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ECLR -11

DIGITAL ELECTRONICS LABORATORY

MINI PROJECT.

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Mini Project Title- Calorie meter for a cyclist

Section- ECE-A.

Prepared By:

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CALORIE METER FOR A CYCLIST

Abstract:

Keeping track of the calorie intake and the energy burnt is essential for any fitness enthusiast. The calorie counter brings awareness to the number of calories burnt over any distance at varying speeds. The calorie counter was made using counters, JK flip flops, MUX, IC555, and other logic gates. It is made to display the number of calories burnt in both calories and joules

Aim

Developing a calorie counter for a cyclist of weights ranging from 50 – 130 Kgs using counter,Multiplier,Shift and add 3 algorithm for Binary to BCD conversion .

Components required

Proteus implementation

1. Adder
2. seven segment display
3. 10 – 4 Bit priority encoder (IC- 74147).
4. IC 74LS48
5. IC 74161 counter
6. AND gate
7. OR gate
8. NOT gate
9. SPDT Switches

Theory

COUNTERS

A special type of sequential circuit used to count the pulse is known as a counter, or a collection of flip flops where the clock signal is applied is known as counters.

The counter is one of the widest applications of the flip flop. Based on the clock pulse, the output of the counter contains a predefined state. The number of the pulse can be counted using the output of the counter.

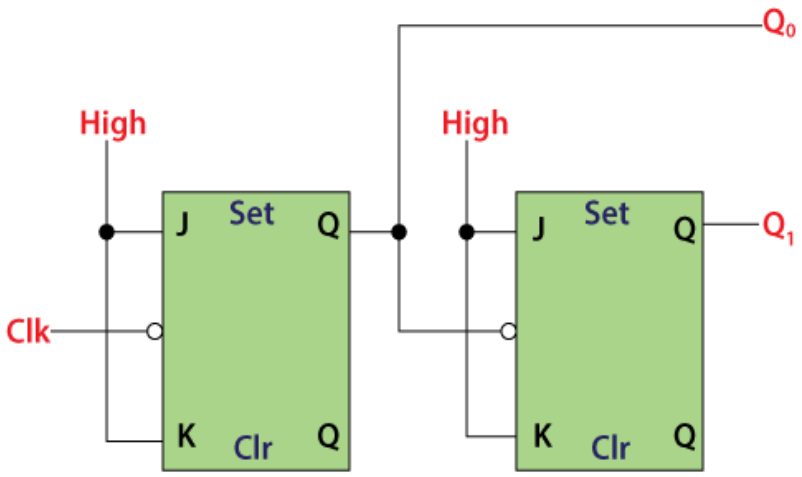
Counters are broadly divided into two categories

Asynchronous counter

Synchronous counter

1. Asynchronous Counter

In the asynchronous counter we don't a use universal clock, only first flip-flop is driven by the main clock and the clock inputthe of rest of the followflip-flopflop is driventhe by output of previous flip-flops.



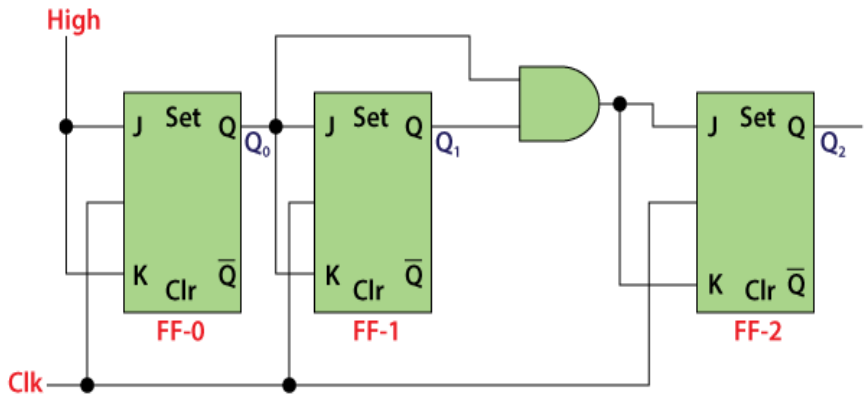
2. Synchronous Counter

Unlike the asynchronous counter, synchronous counter has one global clock which drives each flip flop so output changes in parallel.

