UTM

UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING

FACULTY OF ENGINEERING

SECR1013-08 DIGITAL LOGIC

REPORT: MINI PROJECT

(PHOTOCOPYING XEROX MACHINE)

COURSE : COMPUTER NETWORK AND SECURITY

COURSE CODE : 1SECR

SECTION : O8

TEAM MEMBERS :

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LECTURER : MS.RASHIDAH

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DEDICATION AND ACKNOWLEDGEMENT

We as a group have finished this final mini project with our dedication and sincere to our lecturer,Ms.Rashidah.In this digital logic subject she encouraged us to learn many things about the theory and the practical study.She really nice and patiently explain to us when we did not understand either in class theory or in the lab.She have many ways to guide us and help us until we manage to completely finished this mini project.

We also glad because we have many reference to study before we go in the lab to run this project.We have read through the digital logic book itself,in fact at the book we gained a lots of information for this project,we learn the theory in the book so after that we manage to implement the practical in the lab.

In addition,we also want to thank to our coursemates who are helped us during the lab session.They try to figure out the solution when our group faced the problem,we discuss together to make sure the circuit run very well.We also shared our ideas to modify the Xerox machine from 2-bit counter to 3-bit counter.

Last but not least,we really enjoy because we have the opportunity to finished this final project.We are very thanks to all people who helped us in this project,also this is the best experience for us because know we know how the IC will be program.

BACKGROUND

In this mini project of xerox machine,we implement 3 different compenents on a single GAL device,which are:

- 3-bit Count Up Counter
- 3-bit Comparator
- Clock Disabler

PROBLEM

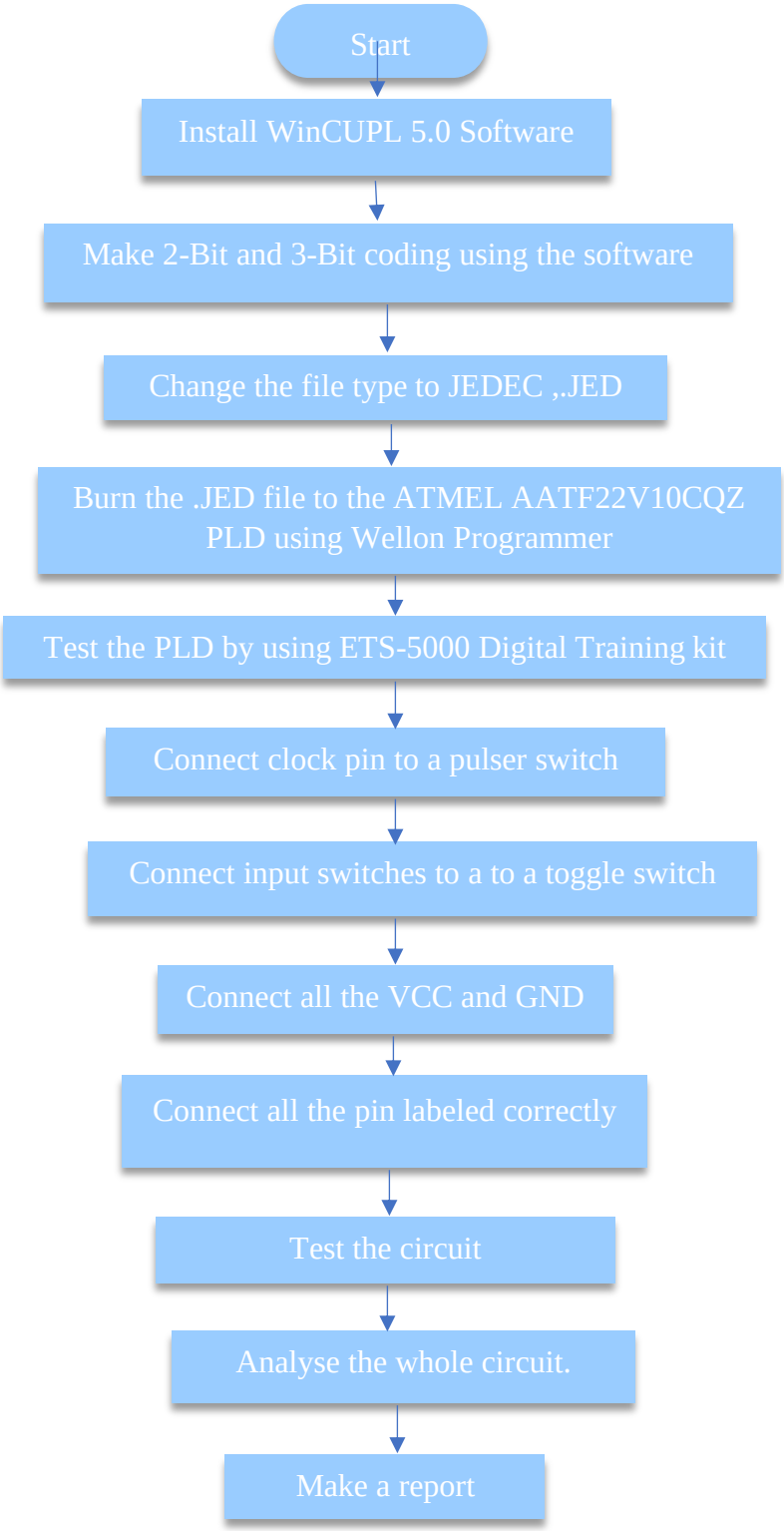
We initially enter the amount of copies that we want to produced,the counter will count the number of amount that has been xerox machine photocopied.Then the machine will stop printing once it reach the number of copies produced.

