

The background features abstract green geometric shapes. On the left, a solid green trapezoid points upwards. On the right, a complex arrangement of overlapping translucent green triangles and polygons creates a layered, crystalline effect. The colors range from a vibrant lime green to a muted sage green.

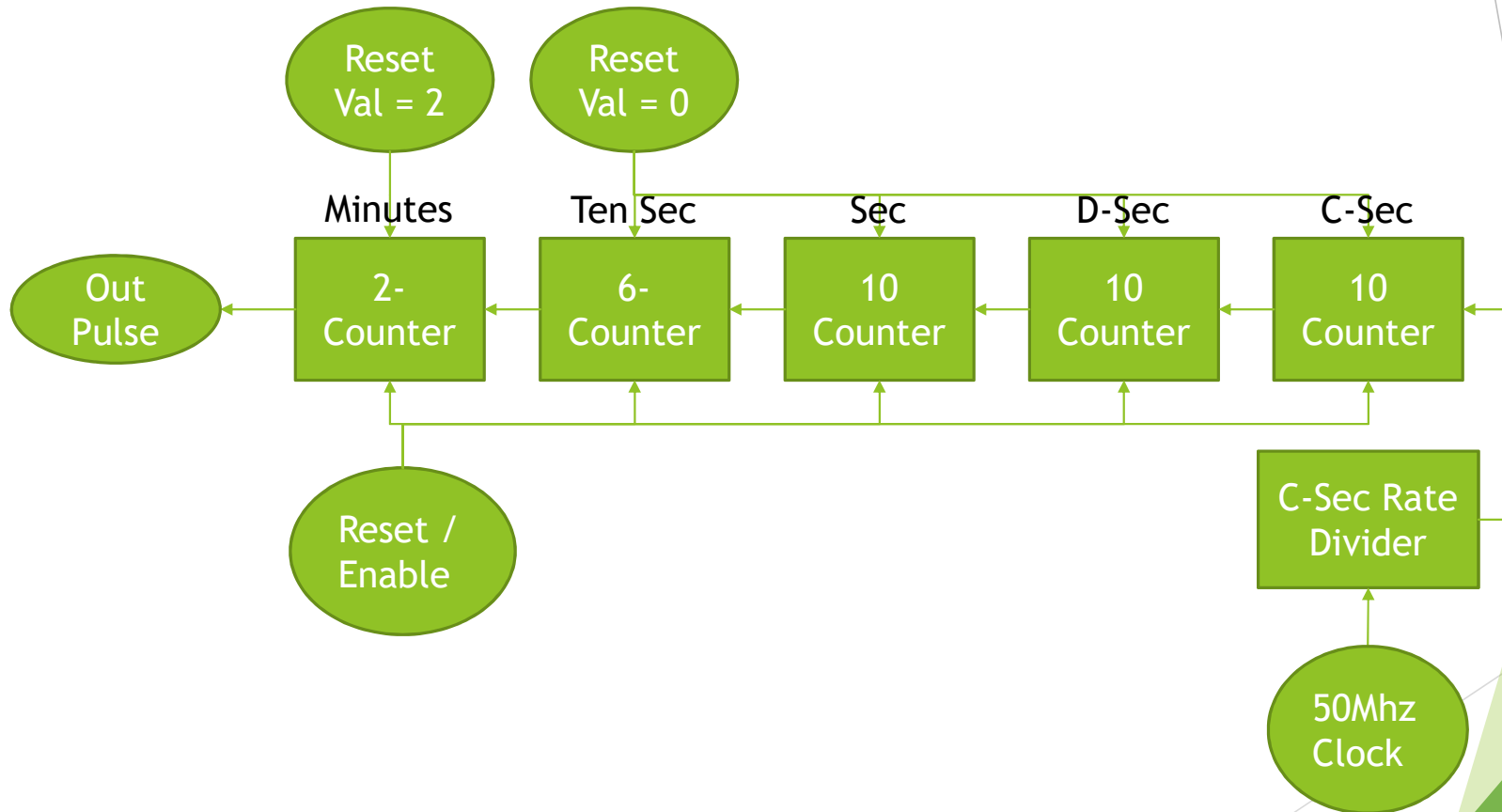
# CSC258 Project

By Brendan Neal and Filip Tomin