The one advantage of synchronous counter over asynchronous counter is,

it can operate on higher frequency than asynchronous counter as

it does not have cumulative delay because of same clock is given to each flip flop.

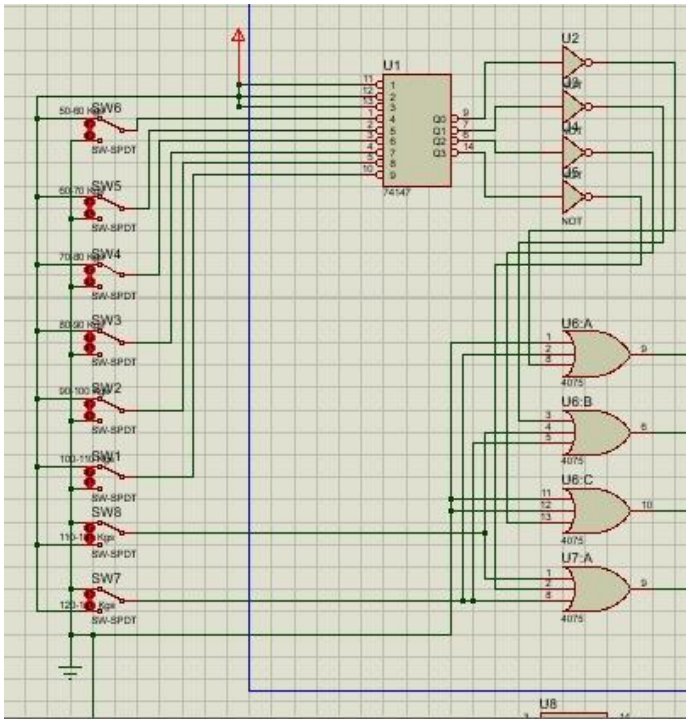


Decade Counter

A decade counter counts ten different states and then reset to its initial states. A simple decade counter will count from 0 to 9 but we can also make the decade counters which can go through any ten states between 0 to 15(for 4 bit counter).

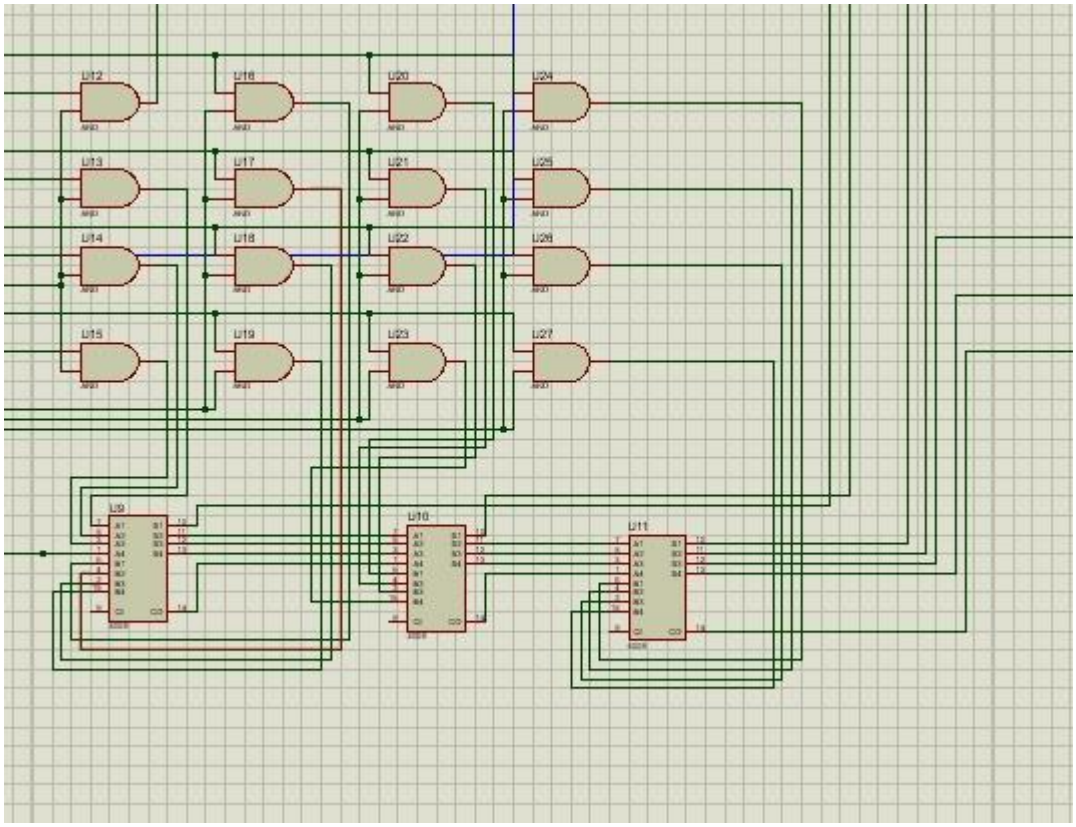
Encoder IC–74147:

