The name of the game is: "Flex"

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ABSTRACT

Most games we find these days require some complicated controller where you have to learn a series of button combinations to control it. The first platform to try to solve this problem was the Wii, but it still comes with some caveat, such as having to learn how to move the Wiimote. The purpose of this project is to have an intuitive controller for the game, your body, which will respond to your movements without having to learn anything beforehand.

Flex is a game where you have to fit your body to the shapes that are coming at you, like the TV show "Hole in the Wall." The game will track the position of your body, as the game progresses the shapes will come faster at you and will be more difficult. Another objective of this project is to be able to play almost right away using few markers to track the player's position (between 6 and 8 Degrees of Freedom), as well as making it accessible to almost everyone by using inexpensive hardware such as the infrared camera found in the Wiimote, which is able to track 4 points with a 45° field of view.

Project Blog: http://tlevy-seniordesign.blogspot.com/

1. INTRODUCTION

Since the beginning of the video game era we have had to learn complicated button combinations to play video games. The first successful implementation to turn this trend around was Nintendo's Wii. Even though this was an improvement this is not a fully intuitive interface, some of the games do require a combination of movement and pressing or releasing buttons. With this we are starting to see a need: More intuitive ways to interact and play videogames.

During E3 2009 Microsoft announced their own implementation of this, Project Natal which is scheduled to be released by the end of 2010. Project Natal promises to be the next generation of "controller-free gaming experience." What this means is that you will be able to play and control the whole system with your hands, voice commands and body. Unfortunately, none of the details of the project have been made public yet.

With these two systems we see the growing trend of having intuitive and even controller-free experiences. The goal of this project is to create such experience. Furthermore, the controller experience would be nothing if the game that you are playing does not engage you into such an experience. This is why a main goal of the project is to create a game that requires you to fully engage.

Flex is a game that resembles the Japanese TV Show *Hole in the Wall.* There will be a wall consisting of cut-outs that will move towards the player. The player will need to assume a position before the wall gets too close. If they can fit through the hole the game will progress and the difficulty of the shapes will increase.

Due to the nature of this game it is necessary to have a full-body controller as opposed to some other interface to properly play. This is why this game is a perfect opportunity to experiment with full-body controllers.

1.1 Design Goals

This project seeks to create a simple and easy to play game. The main objective is to have a controller that we all know how it works and reacts, our body. With this, the users will be able to start playing without a learning curve. The only thing they need to do is move their body.

Due to the ease of use this game has a broad target audience. From hard-core gamers who are starting to enjoy playing intuitive games where you do not need to use +10 buttons to play. To casual and sporadic gamers who want to enjoy simple games.

I hope that this game will integrate properly game play elements, simple graphics, sound, and an intuitive interaction to give the player the feeling that they are immersed in the game and gives them a full sensory experience.

1.2 Projects Features and Functionality

By the end of this project players will be able to:

Wear a number of markers, between a full set of motion capture markers and six to eight markers, and start playing a fully fleshed game. This includes:

Start a new game with increasing levels of difficulty.

Load and save games in progress.

Access the High Score table.

2. RELATED WORK

This project was initially inspired by Johnny C. Lee's presentation during TED 2008 where he introduced Head Tracking for Desktop VR Displays using the Wii Remote, aka Wiimote. The TED video is just a sample of all the work he had done with the Wii Remote.

Lee [Lee07] shows in his website that using the infrared camera in the Wii remote you can accurately track the location of your head and render the view depending on the location. This creates a realistic illusion of depth and space.

Chai and Hodgins [CH05] introduce an approach to performance animation that employs a low number of markers and a video camera to get the data. This aims to be an unobtrusive approach that will hopefully be practical for home use.

Ishigaki et al. [IWZK09] addressed a more in depth problem. Once you have a user interacting in real time with their full body you need to translate the user's performance into corresponding actions in the virtual world that are more expressive.

2.1 Related Games

As mentioned in the introduction the theme of this game was inspired by the Japanese TV Show *Brain Wall* [2007], also known as *Hole in the Wall*.

Namco Bandai released in 2009 the game *Muscle March* for the Wii. This game follows the same principle as the TV show; you need to fit through a hole in a wall. The interaction is quite simple; you need to place the Wiimote and the Nunchuck in the correct position as you approach the wall.

