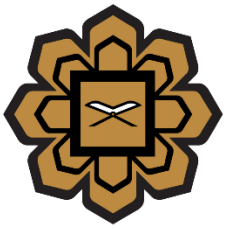

الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
يونيورسيتي إسلام انتارابغسا ملسيا

(Company No. 101067-P)

Garden of Knowledge and Virtue

DLD PROJECT:
RAKA'AH COUNTER

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SUBJECT: Digital System and Microprocessor (MCTE 2332)

SECTION: 1

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INTRODUCTION

Muslims perform a single iteration of prescribed gestures and supplications known as raka'ah as part of the prescribed daily prayer known as salah. Several raka'ah are included in each Muslim prayer.

In general, raka'ah consists of multiple components, which is Takbir, standing in salah, recitation of Sura Al-Fatihah, ruku (bowing), straightening up from ruku (I'tidal), sujud (prostration), rising from sujud and the second sujud before standing again for the next raka'ah.

However, sometimes a person could forget the current raka'ah they are on. It happens for several reasons, such as distraction and so on.

OBJECTIVE

This project aims to design a system that can count the number of current raka'ah of a person in solah/prayer. One common characteristic in every raka'ah is that it consists of two sujuds. The input of this system should be detecting the number of sujuds. The logic circuit will process it, and the output will be displayed so that the person can see the current raka'ah. This system should not be distractive to a person that is performing their prayers.

DESIGN PROCESS

Components required for this project is a sensor or button as an input, a button to reset, a synchronous counting-up flip flops for counting and a 7-segment display as an output.

First, an array consisting of a positive edge-triggered D flip flop is constructed to produce a 3-bit counting sequence. The inverted output of the D flip flop will be fed into the clock trigger of the next flip flop and its data input. The non-inverting output of those flip flops will be fed to the inputs of a 7-segment decoder.

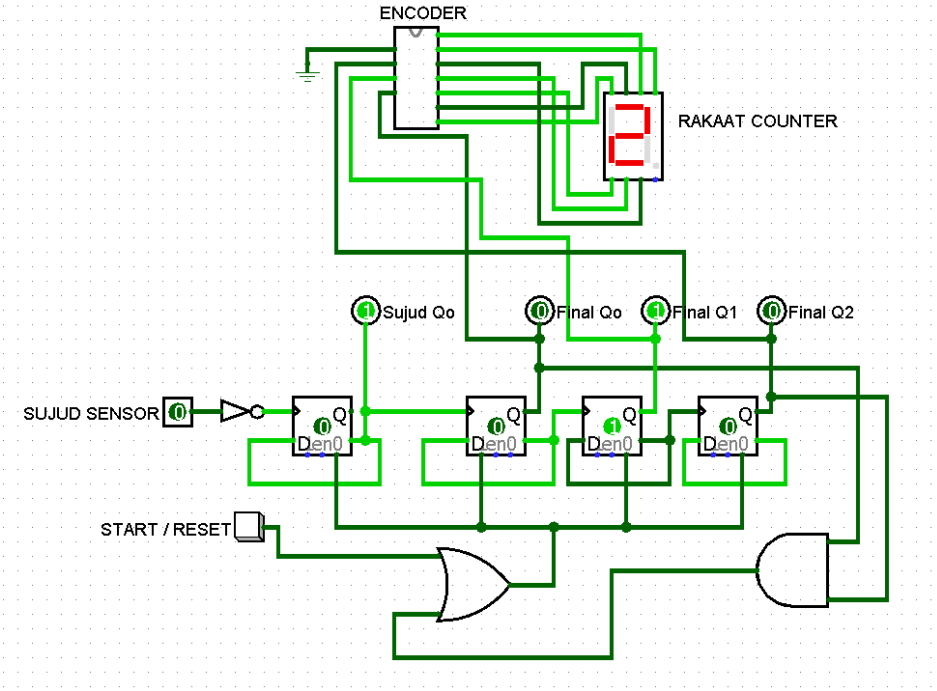
For the user interface input (sujud input), another D flip flop is added up. The inverted output is connected to the clock trigger of the first D flip flop of the counter array.