IC-74147 is a **Decimal to BCD Priority Encoder**. It is a TTL encoder that featured priority decoding of the inputs to ensure that only the highest-order data line is encoded. The '147 and 'LS147 devices encode nine data lines to four-line (8-4-2-1) BCD.



Multiplier circuit (4 x 4)

Considering two 4 bit numbers, They can be multiplied using simple circuit made using adders and AND gates. The circuit is shown below.



Shift and add 3 Algorithm for Binary to BCD conversion:

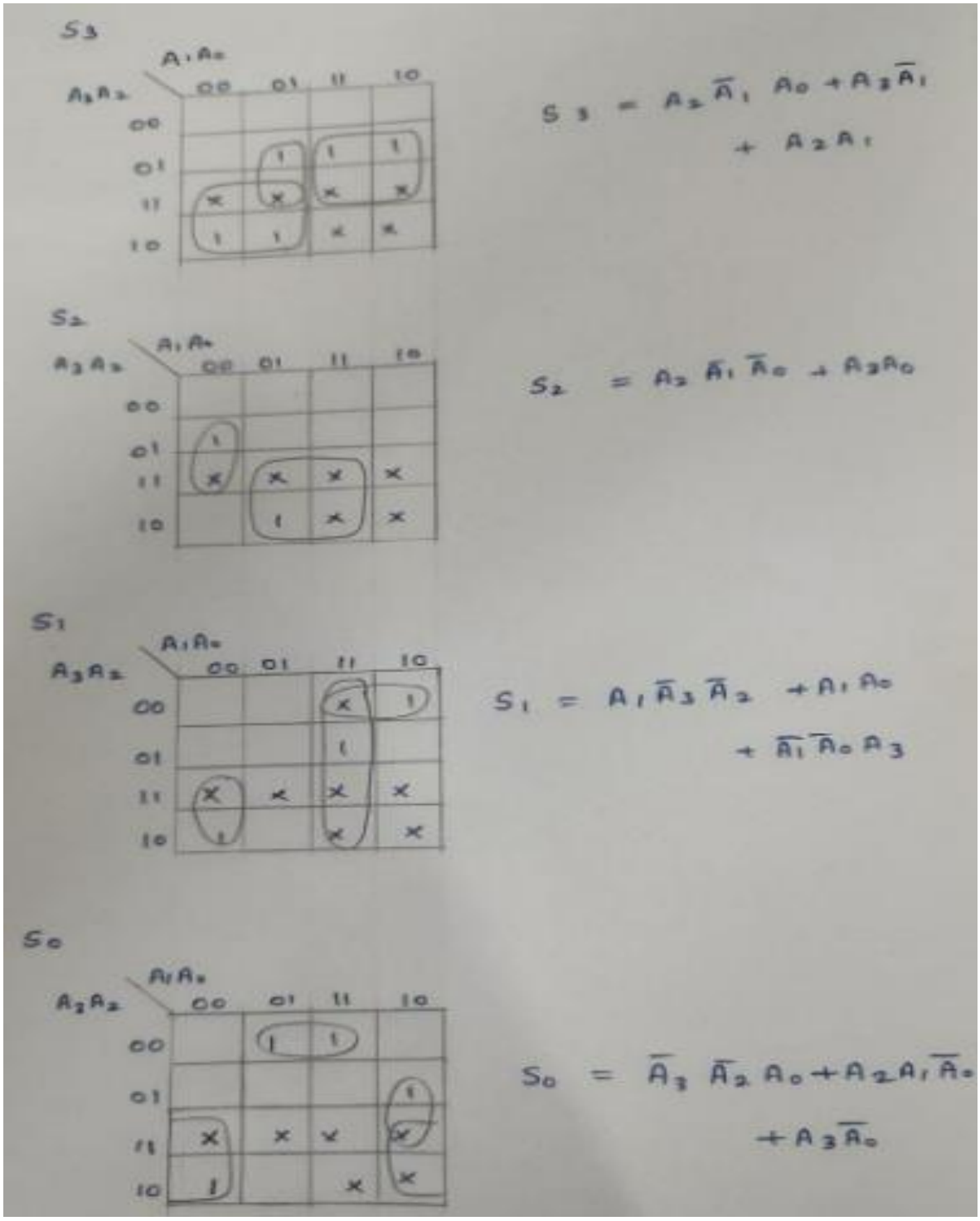
Steps to convert an 8-bit binary number to BCD