OBJECTIVE

The objectives of this laboratory are to introduce the students to:

- Understand how the development of the PLD device
- Can learn a simple Hardware Description Language.

FLOWCHART


Start
Install WinCUPL 5.0 Software
Make 2-Bit and 3-Bit coding using the software
Change the file type to JEDEC ,.JED
Burn the .JED file to the ATMEL AATF22V10CQZ PLD using Wellon Programmer
Test the PLD by using ETS-5000 Digital Training kit
Connect clock pin to a pulser switch
Connect input switches to a to a toggle switch
Connect all the VCC and GND
Connect all the pin labeled correctly
Test the circuit
Analyse the whole circuit.
Make a report

COMPONENTS

- Switches :

- To input the initial amount of copies that user want to print

- 3-bit Count Up Counter :

- To count the amount of copies that has been printed.

- 3-bit Comparator :

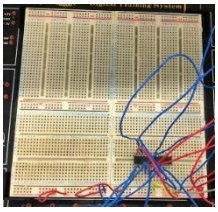
- To compare whether the amount of copies required and also the amount of printed copies has been met.

- Clock Disabler :

- To stop the operation of the counter when the amount of copies and printed copies has been produced.

MATERIALS AND SOFTWARES

- ✓ Breadboard



Use to make electrical connections between components and the circuit can be tested before permanently soldering it together.

- ✓ PLD ATMEL ATF22V10CQZ

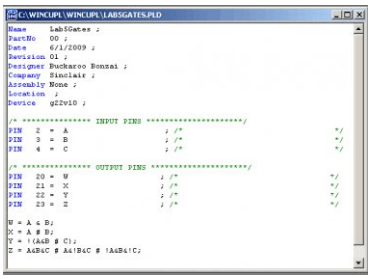
PLD needs to be properly programmed with a JEDEC file (.JED) in order for the PLD to operate as wanted. What has been programmed into this, it will work according to how the user intended.

- ✓ ETS-5000 Digital Training kit

It is suitable for beginners to enhance the comprehension of advance digital theory. The design of Advanced Digital Training System is easy to operate and easy to understand. The function is to test the circuit connected by the user .It also can be used to check for its input and output .

It is a device that can connect GAL 22V10 PLD directly into a program so that coded program can be loaded into the PLD to be tested on the ETS-5000 Digital Training kit.

