# Presentation Two


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# Project Description

The purpose of this project is to create a red, green, blue (RGB) light system in order to illuminate flow so that a camera can detect the flow. The system must have three separate channels that control the different colors individually and must operate within a $1000 budget.

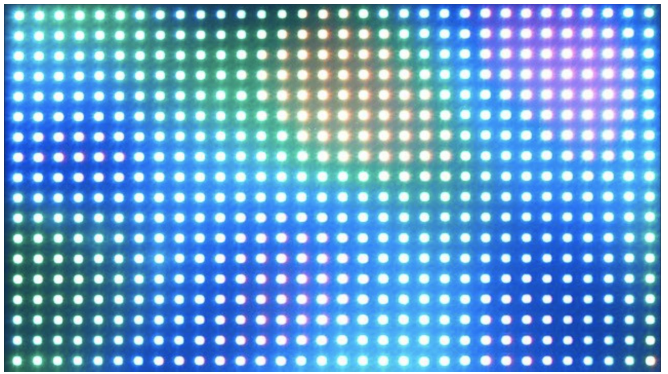

Figure 1: LED array

# Project Description: Black Box

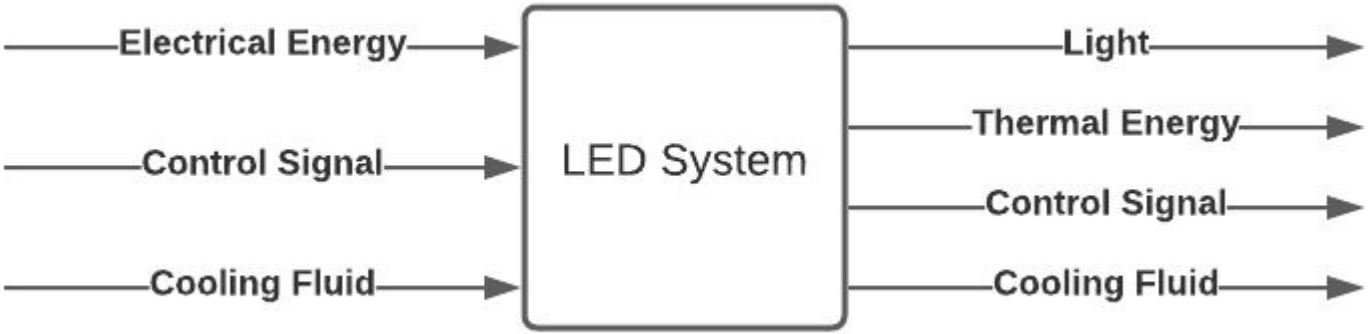


Figure 2: LED Black Box

# Project Description: Functional Model

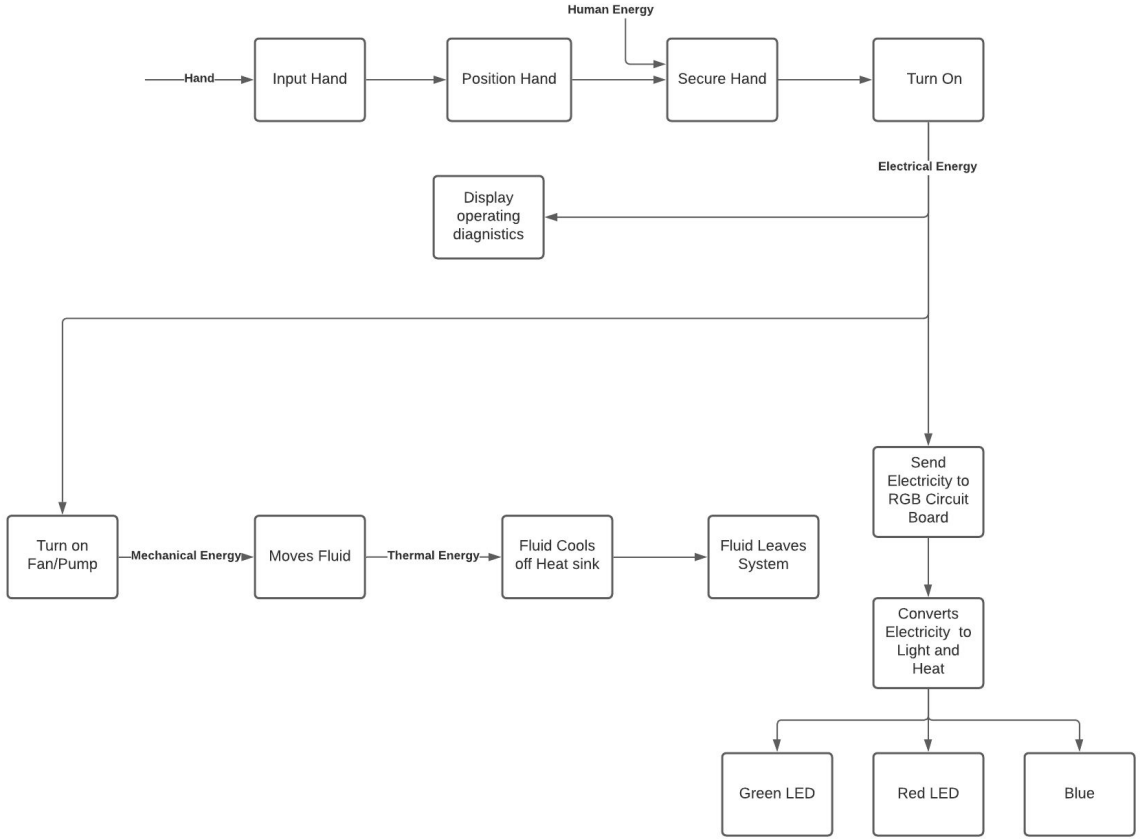


Figure 3: Decompositional Model

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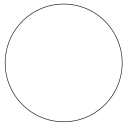
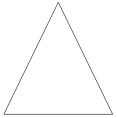
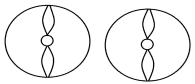
