**To:** Prof. Jie Yang, EE-286 Section 1

**From:** Team 5, EE-286 Section 1

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**Subject:** Project 2: Circuit Design

**Introduction:**

In this memo, we will be creating a pairwise matrix and a decision matrix to begin deciding on the circuit type that our group will be using.

**Pairwise Matrix:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Criteria** | **Precision** | **Speed** | **Complexity** | **Cost** | **Accuracy** | **Geo. Mean** | **Weight** |
| **Precision** | 1 | 5 | 3 | 5 | 1 | 2.37144061 | 0.407202 |
| **Speed** | 1/5 | 1 | 1/3 | 3 | 1/5 | 0.525305561 | 0.090201 |
| **Complexity** | 1/3 | 3 | 1 | 3 | 1/5 | 0.902880451 | 0.155034 |
| **Cost** | 1/5 | 1/3 | 1/3 | 1 | 5 | 0.644394015 | 0.110649 |
| **Accuracy** | 1 | 5 | 5 | 1/5 | 1 | 1.379729661 | 0.236914 |

Using the project technical parameters, our group created a pairwise matrix. The criteria we used were precision, speed, complexity, cost, and accuracy.

**Decision Matrix:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria** | **Serial Approximation** | **Ramp Generator** | **Flash Converter** |
| **Precision** | 3 | 1 | **2** |
| **Speed** | 2 | 1 | **3** |
| **Complexity** | 1 | 2 | **3** |
| **Cost** | 3 | 3 | **2** |
| **Accuracy** | 2 | 1 | **3** |
| **Total** | 11 | 8 | **13** |

The above decision matrix uses a 1 to 3 scale to rate each circuit based on the criteria from the pairwise matrix. This matrix has not taken the weight of each rating into consideration yet, but it gives the group a general idea of what ADC we will be using.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Weight** | **Serial Approximation** | **Ramp Generator** | **Flash Converter** |
| **Precision** | 0.407202 | 1.221606 | 0.407202 | **0.814404** |
| **Speed** | 0.090201 | 0.180402 | 0.090201 | **0.270603** |
| **Complexity** | 0.155034 | 0.155034 | 0.310068 | **0.465102** |
| **Cost** | 0.110649 | 0.331947 | 0.331947 | **0.221298** |
| **Accuracy** | 0.236914 | 0.473828 | 0.236914 | **0.710742** |
| **Total** | 1 | 2.362817 | 1.376332 | **2.482149** |

The above decision matrix takes the matrix from before and multiplies those values by the weight that was calculated in the pairwise matrix. From this matrix, we can conclude that the **Flash Converter method** will be the circuit design of our group. The flash converter won with a total of **2.482149**. This circuit design proved to be one of the most versatile methods given to us. While a little more costly than the other two, this ADC proved to be much more simple in concept than the other two.

**Conclusion:**

Using the decision matrix, our group will be using the Flash converter as our ADC method. The flash converter, while a little more costly, is very simple and can be semi-accurate. The flash converter was the best choice for our team and provided many benefits over the other methods. Our group is happy with this outcome, as the other methods of converting analog to digital used a clock and were a bit out of reach for us.

**Attachments:** none