Operation	Hundreds	Tens	Units	Binary	
HEX				F	F
Start				1 1 1 1	1 1 1 1
Shift 1			1	1 1 1 1	1 1 1
Shift 2			1 1	1 1 1 1	1 1
Shift 3			1 1 1	1 1 1 1	1
Add 3			1 0 1 0	1 1 1 1	1
Shift 4		1	0 1 0 1	1 1 1 1	
Add 3		1	1 0 0 0	1 1 1 1	
Shift 5		1 1	0 0 0 1	1 1 1	
Shift 6		1 1 0	0 0 1 1	1 1	
Add 3		1 0 0 1	0 0 1 1	1 1	
Shift 7	1	0 0 1 0	0 1 1 1	1	
Add 3	1	0 0 1 0	1 0 1 0	1	
Shift 8	1 0	0 1 0 1	0 1 0 1		
BCD	2	5	5		

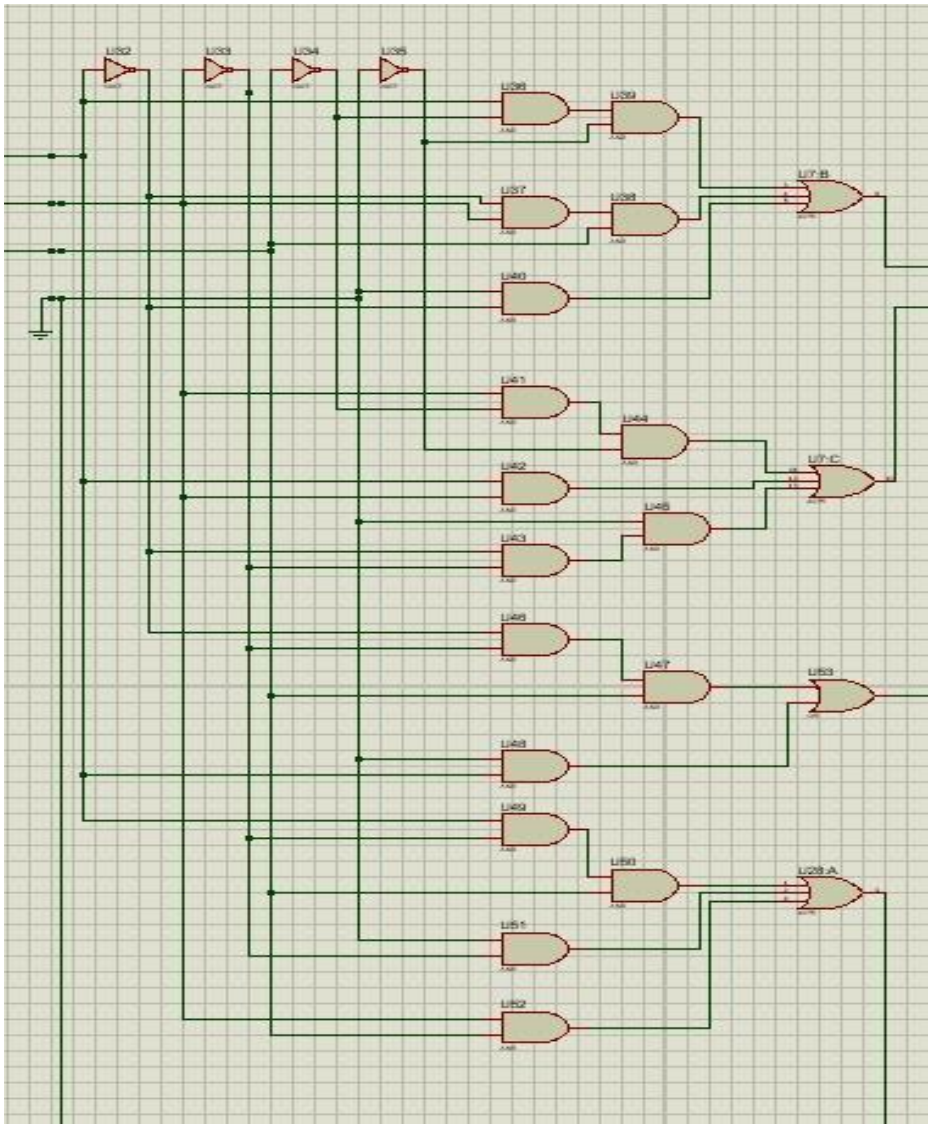
Truth Table for add 3 module :

