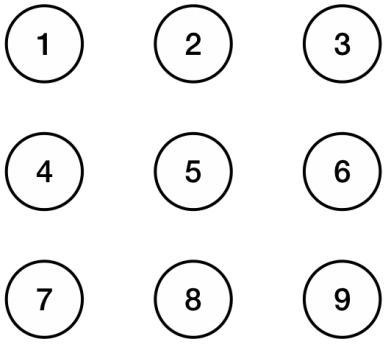
Teaser Game Functional Specification

Description

This system is Teaser game on a 3x3 grid board. Each position on the board has a push button with light that indicates ‘on’ or ‘off’. Users win the game when only the center position’s light is on and the rest is off, and users loose the game when all light is off.

Before the game, users can initialize the game either randomly or manually. During the game, users can only make move that change position state from “on” to “off” by pressing the button associated with that position. When a move is made on a position, the surrounding positions except the center are also toggled to the opposite state. The center position is toggled only when a move is made in a corner position. The move effects can be illustrated in tables below:



Postion Changed (User Move)	Postions Toggled
1	2, 4, 5
2	1, 3
3	2, 5, 6
4	1, 7
5	2, 4, 6, 8
6	3, 9
7	4, 5, 8
8	7, 9
9	5, 6, 8

Users would get sound warning when they try to make an illegal move. Users would also get visual feedback on the LED display about how many moves have been made. “Win” or “Loose” LED light would turn on when users win the game or loose the game. The game may be reset at any time of the game by pressing the “Manual Reset” or “Random Reset” button.

Global Variables

None.

Inputs

There are 9 lighted pushbutton switches on the 3x3 grid for each position, and 2 normal pushbutton switches, “Random Reset” and “Manual Reset”:

Switch Name	Switch Type	Description
Grid Position	Lighted pushbuttons	Toggle the position state and displays the position’s current state. The button light is on when the position is “on” state, and vice versa.
Random Reset	Pushbutton	Shows the top score in the display in a scrolling view, reset the position states randomly and sets the move count to 0.
Manual Reset	Pushbutton	When first pressed, shows the top score in the display in a scrolling view, resets all the position states to “off” and sets the move count to -, users can then manually set the position state. When pressed again, the game begins, and the move count is updated to 0.

Outputs

The 4-digit 7-segment LED display shows the move count. The LEDs for each switch on each position indicates the position’s “on” or “off” state. The LEDs with label “Win” or “Loose” indicates the game state, if neither of the light is on and there is no power failure, the game is still ongoing. The speaker sounds alarm sound when an illegal move or the 10000th move is made(if it is even possible). The SD card stores the top score.

User Interface

The lighted pushbuttons on the 3x3 grid shows the current position states. The 4-digit LED display shows the current move count. Users can attempt to toggle any position's state by pressing the pushbutton. When a position with "on" state is toggled, it changes to the "off" state, the light goes off, its surrounding position are toggled to "on" state (as described in the description), their light turns on, and the move count increments. When a position with "off" state is toggled, the speaker would make an alarming sound, all position states remain the same, and the move count remain the same. When only the center position is "on" and the reset is "off", the "Win" LED lights up and current move count is compared with the move count stored in top score. If current move count is less than the top score, the top score is updated to the current move count. If all position states are "off", the "Loose" LED lights up. When "Random Reset" button is pushed, the system randomly set some positions to be 'on' state and the rest to be 'off', the current move count is set to 0. When "Manual Reset" button is first pushed, the system set all positions to "off" state, users can toggle any position to be "on" state, the current count is set to -1. When users finished setting the board and push "Manual Reset" button again, the game begins with the current position state and the current count is set to 0.

Error Handling

An alarm sound would be made when users try to change a position from "off" to "on" state, i.e. pressing a light-off button, and a different alarm sound would be made when the 10000th move is made. All positions would remain in the same state as before.

If there is a power failure, the system would recover the board state to be the same as the one before the system shuts off.

Algorithms

None.

Data Structures

Move count — integer; stores the current move count; minimum count is -1, maxium count is 9999 moves.

State array — one-dimensional bit array; sotres the 9 positions' current state.

Top score — integer; stores the minimal move count made to make a win in this game's played history.

Limitations

Users can make at most 9999 moves(if this is possible). 10000th move would cause a warning sound and no move effect would happen on the board.

Known Bugs

None.

Special Notes

None.