Bidding Document
Project 14

UAV Patrol System

Preference 1st

Team 2018-10
COMP 2043.GRP
Software Engineering Group Project
University of Nottingham

Developer Group

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Preface

These Standard Bidding Documents for UAV Patrol System(P14) have been prepared by Team 10 of COMP 2043.GRP, and are based on the project briefs on Moodle.

The developer group consisted of six people, Runyu ZHANG, Qichen ZHANG, Yinglun LI, Huixing ZHANG, Zeyu ZHANG, and Yundan WANG, whom are from University of Nottingham, Ningbo, China.

This Project is the first choice of all available projects.

The aim for this project is to set up a website platform to set some important function of UAV as well as follow the object on the ground or other places using at least two machines.

The developer group will work together to complete a full cycle even several cycles of software engineer process, aiming at the website for UAV users and the complete video stream identify objection by using DJI Matrice Series mounted with Manifold onboard SDK.

This group project includes requirements, SE approaches, the website set up and the algorithm of UAV, coding debugging, testing and etc.

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Introduction

1.1 The Developer Team:
why choose us?

1. In out project group, we have the experience in robot packing and tracking way in senior high school and win the second prize in HONGKONG xiehe competition.

2. We are all interest in AI aspect, besides; all of us gained at least 8/10 scores in the AI coursework.

3. Some of us has already learned some basic UAV knowledge and experienced some programming-well robot.

4. Some members are familiar with the whole procedure of the website whatever the design, the build, and the maintain.

1.2 Curriculum Vitae of Team Members

Members of our team generally have the ability and experience of using programming languages such as Java, c, c++, python and have a strong interest in machine learning, artificial intelligence, hardware and software development. Some of the team members have participated in computer competitions and won awards.

There are six members in the team, including a team leader. Everyone has unique advantages as well as clear logic, good understanding and expression skills. When work arrangements are needed, it is generally up to each member to come up with their own ideas, and then analyze them together. The final choice will made by group leader and the tasks will be assigned reasonably to everyone according to their interests and abilities. Therefore, our group is able to complete the project correctly and efficiently.

The following is a brief introduction of our individual team members.

Runyu ZHANG *(Team leader)*

Familiar with C, C++, Python, Java and have experience of writing programs in these languages.
Participated in robot competitions.
-Third prize in national robot competitions in high school and university.
-Second place in the Hong Kong Robot Track Obstacle Race.
Excellent decision making and leadership.
Interested in artificial intelligence and machine learning fields.

Yinglun LI

Skilled in using C and Java and have studied Python and Swift.
Have experience in program development.
-Participated in a smart medical system development.
-Participated in the design and production of some web multimedia.
Second Prize in the Computer and Multimedia Design Competition of the city.
Great understanding in code specification.
Strong aesthetic and design skills.

Zeyu ZHANG

Familiar with C, Java and Database establishment. Self-learned Python foundation.
Worked as an IT intern at an educational institution.
Interested in machine learning, robot programming and AI.
Good understanding and communication ability.
Strong sense of responsibility.

Danyun WANG

Familiar with C, Java and Database establishment.
Worked as an assistant of customer manager at the Bank of Communication.
Interested in machine learning and AI field.
Good understanding and learning ability.
Strong aesthetic and design skills.

Qichen ZHANG

Familiar with C, Java, Haskell and Database establishment.
Having experience in summer research in Neural networks.
Interested in machine learning, robot programming and AI.
Good understanding and communication ability.
Strong sense of responsibility.

Huixing Ren

Familiar with C, Java and Haskell.
Have teaching experience in C language.
Have good program skills and motivated to learn new knowledge
Great understanding and learning ability.
Strong aesthetic and design skills.

1.3 Background of UAV tracking system

An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without a human pilot aboard. UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications between the two. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator or autonomously by onboard computers.

A General Atomics MQ-9 Reaper, a hunter-killer surveillance UAV

A DJI Phantom UAV for commercial and recreational aerial photography

AltiGator civil drone OnyxStar Fox-C8 XT in flight

UAV launch from an air-powered catapult

1.4 Document Outlines

The document bid is structured in the following way:

Chapter 1 is the overview of the development team, and the basic concept of UAV Petrol System.