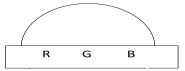
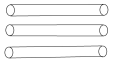
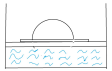
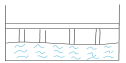
# Concept Generation

Table 1: Morphological Matrix

| | | | | |
|---|---|---|---|---|
| **LED Housing** |  Circular |  Rectangular |  Triangular |  Lego |
| **Cooling** |  Many Small |  Some Medium |  One Large |   Coolant |
| **Packing** |  Tight |  Loose |  Bayern |   RGB Chip |
| **Heat Sink** |  Pin Fin |  Rectangular Fin |  Coolant Reservoir |  Fins and Reservoir |

# CV #1

Benefits:

- Stronger Light Intensity
- Good cooling

Disadvantages:

- Manufacturing cost
- Manufacturing

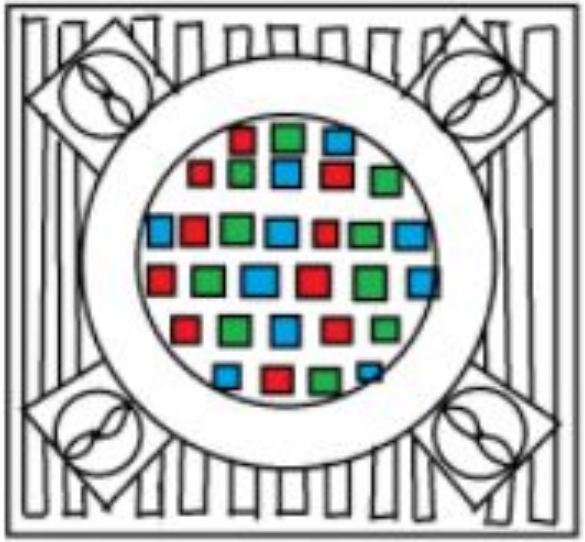


Figure 4 : CV #1

# CV #5

Benefits:

- Good light Intensity
- Easy Manufacturing
- Lower Manufacturing cost
- Durability

Disadvantages:

