The Development of Web Based Application for Visual Novel Engine Prototype

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Abstract— **As of the modern age, younger people have accepted products of technological advancements at the expense of literature. As such, both literacy rate amongst the young and the existence of folklore may enter the status of jeopardy. Libraries, for instance, have become relatively obsolete in the face of modern entertainment. However, technological advancement allows the creation of literature in the format of a game that can become engaging. One of such examples is through a visual novel. Visual novel is a variation of text-based games which became mainstream in Japan. However, it became famous recently due to overtopping multiple major gaming industry franchise in the online game market. As such, the author decided to implement this method of literature to solve the problem which currently plagues both folklore and literacy at this moment by implementing modern web frameworks which include Firebase, *AngularFire*, and Ionic to create a visual novel engine.**

Keywords— *Visual Novel; Text-Based Game; Game; Firebase; Ionic; AngularFire; Literature; Visual Novel Engine; Web Application;*

I. INTRODUCTION

The emergence of internet has created an opportunity for people to obtain information. Through World Wide Web, news websites such as The Jakarta Post.com, social medias such as Facebook.com, and video streaming websites such as YouTube.com have become medias in which people can trade information. The internet has become a part of modern life, and as such plenty of internet users exist, even in Indonesia. In fact, statistics from 2015 has shown that internet users from Indonesia has reached 73 million people [1].

Due to the support the internet provides, it has become easier to read literatures in our current era. As a result, people can simply find information regarding written works based on multiple categories, such as genre, author, and publishing time. Furthermore, the advent of electronical books which can be viewed in devices such as tablets and laptops allows for great practicality for readers [2]. For those who are more frugal and utilitarian, saving space and ease of carrying multiple reading materials at once in the form of electronical books is deemed as a great asset.

However, despite the support that the internet has already provided, it is undeniable that there is a lack of interest in reading literature in Indonesia. As an example, a survey was gathered for six provinces in Indonesia, and from a scale of 1 to 7, Indonesia's reading habit obtains a score of 3.2, which is considered to be below average [3]. Another thing to note is that oral culture is something highly regarded in Indonesia, and as such it may deter literacy in favour of oral information [3]. Furthermore, literacy data was gathered during 2016, and it is shown that Indonesia was the 2nd most illiterate country amongst 61 countries [4], which serves as additional proof of literacy's state in Indonesia. It does not help that literature are generally served in a large pile of text with no interactivity whatsoever, which may lead to the notion that reading literature is boring and reserved only for academics [5]. Another thing to note is that television shows and graphical video games have greater interactivity and stimulates the senses more.

The reason why this prevalent situation matters is because there are some adverse effects if literacy skills were to decline. Studies have shown that emotional intelligence, which is the ability to perceive emotions in order to solve problems as accurately as possible, are closely related to one's capability in understanding literature [6]. As such, if one's literacy skill increases, it may increase one's capacity for intelligence. Therefore, methods that can be used to combat this situation becomes necessary.

In order to improve to improve literacy rate in Indonesia, several methods have been applied, one of which is the implementation of libraries. As a location that is filled to the brim with books, it allows people to access a vast amount of literature within a specific location. Furthermore, it has been shown that by providing an area with a library, people within that general vicinity tend to have a higher tend to have a higher interest in reading and studying compared to the ones that don't have one [7]. Also, due to technological advancement, virtual libraries that can be accessed via internet has become more prevalent, allowing people to access literature online.

Furthermore, technological advancement allows the creative liberty of creating alternative methods of sharing information or literature. For example, to build upon a standard literature format and combining it with gamification method. Such method is called Text-Based Game, also known as Interactive Fiction. Text-Based Game is a type of game that focuses on narration and making choices based on obtained information instead of interactivity within a graphic landscape

It had a moment of fame in 1980, due to its feature where small changes from initial conditions may lead to a large difference as one advances through the course of the gameplay.

As technology progresses further, a variant of Text-Based Game called Visual Novel is created, which then became prevalent in Japan [9]. The difference with Text-Based Game is that Visual Novel also implement static images and voice to complement the abundance of text [10]. The earliest Visual Novel was created produced by *Enix* (presently Square Enix) in 1983 called *Portopia Renzoku Satsujin Jiken* (e.g. The Portopia Serial Killer Series) which received good receptions [11].

