

# **IN 1901 - Microcontroller Based Application Development Project**

## **PROJECT PROPOSAL REPORT**

### **Level 01**

TIC-TAC-TOE GAME

Examiner Mr. B. H. Sudantha

#### **Submitted by:**

Dissanayaka E.J.V.J.	224043L
Asry M.I.M	224015E
Mendis B.I.P.D	224124L
Gunawardhana G.W.G.M	224064C
Bamunusingha C.L.N	224018P

Bachelor of Information Technology  
Faculty of Information Technology  
University of Moratuwa

## Table of Contents

<b>Submitted by:</b> .....	1
1. Introduction.....	1
1.1 Problem in Brief .....	1
1.2 Significance of Study.....	1
1.3 Aim and Objectives.....	1
2. Literature Study.....	3
3. Proposed Solution .....	4
3.1 Features of the Proposed Solution .....	4
3.2 Components required for the proposed solution .....	5
3.3 Nature of the Solution.....	6
3.4 Solution Design .....	7
3.5 Resources .....	8
3.6 Workload Matrix.....	9
4. References .....	10

## **1. Introduction**

The timeless game of Tic-Tac-Toe, known for its simplicity yet endless entertainment, has transcended generations and cultures. Whether called noughts and crosses or X's and O's, this classic game continues to hold a special place in the hearts of people worldwide. From childhood memories with friends and family to casual gatherings and school breaks, Tic-Tac-Toe fosters moments of joy and friendly competition. In the digital age, where innovation intertwines with tradition, we present a modern twist to this beloved game: the Sensor-based Tic-Tac-Toe game using ESP32.

### **1.1 Problem in Brief**

Traditional Tic-Tac-Toe games often lack the interactive and dynamic elements that engage players in novel ways. Static boards and manual inputs limit the game's potential for immersive experiences. Additionally, while physical versions exist, they may not fully capitalize on the advancements in sensor technology and connectivity that define our contemporary era. Thus, there is a need for a refreshed, sensor-based approach to Tic-Tac-Toe, one that seamlessly merges the charm of the past with the innovation of the present.

### **1.2 Significance of Study**

The significance of developing a Sensor-based Tic-Tac-Toe game using ESP32 lies in its ability to reinvent a timeless classic for the modern age. By integrating sensors and ESP32 microcontrollers, this project aims to create an interactive and engaging gaming experience that transcends traditional boundaries. The game's versatility, with its ability to hang on walls and blend seamlessly with any environment, opens doors to new avenues of entertainment and social interaction. Moreover, by leveraging technology to enhance gameplay, we pave the way for innovative applications in educational settings, recreational spaces, and beyond.

### **1.3 Aim and Objectives**

**Aim:**

The aim of this project is to design and implement a Sensor-based Tic-Tac-Toe game using ESP32 microcontrollers, offering a modern and interactive gaming experience. As well as the lighting setup which will give an aesthetic look where the system will be placed.

**Objectives:**

- **Enhancing Traditional Gameplay:** The primary objective of this project is to enhance the traditional Tic-Tac-Toe gameplay experience by integrating sensor technology and IoT principles. And there is a web based storage score management system to show the score on the display.
- **Promoting Interaction and Engagement:** The project aims to promote interaction and engagement among players by leveraging modern technology to create an immersive and intuitive gaming experience.
- **Educational Outreach:** This project seeks to serve as an educational tool for understanding sensor technology, microcontrollers, and IoT applications in a fun and practical manner.
- **Encouraging Innovation:** By combining the timeless appeal of Tic-Tac-Toe with innovative sensor-based technology, the project aims to inspire creativity and innovation in game design and development.
- **Increasing Mindfulness and Flow State:** Engaging in a well-designed game with interesting items such as an illuminating setup can lead to a state of flow, where players become fully immersed and focused on the task at hand. This immersive experience can help individuals temporarily disconnect from stressors and promote mindfulness.

## **2. Literature Study**

- **Historical Evolution of Tic-Tac-Toe:** A study of the historical evolution and cultural significance of Tic-Tac-Toe, examining its enduring popularity across different societies and age groups.
- **Sensor Technology in Gaming:** Reviewing existing literature on the application of sensor technology in gaming, including motion sensors, proximity sensors, and touch sensors, to understand their potential in enhancing gameplay experiences.
- **IoT Integration in Gaming:** Exploring previous research and projects that have integrated Internet of Things (IoT) principles into gaming applications, highlighting successful implementations and identifying areas for improvement.
- **User Experience Design:** Investigating user experience design principles and methodologies to ensure that the sensor-based Tic-Tac-Toe game delivers an intuitive and enjoyable gaming experience for players of all ages.

