

Communication Platform for Sri Lankan Board Game Nerenchi

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Abstract – Nerenchi is one of Sri Lanka's oldest folk board games in which the board has diagonal lines joining the corners and horizontal and vertical lines joining three concentric squares in the centre. It is a strategic game between two players. The game is played by ensuring that one avoids his/her opponent in forming a mill. The player should block the counters of that mill by moving and taking one of his/her pieces every time. The player who has lost all the counters and is blocked from moving will be the loser. This folk game makes much fun, but with time the use of this game has rapidly decreased as a result of the development of online games. Therefore, joining hands with new technology, the implementation of an automated version of the “Nerenchi Board game” will be much impressive. The proposed system has 3 main stages; Detecting objects, Object movement and deciding the next turn of the object to be moved. System design mainly focuses on automating the system by using sensors to detect the exact location and colour of the Nerenchi object. The paper presents a way to detect the existing state of the physical board on the Nerenchi game, and this is a new approach for designing a computerized version of the Sri Lankan folk game called “Nerenchi”.

Keywords: *Nerenchi, folk board game, automated version, sensors, detecting objects*

I. INTRODUCTION

Everybody likes to play games and at the same time, they want to learn about these games. Out of these people prefer to play board games because it's a part of thinking games. A board game is a game that a collection of a set of rules and includes the counters or objects moved or put on the pre-marked surface or board. These types of board games unlike other types of non-board games are played to demonstrate the intellectual domain without the serious logistic and the resource (Meththananda and Hettige,

2015). Therefore, board games have a special place.

Board games have been extremely famous since the old days and have been played in all societies and social orders. The fundamental characteristic of all board games is that they depend on the movement of different items over an explicitly planned board as per a pre-characterized set of rules.(Pandithage and Hettige, n.d.) There is a large portion of the well-known board games in history that are a kind of adjustment of a genuine fight between armed forces. Indeed, even contemporary board games are implementing the logic of defeating the opponent... Since, in the wake of a growing interest in Roman daily life, in the 1970s,(Kruthika et al., 2016) educators working in archaeological museums have discovered Roman games, the so-called “circular merely” or “wheel-type mill” holds an unmitigated triumph. In this seen given the number of “wheel patterns” carved into the floors of Roman streets and squares, the game is considered to be one of the most popular board games of the “Romans”, if not the only board game of which the rules have come down to us

Conventional board games are the which is the genre of tabletop gaming is a social activity and the players gather around a table and together make a common, engaging, and entertaining experience, in which their actions are passed on through interactions with physical items. The important fact is the huge flat digital surfaces present the chance to configure games that consolidate the social favorable circumstances of customary tabletop games with all the more captivating interactivity, dynamic visuals, and associations of computer games. Therefore we could say digital game boards combine the advantages of traditional tables and digital media and provide the opportunity to automate some of the complex tasks during face-to-face collaborative activities.

The ancient folk game of Sri Lanka is a very valuable thing. When fixating on Folk games, as a country having a written history of more than 2500 years, Sri Lanka has come across many folk games and has been the originators to many as well. Since the ancient days, Sri Lanka has had many types of folk games like field games and board games. Some of the folk games that have been famous up to date in Sri Lanka can be listed as "Pancha damima", "Olinda keliya", "An keliya", "Porapol gasima". Among these games, "Nerenchi demima" is one of the very sophisticated Sri Lankan folk games, that is on the brink of extinction and is almost unknown within the society of Sri Lanka.

Sri Lanka has across many folk games and has been the originators to many as well. "Nerenchi" is one of the most important ancient folk games in Sri Lanka. Nerenchi is one of Sri Lanka's oldest board games, in which the board has diagonal lines joining the corners and horizontal and vertical lines joining three concentric squares in the centre.

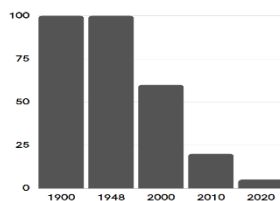


Figure 01: Folk games population in Sri Lanka

Figure 1 shows the use of ancient folk games in Sri Lanka is now rapidly declining. For considering this chart we can see a huge decrease in the tendency to focus on falk games in Sri Lanka. This game is also going to extinct. So nerenchi has mainly two parts. In the first part is the objects have to be laid on the board. In this part, 24 objects must be placed from the 12 objects each player has. When three objects are placed in a straight line horizontally, vertically, or diagonally, the player is rewarded with a bonus chance called "Nerenchi". When either the number of pieces on the board reaches 24 or one players placed all 12 objects on the board, the second part of the game begins where the players can move and capture each other's objects when the player is rewarded with a nerenchi. The behaviour of each of these phases is governed by a set of simple rules (Meththananda and Hettige, 2015). But today, it is common knowledge that these ancient folk sports are on the verge of extinction. The main reason for that the new generation is unaware of these ancient folk

games and has no interest in playing these games. As the modern world advances with technology, everyone is tempted to use technology. In the modern world, everything is automated. For this reason, people are more inclined towards these new technological things. For this reason, it is not important to automate these Sri Lankan folk games. The reason is that people are becoming more and more interested in these sports. Therefore, it is important to develop these old sports with new technology. This is why it is important to automate this Sri Lankan folk game "Nerenchi".

