

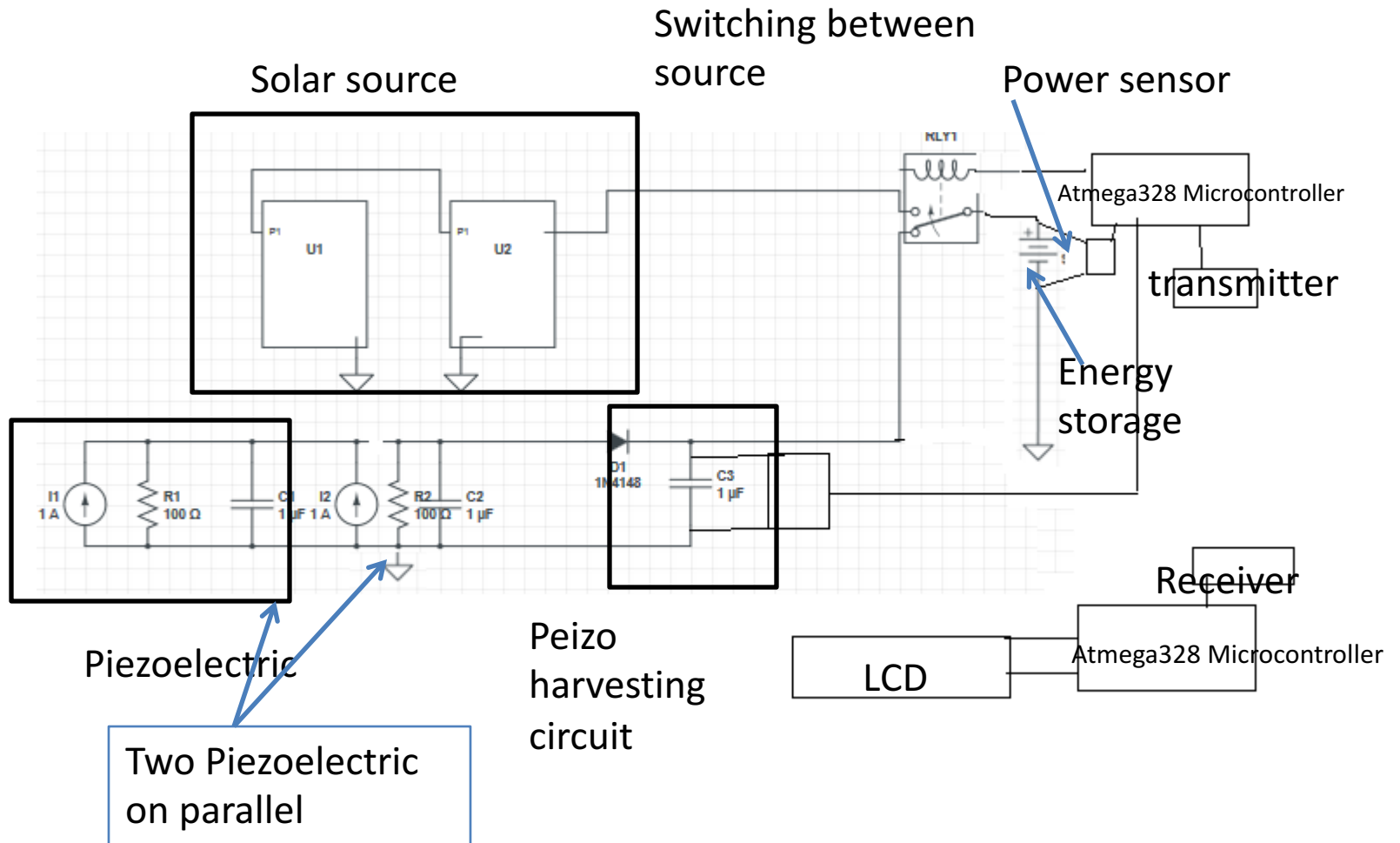


# Arabian Gulf Engineers

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Instructor: Dr. Steven  
Beyerlein and Dr. Lee**

# Design Overall



# Solar panel



# Solar Material

- The photovoltaic are Polycrystalline generating 10 Watts.
- The P.V. panel contains 36 solar cells.

## Product Specifications

Manufactured By	Solar Goes Green
Sold By	Houzz
Size/Weight	W 15" / D 13" / H 2" / 3 lb.
Materials	Polychyrstalline
Assembly Required	Yes
Category	Led Bulbs
Style	Transitional

# Testing Solar Panel

- Date: June, 30,2016
- Time:12:30 PM

Conditions	V (DC) volts	A (Amps)
Max (under the sun light)	21.44	0.268
One Panel ( half shaded)	17.34	$7.4 \times 10^{-3}$
Under the shade	15.87	0.019

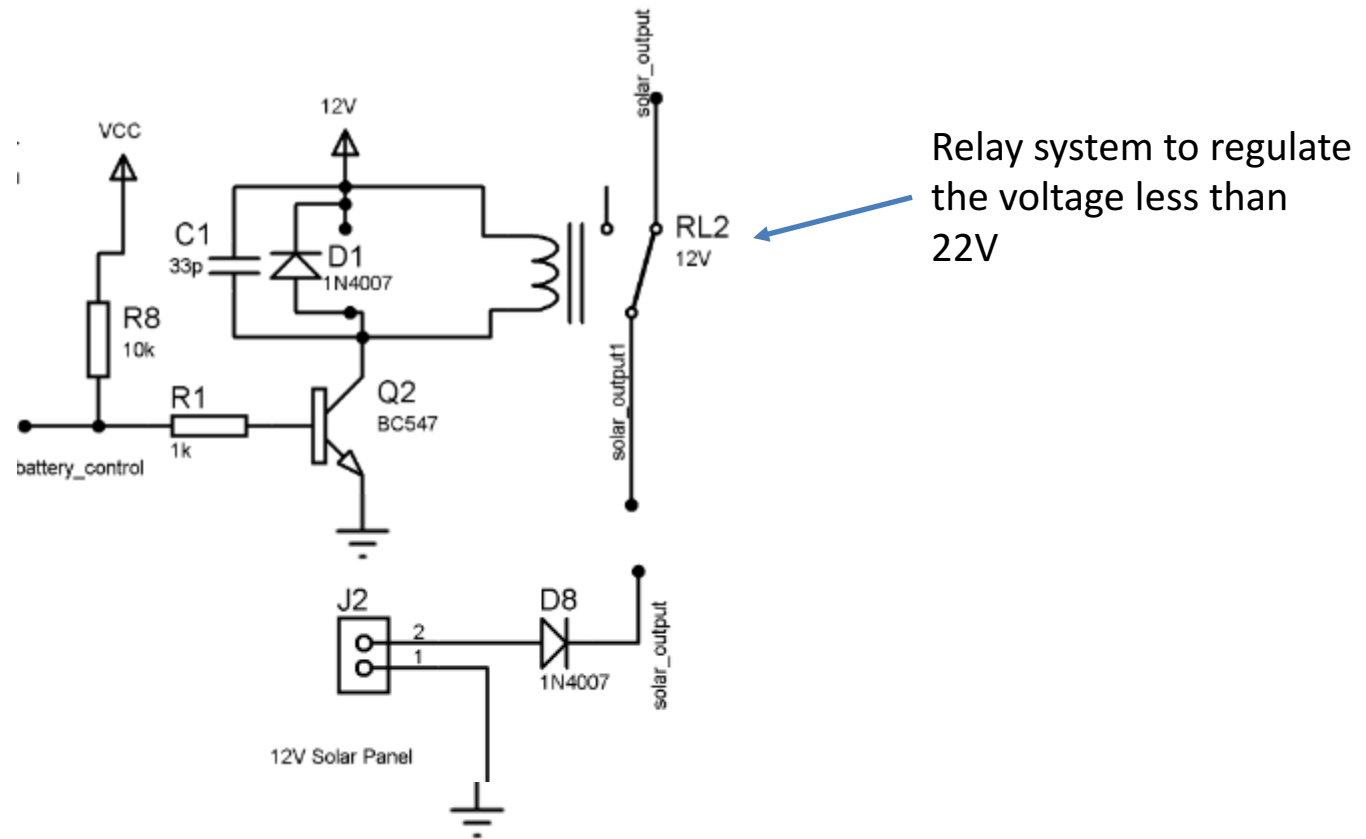
- Average voltage= 20.4 V
- Average current= 2.75 mA

