Cse260 Group Lab Report

Asynchronous Counter

Group Number: 9

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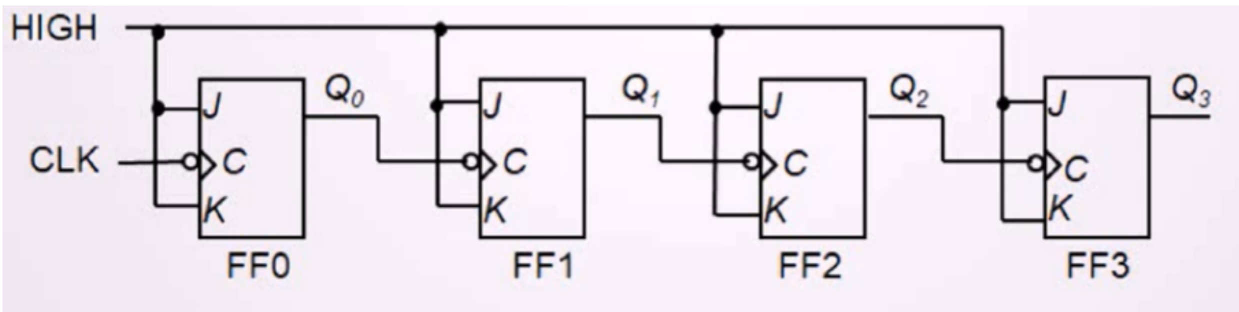
Introduction

The Asynchronous counter is an Asynchronous Sequential Circuit. The word 'Asynchronous' refers to states that don't have a fixed time relationship with each other. A counter is a register that goes through a predetermined sequence of states upon the application of clock pulses. And Hence an Asynchronous Counter is a counter that is used for controlling the operation timing by sending a pulse only when the previous operation is completed rather than sending it in regular intervals. It is also called the ripple counter.



In an Asynchronous Counter, the output changes without the clock input at any time. They use flip-flops that are successively linked so that the input clock pulse arrives to ripple through the counter. Flip-Flop doesn't have a common clock pulse. So, their states don't change exactly at the same time. 1st Flip-Flop has a clock, output- of each Flip-Flop will act as a clock to the next Flip-Flop in the counter. It uses Toggle or D Flipflop, in which the clock pulse ripples over the circuit.

Proposed Model/System

Our lab project is basically regarding asynchronous counters using flip flops. We know that the asynchronous counter is another version of the counter which we use to count any numerical aspect. Using this counter we can build various types of counters like Human attendance counter, Digital counter, stopwatch, alarm clock, fixed timer, moving machine controlling, multiplexing circuits, and so on. We are using this counter because it is very much budget-friendly and also it is very reliable. Besides, it takes less time to count rather than other counters. Moreover, It does not have any fixed time relationship with each other. Which means it does not depend on others to count. Furthermore, the asynchronous counter does not change exactly at the same time. Asynchronous counter means integration of Flip-Flops. This means if we are giving input to 1one Flip-Flop it will show an output but the other Flip-Flops may or may not show any output. For example, in a human attendance counter, we do not know when the next human being will pass through the sensor to increase the counter number. For that reason, we use this counter to count. Asynchronous counters are also used as Truncated counters. These can be used to design any mod number counters like even Mod or odd Mod. These are used for low power applications and low noise emissions. These are used in designing asynchronous decade counters. Also used in Ring counter and Johnson counter. Asynchronous counters are used in Mod N ripple-counters. Asynchronous counters are used as frequency dividers, as to divided by N counters. For all those advantages we think that it will be the best option to choose an asynchronous counter for making any kind of counter.

Experimental Setup:

7SEG-COM-CAT-GRN: Display to any sort of decimal output. The 7 segment displays are one of the popular types of display used in various types of embedded applications and devices. These displays have 8 LEDs inside them to display numbers and alphabets.