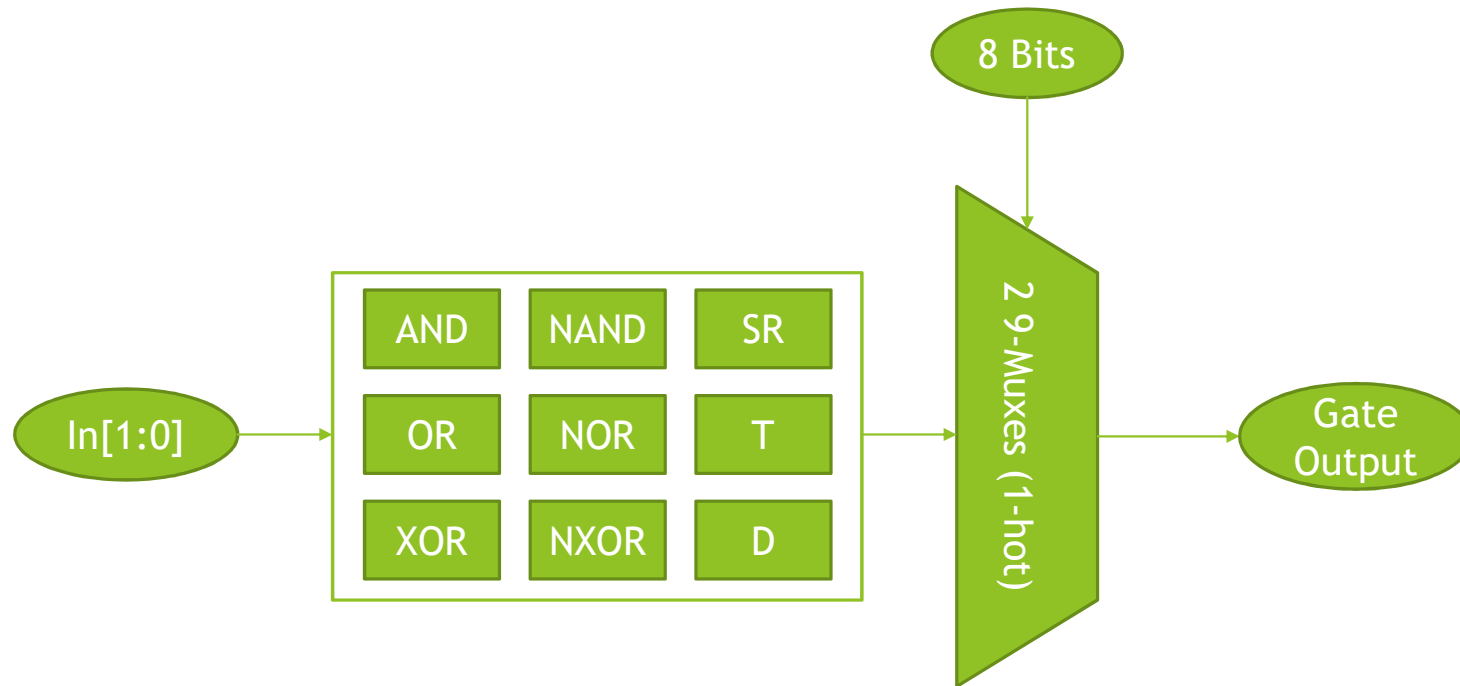
# Project Description - Logic Gate Quiz

- ▶ Win Condition
  - ▶ Solve all 9 gates in 2 minutes
- ▶ Rules
  - ▶ Logic gates are given randomly
  - ▶ Player uses board switches to test the IO of the gate
  - ▶ Player inputs a number corresponding to the gate
  - ▶ Right number -> move on to next gate
  - ▶ Wrong number -> player must select another gate number (with no IO support!)

