

Project Option #2: Solar Survey

Use the Arduino hardware module to perform a solar survey of an area/city of your choosing.

Your team will select the area/city to survey by taking enough data to fully cover the area you've selected. Later you will use this data to create the solar profile of the area you have surveyed.

Task 1: To help the survey process, create a GUI that:

- Displays a map of the area (screenshot from Google maps is OK)
- Allow the user to indicate their location, and the time/date. Store this information.
- After the user has finished recording the location, and time/date, the Arduino hardware should automatically start to perform the trials. Allow the user to reposition the hardware module in between trials. See below for what should be recorded in each trial.

Survey Procedure:

- The number of Arduino hardware units you use will depend on the number of teams signed-up for this project option. This will be announced by the TA.
- Minimum of 10 locations per team member (you will need more if the area is large), and 10 trials per location.
 - Each location should be fairly far apart
 - Example: 10 evenly spaced locations in-between highway 113 (WEST), Mace Blvd (EAST), Covell Blvd (NORTH), and highway 80 (SOUTH) is a good example.
 - 250 data points per trial.
 - Watch out for the orientation of the hardware module.
 - Survey the location at three different times of the day – on the same day.
 - Preferably once in the morning, once in afternoon, and once near sunset.
 - For each trial, perform:
 - Load sweep: sweep the variable resistor 0 from resistance code 0 to 255, while keeping variable resistor 1 at resistance code of 128. Record the voltage at each resistance code.
 - Open circuit voltage sweep: Remove the open circuit jumper. Set both variable resistors to resistance code of 255. Record 256 data points.

Task 2: Finally, after all the data has been collected, write a GUI that displays a color plot on top of the map of the area your team has surveyed. Your GUI should allow the user to:

- Select whether to display the plot using
 - Maximum Power Point: calculate using the data from “Load sweep” trial. For each data value, calculate the power by squaring the data value, then dividing the result by the corresponding resistance value. Calculate the power of all data points. The maximum power point is simply the largest power value.
$$\text{Maximum power point} = \max(\text{data point}^2 / \text{load resistance})$$
 - Open Circuit Voltage

Note: For both plot methods, you will need to interpolate the data at locations where data is not available.