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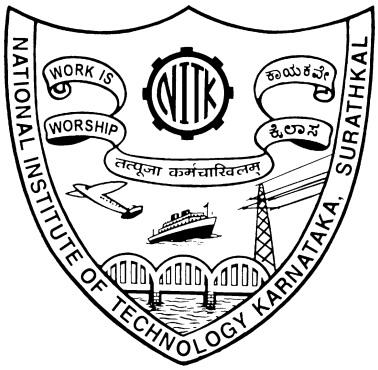

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Digital system Project on

MOVING MESSAGE DISPLAY

Submitted by:

Sangeetha G.S. 14CO141

Samanvita Sastry 14CO139

Submitted to:

Ms.Shilpa

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INTRODUCTION:

Moving Message Display - In this project, we have implemented a moving screen display. Here, we make the word “STOP” slide over a six-slot display panel.

Initially, in the first clock, “S” appears in the first slot, “T” appears in the second, “O” in the third and “P” in the fourth. In the second clock, “S” appears in the second slot, “T” in third, “O” in fourth and “P” in fifth. Next, “S” appears in the third, “T” in fourth, “O” in fifth and “P” in sixth. In the fourth clock, “S” appears in the fourth slot, “T” in fifth, “O” in sixth and “P” disappears. Then, “S” in fifth, “T” in sixth, “O” disappears. Next, “S” appears in the last slot and “T” disappears. Finally “S” also disappears. In the next clock cycle, the whole process repeats. Thus the message “STOP” moves over the six-slot display panel.

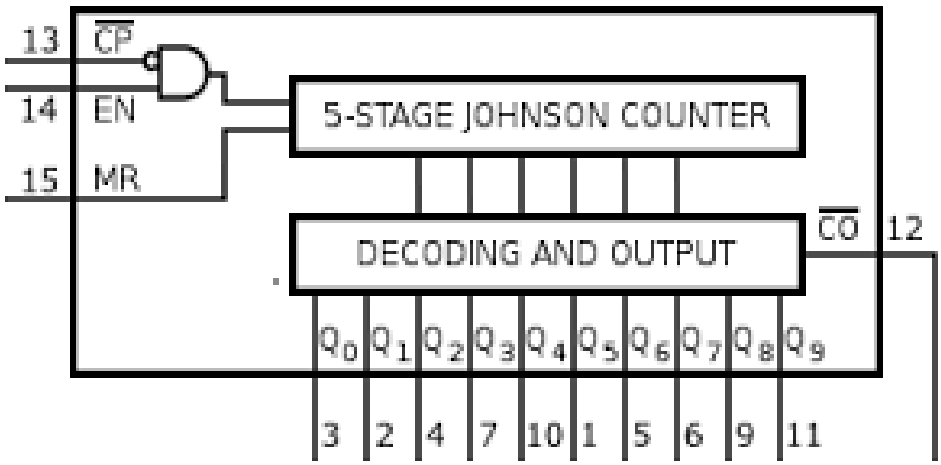
The moving message display has been implemented using IC 4017 and a display panel that comprises of six seven segment display.

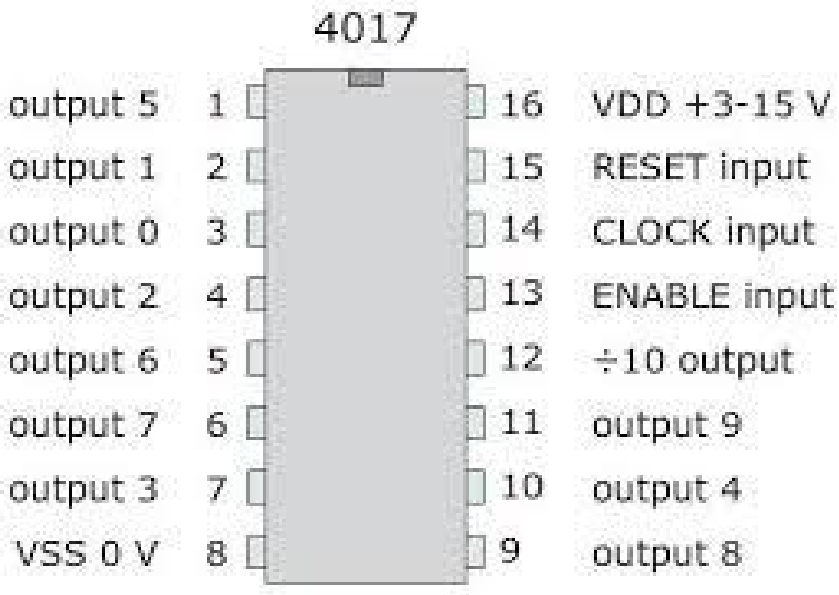
OBJECTIVE AND SCOPE:

A moving message display or a scrolling message display is an excellent method of communicating information. The smooth sailing effect of the characters makes more information accessible through a small passage. Hence, a longer message can be read in the available space with the help of this scrolling. A small scrolling message display carrying a very few number of characters can be built using ordinary digital ICs. When a microcontroller is not used, the moving message to be displayed is hardwired to the seven segment display panel. When a microcontroller is used, an LED matrix can be created and it can be programmed to display any particular message in the display panel. Thus, a moving message display is a very effective method to display any information in a space efficient way also. The concept of moving message display can also be extended to make designs or patterns move on LED matrices in various places.

