COP290: Design Practices
Design Document
Pocket Tanks

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1 Introduction

1.1 Purpose

The purpose of this document is to describe the implementation of "Pocket Tank web game" developed by us.

1.2 Scope

The Software consist of following functionality.

1. **Offline Gaming:** Pocket Tank will be played on one computer by both the players.
2. **Server Side:** Server will be created so that 2 players can play this game from their computer.
3. **Chat System:** Chatting Facility for players to communicate during their match.

2 Overall Design

2.1 About

Part 1: In this portion of the program, two players will be able to compete with each other on one computer. Each player will have their turn alternatively. This single node server application will have a option for team up so total of 4 players can play this game in a team of 2.

Part 2: In this portion of the program, two players will be able to compete with each other through different computers connected on same server. Each player will have their turn alternatively.

Part 3: Chatting system will provide facility for video, audio and text exchange facility to the players to communicate will each other. It can only be activated by players.

2.2 Game Design

Weapons There will be a total of 20 weapons available to players. Out of which players can select 10 weapons in their armory. There will be a option for automatic selection for the player(It will be either completely random selection or some predefined armory will be given to the player). On online mode of the game players will not see other player's selection of weapons until his selection is completed.

1. Weapon 1
   Single Shot The default weapon, medium sized explosion and good points.

2. Weapon 2
   Big Shot Large explosion radius, but points are low.

3. Weapon 3
   3 Shot 3 bullet spread, medium explosion size, low points per explosion.

4. Weapon 4
   5 Shot 5 bullet spread, medium explosion size, very low points per explosion

5. Weapon 5
   Jackhammer Bullet bounces straight up 5 times... lots of fun to use

6. Weapon 6
   Heatseeker If the bullet gets close to the opponents tank, it flies toward it

7. Weapon 7
   Tracer Fires a spread of 5 bullets that tell you how much to change your angle for the next turn

8. Weapon 8
   Pile Driver Small amount of damage, but explosions are directed down creating a hole

9. Weapon 9
   Dirt Mover Directional dirt removal based on the angle when fired

10. Weapon 10
    Crazy Ivan Proximity-based multi-warhead with unusual yet fun results

11. Weapon 11
    Spider Spider web effect that sprays the closest tank when it goes off

12. Weapon 12
    Sniper Rifle No explosion radius, large points, throws the tank nicely, deadly

13. Weapon 13
    Magic Wall Vertical wall will grow where the bullet lands

14. Weapon 14
    Dirt Slinger V-shape dirt effect based on location where bullet lands

15. Weapon 15
    Zapper Laser beam emits from bullet if it gets close to tank

16. Weapon 16
    Napalm Exploding liquid that covers and burns everything caught in its wake

17. Weapon 17
    Hail Storm Hundreds of bouncing ice pellets that flow along the ground

18. Weapon 18
    Ground Hog Ground weapon that tunnels through the dirt and explodes on other side

19. Weapon 19
    Worm Ground weapon that tunnels through dirt, but tries to dig upward

20. Weapon 20
    Homing Worm Same as worm, but stops when it passes under tank and rises upward

21. Weapon 21
    Skipper Skips a number of times before exploding

22. Weapon 22
    Chain Reaction Random explosions in the general area where the bullet landed

23. Weapon 23
    Pineapple Shell explodes when close to a tank, emitting a large number of tiny explosions

24. Weapon 24
    Firecracker Horizontal spread of explosions based on where the bullet lands

25. Weapon 25
    Homing Missile Stops horizontal speed when it passes over a tank

26. Weapon 26
    Dirtball Dirt forms where bullet lands

27. Weapon 27
    Tommy Gun A very satisfying automatic machine gun-style weapon

28. Weapon 28
    Mountain Mover Explosion removes dirt, but takes no points from tank

29. Weapon 29
    Scatter Shot 5 bullets spread upward where bullet lands

30. Weapon 30
    Cruiser Bullet 'cruises' along terrain for a few seconds before exploding

If a player has played before so their will be a option to select his last used set of weapon.

Terrain: Terrain will be randomly generate for each game and will remain intact unless damaged by weapons.

Background: There will be 3 backgrounds for the game:

1. **Day**
2. **Night**
3. **Rainy**

Players can choose the background they want or the program will automatically select it based on the time of the day. For Rainy background, it will be selected in the months of July to October(With a 50 percent chance).

Power: Scroll indicator will be provided for adjustment in power. Power is basically the velocity with which weapon's fire will leave the weapon.

Angle: For adjustment in angle of projection either player can use mouse to point the angle or Adjust it through scroll indicator. There will be a marker which will give the hint about the angle.
In online mode of the game opposite player can see how the projectile of another player will go.

Battle Modes:

1. **Offline Mode**
   (a) **Single Player:** In it opposition will be computer(An Intelligent Player). Computer will know your location atleast 70 percent of time correctly and attacks accordingly.
   (b) **One on One:** In it one player will battle another player head on.
   (c) **Team Battle:** In it there will teams of 2 players which will battle in same terrain.
2. **Online Mode**
   (a) **Single Player:** In it opposition will be computer(An Intelligent Player). Computer will know your location atleast 70 percent of time correctly and attacks accordingly.
   (b) **One on One:** In it one player will battle another player head on.