To conclude, the author tried to develop a media which can be used to create and share stories and/or literature in the form of visual novels that can be used as an alternative platform for reader and writer. The technology that the author utilizes for this project include AngularFire2 and Firebase for handling the back-end and database, and Ionic3 for handling the interface. The author will focus more on the back-end process of this application which has been named as "Trinity".

II. THEORETICAL FOUNDATION

A. Video Games

Video games, unlike other forms of media which are enjoyed passively, requires the user to actively participate the media's list of actions [12]. Based on the player's inputted action, the media will then perform its own set of actions which the player must react towards. This resultant interaction that goes back and forth between the player and the media is what defines a video game.

Video games originated back in 1961, where an MIT student by the name of Steve Russell created *Spacewar* [13]. Soon after, in 1972, a commercial video game called Pong which simulates table tennis was created [13]. The creation of video game is still going strong even until the present. A statistic by the Entertainment Software Association to prove has shown that by 2009 – 2012, video games have an annual increase of 9.7 percent per year [14].

Video games have multiple genres, of which one of the way to categorize it is based on its complexity and social level. Although video game genres are not limited to this method of categorization, using it can provide a conceptualization of what potential it may hold [12]. One of these genres include the existence of Text-Based Game, also known as Interactive Fiction.

B. Text-Based Games

Text-Based Game, also known as Interactive Fiction, is an experience where the player take action within a story-driven game to alter the course of the story according to pre-set choices

It is generally played through a text-editor, where the players are either free to input any words they want or pick from pre-set choices, although it will only progress if the player input something relevant to the game itself.

There are several ways to categorize text-based games, of which one of them is based on the narration type. There are two types of story-driven text-based games. One is a kinetic story text-based game, where regardless of whether choices are provided or not, does not alter the existing endings [16]. However, the player may be judged based on the choices that are made. For example, through a numeral score that judges morality. On the other hand, dynamic story text-based game, is one where the choices that the player made will enter branching stories according to the pre-set plot graph [8]. As the player progresses and picks different choices, a personal ending may be achieved.

C. Visual Novel

Visual novel, a variation of text-based game, is an interactive fiction that focuses even more on narration compared to its predecessor [10]. By taking in the role of the main character, it allows the player to immerse themselves within the story even more. Another difference with text-based game besides the narration level is that it complements the narration with picture and audio to appeal more towards the audience, which text-based games lack.

Historically, its advent began at 1983, when *Enix* created a game called *Portopia Renzoku Satsujin Jiken* (e.g. The Portopia Serial Killer Series) [17]. It is a type of puzzle-based adventure game that implements the sprite-on-background method as a way to show the scene, albeit rather stiff. As time progresses, a new visual novel named Snatcher that was created at 1994 shows a more dynamic image by showing emphasis towards the facial expression, the pistol, and the line of target [17], creating a more believable and understood image.

Unlike a standard game where players have a great deal of freedom in controlling their avatar, it is more akin to reading a novel, although it does require interaction every now and then

As the player progresses through the story, they will be given dialogue choices which may or not may impact the storyline. The accumulation of these choices will decide the type of ending that the player may obtain, although some exceptions exist. Kinetic novel, for example, is a type of visual novel where the players only go through a prescribed, one-way storyline [16].

The media is still a great hit in Japan, and does not lack reception overseas [18]. One such famous visual novel is called Fate/Stay Night, which was produced for Personal Computers by Type-Moon back in 2004 [19]. It is one of the highest selling Visual Novel to be known, and has been ported to PlayStation 2 in 2007 and PlayStation Vita in 2014 [20]. It had a prequel novel, sequel visual novel, three anime/manga adaptations, two spin-offs, and two movie adaptations with another movie adaptation planned [20]. This alone show the testament of how desirable and effective the media is.

D. Web Application

Web application is a broad term which is used to describe websites that can change its state depending on user's

input[21]. The architecture of a web application is separated according to the function, namely the server side and the client side. The client side does not need to prepare anything to access it, as all of the necessary function are already prepared on the server side. As such, clients only need to worry about the data that they input.

E. Development Technologies

HTML, which stands for Hypertext Markup Language, is the language that is used for creating basic website. The function is correlated to its name, where Hypertext is the link that people use to move around a website, whereas *Markup* means the tags that are used to alter the website's appearance, such as using bullets and italicized text for example [22].