- Cooling
- Safety

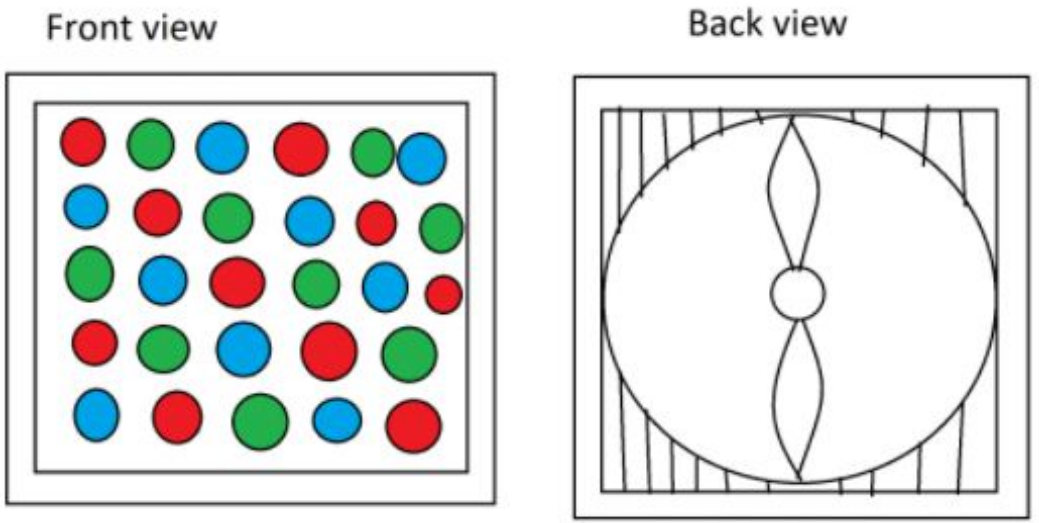



Figure 5 : CV #5

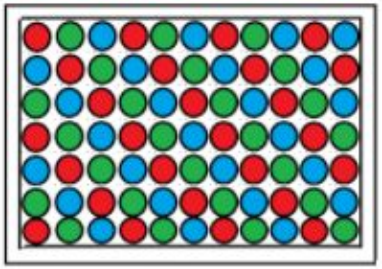
# CV #8

Benefits:

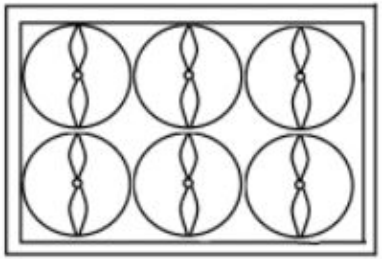
- Easier manufacturing
- Manufacturing cost low
- Light intensity good

Disadvantages:

- Harder to assemble more fans
- Lower durability



Front view



Back view

Figure 6: CV #8

# Concept Evaluation

Table 2: Pugh Chart

| | | Concepts | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Selection Criteria | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Cost | | Datum | - | - | - | + | - | - | s |
| Light Intensity | | | - | - | s | + | s | - | + |
| Durability | | | - | - | s | s | - | - | s |
| Size | | | - | - | - | + | - | - | + |
| Cooling Performance | | | + | + | + | - | + | + | s |
| Safety | | | + | + | + | s | + | - | s |
| Total + | | | 2 | 2 | 2 | 3 | 2 | 1 | 2 |
| Total - | | | 4 | 4 | 2 | 1 | 3 | 5 | 0 |
| Total s | | | 0 | 0 | 2 | 2 | 1 | 0 | 4 |
| Scores | | 0 | -2 | -2 | 0 | 2 | -1 | -4 | 2 |

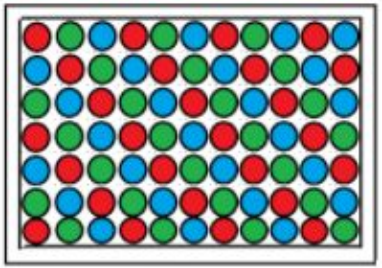
# Concept Evaluation

Table 3: Decision Matrix

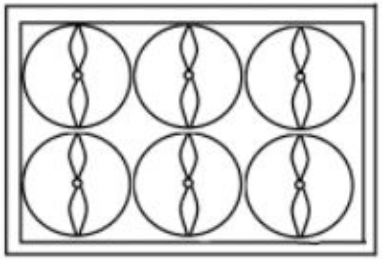
| | | CV 1 | | CV 5 | | CV 8 | |
|---|---|---|---|---|---|---|---|
| | Weights | Raw Score | Weighted Score | Raw Score | Weighted Score | Raw Score | Weighted Score |
| Cost | 20% | 4 | 0.8 | 7 | 1.4 | 6 | 1.2 |
| Light Intensity | 30% | 8 | 2.4 | 6 | 1.8 | 6 | 1.8 |
| Durability | 10% | 6 | 0.6 | 7 | 0.7 | 5 | 0.5 |
| Size | 5% | 6 | 0.3 | 8 | 0.4 | 8 | 0.4 |
| Cooling Performance | 20% | 6 | 1.2 | 5 | 1 | 8 | 1.6 |
| Safety | 15% | 6 | 0.9 | 6 | 0.9 | 6 | 0.9 |
| Total | | 36 | 6.2 | 39 | 6.2 | 39 | 6.4 |
| Relative rank | | | 3 | | 2 | | 1 |

