Microprocessors Lab (EP-315) Project Report

Snake Game on a 4x4 LED Matrix

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Objectives:-

1) To create a 4x4 LED display matrix using only eight outputs from the Arduino.

2)To make the joystick for controlling the snake.

3)To write a code to execute the snake game in the LED display using the Arduino.

Snake Game:-

The snake game which we are planning to execute in this project is a simplified version of the very popular snake game which all of us are familiar with. In this game, the interface asks the user to press any key so that the game could resume. The game starts on receiving this input from the key and displays the present position of snake(which we set as the first pixel in the display) in the LED display. It then displays the position of the mice, and sets a time limit in which we need to move the snake to the mice using the four switches of mini-joystick. If this is successfully accomplished, the interface displays a congratulatory message; otherwise, the game gets over and is reset.
This can be further complicated by introducing more levels in which time limit decreases and the snake's speed increases.

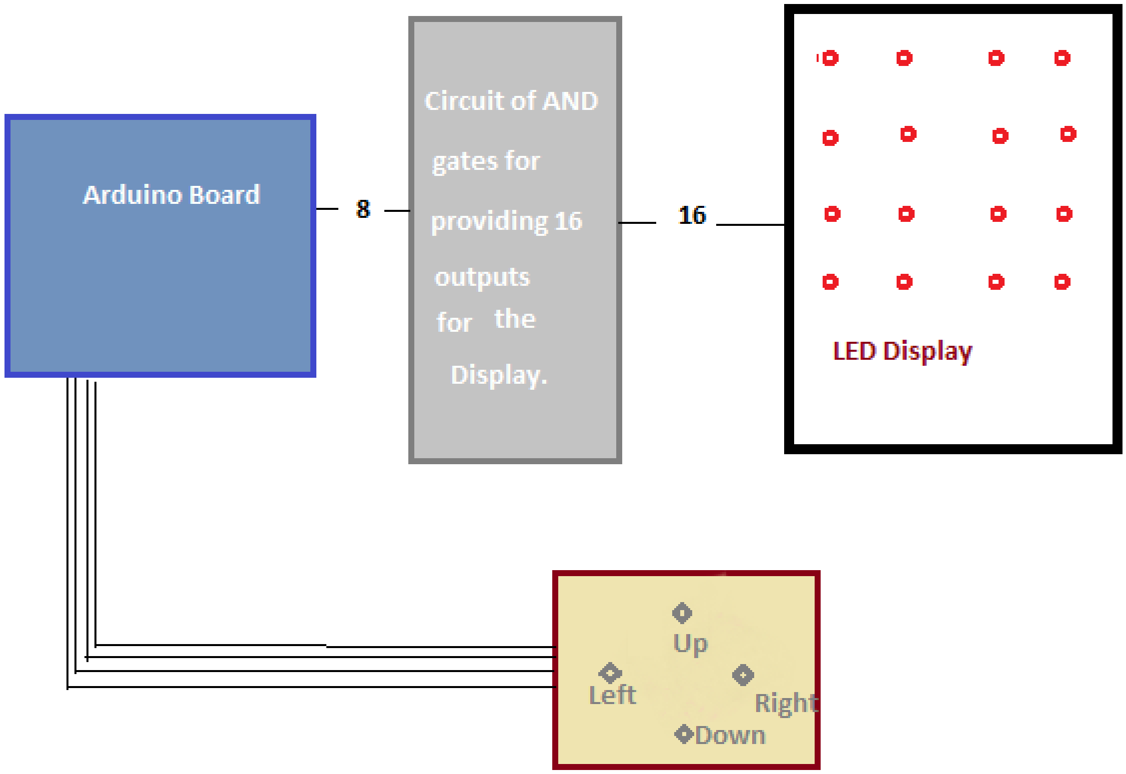
Strategy:-

The first step is to make an LED display board which will use only eight out puts from the Arduino board. This step involves lots of soldering work and is very time consuming. The eight out puts from the Arduino can be paired with each other to form sixteen unique pairs, each pair from which passes through an AND gate. The sixteen outputs thus generated from the AND gate will be served to the positive of the LED. Thus each LED can be represented by (x,y).