# Specs of Charger controller

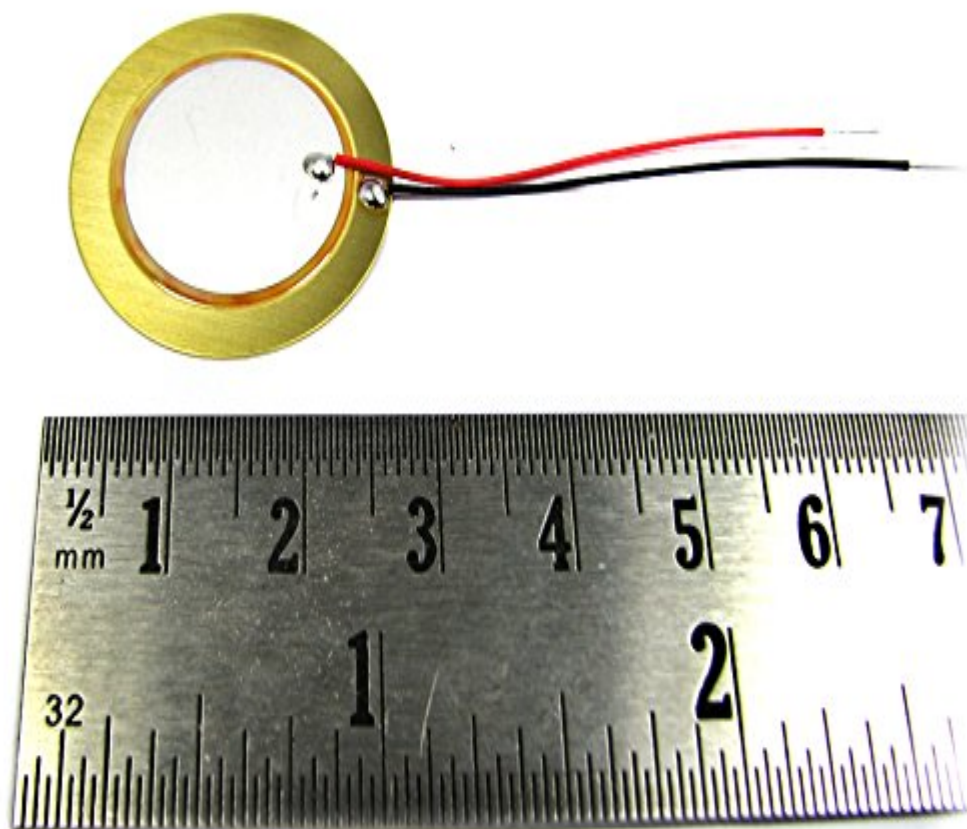
- Provides voltage status on the LCD
- Prevents battery over-charging
- Prevents Battery from over-discharge
- Prevents current to go back to the solar panel.

