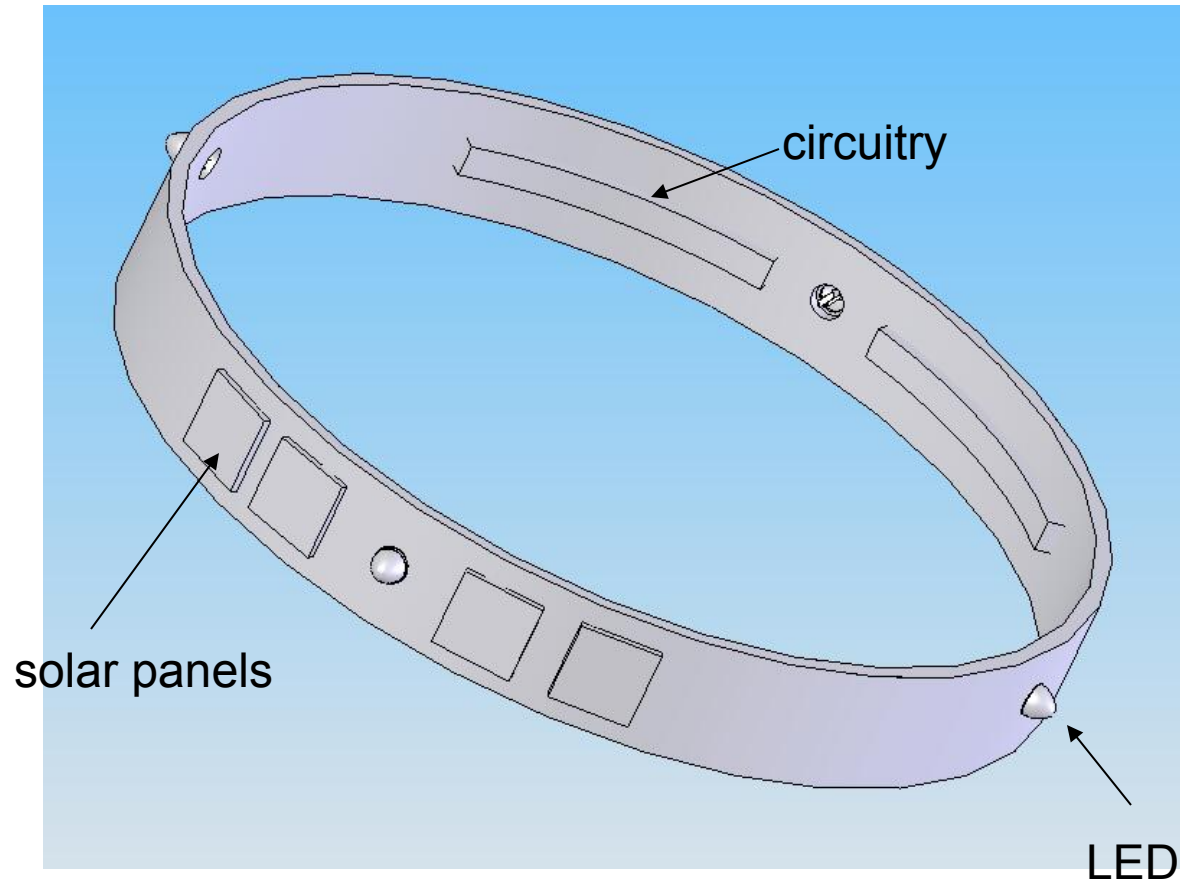# Problem #2:

- Every year, thousands of animals (both livestock and domestic pets) get lost at night

- Farmers can't find their cattle at night, and drivers can't see wandering cattle

- Current methods for detecting animals in the dark involve short-lived battery-powered LEDs or bells that are difficult to detect in the dark.

