Anna Run Game

PROJECT REPORT

HUMAN COMPUTER INTERACTION (CSE4015)

Slot: A1+TA1

Submitted in partial fulfilment for the award of the degree of

B. Tech in Computer Science & Engineering.

By

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Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

November 2020

DECLARATION

We hereby declare that the thesis entitled **"ANNA RUN GAME"** submitted by us, for the award of the degree of B.Tech. Computer Science and Engineering, is a record of bonafide work carried out by us under the supervision of Prof. SHASHANK MOULI SATAPATHY.

We further declare that the work reported in this thesis has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Place: Vellore

Date: 01-11-20 Signature of the Candidate

CERTIFICATE

This is to certify that the thesis entitled "**ANNA RUN GAME**" submitted by **Ishaan Ohri (18BCE0265), Anmol Pant (18BCE0283)** and **Kunal Singh (18BCI0189)** for the award of the degree of B.Tech. Computer Science and Engineering, is a record of bonafide work carried out by him/her under our supervision.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

The Project report fulfils the requirements and regulations of VIT and in my opinion meets the necessary standards for submission.

Signature of the Guide **Signature of HOD**

Internal Examiner **External Examiner**

ACKNOWLEDGEMENT

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Place: Vellore

Date: 28-10-20 Name of the student

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PROJECT OVERVIEW

AnnaRun is a web application made by VITians for VITians. The game takes inspiration from a student's daily life at VIT, running away from the red tag anna, preventing any kind of encounter. The game is a 2D runner game which takes inspiration form PAC-MAN. The game is built using p5.js, which is a client-side library for creating graphic and interactive experiences, based on the core principles of processing. The front-end library lets us make use of 2D animations because of which the design of the game was possible. Being a web-based application, AnnaRun can be accessed by anyone from anywhere on any device. It being a responsive application, adapts to different screen sizes, be it be a desktop, a laptop or a mobile phone.

In case of a desktop or a laptop, game can be played via the arrow keys and in case of a mobile, it can be played simply by swiping the fingers. In the entire course of the game, the student (the playing character) has to drink all the cups of coffee available on the map avoiding a collision with any of the annas. A collision with any of the annas will end the game and the student will have to restart from score zero. The map tries to pictorially represent a situation similar to that of the campus. At various locations over the map, there exist collectable powerups, which the student can collect, which would disable the power of the anna. It disables the power of the annas for a specific amount of time, during which if a student collides with the anna, the anna goes to its starting point. Collecting the coffee cups and these power ups fetches the user points and increase their score. After the user collects all the coffee cups, the level is completed. The game involves 3 different levels with increasing difficulty. As the level progresses, the number of powerups decrease while the number of annas increase and the speed of each anna also increases. The game also provides a background audio which makes it much more interactive.

INTRODUCTION

Anna run, a VIT themed escape and runner game, stemmed from an idea of creating a game development based project, for the edification of our fellow VITians. The player has to try and escape the Vellore Institute of Technology based maze with red tag annas being in close pursuit. The game map would be based on our campus and the player must collect all the rewards before being caught by the red tags to progress to the next level.

The sheer motivation behind the project was to come up with a **game development based project**, and adding a personal touch to it. The idea for Anna Run stemmed from the need of designing a game, for VITians, by VITians, where your avatar has to run around the campus themed map, collecting rewards, evading obstacles and red tag annas, in this one of a kind Vellore Institute of Technology themed escape and runner game. Also the fact that the game will be designed taking into due consideration both the geography and topography of our campus and the thought process of every VITian, it is something new and intuitive, to not only implement and develop but also play and enjoy, which further motivated us to pick this game as our project.

BACKGROUND / RELATED WORK

AnnaRun came in as an alternate to our previous project which got rejected on the grounds of being on a repetitive topic. Since all of us were new to game development as a domain, we first decided to explore our options when it comes to the platform on which we wanted to start building our game on. The first option was using Unity [1][2] / Blender [3][4], but the drawback in using either was the niche amount of knowledge each one of us had about the two platforms. The other option was making a mobile application [5], but developing the game for the iOS platform was giving a few setbacks. The final option that stood in front of us was developing a web-based application [6][7]. As the website would be a responsive application, its development would solve most of our concerns. It would cater for all the users; be it be users using a desktop or a mobile on any operating system. The frontend uses the p5.js [8] library which is a client-side library for creating graphic and interactive experiences. With the use of p5.js we could make use of the canvas object of a webpage and add animations to it in such a way that it would suffice our requirements. This would not only allow us to create 2D objects and animations like unity, but to also easily deploy and host our game on a web application-based environment for the edification and easy use of the masses. As all of us had only the basic knowledge of front-end development, we decided to take this as a challenge and an actual personal project, rather than it being just another J component project.

REAL LIFE APPLICABILITY

Video games have now surpassed the designation of "fad" or "new technology" to become a staple form of contemporary entertainment. The best source of entertainment and amusement is often something one closely identifies with and relates to. Video games have now also been proven as one of the best ways to cope and deal with stress. We have ideated over and chosen a VIT based game development based project as its human tendency to relate with similar people and online characters, as opposed to an ‘idealized’ version of something.