# Charger Controller

- The solar charge controller

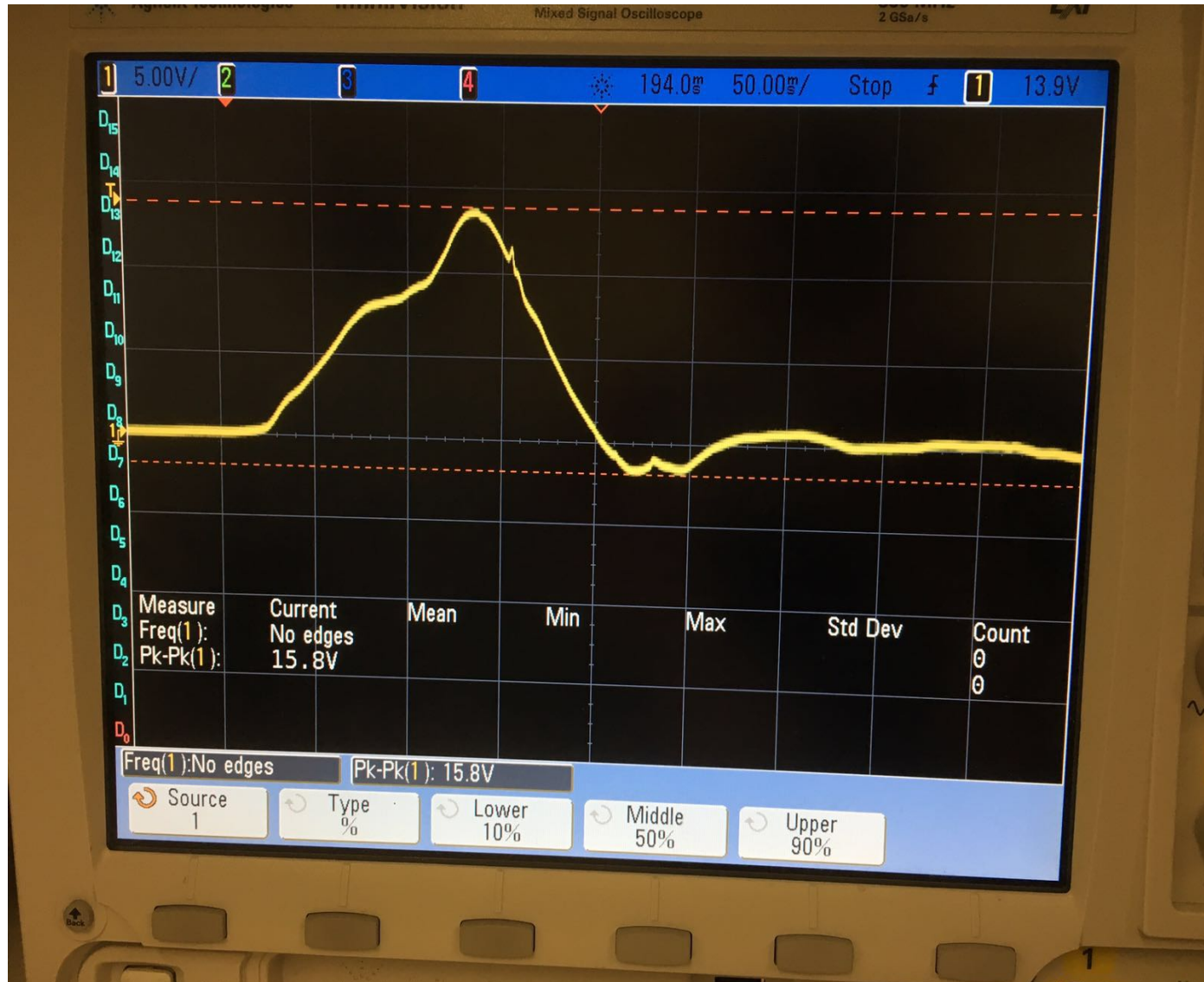


# Piezoelectric



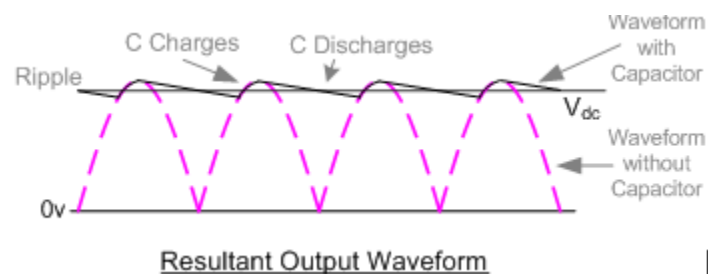
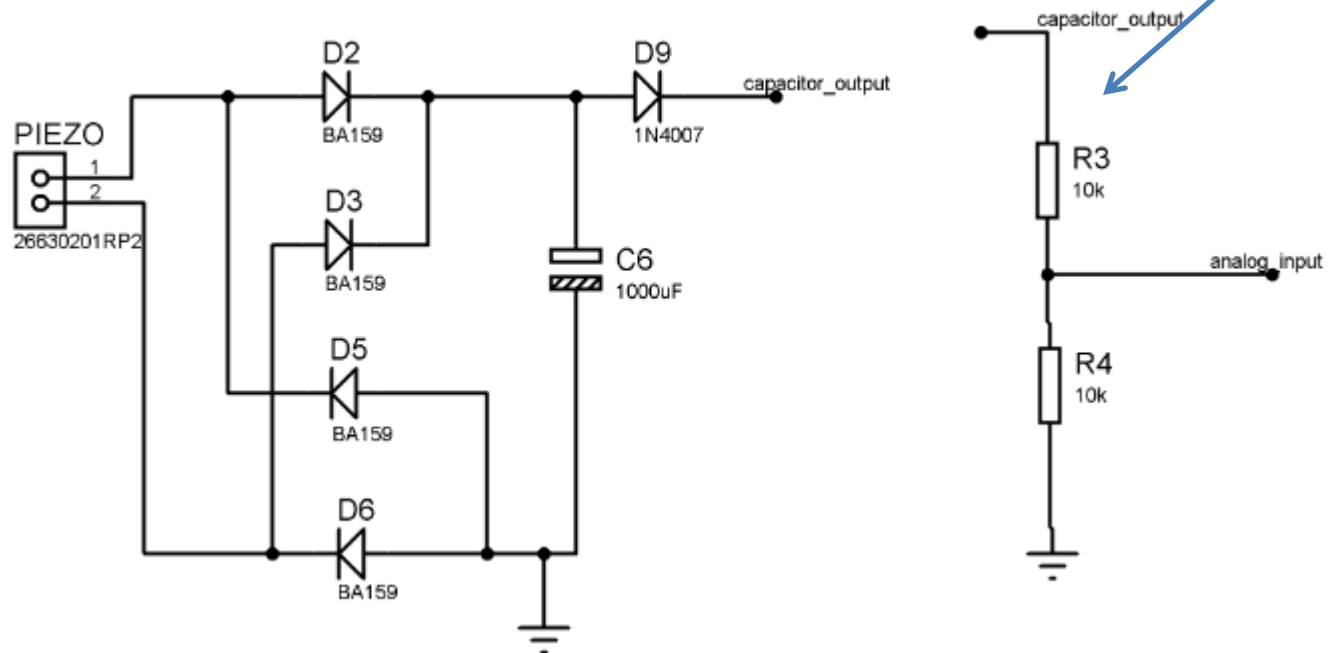


