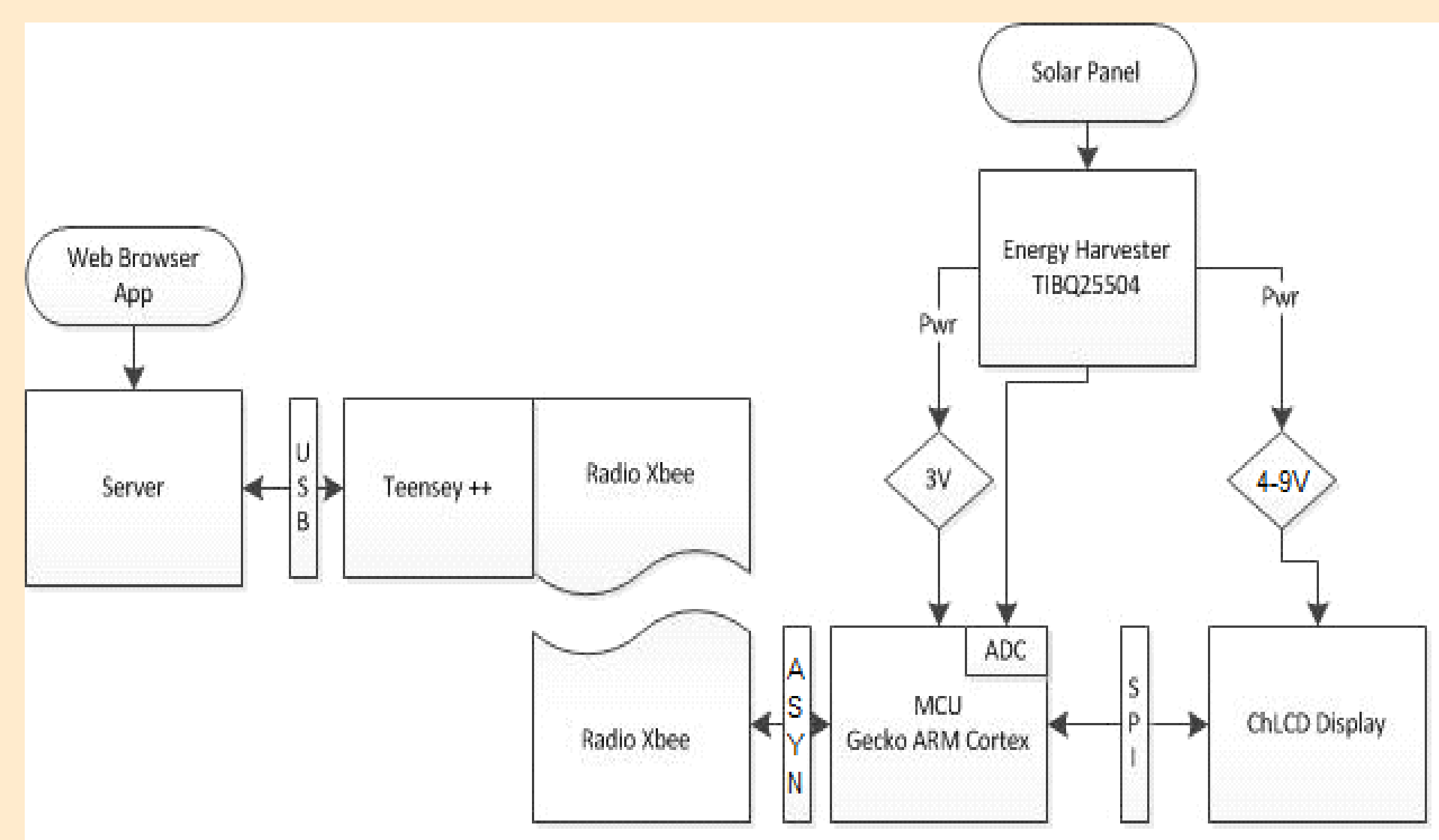


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Introduction

Door displays are used in most businesses and schools to identify room numbers, but are difficult to change and offer little information. What if they could be updated automatically, and be powered completely with indoor solar energy? Such a device would need to consume as little energy as possible, store collected energy for display updates, and know when an update is available.