LIST OF COMPONENTS:

1. **Decade counter [IC 4017]** - A scrolling screen is implemented using a decade counter (also known as Johnson counter). 4017 IC is a CMOS counter/divider integrated circuit, actually a decade counter with 10 decode outputs. It is 5-stage Johnson counters having 10 decoded outputs. Thus, only one of the ten outputs of the IC 4017 is high for every clock. After 10 clock pulses the IC resets itself and the sequence continues.





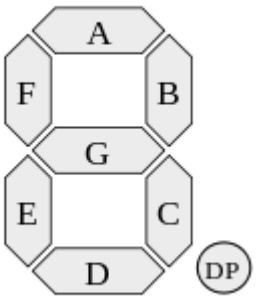
2. DIGITAL CLOCK :

Digital clock provides a clock pulse which is continuous and gives an alternate high and low pulse alternately. This when connected to the clock input of the IC 4017 will make the IC output high in a sequential manner. Thus the first output of the IC will be high in the first clock, second in the second clock and so on. After the 10^{th} clock pulse it again resets and the outputs become sequentially high. Thus clock ensures that only one of the outputs of IC is high at a time.

3. SEVEN SEGMENT DISPLAY:

This experiment uses 6 seven segment displays to show the movement of the message “STOP” over the entire panel. A seven segment display, as the name suggests has seven segments that can make the letters S, T, O and P.

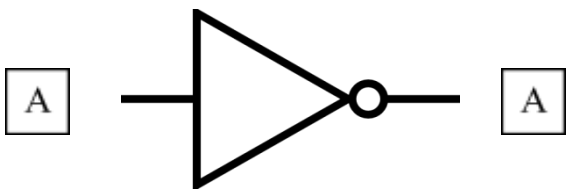
The seven segment used is active low, i.e. it displays a segment when the input to the segment is low.



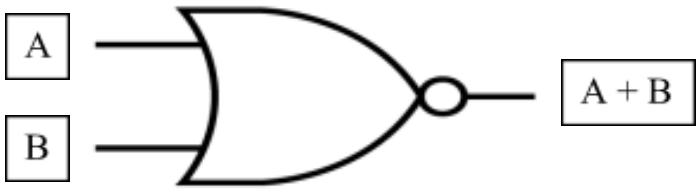
To display the letter “S” only A, C, D, F and G segments have to be low. To display the letter “T” only D, E, F and G segments have to be low. To display the letter “O” only A, B, C, D, E, F and G segments have to be low. To display the letter “S” only A, B, E, F and G segments have to be low.

4. LOGIC GATES :

1. NOT GATE



2. NOR GATE



Basic gates such as NOT and NOR gate also known as the universal gates have been used in the circuit. Since the seven segment display used is active low we need to supply the negated output if the IC 4017 as input to the seven segment display. Also, since each segment of each seven segment display is needed to display more than one alphabet of the word “STOP” the NOR gate is used.

Along with the above mentioned elements, connecting wires and the VDD and VSS sources are used for the IC 4017 and the seven segment display.

METHODOLOGY:

The circuit for moving message display comprises of 1 4017 CMOS IC, 6 seven segment LED display, the supply voltage (5V) and basic gates that include 2 NOT gates and two, three and four input NOR gates. As mentioned earlier the IC 4017 has 16 pins. The 16^{th} pin of the IC is connected to the VDD (5V). The 8^{th} pin is connected to VSS (0V). The 15^{th} pin of the IC is also connected to the 0V since it is the reset pin. The 14^{th} pin is connected to the clock. Since we are not using a microcontroller we have to hardwire the text message that we want display and here that message is “STOP”. The working can be divided into the following stages:

Working of IC 4017:

The **4017 IC** is a 16-pin CMOS decade counter from the 4000 series. It takes clock pulses from the clock input, and makes one of the ten outputs come on in sequence each time a clock pulse arrives. The ten outputs are produced by the Johnson Counter in the IC.