### **3. Proposed Solution**

The proposed Tic-Tac-Toe game box aims to deliver a unique and engaging gaming experience through the integration of Arduino, IoT, and various sensors. The game box stands apart from others on the market due to its features that enhance the overall user experience and functionality. The game box will use various sensors and devices to interact with the user and display the game state, winner, and countdown time. The proximity sensor will be used to detect the presence of the user. By implementing signal amplification techniques and considering the use of multiple RFID sensors for improved accuracy develop error-handling mechanisms to address potential interference. The algorithm for the AI opponent is based on the decision tree technique, which uses a set of rules to determine the best move for each board state. The LED display will be used to show the game mode, the player's turn, the winner, and the countdown time. The lighting setup gives an aesthetic look to the surroundings in which the system is positioned during non-gaming situations. Finally, in our system there is a web based storage to collect the information about the scores.

#### **3.1 Features of the Proposed Solution**

- **Interactive Gameplay:** Players can interact with the game board using gestures, enhancing the immersive nature of the Tic-Tac-Toe experience.
- **Real-Time Feedback:** The game board provides real-time feedback to players, displaying their moves and updating the game state dynamically.
- **Multiplayer Support:** The solution supports multiplayer gameplay, allowing multiple players to compete against each other locally.

- Customizable Settings: Players can customize game settings such as game modes to suit their preferences.
- Educational Resources: The solution includes educational resources and tutorials to help users understand the underlying technology and principles behind sensor-based gaming.
- Multiplayer and Ranking: A web-based database facilitates multiplayer functionality by storing game state. This adds a competitive element to the game and encourages users to strive for higher scores.

### **3.2 Components required for the proposed solution**

i) Proximity sensors(IR) (LM 393)-

using this sensor detects the hand when the player enters the selected grid.

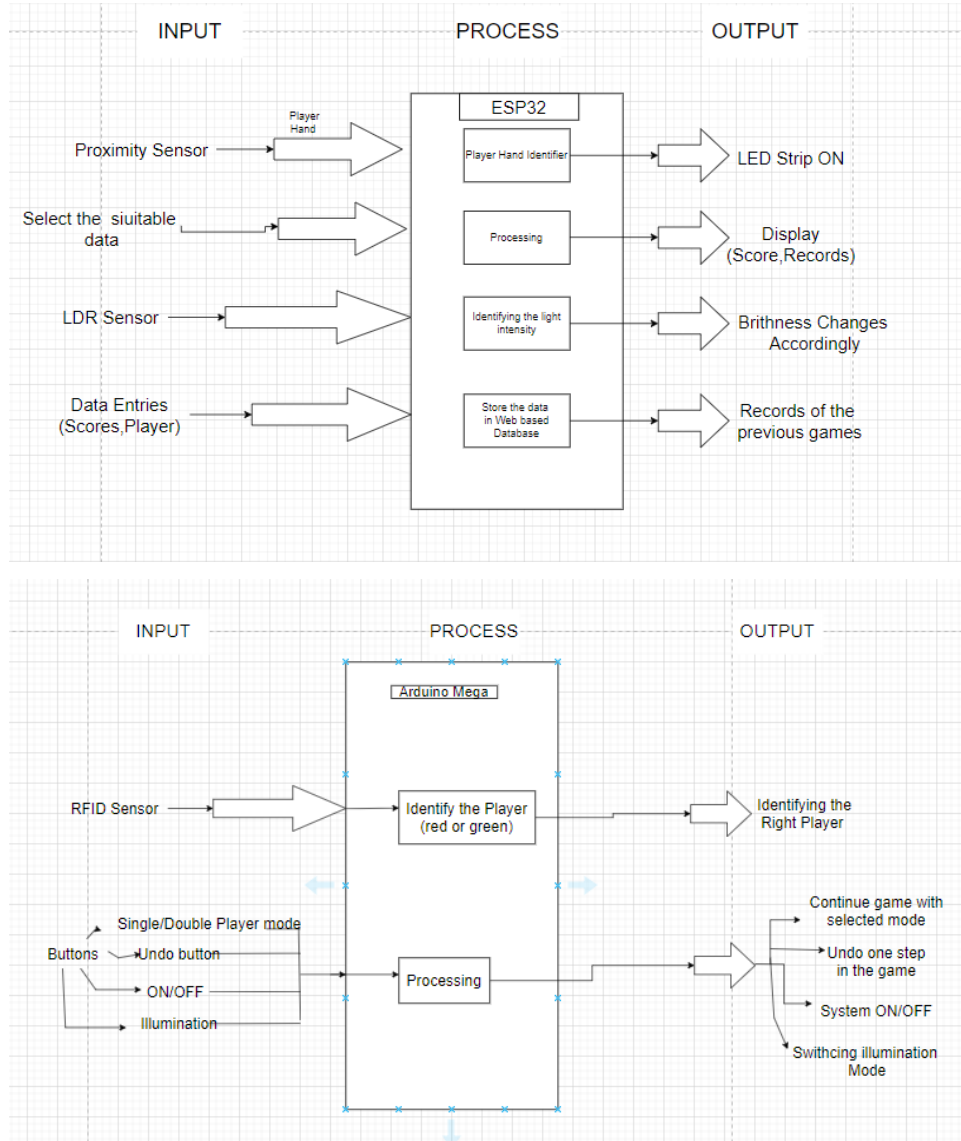
ii) RFID reader (RC 522) -

using this sensor prevents a third party from playing in the game other than the two players and a player's turn prevents another player from playing.

