In our midterm project we created a proof of concept for using a solar panel to charge a battery and simultaneously sense light levels. For our final, we will build on our previous findings and develop a functional prototype (1.0) for solar-powered Botanicalls.

GOALS:

-devise a "last gasp" method for battery monitoring

-create a circuit to trigger this method

-evaluate solar panels for outdoor lighting

-evaluate solar panels for indoor lighting situations

Calculating Botanicalls Power Consumption

Estimated current draw for Botanicalls:

Radio on: 109mA
Radio off: 15mA

Daily use:

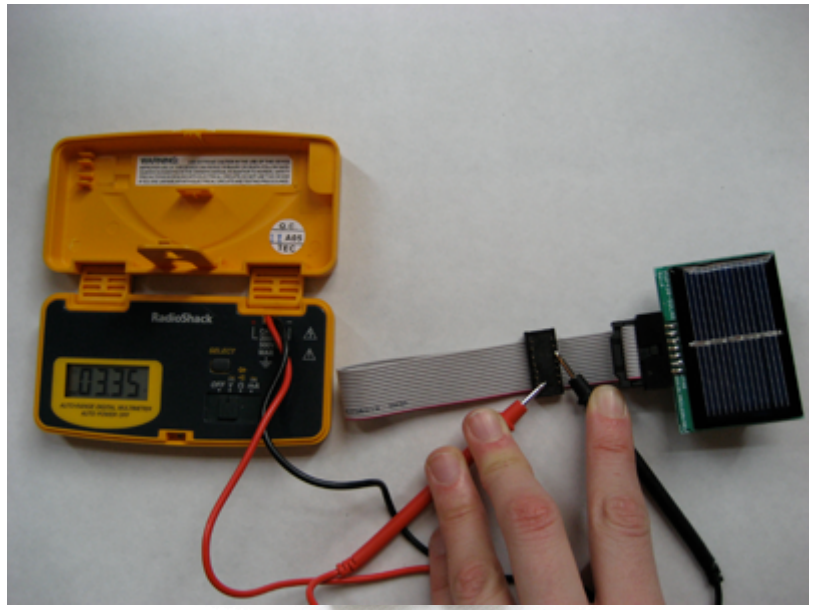
Radios are on for 30 seconds per contact (max)
24 data uploads per day
Average of 4 phone calls in an active day
Max of 30 phone calls per day (!)
So 14 minutes on an average day
...and 27 minutes on a maximum day

24 hours * 60 minutes = 1440 minutes
23.75 @ 15mA = 356mAh
.25 @ 109mA = 27mAh

Average Day = 383mAh @ 5.5V

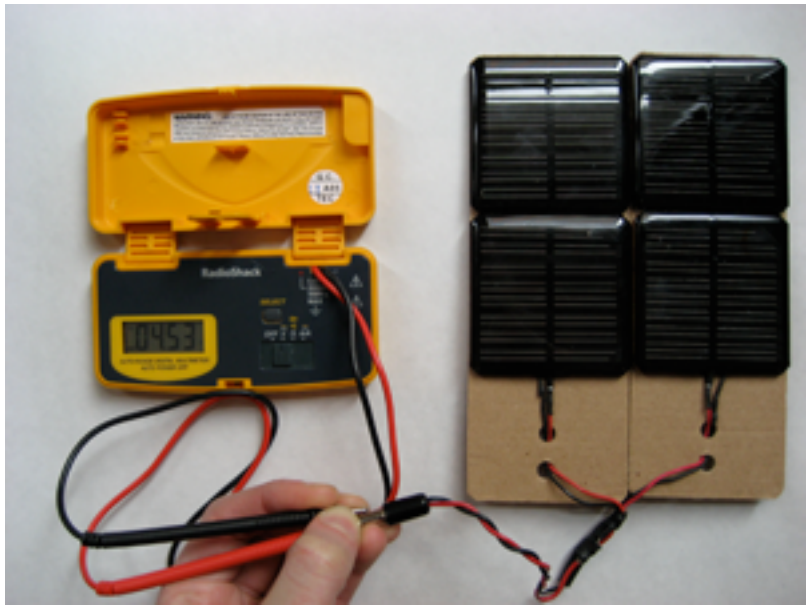
(Max Day = 353 + 55 = 408mAh @ 5.5V)