Although like most games, this game also primarily is for entertainment purposes, but it takes into due consideration the behaviour and psyche of each and every VIT student and the nostalgia that comes associated with being away from the campus for months altogether in these trying times. Hence, our game would include diverse range of maps and settings, inspired from our very own campus, where our character has to look for rewards while evading the red tags annas, amidst many other obstacles, who might try to catch you. It would not only be something new, but something each and every VITian would identify with and strongly relate to.

The game houses the potential to act as a platform and a connecting link amidst all VITians and can provide a medium and get-away as they face the challenges the campus life throws at them, both physically and virtually, as games are often known to help with healthy and effective channelization of emotions.

INDIVIDUAL CONTRIBUTIONS

In the initial phase of development all of us decided to each explore different frameworks to make the game idea a reality. The contributions of each and every member in the initial ideation and in the actual development phase are listed below:

- Ishaan Ohri: Ideation on how the game should look and to explore various java libraries to determine the feasibility of an android app based implementation and foresee the complications that might arise if such an implementation is chosen.
- Anmol Pant: Ideation on the details of the game like the number of levels and their difficulty and to explore unity and blender for 2D game development and try to foresee any additional complications and difficulties that might arise if a unity-based implementation is picked. Also, all the documentation of the project for the reviews.
- Kunal Singh: After the rejection of our first project idea on the grounds of redundancy, it was Kunal who came up with the idea of making this one of a kind runner game for VITians, by VITians and named it Anna Run. Kunal was also responsible for exploring various web-based frameworks and 2D animation libraries that could be used to make this game a reality.

After putting in a lot of thought, we decided to go with p5.js, a 2D animation JavaScript library as a base that could help us make, design and animate the actors in the game, moreover a web based solution might also give us the liberty of using other design and beautification tools like, Tailwind, Sass, etc. and could also add a certain degree of familiarity to this otherwise unknown and alien domain of game development. Hosting our game on the web would also allow it to reach a wider audience.

After the initial ideation phase, **Kunal** was involved in the design of the game and how the characters and the in-game screens would look like. He also contributed

to the creation and hosting of the react app on which the whole game is built. **Anmol** and **Ishaan** were involved in how the characters and in game entities would move on the screen, how the map would be rendered, how to collect powerups and increase the score, etc. ie. The functional part of the application was only made possible by the contribution of all three of the members alike as none of us were familiar with game development as a domain to begin with. **Ishaan** was also involved in the backend part of the application development, dockerizing the same and deploying it on a domain, whereas amidst the development part, **Anmol** was the one handling the documentation for the project.

Hence, the contributions of all the members proved vital in turning this idea into reality.

TOOLS AND TECHNOLOGIES USED

- HTML for web browser display.
- CSS for styling.
- The whole application is a **react** web application.
- P5.js for 2D animations
- Docker for deployment
- Visual Studio 2019 as the primary text editing software.

Hardware Requirements:

-Any elementary Pentium series or above processor.

-200 mb HDD space (or use the online deployment URL instead of running it locally)

-128 mb RAM.

