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## **20443413- ENEL 384 FINAL PROJECT REPORT**

For my project, I decided to implement a design that automatically counts months and displays the number of days in that month simultaneously(including leap years). I achieved this using a Basys-3 programmable FPGA device, using the Vivado application to write the code and program the logic using VHDL for this design to be implemented.

### **HOW THE PROGRAM WORKS**

My Basys-3 board has 16 LEDs, 16 switches and 4 seven-segment display lights. For the logical display on my board, I wanted the first four LEDs (counting from the left) to display the month's number in binary. Then I wanted the next four LEDs to display the number of days in the month. The number of days were displayed as follows; 1 LED show a month 29 days, 2 LEDs show a month has 28 days, 3 LEDs show a month has 30 days and 4 LEDs show a month has 31 days. I also used 3 of the 4 seven-segment displays to show the number of days simultaneously with the LEDs. The logic for those seven-segment displays were displayed as follows; the last figure of the number of days in that month is displayed. So when a month has 28 days- 8 is displayed, 30 days - 0 is displayed, 29 days- 9 is displayed and 31 days- 1 is displayed. Also as a special feature, when it is my birth month (June) the 16th LED blinks on. The first switch( counting from the left) is to start or stop the counter. The leap year feature is also implemented so that when the second switch is on, February displays 29 days instead of 28.

To begin this code, I used the clock feature so that my chip would automatically count incrementally, however because of the high frequency the period of counting needed to be reduced. Because frequency is inversely proportional to period, all I needed to do was make a process where the clock counts to a very high number before it adds 1 to my month count until it reaches 12. After the clock reaches its limit and the month is incremented by one, then it is passed to another process. This process uses case statements that display the number of days both on the LEDs and the seven segment section lights when the corresponding month is being displayed. I also utilized an if statement to check if the leap year switch is on and another case statement displays a different set output for the number of days because it is a leap year. For my special feature, I used an if statement that checks if the month count is on 6 and sets the 16th LED to '1' which is on. In the figure below, it shows when the month count is on 6 with the first 4 LEDs from the left showing "0110" in binary. Then the next 4 LEDs are 3 LEDs on which represent 30 days and on the seven-segment display, a zero is displayed which shows that the month has 30 days.

