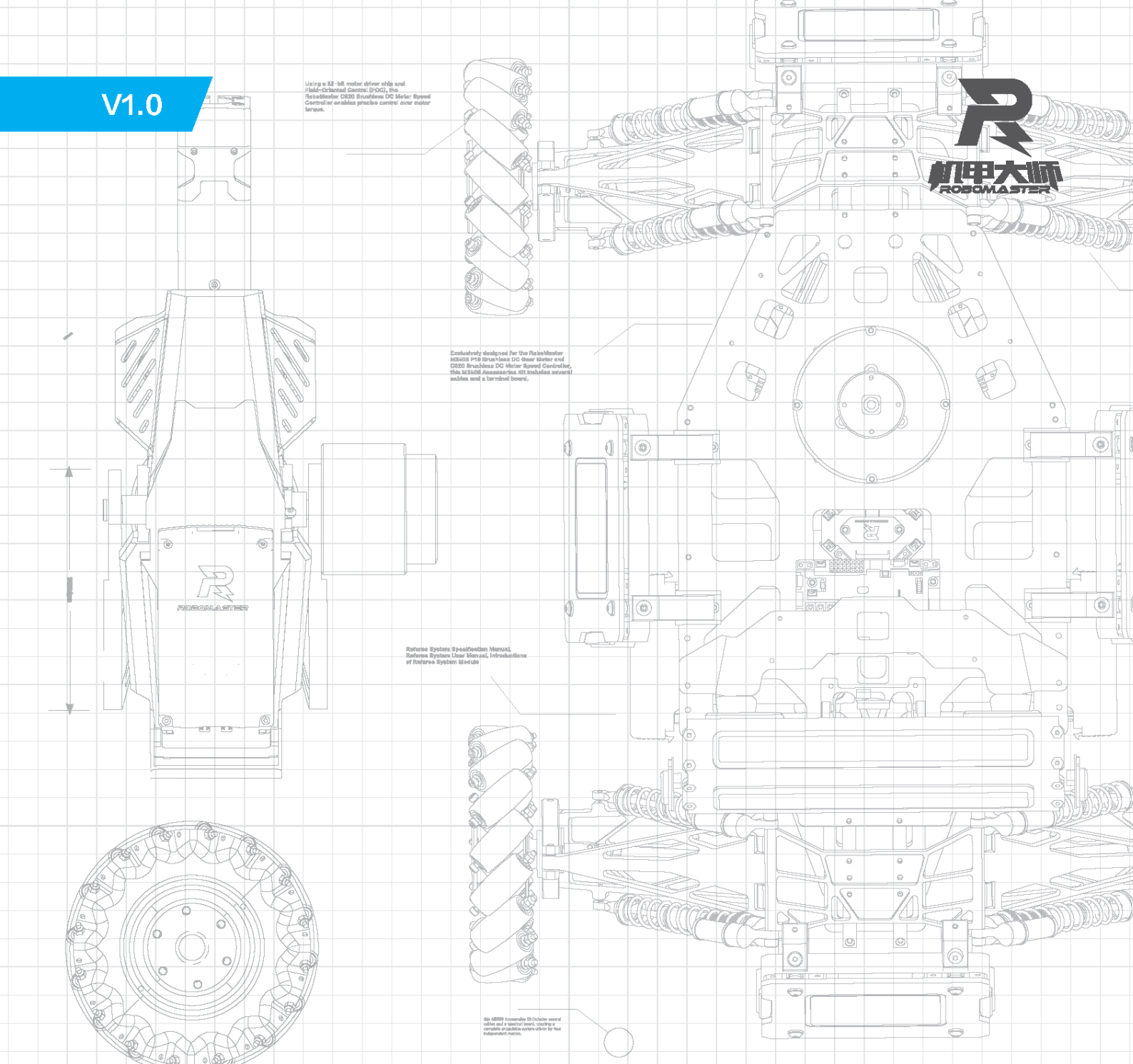
V1.0



ROBOMASTER 2020
AI CHALLENGE ONLINE ASSESSMENT

PARTICIPANT MANUAL

Prepared by the RoboMaster Organizing Committee

Released in July, 2020

Statement

Participants are forbidden from engaging or participating in any actions determined by the RoboMaster Organizing Committee (hereinafter referred to as “the RMOC”) as involving public disputes or sensitive issues or causing offence to the public or certain social groups, or damaging the image of RoboMaster; otherwise, RMOC shall have the right to disqualify offending persons permanently from the competition.