One of the most famous ancient folk sports in Sri Lanka in Nerenchi, it is now on the verge of extinction. The following are the main reasons for this.

- The Sri Lankan board game "Nerenchi" being under the threat of extinction.
- A lot of peoples are don't know how to play this folk game and lessening number of peoples are who knows how to play the game "Nerenchi".
- Equipment and usage opportunities in this folk game are under threat.
- The art of the game and the craft of the board being endangered.

Consider the problem, the Sri Lankan board game "Nerenchi" is a thinking game. A lot of peoples are don't know how to play this folk game and lessing number of peoples are who knows how to play the game "Nerenchi". Equipment and usage opportunities in folk games are under threat. The art of the game and the craft of the board being endangered. This game has not yet been developed that suits our culture and thinking pattern. But in this system, we will be focusing on the first part of the game like identify the Nerenchi object's colours and these values put into the array.

II. LITERATURE REVIEW

These are some related works in my system and we have to come across much-related work, and a few works are explained below.

The main reference for my project was the Computational model (Meththananda and Hettige, 2015) developed for the game "Nerenchi" itself. In this research, they have implemented the board game as a computer game through web architecture and using the

.NET framework with MySQL. The game engine identifies the occurrences of a “Nerenchi” (placing the pieces of a single-player along aside), and it alerts the system. This research has come up with a mathematical model, where it uses matrices to calculate the occurrences and the frequency of occurring a Nerenchi.

Another paper, which has been one of the major references for my system is “Image Processing Approach to Detect Tokens on a Nerenchi board”. This system is mainly focusing on Image processing techniques. (Pandithage and Hettige, n.d.) These image processing algorithms are used to identify Nerenchi pieces. But the research project main disadvantage of this project is the inability to identify the object under the lighting condition and the disadvantage of this project is the inability to accurately identify the exact difference between white and black at any time and under any condition.

Another paper, which has been one of the major references for my system is research had been conducted where the main objective had been to better understand the abilities and limitations of retrograde analysis with the use of Nine men’s morris (Gasser, 1996). Retrograde analysis is a method of calculation that finds the optimal play for all possible board positions in a specific endgame. They have accomplished retrograde analysis with 3 procedures Initialization, Loss backup, and Win backup. With these methods, they have concluded the full analysis of the board game Nine men’s morris saying that it is a draw.

Another paper, which has been one of the major references for my system is as per how to solve Nine men's morris has discussed using 'Retrograde analysis', (Gasser and Eth, 1990) which is often used in chess automation and analysis. This method is more advantageous because retrograde analysis handles cycles more efficiently than forwarding search. They have also used a combination of alpha-beta search and endgame databases, where they have concluded that Nine men’s morris is a draw, and completely depends on how each player moves their pieces (Gasser, 1996)

One of the main papers I was referred for this research had created an adaptive learning program written in python to speed up the process of finding the optimal moves a player should make in a given game state. And lastly, had designed an AI to test the general patterns that

they had discovered and prove that it gives an advantage for the player. The game theory had been based on the minimax algorithm.

Deep Networks have also been tried on Nine men’s morris, where their system consists of three different neural networks, each predicting one part of the move. Then they have modelled the problem as a collection of three supervised learning tasks (Chesani et al., 2018). Their main aim had been to analyze whether such subsymbolic systems are capable of learning to play a game by the rules (Angelkov et al., 2015).

The following table shows the summary of what I have learned from the related work and what I have decided on working on in my project.