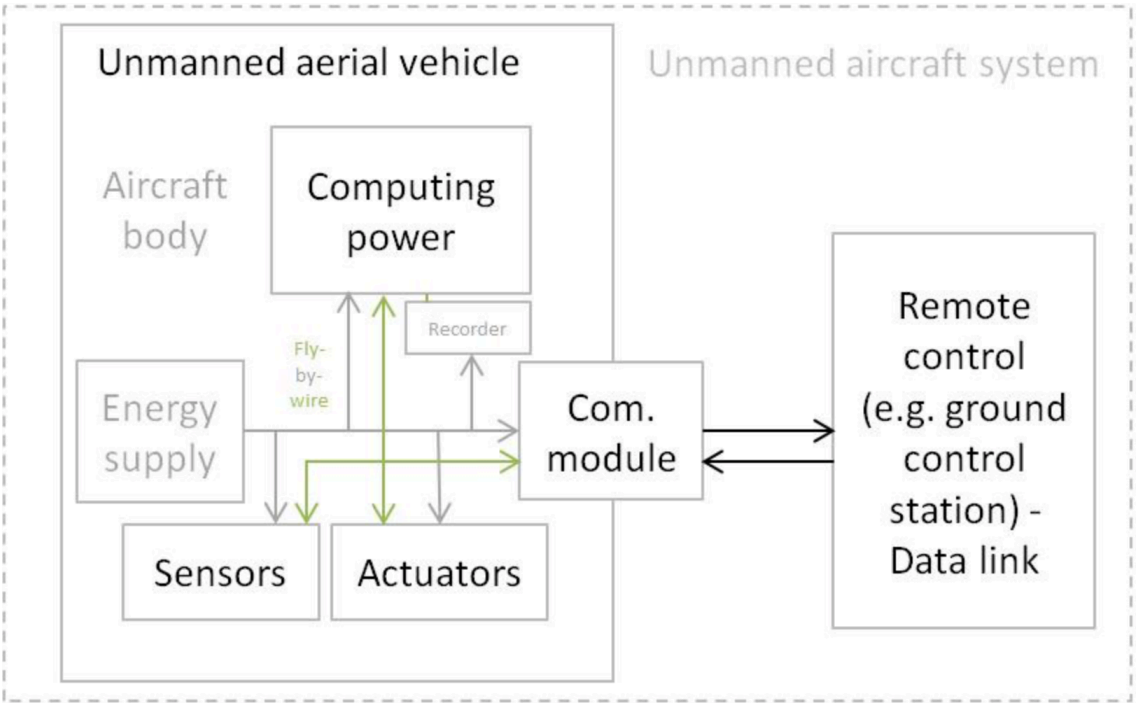
Chapter 2 continues on the concept of UAV by first providing a detailed explanation of the definition of UAV and describing the elements of IT. Then, it discusses the feasibility for petrol system

Chapter 3 describes the development process using the software engineering. It concludes the requirements, approach and methods, design, coding, debugging and test.

Chapter 4 presents the schedule of the process of the whole development, including the important dates during the year.

