**Infantry Supply Station Design for DJI RoboMasters Competition**

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# Introduction

DJI RoboMasters competition, is an annual robotics competition for postsecondary students across the globe that is intended to offer a platform to promote exchange and dialog among researcher and students alike. This global tournament is sponsored by SZ DJI Technology Co. LTD, and hosted by Communist Youth League of China, Secretariat of All-China Students’ Federation, and Shenzhen Municipal Government. To promote a fair and balanced competition platform, a set of annually updated competition rules are provided by the organizers of the contest, i.e. Technology Innovation Committee of Nanshan District Government of Shenzhen Municipality. The competition uses a range of robots, including Aerial, Base, Hero, Standard, and Engineering robots, each of which must satisfy a certain set of requirements. During the competition robots are able to fire bullets of standardized size at a Referee System attached to the sides of robots. Robots are equipped by HD cameras and are controlled wirelessly from another control room. Robots are able to refuel their ammunition anytime during the game at a stationary Supply Station that collects limited bullets distributed to teams at fixed intervals during the game. In total, eight hundred bullets of 2.6 g (±5%), plastic (TPE 90), of diameter 17 mm (-3% to 0%) are released in total during the game; 200 bullets initially, 300 bullets at 2 minutes 30 seconds mark, and 300 bullets at 5 minutes mark. A Base robot may also be refueled by an Engineering or Hero robots, while the Hero robot may be also refueled by Engineering or Arial robots. Engineering robot collects ammunition from the battle ground while Aerial robot gathers ammo from a resource column, tarmac, Hero, or Engineering robot.

University of Alberta’s RoboMasters Student group competed for the first time in 2017 and is planning to compete again in 2018. Previously, they used a mechanically-triggered supply station that was activated while a robot was pushing a mechanical lever. The supply station lacked the control needed to refill robots with accuracy and speed. The team needs to redesign the station to allow for accurate loading of about 50 bullets at a fast pace, while ensuring no bullets gets jammed in the supply station. Various robots are allowed to refuel at the supply station, see table 1, but the team is planning to use the supply station only to refuel 3 infantry robots. The supply station needs to confirm with the RoboMasters organizing committees’ mandated rules. Moreover, the team needs the station to autodetect, auto release ammunition, and refuel two infantry robots simultaneously. A team of mechanical engineering students are designing 3 infantry robots that would be using this supply station. Clear communication with this team would be necessary throughout the year to ensure that the supply station would be fit for use by the infantry robots. Specifically, for our design, we need to know the shape, location, dimensions of robots’ ammunition container. The client’s main goals and constrains could be summarized as follows:

1. Conforms with DJI RoboMasters’ competition rules,
2. Safe to use,
3. Fast ammunition loading rate; the faster the better,
4. Absolutely no jamming of bullets in the station,
5. Fully automatic,
6. Able to refuel two robots simultaneously,
7. Can be easily setup and carried by two personnel,

**Table 1:** DJI RoboMasters allowed robots and refueling mechanism. University of Alberta team is planning to use refueling station only for Standard Infantry Robots.

|  |  |  |  |
| --- | --- | --- | --- |
| Robot | Quantity | Function | Bullet Supply Method |
| Base Robot | 1 | Automatic Self-Defense Robot | >Initial 300 bullet |
| Hero Robot | 1 | Has high offensive power | >Refueling Station  >Engineering Robot  >Resource Island  >Aerial Robot |
| Engineering Robot | 0-1 | Assistant Robot, heals and gathering ammo from battle field | >Tarmac  >Resource Island  >Aerial Robot |
| Standard Infantry Robot | 0-3 | Fight flexibility | >Refueling Station  >Engineering Robot  >Resource Island  >Hero Robot |
| Aerial Robot | 0-1 | Supplies aerial support, may help in refueling, and may occupy healing columns | >Tarmac  >Resource Column  >Engineering Robot  >Hero Robot |
| Refueling Station | 0-1 | Ammunition supply station, collects ammunition, and automatically dispenses ammunition | >Official Supply Mechanism |

# Competition Refueling Station Regulat0ions and Standards

DJI RoboMasters require the station to be satisfy the following constrains:

1. be fully automatic,
2. able to handle 17 mm in diameter ammunition,
3. has maximum dimension of 1000x1000x1000 mm,
4. without an active movement or firing mechanism,
5. self-balancing; i.e. cannot be fixed to the ground using tape or materials that can damage the competition area,
6. maximum supply voltage of 30 volts, and maximum total power of 200 Wh
7. if radio communication is employed, a bandwidth of less than 40 MHz within 2.412 to 2.472 GHz is used