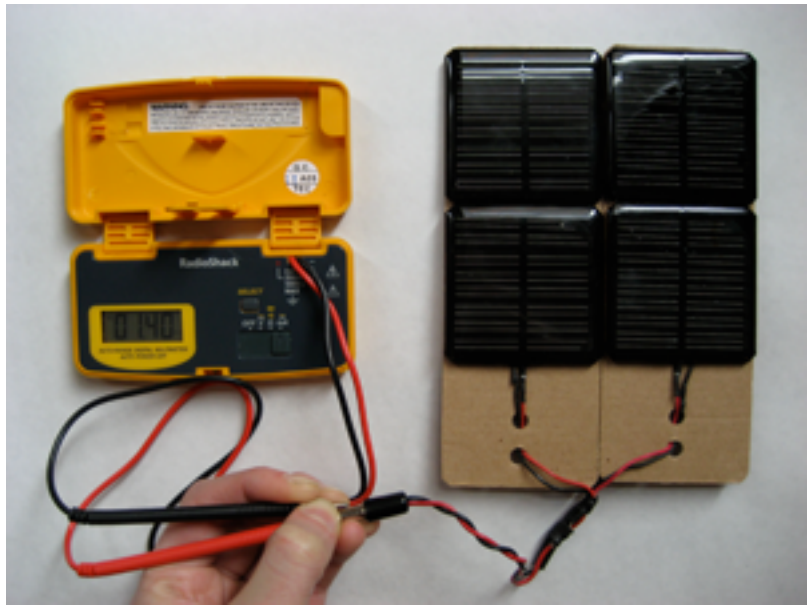
“Little guy”



Source:	Sparkfun
Size:	2.1x1.9”
Panel open circuit voltage:	2.2V
with DC/DC voltage boost:	3.3V
ITP (east windows):	3.35V
Short circuit current:	80mA
ITP (east windows):	?mA

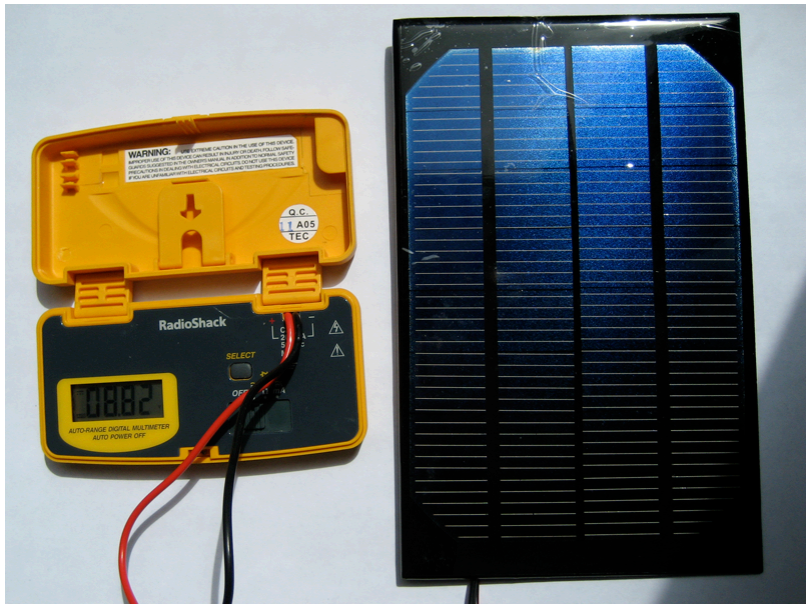
“Grid Guys”