CSS, which stands for Cascading Style Sheet, is a mechanism which relates to HTML that functions as a way to alter the style of an HTML website [23]. Unlike regular set language, CSS can be created in a way that uses regular language so that it will be completely readable by human language. Another feature to note is that a CSS can be used to alter either one page or even multiple pages at once.

JavaScript is a type of language that was created back in 1995 in order to add programs for Netscape, one of the first browsers to exist [24]. As it is now, however, it is a language that allows the capability of programming directly on the client side of the website. It provides a wide variety of interactivity, such as implementing form validation and multimedia usage.

Firebase is a service created and hosted by Google during 2011 that works as architecture and flexible back-end for a wide array of applications [25]. It provides the programmer with a server and database on the cloud, which can be updated real-time. The database provided is NoSQL built, meaning that there is no need to arrange the data so that it can be accessed relationally. Furthermore, it has its own file storage so that users will not need to store it in the database in BLOB format. Besides providing architectural support for the programmer, it also has its own array of API and authentication method [26]. The API provided allows the user to create a quick prototype for an idea's proof of concept. Furthermore, the authentication method allows user to login either via email/password or existing social media accounts such as Google+ and Facebook.

AngularFire is the official library for AngularJS that was made to support Firebase [27]. AngularJS by itself is a framework that was created so that developers can create single page web applications [28]. *AngularFire* takes this step further by providing set methods to query objects both individually and in the form of lists. Furthermore, it also simplifies the authentication process that Firebase provides [29].

Ionic is a framework designed to create mobile application and/or website application that is designed for mobile use [30]. As of version 2, it has received modifications that allow it to be used in tandem with AngularJS, allowing it to be used to modify the user interface of web applications accordingly to fit mobile use.

Furthermore, it has inbuilt sets of animation, CSS designs, and responsiveness for use.

III. PROBLEM ANALYSIS

A. Existing Problem

Reading and writing is one of many viable ways to share information. Although in the past it is considered as a privilege only for the upper class, due to the advancement of technology and internet, it has become more accessible to everyone in the modern era. For example, although the United Kingdom used to hold this notion, this mindset was changed during the start of the 18th century, where the lower classes begun to self-study literacy skills [31]. Literacy itself has also evolved over the years, changing from only formal written, fact based format to fictitious, picture styled books due to John Locke's idea of tabula rasa, which states that children will become who they are based on what they perceive [32].

One of those literature type is folktale, which arises from folklore in general. Folktale is originally a form of oral tradition, where exaggerated stories that contains an inkling of truth is spread from older generations to the younger ones. It is considered to be one of the ideal way to teach multiple ideas for children, such as safety and morals without being too information dense for the receiver of the story [33]. As technology evolves, it starts to become recorded and published in a written format.

An example of a more modern type of literature is a form of narrative focused genre of game, generally known as either Text-Based Game or Interactive Fiction. It is a form of video game that mainly uses narration as its selling point and allowing interaction for players in the form of choices [34]. A variant of this, called Visual Novel, implements the usage of audio and pictures to enhance the reader's immersion within the game.

Although it has seen great success in portals such as Steam [18], to create one is not as simple as it looks. For instance, a website that goes by the name textadventures.co.uk exists as both a portal for reading and creating text-based games. However, it has an underlying problem. To create a Text-Based Game, the user must comply with the concept of using a text editor, even though using a graphical user interface would increase productivity and focus [35].

Another example is *Ren'Py*, an engine that was designed specifically to create Visual Novels. To implement it, not only does one must understand scripting within a text editor, advanced creation that requires certain functions such as screen panning or moving character requires the usage of Python language [36]. Furthermore, it requires installation instead of being available directly within a web application.

Yet another alternative engine is called *WebStory*, which is implemented in the form of a web application. This engine too lacks the ability to create a Text-Based Game through the usage of graphical user interface. Furthermore, there is no dynamic implementation at all. Using the *WebStory* engine requires every conversation and assets to be hardcoded,

instead of retrieving it from through another source such as a database [37].