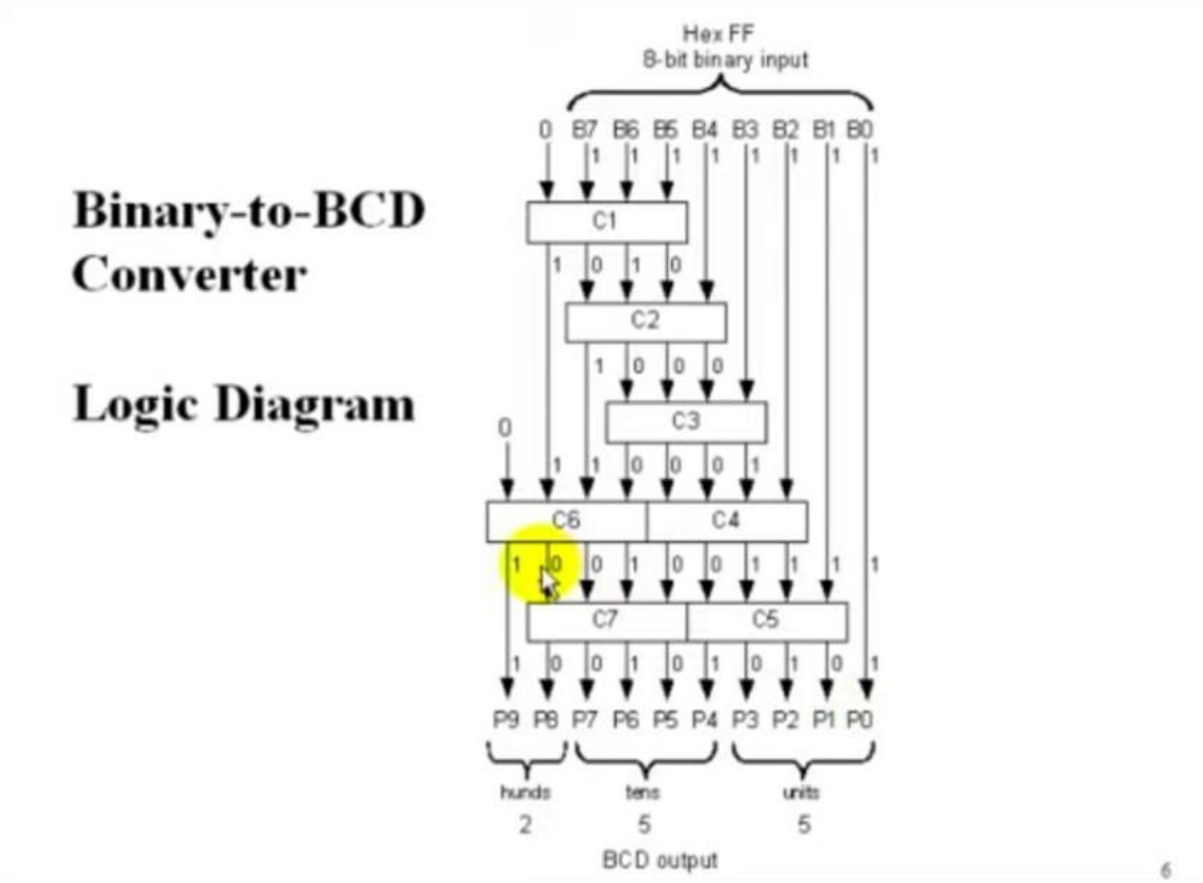
A3	A2	A1	A0	S3	S2	S1	S0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	0
0	0	1	1	0	0	1	1
0	1	0	0	0	1	0	0
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0
1	0	1	0	X	X	X	X
1	0	1	1	X	X	X	X
1	1	0	0	X	X	X	X
1	1	0	1	X	X	X	X
1	1	1	0	X	X	X	X
1	1	1	1	X	X	X	X

K-Map for Add 3 module :

