Team 18: Final Project Design

Fan Ye, Guanyu Li, Hanwen Jia, Hidalgo Danie, Xingjian Ding

Project Name

Drone parking lot management system

Project Synopsis

Our software can automatically analyze and identify vehicle information by transmitting images through drones and process them accordingly.

Project Description

• Why is the project being undertaken?

The project was inspired by everyday life. Conducive to drones to deal with complex traffic environments and unexpected situations, saving manpower and improving efficiency.

• Describe an opportunity or problem that the project is to address.

In our daily life, our software is very practical. For example, the school has a lot of parking lots, but there are restrictions on the permit. Every day, the school's management vehicles must travel throughout the campus to inquire about illegal vehicles. This work can be perfectly replaced by our software. Conducive to the identification of the license plate for the drone and return to the database for comparison, reducing a work that may take hours to a few minutes

• What will be the end result of the project?

This system will be a combination with the drone. In addition to the license plate check, our software can also dredge traffic through the speaker and laser

Project Milestones

<u>First semester</u>

● focus on software

- ○ Estimated completion date: whole semester
- design a software which can find out car plate number from a picture
  - ○ Estimated completion date: 12/1/2019
- test and make sure this software is worked and user friendly
  - ○ Estimated completion date: 12/31/2019

<u>Second semester</u>

- related our software to drone
  - ○ Estimated completion date: 1/31/2020
- test our drone with software
  - ○ Estimated completion date: 2/29/2020
- figure out the issue from test
  - ○ Estimated completion date: 3/31/2020

Project Budget

• Hardware, software, and/or computing resources

A drone with a high-resolution camera and a certain load capacity, and software for the drone (depending on which brand of drone is used)

• Estimated cost

$500-2000

• Vendor

DJI

• Special training (e.g., VR)

Machine learning training.

• When they will be required

In the spring semester , 2020.

Work Plan

• Who will do what

Fan Ye, Guanyu Li will focus on the development of mobile software.

Hanwen Jia,and Fan ye will working on the drone functioning

Hidalgo Daniel, Xingjian Ding will focus on the development and design of the PC software and database management.

Everyone has to do researching and working on the image recognition and machine learning.

Gantt Charts

Task ID	Work Breakdown Structure	Planned Start	Planned Finish	Progress
1	Discuss the project topic & idea	2019/09/27	2019/11/3	done
2	Project requirements defined	2019/10/04	2019/11/10	done
3	Image recognition research	2019/10/11	2019/10/18	done
4	Discussing Initial desgin	2019/10/18	2019/10/24	done
5	Divide work build front-end implementation	2019/10/25	2019/10/31	in progress
6	Free work	2019/11/01	2019/11/07	plan
7	Team meeting for Report current progress	2019/11/08	2019/11/14	plan
8	Start the license plate recognition section	2019/11/15	2019/11/21	plan
9	Start the license plate recognition section	2019/11/22	2019/11/28	plan
10	Issure reporting	2019/11/29	2019/12/07	plan

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10	Issure reporting

Date	Task	Status			Name
2019-9-30	Discuss the project topic & idea	Completed			Fan Ye
2019-10-7	Project requirements defined	Completed			Hanwen Jia
2019-10-14	Image recognition research	Completed			Edmundo Daniel Hidalgo
2019-10-21	Discussing initial desgin	Completed			
2019-10-28	Divide work build front-end implementation	Completed			
2019-11-4	Free work	Completed			
2019-11-11	Team meeting - Reporting current progress	Completed			
2019-11-18	Test drone and test the angle and height	In-progress			
2019-11-25	Test license plate detection algorithms	In-progress	*		
2019-12-2	Test refined license plate detection algorithms	Planned			
2019-12-6	Submit team status report	In-progress			
2019-12-9	Begin Optical Character Recognition (OCR) training and testing	In-progress			
2019-12-16	Finals Week	Planned			
2019-12-23	Winter Break	Planned	*		
2019-12-30	Winter Break	Planned	*		
2020-1-6	Winter Break	Planned	*		
2020-1-13	Team online meeting for planning interface design(canceled)	Planned	*		
2020-1-20	Team meating about UI implementation (delayed by missing group memmber)	Planned	*		
2020-1-27	working on demo	changed	*		
2020-2-3	working on demo	changed	*		
2020-2-10	testing the video streaming through dron.	changed	*		
2020-2-17	Discussing UI design	changed			
2020-2-24	Test the version in real situation	Planned			
2020-3-2	Test duplicate vehicle detection	Planned	*		
2020-3-9	Test whole project without UI ,	Planned			
2020-3-16	collect the issue we have and finding solution (if not, keep woking on UI.	planned			
2020-3-23	UI implementation	planned			
2020-3-30	Deadline for UI implementaion	planned			
2020-4-6	Final test of the project	planned			
2020-4-13	Fix and deal with bugs	planned			
2020-4-20	In planning	In planning			

Preliminary Project Design

License Plate Detection

How the software works

Our project using drone to determine the license plate around the parking lot and help school to find those cars without permit. it divided into two main sections, the automatic control of the drone and the identification of the license plate.

