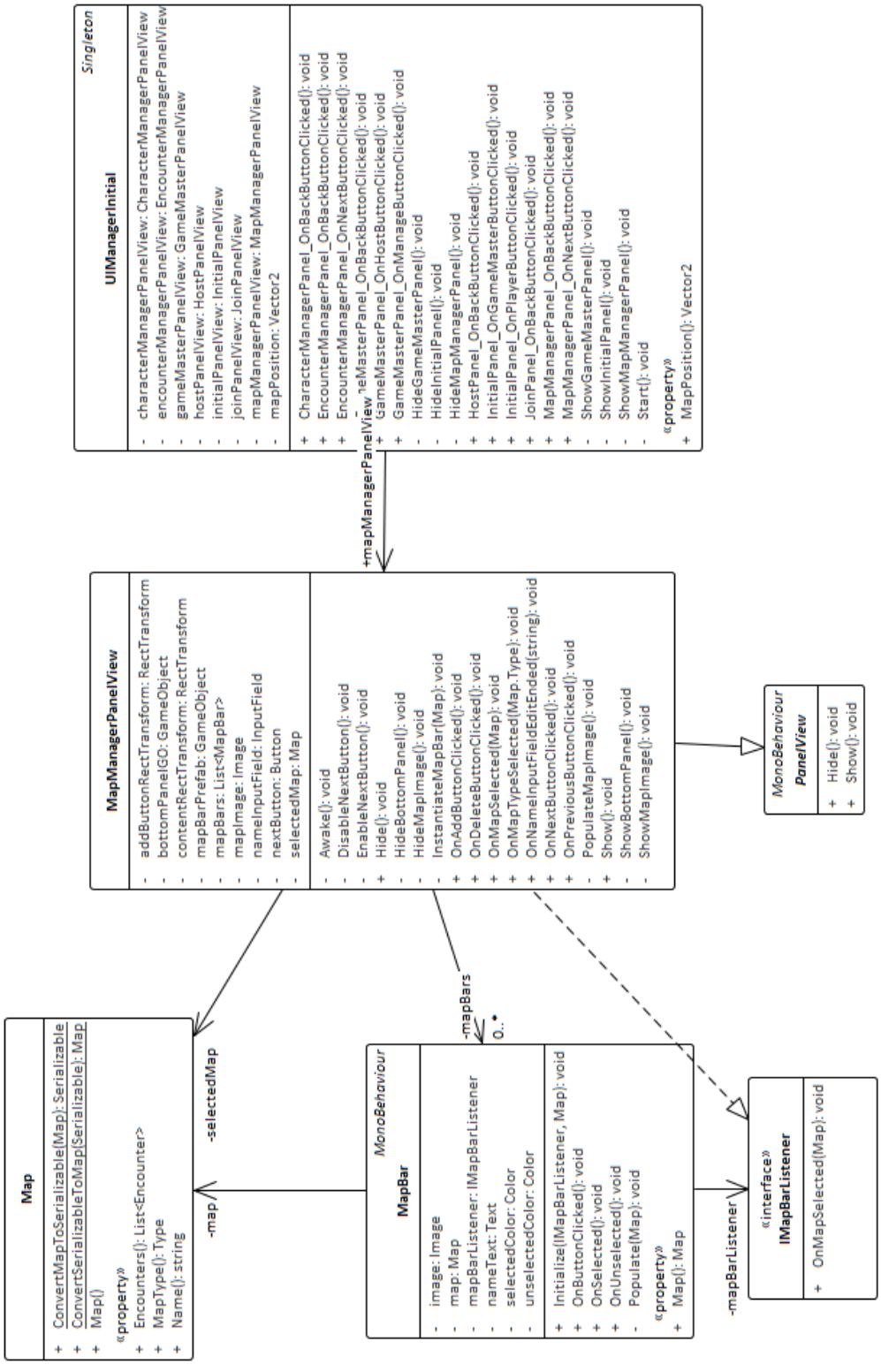
How likely is it that you would recommend myFRP to a friend?