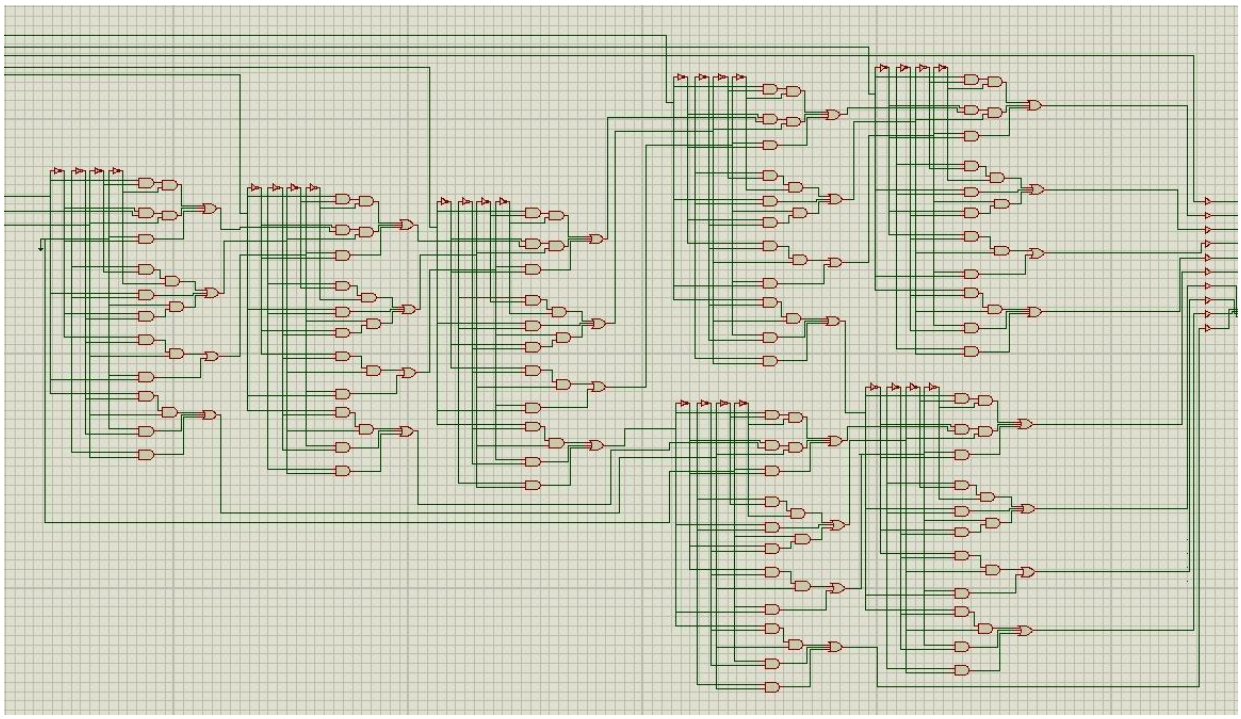


Add 3 Module :

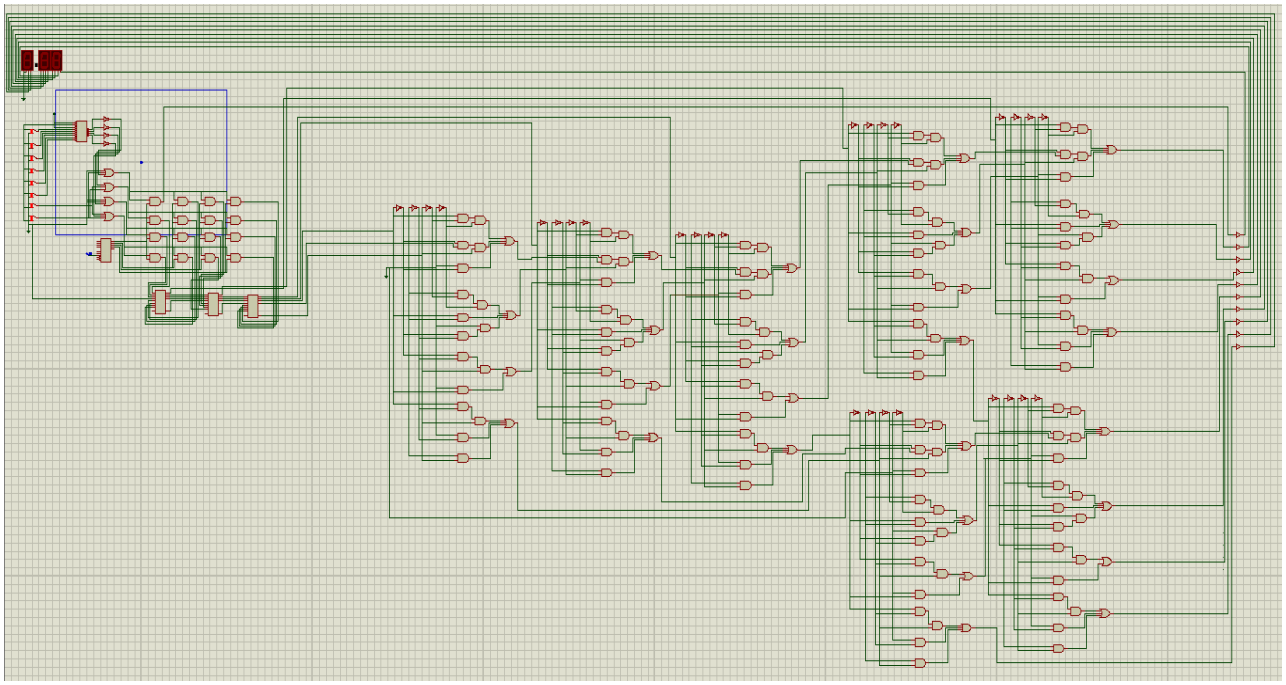

U32
U33
U34
U35
U36
U39
U37
U38
U40
U41
U44
U42
U45
U43
U46
U47
U48
U49
U50
U51
U52
U7:B
U7:C
U28:A



Binary to BCD converter :



COMPLETE CIRCUIT :



Working of calorie meter

The average diameter of the wheel is taken as 67 cm , hence the radius of the wheel is taken as 0.335 m. The circumference of the wheel is 2.1038 m (2*pi*0.335) .