# Piezo Waveform

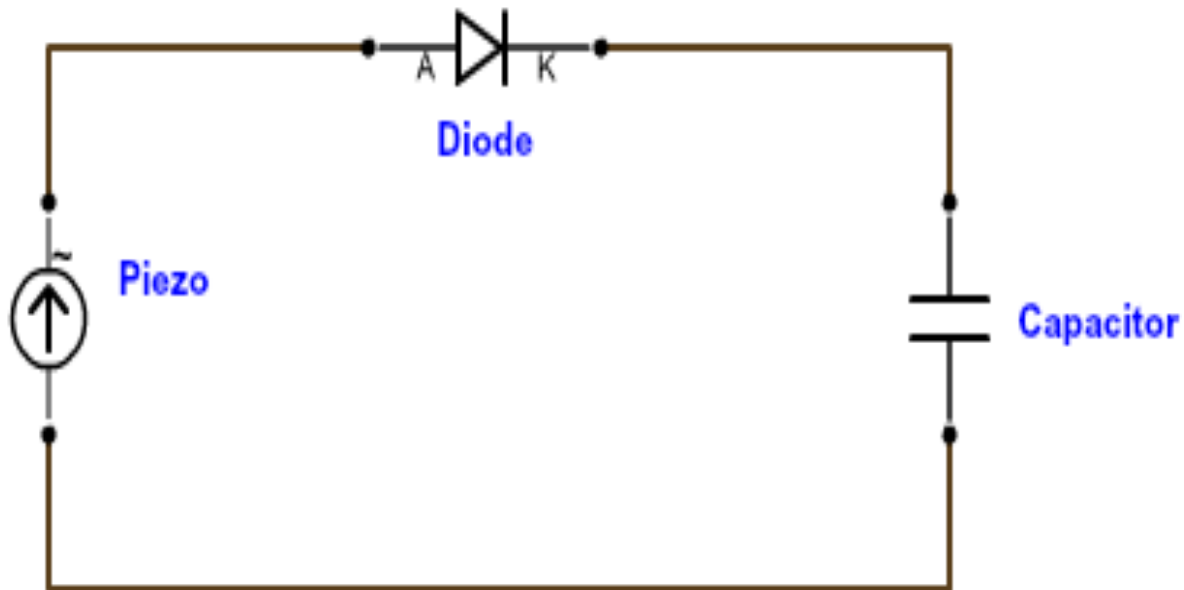


# Piezoelectric system

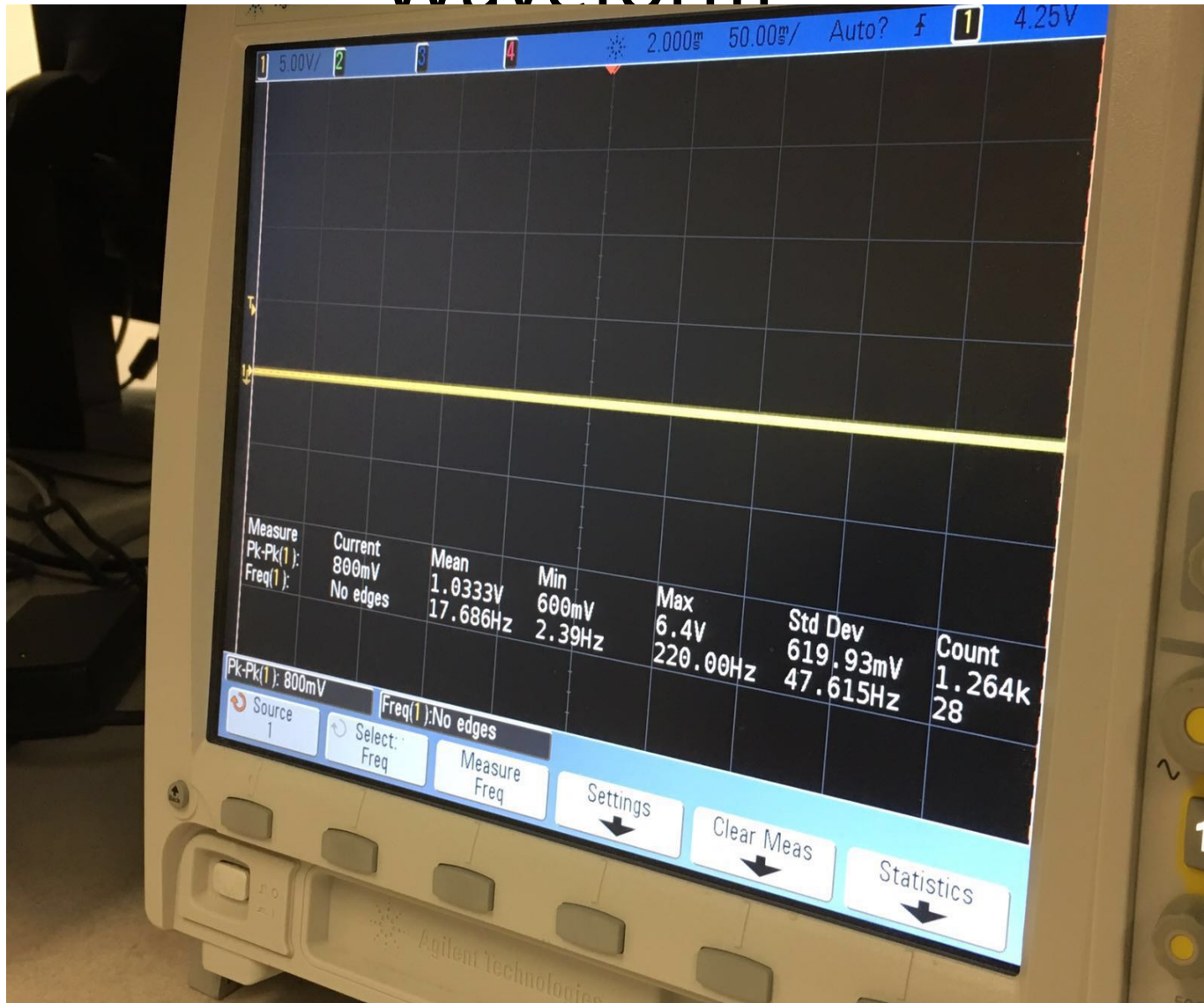
Voltage divider  
to sense the  
voltage status.



# Basic Piezoelectric Harvesting Circuit



# Piezo with the harvesting Circuit Waveform



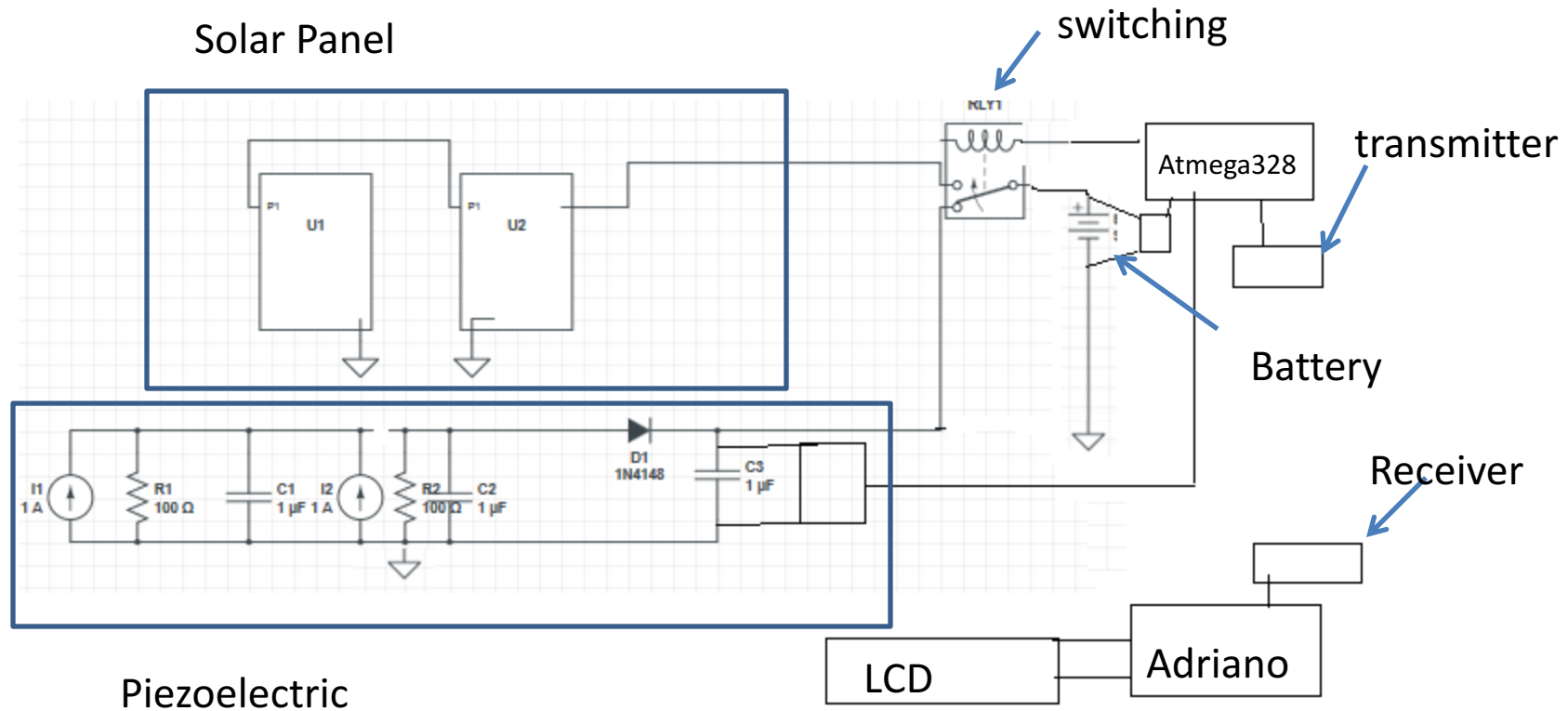
# Piezoelectric Energy by stepping

$$\begin{aligned}\text{❖ Energy} &= \frac{1}{2} * C * V^2 \\ &= \frac{1}{2} * (22\mu\text{F}) * (22.5\text{V})^2 \\ &= 5.57\text{mJ}/60 \text{ steps} \\ \\ \text{❖ Energy/steps} &= 5.57\text{mJ}/60\text{steps} \\ &= 92.8\mu\text{J}/\text{step}\end{aligned}$$