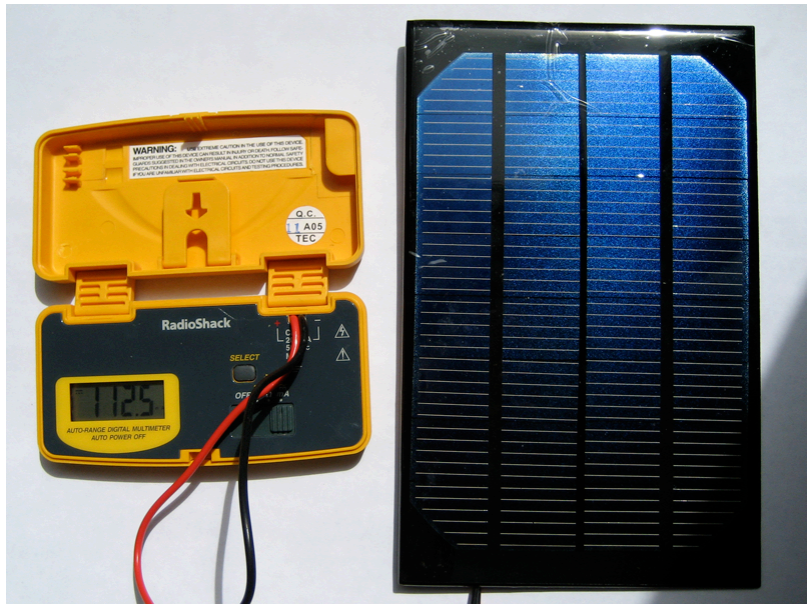




Source:	Sundance Solar
Size:	2x2”
Open circuit voltage:	3.6V each
Grid expected:	7.2V
Grid at ITP:	4.5V
Short circuit current:	50mA each
Grid expected:	100mA
Grid at ITP:	140mA

“Big Dude”





Source:	Sparkfun
Size:	7x4.5”
Open circuit voltage:	8V
Sparkfun (outside):	9.15V
ITP (east windows):	8.82V
Short circuit current:	310mA
Sparkfun (outside):	280mA
Sparkfun (inside):	110mA
ITP (east windows):	112mA

Outdoors:

expectations based upon specs and online calculators

“LITTLE GUY”:

Should produce 40mA at 1.2 Volts (nominal voltage of the rechargeable battery).

Let's say then that we're looking at 25% of that per day, since we're not aiming it at the sun.

Results: 10mAh over an average of circa 10 hours so 100mAh.

This is not enough to keep our system running for more than a few hours. The **small panel won't cut it**.

“BIG DUDE”:

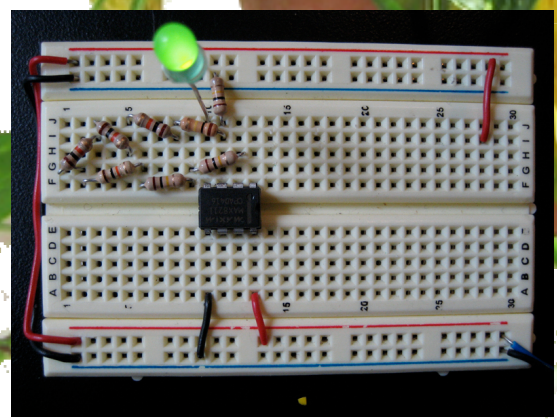
Rated at 8 Volts and 310mA short-circuit. It should produce 182mA at 3.3 Volts.

Again, 25% of that per day, since we're not aiming directly at the sun.

Results: 45mAh over an average of circa 10 hours so 450mAh.