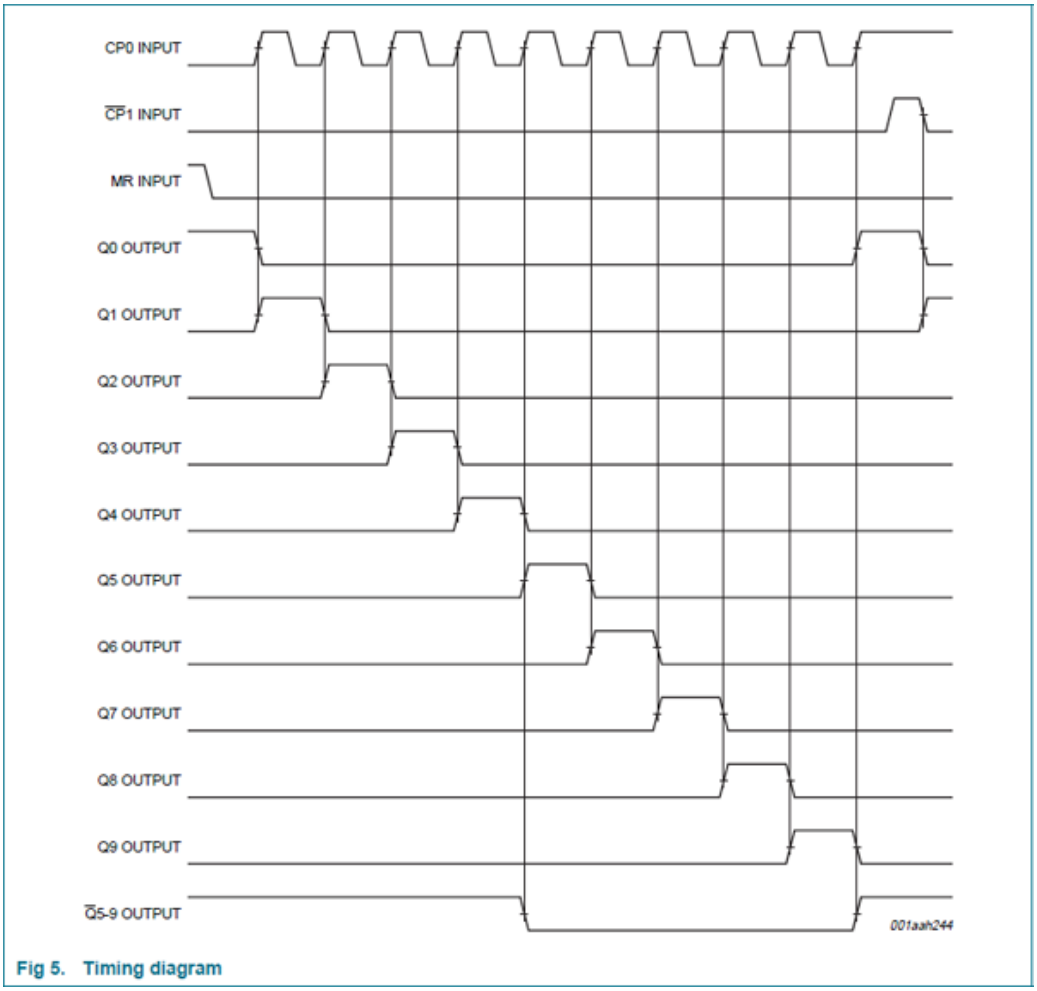


Fig 5. Timing diagram

Pin number	Name	Purpose
1	6	The 6th sequential output
2	2	The 2nd sequential output
3	1	The 1st sequential output
4	3	The 3rd sequential output
5	7	The 7th sequential output
6	8	The 8th sequential output
7	4	The 4th sequential output
8	0 V, V_{DD}	The connection to the 0 V rail

9	9	The 9th sequential output
10	5	The 5th sequential output
11	10	The 10th sequential output
12	CO	**C**arry **o**ut output - outputs high on counts 0 to 4, outputs low on counts 5 to 9 (thus a transition from low to high occurs when counting from 9 back to 0)
13	LE	**L**atch **e**nable - latches on the current output when high (i.e. the chip counts when LE is low)
14	CLK	**Cl**oc**k** in
15	RST	**R**e**s**e**t** - sets output 1 high and outputs 2 through 10 low, when taken high
16	+9 V, V_{cc}	The connection to the $+V_{cc}$ rail (voltage between +3 V and +15 V)

Thus in every clock, only one of the output pins of 4017 IC is high and is connected to the seven segment display accordingly to display the message “STOP” sequentially.

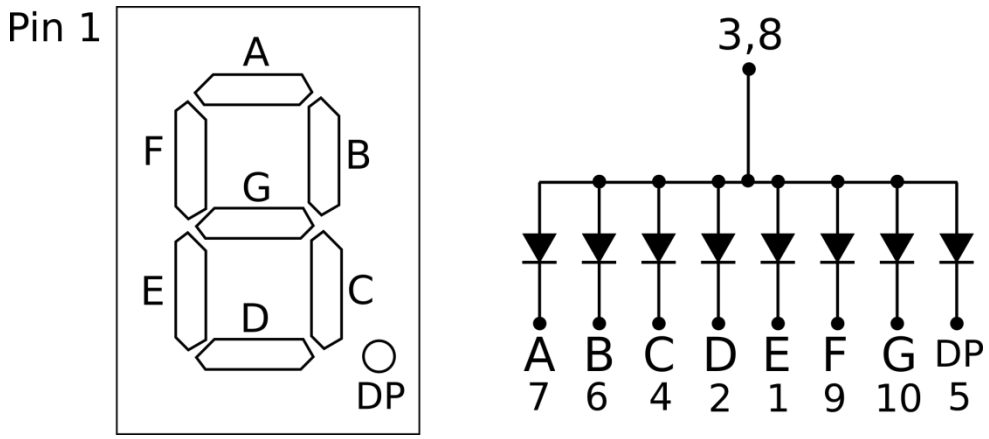
The pace at which the message moves can be altered by changing the frequency of the clock input to the IC.

