Indian Sub-Continent Risk Game

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Abstract— **"**Indian Sub-continent risk game" is a turn based strategy game having AI players. To give an authentic feel, this game uses a map of ancient India and ancient names for the territories. The dice rolled decides whether a battle is either won or lost. This game can be played against 2 AI players or against human players. The game is developed using Python's pygame library which has features for basic game development. The user interfaces includes animations like dice being rolled and striking out each other, sound effects for victory and defeat. In turn based games such as Risk it is important to keep the users attention while the AI is playing its turn, to prevent the user from becoming impatient and as such the game incorporates animations and sound effects that are necessary to prevent the game from becoming mundane. The game can be played by users who are as young as 8 to as old as possible. The game has been designed to last for an average of about half an hour.

Keywords— turn-based-game, strategy-games, probability, dice-rolls, world-domination, Risk, Artificial Intelligence

I. INTRODUCTION

From a Star Wars version to the Secret Mission Risk[1] there are various versions of games available. In the standard version of "Risk" it is a strategy board game of diplomacy, conflict and conquest for two to six players[2]. Risk is a game of strategy and chance where the end goal is to conquer the entire map[3]. In most cases the map is a world map, while in the project, we have designed the game exclusively for the Indian Sub-Continent.

 The moves that are allowed in the game are placing the troops in a territory that belongs to you, moving troops within your own territories, and lastly attacking neighboring territories.

The game is designed for players hailing from South Asia. The game has a unique and authentic medieval feel where the players territories are erstwhile South Asian Kingdoms and hence the territories have ancient names.

As a game that involves both strategy and luck, the game is aptly known as Risk because the player needs to be aggressive and take risks to win the game. You can use your experience playing Risk in real life to understand politics, learn fast decision making, economics, and psychology[5].

The main objective of the game is to conqueror the entire map of the Sub-Continent. Players do this by rolling dice and based on this either the defender or attacker loses an army. The dice winning condition for the attacker is that he/she has

to get a higher roll, although to even the odds the attacker is usually also allocated one extra dice as compared to the defender.

The map has certain mutually exclusive areas which are "bonus areas", meaning that if a player captures such a territory he is eligible to obtain the bonus in number of troops corresponding to the said "bonus area".

The purpose of developing "Indian Sub-continent risk game" is to engage the user in a game that has depth, good run time and that can be played by both children and adults alike. The purpose of writing this paper is to document this particular Risk game's development so as to bring in more collaboration and cooperation among developers of Risk games so that we can continue developing great Risk games. The paper contains the findings to the question of what a user wants in a Risk game and a short summary on the previous research documents that cover the scope, AI, and new developments in the Risk game industry. However, this paper details the development of a straightforward Risk game without the complications of factoring in the element of luck that the cards signify in the classical version of Risk.

The remaining part of the paper is segregated as follows. Section II presents the findings of various research publications on the classical version of the Risk game. Section III discusses game flow, AI in Risk games in general and in this game in particular. The results section (section IV) talks about what users want in a game of Risk and what a good Risk game would look like. The last section (section V)

elaborates on future work that can be implemented to improve the game.

II. RELATED WORK

It has been found that the chances of winning a battle are a lot more favorable for the attacker than was originally thought. The logical recommendation then is for the attacker to be more aggressive[6].

The best strategy for a player is to have dynamic plans with reasonable goals to aim for[7]. A plan must be charted that best connects the actions of the player to maximize probability of reaching the goal.

Many studies have researched the probability calculations that are part of the game play. Prominent previous works include Garrett Robinson's "The Strategy of Risk", Jason A. Osborne's "Markov Chains for the RISK Board Game Revisited" and Michael Wolf's "An Intelligent Artificial Player for the Game of Risk". There have been many comprehensive and versatile studies researching various aspects like the probability, artificial intelligence, and strategies of the game.