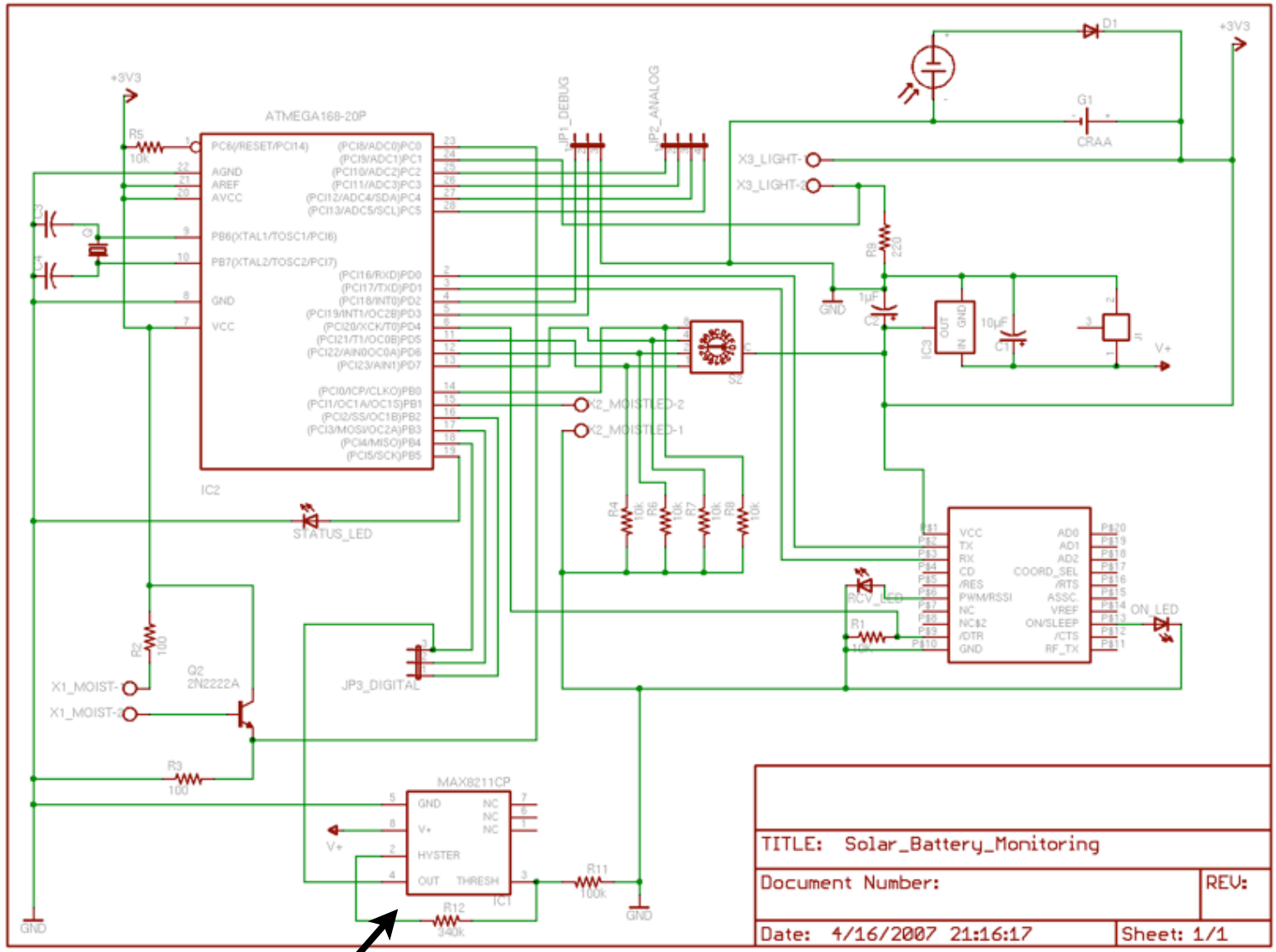
This is just enough to keep our system running. The **big panel will work**, and better if we can aim it towards the sun.