# Final Design Choice

CV#8



Front view



Back view

Figure 6: CV #8

# Rough CAD

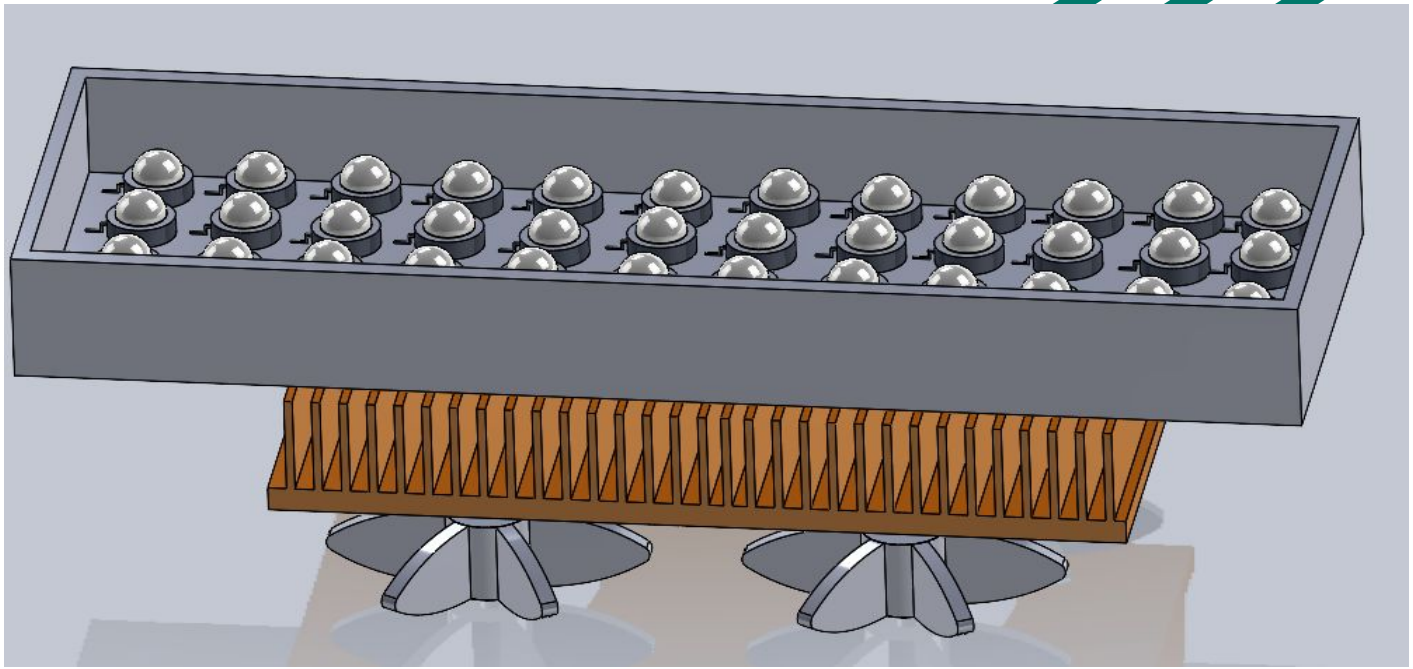


Figure 7: Rough CAD Model

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# LED Selection

Figure 8: Cree Xlamp XM-L Color

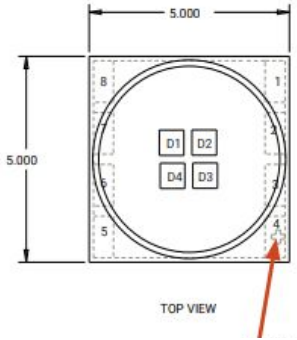


Figure 9: LED top view with pin layout

- Small surface mounted LED with a high efficacy.
- 25 mm^2 allows for tightly compacting the LEDs in order to collimate the Light
- 111 Lm/W at peak conditions is highly efficient for this size of LED
- Contains a Red , Green ,Blue and White channel