Idea 2: LED Collar

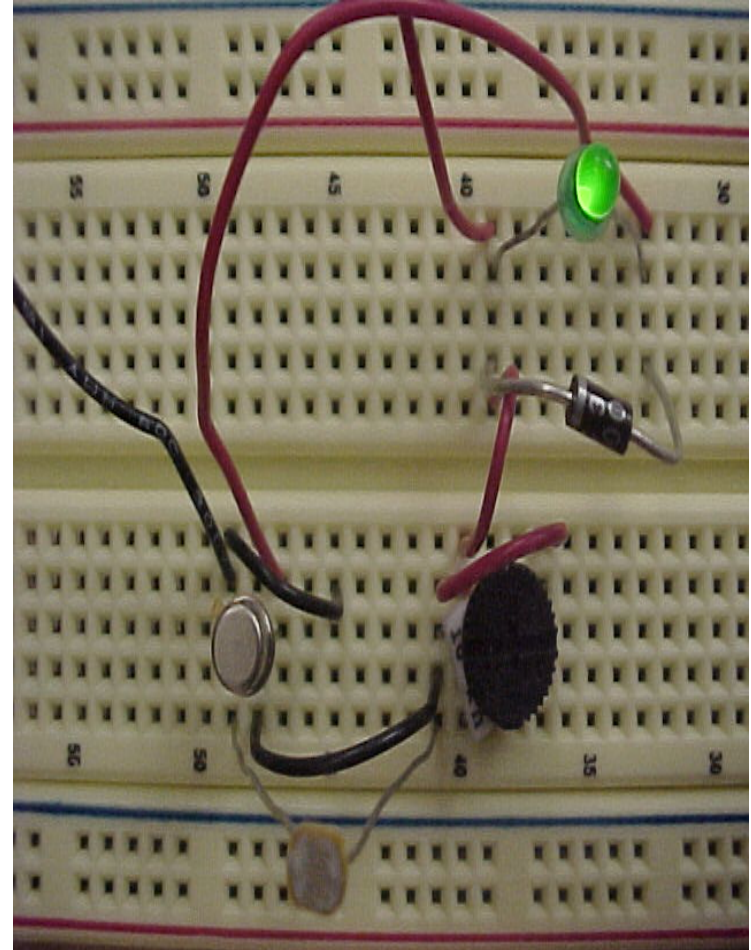circuitry

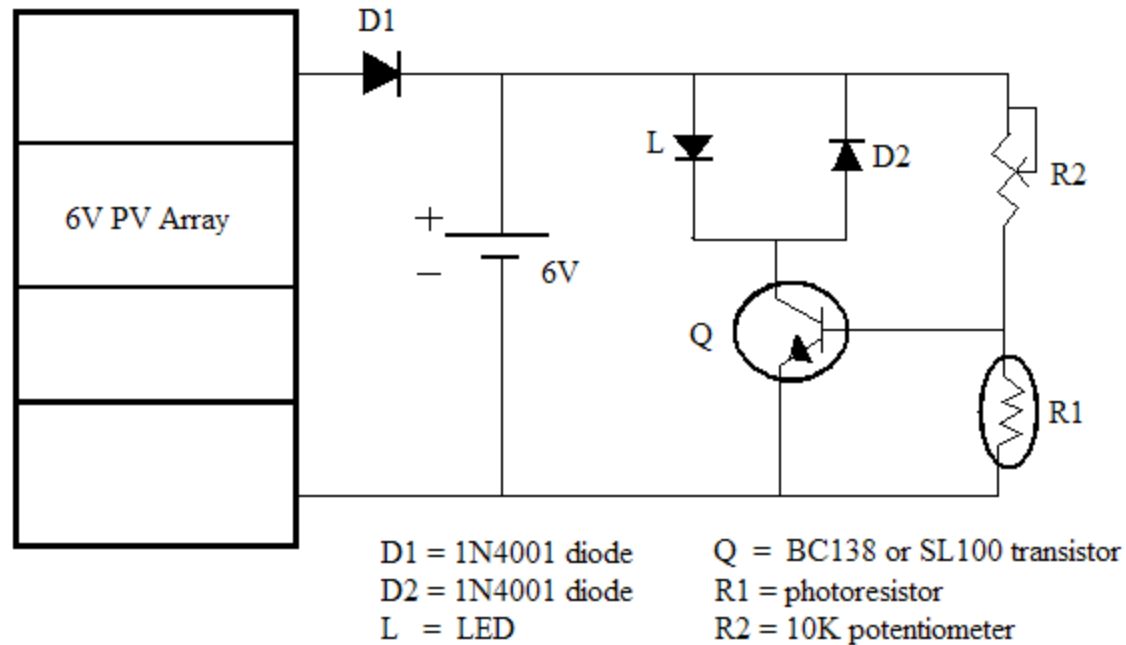solar panels

LED

Features

- LEDs illuminate animal collar at night – ½ mile visibility
- Custom, solar-powered rechargeable battery storage

Process:

- Photoresistor triggers battery to illuminate the LED at night

Circuit Design

6V PV Array

D1

L   D2   R2

Q

R1

+
−   6V

D1 = 1N4001 diode   Q = BC138 or SL100 transistor
D2 = 1N4001 diode   R1 = photoresistor
L   = LED   R2 = 10K potentiometer

Observations & Calculations

- **Energy needed to power LED for 12 hours (1 night):**
  - 70 mW per LED x 4 LEDs = 280 mW
  - 0.25 second-long pulse every 2 seconds
  - 0.280 W * 43200 seconds/8 = 1512 J (pulsing)
- **Energy per in^2 of solar cell stored in 12 hours:**
  - Sun power in ideal conditions = 625 mW/in^2
  - Avg. efficiency of solar cell = 15%
  - Avg. efficiency of battery charging/discharging = 75%
  - Avg. efficiency due to climate and geometry = 10%
  - Avg. power per in^2 of solar cell (with efficiencies) = 7 mW
  - 0.007 W * 43200 seconds = 302.4 J
- **Surface area needed to provide sufficient power:**
  - 1512 J/ 302.4 J = 5.0 in^2 of solar paneling

Concerns

- Changes in daylight hours
  - Calculations are based on 12 hour nights
  - 10 in^2 of solar paneling needed in winter w/16 hour nights (would increase cost by ~$3.50)

- Varying efficiencies

- Cost
  - Overhead and manufacturing costs will drive up prices – are consumers willing to pay that much?

Projected Cost of Materials

4 LEDs	$1.00
2 AA batteries	$2.00
1 diode	$0.10
1 photo resistor	$0.25
1 resistor	$0.10
solar panels	$3.50
belt/collar	$1.00
TOTAL =	**$7.95**

Market

- **Customer Base:**
  - 100 million cows in the US
  - 95 million other livestock
  - 130 million domestic pets
- **Precedent:**
  - LED dog collar = ~$17.50
- **Market Gross Profit:**
  - Year 1: 325 million * 2% * $17.50 = $115 kk
  - Year 2: 325 million * additional 5% * $17.50 = $285 kk
  - Year 3: 325 million * additional 10% * $17.50 = $570 kk
  - TOTAL in first 3 years = ~$1 billion