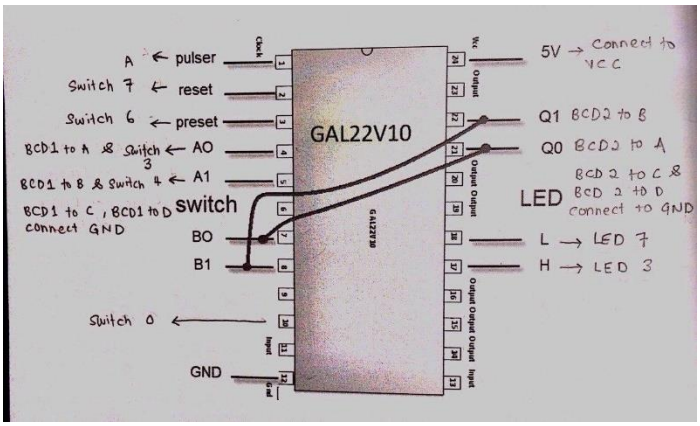
- ✓ WinCUPL 5.0 Software



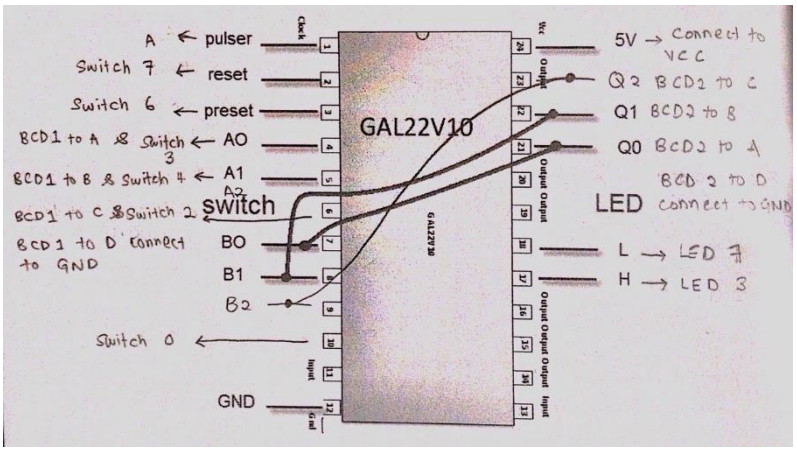
-It is a complete and user-friendly design software that is suitable for all Atmel SPLDs and CPLDs..By using this software, the user can do coding and provide instruction to the device.

CIRCUIT IMPLEMENTATION

- 2-bit Circuit Implementation



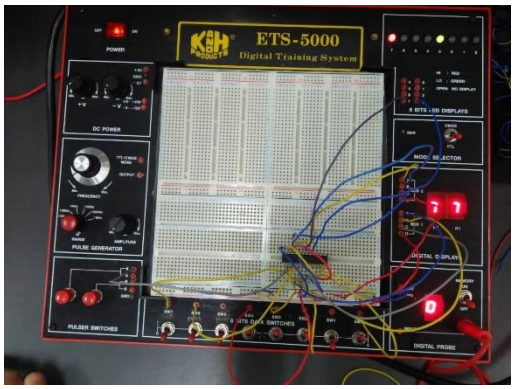
Pin 1 act as counter control by the clock. The counter shows how many copies the machine has printed. Pin 2 and Pin 3 is a reset and preset button which reset the number of copies to initial which is 0. A0 and A1 are the inputs which the user can control to set how many copies they want. Each switch represents a single bit. B0 and B1 act as comparator to the outputs, Q0 and Q1. 2-Bit circuit only required connection to BCD to A and B while the others connected to the GND. Lastly, Pin 16 and 17 are connected to LED Display 7 and 3 that shows the changes of colour when the maximum number of copies met with the number of copies user has made.



- 3-bit Cicuit Implementation

Pin 1 act as counter control by the clock. The counter shows how many copies the machine has printed. Pin 2 and Pin 3 is a reset and preset button which reset the number of copies to initial which is 0. This time, one more input is added which make it 3 inputs for 3-Bit. A0, A1 and A2 are the inputs which the user can control to set how many copies they want. Each switch represents a single bit. The comparator also increase by one , B0,B1 and B2 .It compares number of copies to the output, Q0,Q1and Q2. 3-Bit circuit required connection to BCD to A,B and C while D is connected to the GND. Lastly, Pin 16 and 17 are connected to LED Display 7 and 3 that shows the changes of colour when the maximum number of copies met with the number of copies user has made.

PHYSICAL SYSTEM IMPLEMENTATION OF XEROX MACHINE.



1.Input Switch

There are 3 switches that we use to input the number of copies that we required to produced.One switch only can represents single bit respectively which are A0,A1 and A2.A0 will represent the LSB and the A2 will represent the MSB.To implement this machine,the user has to key in the number of copies that they want as the input,which allow the required number from 0 to 7 only.The user will get the output from the 7-segment digital display.