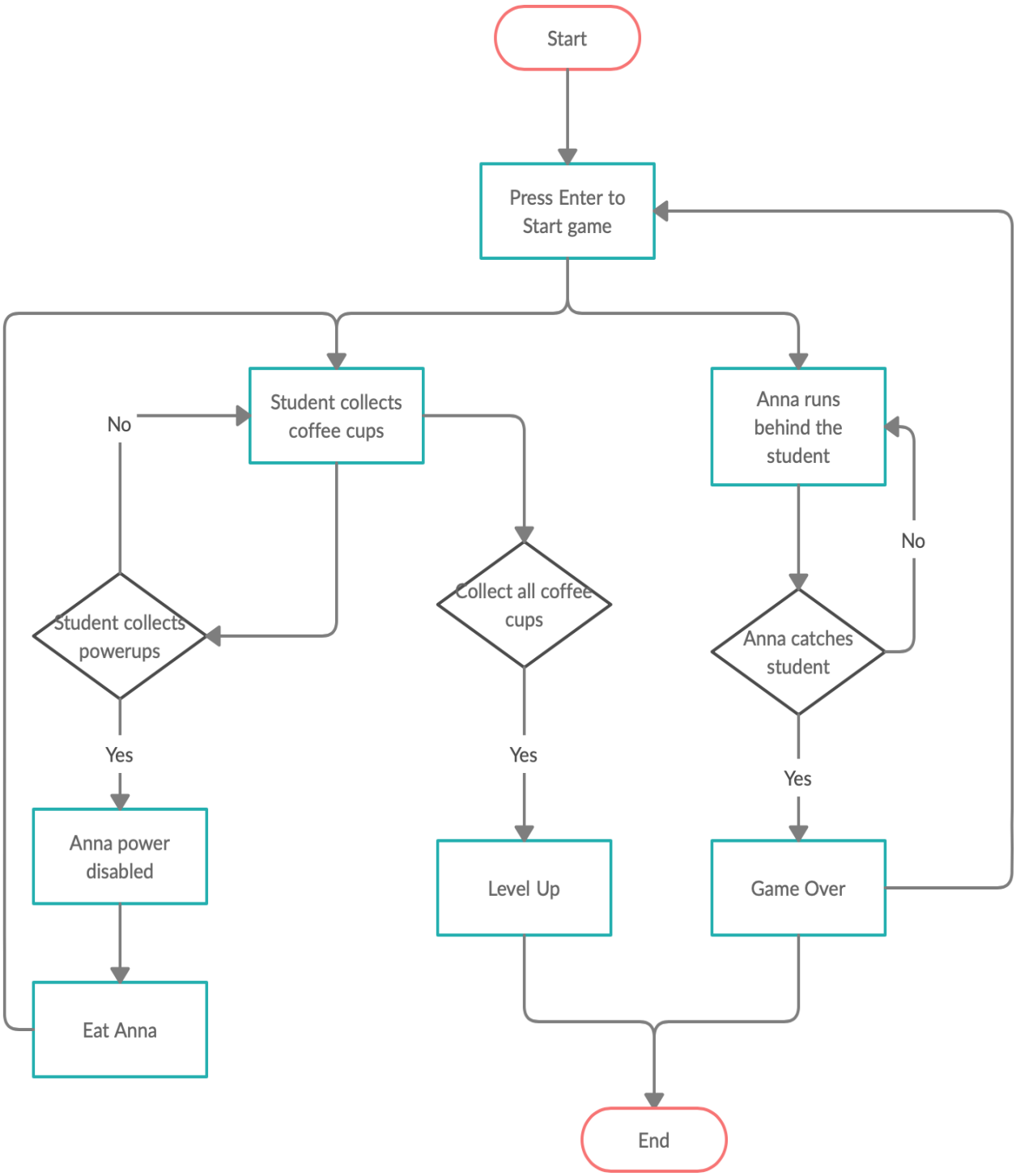
Software Specifications:

-Should Support Windows XP and above.

- Any modern and updated browser that supports webgl like Chrome, Firefox, Safari, etc.

- Should have NPM and associated packages installed.

PROPOSED SYSTEM FLOW



WORKING METHODOLOGY

The working methodology of our game can be best understood by the Goal Operator Methods and Selection Rule (GOMS) analysis of the same.

Goal: To clear the level and collect all powerups while doing so, so as to make a high score.
Operator: The person playing the game and making the keystrokes.
Methods: The method is to use the arrow keys to move around the VIT themed maze, avoiding annas and collecting powerups.
Selection Rule: User can decide whether to use the keyboard or the touch screen to play the game, the difficulty level can also be altered and controlled, depending on the level.

As the above GOMS analysis indicates, the user (player) has to navigate and guide his avatar through the 2D maze, collecting all the powerups whilst avoiding the Annas and try to amass the highest score by crossing as many levels as possible.

The game uses a 2D animation JavaScript library called p5.js for canvas manipulation to produce motion in the avatar and annas.