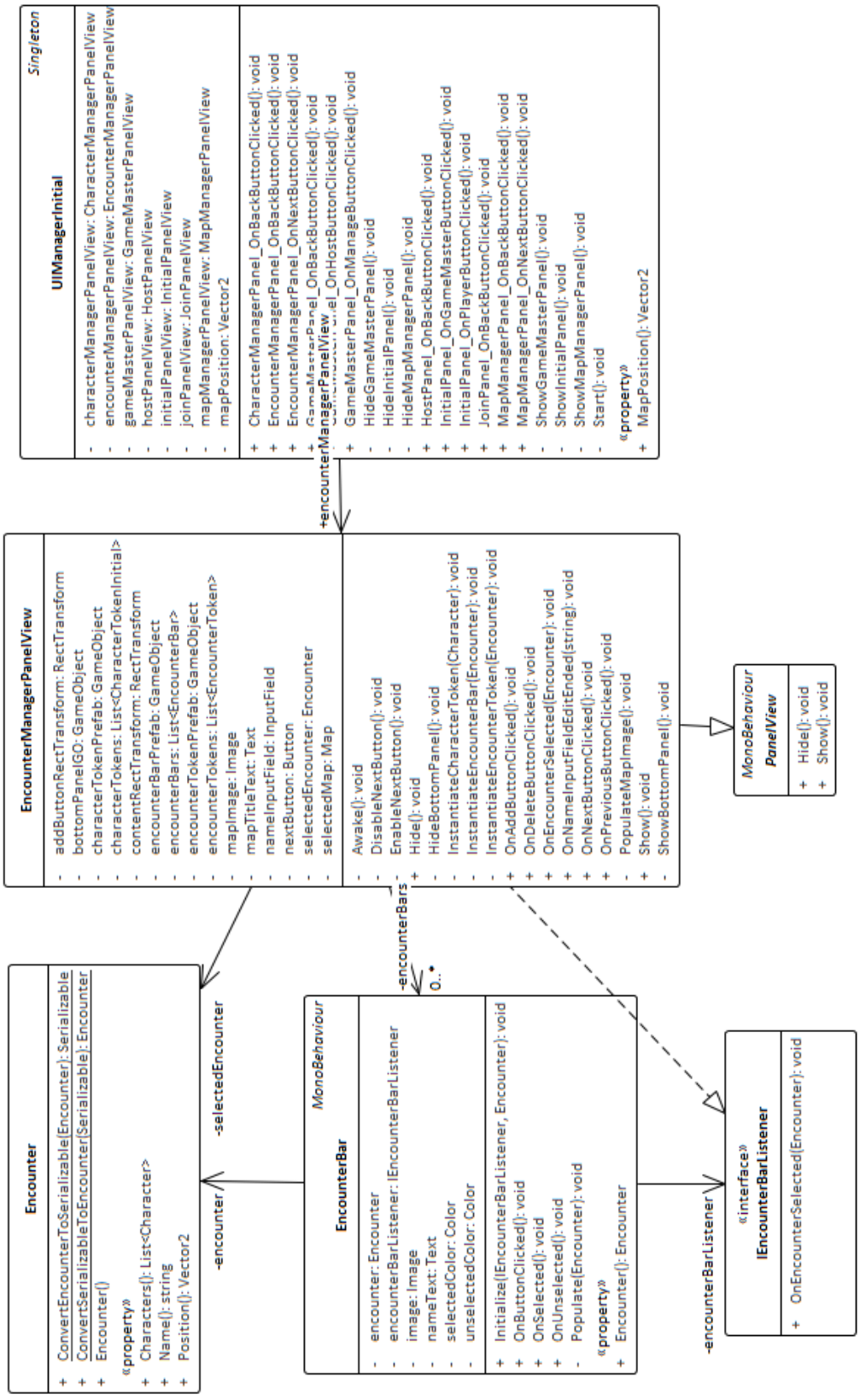
APPENDIX D: MYFRP UI DIAGRAM



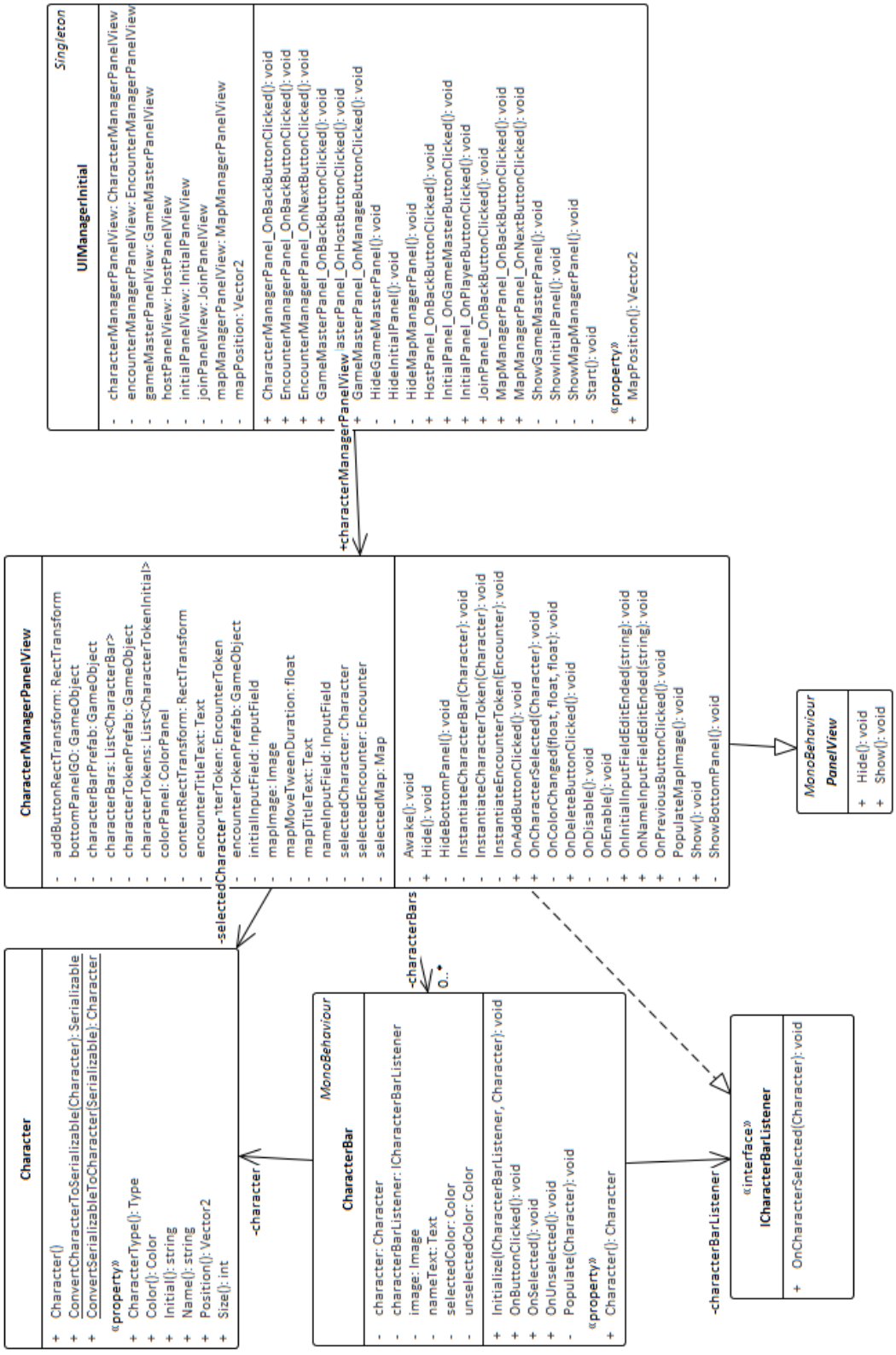
APPENDIX E: MYFRP UML DIAGRAM – MAP MODULE



APPENDIX F: MYFRP UML DIAGRAM – ENCOUNTER MODULE



APPENDIX G: MYFRP UML DIAGRAM – CHARACTER MODULE



APPENDIX H: MYFRP UML DIAGRAM – NETWORK MODULE

APPENDIX I: MYFRP CHARACTERTOKENMAIN CLASS

```
using System;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.EventSystems;

public class CharacterTokenMain : Photon.PunBehaviour, IBeginDragHandler,
IDragHandler, IEndDragHandler, IPointerDownHandler
{
    #region Fields
    [Header("References")]
    [SerializeField]
    private Text initialText;
    [SerializeField]
    private Image image;

    public Action<Character> OnCharacterSelected;

    private RectTransform rectTransform;
    private RectTransform parentRectTransform;
    private Character character;
    #endregion

    #region Properties
    public Vector2 Position
    {
        get
        {
            return character.Position;
        }
        set
        {
            character.Position = value;
        }
    }

    public string Initial
    {
        set
        {
            initialText.text = value;
        }
    }

    public Character Character
    {
        get
        {
            return character;
        }
    }
    #endregion

    #region MonoBehaviour methods
    void Awake()
    {
        rectTransform = GetComponent<RectTransform>();
    }
```

```
void Start()
{
    transform.localScale = Vector2.one;

    GameObject mapParentGO = GameObject.FindGameObjectWithTag("MapParent");

    parentRectTransform = mapParentGO.GetComponent<RectTransform>();
    rectTransform.SetParent(mapParentGO.GetComponent<RectTransform>());
}
#endregion

#region IBeginDragHandler
public void OnBeginDrag(PointerEventData eventData)
{
    if (photonView.isMine)
    {
        rectTransform.SetParent(parentRectTransform.parent);
    }
}
#endregion

#region IDragHandler
public void OnDrag(PointerEventData eventData)
