



Solar Power Rechargeable LED LAMP

TQ Systems

By:

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Overview

- The Problem
- Initial Designs
- Requirements
- Identified Issues
- Proposed Design
- Costs
- Summary

Problem:

- Small remote village with limited electricity
- Objective is to develop cleaner, safer portable lighting for the villagers
- Must be efficient, low cost, and use rechargeable batteries

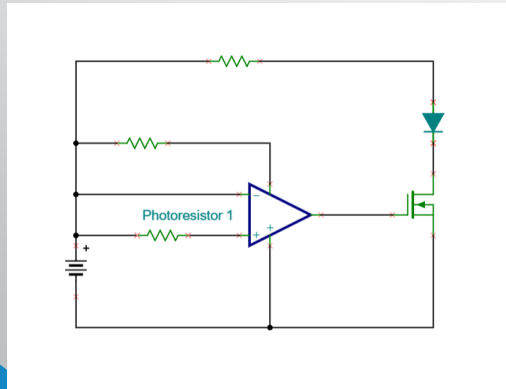
Requirements

Category	Requirement
Efficiency	75% efficient
Cost	Under \$50 per unit
Time Duration	Lasts 8-12 hours
Batteries	Removable and rechargeable
Operation	Emit light only when ambient lighting is not sufficient for tasks
Usability	Portable lighting source

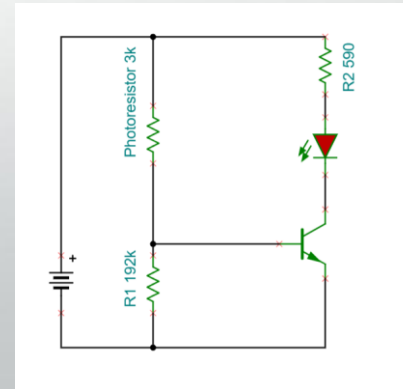
Initial Designs (Trade Studies)

- Op-amp into MOSFET (trade #1)
- Voltage divider into npn transistor (trade #2)