Design & Components



Functional Diagram



Microcontroller



Cholestric LCD Display
(Low Energy Display)



Xbee 2.4GHz Radio
(Wireless Communication)



Energy Harvester



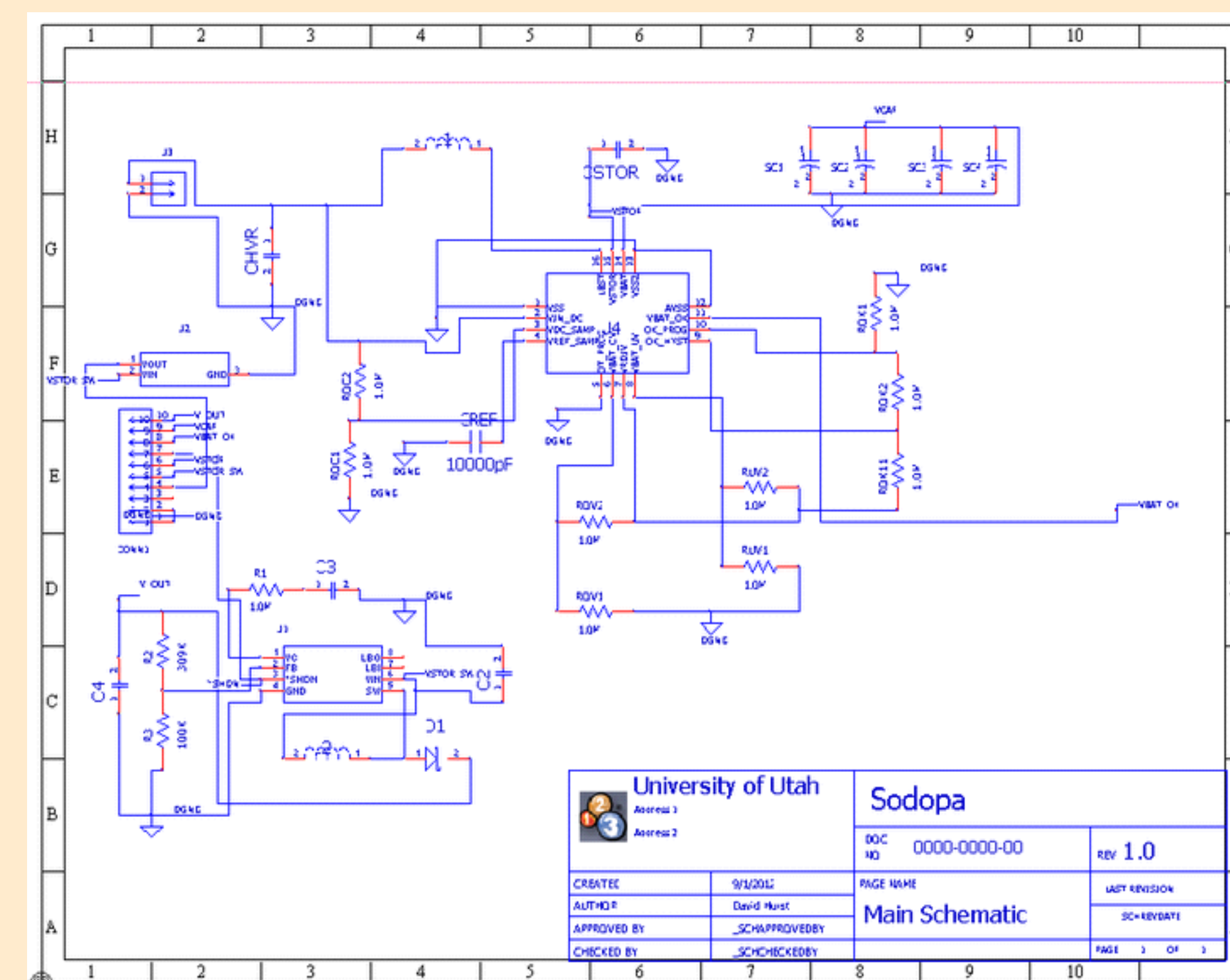
Solar Panel