The Artificial Intelligence for the game evaluates a position by checking all possible good moves that can be made, then evaluate its likely corresponding result. The factors on which a move can be evaluated are:

- What are the chances of winning the territory that you attack?
- After the attack does the territories occupied have less number of entry points to attack(does it have well-guarded bottlenecks)?
- Does attacking a given territory increase the percentage of your territories in a bonus region or win you the bonus?[8]
- Is it possible to attack an opponents bonus territory, thus denying him/her a troop bonus?

One of the key advantages that an AI has over a human player is that an AI can think many steps ahead while human players cannot think and calculate many steps ahead. The AI must exploit this advantage.

III. METHODOLOGY

When playing Risk it is very important to know the probability of the success of an attack or series of attacks (campaign) and also the losses that will be incurred by both the attacker and the victim. In any attack it is better to "throw in everything you've got" to maximize your chances of victory in the battle.

Controlling many territories is clearly a good thing. Though if you attack too many territories and spread your forces too

thin you could open yourself to attack from your opponents. While on the other hand if you play too conservatively you risk the chance of allowing an opponent to gain territories and increase his/her number of territories. The key in winning this game is striking a balance between attacking and defending.

Fig 1: Screenshot of the game

The game's artificial intelligence can be based on the following questions that Baris Tan addresses in book
If you attack a territory with your armies, what is the probability that you will capture this territory? If you engage in a war, how many armies should you expect to lose depending on the number of armies your opponent has on that territory?[9]

The AI that was developed for this game is a fairly straightforward AI which looks at the immediate gains of a move rather than looking several moves ahead.
It first makes a list of all territories it can attack. It than filters this list on the criteria of whether the attack will be successful. We then choose attacks on the following criterion: does it get the player closer to winning the bonus?, Is the position after the attack vulnerable to attacks from opponents? After the attacks the AI evaluates the graph of the territories in possession and identifies vulnerable bottlenecks and sends troops to reinforce those bottlenecks. The user interface of Indian Sub-continent risk game is shown in Fig 1.

Game-flow:
The game has three phases: placing the troops, making the attacks, and finally placing reinforcements. The three phases are depicted in Fig 2.
The player is allocated a number of troops based on the territories the player controls. The player is to place it,

usually on territories the player wants to either attack from or defend. The second phase is the attack phase and in this phase the player makes attacks which will be executed then and there. The last phase is the reinforcement phase where the player moves troop within the territories he/she controls.
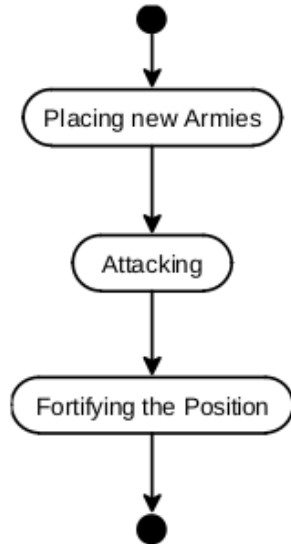

Fig 2: Three phases in Risk game

IV. RESULTS AND DISCUSSION

Based on the research available as of the time of publishing of this paper it can be concluded that people want a Risk type game that is not too long and does not become boring for the loosing side. In most risk type game even winning is tedious as one has to conquer the entire map to actually conclude the game.

A good and popular game of Risk would include a sophisticated Artificial Intelligence while proving the human players an option to form alliances. Another feature that could be added is more detailed territories. Territories having a population, level of loyalty to its ruler, level of cultures and amount of resources.

V. CONCLUSION AND FUTURE SCOPE

A better version of this game could be made by implementing a more sophisticated AI. The card concept that is present in many games was not implemented in this game, this too could have been implemented. Other Risk type games have multiple maps like Asia, China, Europe, world map[10]. This can be implemented along with the option to choose your initial territories rather than it be randomly allocated.

A good artificial intelligence for this game would be one created by machine learning and tempered by probabilistic reasoning as this goes a long way in most popular board games[11].

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