Table I – Summary of the references

Reference	Features							
	Basic analysis and solving the game	Web application to play the game with game engine	Apply retrograde analysis	Apply deep networks	Use an Expert system	Use image processing to automate the game	Automating using robot manipulation	Fully automated system with game engine
Analyzing Nine Men's Morris For g Optimal Strategy	✓							
Solving Nine Men's Morris	✓							
Computational Model for Sri Lankan Board Game Nerenchi	✓	✓						
Applying Retrograde Analysis to Nine Men's Morris	✓		✓					
Can Deep Networks Learn to Play by the Rules? A Case Study on Nine Men's Morris	✓			✓				
Automated Chess Tutor		✓			✓			
Using Image Processing Techniques to Automate Chess Game Recording	✓					✓		
Automated Chess Playing with a Robot Manipulator							✓	
Fully Automated approach for Nerenchi	✓	✓						✓

III. PROPOSED SOLUTION

In my solution, we will consider 3 stages to automate the nerenchi game.

1. Identify the objects
2. Move the objects
3. Identify the next stage

In this paper, the solution is how to identify objects with 100% accuracy.

The proposed system comprises hardware & software modules. The hardware of the proposed system comprises the following components.

- Arduino Mega Board
Arduino mega board is used to integrate all the functions and parameters of the IR sensor and IC.

- 24 IR sensor modules
The nerenchi objects are detecting using an IR sensor and data is taken from its analogue out and passing to the CD4052B multiplexer.
- CD4052B Multiplexer
All the data coming from the IR sensor is taken from this IC. Using this IC we can multiply the data inputs. We used 3 IC's because there are not enough analogue pins on the Arduino board.

The hardware modules of the system are connected as follows. Mainly our system has two main parts virtual model for Nerenchi and the Mechanical model. For the virtual model in the nerenchi part, we create software solutions for storing the array values.

A. Nerenchi Board

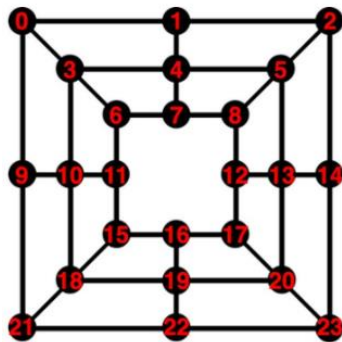


Figure 2: Nerenchi board array design

Figure 2 shows the nerenchi board is numbered. These numbers are taken as locations in the array. If there are no objects on the board the array value is 0.

Position matrix:

[0 0]

The array changes according to the way the objects are placed on the nerenchi board. The system maps to way to white colour objects are placed by the user to see where the black colour objects should be placed. Then get the array, no objects on the board put 0 value, white colour objects are 1 and black colour objects are value 2.

Position matrix:

[0 1 0 1 0 2 1 0 0 0 0 2 0 0 0 0 0 2 1 0 0 0 0]

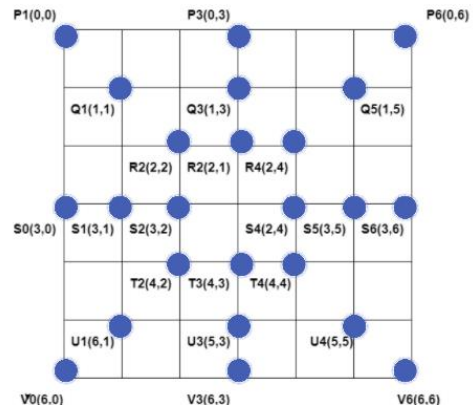


Figure 3: Nerenchi Board Matrix Design

Figure 3 shows how the matrix design is attached to the nerenchi board and put the unique mathematical point for each object in the nerenchi board.

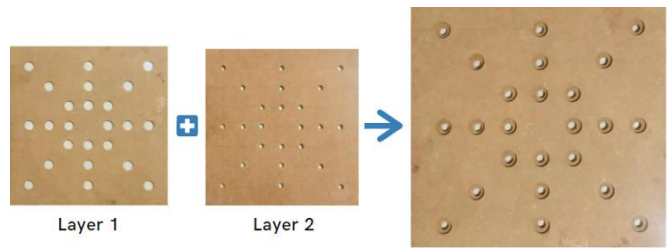


Figure 4: Nerenchi Board Design

Figure 4 shows the nerenchi board design. We used 2 layers. Layer 1 was used to hold the object and layer 2 to attach the object sensors. This complete board is used as a sensor panel and we input sensors for every hole where 24 objects are placed on the board.

B. Hardware Mechanism

IR sensors mainly used in creating the hardware mechanism to identify the object locations and identify the object colours.