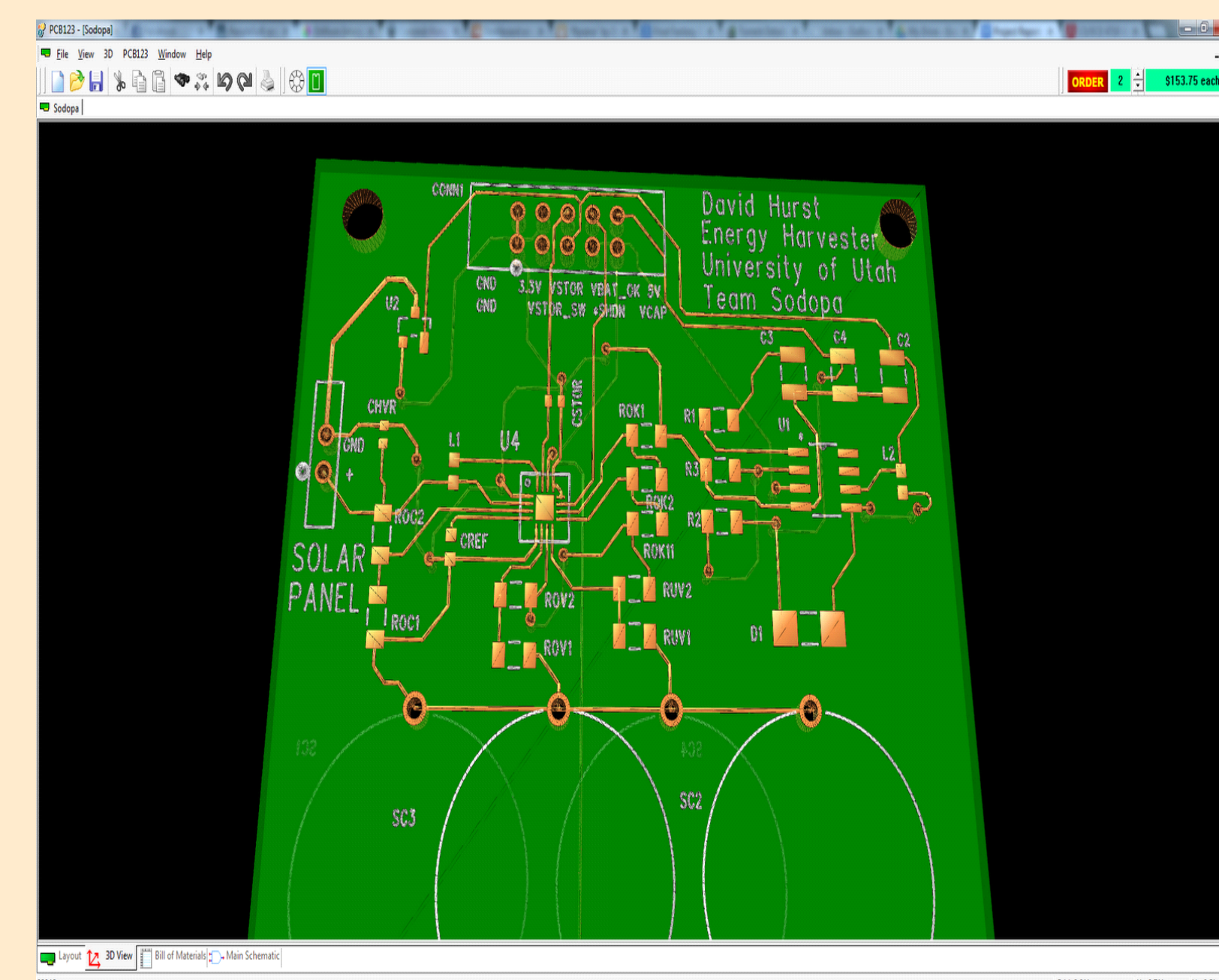
Super Capacitor
(Energy storage)

Energy Harvester

- Collect and store energy from solar panel
- Shut off device if too little energy available
- Maximize energy harvesting rate