There are other games that follow this principle, such as *Hole in a Wall 3D* for the iPhone. In this game you have to fit random shapes as a wall approaches. Even though it follows the same principle as the TV Show it does not give an innovative interaction with the game.

3. PROJECT PROPOSAL

Flex is more than just a game; it intends to create a fully interactive experience.

This project will implement a detection of the user's movements in real time through a motion capture system. The real time data collected will then be used as the controller for the game. This has to be done in an efficient way so that there is no time lag and the game can be fully enjoyed.

3.1 Anticipated Approach

The first step, which I consider the skeleton of the game, will be to create a framework and setup the environment, i.e. an understandable visualization, in which the game will be played. With this setup up I will be able to integrate all the game logic with a finite state machine.

Once the skeleton is in place I will be able to build the collision detection needed for the wall-player interaction. Initially I will test the game with pre-captured sample data. Once the sample data is working I will integrate it with the real time data. This data will initially be obtained with a full set of motion capture markers.

Finally, I will polish the game by creating more shapes and levels to play and designing the sound for it.

3.2 Target Platforms

The game will be coded in C++ using Ogre Game engine, Fmod sound engine, and a motion capture system will be the link between the user and the game.

3.3 Evaluation Criteria

The game will be fully playable. The game should respond in a natural way and there should not be a learning curve or a non-steep learning curve.

4. RESEARCH TIMELINE

Project Milestone Report (Alpha Version)

- Completed all background reading
- Framework/Visualization is functioning
- Simple base case example for the wall moving works
- Finite State Machine and Game Logic are in place
- Parser to read Motion Data

Project Final Deliverables

- Fully playable game that emulates the TV Show
- A Skeleton or Shadow character that will be controlled by the player's movements.

Project Future Tasks

- The first step would be to use a low number of markers to control the character. The next step would be to have a marker-free system in place.
- Add gesture based response so the character can dive through a hole. This will simulate motions that the player might not be able to do in real life but will be useful for the game.

See figure 1 for Gant Chart.

5. Game Logic

A game would be played as follows:

1. Player Starts the game (Figure 2)
2. There is a countdown (3,2,1) (Figure 3)
3. Hole in the wall is revealed (Figure 4)
4. Wall Starts moving (there will be markers on the floor as visual feedback to know how close the wall is) (Figure 5)
5. Wall gets to the playing area

   a. If the player fits into the shape you get visual feedback and points are awarded (Figures 6 & 7)
   b. If the player does not fit into the shape visual feedback is provided and the player loses a life (you start with 3 lives) (Figures 8 & 9)
6. Repeat from [2] until:
   a. Player beats the level. The game gets harder by providing harder to fit-in shapes and increasing the speed at which the wall moves.
   b. Player loses 3 lives

APPENDIX

Videos

- **a.** Hole in the Wall TV Show: http://www.youtube.com/watch?v=t-zxi_Y4Xu8
- **b.** Johnny Lee's TED talk: http://www.ted.com/talks/johnny_lee_demos_wii_remote_hacks.html
- **c.** Namco's Muscle March: http://www.gamespot.com/news/6209821.html

References

[CH05] CHAI J., HODGINS J. K.: Performance Animation from Low-dimensional Control Signals. *ACM SIGGRAPH 2005 Papers* (August 2005), 686-696.

[IWZK09] ISHIGAKI S., WHITE T., ZORDAN V. B., KAREN LIU C.: Performance-based Control Interface for Character Animation. *ACM TOG 28, 3* (August 2009), 1-8. (Proc. ACM SIGGRAPH 2009).

[Lee07] LEE J. C.: Tracking fingers with the Wii remote. *Online, Available:* http://johnnylee.net/projects/wii/

