Marquis Green

Electronics Design & Prototype

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**Final Project Problem Statement**

**GOAL:**

The Goal for this project was to design and implement one noise filtering circuit for non-ideal push button. The design can only include any analog and digital component avaliable to us in the school’s laboratory. The design cannot include any Arduino or equivalent components in the circuit. The 0V and 3.3V with the low input threshold being a maximum 0.4V and the high input threshold being minimum 2.0V. The minimum resistors that can be utilized for the creation of this circuit must be minimum 1kOhm.

We must create the design in Multisim and Simulate design in Multisim for both transient analysis and DC. In addition to this we must also implement the design on breadboard and perform bench verification. Once this is completed, we verify the design and record the

oscilloscope capture.

**DESIGN:**

After researching various ways to create a noise filter circuit for a non-ideal push button it was quickly realized that this could be implemented multiple ways. To limit the circuit designs we would consider we would only look at those that had the avaliable components to us. Once the research was completed, we agreed upon an RC debounce circuit which was one of the simplest designs yet a pretty complex circuit. The components we used were two resistors, a capacitor, and a push button. The values of the components that decided to use were based on making sure that the capacitors voltage stages above the required threshold. The resistors in the circuit can be utilized to limit the flow of current in our circuit. In addition to this in some circuits we noticed that the resistors were also utilized to adjust signal levels. In our circuit the resistors were utilized to control the capacitors charge time and once it reaches the necessary level it sets the debounce time for the condition where the switch will open. A capacitor can be used to store electric energy when it is connected to its charging circuit. When this component is disconnected from the charging circuit, it can dissipate the stored energy. In our circuit this the capacitor and resistors are used to get rid of the bounces. The push button that was utilized in our circuit was essentially used as a switch. When the push button is pressed, we would see some logic output such as a high as a 1. When you press the push button in our circuit the voltage across the capacitor is zero but due to the values of the resistor and capacitor that we used it will start to rise. The bouncing of the contacts on the pushbutton will push the voltage down and slow the time it takes for the capacitor to be charged. The capacitor is being charged and discharged through a resistor in our circuit.

**CALCULATIONS:**

Vcap= Vinitial (e^-t/RC)

Vcap= Voltage across capacitor

Vinitial= Voltage initially across capacitor

t= time

R and C = Resistor and Capacitor values

Charging the capacitor

Vth= Vfinal(1-e^-t/RC)

Vth= worst case transition point for high signal

Vfinal = final charged value – power supply in circuit