Board Schematics



Board Layout

| Row | Part | Description | Component | Package | Ref Des |
|-------|-----------------|----------------------------------|-----------------------|------------------|--|
| 1 | 06034D475KAT2A | CAP CERM 4.7UF 10% 4V XSR 0603 | AVX Corporation | CC0603L | CSTOR, CHVR |
| 2 | LT1308ACS8 | IC DC DC CONV SINGLE CELL 4-S0IC | Linear Technology | S08-P50-A157 | U1 |
| 3 | 12106D476KAT2A | CAP CERM 47UF 10% 6.3V XSR 1210 | AVX Corporation | CC1210N | C2, C3, C4 |
| 4 | 10BQ915 | DIODE SCHOTTKY 15V 1A SMD | Vishay/Semiconductors | DSO-C1X1.3 | D1 |
| 5 | 10073456-0011F | CONN HEADER 10POS DUAL VERT PCB | FCI | CON10_2X5_US_FCI | CONN1 |
| 6 | BRC1608T1R0M | INDUCTOR 1.0UH 850MA 20% SMD | Taiyo Yuden | IND0603_39N_TAI | L1, L2 |
| 7 | 66226-0022LF | CONN PLUG 2POS 2.54MM VERT TIN | FCI | CON2_1X2_U_FCI | U3 |
| 8 | BQ25504 | | TI | SOT758-1 | U4 |
| 9 | CRCW12061 0MNEA | Resistor Shape | Vishay | RC1206N | ROV2, RUV1, ROK1, ROV1, RUV2, ROK2, ROK1, ROC2, ROC1, R2, R3, R1 |
| 10 | LM3480DM3-3.3 | IC 3.3V 100MA LDO VREG SOT23 | National | SOT-23 | U2 |
| 11 | ECJ-1VB1C103K | | Panasonic | CC0603N | CREF |
| Total | | | | | |

Parts List

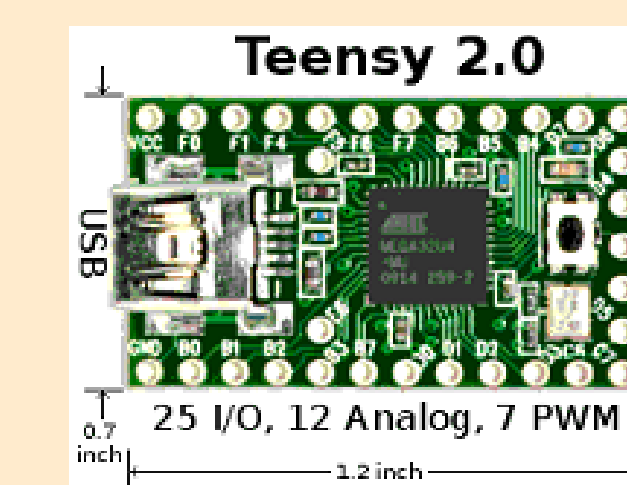
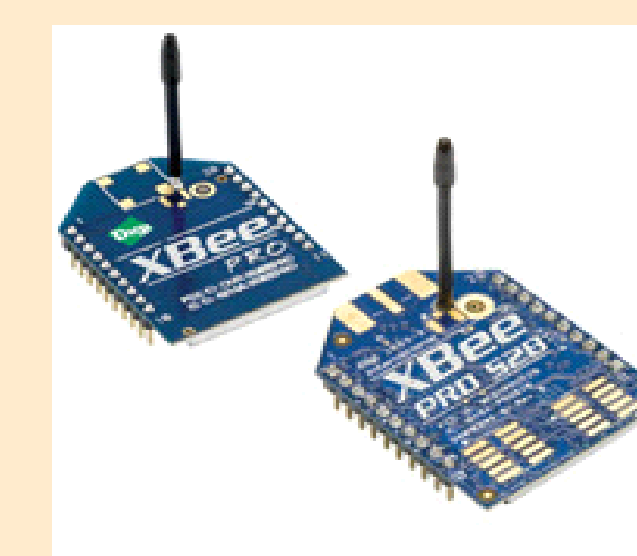
Gecko Micro-controller

- Request display updates from host
- Automatically sleep itself, radio, and display
- Wake up periodically to check for updates
- Write updates to display via SPI interface
- Button to immediately check for updates
- Perform error checking on received packets