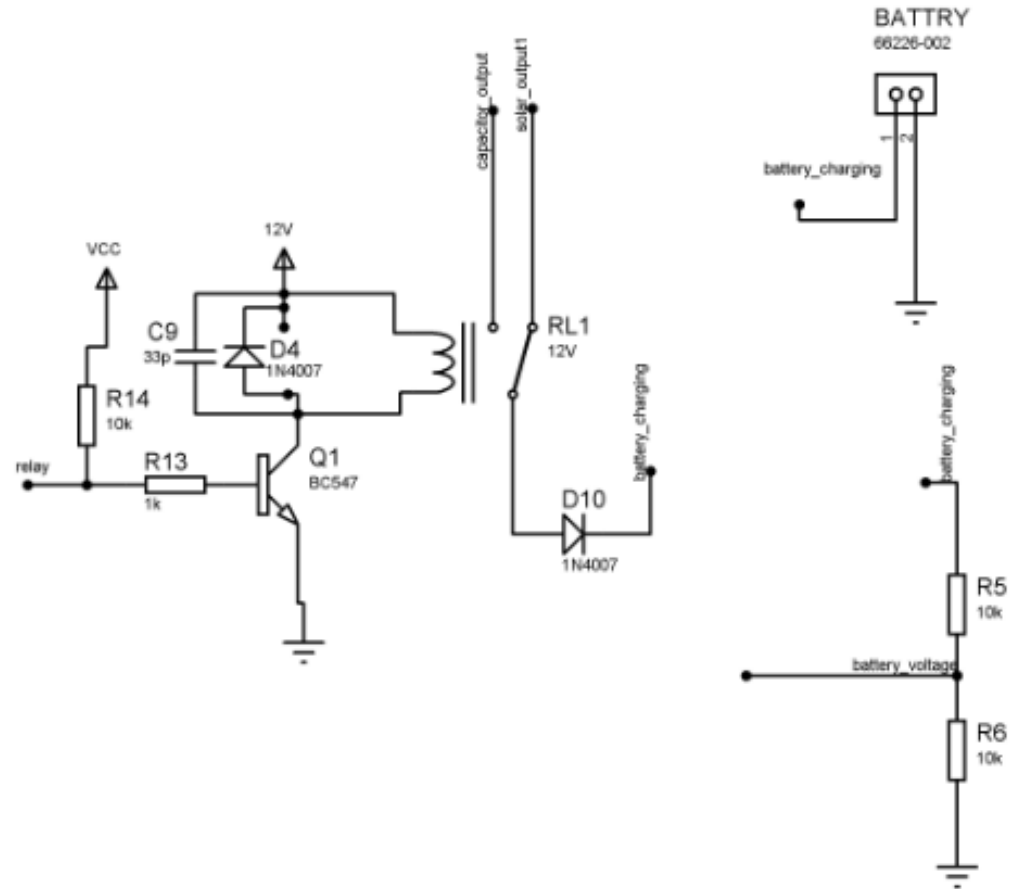
# piezo Energy by car

$$\begin{aligned}\text{❖ Energy} &= (mgh) * (\#cars/hr) \\ &= [(1800kg)(9.81m/s^2)(4.8*10^{-4}m)] * [60cars/hr] \\ &= 508.6 \text{ J/hr}\end{aligned}$$