2. UAV Patrol system

2.1 Defining UAV Patrol system

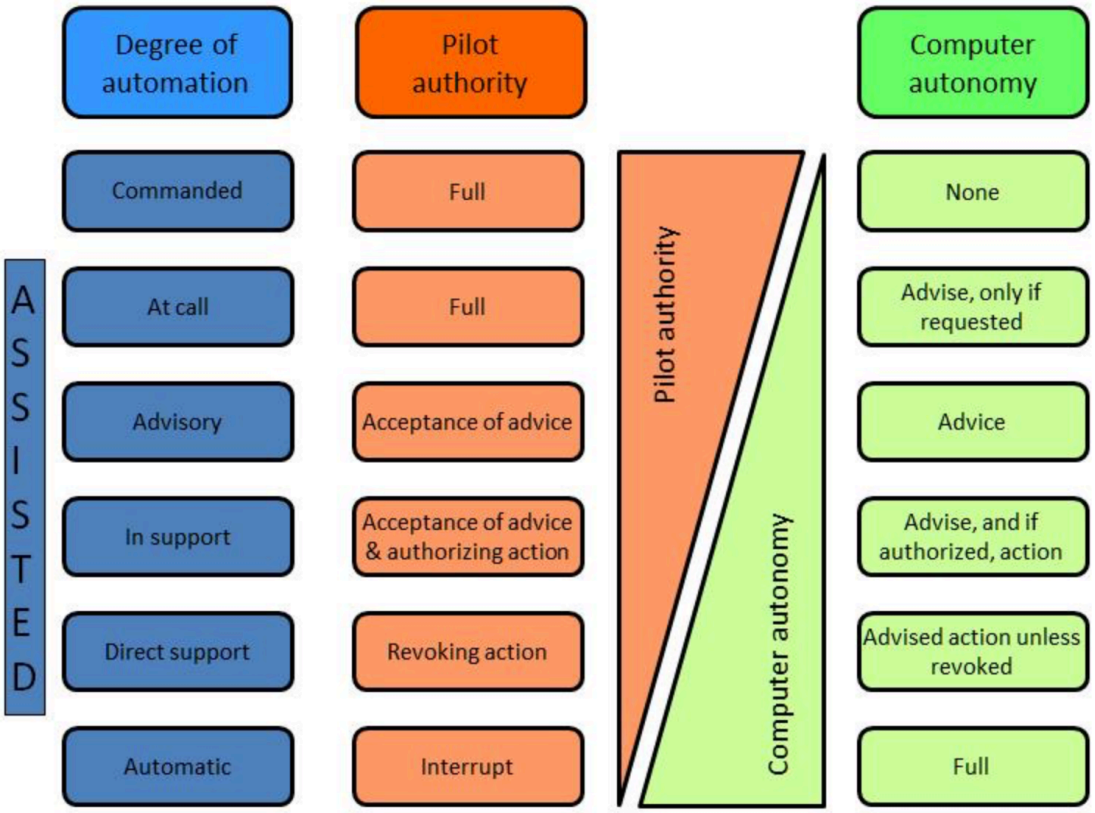


Manned and unmanned aircraft of the same type generally have recognizably similar physical components. The main exceptions are the cockpit and environmental control system or life support systems. Some UAVs carry payloads (such as a camera) that weigh considerably less than an adult human, and as a result can be considerably smaller. Though they carry heavy payloads, weaponized military UAVs are lighter than their manned counterparts with comparable armaments.

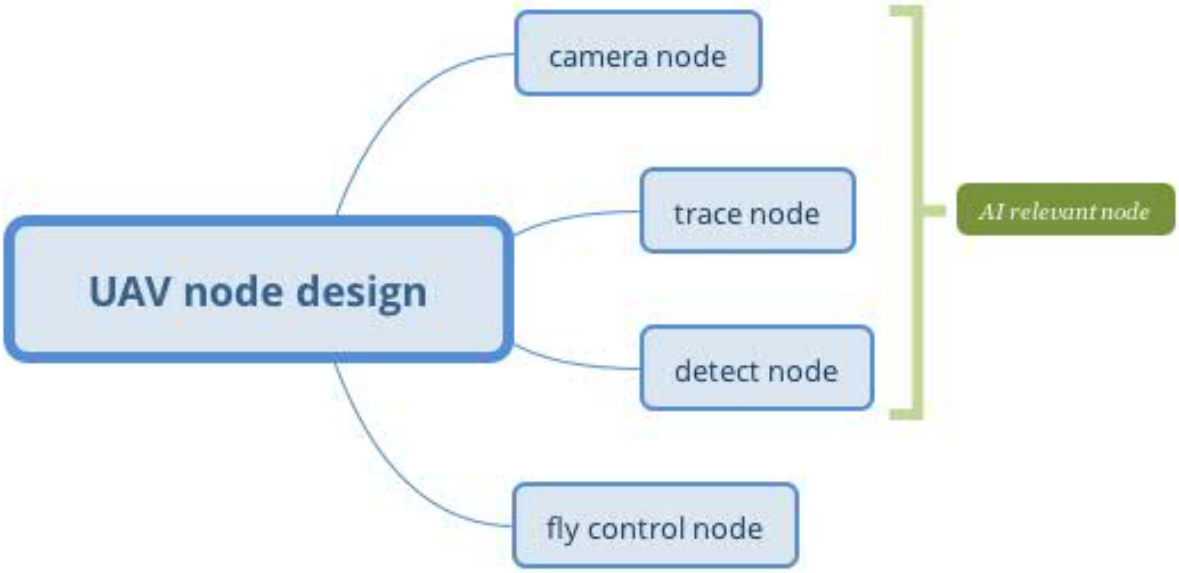
Small civilian UAVs have no life-critical systems, and can thus be built out of lighter but less sturdy materials and shapes, and can use less robustly tested electronic control systems. For small UAVs, the quadcopter design has become popular, though this layout is rarely used for manned aircraft. Miniaturization means that less-powerful propulsion technologies can be used that are not feasible for manned aircraft, such as small electric motors and batteries.

Control systems for UAVs are often different than manned craft. For remote human control, a camera and video link almost always replace the cockpit windows; radio-transmitted digital commands replace physical cockpit

controls. Autopilot software is used on both manned and unmanned aircraft, with varying feature sets.



This diagram shows the control relationship between the pilot and the base computer on the ground.



The above diagram illustrates the actually how the UAV system work and contains how many parts, the camera node takes the video stream and using the digital algorithm(manifold) to transfer to RGB picture in vue module in 25 FPS 1280^720. In the second procedure, the detect node using the library function to process the picture and find the actually the trace project and analysis the action and speed. In the final part, the fly control and trace node using combined together in the software and hardware to control the UAV to follow the object.

2.1.2 Elements of technology

Webpage: html5 + css3 + javascript visual stdio code

Camera and Dji UAV: linux(Ubuntu) + manifold + Dji Onboard SDK + python (pycharm)

Video stream process: python2.7/python3

2.2 relevant technology used in relevant projects

Equipment: Raspberry Pi USB camera JoyStick Arduino UNO
development environment: macOS(pycharm), linux(Geany)

Relevant video:http://www.tudou.com/programs/view/68JDFqex1y

3. Program Development

3.1 Requirements

Users ask the basic control to UAV on the ground by using the webpages such as take off, landing, position control through SDK. Besides, the petrol system are essential based automatic object recognition module from videos taken by an UAV onboard camera.