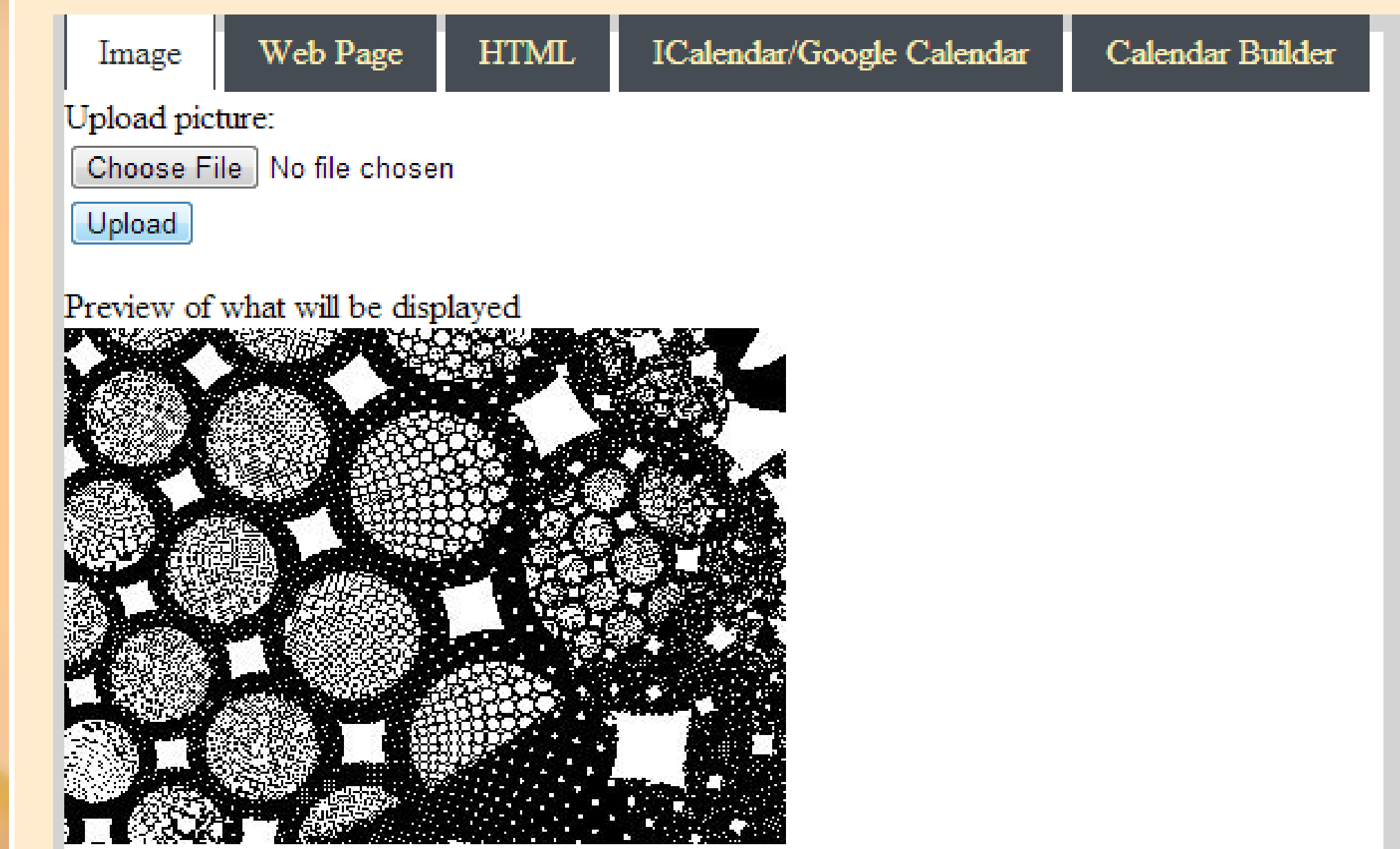
USB Dongle

- Connects to user's computer
- Receives update request wireless
- Sends request on to host computer via USB
- Teensy 2.0 attached to Xbee Radio



Web Interface

- Upload images and schedule updates
- Preview image to be sent
- Automatically parse any HTML web page
- Compatible with any google calendar
- Communicates with USB Dongle to send updates to device



Web interface main page

Results

- Unit stores ~40 Joules of energy
- Charges at the rate of ~1V/hour in Sr. Hardware lab lighting conditions (2ma input from solar panel) with no load
- Charges at half that rate with gecko micro-controller in sleep mode 1 (about 1mA current consumption)
- An update cycle drops the capacitor level by about .5 volts

Special thanks to:

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