The 7-segment decoder is made up of many AND, OR and NOT gates. The function is to convert the binary input from the flip flop to a signal for every 7-segment pins. The minimum digit it needs to show is 0, and the maximum is 4. Since digit 0 to 4 only require 3-bit, the MSB of the encoder is always LOW so that it can be connected to the ground.

Lastly, the reset or start button is required to set the input flip flop and reset the counter flip flop. As a result, the counter will start at number 1 instead of zero. To set the D flip flop to HIGH asynchronously, the SET pin needs to be HIGH. On the other hand, to reset the counter or make it LOW, the RESET pin is HIGH. The counter will also automatically reset itself when the counter reaches value 4, the maximum raka'ah in salah.

DETAILED DESIGN

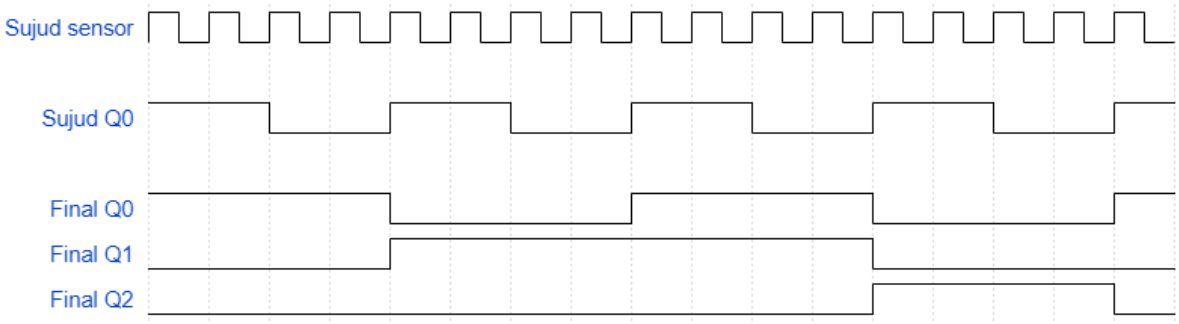
Logisim (for the whole circuit)



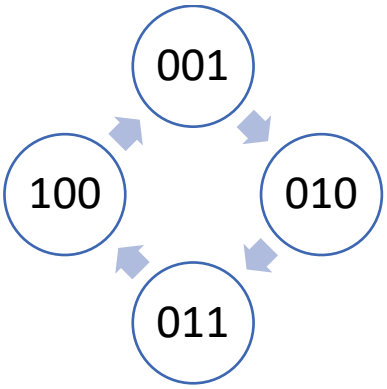
Truth table (for D flip flops)

Input (Sujud sensor)	Output (Sujud Q_0)	Final Q_2	Final Q_1	Final Q_0	Counter
0	1	0	0	1	1
1	1	0	0	1	
0	0	0	0	1	
1	0	0	0	1	
0	1	0	1	0	2
1	1	0	1	0	
0	0	0	1	0	
1	0	0	1	0	
0	1	0	1	1	3
1	1	0	1	1	
0	0	0	1	1	
1	0	0	1	1	
0	1	1	0	0	4
1	1	1	0	0	
0	0	1	0	0	
1	0	1	0	0	
0	1	0	0	1	Reset to 1

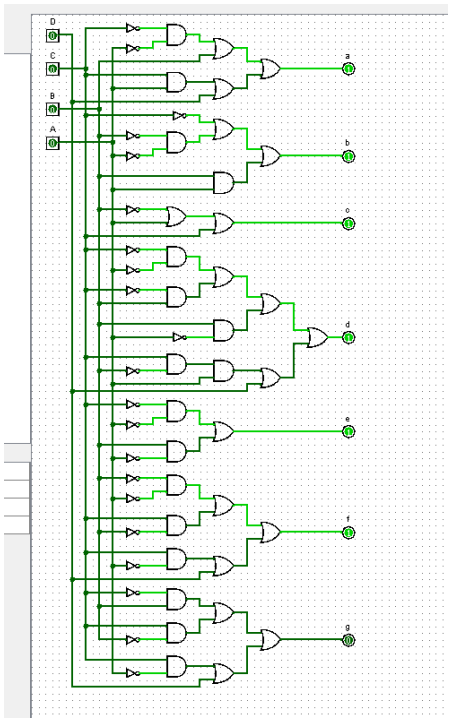
Wave diagram



State diagram



Logisim (7 Segment encoder)



