Setup Step 1.2
Traffic Light assembly

The following Issues Were Spotted on the Traffic Lights:

1) The LED cables need to be longer
   It would be better to order longer cables for connection instead of joining smaller ones.

2) The traffic lights are not fully stable.
   The traffic lights are still wobbly even after placing the base plate below the tiles. The double sided tape will work if the surface below the tile is rigid. In 226 the carpet below the tiles lift when attached with double sided tape and makes the assembly woobly.

3) The led lights need to be covered to make them visible only from front side.
   One traffic light has been tested with rubber tubing on led lights. The holes were increased to fit the tubing. The setup needs to be evaluated

4) The LED lights have to be 8 inch from the tiles to be visible by robots. So, the light box should be hung from the horizontal frame.
   A test configuration is shown in a traffic light assembly in 226. Two new holes were made on top diagonal corners. A aluminum string is used to suspend the box from the frame. The setup needs to be evaluated
The traffic light is composed of the following items:

1 x 4” x 6” x 1/4” base plate
2 x 18” length 1” T-slot aluminum
4 x T-slot aluminum right angle bracket
1 x 3” PVC cube
8 taller nylon standoffs
4 short nylon screws
4 nylon nuts
1 x Raspberry Pi
1 x Micro SD card with Duckietown image
1 x PiCam fisheye camera
1 x camera mount
1 x bottom half raspberry pi case
1 x 16-channel PWM/Servo HAT
1 x RPi 2 LSD board
4 x LEDs
1 x battery
1 x USB to micro-usb cable
1 x usb to barrel cable
jumper cables
various cable ties

Assembled traffic light:
1. **Construct Traffic Light Structure**

**Side:**

- 18" T-Slot

**Top:**

- 6" Aluminum Plate

T-Slot aluminum assembled using right angle brackets and included hardware. Vertical (15") T-slot piece is attached to base plate using bolt from bracket and tapped hole. A washer will need to be placed under bolt head to limit bolt projection from underside of base plate.
2. Traffic Light Cube

[Diagram showing dimensions and parts of the traffic light cube]

- 0.75" space
- 1.5" space
- 0.5" vertical space
- 0.15" circle
- 0.397" circle

[Diagram showing 3" by 3" cube with 18" T-Slot and Zip Tie]
Thin-walled PVC cubes have holes pre-drilled. The 4 x 0.397” holes in the cube faces are for mounting LEDs. The 4 x 0.15” holes are for attaching cube to the 18” T-slot piece using zip ties.
3. Assemble Pi and Hats

Assemble the Raspberry Pi and Hats according to the Duckiebot assembly instructions. Stack the boards:

1. Screw the first four standoffs into the Pi and secure on bottom with nuts. Make sure to plug in camera.

2. Stack the 16-channel PWM/Servo HAT onto Raspberry Pi, both sets of GPIO pins over each other and screw the standoffs to secure it. ****Note that when assembling a car, the DC Motor Hat goes between the Pi and the PWM hat. For a traffic light, the DC Motor Hat is not needed and will be omitted.****
3. Stack the RPi 2 LSD board onto the PWM/Servo HAT, both sets of GPIO pins over each other and screw the standoffs to secure it. **Note that for the traffic light, the finished stack will be three layers: 1. Pi, 2. PWM Hat, 3. RPi2 LSD Board**
Mount Pi and stacked hats into the modified Pi case. Secure in case with double-sided tape. Attach Pi case to right angle bracket with zip ties (place zip ties through holes in case before securing Pi with tape).
4. Mount Camera on Traffic Light Vertical

Mount pi camera to right angle bracket using zip ties
5. Assemble and Position LEDs

Follow the instructions at Setup Step 5.0 LED Car Setup and test.

Hot glue LEDs into the holes in the PVC cube and secure wires with Zip Ties

6. Mount Battery and Power Cables

Battery should be attached alongside vertical T-slot aluminum using zip ties. Battery provides counterweight to cantilevered light. Using usb-micro usb cable and usb-barrel cable to power Pi and hats.
7. Setup Software of Pi and Laptop

The traffic lights are basically a car without the chassis and actuators. The Pi and hats are the same as the car, and they will be run using the same software. To setup the Pi and make sure
that you can connect via wifi and ssh, follow the directions here: Setup Step 2: From SD Image to Remote Control and Setup Step 2.1 Joystick + camera output in remote laptop.

After following the instructions from the two documents above, you should be able to ssh into the traffic light’s Pi without the need for a password and remote roslaunch.

The Pi camera on the traffic light can be used to view the intersection in real time using RViz.

laptop $roslaunch duckietown camera.launch veh:=mercedes