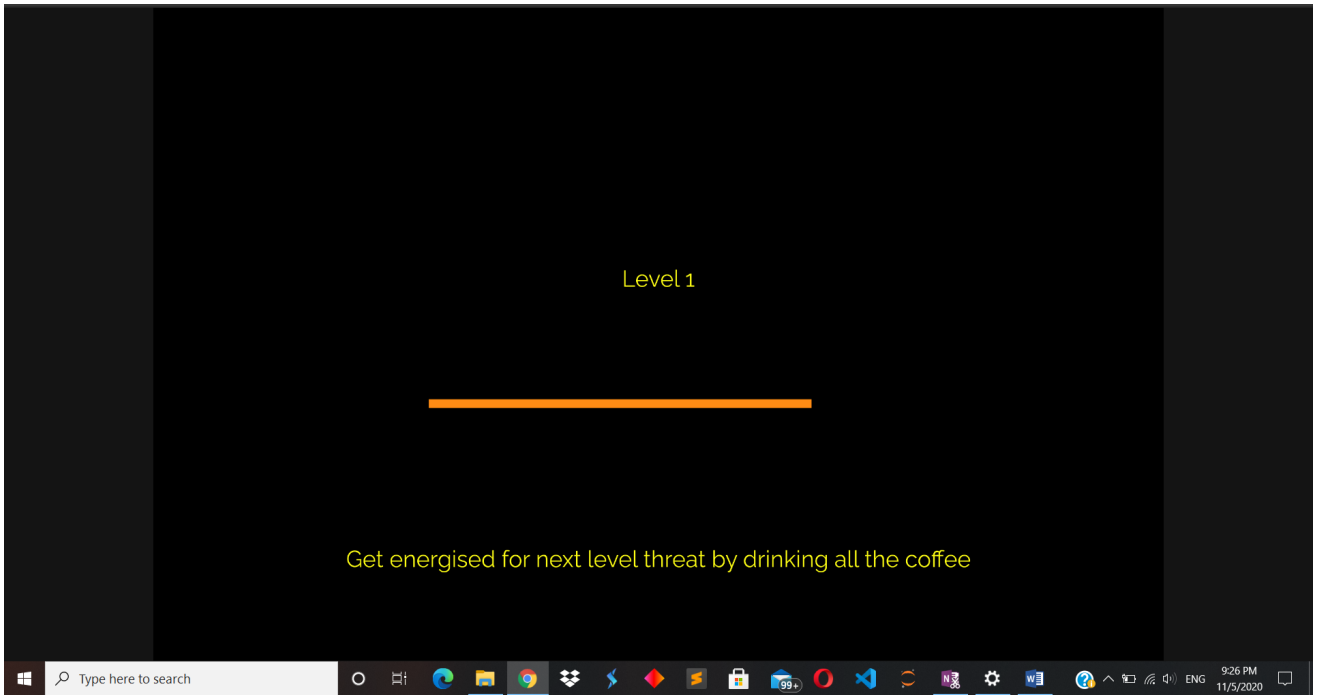
IMPLEMENTATION RESULTS AND USER INTERFACES

Our game incorporates an interactive and intuitive user interface in the form of different screens, shown at different times based on the actions the user performs. Here are some of the user interfaces present in our application.

THE START SCREEN:

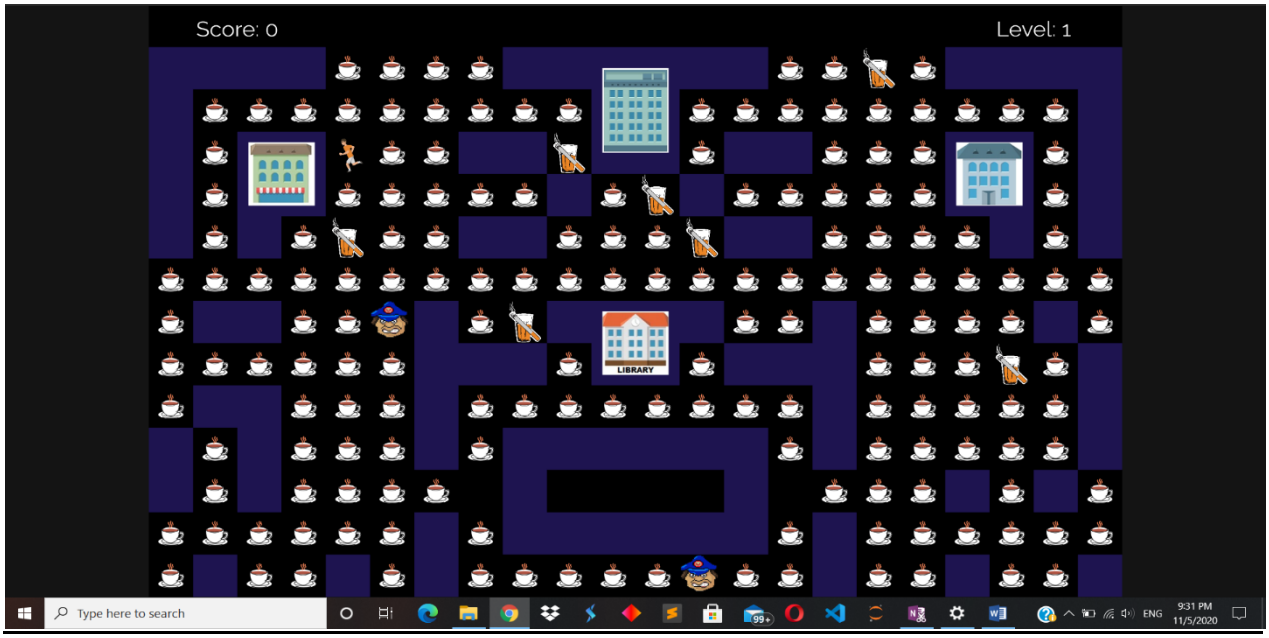
As the game begins and the URL is entered, after the loading screen, the user is greeted with a message on how to start the game, and the local high score for the user on their machine and browser. In my case, it happens to be 907 and hence it gets displayed along with the press enter to start message. As the game is playable on mobile touchscreen devices as well, hence a tap to start option is also made available.

THE LOADING SCREEN:



When the user presses the enter button, a loading screen pops up, unnecessary details have been avoided here to make the screen look as minimalistic as possible. There is a loader in the middle of the screen, making the user well aware of the status of how much the game has been loaded. The level, along with a unique hint on how to play the game is also provided at the loading screen.