B. Existing Solution

As creating products via graphical user interface is considered to be more efficient, several relevant engines will be discussed here. The first one is Quest, an engine provided by textadventures.co.uk alongside with Squiggly. However, unlike its counterpart, it does not implement scripting language at all. Instead, it uses existing named textboxes so that users can intuitively tell how to create a game [38]. Another notable thing is that the reader also provides mobile compatibility, allowing for portable reading. The downside is that like other Text-Based Games, flair such as audio and pictures are unable to be added during the course of gameplay itself.

Another graphical user interface based engine is *TyranoBuilder*, which is used to create Visual Novels. It implements a drag-and-drop method to let user construct the sequence of appearance of assets within a scene, and the flow of the existing scenes themselves [39]. Although the software itself needs to be installed on a computer, the games themselves are compatible with HTML and mobile versions. However, effects such as image panning and zoom requires the understanding of the JavaScript language.

Yet another graphical user interface based engine is Unity. Being a versatile engine that is able to create multiple types of game, Visual Novels is also included within its scope. By using Unity, authors are able to freely edit the usage of assets such as audio and pictures through the GUI system [40]. However, to insert narration, dialogue, and branching path requires the author to understand scripting language and C# language.

C. Analysis of Existing Solutions

Even though the existing solutions have each of their own appealing points, it does not necessarily mean they are without flaws. To simplify the comparison process, the author has decided to break down the points into platforms in which the solution is able to work on, the comfort level in using the application, and gimmicks which can be added into the content of created visual novels through the usage of a solution.

Quest, while being web and mobile friendly, also provides a step-by-step tutorial for aspiring users. Furthermore, no installation is necessary to save space and time. However, the lack of gimmick such as the addition of pictures and audios is a flaw in its own right.

TyranoBuilder is also a solution which shows versatility by being both web and mobile compatible. It also shows the ability to insert audio and images. Tutorial is also provided for users, and it is provided in an intuitive chart form. However, installation is required to be able to run this solution. Furthermore, creation of higher-complexity visual novel requires understanding of scripting language.

Unity, being a general-purpose game creation software, is also both web and mobile friendly. This powerful engine supports the ability to add additional gimmicks such as audio

and pictures and the ability to alter those directly. However, installation is mandatory, and usage of this application requires the understanding of C# programming language.

D. Proposed Solution

In order to build an application which can be used as an alternative media to share literatures, the author has tried to analyse the advantages and disadvantages of the currently existing solution. Based on the analysis, the author then decided to implement a graphical user interface based Text-Based Game engine, while allowing pictures and audio unto the media of choice. Namely put, the creation of a visual novel engine inside a web application called "*Trinity*".

The creation of the visual novel itself can be done through the use of simple, intuitive GUI. The engine will be hosted within a web application, and readers will be able to view the created games via website. The website will be furnished so that it would be mobile compatible. The following are the features of the web application prototype to envision this result:

- User registration, in which non-registered users are able to register themselves via third-party authentication such as Google+. Doing that allows them to create visual novels.

- Visual novel reader, which allows both non-registered readers and registered readers to read visual novels within the website.

- Visual novel engine, which allows registered users to create visual novels, stories that can be embedded with audio and pictures which can then be hosted in the website itself. The system itself will be using a graphical user interface system for user's ease of creation. The users can also read the visual novel in a separate page after one has been created.

- Search system, which allows users to search for a certain visual novel within the website.

Based on the advantages and disadvantages of the currently existing solution, the author decided to implement a graphical user interface based Text-Based Game engine, while allowing pictures and audio unto the media of choice. Namely put, the creation of a visual novel engine inside a web application.

IV. SOLUTION DESIGN AND PROPOSED SYSTEM

This thesis' project is about the creation of a text-based game web application prototype which serves as an engine which can create a visual novel, and as a reading media where those created visual novels can be published. Being a web application, the author decided to develop it using a combination of Angular framework for minimal full-page loading, Ionic framework to make the website more mobile-friendly, Firebase which acts as a system architecture and back-end functions, and AngularFire library for simplifying data query from Firebase database.
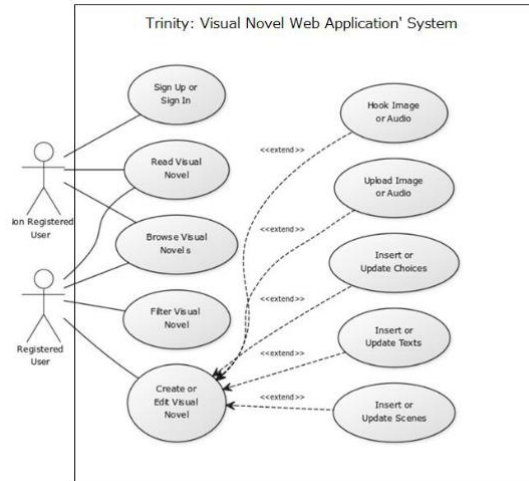
A. Use Case