Battery Monitoring

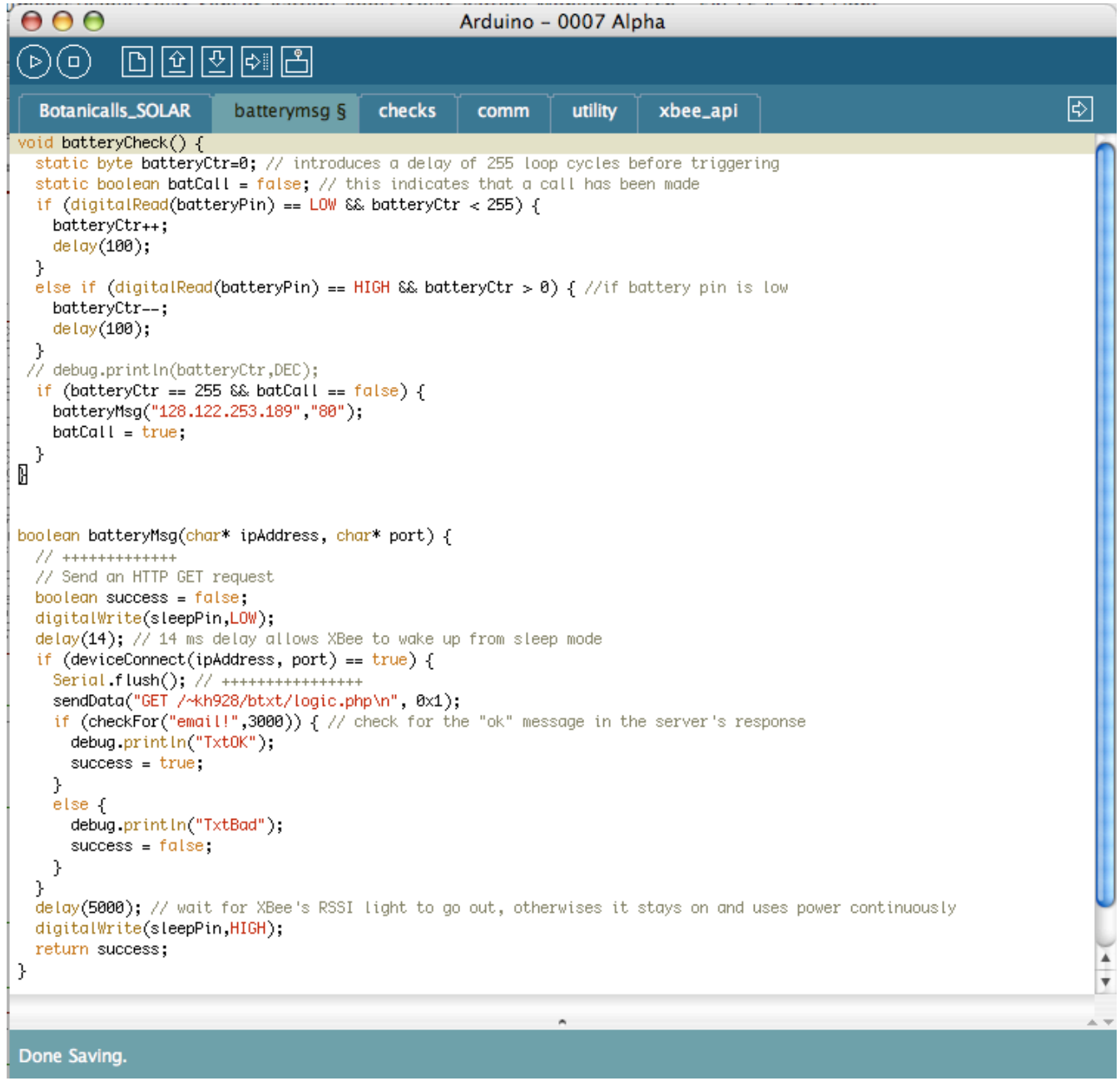


R1 = 100K
R2 = 340K
R3 = N/A

Botanicalls circuit with battery monitoring:



Maxim 8211


Arduino - 0007 Alpha
Botanicalls_SOLAR
batterymsg §
checks
comm
utility
xbee_api
void batteryCheck() {
static byte batteryCtr=0; // introduces a delay of 255 loop cycles before triggering
static boolean batCall = false; // this indicates that a call has been made
if (digitalRead(batteryPin) == LOW && batteryCtr < 255) {
batteryCtr++;
delay(100);
}
else if (digitalRead(batteryPin) == HIGH && batteryCtr > 0) { //if battery pin is low
batteryCtr--;
delay(100);
}
// debug.println(batteryCtr,DEC);
if (batteryCtr == 255 && batCall == false) {
batteryMsg("128.122.253.189","80");
batCall = true;
}
}
boolean batteryMsg(char* ipAddress, char* port) {
// ++++++++++++
// Send an HTTP GET request
boolean success = false;
digitalWrite(sleepPin,LOW);
delay(14); // 14 ms delay allows XBee to wake up from sleep mode
if (deviceConnect(ipAddress, port) == true) {
Serial.flush(); // +++++++++++++++
sendData("GET /~kh928/btxt/logic.php\n", 0x1);
if (checkFor("email!",3000)) { // check for the "ok" message in the server's response
debug.println("TxtOK");
success = true;
}
else {
debug.println("TxtBad");
success = false;
}
}
delay(5000); // wait for XBee's RSSI light to go out, otherwises it stays on and uses power continuously
digitalWrite(sleepPin,HIGH);
return success;
}
Done Saving.

