Trajectory Tracking and Accident Warning of Dangerous Vehicles on the Highway

马莹莹、高德超、王邦铮、刘学渊、刘莹

Northeastern University, Shenyang, Liaoning, China

Introduction

"两客一危车辆" refer to tourist chartered, long-distance passenger vehicles and road-specific vehicles that transport dangerous chemicals, fireworks and firecrackers, and civilian explosives.

In recent years, with the rapid development of freeway, the traffic volume has increased rapidly, and the number of traffic accidents caused by hazardous chemicals has increased, which has brought great negative impacts on the society and seriously threatened people's personal safety.

At present, the domestic highway management department cannot know the specific driving trajectory of the vehicle on the freeway, and cannot effectively prevent possible accident. It is also difficult to find and warn immediately when an accident occurs.

Aim

We hope to collect and analyze information such as images, sounds, road conditions, and weather conditions, track the trajectories of dangerous vehicles on the freeway, and combine more information to prevent accidents. This will increase the ability of the freeway management department to monitor the dangerous vehicle, reduce the frequency of accidents, and improve highway traffic safety.

Method

- Collect video and sound of vehicles traveling on fixed but different locations on the highway
- Identify dangerous vehicles from the video and get vehicle pictures
- Get the characteristics of the dangerous vehicle from the picture and upload it to the server
- The server finds the vehicle from the database based on the feature, adding location and time to the recorded trajectory
- Analyze the trajectory to determine possible problems
- Directly judge the accident based on video and audio
- After the accident is identified, a warning is issued to the vehicle behind the accident section

We use the Raspberry Pi to collect video and sound. In addition to the computing power, the Raspberry Pi has a wealth of external devices that can be added to complete the functions we need for acquisition, processing, uploading, and warning. It is also relatively inexpensive.

Target recognition algorithm captures dangerous vehicle pictures from video

A classification algorithm is run to obtain the characteristics of the vehicle. When we determined the vehicle kind, we used the inception-v3 model for migration learning, and obtained a classifier with high accuracy. The vehicles can be divided into "coach", "truck" and "Hazardous chemicals vehicle". We have now adopted its color and kind as features, and features such as size and pattern will be adopted after the accuracy is high enough.

The server generates trajectories based on feature and logic analysis.

The track contains a lot of information, such as: If a car stays for a long time on a section without a service area, it may not be normal.

Of course, there are many information that can be obtained directly from the sensor. For example, if the sound suddenly becomes large at a certain moment, it may be a collision or an explosion. If the flame sensor responds, there must be an accident.

If an accident occurs in front, the buzzer and led light will give an indication to avoid the occurrence of a secondary accident.

Stage results and future expectations

We have now completed the construction of the overall system. This system includes the edge side and the server side.

The Raspberry Pi is the edge side of the system. Its current job is to capture and process data, capture video through the Raspberry Pi camera, and listen to audio on the microphone. We installed a 64-bit debian9 system for Raspberry and configured tensorflow.

We have completed the three functions of target capture, color acquisition and kind acquisition. They run on the Raspberry Pi, allowing us to get the characteristics of every dangerous vehicle captured by the Raspberry Pi.

The server side can accept the features sent by the Raspberry Pi and generate a vehicle driving track to display on the page.
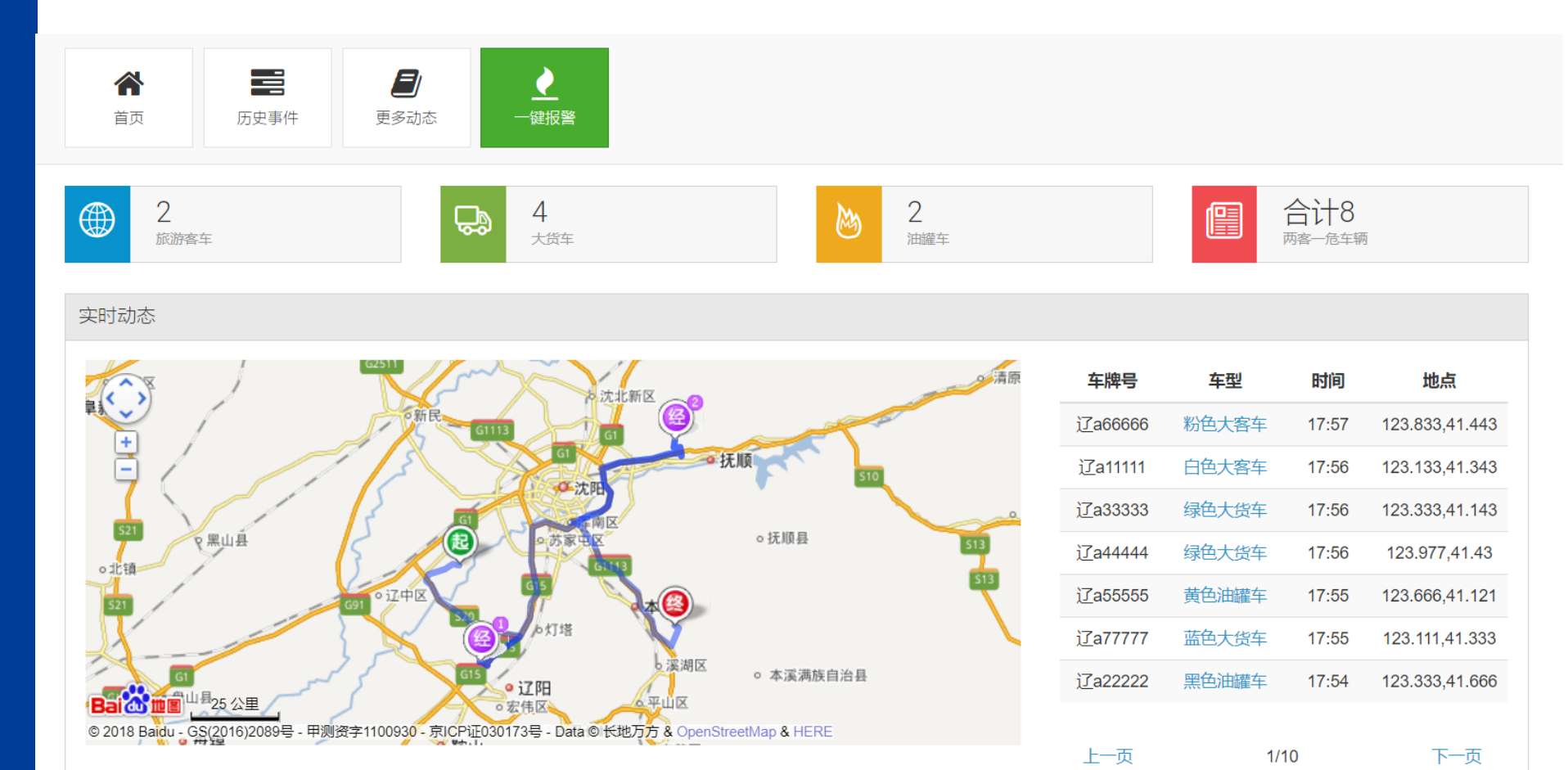
This is our front page

Acknowledgements

Thanks to the work of teammates, they have spent a lot of time and energy on this project. Thanks to the guidance of Teacher Guo Jun, he gave us many guidelines. Thanks to the equipment provided by the Academy for our experiments.