First, the user is asked his weight range as input.

The ranges are :

- 50 -60 Kg
- 60-70 Kg
- 70-80 Kg
- 80-90 Kg
- 90-100 Kg
- 100-110 Kg
- 110-120 Kg
- 120-130 Kg

FROM STATISTICAL DATA , WE FOUND THAT A CYCLIST RIDING FOR 12 MILES BURN A CERTAIN AMOUNT OF CALORIES BASED ON HIS WEIGHT

12 MILES IS EQUAL TO 19312.1 METRES

FROM THIS DATA WE CAN FIND THE NUMBER OF ROTATIONS BY USING THE FORMULA
NO.OF ROTATIONS = DISTANCE /CIRCUMFERENCE OF WHEEL
SO FOR 12 MILES IT IS 19312/2.1038 THAT IS 9180.

SO PER ROTATION OF WHEEL THE AMOUNT BURNT FOR A X KG PERSON IS GIVEN BY Y/9180 . X IS THE WEIGHT OF THE PERSON RIDING . AND Y IS THE AMOUNT OF CALORIES BURNT BY HIM FOR 12 MILES
SIMILARLY FOR A PERSONS WITH WEIGHTS

- 50 -60 Kg
- 60-70 Kg
- 70-80 Kg
- 80-90 Kg
- 90-100 Kg
- 100-110 Kg
- 110-120 Kg
- 120-130 Kg

HAVE THE CALORIES BURNT AS FOLLOWS:

1. FOR A 50 -60KG PERSON THE AMOUNT OF CALORIES BURNT IS 420 CALORIES FOR 12 MILES,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.04 CALORIES
2. FOR A 60-70 KG PERSON THE AMOUNT OF CALORIES BURNT IS 504 CALORIES FRO 12 MILES ,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.05 CALORIES
3. FOR A 70-80 KG PERSON THE AMOUNT OF CALORIES BURNT IS 588 CALORIES FOR 12 MILES ,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.06 CALORIES

4. FOR A 80-90 KG PERSON THE AMOUNT OF CALORIES BURNT IS 672 CALORIES FOR 12 MILES ,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.07 CALORIES
5. FOR A 90-100 KG PERSON THE AMOUNT OF CALORIES BURNT IS 756 CALORIES FOR 12 MILES,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.08 CALORIES
6. FOR A 100-110 KG PERSON THE AMOUNT OF CALORIES BURNT IS 840 CALORIES FOR 12 MILES,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.09 CALORIES
7. FOR A 110-120 KG PERSON THE AMOUNT OF CALORIES BURNT IS 924 CALORIES FRO 12 MILES ,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.1 CALORIES
8. FOR A 120 - 130 KG PERSON THE AMOUNT OF CALORIES BURNT IS 1008 CALORIES FOR 12 MILES,BY ABOVE CALCULATIONS THE AMOUNT OF CALORIES BURNT PER ROTATION OF WHEEL IS APPROXIMATELY 0.11 CALORIES.

Then the corresponding constant that is obtained using the above calculation is multiplied with the number of rotations of wheel (Measured by the counter) using our Multiplier circuit. This binary 8 bit result is sent to the Binary to BCD converter circuit built and the final result is displayed in the 7-segment display.

Scalability :

The prototype that we have designed can only count calories for 15 rotations of a cycle wheel .But this could be scaled to any number of counts.

The number of rotations of a wheel can be gathered using IR sensor module.

RESULT

A Calorie counter for a cyclist is successfully designed using encoders,counter,shift and add 3 algorithm and Binary to BDD conversion logic.