# Switching Between Sources



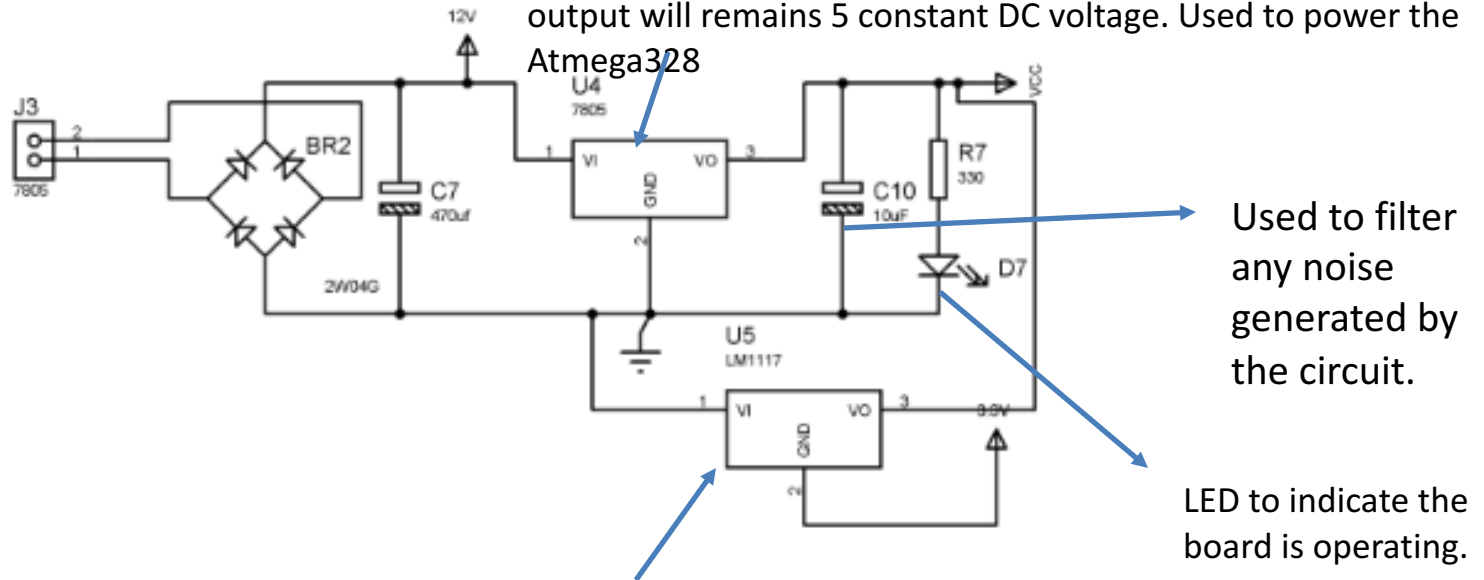
# Switching Between Sources





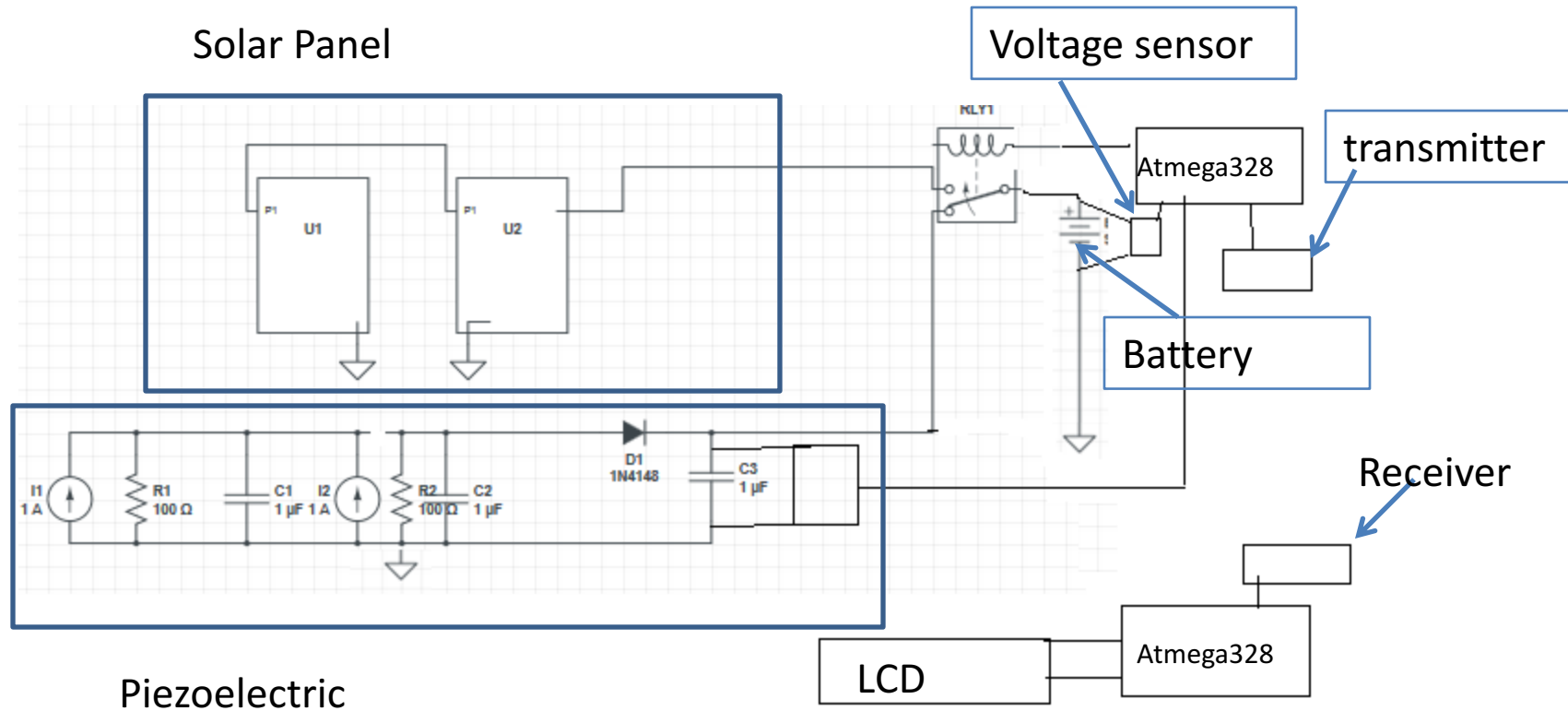
# Board Power Supply

To regulate changes from about 8 to 15 V as input depending on the AC voltage regulation between 160 to 270 AC V, while the output will remain 5 constant DC voltage. Used to power the Atmega328

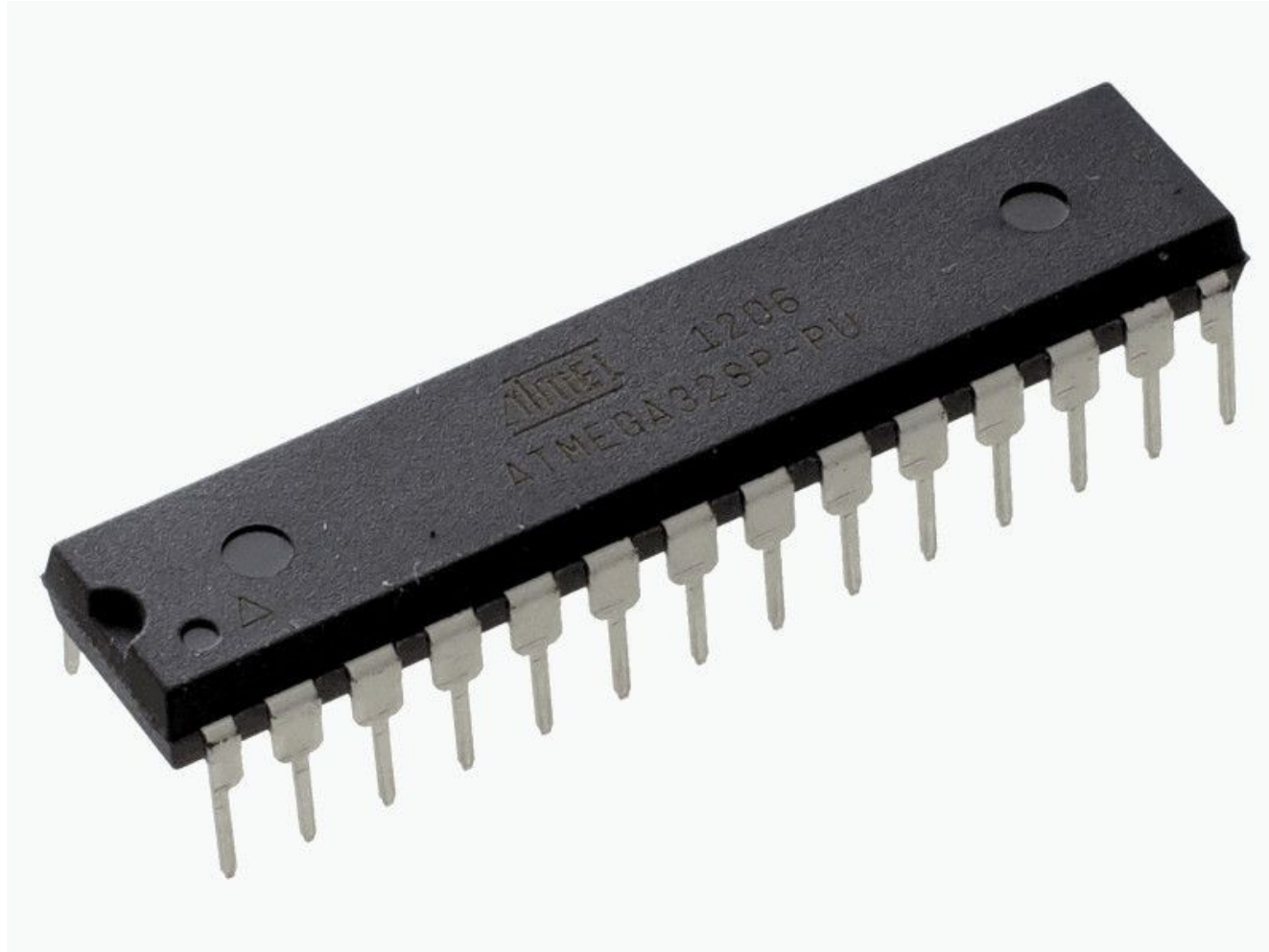


To regulate the 5 DC voltage to 3.3 DC voltage to power the ZigBee.