Using this Manual

Legend

Penalty zone	Important notes	Hints and tips	Definitions and references

Release Notes

Date	Version	Changes
2020.07.15	V1.0	First release

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1. Introduction

Founded by DJI Technology Co., Ltd. and designed for young engineers, RoboMaster is a global educational robotics program that includes competitions, campus clubs, cultural merchandise and other initiatives.

In 2015, DJI has launched the RoboMaster Robotics Competition, hoping to cultivate a group of talented engineers and scientists. In this competition, the teams need to develop a group of ground robots and aerial robots to fire projectiles on the battlefield and battle against each other. The data interaction of the robots is monitored by a special referee system. The referee system converts damage inflicted by projectiles into dynamic changes in HP, and finally presents it to the audience on a game-like viewing page. The competitive mode of modern robots is constantly evolving.

In recent years, deep learning technology has also been brought up in numerous fields, reshaping the frontiers of computer vision and other areas of artificial intelligence research. In robot research, deep neural network (DNN)-based reinforcement learning enables robots to make decisions autonomously. As well-known games such as Go, Warcraft, and StarCraft are used as research platforms, the potential for the application of robotic autonomous decision-making in our daily life is unlimited. As an emerging robotics academic platform, the RMOC launched the RoboMaster AI Challenge, which enables global enthusiasts to research DNN-based robotics. Research results are expected to be applied in industries such as field rescue, autonomous driving, and autonomous logistics to benefit our lives.

Online assessment has been introduced for RoboMaster 2020 to replace the offline AI Challenge competition due to the COVID-19 pandemic. Teams that have successfully registered for this season can participate in the online assessment according to their actual situations. The RMOC will set three awards for assessment in three aspects – Navigation and Motion Planning, Perception, and Decision.

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2. Online Assessment Schedule

The online assessment will be carried out by submission of videos by participants online.

Table 2-1 Online assessment schedule

Schedule (Beijing time)	**Item**	**Remarks**
July 15, 2020, 12: 00 pm - July 31, 2020, 12: 00 pm	Confirming participation	Register for online assessment and to confirm the group to participate in via the Registration System
August 24, 2020, 12:00 pm - August 27, 2020, 20:00 pm	Submitting the video (s) and the code	Teams that have successfully registered for online assessment should submit their videos and the code to the registration system
August 31, 2020 – September 4, 2020	Assessment	The RMOC performs assessment based on the Assessment Specification
By September 15, 2020	Announcing the winners	The list of winners will be published on the RoboMaster Official Website

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3. Participants and Requirements

3.1 Participants

Teams that have successfully registered for this season can participate in the online AI Challenge assessment.

The presenter demonstrating the video shall be decided by the team itself.

3.2 Participating Groups

Due to the limitations of human resources and environment restrictions caused by the COVID-19 pandemic, to ensure fair competition and objective assessment, the participating teams can choose one of the three technical groups (Navigation and Motion Planning, Perception, and Decision) to submit their videos for. If more than one group is chosen, the videos shall be submitted to each group respectively.

The technical details and their results of the robots shall involve one of the following categories:

Group I: Navigation and Motion Planning

Being able to plan their motions in the competition so that they can move at high speed without any collision; being alert to and effectively avoid any static obstacles or other robots in high-speed motion; the entire motion should be smooth and free from turbulence.

Group II: Perception (positioning and recognizing the vehicles of the enemy robots and their own)

Being able to detect and recognize the targets in a stable and accurate manner with the help of their Outpost and the Perception system, and to indicate the targets' locations and attitudes data in a particular coordinate system.