2. 3-bit Count Up Counter

The 3-bit count up counter that we use is 3-bit Dual JK flip-flop negative edge.In this machine,the counter will count if there are an edge of the clock signal,the counter was controlled by the clock.We determine when the counter should stop counting and when it should keep on counting by implemented as in WinCUPL code that will programmed into GAL.In that code we have to make a condition which is when it should stop and keep counting.We have been produced the coding for 2-bit and 3-bit also before we run this mini project.The code in file PLD we have to convert it into JED file,because the JED program will burned into ATMEL 22V10 by using a Wellon programmer in the lab.

3. 3-bit Comparator

The comparator uses three 2-input XNOR gates to compare value from 2 sources which are the input switch and the counter.If the input for the two input sources are same, the output will be 0 and the it wil be send to NOT gate and it will convert it into 1 and will display as High.Therefore,when all the input from the input switches and counter are same,the output will be 0 and send it to clock enabler and it will stop the photocopying machine.

4. Clock Enabler/Disabler

The clock disabler is design to disable the clock,it use to stop the operation of the counter when the amount of copies and printed are same.The clock enabler can only active when all input are high so that it will send to counter to keep on count the number of photocopying.

DISCUSSION

1.Summarizes of the whole project

We successfully manage to complete this mini project,we figure out the solution to our problem that can make our circuit function well.We realise that in a real life has more complex circuit in the xerox machine,what are we have done just only a simpe basic xerox machine.This project give us experience to make a xerox machine, we also gained some knowledge which are now we know in the photocopying machine have a components like clock diabler,comparator and counter.We only manage on design the circuit by using the 2-bit and 3-bit counter only and we know in the real machine it could be more complexing that what are we have done in this project.

2.Strength/achievements

We have faced many difficult on run this project but we manage it very well and also we see some of our potential while design this project.We manage to design the circuit without broke the flip-flop IC's.We know that we lack of knowledge on practical works so we manage to study about all this components and the circuit.We know the theory based on the study that we have done but we have implement the theory knowledge to the practical works.We realise even at the first time we did not know how to burn the program into the flip-flop and finally that was an achievement for us because we manage to do it well without any problem while burn it.

3. The problem that we faced

To be clear,we did not faced many problem when design the circuit.The 2-bit circuit run very wel without any problem but we faced the problem when we do the 3-bit circuit.We have make a checking of the wire connecting,the switches,the ground and also the voltage.We also have check the IC was working but our output was wrong which is it should be start count from 00 but our circuit it start from 40.After we check all those this many times,we figure out the solution which is we realise that we wire connected are not same are the code we have been program into the IC.In our code the b2 which at pin 9 should be connected to q2 at pin 23 but we put it at pin 20,so the output will display wrong but it effected from the code program.

4.Some new function suggestions for improvement and future works.

We can use the multiplexer because it can let the user to select the printing properties and we also can use demultiplexer to determine which properties of printing that user had selected.

CONCLUSION

While doing this project, we had many difficulties to obtain the correct output which determines the number of copies produced by the Xerox photocopying machine. We realized that our lack of understanding of this project before conducting the practical works makes us facing such problems. If we analyze the coding beforehand, we would not have this kind of mistake. But, at the end of the day, we were managed to pull off this mini project.

We understood that the key to success is to communicate with each other to solve the problems. As a team, we worked together to figure out the solutions and produced the expected outcomes. We learned how to build teamwork in a group by participating in the project. For example, one of us guides the other one to connect the wires based on the labeling we had done.

After this project, we gained new knowledge on how the machine works although this Mini project only shows a part of the machine, we already know the surface of this machine and would like to learn more.

As computer science students, we realize that it is important to learn Digital Logic subject because this subject consists of hardware components in the machine which related to computational programming. In the future, we would like to develop our programming skills not only limited to the program but also can be applied in the industry too. Therefore, we aim to expand our skills by creating machines or tools that are useful for people in the future.

REFERENCES

1.Digital Logic book(Fifth Edition),Abd Bahrim,Mazleena Salleh,Mohd Fo'ad Rohani,Ismail Fauzi Isnin.(2018).Johor,Malaysia.Desktop Publisher.