iii) Light Dependent Resistor (LDR) sensor (GL 12528)-

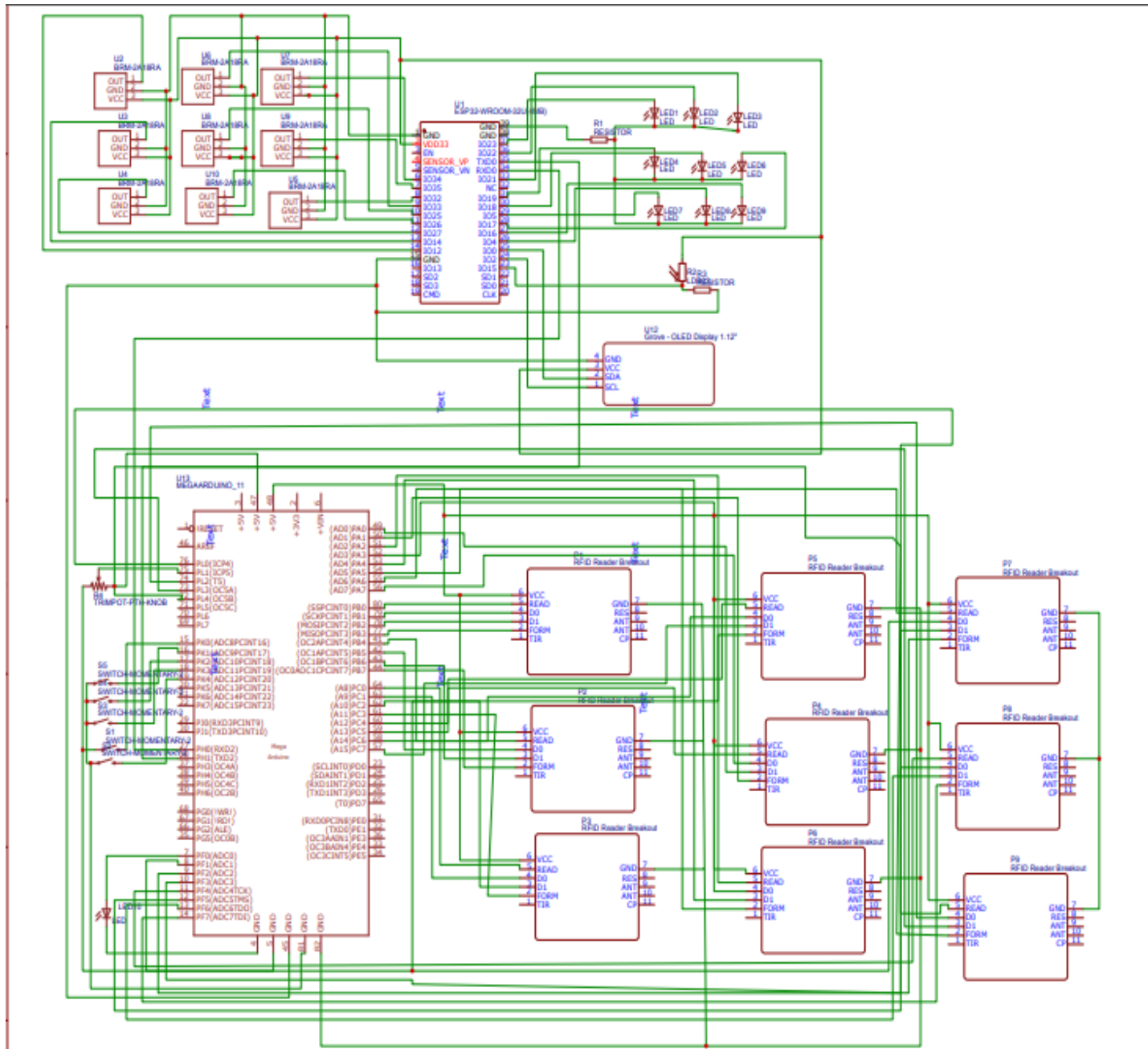
using the LDR sensor Controls the amount of brightness by detecting the ambient light intensity.