THE GAME SCREEN:

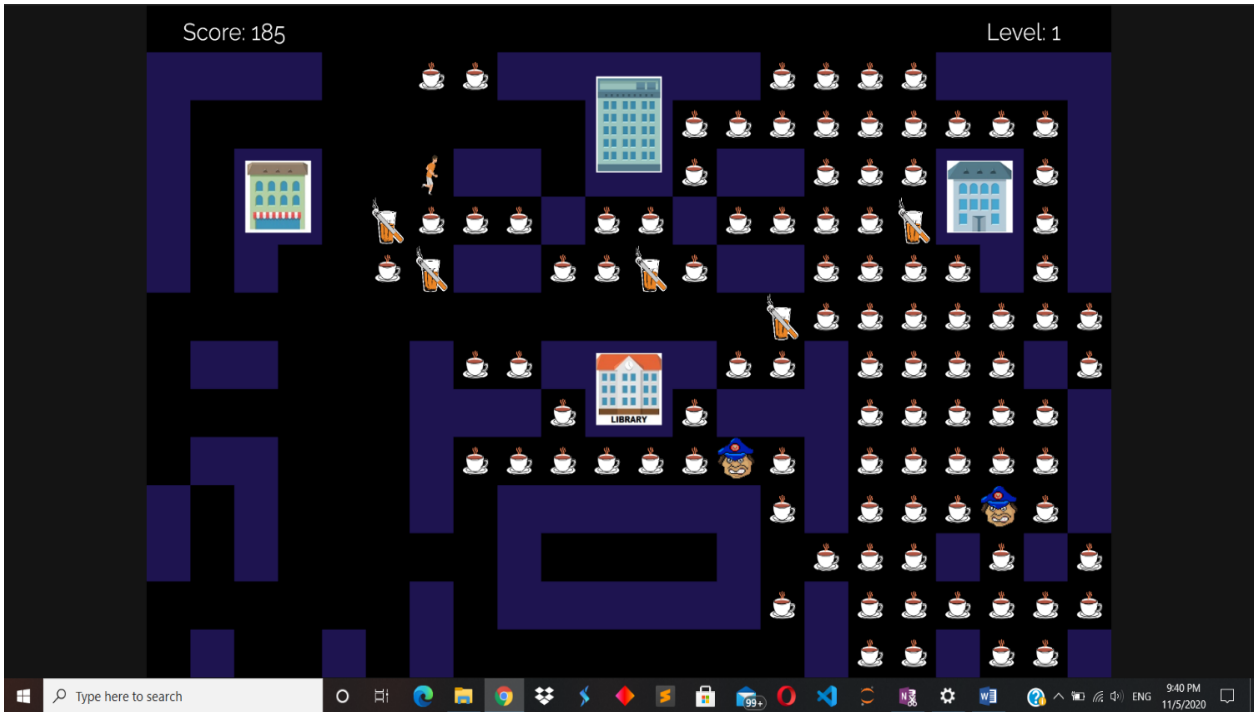


Finally, when our game is completely loaded and it begins, we see the overall game interface where a 2-dimensional maze has been rendered and our avatar (the student) must collect the coffees, and the powerups (the tea and cigarette) and avoid the Annas at the same time. While powered up, if and when our avatar runs into an Anna, the must restart from the beginning of the maze and the game ends if we get caught by the annas while not powered up.

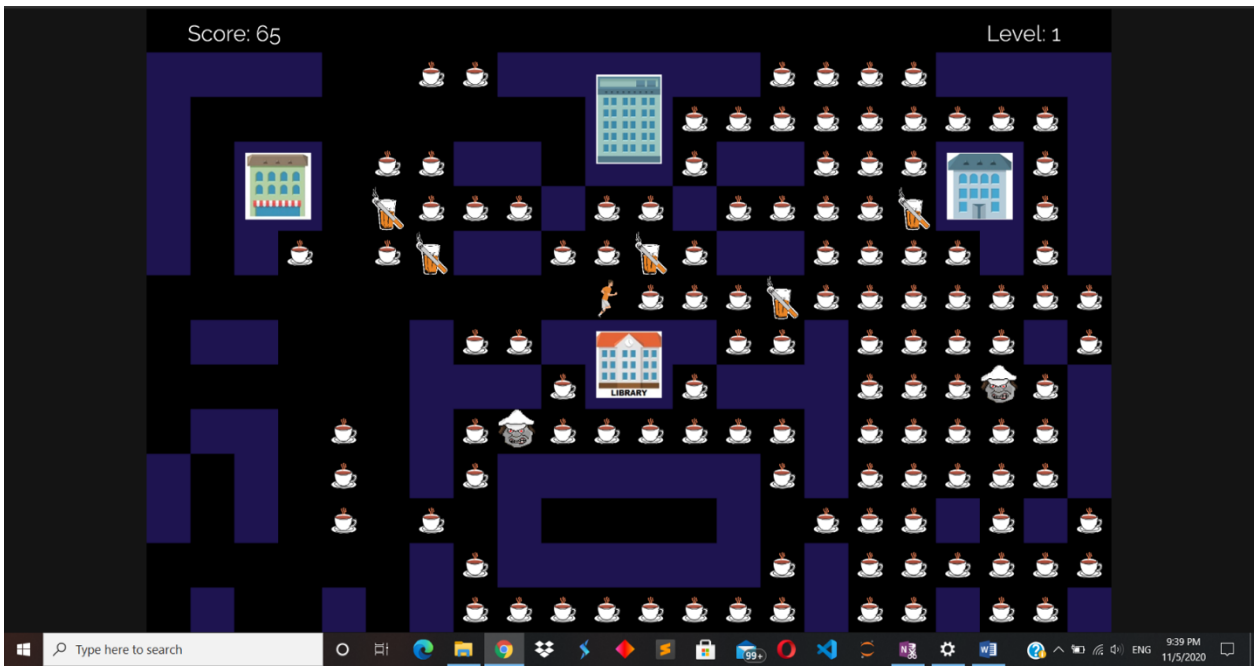
The buildings were supposed to be inspired from the buildings in our campus, but currently all of us lacked an in-depth knowledge of design tools like Adobe Illustrator, so as to design the buildings which were to be inserted, so we had to make do with what we found online. This can be added as a future design or user interface improvement, where the buildings are also 2 dimensional objects designed specifically keeping in mind the buildings in our campus.