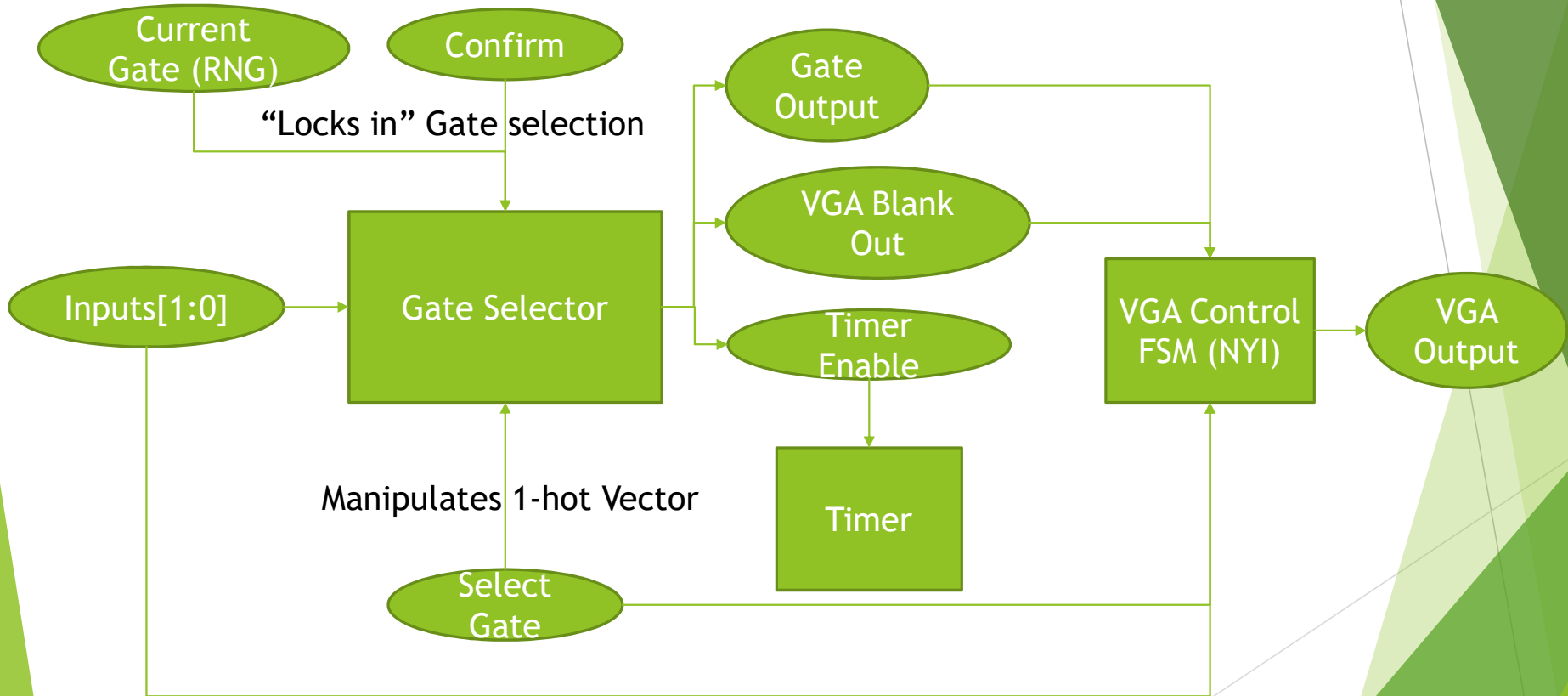
# Block Diagram - Timer



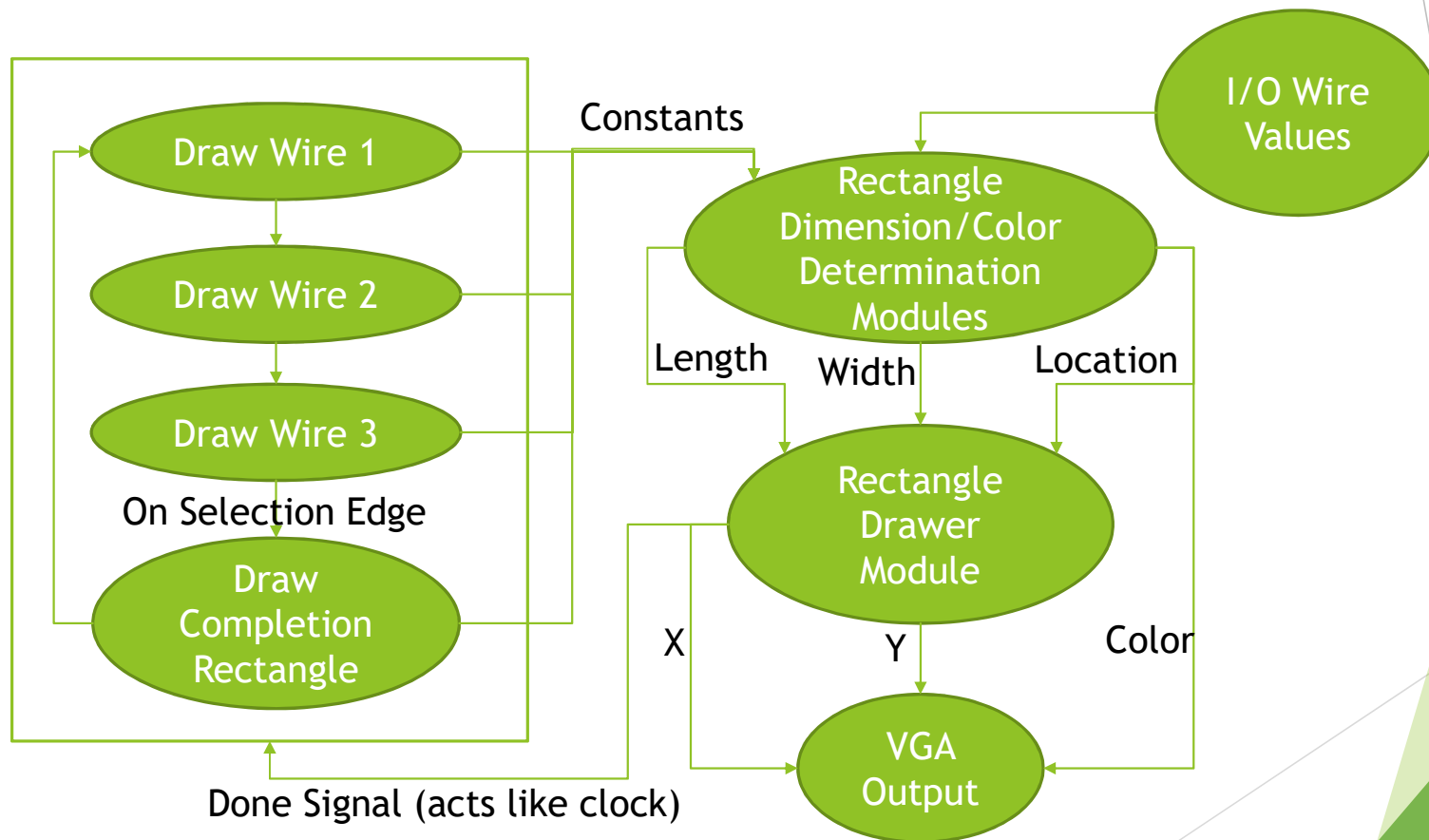
## Block Diagram - Gate Selector



# Block Diagram - Gate Control



## Block Diagram - VGA FSM (NYI)



## Interesting Aspects

- ▶ Two minute timer (not hex!)
  - ▶ Looks cool
  - ▶ Harder to get working than we thought
- ▶ Gate Selector
  - ▶ Works flawlessly
  - ▶ Easy to incorporate in the final design

## Difficulties (first milestone)

- ▶ Board switches were inconsistent
  - ▶ Made testing the gate select difficult
- ▶ Timer odd-second skip issue
  - ▶ Timer would skip every odd second (e.g. 37 sec -> 35 sec -> ...)
- ▶ Not being able to properly simulate the timer in MS
  - ▶ Timer values were completely uncertain in MS but the timer actually worked on the board
  - ▶ Meant we could only do our testing and editing during lab hours
- ▶ MS compiles differently compared to QP
  - ▶ We had to edit code that compiled in MS in order for it to compile in QP