Figure. 1. Trinity's Use Case Diagram

As shown on the figure above, five features exist within the website, of which one of those contain extendable features which supports the actual action. Amongst those five, accessibility is separated based on the user's credentials. Details of each actions are:

- Sign Up or Sign In, where users are able to register or login to the website in order to obtain credentials. Registration is done by providing their email address along with a password of their choice, which allows the user to login after the registration is finished. An alternate option would be to both register and login by providing a Google+ or a Facebook account.

- Browse Visual Novels, which allows users to search through the website page which contains an array of visual novels. If the user is inclined to search more systematically, a search bar is provided so that users can find certain visual novels.

- Read Visual Novels, where if the users have found a visual novel which intrigues them, they are able to read through it. Depending on the creator, the visual novel may or may not contain choices, images, or audio to complement the visual novel itself.

- Filter Visual Novels, which allows registered users to search for a visual novel via the usage of a search bar.

- Create or Edit Visual Novels, which allows registered users to create a visual novel. Within this case, users are able to add not only scenes and texts which serve as the reading material, but also additional flairs such as audios, images, and choices to make a more compelling story
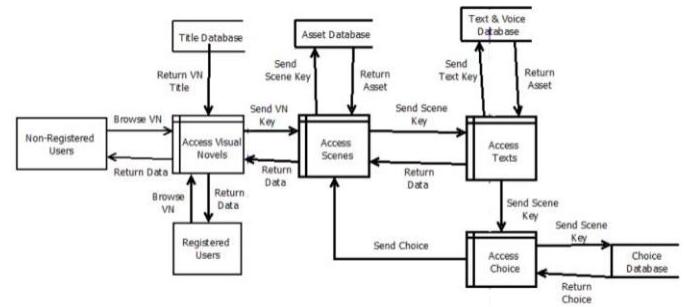
B. Data Flow Diagram

Figure. 2. Trinity's Data Flow Diagram

The figure above shows a context data flow diagram which represents a visual novel reader system. Within it, there is only one entity, which is the Non-Registered & Registered Users. As they have the same privilege within the reader system, they are considered as a single and same entity. They are able to pick one out of multiple existing visual novels, which is being returned via query from the database.

Once a particular visual novel has been chosen, a key which contains the unique id of the visual novel is retrieved and used for the rest of the process, as to not use the wrong visual novel data. After that, the initial key of that particular visual novel is sent to be queried by the next process. During the Access Scene process, the previously sent key is used to query the database, and results in retrieving multiple assets that is registered to the scene such as music and background image.

Afterwards, the initial key of that particular scene is sent to activate the first series of text within the scene, which will also be used to retrieve the audio which corresponds to particular texts. The process will then loop itself until all texts within the scene has been retrieved, which leads to the reader making a choice based upon the information that they have read. Once the choice has been made, the key of the choice is sent to the Access Scene process, which activates a scene based upon the key being sent. This whole process continues indefinitely until a final scene has been achieved.
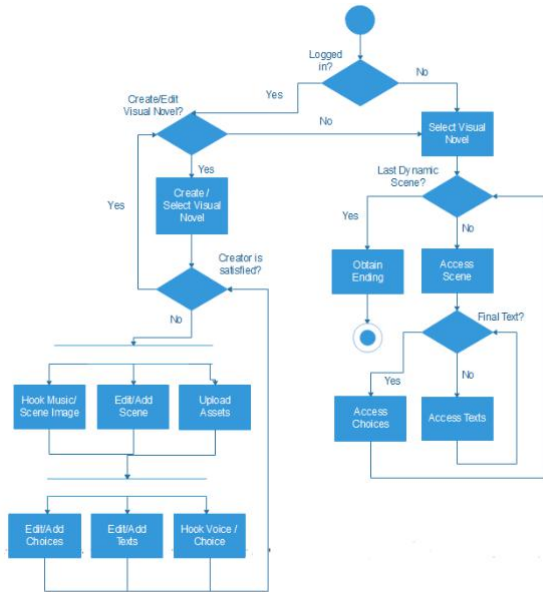
C. *Activity Diagram*

Figure. 3. Activity Diagram

As shown on the activity diagram, the first thing that the system judge is whether the user has credentials or not. Depending on that, capabilities of the user may be limited to simply reading a visual novel. On the other hand, a fully registered user has the ability to create a visual novel or edit his creation and publish it so other people can see.