3.2 Software Approaches and Methods

We would divide the whole project into two parts. 1. The webpages and the connection and transfer between the control machine and UAV steadily. 2. the video stream collect, transfer, process and analysis the fly control system. We will apply agile development. We have six students who are in the small teams, with small budgets. Agile methods exist to be flexible about the SE stages, there are times when it is good to plan, which gives us possibilities to fix our problem.

3.3 Website and algorithm Design

In the webpage, the basic function should be fixed for many times and improve its stability. Besides, the connection between the base ground equipment and the UAV is a serious problem in the project. Considering about the process unit power on the UAV and the camera video stream quality, we need try best to improve the code quality and frame clear and easy. Using less resources algorithm may be a considerable solution.

3.4 Coding

Coding is very important. Well coding means “easy to maintain”. In order to code to certain standards, we will coding according to certain strategies and keep good coding manners. One student will be the manager and other five students will be in charge of different developing parts, but all of us will have enough ideas of the whole situation. We will communicate frequently, and be sure that all of people meet the requirements.Besides, the third parts libraries are our main aim to follow

them and find some key point to equip on our projects.

3.5 Debugging

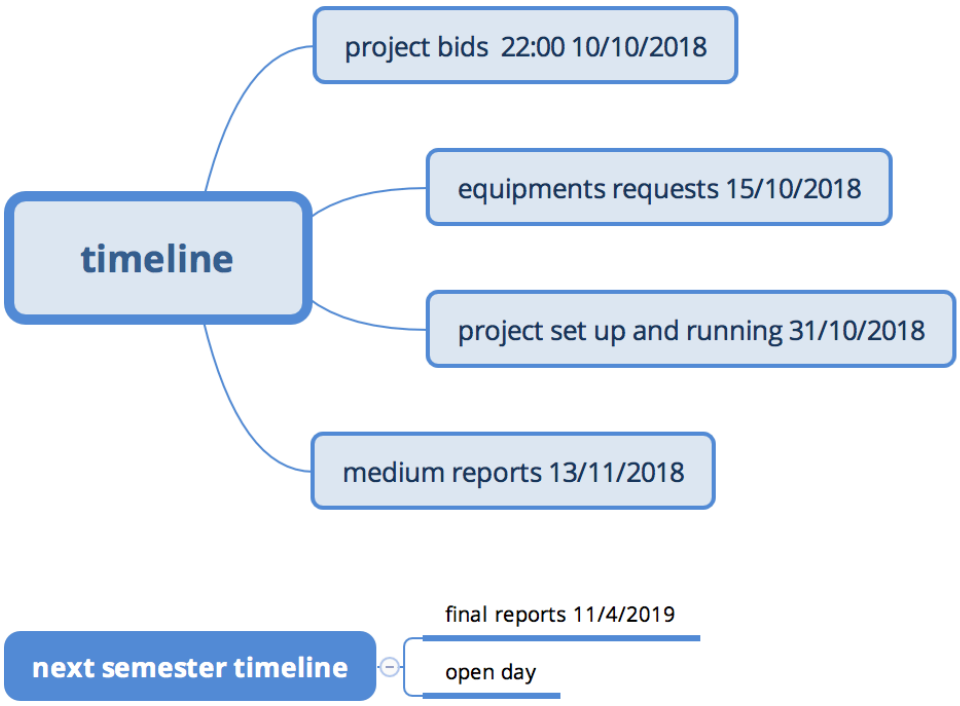
Debugging is a social, multi-faceted skill. So, we should first find bugs, try and reproduce it. We may use some debugging strategy such as binary search and hypothesis testing. Also, we may use a bug tracker which records data to help us judge the defect. Our group will print out the code and do a group code inspection twice a week or once a month.

3.6 Testing

First, we will build a test plan that developers can use it to test code before delivering it and managers can use it to estimate testing workload, and schedule it and include it in the budget. We may use Unit Testing to test the individual pieces and Integration Testing when we test combinations of pieces. Following are the Release Testing and Acceptance Testing. We will consider the result and may need to change our framework until the acceptance goes very successfully. Finally, the actually flying test is essential and we would try our best to take more time on that project.

4.Schedule

4.1 Important dates



Appendix and Reference

All the relevant information and picture are from the website wiki and design by the group 10 in GRP 2018. Thanks for the reference and resources.

relevant url:

https://blog.csdn.net/zouyu1746430162/article/details/78172258

https://blog.csdn.net/weixin_36441117/article/details/72811196

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