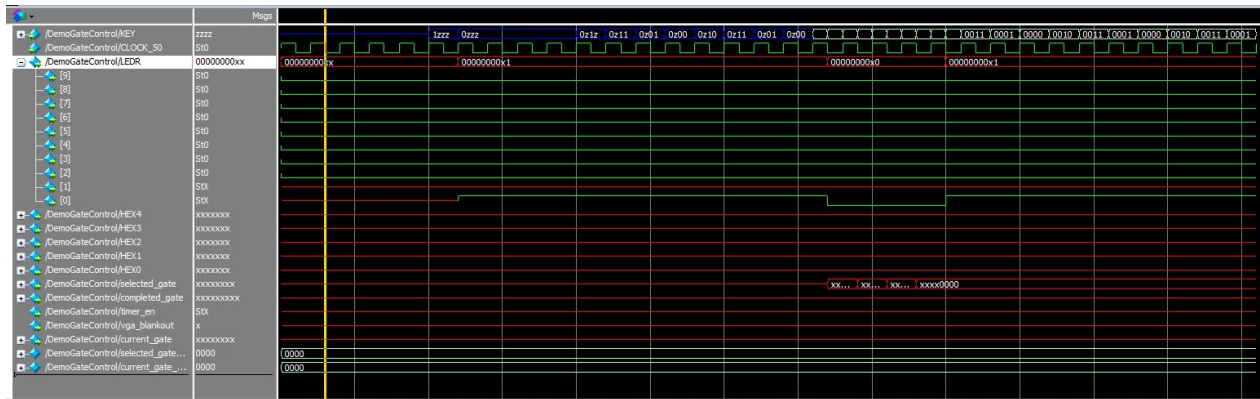
## Difficulties (second milestone)

- ▶ Timer odd-second skip issue was still occurring
  - ▶ Managed to fix it by changing `<=` to `=` for assignments in an always block (???)
- ▶ Getting our background loaded on to the VGA
  - ▶ Had some misunderstandings about the maximum resolution allowed
- ▶ Figuring out how to properly draw things on the VGA
  - ▶ Stuff can't be drawn in parallel!

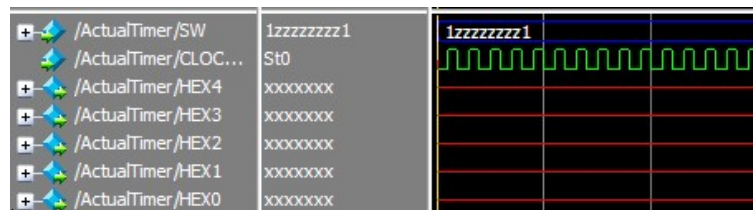
## Difficulties (last milestone)

- ▶ Timer broke again
  - ▶ We loaded the newer code onto the board and it still had the same odd-skip issue
  - ▶ Random lines started appearing on HEX5 (even though we never used it in our code)
- ▶ Getting the gate control working
  - ▶ We decided to abandon the VGA implementation because it would take too much time, and use the board IO instead
  - ▶ MS once again failed to produce any meaningful results when testing (uncertain values)
  - ▶ When restricted to using the boards we were unable to debug this component in time
- ▶ Boards wouldn't load our project (third lab session)
  - ▶ We have no idea why this happened - our code was compiling but not loading
- ▶ Note: we have a more recent version of our DemoGateControl.v on the lab computers but it doesn't work as it can't load onto the board

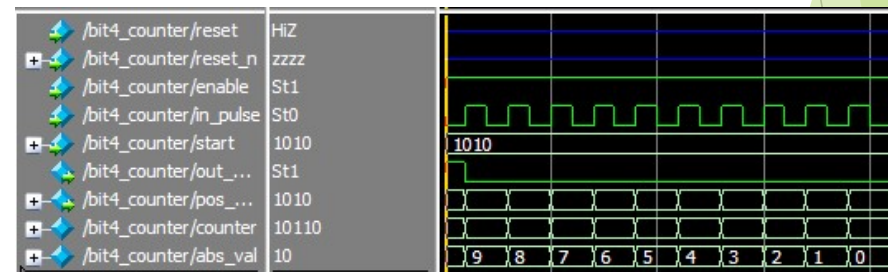
# ModelSim Uncertainty Images



MS gate control simulation uncertainties



MS timer simulation uncertainties



Underlying component of timer works properly

## Lessons Learned

- ▶ MS compiles differently than QP
- ▶ Things that work on MS may not work on QP and vice versa
- ▶  $\leq$  may not always be appropriate for an always block
- ▶ Sometimes the board is the source of your problems
- ▶ Sometimes uncertain things in MS work on the board