Rugged Outdoor Time Lapse

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Version 1.0

Check for the most recent version of this file at:
https://github.com/vinmarshall/Radio-Shack-Time-Lapse

Instructions:

1. Source Parts

Before you start, you'll need to gather all of the parts needed to build the project. Everything you will need is listed in the ./parts/ordering_BOM file along with the sources.

You may want to outsource the control panel and the printed circuit board. Information about sources for those parts is in the relevant step of the instructions.

2. Circuit Board

The printed circuit board layout for this project can be found in the ./PCB directory.

You can order this PCB from ExpressPCB (www.expresspcb.com – 3 for $75 or $51, with or without the silkscreen and soldermask), or from me (vlm@2552.com - $30 with silkscreen and soldermask).

If you'd like to make the circuit board yourself, you can etch one on your own – with just a couple of wire jumpers on the top side, this could be a one sided layout – or you can do point to point wiring. I designed the PCB to have the same mounting hole pattern as Radio Shack p/n 276-168.

However you choose to make the circuit board, you'll use the ./parts/circuit_board_BOM and the ./PCB/pcb_components.bmp files to locate components on the board.

Solder everything in place, being careful to avoid solder bridges and cold joints. Attach heat sinks to the two voltage regulator ICs.

Test the board in the next step, after connecting the front panel controls.

3. Front Panel

The ./front_panel/rs_time_lapse.fpd file is a panel you can order from Front Panel Express (www.frontpanelexpress.com). A DXF of the panel dimensions is also included in that directory if you'd like to make it yourself or take it to a local shop.

The controls and indicators in the front panel need to have leads attached that will connect them to the circuit board. Refer to the pictures in ./images/panel and pay attention to the position of the leads in the plastic connector body. You will be aligning pin #1 of these connectors (see the arrow in

./images/panel/jumper.jpg) with the corresponding header pin #1 on the circuit board (see the square pads in ./images/panel/pins.jpg).

Test the voltage regulation section of the circuit at this point. Connect the power switch and the power indicator LED from the front panel to the circuit board. Then connect the battery. Pay attention to the correct polarity when making the battery and LED connections. Using a multimeter, verify that regulator U1 is putting out 5V and regulator U2 is putting out 4.2V.

4. Arduino

If you don't already have it, download the Arduino software from http://www.arduino.cc/.

Open the Arduino software and connect the Arduino to your computer via USB. Under the "Tools" drop down menu, select your board type (Arduino UNO for this project) and serial port (/dev/tty.usbmodem***). Open the time_lapse_code.pde file and download the program to the Arduino.

If you have any problems with connecting and programming the Arduino, consult the help available in the Arduino forums at http://arduino.cc/forum/.

Once the Arduino has been successfully programmed, disconnect it from the computer and attach it to the circuit board using the #4-40 nylon standoffs with the USB port facing away from the voltage regulator ICs. Arduino headers connect to the J3, J4, J5, and J6 header pins on the circuit board.

5. Attach The Circuit Board

The circuit board attaches to the back of the control panel with four long #6-32 hex standoffs and eight #6-32 machine screws. Mount the circuit board so that the Arduino is toward the control panel and the components on the PCB are pointing away.

Connect all of the jumpers from the front panel LEDs and controls to the headers on the PCB. The ./PCB/components.bmp image shows where to connect each lead. Align pin #1 on the jumpers (arrow) with pin #1 on the circuit board (square pad).

6. Prepare The Pelican Case

The camera, battery, solar panel port, porthole window, and a support for the control panel have to be mounted in the pelican case.

To install the "panel frame" that supports the control panel, follow the instructions that came with it.

Refer to the pictures in ./images/pelican for mounting the rest of the components. The exact placement is not crucial, other than ensuring that the camera lines up with the porthole when it has the lens out. That clearance is tight and you'll have to pay attention to getting it right or the porthole will interfere with the lens opening.

Seal the mounting holes with RTV except for the big one for the porthole, which comes with it's own gasket. Use 3M DP-8010 epoxy to attach the hold downs for the battery. Let the epoxy cure for at least 8 hours before installing the battery.