The game also features background music to improve the experience of the player playing the same and add to its overall appeal.

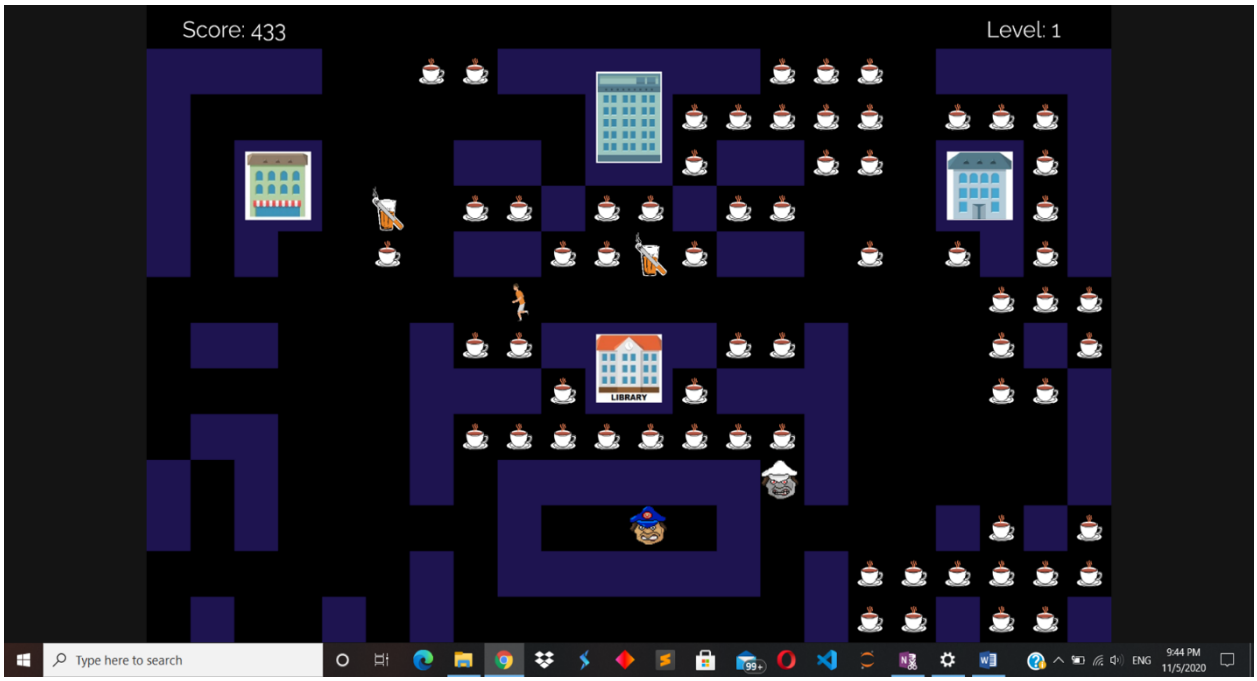
IN GAME SCREENSHOT(S):



The score increases as we get the collectables.