In 7 clocks the LED outputs will look as shown :

S	T	O	P			
	S	T	O	P		
		S	T	O	P	
			S	T	O	P
				S	T	O
					S	T
						S

GIVING INPUTS TO THE LED DISPLAY:

Each seven segment display is used to display a letter. In the first clock the first, second, third and the fourth seven segment displays have to output S,T,O and P respectively. This then gets shifted to the second, third, fourth and fifth seven segment display in the second clock and so on. The structure of the seven segment display is as shown:



To display the letter “S” only A, C, D, F and G segments have to be low. To display the letter “T” only D, E, F and G segments have to be low. To display the letter “O” only A, B, C, D, E, F and G segments have to be low. To display the letter “S” only A, B, E, F and G segments have to be low. Keeping the above fact in mind for every clock we have designed the inputs to the seven segment display based on which pin of the IC 4017 will be active in the clock. The truth table for inputs to each of the seven segment display and the equations are as shown below:

1. First seven segment display: Displays only “S” in the fourth clock.

	A	B	C	D	E	F	G
CLOCK 1	1		1	1		1	1
CLOCK 2							
CLOCK 3							
CLOCK 4							
CLOCK 5							
CLOCK 6							
CLOCK 7							

A = (O1)’
B
C = (O1)’
D = (O1)’
E
F = (O1)’
G = (O1)’

2. Second seven segment display: Displays “S” in the first clock and “T” in the next.

	A	B	C	D	E	F	G
CLOCK 1				1	1	1	1
CLOCK 2	1		1	1		1	1
CLOCK 3							
CLOCK 4							
CLOCK 5							
CLOCK 6							
CLOCK 7							

A = (O2)’
B
C = (O2)’
D = (O1 + O2)’
E = (O1)’
F = (O1 + O2)’
G = (O1 + O2)’

3. Third seven segment display: It displays “O” in the first clock, “T” in the second and “S” in the third.

	A	B	C	D	E	F	G
CLOCK 1	1	1	1	1	1	1	
CLOCK 2				1	1	1	1
CLOCK 3	1		1	1		1	1
CLOCK 4							
CLOCK 5							
CLOCK 6							
CLOCK 7							

A = (O1 + O3)’
B = (O1)’
C = (O1 + O3)’
D = (O1 + O2 + O3)’
E = (O1 + O2)’
F = (O1 + O2 + O3)’
G = (O2 + O3)’

4. Fourth seven segment display: It displays “P” in the first clock, “O” in the second, “T” in the third and “S” in the fourth clock.

	A	B	C	D	E	F	G
CLOCK 1	1	1			1	1	1
CLOCK 2	1	1	1	1	1	1	
CLOCK 3				1	1	1	1
CLOCK 4	1		1	1		1	1
CLOCK 5							
CLOCK 6							
CLOCK 7							

A = (O1 + O2 + O4)’
B = (O1 + O2)’
C = (O2 + O4)’
D = (O2 + O3 + O4)’
E = (O1 + O2 + O3)’
F = (O1 + O2 + O3 + O4)’
G = (O1 + O3 + O4)’

5. Fifth seven segment display: It displays “P” in the second clock, “O” in the third, “T” in the fourth and “S” in the fifth clock.

	A	B	C	D	E	F	G
CLOCK 1							
CLOCK 2	1	1			1	1	1
CLOCK 3	1	1	1	1	1	1	
CLOCK 4				1	1	1	1
CLOCK 5	1		1	1		1	1
CLOCK 6							
CLOCK 7							

A = (O2 + O3 + O5)'
B = (O2 + O3)'
C = (O3 + O5)'
D = (O3 + O4 + O5)'
E = (O2 + O3 + O4)'
F = (O2 + O3 + O4 + O5)'
G = (O2 + O4 + O5)'

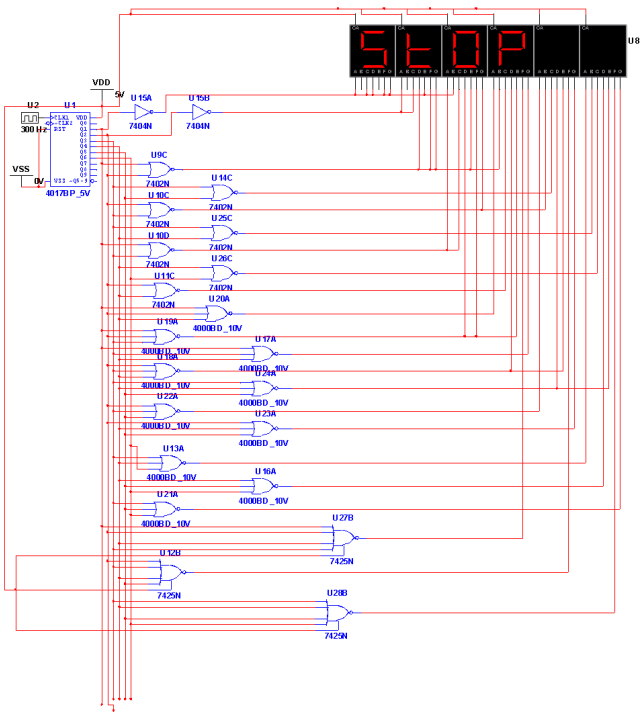
6. Sixth seven segment display: It displays "P" in the third clock, "O" in the fourth, "T" in the fifth and "S" in the sixth clock.