Trade #1



Trade #2



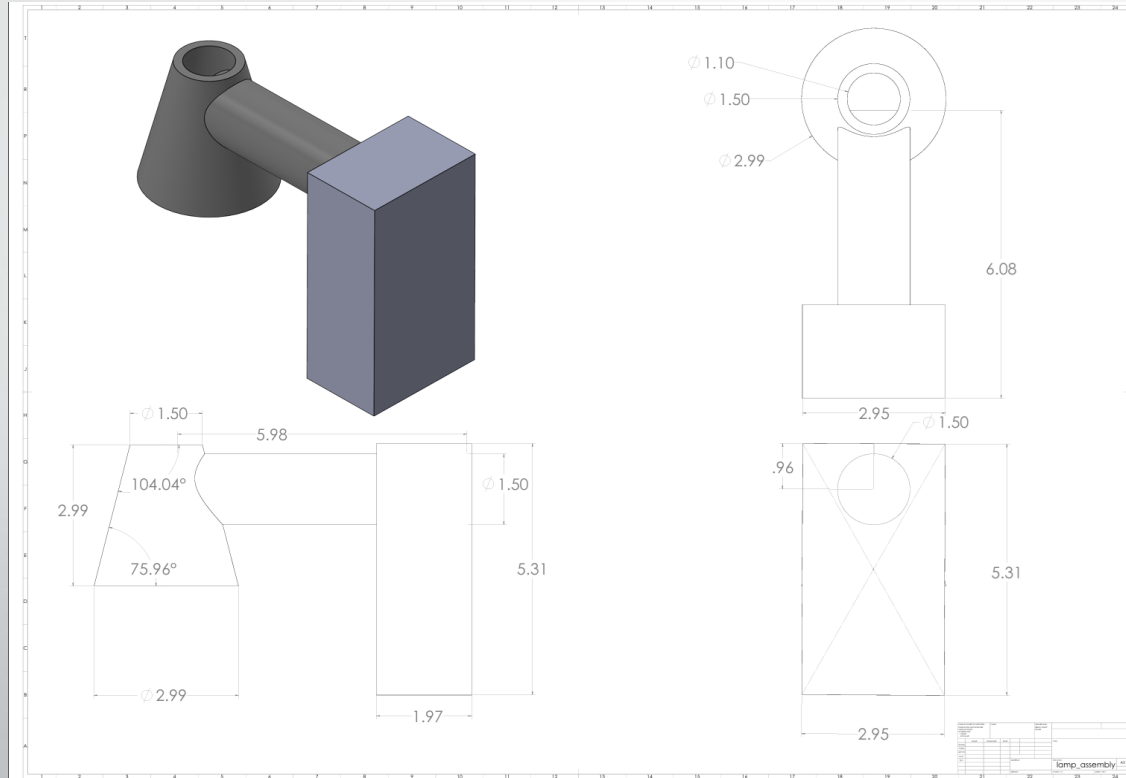
Trade #1

- This design did not provide enough voltage to the LED for it to get to full brightness
- We switched out the MOSFET for a transistor that was rated for less power and was better suited for this application
- This circuit was overly complicated and could be simplified

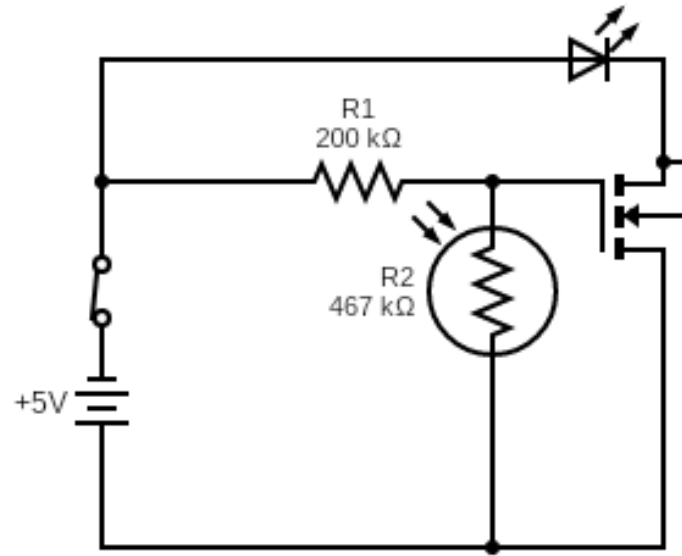
Trade #2

- Trade #2 worked as planned however it was not efficient
- The voltage divider consumed most of the power
- We revised the design by lowering the resistances of the voltage divider
- We were then able to decrease the source voltage which required less batteries which made the design lower cost.

Proposed Packaging Design:



Final Proposed Electrical Design



LEDs and Batteries

- Cool White LED BA9s 1.2 W
- Batteries are 18650, 3.7 V, 9900mAh

Costs:

Total: \$29.17

Item	Qty	Unit Price	Extended Price
LED	1	\$3.99	\$3.99
Batteries	2	\$5.50	\$11.00
Light Bulb Socket	1	\$1.80	\$1.80
Rocker Switch	1	\$1.72	\$1.72
2x2 Protoboard	1	\$2.59	\$2.59
Box for Base	1	\$1.99	\$1.99
LDR 30-50k Ohm	1	\$2.78	\$2.78
3-D Printed Base	1	\$3.00	\$3.00

Summary:

Item	Requirement	Actual
Efficiency	75% efficient	96.3% efficient
Cost	Under \$50 per unit	\$29.17 per unit
Time Duration	Lasts 8-12 hours	Lasts 61.1 hours
Batteries	Removable and rechargeable	Achieved
Operation	Emit light only when ambient lighting is not sufficient for tasks	Achieved
Usability	Portable lighting source	Achieved

The design met all the customer requirements.