FPGA-based Cognitive Pattern Recognition Training System

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# Project description

# Module Descriptions

#### Bomb Squad

The Bomb Squad module is the top level module.

#### Authentication

The authentication module receives an 8-bit string from mechanical switches and stores them in the user\_cred reg variable. Then a Finite State Machine starts by checking if a pulse has been received from the button shaper by checking the net submit input signal. In the next step the module retrieves the credential stored in the first address of a rom file and compares it with the 8-bit input signal. If the comparison succeeds, the module proceeds to send 2 signal flags to the game controller. The signal flag s\_update is used to inform the game controller that a user has successfully logged in. The signal User is employed to identify the user by checking its input id to a mapped table of ids. If a comparison fails, the module retrieves the information stored in the next address to the one already tested. If the module reaches the last meaningful address in the ROM, it will update the signal s\_update to inform the game controller that the comparison failed.

#### Countdown

Contains a predetermined starting value in seconds across three 4-bit internal registers which decrements each time a pulse is send from the OneSecTimer module.

#### Game Controller

The Game Controller module is the game controller for the entire game; it determines the state of the game based on signals from the other modules. The first state of the game begins at the user authentication stage. The module receives a signal from the authentication module upon successful authentication. The module outputs a signal s\_current which is used as a control signal to signify the state of the game. This module will perform the logical operations to decide which module’s signals have priority over others. Game ending conditions, such as the time running out or the user entering the incorrect pattern during the user input process, have precedence over all other signals.

#### LCD Controller

#### LED Driver

#### LFSR 8-Bit

#### One Second Timer

#### RAM Controller

#### Sequence Key Builder

The SequenceKeyBuilder module creates the key from the LFSR. It generates the puzzle pattern to be displayed on the seven segment display.

#### Sequence Key Generator

#### Sequence Verifier

The SequenceVerifier module is the module that verifies the puzzle sequence that the user has entered. The module will receive the sequence from the sequence generator and will compare the corresponding solution to the sequence. The verify signal initiates the sequence to be verified by the sequence verifier. The result signal, which is sent to the game controller, is updated every time the user enters a segment of the pattern. If the user incorrectly enters the sequence, the result signal will change to signal the game controller to reach a game over state.

#### Seven Segment Timer

#### SSD Sequence

#### Time Assignment