Truth table

Input				Output						
D	**C**	**B**	**A**	**a**	**b**	**c**	**d**	**e**	**f**	**g**
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1

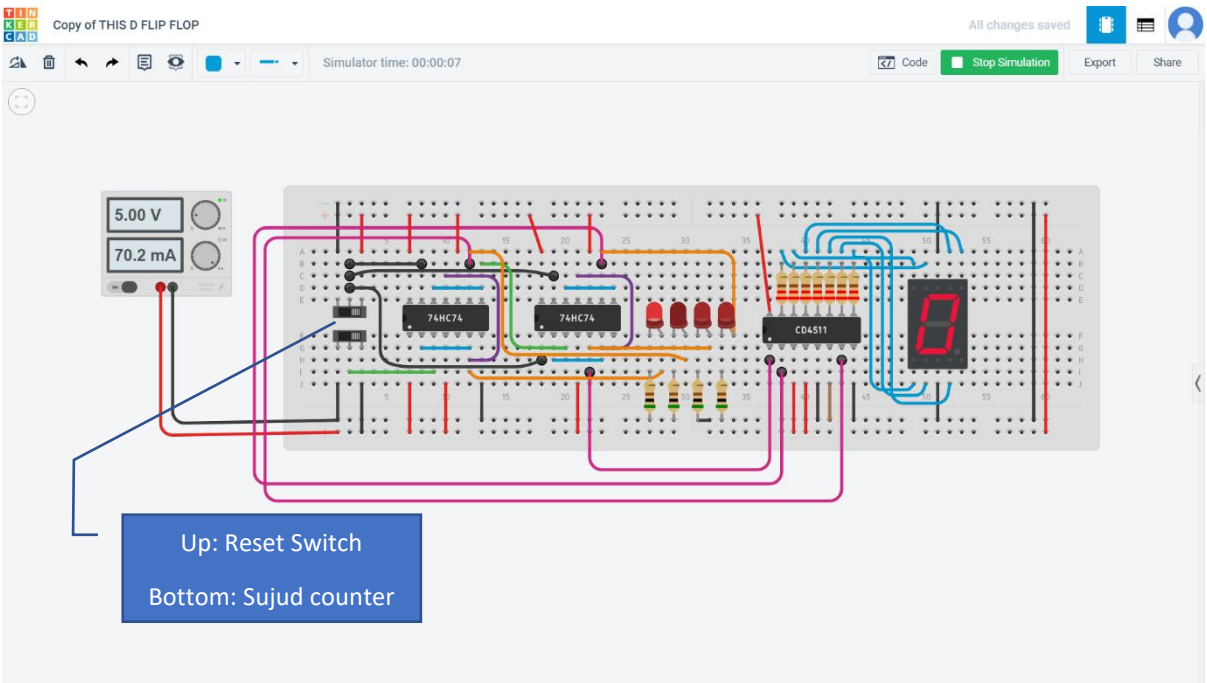
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	0	1	1
1	0	0	1	1	1	1	1	0	1	1
1	0	1	0	1	1	0	1	1	1	1
1	0	1	1	1	1	1	1	0	1	1
1	1	0	0	1	1	1	1	0	1	1
1	1	0	1	1	0	1	1	0	1	1
1	1	1	0	1	0	1	1	1	1	1
1	1	1	1	1	1	1	1	0	1	1

DESIGN VERIFICATION

Components:

1. Dual D Flip-Flop – 74HC74
2. Power Supply
3. Slide switch
4. Red LED
5. 500 Ω Resistor
6. 220 Ω Resistor
7. 7-Segment Decoder – CD4511
8. Cathode 7 Segment Display

Tinkercad link: https://www.tinkercad.com/things/3XNPISfJVB1



Tinkercad’s D flip flop has a slightly different implementation than Logisim. Tinkercad version requires the SET and RESET pins in HIGH to activate the IC. Meanwhile, in Logisim, SET and RESET need to be on LOW.

CONCLUSIONS

In conclusion, the objective of this project has been achieved. This project may benefit the Muslim community as it is cost-effective and easily implemented, and improvised. In addition, this project can be deployed with another approach and already accessible by many peoples, such as developing a mobile app with some extra features and functionality.