An-Najah National University
Faculty of Engineering and IT

جامعة النجاح الوطنية
كلية الهندسة وتكنولوجيا المعلومات

Computer Engineering Department
Course Name: Microprocessor Lab Number: 10636392
Lab Report Grading Sheet

Instructor: Dr. Aladdin Masri	Experiment #: 4
Academic Year: 2019/2020	Experiment: LED 16x16 Dot Matrix Display
Semester: Summer Semester	

Students	
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3-	4-
Performed on: 18th of August	Submitted on: 18th of August

Report's Outcomes

ILO __ =( ) %	ILO __ =( ) %	ILO __ =( ) %	ILO __ =( ) %	ILO __ =( ) %

Evaluation Criterion	Grade	Points
Abstract answers of the questions: "What did you do? How did you do it? What did you find?"	0.5	
Introduction and Theory Sufficient, clear and complete statement of objectives. In addition to Presents sufficiently the theoretical basis.	1.5	
Apparatus/ Procedure Apparatus sufficiently described to enable another experimenter to identify the equipment needed to conduct the experiment. Procedure sufficiently described.	2	
Experimental Results and Discussion (In-Lab Worksheet) Crisp explanation of experimental results. Comparison of theoretical predictions to experimental results, including discussion of accuracy and error analysis in some cases.	4	
Conclusions and Recommendations Conclusions summarize the major findings from the experimental results with adequate specificity. Recommendations appropriate in light of conclusions. Correct grammar.	1	
Appearance Title page is complete, page numbers applied, content is well organized, correct spelling, fonts are consistent, good visual appeal.	1	
Total	10	

Abstract:

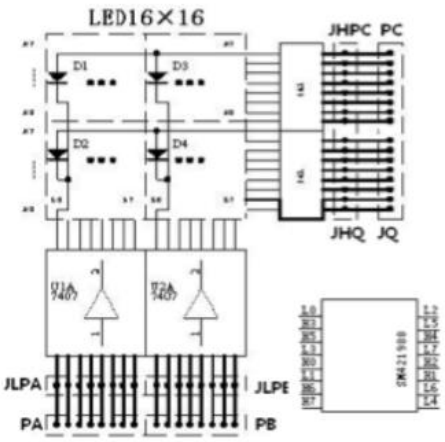
In this experiment, we will be displaying certain shapes/animations on a 16x16 LED display on the microprocessor kit.

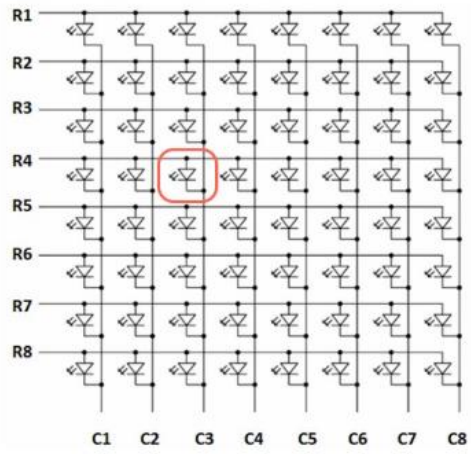
Objectives:

- To be more familiar with the 16x16 LED matrix and how it works.
- To understand the concept of interfacing an LED matrix with the microprocessor.

Procedure:

The 16x16 LED matrix consists of 4 8x8 common cathode LED matrices, which makes it 256 LEDs in total. The LED matrix is used to display different information such as static text or symbols, or animated images.





The 8x8 LED matrix consists of 8 rows and 8 columns, where all anodes of the LEDs in a single row are connected together, and all cathodes of a single column are connected together. Hence, to light up a single LED, it has to be addressed by it's location, by giving the row number a LOW value and the column number a HIGH value.

The rows/columns are interfaced with the microprocessor via 8255, where the upper row is connected to port C, and the two columns are connected to ports A and B respectively.

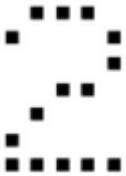
This experiment consists of two parts:

1- Displaying a single digit on the first 8x8 LED matrix (2 in our case).
2- Animating a single pillar that rotates over the upper 8x16 LED matrix.

Procedure: *(cont.)*

Part 1:

We cannot simply display the number “2” easily on our matrix, as it cannot be done in a single selection process. The idea behind this part is that we will be showing the number “2” column by column where the human eye cannot realize that one column is only on at a time.