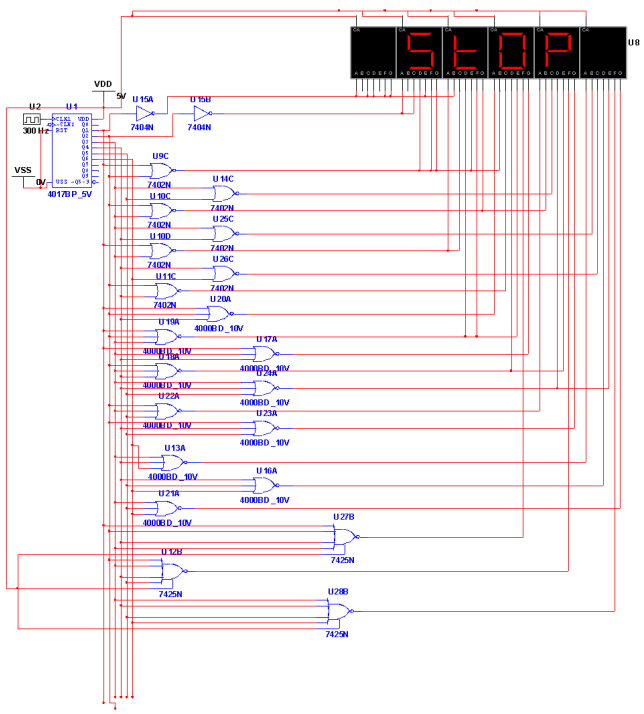
	A	B	C	D	E	F	G
CLOCK 1							
CLOCK 2							
CLOCK 3	1	1			1	1	1
CLOCK 4	1	1	1	1	1	1	
CLOCK 5				1	1	1	1
CLOCK 6	1		1	1		1	1
CLOCK 7							

A = (O3 + O4 + O6)'
B = (O3 + O4)'
C = (O4 + O6)'
D = (O4 + O5 + O6)'
E = (O3 + O4 + O5)'
F = (O3 + O4 + O5 + O6)'
G = (O3 + O5 + O6)'

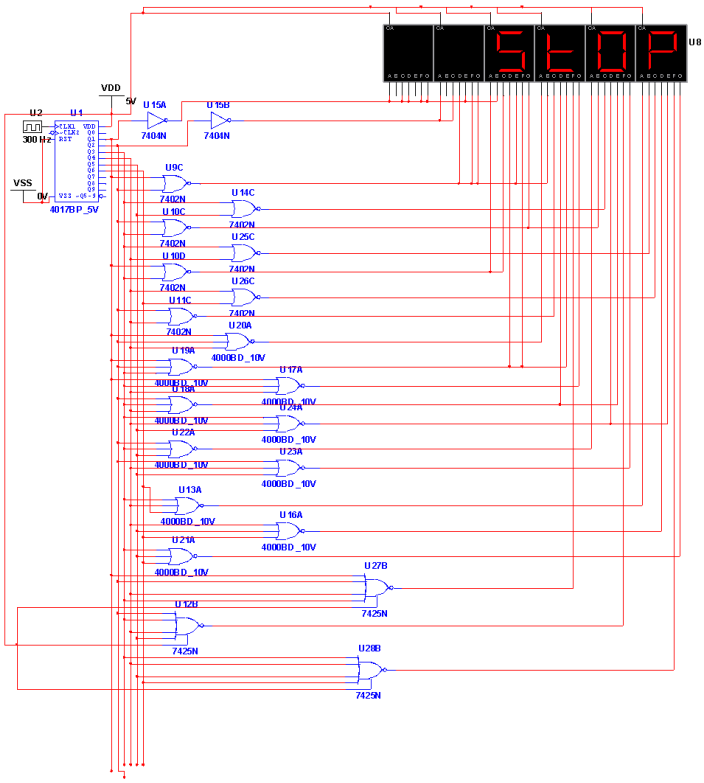
Thus, the above connections are made using two, three and four input NOR gates along with 2 NOT gates. The voltage input for the seven segment displays is given as 5V.

For every clock, the display of the LED is as shown:

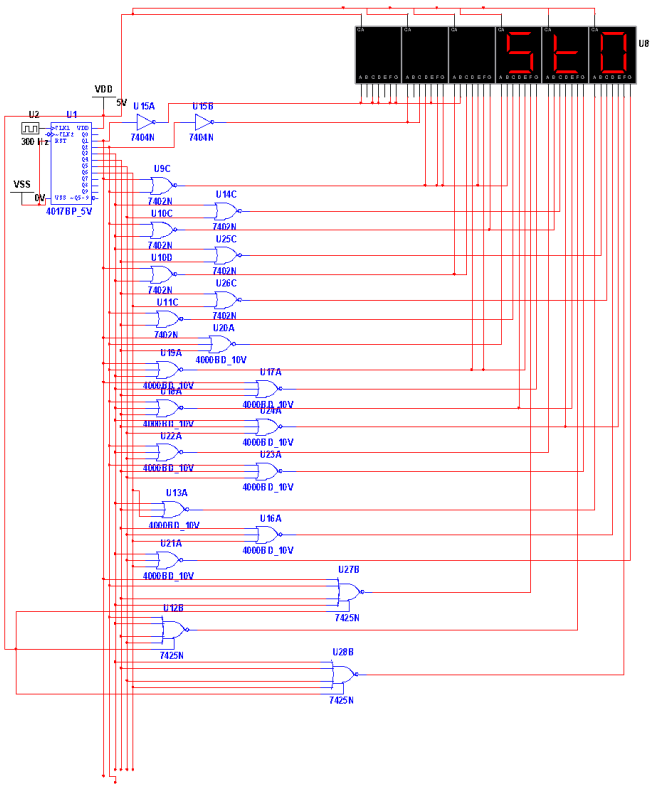




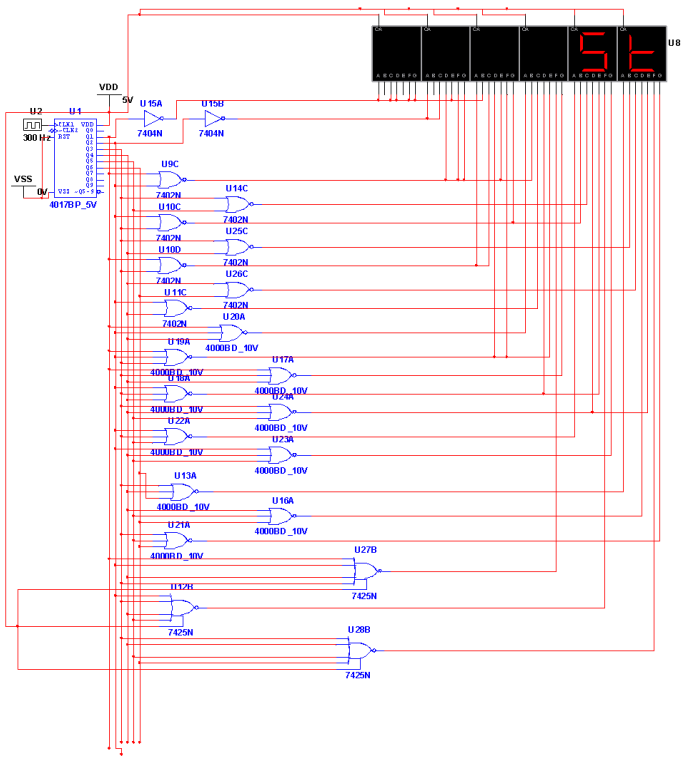
CLOCK 1



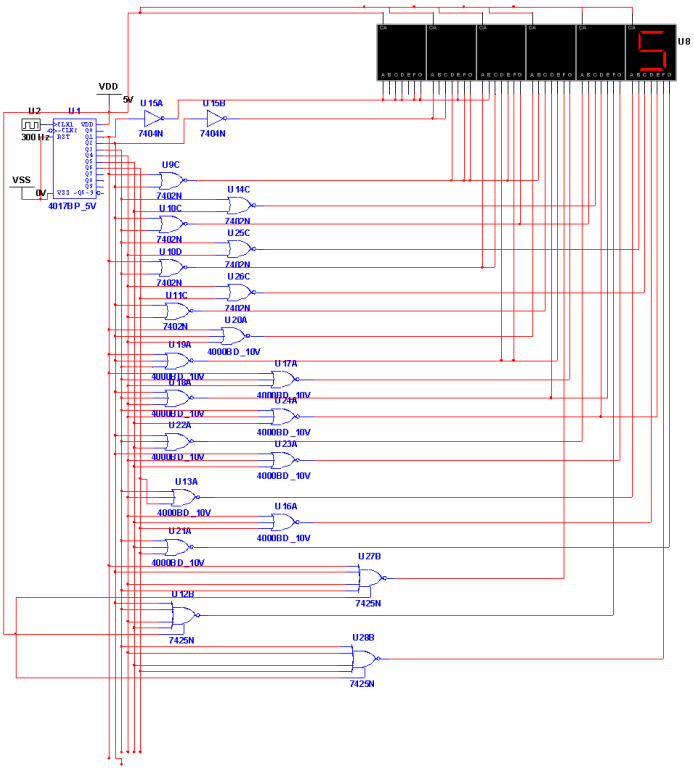
CLOCK 2



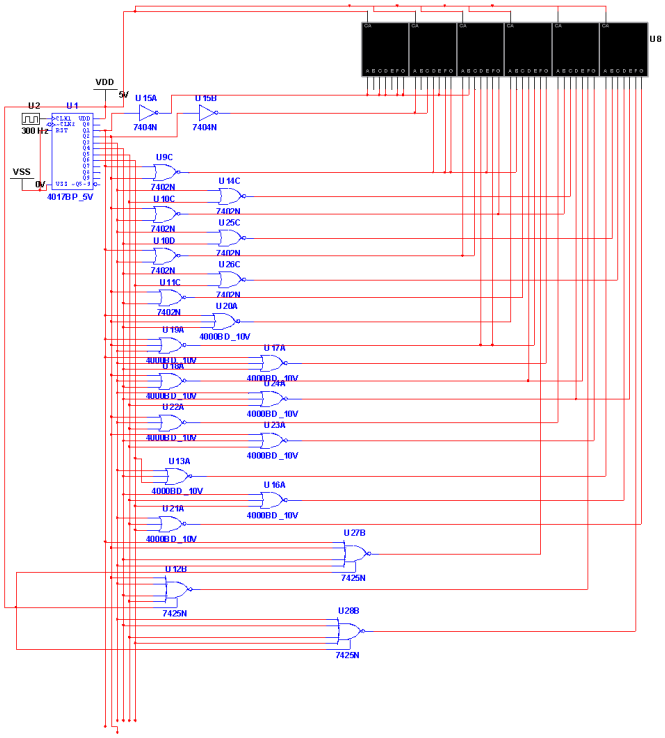
CLOCK 3



CLOCK 4



CLOCK 5 **CLOCK 6**



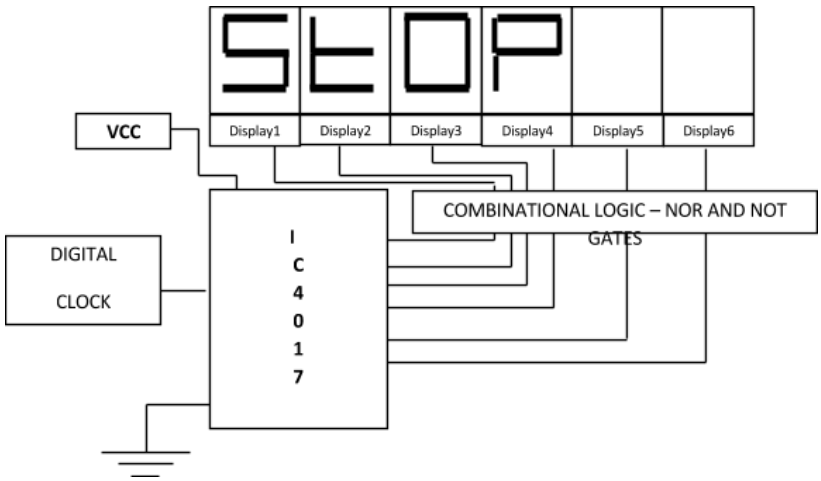
CLOCK 7

Hence, for every clock, the word STOP moves along the six segment led display and appears as a moving message.