{
    if (photonView.isMine)
    {
        rectTransform.position = eventData.position;
    }
}
#endregion

#region IEndDragHandler
public void OnEndDrag(PointerEventData eventData)
{
    if (photonView.isMine)
    {
        rectTransform.SetParent(parentRectTransform, true);
        Position = rectTransform.anchoredPosition;
    }
}
#endregion

#region IPointerClickHandler
public void OnPointerDown(PointerEventData eventData)
{
    if (photonView.isMine)
    {
        NotifyCharacterSelected();
    }
}
#endregion

#region RPC methods
[PunRPC]
public void SetColor(float r, float g, float b)
{
    image.color = new Color(r, g, b);
}
```

```
    [PunRPC]
    public void SetInitial(string value)
    {
        Initial = value;
    }
    #endregion

    #region Public methods
    public void Initialize(RectTransform parentRectTransform, Character
character)
    {
        this.parentRectTransform = parentRectTransform;
        this.character = character;

        rectTransform.SetParent(parentRectTransform);
        rectTransform.anchoredPosition = character.Position;

        photonView.RPC("SetColor", PhotonTargets.All, character.Color.r,
character.Color.g, character.Color.b);
        photonView.RPC("SetInitial", PhotonTargets.All, character.Initial);
    }
    #endregion

    #region Private methods
    private void NotifyCharacterSelected()
    {
        if (OnCharacterSelected != null)
        {
            OnCharacterSelected(character);
        }
    }
    #endregion
}
```

APPENDIX J: MYFRP GMMANAGER CLASS

```
using System.Collections.Generic;
using Gamelogic.Extensions;

public class GMManager : Singleton<GMManager>
{
    #region Fields
    private GMData gmData;
    private Map currentMap;
    private Encounter currentEncounter;
    private Character currentCharacter;
    #endregion

    #region Properties
    public Map CurrentMap
    {
        get
        {
            return currentMap;
        }
        set
        {
            currentMap = value;
