

An Exploration of 'Python Programming' Pedagogy in Drone Application Technology Aligned with the 5G Networking and O&M Skills Competition

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Abstract:

With the rapid development of 5G and Artificial Intelligence, talent cultivation for the Drone Application Technology major faces new opportunities and challenges. The "Python Programming" course offered by the Drone Application Technology major at Zhejiang Business Technology Institute (School of Artificial Intelligence) is not only foundational for students' computational thinking but also a critical bridge connecting intelligent drone applications with 5G communication, operations, and maintenance (O&M). This paper uses the Zhejiang Provincial Vocational College Skills Competition "5G Networking and O&M" as a focal point to explore how to integrate the competition's core skill requirements into the "Python Programming" curriculum. The goal is to achieve competition-driven teaching and learning, cultivating composite, high-skill technical talents who meet the evolving needs of the industry.

Keywords — Python Programming, Drone Technology, 5G, Operations & Maintenance

I. INTRODUCTION

Driven by the national "New Infrastructure" strategy, the integrated application of 5G, AI, and drone technology is deepening. Drones, as "aerial intelligent terminals," heavily rely on the high bandwidth, low latency, and broad connectivity provided by 5G networks for advanced applications such as high-definition video transmission, beyond-visual-line-of-sight (BVLOS) control, and swarm coordination. The Drone Application Technology major at Zhejiang Business Technology Institute (School of Artificial Intelligence) has acutely recognized this trend. However, students in this major must not only understand flight, aerial photography, and data processing but also the 5G networks that carry their data streams. Meanwhile, "Python Programming," as a language course that is both a general-purpose and specialized tool (especially for the School of AI), is becoming the core instrument for achieving this automation and intelligence. How to connect isolated course

teaching with cutting-edge skills competitions, particularly the "5G Networking and O&M" competition, is a key challenge in our teaching reform exploration this semester.

II. PYTHON PROGRAMMING: THE "ADHESIVE" BINDING DRONES AND 5G O&M

First, Python plays a vital role in the field of drone applications. From DJI's Software Development Kit (SDK) to the open-source MAVSDK (MAVLink), Python provides concise and efficient interfaces, allowing students to use code to achieve automatic flight, mission planning, data acquisition, and preliminary image recognition. This is taught as a core case study in our "Python Programming" course, tightly integrating abstract programming logic with the professional equipment students are familiar with, which greatly stimulates their learning interest.

Second, the modernization of 5G network O&M is fundamentally shifting from traditional manual

configuration to automated, intelligent operations. Python is the language of choice for achieving Network Automation. In the "5G Networking and O&M" competition, the assessment focus is no longer just on hardware connections but includes the virtualized deployment of the 5G core network and base stations, network slicing configuration, fault troubleshooting, and performance monitoring. These advanced operations increasingly rely on automated scripts to be completed efficiently.

Therefore, the Python language becomes a perfect "adhesive." In our curriculum design, students learn Python, on one hand, to build a foundation for the drones themselves (e.g., flight control scripts, data processing). On the other hand, it prepares them for the O&M and management of the 5G network environment that drones depend on (e.g., automated testing, performance monitoring). This gives the "Python Programming" course a natural potential and clear pathway to align with the 5G O&M competition.

III. CURRICULUM DESIGN: ALIGNING 'PYTHON PROGRAMMING' WITH THE 5G O&M COMPETITION

To integrate the essence of the 5G O&M competition into daily teaching, we designed three core modules within the "Python Programming" curriculum. The first module is "Network Automation Basics." We introduce Python libraries such as Paramiko and Netmiko. The teaching is no longer limited to "printing a multiplication table" but instead features practical, professional projects like "Using Python to batch-login and configure three (virtual) switches/routers." This directly targets the competition's skill requirements for batch configuration and inspection of network devices.

The second module is "API Interaction and Data Collection." Modern 5G network equipment (especially virtualized network functions, or NFV) is often managed via REST APIs. We added the requests library to the Python curriculum, teaching students how to use Python to call APIs to query and control network device status. For example, a project might involve simulating the retrieval of real-time traffic data from a 5G base station, which lays the groundwork for subsequent data analysis

and is a key step in monitoring and troubleshooting within the competition.

The third module is "O&M Data Analysis and Visualization." 5G O&M generates massive amounts of log data and Key Performance Indicators (KPIs). In the "5G Networking and O&M" competition, the ability to quickly identify problems from data is a core competency. We use Python's Pandas and Matplotlib libraries to design a "5G Network Performance Log Analysis" project. Students are required to write Python scripts to process simulated base station log files, automatically filter for periods of high latency or high packet loss, and generate visual reports. This not only hones their Python data processing skills but also familiarizes them with a realistic 5G network O&M scenario.

IV. REFLECTION ON TEACHING PRACTICE: FROM "ABLE TO FLY" TO "ABLE TO INTELLIGENTLY CONNECT"

Through this semester's teaching practice, we found this integrated model yielded significant results. First, students' learning objectives became far clearer. When students understood that Python scripts could be used to automatically dispatch drone swarms and also analyze the 5G network performance that guarantees their communication, their motivation to learn Python shifted from "passing an exam" to "solving real professional problems."

Second, the teaching content achieved both a "reduction in complexity" for access and an "elevation in thinking" for application. The 5G O&M competition's knowledge system is vast and complex, making it difficult for drone major students to learn directly. However, by using Python as a tool, we "reduced the dimension" of these topics into specific, manageable programming tasks (e.g., "write a script to check network connectivity," "write a script to analyze logs"), making it much easier for students to get started. At the same time, this guided students to "elevate their thinking," encouraging them to shift from the role of a "drone pilot" to that of a "drone system O&M engineer" or "drone data analyst," thereby grasping the "Cloud-Pipe-Device" global perspective.

Finally, this teaching model has served as an effective screening mechanism for identifying outstanding talent for skills competitions. Students who excel in the Python course often possess strong logical thinking and automated scripting abilities. They can be seamlessly transferred to the "5G Networking and O&M" competition training team because they have already mastered the automation and data analysis tools required for the competition. This creates a virtuous cycle between curriculum teaching and competition training, using a universal course to achieve early discovery and cultivation of top-tier talent.

V. CONCLUSIONS

In summary, the initiative by the Drone Application Technology major at Zhejiang Business Technology Institute (School of AI) to proactively align the "Python Programming" course with the skill standards of the "5G Networking and O&M" competition is a valuable and successful teaching reform experiment. This fusion not only strengthens students' programming skills and automation mindset but, more importantly, it connects the three seemingly independent fields of drone applications, Python programming, and 5G communications. It

builds a multi-dimensional, forward-looking knowledge structure for students. Looking ahead, we will continue to deepen this "Course-Competition Integration" model, introducing more real-world industry cases that combine drones and 5G into the classroom. Our ultimate goal is to cultivate high-quality, composite talents who truly "understand flight, can program, know networks, and can perform O&M."

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