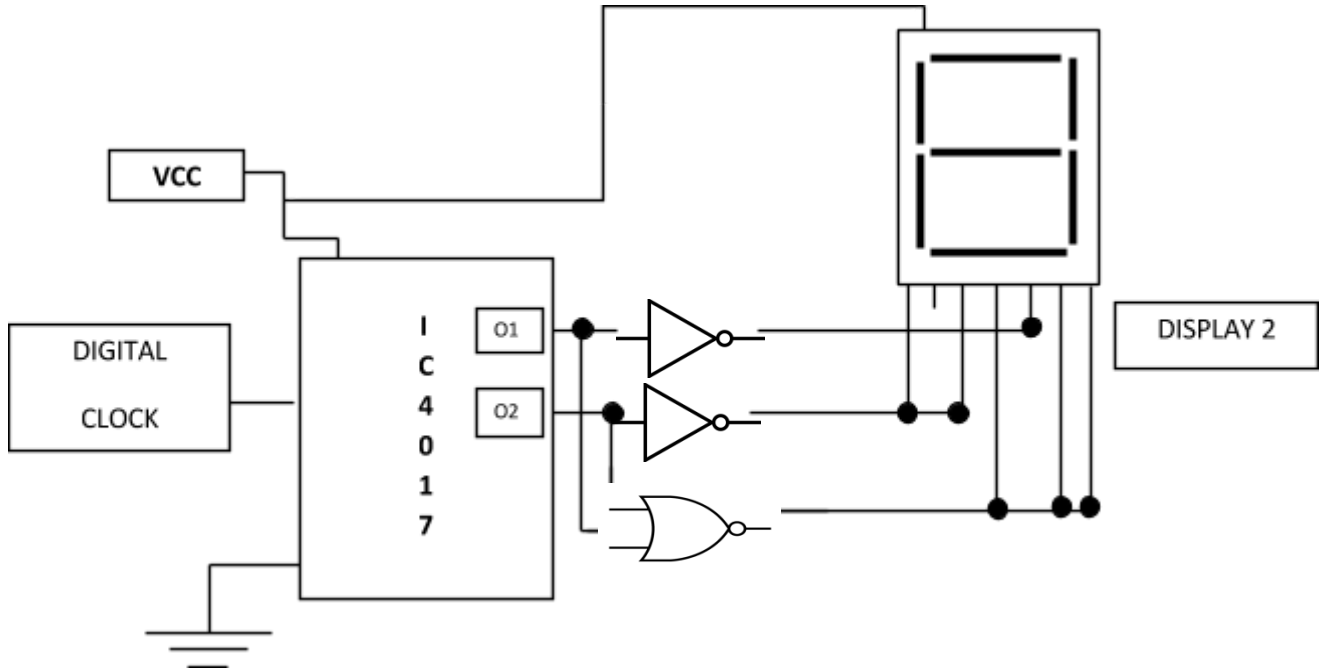
LOGIC CIRCUIT:

The main diagram of the moving message display circuit includes a digital clock that is connected to the IC 4017. The outputs of the IC are connected to the seven segment display as explained in the methodology section. The block diagram is shown as follows:

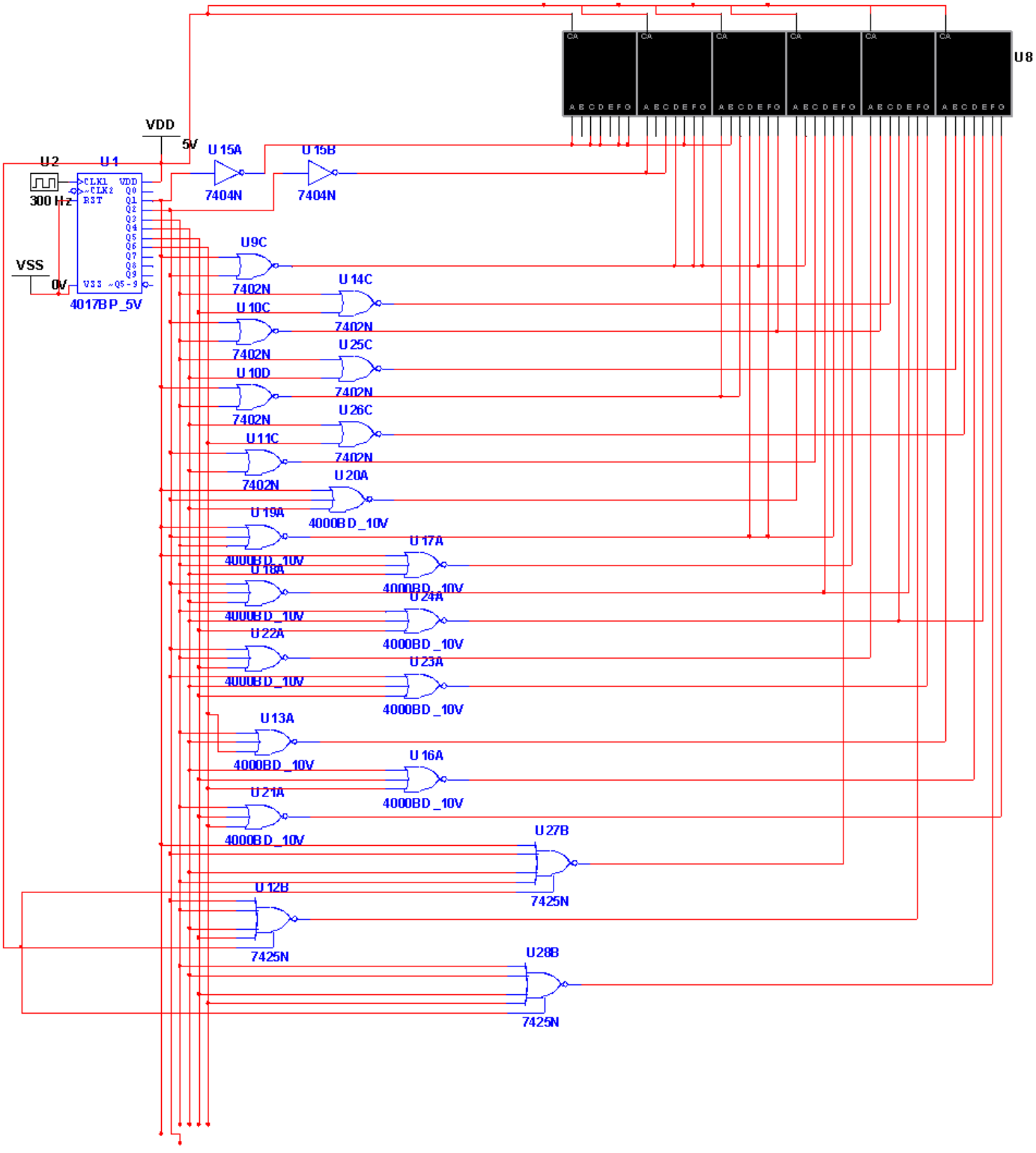
MAIN CIRCUIT:



SUBCIRCUIT: The connection to the seven segment display is shown (with display2).



Thus, the circuit when implemented fully will appear like this:



MOVING MESSAGE DISPLAY

MERITS AND DEMERITS:

Merits:

1) It successfully conveys important information to the public.
2) We can use different coloured LEDs to add effect to the display.
3) Using Moving Message Display uses space efficiently and hence, it can be used in vehicles and places where there is not enough space to display the whole message at once.
4) When microcontrollers are used, the text in the display can be changed by changing the program.

Demerits:

1) Since many basic gates are used to give the inputs to the seven segment display, there is delay in the display and hence the letters take different time to disappear and reappear. So sometimes the display might appear a little hazy.

LIST OF REFERENCES:

Below mentioned are some of the links we found useful to design the moving message display circuit that is explained in this report.

1) http://www.wikipedia.org
2) http://www.brighthubengineering.com/diy-electronics-devices/92009-build-a-scrolling-message-display-circuit/#imgn_2
3) http://www.brighthubengineering.com/diy-electronics-devices/56532-pin-configuration-of-ic-4017-decade-counter/
4) http://www.ni.com/white-paper/10710/en/
5) Digital Design and Computer Design, by Morris Mano