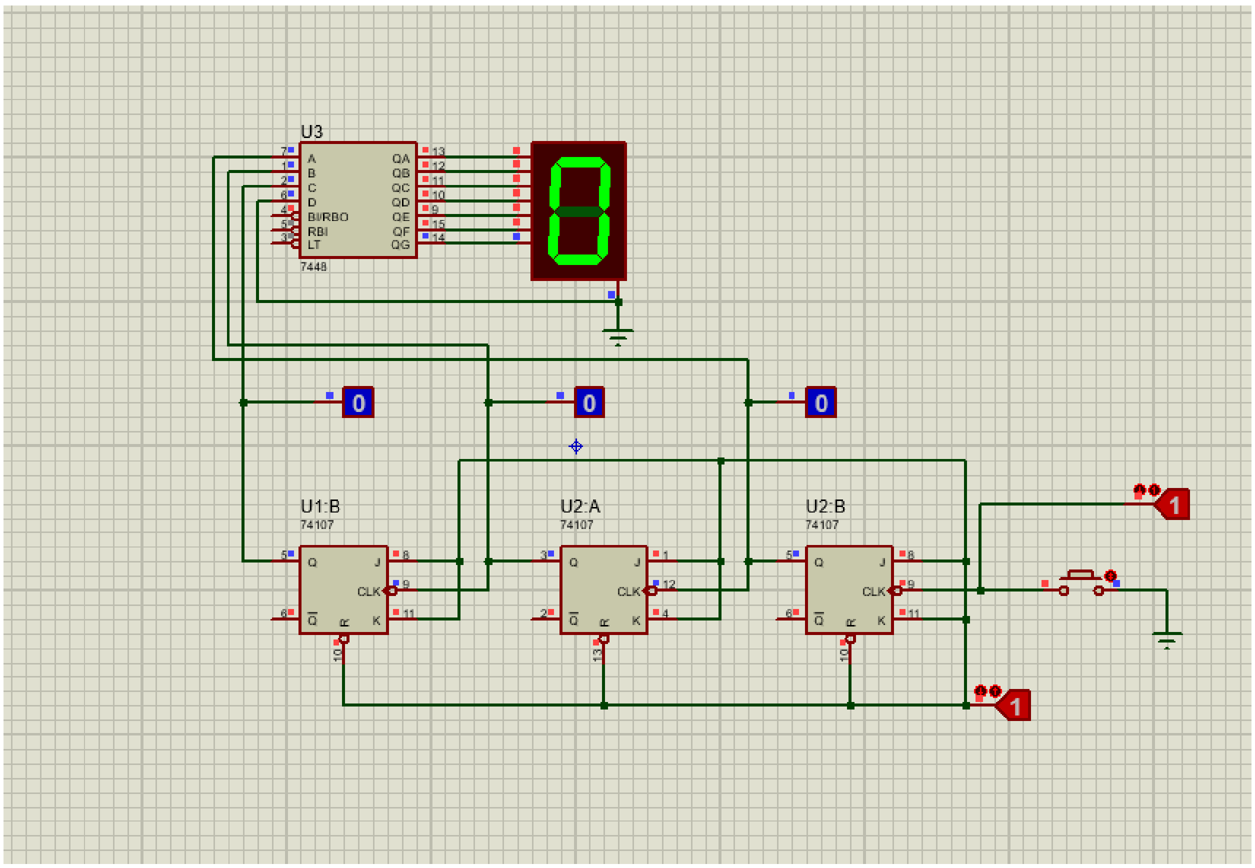
7448 IC: Decoder to convert the binary signal to decimal. It's a BCD to seven segments decoder that is used to display numbers decoded in binary coded decimal format. The 7-Segment is a small seven LED-based device used to represent a single numeric value from 0 to 9. Each 7-Segment has seven input pins to light up a single led in the seven segments.

74107 IC : 3 jk flip flop used for making the 3 bit counter. We placed 3 flip flops side by side. The rightmost flip flop will be used as Least Significant bit and the leftmost will be the most significant bit. The J and K are kept high and the resets of each of the flip flops are kept high. Otherwise, the counter will not work. The output of the first flip flop is connected with the clock input of the second one. The second one is connected with the third and the third with the fourth.

BUTTON: Button to use the counter easily. We used a button that is connected with the clock of the rightmost flip flop. When we press the button, the digit will increase by 1 bit and continue up to seven. The count will change only when the value of input becomes 1 to 0. A switch is used to turn on and off the clock.

LOGIC PROBE(BIG): Three logic probes are connected with the output of three flip flops as they will be used as the display of the 3 bits. Furthermore, we used a 7-segment display to deliver the output as a decimal. To connect the outputs, we used a decoder so that the binary value is converted to decimal.

LOGICSTATE: logic state for pulse input and jk and the reset is set high in order to work the circuit.for analyzing and troubleshooting the logical states (boolean 0 or 1) of a digital circuit.