First of all, we need to configure the 8255 as all output ports:

```
7  MOV DX, 0FF2BH
8  MOV AL, 80H
9  OUT DX, AL
```

Now we need to turn on the first column only by giving it LOW and the other columns HIGH, and turn on the required rows for the first column, in our case it would be row 0, 1 and 5.

The following table summarizes the values for each column (Columns 5-7 and Row 7 and not used):

-	Column 0	Column 1	Column 2	Column 3	Column 4
Row 6	0	1	1	1	0
Row 5	1	0	0	0	1
Row 4	0	0	0	0	1
Row 3	0	0	1	1	0
Row 2	0	1	0	0	0
Row 1	1	0	0	0	0
Row 0	1	1	1	1	1

All that has to be done is to enable a column, enable the corresponding rows for the column, call a small delay, then move on to the following column, and repeat:

Procedure: *(cont.)*

Part 1: *(cont.)*

```
11  BEGIN:
12  ;ROW
13  MOV DX, 0FF2AH
14  MOV AL, 00100011B
15  OUT DX, AL
16
17  ;COL
18  MOV DX, 0FF28H
19  MOV AL, 11111110B
20  OUT DX, AL
21
22  CALL DELAY
23
24  ;ROW
25  MOV DX, 0FF2AH
26  MOV AL, 01000101B
27  OUT DX, AL
28
29  ;COL
30  MOV DX, 0FF28H
31  MOV AL, 11111101B
32  OUT DX, AL
33
34  CALL DELAY
35
36  ;ROW
37  MOV DX, 0FF2AH
38  MOV AL, 01001001B
39  OUT DX, AL
40
41  ;COL
42  MOV DX, 0FF28H
43  MOV AL, 11111011B
44  OUT DX, AL
45
46  CALL DELAY
```

```
48  ;ROW
49  MOV DX, 0FF2AH
50  MOV AL, 01001001B
51  OUT DX, AL
52
53  ;COL
54  MOV DX, 0FF28H
55  MOV AL, 11110111B
56  OUT DX, AL
57
58  CALL DELAY
59
60  ;ROW
61  MOV DX, 0FF2AH
62  MOV AL, 00110001B
63  OUT DX, AL
64
65  ;COL
66  MOV DX, 0FF28H
67  MOV AL, 11101111B
68  OUT DX, AL
69
70  CALL DELAY
71
72  JMP BEGIN
```

Procedure: *(cont.)*

Part 2:

The idea behind this part is very simple, since we are drawing a single pillar with no complex shapes, we need to turn on all rows (0FFH) and turn on a single column. To animate the pillar, all we need to do it to rotate the column register.

8255 configuration:

```
7   MOV DX, 0FF2BH
8   MOV AL, 80H
9   OUT DX, AL
```

This line of code will enable all rows:

```
11  ;ROW
12  MOV DX, 0FF2AH
13  MOV AL, 0FFH
14  OUT DX, AL
```

We will disable all columns connected to port B, so no issues occur:

```
16  LL:
17
18  MOV DX, 0FF29H
19  MOV AL, 0FFH
20  OUT DX, AL
```

Now we will enable the first column for port A, and rotate 8 times:

```
22  MOV AL, 0FEH
23  MOV CX, 8
24
25  MOV DX, 0FF28H
26
27  COL:
28  OUT DX, AL
29  ROL AL
30  PUSH CX
31  CALL DELAY
32  POP CX
33  LOOP COL
```

Procedure: *(cont.)*

Part 2: *(cont.)*

Now we will do the opposite of what we did, we will disable the columns connected to port A, so no issues would occur:

```
35  MOV DX, 0FF28H
36  MOV AL, 0FFH
37  OUT DX, AL
```

Then we will enable the first column for port B and rotate 8 times, then repeat the whole process:

```
39  MOV AL, 0FEH
40  MOV CX, 8
41
42  MOV DX, 0FF29H
43
44  COL2:
45  OUT DX, AL
46  ROL AL
47  PUSH CX
48  CALL DELAY
49  POP CX
50  LOOP COL2
51  JMP LL
```

Conclusion:

In the end, we learned how to use the 16x16 LED Matrix provided by the kit. We learned the concept behind using it. Additionally, we learned how to display certain patterns/animations on the dot matrix by mocking the human's eye.