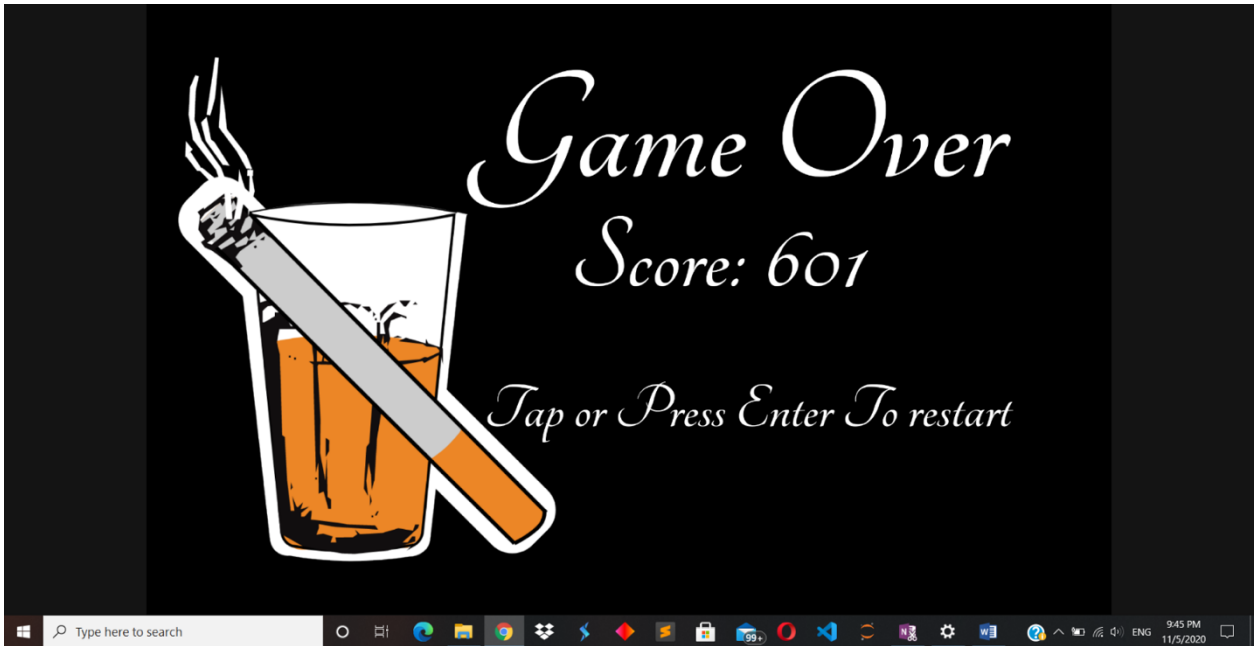
The annas turn black and white when we get a power up, to indicate we can obtain more points by neutralizing them whilst powered up.



The annas must start again from the middle of the maze if we touch them while we are powered up.
The game features 3 levels with increasing difficulty, with the number and speed of Annas increasing with each passing level, to add to the overall appeal of the game and cater to the players of different skill levels.

On the completion of a level, the loading screen features again with the loader and a tip. As the level increases, so does the speed and number of Annas, with the number of powerups available going down slightly. A future enhancement could be changing the buildings and the maze structure too with each passing level.

GAME OVER SCREEN:



If one gets caught by the Anna, a game over screen with the game score pops up. The user can always restart the game by pressing the enter key and the game stores the highest score of the user to display it at the beginning of the game.

NEILSEN'S 10-POINT HEURISTICS

1. Visibility of system status

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
Our project does the same via on screen notifications and level completion messages, and if the user is eliminated the system displays the highest score accompanied by a 'game over' message. The game also includes real time loading bars and tips for players.

2. Match between system and the real world

The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Few have followed real-world conventions, making information appear in a natural and logical order.
We have tried our level best to make our game as realistic when it comes to life at vit and how dreaded red tag annas are in campus, hence the player can relate the in-game experience to what they usually see around them in the campus.

3. User control and freedom

As our project is a game development-based project, if the user mistakenly gets caught by the Anna, then the game exits and the score is displayed on the user's screen. Since in a game, wrong moves must be penalized, there is limited degree of freedom when it comes to 'reversing' or 'undo-ing' the wrong moves made, but we have incorporated all the required functionalities like keyboard and touch level movement options for the in game avatar, so that the user feels they are in control of the system and not the other way around.

4. Consistency and standards

In our game we have implemented the standard keystrokes for all avatar movements which are well known to everyone (like arrow keys, W-A-S-D, space bar for pause etc.). Thereby maintaining consistency throughout and following the already prescribed standards. For touch screen devices, like most games and apps, the direction of the avatar's motion can be altered by swiping in the desired direction we wish to redirect it to.

5. Error prevention

The code for our application is robust enough to handle any and all unforeseen exceptions that might arise due to the player deliberately or accidentally pressing the wrong keys. Whenever a wrong key is pressed, the game has been programmed in such a way so as to ignore that keystroke and let the user continue with their game. Unless and until the user presses the pause, button or is eliminated the game ignores all errors made in the form of keyboard and mouse interrupts by the user.

6. Recognition rather than recall

We have tried to minimize the user's memory load by making objects, actions, and options visible. The user does not have to remember any information from one part of the dialogue to another. The game once started, takes up the entirety of the user's browser window so as to make all the available options visible to the user like level, score, etc.

7. Flexibility and efficiency of use

The game can cater to both novice and expert users by means of levels of increasing difficulty. So, as the novice user learns to play the game over time and hopefully, gets gradually better at it, they can try their hand at the levels that follow the primary and initial level, which are slightly trickier and faster paced. Frequent

actions, like replay and pause, have been tailored to action keys like ‘Enter’ and ‘space bar’.

8. Aesthetic and minimalist design

The game takes design inspiration from a popular game Pacman, but with added design enhancements so as to make the game relatable for VIT students. Hence the game design is minimalistic and incorporates a 2D map of the campus in the most aesthetic and visually pleasing way possible, the collectables are evenly spaced and the avatar can obtain powerups by just hovering over them.

9. Help users recognize, diagnose, and recover from errors

As we have developed a game as our project, there is not much scope for errors on the side of the user, except getting caught by the anna and getting out, after which a full screen ‘game over’ message along with the high score of the user is displayed.