# Preliminary Circuit Design

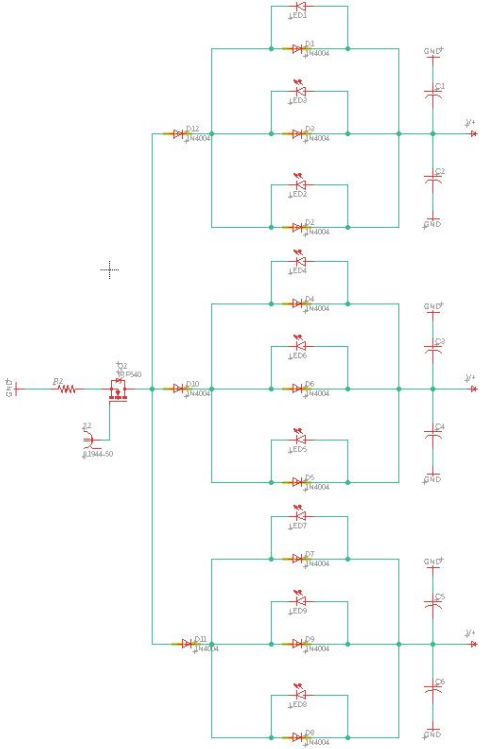

Figure 10: Full circuit Sample

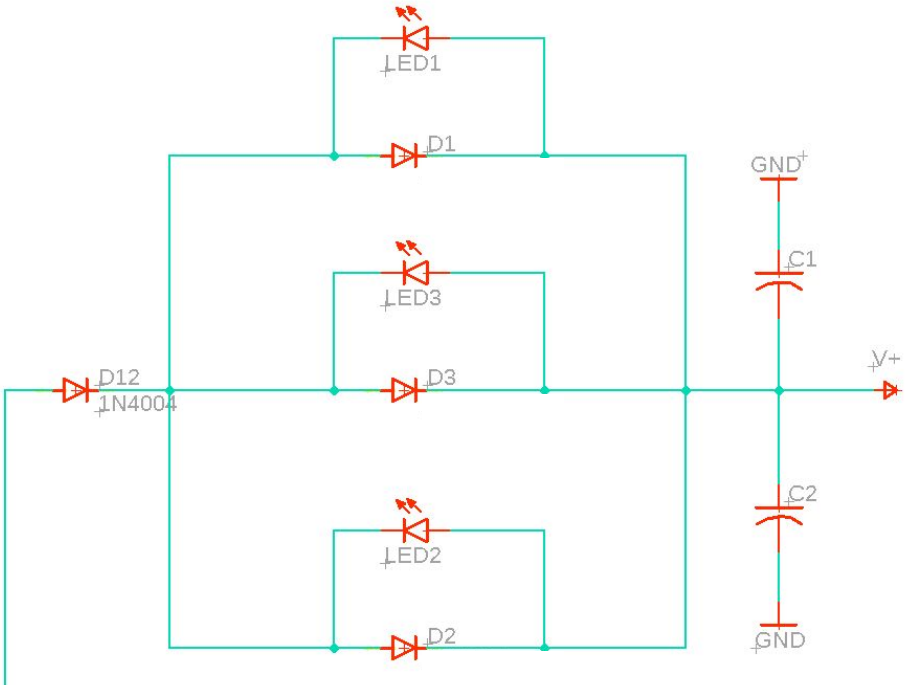


Figure 11: Single Channel Sample

# Budget Planning

Table 4: Bill of Materials

| No. | Qt. | Name | Function | Cost |
|---|---|---|---|---|
| 1 | 75 | LED chip | Convert the electrical energy into light | $300 |
| 2 | 1 | Heat sink | Fill gaps between the fan and cooling part, make cooling more efficient | $52 |
| 3 | 3 | Fan | Push air and keep cooling | ~$150 |
| 4 | 1 | Circuit board | Control the system | ~$150 |
| 5 | 3 | BNC I/O port | Cable Input port for the TTL signal | $5 |
| 6 | 3 | Rectifier Diode | Keep the current from flowing in reverse through the LEDs | $2 |
| 7 | 1 | Mosfet | An N-Channel power mosfet to stabilize the pulse input. | $5 |
| 8 | 1 | Resistors | Circuit component | $1 |
| 9 | 6 | Capacitors | Circuit component | $15 |
| 10 | 1 | Housing | Hold the system together | $30 |
| Total Budget ($1000) | | | | $705 |

- Roughly 70% of the total budget will go to the final solution.
- The Fan and Circuit Board costs are mostly unknown at the moment and were set to a high value until decided upon.
- As a contingency for shipping costs 10% of the budget will be set aside ($100).
- The remaining 20% of the budget will be used in case of part failures.

# QUESTIONS?