2. https://www.alphaomega-electronics.com/en/training-education-systems/1978-ets-5000-sistema-avanzado-de-entrenamiento-para-electronica-digital.html

3. http://ww1.microchip.com/downloads/en/AppNotes/Atmel-8979-PLD-Programming-ApplicationNote.pdf

4.Source code program of 2-bit and 3-bit

APPENDIX

Program source code for **2-bit XEROX system**

```
Name     lab4 ;
PartNo   00 ;
Date     12/16/2019 ;
Revision 01 ;
Designer Engineer ;
Company  UTM ;
Assembly None ;
Location  ;
Device   G22V10 ;

/* *************** INPUT PINS *********************/
PIN 1 = clk ;          /* clock */
PIN 2 = reset ;                /* reset */
PIN 3 = preset ;               /* preset */
PIN 4 = a0 ;                   /* Comparator A */
PIN 5 = a1 ;                   /* */
PIN 7 = b0 ;                   /* Comparator B */
PIN 8 = b1 ;                   /* */
PIN 10 = startPrt ;            /* Start Printing */

/* *************** OUTPUT PINS *********************/
PIN 17 = diffCmp ;             /* XOR (A B not equal HIGH) */
PIN 18 = sameCmp ;             /* XNOR (A B equal HIGH) */
PIN 21 = q0 ;          /* output counter */
PIN 22 = q1 ;          /* output counter */

/***** Function Comparator************************/
sameCmp = !(a0$b0)&!(a1$b1);
diffCmp = !sameCmp ;

/**** Function Clock Enabler *********************/
clkEn=startPrt & diffCmp;

/*** Function Counter 2 Bit UP *******************/
field count =[q1..0];
$define s0 'b' 00
$define s1 'b' 01
$define s2 'b' 10
$define s3 'b' 11

count.ar=reset;        /* connect reg AR to reset (Asyn Mode) */
count.sp=preset;       /* connect reg AR to preset (Syn Mode) */

sequence count{
       present s0 if clkEn next s1;
              default next s0;
       present s1 if clkEn next s2;
              default next s1;
       present s2 if clkEn next s3;
              default next s2;
       present s3 if clkEn next s3;
              default next s3;
}
```

Program source code for **3-bit XEROX system**

```
Name     3bit ;
PartNo   00 ;
Date     12/16/2019 ;
Revision 01 ;
Designer Engineer ;
Company  UTM ;
Assembly None ;
Location  ;
Device   G22V10 ;

/* *************** INPUT PINS *********************/
PIN 1 = clk ;          /* clock */
PIN 2 = reset ;                /* reset */
PIN 3 = preset ;               /* preset */
PIN 4 = a0 ;                   /* Comparator A */
PIN 5 = a1 ;
PIN 6 = a2 ;                   /* */
PIN 7 = b0 ;                   /* Comparator B */
PIN 8 = b1 ;
PIN 9 = b2 ;                   /* */
PIN 10 = startPrt ;            /* Start Printing */

/* *************** OUTPUT PINS *********************/
PIN 17 = diffCmp ;             /* XOR (A B not equal HIGH) */
PIN 18 = sameCmp ;             /* XNOR (A B equal HIGH) */
PIN 21 = q0 ;          /* output counter */
PIN 22 = q1 ;
PIN 23 = q2 ;          /* output counter */

/***** Function Comparator************************/
sameCmp = !(a0$b0)&!(a1$b1)&!(a2$b2);
diffCmp = !sameCmp ;

/**** Function Clock Enabler *********************/
clkEn=startPrt & diffCmp;

/*** Function Counter 2 Bit UP *******************/
field count =[q2..0];
$define s0 'b' 000
$define s1 'b' 001
$define s2 'b' 010
$define s3 'b' 011
$define s4 'b' 100
$define s5 'b' 101
$define s6 'b' 110
$define s7 'b' 111


count.ar=reset;        /* connect reg AR to reset (Asyn Mode) */
count.sp=preset;       /* connect reg AR to preset (Syn Mode) */

sequence count{
        present s0 if clkEn next s1;
                default next s0;
        present s1 if clkEn next s2;
                default next s1;
        present s2 if clkEn next s3;
                default next s2;
        present s3 if clkEn next s4;
                default next s3;
        present s4 if clkEn next s5;
                default next s4;
        present s5 if clkEn next s6;
                default next s5;
        present s6 if clkEn next s7;
                default next s6;
        present s7 if clkEn next s7;
                default next s7;
}
```