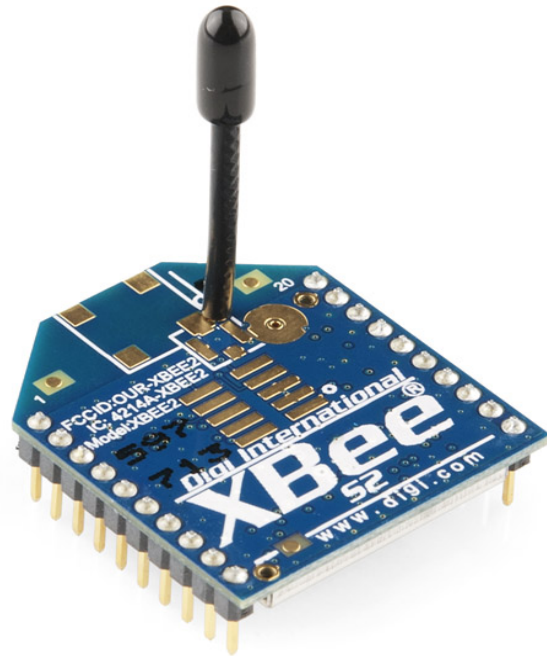
# Wireless Device



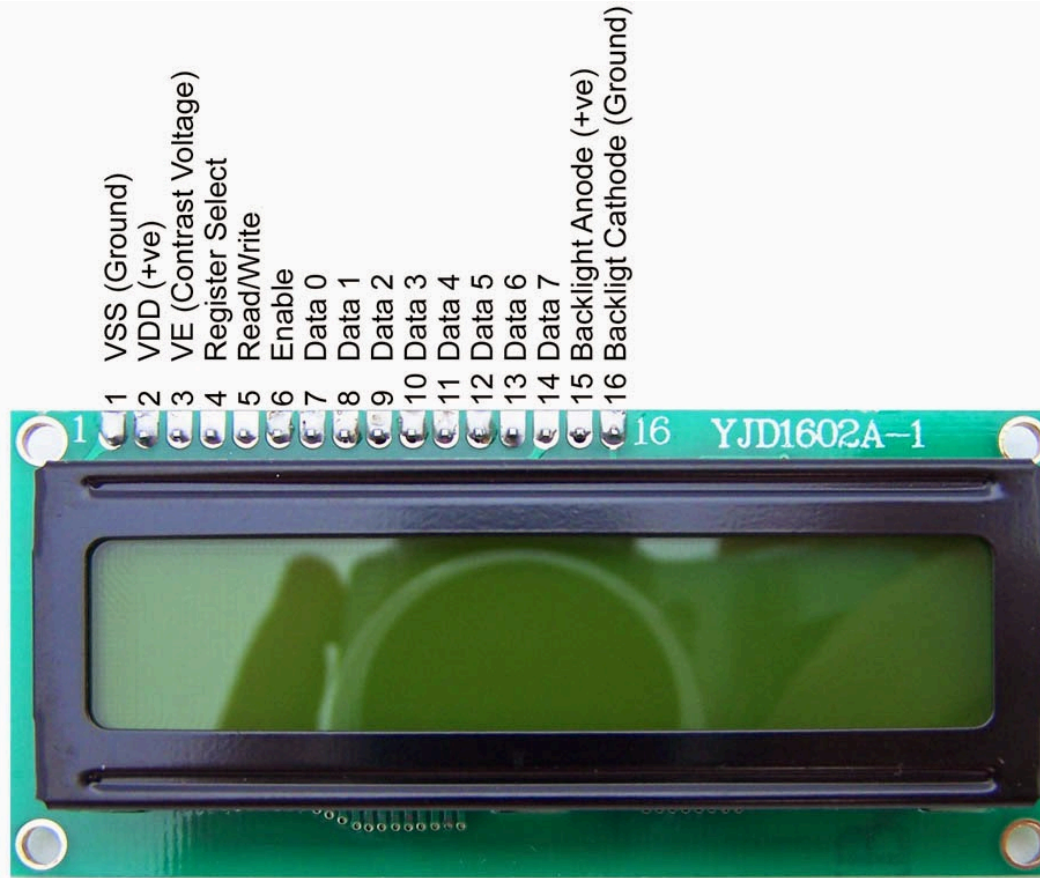
# AtMega 328

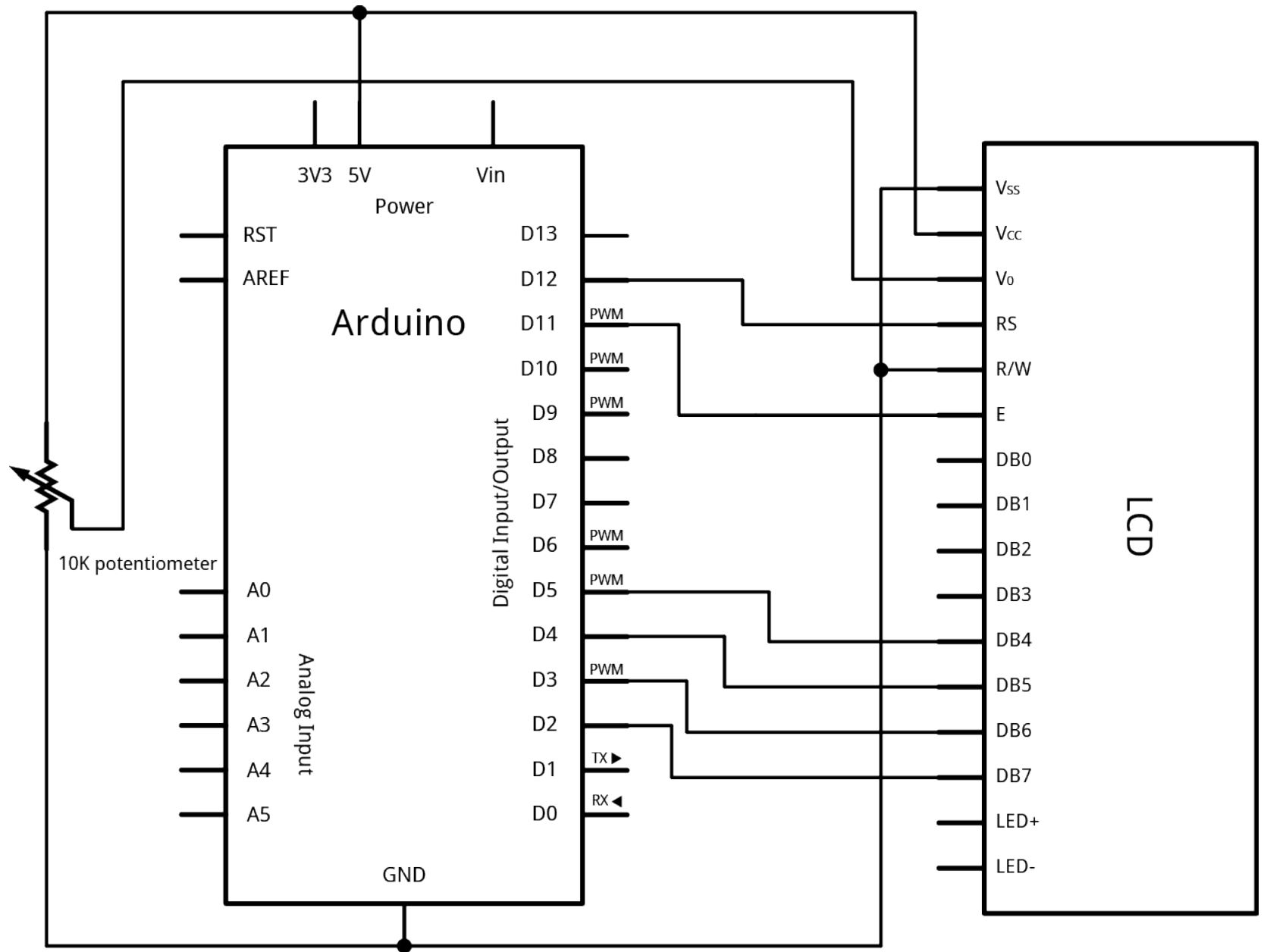


# Zigbee



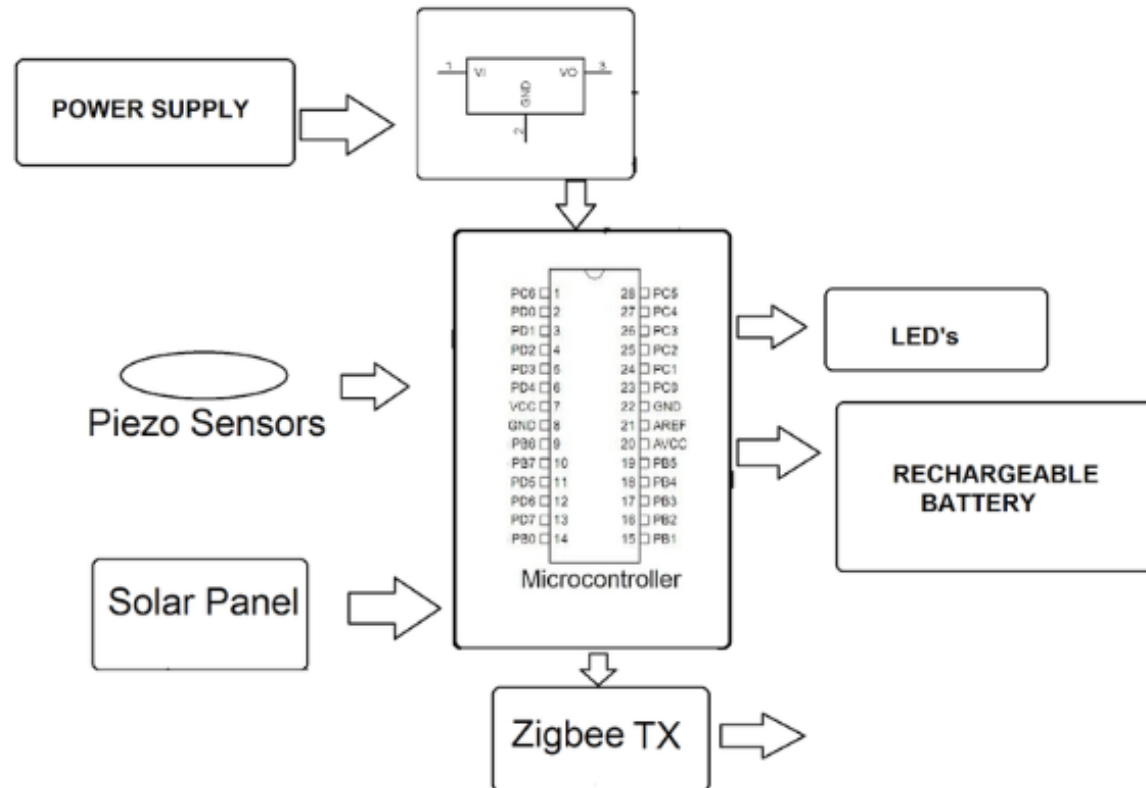
# LCD display





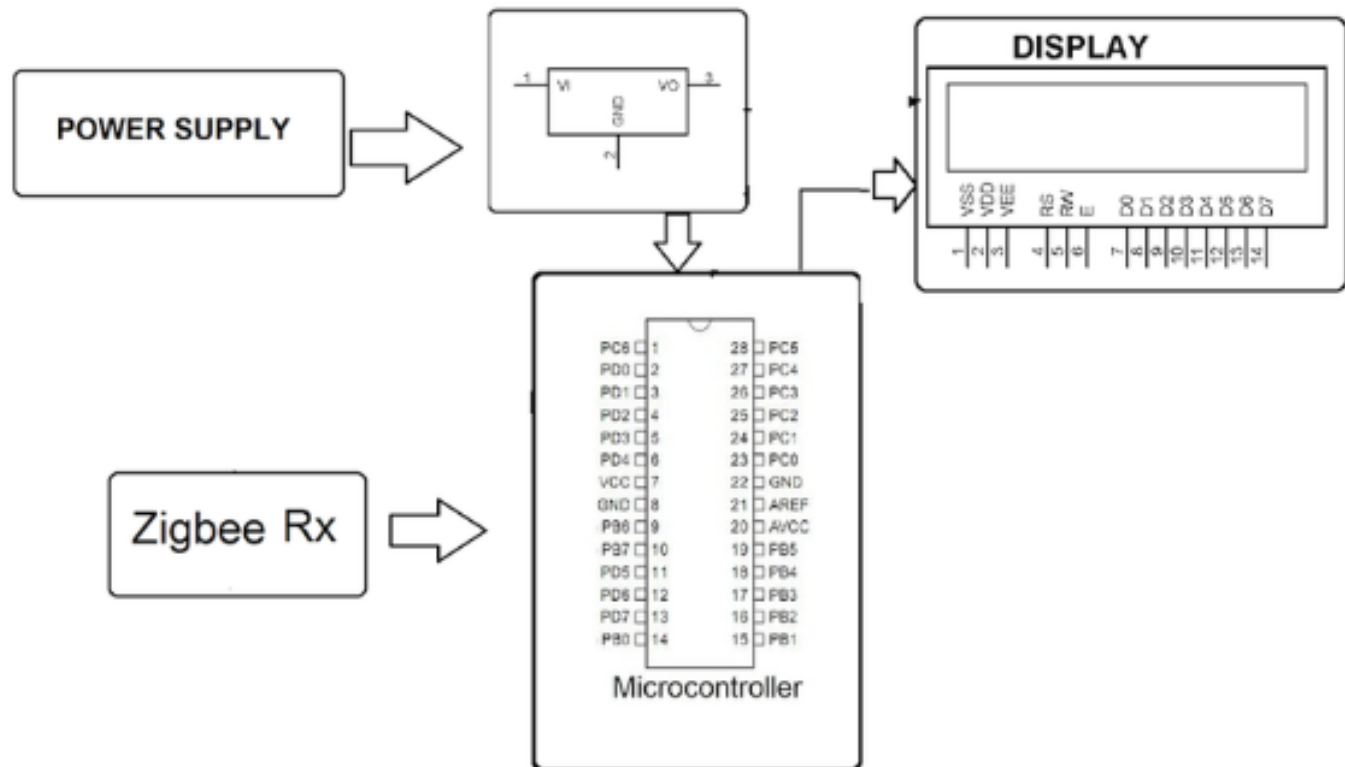
# Transmitter Schematic

Transmitter:



# Receiver Schematic

## Receiver:





# Reset Button



# Energy Storage

- Using lead acid battery.



- We picked lead Acid battery rather than lithium battery because:
  1. Its is cheaper
  2. Good in high and low temperature
  3. Safer.

# Prototype