To read one, the user simply has to go through a linear process. Firstly, the user must pick one out of several possible existing visual novels. After one has been chosen, the user will then iterate through a loop of both scene and texts. At first, the chosen scene will be chosen through the initial key. However, as users go through the lists of texts within the scene, they will then reach a point where they have to make a choice. Based on that choice, the user will enter a particular scene, which will contain its own choices and texts. This process continues indefinitely until the final scene has been reached, which is represented as the Obtain Ending process.

To create one, the conditions are akin to the process of reading one. However, the user starts one loop above the initial process, letting the user choose whether or not to continue creating or editing based on their personal satisfaction. Afterwards, the same process as the reading activity, except instead of reading, the user has the capability to add and/or edit existing scenes and texts. Within the add and edit processes, the user also has the capability to upload and hook assets such as audio and image accordingly to increase the flair and interest rate for readers.

V. SYSTEM IMPLEMENTATION

A. *Software Requirement*

Trinity Visual Novel Studio is a web application which requires the usage of web browsers that is able to support modern functionalities such as HTML5 and JavaScript. Included within this list are modern browsers such as Microsoft Edge, Mozilla Firefox, Google Chrome, and Safari.

However, if it were to be run in the localhost as a prototype project for testing purposes, there are several installation packages that needs to be installed first. Listed amongst these include Node Package Manager, Firebase, AngularFire2, and Ionic3, which has been mentioned prior in the paper.

B. *Hardware Requirement*

Although there are no real hardware requirements for this application, it is preferable to use a device is widescreen compatible for maximum enjoyment of the visual novel. Furthermore, internet connection is a necessity since the data is hosted within the Firebase cloud.

C. *Application Testing*

To see whether or not the application is working as intended, a test of functionality will be performed in order to check whether or not the scope that has been mentioned for the proposed solution has been fulfilled.

1) Authentication System

The application has shown to be able to authenticate users through the usage of a Google+ account.

2) Visual Novel Reader

The application has shown the ability to provide a visual novel that users can read regardless of whether they are authenticated within the system or not.

3) Visual Novel Engine

The application has shown the ability to create a visual novel engine for users that have already authenticated themselves within a graphical user interface system.

4) Search System

The application has shown the ability to allow non-authenticated users to search for existing visual novels and for authenticated users to search for their own created visual novels using a search bar.

VI. DISCUSSION

A. *Application Discussion*

Based on the extensive test cases as shown on the previous chapter, the original scope has been fulfilled, as users are able to register using a third-party authentication to establish their account within the system. Furthermore, both non-registered users and registered users are able to search

for visual novels and read those. Users are also able to browse visual novels via existing games page, and filter certain visual novels through the usage of a search bar.

On the other hand, registered users are able to create visual novels in within a page dedicated to creating one. Creating of a scene can be done through a simple click, and entering that very scene allows user to add assets which have been neatly categorized into Text, Assets, and Choices in the form of accordion list. Opening each category reveals that users can simply add and/or edit the objects of interest.

In comparison with standard text-based games, the widely known ones such as Quest and Squiggly are provided within a web platform, and free from operating system constraints. Trinity also follows this method. However, text-based games are limited in that generic ones do not use audio and pictures. Furthermore, there is no need for scripting language whatsoever, unlike Squiggly.

When compared with other visual novel applications, one thing that stood out is that Trinity requires no installation and is free from operating system constraints, akin to other text-based game creators. For instance, *TyranoBuilder* only comes with Windows and MacOS versions, and as such other operating systems are unable to be installed with it.

