Writeup for Highway Driving Project

Variables Explanation

- too_longer: I use this variable to mark if ego car decelerates for too long. If so it may be because this lane is too crowded or the car in front of it moves so slowly. If it reaches 40, then ego car should try another lane if lane change is safe right now.(declare in line 200)
- change_left: to mark if it is safe to change to left lane. (declare in line 239)
- change_right: to mark if it is safe to change to right lane. (declare in line 240)

How do I do this:

Most of my code is the same as what we talked about in "Project Q&A" section. But I add some code to tell the car when to change lane.

```
260                 if((d<(2+4*(lane+1)+2))&&(d>(2+4*(lane+1)-2))){
261                    double vx=sensor_fusion[i][3];
262                    double vy=sensor_fusion[i][4];
263                    double check_speed=sqrt(vx*vx+vy*vy);
264                    double check_car_s=sensor_fusion[i][5];
265                    check_car_s+=(double)prev_size*0.02*check_speed;
266                   if((check_car_s>car_s)&&((check_car_s-car_s)<35))
267                      change_right=false;
268                   if((check_car_s<car_s)&&((car_s-check_car_s)<35))
269                      change_right=false;
270                 }
```

Image1

I used code in image1 to determine if it is safe to change lane by checking if there is a 70(front 35+ rear 35)m gap next to the current lane. Code in image1 is checking the lane on the right of ego lane. How to check lane on the left of ego lane is nearly the same. 35 is determined by trying, I tried 25 and ego car runs into another car, 35 seems to work well.

```
241                 if(lane==0)
242                    change_left=false;
243                 if(lane==2)
244                    change_right=false;
```

Image2

Code in image 2 to check if ego lane is on the side of the road, if current lane is outermost lane, then ego car can not change to right lane.

```
284            if(too_close){
285             ref_vel-=0.224;
286               too_longer+=1;
287               if(change_left&&(too_longer>40)){
288                  too_longer=0;
289                  lane-=1;}
290               else if(change_right&&(too_longer>40)){
291                  lane+=1;
292                  too_longer=0;}
293
294            }
295            else if(ref_vel<49.5){
296                 ref_vel+=0.224;
297
298             }
```

Image3

Code in image3 is to determine whether to change lane or not. At first I checked data from sensor fusion to see if ego car is too close to the car in front of it. If so ego car need to slow down. And I add one to too_longer, it help the car remember how many times it decelerate, if too_longer reaches to 40, then this lane may be too crowded or the car in front of ego car drives too slowly, so better try another lane.

If too_longer is set above 40, let's say 100, ego car may seem "trapped" behind a slow vehicle for too long. If too_longer is set below 40, let's say 10, ego car seems too impatient, 40 works fine in this project.