Once the display is ready, and the connections with Arduino are made, we can make the joystick for controlling the snake. This can be made using four switched and four pins from Arduino which are ste in input mode.

The programming part is in accordance with the rules of the game. It analyses the inputs from the joystick and passes outputs to the AND gates which then passes it on to the LED display.

The system looks vaguely as follows:

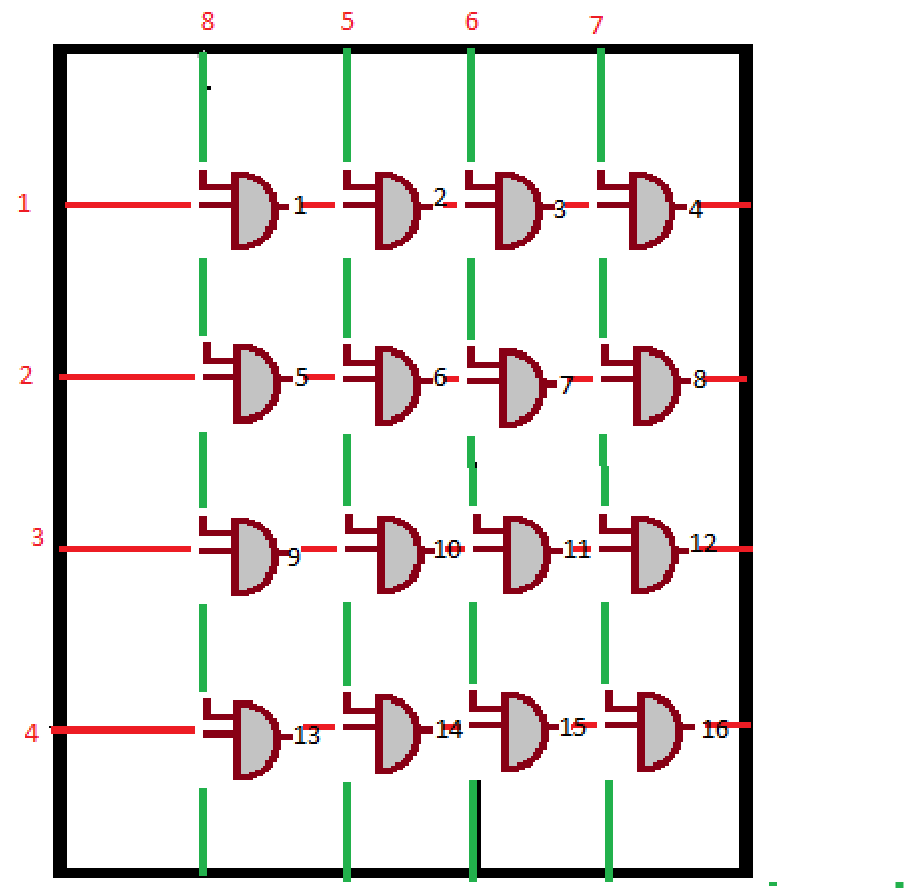


Components used:-

1)Sixteen LEDs.
2)Switches, Resistors, Wires, PCB, Bread boards and wires.
3) Four IC 7408s.

The AND Gate Circuit:-

The AND gates-circuit uses sixteen not gates to create 16 outputs from eight outputs. This can be done by thinking of an LED as a combination of two outputs which will then form unique pairs. Thus, from 2N outputs, we can get NxN outputs. The mesh of wires can be quite tedious to handle. This concept can be summarized in a diagram as:



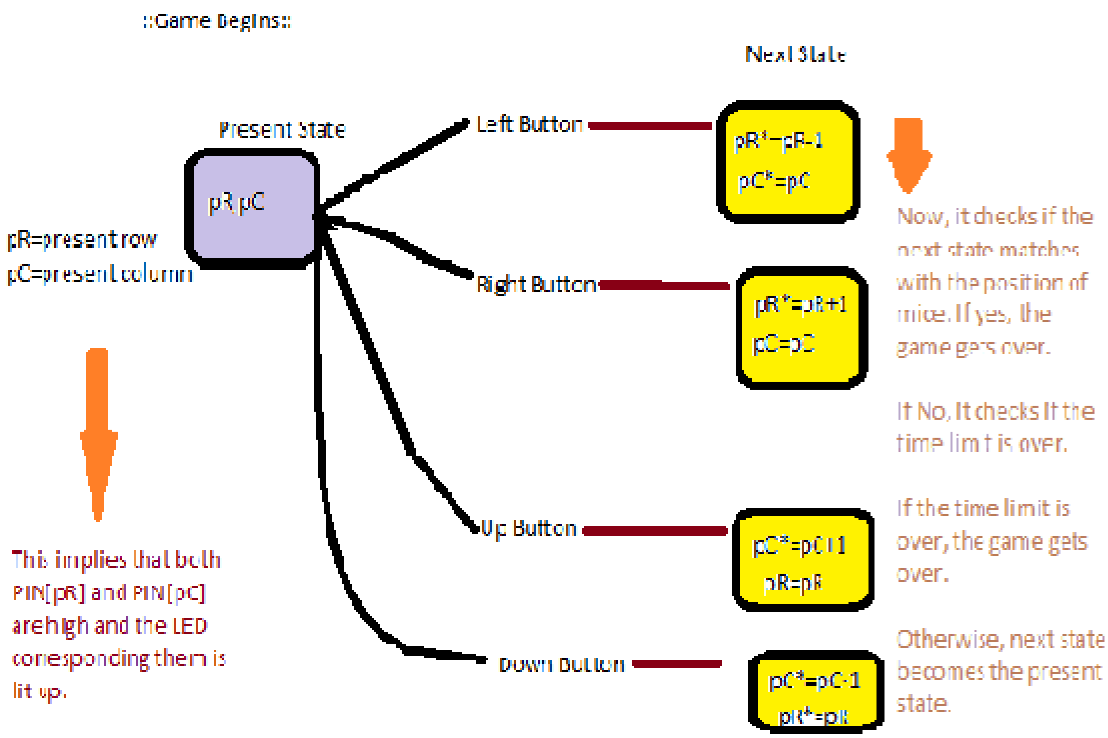
Here, we can see that the wires numbered from 1 to 8 represents the outputs coming from the Arduino board, and the wires numbered 1 to 16 are the outputs. We can see that if both the pins 1 and 8 are raised high, then the top most AND gate gives an output HIGH which is fed to the topmost LED. Thus the top most LED is represented as (1,5). So, the LEDs in the order are (1,8),(1,5),(1,6),(1,7), (2,8),(2,5),(2,6),(2,7), (3,8),(3,5),(3,6),(3,7), (4,8),(4,5),(4,6),(4,7).

Programming Logic

Since the distribution of PINs in the circuit is not in a particular order, we can put them in an array by the name PIN for manipulation. Like in the situation shown in the previous figure, we can declare an array PIN[8]=1,2,3,4,8,5,6,7. Now, PIN[0] to PIN[3] represents the row coordinates and the rest the column coordinates.

Now this is flexible for usage in the programming.

The algorithm is very simple and can be visualized in a state diagram such as:



We have to take care that the value of pC is always from 4 to 7, and the value of row is from 0 to 3. If the value of pC spills on to 8 or 3, it should be set back to 4 or 7 respectively. Similarly for pR, if its value spills over to 4 or -1, it should be set back to 0 or 3 respectively. This creates the effect that the snake goes into the right wall and come through the left.(goes through the up and comes through the down).

Problems faced, and measures taken

1) Initially, on an attempt with no resistors to pull down the switch

to ground, a voltage was experienced even when the switch was off. This caused problem with the working of joystick. Later, 3.9 kilo ohms resistors were used for this purpose.

2)The fact that AND gate took floating PINs as high was initially overlooked. This was later solved in the program by making it compulsory to pull all the outputs down to low before lighting any LEDs.

3) The program was initially very clumsy which caused lots of troubles with debugging. Separate functions were made to switch on, switch off LEDs, to begin the game, to reset the system etc..

Things Learned

1)The working of gates and how to implement gates in a complicated circuit.
2)The complexities regarding making an LED display matrix.

Cost of the Project NIL: all the components were available in the lab.