7. Other Wiring

Use the pictures in ./images/wiring to wire the solar power and battery connections and the daylight sensing photocell. Polarity matters for the battery connections. Use the smallest photoresistor in the Radio Shack assortment. Glue it into place in the porthole such that it will not interfere with the opening of the camera lens.

8. Mount the SD Card Extension

Bend a scrap of aluminum or cut a section of aluminum angle to make a mounting tab for the extended SD card socket. Glue the SD card socket onto this tab.

Then position the socket so that the SD card fits through the slot in the front panel and transfer the mounting holes from the front panel onto the SD card socket's mounting tab. Drill the holes and mount the SD card socket to the front panel.

9. Modify The Camera

The camera needs to be modified so that the Arduino can take control of the power and shutter buttons. Modifying the camera is, by far, the most difficult part of this project. You will probably first want to practice this procedure a few times on cameras that you didn't just spend over $100 on. You can easily destroy the camera with this step if you are not careful.

WARNING:

While working with the camera, be extremely careful not to shock yourself with the flash capacitor. It hurts. Especially the second time.

Avoid contact with any leads or wiring connected to the large capacitor in the front right of the camera. Some of it's wiring is close to the power and shutter buttons that you will be modifying. Identify where these leads are before you start the modifications.

Refer to the pictures in ./images/camera for details on this process:

1. Remove the 4 external screws.
2. Carefully pry off the back cover.
3. Carefully pry off the front cover. It flips up, with a tab between the power and shutter buttons retaining it.
4. Pop off the cover holding the shutter and power buttons and remove those buttons to create openings for the wires to pass through. Drill a hole through where the shutter button was to create extra clearance.
5. Cut the end off of a 2 wire jumper, strip and tin the wires, and solder it on top of the (very

small) leads for the power button. Refer to the pictures for which leads to piggyback on. Visually inspect this through a magnifying glass to make sure that you didn't bridge the solder onto another trace or onto the body of the original switch. Test the camera after doing this. With a battery in the camera, you should now be able turn the camera on by briefly shorting the two wires in the jumper together. Go back and try again if it didn't work.

6. Repeat step 5 for the shutter button. Refer to the pictures.
7. Fix the leads in hot glue or epoxy to keep them from getting pulled off of their connections. When potting these leads, keep in mind where the cover will fit and how little space is available.
8. Fish the jumpers through their respective holes in the plastic button cover that you removed in step 4 and reinstall it.
9. Reverse steps 1 through 3 to put the camera back together. Verify that the camera still works by turning on the power and shooting a picture using the new leads. Go back and try again if it doesn't.
10. Attach a jumper to a photoresistor as you did for the daylight sensor and glue that sensor to the screen on the back of the camera.
11. Use a cable clamp to secure all of the leads.
12. Replace the camera battery with the battery adapter from the AC power kit.

10. Put It All Together

Put the camera on the mount, making sure the lens still clears the porthole. Plug in the SD card extension cable and the power cable. Plug the 3 sets of leads from the camera onto their respective headers on the circuit board.

Turn the power switch off. Connect the leads from the battery to the screw terminals (J1) on the circuit board. Take a minute to double check all of your wiring.

Install the front panel into the Pelican case.

Turn the enable switch off. Set the interval knob all the way to the right. Cross fingers. Turn the power switch on. The power light should come on. If you are in daylight or a bright room, the “daylight” light on the panel should also come on. If it isn't on, make sure there is sufficient ambient light.

With the power and daylight lights on, flip the enable switch to on. After about 5 seconds, the green status light should come on and remain on for about 5 seconds while the camera powers up and shoots a picture.

You can adjust the range of the available time intervals. See the Arduino code for more details.

11. Operating Instructions

The interval between pictures is set by the interval knob on the front panel. Turning the knob to the right takes pictures more frequently. The time lapse will not shoot pictures unless there is daylight and

the enable switch is on.

Insert an SD card before turning on the camera. When you need to change SD cards, turn the enable switch off and wait for the camera to power down. You can verify this by looking through the porthole to confirm that the lens is retracted. After swapping SD cards, you can turn the enable switch back on and operation will resume as normal.

Turn the enable switch off and allow the camera to power down before turning off the main power switch.