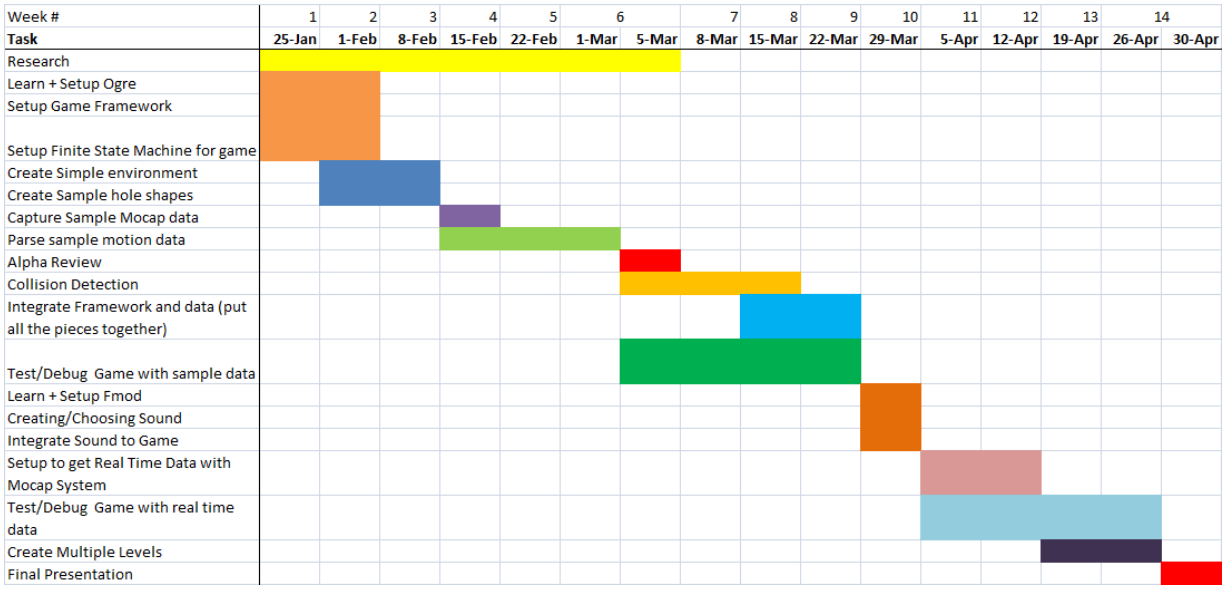

Figure 1: *Gantt Chart for Project Time line*

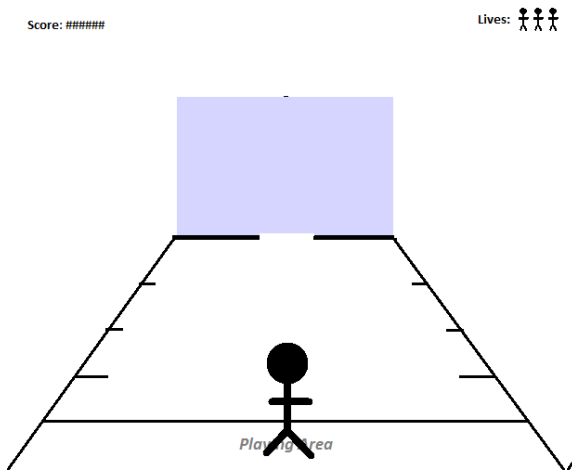

Figure 2: *Starting Game*

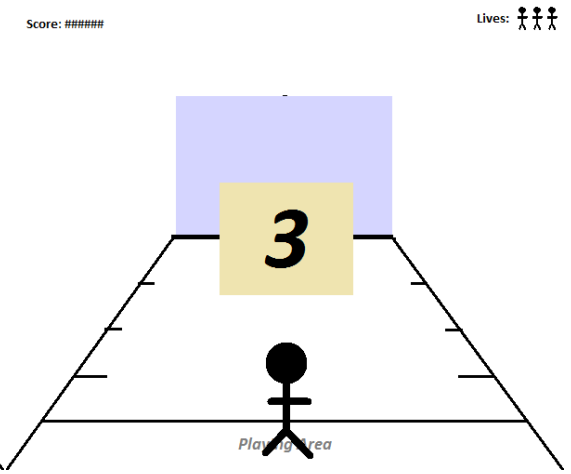

Figure 3: *Countdown*

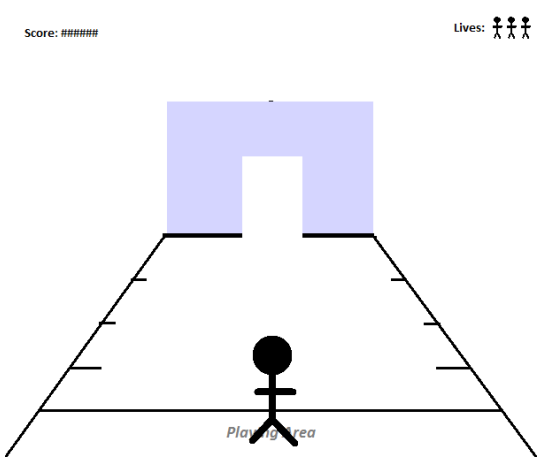

Figure 4: *Hole is Revealed*

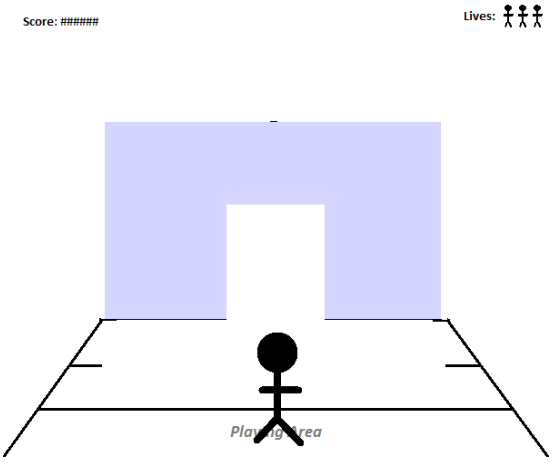