Our project logic is we controlling the drone and designing a standard route for the drone. Let the drone fly around the parking lot between a certain time inteval. The drone upload the pictures to the computer which running our software. Next part is about software. The software pick up the licence plates from picture and compare with the database school has. The we can get the car without permit. The final part is send email to those people who do not has the permit and park at wrong place.

Design Constraints - Technical Constraints
- LibrariesImages of the patrol area are taken… DECIDE HOW
- Image processing techniques are used to remove unnecessary details from taken images in order to reduce them to just reduce the overall computational complexity
- Optical character recognition (OCR) is then used to read license plates, with regular expressions being used to filter out invalid text (such as bumper stickers and partial results)
- License plates are then compared against a local database containing vehicles registered for parking, and license plates that are not found in the database are tagged for possible violation
- License plates tagged as being in violation are saved in the drone's storage and encrypted in order to prevent privacy issues

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  - Computer Vision: OpenCV is an open source library that works on a wide range of CPU architectures. This allows for prototyping and development on non-target platform with rapid porting to…
  - Computation: NumPy offers Python bindings to
- Language
  - OpenCV has native Python and C++ bindings which allow for an extreme amount of flexibility. There is no single answer for language because performance considerations will dictate…
  - Python comes with support for a wide range of modules that offer more core functionality than what is found in C++. Python's popularity... Our choice of Python and C++
  - C++ will act as a fall back language meant only for the most…
- Operating system or platforms supported
  - Our program has no platform restrictions, but the drone API can only be developed through the SDK tool of the IOS platform.

Design Constraints - Business Constraints
- Schedule -
  - As a senior design, the project's launch time will be at the end of next spring semester.
  - In this semester we will focus on and deal with drone problems, including setting up auto-cruise, uploading images, and handling different situations. This is not a very simple process. To identify different license plates in the parking lot, you need a suitable angle and a suitable scale. We can't solve these problems, then our progress is very likely to be delayed.
  - In the spring of 2020, the focus of the project will focus on image recognition, identification of license plates, and design algorithms to process license plate data.
- Team composition and make-up

- - Our project involves mobile devices, but all of our team members do not have extensive mobile development experience and need a expert to training us on that. This project relies on machine learning, Danie will be responsible for machine learning, and fanye will be responsible for the use of drone hardware.
- Budget
  - hardware-On the hardware side, we need a mobile device with IOS or Android, a drone, and a machine running image recognition. The most expensive part is the drone, and the DJI mavic pro we currently use may not meet our requirements. A drone with HD camera will be on budget, no additional budget on other hardware
  - On the software side, we will use open source databases and machine learning libraries, so we won't consider it within budget.
- Identifying Constraints
  - This city ordinance prohibits the use of **drones** on or near airport property. This city ordinance prohibits **drones** from flying near people, over large events, or over private property without prior permission.
- Software licensing restrictions or requirements - Our project requires DJi's GS pro software to program the drone, including setting the route, setting the camera angle, and setting the time to perform the mission

User Interface

Finally we will have a complete webpage which to introduce our project and allow user to check the result and information about the drone detective result. Managers can use this webpage to send email to those people who will get tickets, check different parking lots situations and comfire the picture with unpermitted parking car.

Ethical Issues

Our project does involve some ethical issues to some extent. First, the drone's camera involves privacy. We need to make sure that the drone only shoots the license plate data without involving the owner's privacy. People are emotionally able to accept drones that can take pictures to fly on campus. If our project wants to be commercial, this is a problem we have to face. On a certain level, we have almost installed a high-definition camera for the entire campus. How to ensure the security of data will be the key to solving ethical issues

Intellectual Property Issues

Regarding intellectual property, we don't have much trouble at the moment. But if our project is to be commercialized, then we really need to consider this issue. First of all, we are not the ones who manufacture drones, so using other brands of drones may require the use of drone investment software. At the heart of our project is machine learning, and we use an open source machine learning library. In this respect, we also need some attention. We have not carefully understood the open source agreement. But the main problem is still from drones. We may use the path-finding algorithm that comes with the drone.

Change Log

At the beginning of the project, we wanted to do some extra features. For example, the mobile app allows the administrator to read the data of the drone. Now we have decided to focus more time on handling the drone's cruise and vehicle identification.

In the initial plan, we wanted to use drones to send pictures to a computer to identify vehicle license plates. But with the actual test, we found that the transmission problem was a big problem. We decided to try to use the live function of the drone for image transmission, but this requires better network conditions