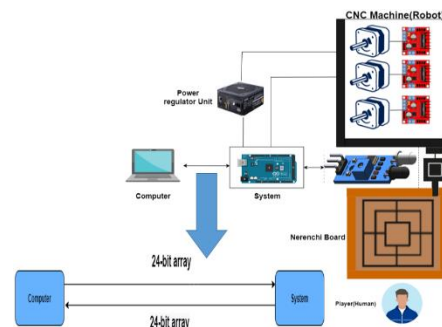


Figure 5: Proposed System

Figure 5 shows the mechanical solution for identifying the nerenchi objects on the board. The robot will develop a CNC model and all the input data are collected on the IR sensors. This system mainly connected to the computer. When the user places objects on the board a new 24-bit array is generated by the system(computer). Then this new 24-bit array is sent to the computer. The computer process this using an algorithm and creates a new array where the computer will place the objects on the board. Now the array is sent back to the system and finally, the system uses a CNC machine to position the objects in the relevant location.

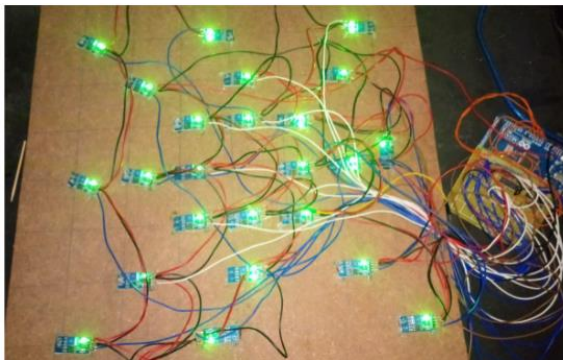


Figure 6: Nerenchi Board with sensors

Figure 6 shows input a sensor for every hole where 24 objects are placed on the board. This sensor identifies whether the object was on the board. Similarly, the sensor gives feedback to the system array about the location of the object on the board. This whole process takes place through 3 multiplexers. It uses a multiplexer called CD4052B. The output of the sensors from these 3 multiplexers is taken as an input and it is multiplexed and given to the Arduino.

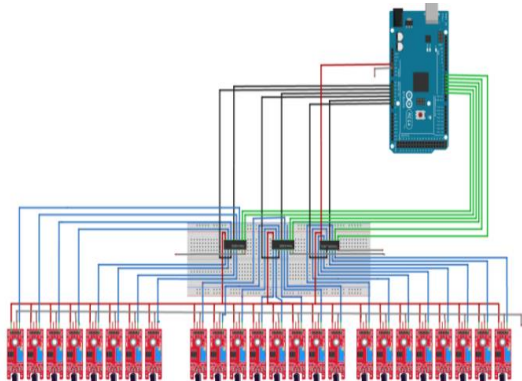


Figure 7: Circuit Diagram

Figure 7 shows the diagram of the system we created for the automated nerenchi board. This is the circuit of 3 multiplexers. There are 24 objects on the nerenchi board. All the 24 objects are taken from these 3 ICs. These ICs connect these 24 objects to the Arduino.

C. CD4052B Multiplexer

This is the multiplexer we are used. He can do dual channel multiplexer as well as Demultiplexer. This multiplexer has an analogue switch. There are main two pins like 2 pins X COM and YCOM. These pins are Connect the analogue ping of the Arduino board to this. we've put 3 ICs like this. The pins A and B change the mod here. These are digital pins. The relevant feedback is given by 8 channels here.

D. Output Array

8	0	0	8	0	0	8
0	8	0	8	0	8	0
0	0	8	8	8	0	0
8	8	8	0	8	8	8
0	0	1	2	8	0	0
0	1	0	2	0	8	0
1	0	0	2	0	0	8

Figure 8: Array output

Figure 8 shows the final output values of the Nerenchi board. There are no objects in the board array value is display value 0 and if there are any white objects in the nerenchi board array value is display value 1 and if there are any black colour objects in the nerenchi board array value is display value 2 in array output.

IV. DISCUSSION AND CONCLUSION

A board game has been esteemed since the past. They consist of a set of rules which focuses on improving decision making and social skills. With the development of technology and innovation of computerized gaming and social media platforms, especially the younger generations have no interest in folk games anymore. Even the folk games also computerized now. Neranchi is one of the very famous folk game in ancient times but at present, the children don't even have a sight of knowledge about what Neranchi is. So as Sri Lankans we should have a focus on promoting our culture with the advancement of technology

without making our ancestral techniques to have vanished. Having this thought in mind, I have proposed to implement the computerized version of the Neranchi board game. A similar type of this game was implemented before and it made some difficulties when identifying the exact location and the colour of neranchi objects using Image processing techniques.

After going through other researches and related materials, as a remedy for this issue, I have proposed to use sensors to identify the locations and colour to avoid this problem. The proposed system has 3 main stages;

- Detecting objects
- Object movement
- Deciding the next turn of the object be moved.

The paper presents how to detect the existing state of objects in a physical board on a neranchi game.

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