        }
    }

    public Encounter CurrentEncounter
    {
        get
        {
            return currentEncounter;
        }
        set
        {
            currentEncounter = value;
        }
    }

    public Character CurrentCharacter
    {
        get
        {
            return currentCharacter;
        }
        set
        {
            currentCharacter = value;
        }
    }
    #endregion

    #region MonoBehaviour methods
    void Awake()
    {
        gmData = Persistence.RetrieveGMData();
    }

    void OnApplicationFocus(bool hasFocus)
    {
```

```
    if (hasFocus == false)
    {
        Persistence.PersistGMData(gmData);
    }
}

void OnApplicationPause(bool pauseStatus)
{
    if (pauseStatus == true)
    {
        Persistence.PersistGMData(gmData);
    }
}

void OnApplicationQuit()
{
    Persistence.PersistGMData(gmData);
}
#endregion

#region Public methods
// Map
public List<Map> GetMaps()
{
    return gmData.Maps;
}

public Map AddNewMap()
{
    Map map = new Map();
    gmData.Maps.Add(map);
    Persistence.PersistGMData(gmData);
    return map;
}

public void DeleteMap(Map map)
{
    gmData.Maps.Remove(map);
    Persistence.PersistGMData(gmData);
}

// Encounter
public Encounter AddNewEncounter()
{
    Encounter encounter = new Encounter();
    currentMap.Encounters.Add(encounter);
    Persistence.PersistGMData(gmData);
    return encounter;
}

public void DeleteEncounter(Encounter encounter)
{
    currentMap.Encounters.Remove(encounter);
    Persistence.PersistGMData(gmData);
}

// Character
public Character AddNewCharacter()
{
    Character character = new Character();
```

```
            currentEncounter.Characters.Add(character);
            Persistence.PersistGMData(gmData);
            return character;
        }

        public void DeleteCharacter(Character character)
        {
            currentEncounter.Characters.Remove(character);
            Persistence.PersistGMData(gmData);
        }
        #endregion
    }
```