text message

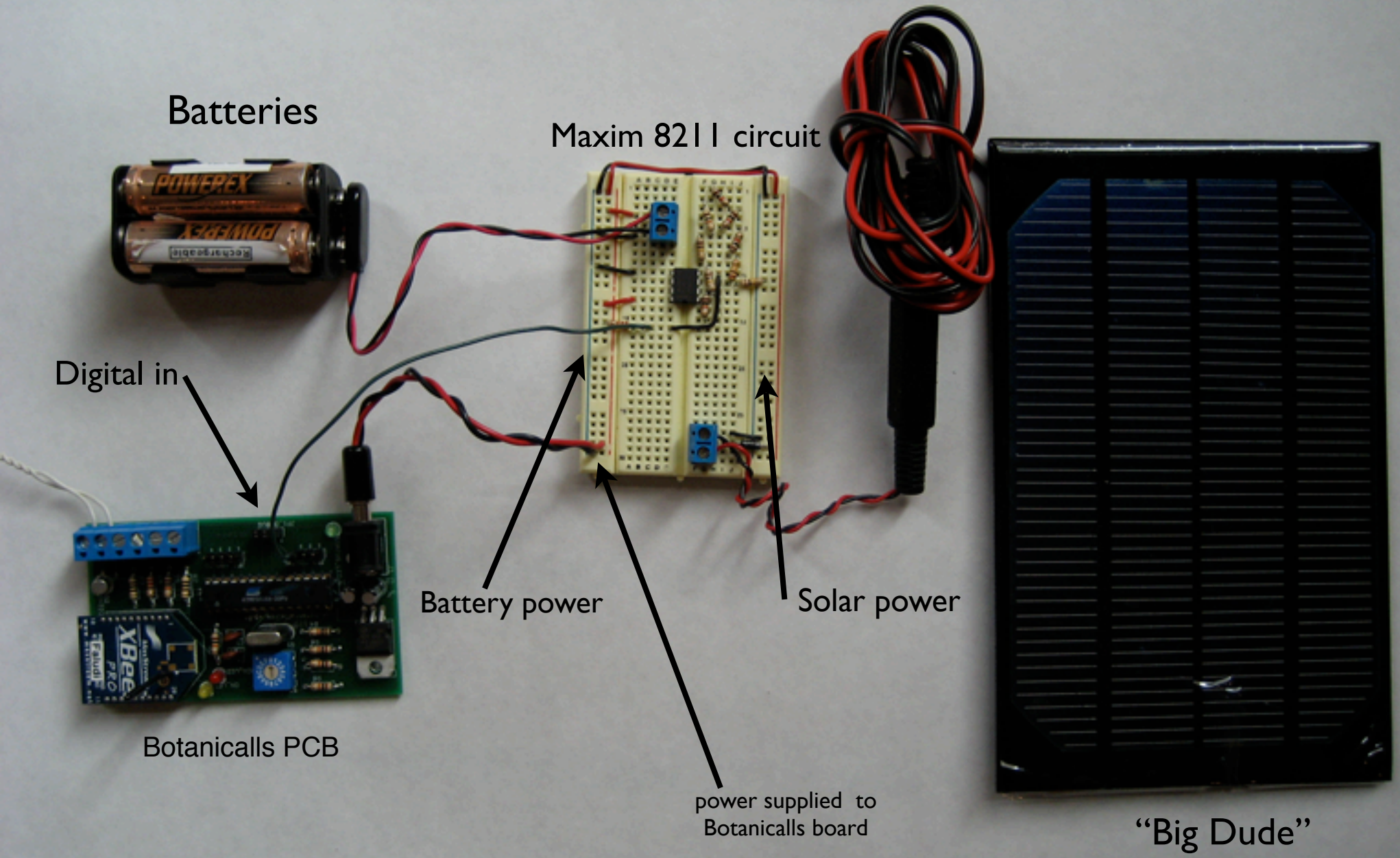
logic.php

Last Saved: 04/16/07 10:17:58 PM
File Path: sftp://kh928:@itp.nyu.edu/public_html/btxt/logic.php

logic.php

```
5
6   if ($send_email == 1)
7   {
8       echo "<h1>We are sending email!</h1><hr>";
9   }
10  else
11  {
12      echo "<h1>We are NOT sending email!</h1><hr>";
13  }
14
15
16  # change these values to fit your own app
17  $your_app_email = "botanicalls@gmail.com";
18  $your_app_name = "Botanicalls";
19
20  /*
21  YOU WOULD HIT THIS SCRIPT FROM...
22  http://itp.nyu.edu/~YOUR_NET_ID_HERE/ubicomp07/logic.php?task=sms&to=MY@EMAIL.COM&from=YOUR@EMAIL.COM&subject=te
23  */
24
25
26  //$from = "rob@faludi.com";
27  $from = "9178417494@vtext.com";
28
29  list($number, $host) = split ('[@]', $from);
30
31  echo "<b>from:</b> " . $from . "<br>";
32
33
34  $message = "The batteries on the English Ivy are low. You should change them soon!";
35
36  shootMail($number, $host, $your_app_name, $your_app_email, $message, $file2send);
37
38  ?>
39
40
41  <?
42  function shootMail($number, $host, $your_app_name, $your_app_email, $message, $file2send)
43  {
44
45      #global $mySql;          #comment this line out if we don't have MySQL running
46      global $number;
47      global $host;
48      global $your_app_name;
49      global $your_app_email;
50      global $message;
51      global $file2send;
52      global $send_email;
53
54      $subject = "";
55
56      echo "<b>Send message:</b><br>";
57      echo "<b>number:</b> " . $number . "<br>";
58      echo "<b>host:</b> " . $host . "<br>";
59      echo "<b>send to:</b> " . $number . "@" . $host . "<br>";
60      echo "<b>from:</b> " . $your_app_name . " (" . $your_app_email . ")<br>";
61      echo "<b>file to send (if any):</b> " . $file2send . "<br>";
62      echo "<b>msg:</b> " . $message . "<br>";
63      echo "<b>msg length:</b> " . strlen($message) . "<br>";
64
65
66
67
68
69      # ----------------------------------------------------------------------
70      # WE ARE NOW USING DIFFERENT SETTINGS FOR ITP vs. NON-ITP
```

WORKING CIRCUIT:



CONCLUSIONS:

-"last gasp" method works & is robust

-8211 circuit works but still offers mystery

-small panels are inappropriate for indoor lighting

-outdoors direct sun can power Botanicalls