Sound and Music: Every Weapon will have it's own characteristic sound which will be played when it is fired. Besides this game will have a general music playing on.
During Audio transmission, Music's volume will be slowed down or will be pause.
Players will have a option to disable sound and music.

Chatting

1. **Texting:** Simple text to text message communication with some abbrevations which will play some message audio that other player can hear.
   Abbrevations are:
   GL "Good Luck".
   GG "Good Game".
   NS "Nice Shot".
   OP "Oops".
   HH "Hehehe". etc.

2. **Audio and Video:** It will only work when the players agree to do so. Player will always have an option to mute/unmute audio. Both of them can work individually also.

Authentication: In online mode of the game one player will create the server and other will join the game. During server creation,host can specify a pin so that only that person could play this game who is supposed to play it.

Tanks: Tanks will be avaible to choose from various color.
Movement:Maximum 4 movements will be allowed.

Scoring: Each weapon will have it's own set of damage points and purpose so based on that player's score will increase or decrease. Minimum score allowed will be 0.
During any session of game, game will record the history about the scores of the players along with their player id(which they have to submit at the start

of the game). When the game is going to be quit, player will be given an option to either save his weapon selection for further use or delete his record.

3 Physics

Basics-: A projectile is an object that is given an initial velocity, and is acted on by gravity. The path the object follows is determined by these effects (ignoring air resistance). This path is the object's trajectory. The trajectory has horizontal (x) and vertical (y) components. Velocity is a vector (it has magnitude and direction), so the overall velocity of an object can be found with vector addition of the x and y components:

$$v^2 = {v_x}^2 + {v_y}^2$$

The units to express the horizontal and vertical distances are meters (m). The horizontal and vertical velocities are expressed in meters per second (m/s).

Horizontal distance

$$x = v_x * t$$

Vertical distance

$$y = v_y * t - \frac{g * t^2}{2}$$

Horizontal velocity
Horizontal velocity = Initial Horizontal velocity

$$v_x = v_{xo}$$

Vertical velocity

$$v_y = v_{yo} - g * t$$

$$x = Horizontaldistance(m)$$

$$y = Verticaldistance(m)$$

$$v = Velocity(combinedcomponents, m/s)$$

$$v_x = Horizontalvelocity(m/s)$$

$$v_y = Verticalvelocity(m/s)$$

$$v_{xo} = initialhorizontalvelocity(m/s)$$

$$v_{yo} = initialverticalvelocity(m/s)$$

$$t = time(s)$$

$$g = accelerationduetogravity(9.80m/s^2)$$

These equations give will give the coordinates of the weapon thrown in the plane of the game. Now we will also have co-ordinates of the terrain by comparing the two co-ordinates we will check if weapon has collided with the terrain or is still in air etc. All these calculations are very trivial using co-ordinate geometry formulaes

4 Software Requirements

As this is a web based application so only the server computer will need to have required software.

1. **Database:** Firebase, MongoDB or MySQL,Preferably MySQL will be used.
2. **Node Js and npm:** For creating server.
3. **Web Browser:** Chrome or Firefox, to run the game.

5 Technical Process

Following would be the Languages/tools would be used to develop this game

1. **HTML5** It will provide basic structure to frontend of Pocket Tanks.

2. **Styling**
   CSS3 and Bootstrap
   These will provide a better presentation for structure of HTML and graphics.

3. **Graphics Rendering**
   HTML Canvas or CreateJs(EaselJs and TweenJs)
   These will generate graphics and animination like Terrain, Tanks etc for the game .

4. **Music and Sound**
   CreateJs(SoundJs)
   For providing music and sound to the game we will use SoundJs. Each kind of event in the game will have a different sound which will be played when that event occurs. For Music in game, It will run through out the game unless the play mute it. User will have the option to adjust volume of the music and sound.

5. **Functionality**
   Javascript AngularJs
   These will handle the working of the game. Movement of graphical component will be handled by these and all the frontend work like DOM handling etc will be covered.

6. **Server-side Programming with TCP**
   NodeJs and ExpressJs
   Backend will be handled by NodeJs and ExpressJs. It will create a server and handle all requests or control demanded by the client. Database will also be handled by this.

7. **Database**
   FireBase,MongoDB or MySQL
   MySQL will be used for data storage. As it is a Relational Database management system data will be stored in form of Tables.
   Player Id will the primary key for database.

8. **Communition between Server and Client**
   socket.io
   For Real time communication between server and client socket.io will be used.

It will also handle texting in the game and transfer data between client and the server.

9. **Video and Audio Transmission**
   WebRTC and PeerJs
   WebRTC is also used for Real time communication between client and server. It allows audio and video communication to work inside web pages by allowing direct peer to peer communication.
   For Peer to Peer communication, PeerJS will be used which will create a PeerServer, on that server we can have a secure video and audio transmission. PeerJS simplifies WebRTC peer to peer data,video and audio calls.