However, *TyranoBuilder's* graphical user interface is far more flexible in terms of creating and/or editing scenes and assets. For example, *TyranoBuilder* implements a drag-and-drop function which can be applied universally to scenes and assets. In contrast, Trinity is limited the usage of only click and touch.

In retrospect however, *TyranoBuilder*, *Renpy*, and Unity requires scripting language in order to implement the usage of flexible image. This is not an issue with Trinity. Furthermore, although Unity has far more flexibility in creating games, it can be considered non-user friendly due to the wide array of functions that needs further terminology study.

B. Constraint

Although the original scopes have been fulfilled, the program contains several limitations. Firstly, due to the discrepancies between the technologies of the front-end side and the back-end side, the author is unable to combine them both effectively, and as such the front-end must be recreated from scratch instead of modifying the created front-end.

Furthermore, unlike other applications which are offline based, this application requires the constant usage of internet. In the event that the internet connection were to be cut off, then accessing assets such as images and audios in the middle of usage will be halted.

To add further, *AngularFire* and Firebase are relatively modern technologies that have been created and is constantly being updated. As such, updating the packages and/or libraries require fundamental parts of the code to be refactored to follow the updated changes, since otherwise it will not work properly.

Lastly, there were changes in the original scope. Originally, the application was intended to be a pure desktop web application. However, the application as requested to be more accommodating for mobile-users. As such, there was the addition of using Ionic for the project.

However, as stated by the Ionic development team themselves, the newest Ionic version is incompatible with the newest version of Android Studio [69]. As such, testing via building and running virtual Android workspace is non-feasible. Building on iOS is a non-scenario due to the author and author's partners running Windows machine, and running it as a virtual machine takes up too many resources. As such, testing is limited only via Firefox's Development Mode.

VII. CONCLUSION AND RECOMMENDATION

A. Conclusion

As per discussed on the previous chapters, the large scope of the problem is the lack of reading literacy within Indonesia. However, as the scope is still too large, the author then proceeded to locate a problem which relates to it, namely the usage of game-based literatures. By using that as a basis, the intention of this thesis is to create a web application prototype as an alternative media called Trinity in which people can read and share stories and/or literatures.

The process of creation requires the basic web development technologies, namely HTML5, CSS, and *Javascript*. Going further than that, newer technologies such as Firebase for architecture, *AngularFire* for handling the back-end, and Ionic for the interface.

Under the consideration of the data flow and user-friendliness, instead of creating a system where the website can handle all the data through a single page, Trinity uses a system where the data are separated into smaller chunks divided by category of objects in order to visualize how the data can flow easily. Furthermore, the application was created as with the intention of being able to create visual novels through graphical user interface for easier learning curve.

Trinity, although still very much under an alpha stage, is already able to run the necessary core function in order to both create and read visual novels within its platform. It has shown the ability to add scenes and text accordingly, add and attach assets such as images and audio, and the ability to search created visual novels all in graphical user interface. As such, although lacking in other functions, users are already capable of using it as both a reading media and a story creation media.

Comparison between existing solution has shown that although each solution has its own perks, and Trinity has its own points that excel. For instance, mentioned previously were several text-based games that require scripting languages, which Trinity does not require. Furthermore, since Trinity is a web-based application, it has no operating system requirement in order to function. However, it lacks the flexibility in that has been shown in some visual novel

application, both in graphical user interface usage and detail in creation.

Overall, this thesis' scope and aim has been successfully completed, and as such there is the expectation that this application has the potential able to reading interest, if ever so slightly. Furthermore, as it successfully finishes as a GUI-based visual novel creator, it is expected that users are not so afraid of the learning curves that it takes to create a visual novel or text-based games through more conventional tools such as Ren'Py, Unity, and Squiggly.

B. Recommendations

The prior chapter has listed the issues that the author has come to terms with during the development of the application. As such, here is a list of recommendations that the author has for the future of this application:

- Redevelop the application without using Firebase. Although it is great for prototyping, there will be scaling issues in the future and it requires the developers to pay extra money so that it can scale accordingly.

- Create a more cohesive scene connection checker, for example through the usage of flowchart based front-end such as Go.js. Although users are technically able to connect scenes with one another, there is no real method of checking how those scenes connect with one another.

- Due to the modern frameworks developing and progressing endlessly, some might find it difficult to develop the application. As such, it may be considered wise to redevelop the application using an older and more stable framework.

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