### 3.3 Nature of the Solution



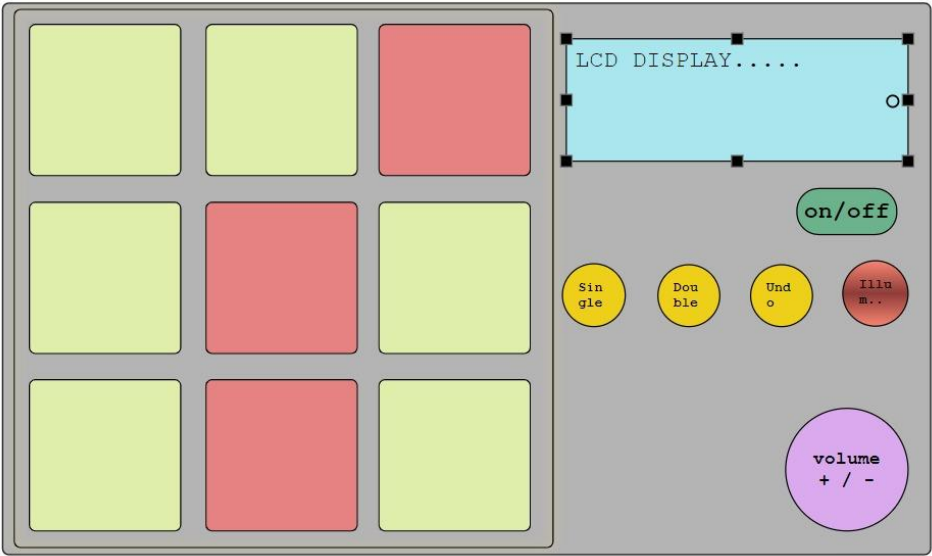
**Figure 01: Block diagram of the input, process and output**



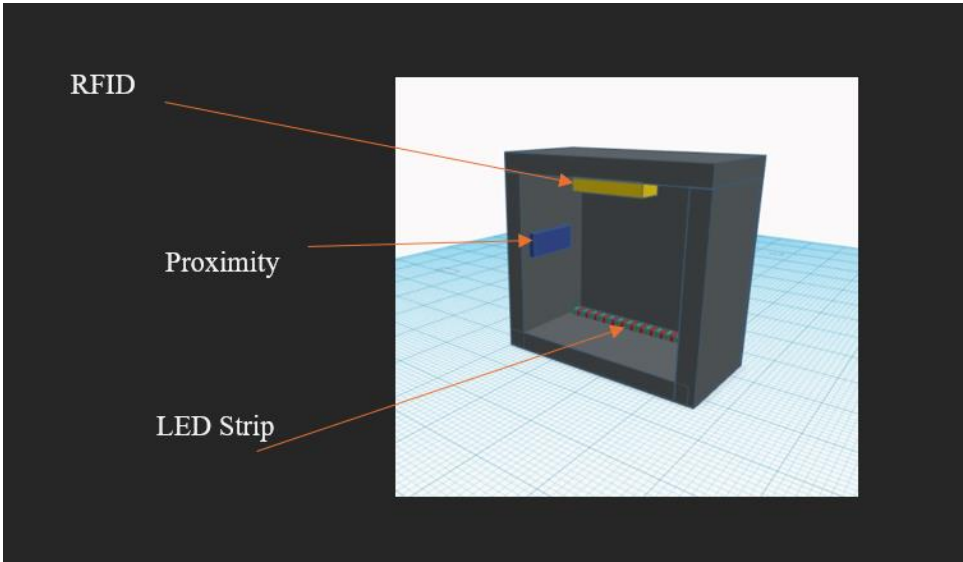


### 3.4 Solution Design

**Figure 02: High level design of the product**



**Figure 03: A graphical or 3D view of the solution (if applicable)**



Above one grid's 3D view

**3.5 Resources**

**Table 01: Components with budget allocation**

Component	Unit Price (LKR)	Unit	Total Price
Inductive Proximity sensors	800.00	9	5400.00
RFID readers (9) and Cards (2)	500	9	4500.00
12 V adapter	1300.00	1	1300.00
5V adapter	1300.00	1	1300.00
ESP32	3000.00	1	3000.00
RGB led strip	2000.00	1	2000.00
Buzzer	500.00	1	500.00
wooden box	2500.00	1	2500.00
Arduino Mega	3500.00	1	3500.00
I2C Module(lcd screen)	700.00	1	700.00
others	3000.00	-	3000.00
<b>Total</b>			<u>29700.00</u>

### 3.6 Workload Matrix

**Table 02: Workload Matrix**

Registration Number	Assigned Responsibilities
224043L	Multiplayer Mode
224015E	Single Player Mode
224124L	Illumination mode and LDR sensor
224064C	Web base data base
224018P	RFID readers

#### **4. References**

<https://www.youtube.com/watch?v=UJNcmLLFB14> - YouTube Video.

[Internet of Things \(IoT\). What is IoT? | by Sciforce | Sciforce | Medium](#) - IOT projects