10. Help and documentation

Our GitHub repository’s README.md file contains all the help the user might need from running the game locally on their machine to how to play, complete with in game screenshots and frameworks used to develop the same.

COMPARATIVE ANALYSIS WITH SIMILAR WORKS

Maze running and escape games that started with arcade games like PacMan, have recently stemmed up and have been a dominant force in the market in the last 2-3 years, with games like Temple Run, Subway Surfers etc. occupying the center stage now. Although the concept and inspiration drawn might be the same from the above mentioned works, but the implementation is what differs. These games, although similar in concept themselves, differ in terms of the setting, sounds and the theme in which the game is played. Anna Run would also be a maze running and escape game, but with its topography and map being VIT themed.

Anna Run, like most running games, will feature an interactive user interface that not only would make it easy and interactive to play and grasp even for novice and first time users, but also additive, as players progress in the game and unlock higher levels.

The game houses a unique and intuitive idea of integrating game development with our college life and incorporating the behaviours and sentiments of VITians in the form of a VIT themed user interface and design.

The target audiences for the game would primarily be VITians, preferably, but not limited to, the Vellore Campus. The game will be designed adeptly keeping in mind the geography and topography of our campus and the psyche of every VITian, incorporating the challenges and struggles a VITian faces in everyday life and trying to find their way out of the campus evading them and avoiding the red tag annas, who might try to catch you.

The application based environment would ensure easy availability and installation for the all the users. And provided it is not only unique, has a VIT themed user interface & design and is also easy to play we expect the game to be a huge success and act as a unifying factor amidst VITians all over the nation.

So, whereas maze runner games like subway surfers, pacman, etc. are very generic in nature, Annarun on the other hand is made keeping a very specific user base in mind, ie. VITians, hence we expect Anna Run to do well in terms of popularity amidst VITians with its USP being its specificity and ability to cater to the selective user base it is made for.

CONCLUSION

In the scope of this project we got a chance to try our hand at game development using p5.js, a javascript framework designed specifically for 2D animations. We implemented a VIT themed maze runner game, featuring the player (as a student) and the Annas as the villians, running behind the student. The player has to find their way around the maze, collecting powerups and completing levels, trying to get the highest score possible. We have made the game into a fully responsive web application that can be played and accessed via PCs and mobile devices alike.

The sheer motivation behind the project was to come up with a game development based project, and adding a personal touch to it. The idea for Anna Run stemmed from the need of designing a game, for VITians, by VITians, where your avatar has to run around the campus themed map, collecting rewards, evading obstacles and red tag annas, in this one of a kind Vellore Institute of Technology themed escape and runner game. The javascript framework used manipulates the canvas object of the webpage to produce animation and motion amidst the entities.

The game has been made and designed taking into due consideration the mindset and psyche of VITians and the principles of Human Computer Interaction, where the UI has just the right amount of information so as to make it minimalistic yet functional. Background music along with pre and post-game interfaces have also been incorporated so as to enhance and improve the overall user experience.

We not only managed to develop the application from scratch in the allotted time span but also tested the same by making different users play our game on different devices, to make sure it was functional on all of them.

After successfully building our application, we tested the same on different devices, with users of different age groups and people with diverse needs, to make sure the application catered to all of them.

All in all, it was a one of its kind learning experience, talking us through the whole software development cycle and helping us apply the concepts learnt in the classroom to build a real world application. As neither of us were familiar to game development as a domain before this, this hands on project experience has opened a new horizon for us and we would love to explore game development as a domain further.

FUTURE SCOPE

Once the basic and functional version of the project is up and running, the game based implementation would ensure that there is always further scope of improvement and development and always room for new features to be added and incorporated in future versions and updates, keeping in mind the needs of the users. Features in newer versions can be added in the form of updates, taking into account the reviews and user complaints and feedback. Currently we would like to add a designer to our ranks to help is with more realistic, VIT specific svgs of buildings so as to give the game a more campus like feel. Next we could add more levels or different kinds of powerups, each performing a different function or having different weightage as far as the score calculation is concerned.

Then once in campus, we would first like to expand the user base of the game by promoting the idea of the same amidst students. The fact that it is a unique idea coupled with the VIT themed user interface, would definitely give it a competitive edge over its counterparts, especially among fellow VITians. Hence we expect the game to be a huge success, if properly marketed, attributing to the fact that it is a game made by VITians, for VITians, keeping in mind their sentiments and behaviours.

We could also partner with student organizations like VITspot, for promotional activities and if the game ends up gaining the attention it deserves, we can roll out new features in future updates and maybe try to get some organizations and companies in and around Vellore to sponsor the same and run their ads on our website.

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11. https://github.com/anmolpant/HCI-Project
12. https://annarun.tk/

APPENDIX

a) **Link to ppt:** https://rb.gy/fwng8l

b) **Link to pre-recorded demonstration video:** https://rb.gy/pcvf7v

c) **Link to access source files:** https://github.com/anmolpant/HCI-Project

d) **Project Website:** https://annarun.tk/