Figure 5: *Wall approaches player*

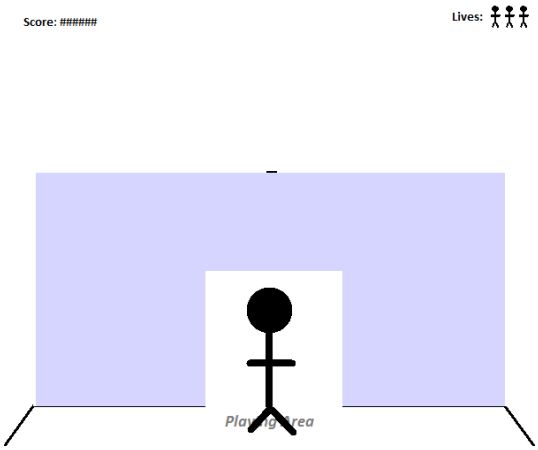

Figure 6: *Player fits through hole*

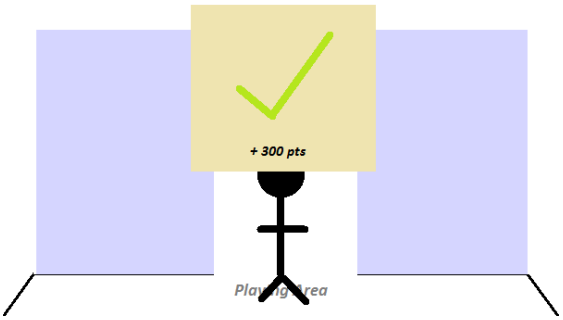

Figure 7: *Winning Feedback*

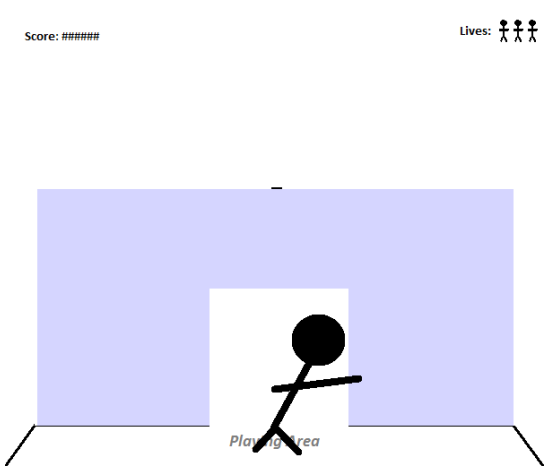

Figure 8: *Player doesn't fit through hole*

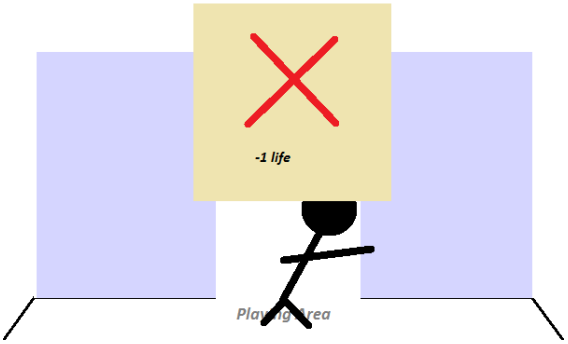

Figure 9: *Losing Feedback*