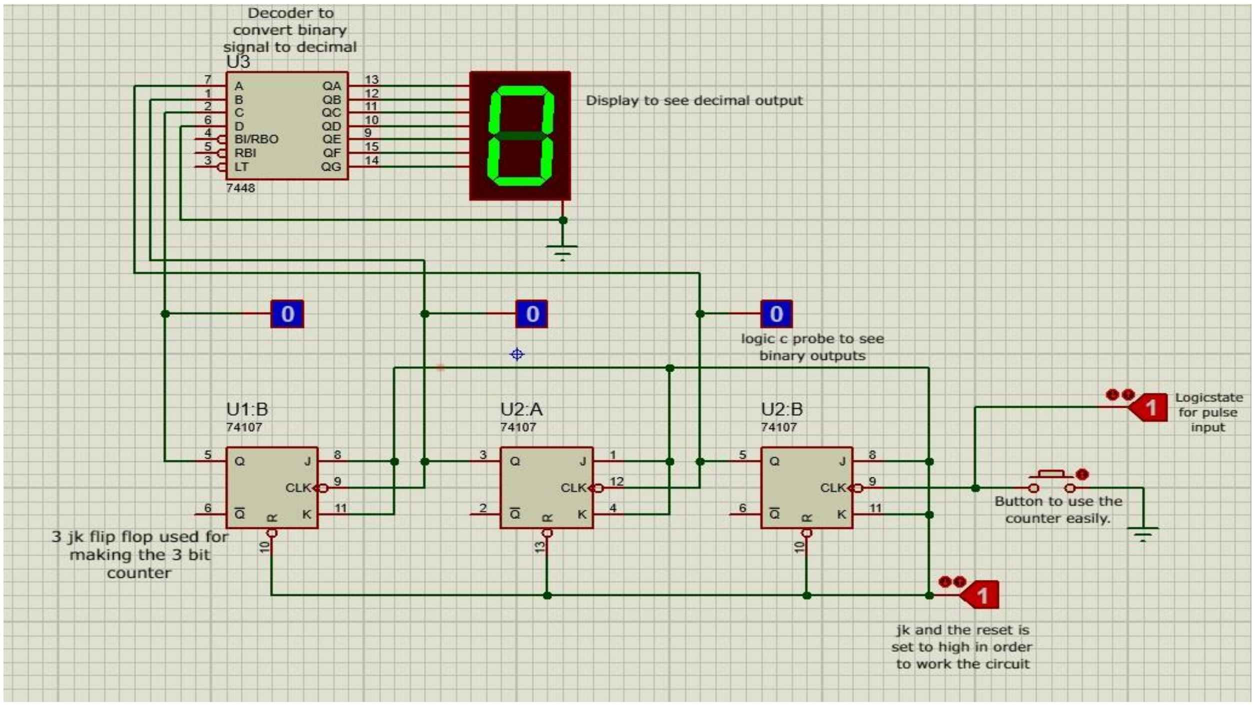


Results and Analysis:

The counter initially remains 0. The clock input normally stays high. If we press the button, the high turns into low (1 to 0) then, the bit increases and if we release the button the state turns low to high (0 to 1). The counter will only increase if the state turns from high to low (1 to 0). The increment will occur like the following truth table:

Clock pulse	**Decimal**	**Output D**	**Output C**	**Output B**	**Output A**
1	0	0	0	0	0
2	1	0	0	0	1
3	2	0	0	1	0
4	3	0	0	1	1
5	4	0	1	0	0
6	5	0	1	0	1
7	6	0	1	1	0
8	7	0	1	1	1

When the clock is set from 1 to 0 (we are using a button for ease), the flip flop starts to work as it is the negatively triggered ic(JK flip flop). Here, the output becomes 1 and that output enters the clock input of the second flip flop. As we know, the flip flop will not work until the value becomes 0. Again, when we press the button, the first flip flop gets the input and changes the output to 0 and that output enters the clock input of the second one. As a result, the output of the second one changes its value to 1. The same process will also occur with the third flipflop and thus it changes and increases the value of the counter.



Conclusion:

One of the main limitations with asynchronous counters is that there is a small delay between the arrival of the clock pulse at its input and it is present at its output due to the internal circuitry of the gate. In asynchronous circuits this delay is called the internal Propagation Delay giving the asynchronous ripple counter the nickname of “propagation counter” and in some high-frequency cases, this delay can produce false output counts.

In large bit ripple counter circuits, if the delays of the separate stages are all added together to give a summed delay at the end of the counter chain the difference in time between the input signal and the counted output signal can be very huge. This is why the Asynchronous Counter is usually not used in high-frequency counting circuits where large numbers of bits are included.

Also, the outputs from the counter do not have a fixed time relationship with each other and do not occur at the same instant in time due to their clocking sequence. In other words, the output frequencies become available one by one, a sort of domino effect. Then, the more flip-flops that are added to an asynchronous counter chain the lower the maximum operating frequency becomes to ensure accurate counting. To overcome the problem of propagation delay, Synchronous Counters were developed.

All in all, Asynchronous Counter takes in binary value and gives us a decimal value based on the clock input supplied to the arrangement's least signal bit flip-flop.