Group III: Decision (decision making and planning under multi-robot conditions)

Being able to effectively implement the Decision system in the real competition scenarios and carry out appropriate and effective decision making activities according to different competition scenarios.

3.3 Participation Requirements

Two types of materials should be submitted for assessment: the video(s) and the code (including the instruction documents). Details can be found below:

Table 3-1 Requirements on Materials for Assessment

Materials	Format	Specification
Video	● Encrypted video(s) uploaded onto YouTube or other online platforms	1. Basic information such as the school name, team name, date and location of shooting should be indicated at the beginning of the video 2. It is recommended that the video consisting of the three parts as shown below

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Materials	Format	Specification
	● The video link(s) and the corresponding password(s) should be provided in the "Video Link" and "Video Password" fields in the registration system respectively	a) Introduction to the robot system: Describe the sensor and computing devices of the robot b) Introduction to the algorithms: Introduce the algorithm framework and process c) Introduction to the actual effects and indicators: Present the process that has actually been implemented and explain the indicators to evaluate the effects such as accuracy, speed, interaction, etc. The team is welcome to use simulators as a supplement for the explanation of certain specifications. If the team is unable to shoot the actual robots, recording the simulators can be an option, however with the actual scene would be preferred. For more details on the assessment requirements, please see "Table 4-1 Assessment Criteria" 3. Please do not include any irrelevant scenes in the video. Non-essential parts in the video should apply faster playback speed (playback speed should also be specified), to make sure that the video is concise and clear. The video should be no longer than 10 minutes 4. It is recommended to take multiple clips of different tasks and edit these clips within reasons to ensure the readability of the entire video. Misleading special effects or post-processing are strictly prohibited, as well as positioning the camera or using manual control to achieve automatic task execution. Any violations will be treated as cheating, and those deemed as serious offenders will be disqualified 5. Voice-over and text explanation can be used to support the video if needed
Code	● Store the code in the public repository on Github ● Enter the Github link in the "Github Link" field	1. Instruction documents are required. If "wiki" or "readme" files are not found in the submission, the code section will be considered as invalid and thus not be assessed 2. The participating group can just offer open source code of one of the technical points (for example, the perception group

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Materials	Format	Specification
	in the registration system	can just offer the open source code of the outpost zone positioning algorithm) 3. For more details on the assessment requirements, please see “Table 4-1 Assessment Criteria”

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4. Score Breakdown and Assessment Criteria

Teams shall demonstrate their work for the RM2020 competition season based on the following tables, which will be scored according to the weight of each assessment area. The score will then be converted into the original technical score as part of the total score.

Table 4-1 Assessment Criteria

Area	Item	Content	Weight (%)
Video Display	Introduction to the Robot System	Describe **the sensor specifications of the entire robot and the environment of its computing devices**	6
	Algorithm Designs	From engineering perspective: Clearly present the framework and process of the entire system and highlight what engineering issues are resolved. Detailed introduction and proof can be included in the text file and store in the repository together with the code	7
		From innovation perspective: Clearly present the framework and process of the entire algorithm and highlight its innovative and outstanding features. Detailed introduction and proof can be included in the text file and store in the repository together with the code	7
	Actual Effects and Indicators	**Group I: Navigation** Being able to plan high-speed motions in a map consisting of static obstacles (7%); effectively avoid any mobile obstacles appearing (7%); and navigate through the narrow path between the obstacles (6%)	20
		Group II: Perception Being able to identify the enemy robots mounting armor plates (4%); identify enemy robots (8%); and identify enemy robots by Outpost (8%). The results will be visualized and compared with the benchmark data to demonstrate the positioning accuracy	
		Group III: Decision	

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		The essential scenes to be presented shall include: Multi-robot collaboration in various circumstances where the robots have different HPs, attack powers, and remaining projectiles (13%), effective single-robot operation (7%), etc.	
Code Display	Algorithm Code Display	a) Instruction documents are required. If "wiki" or "readme" files are not found in the submission, the code section will be invalid and thus not be assessed b) Software function introduction c) Present the effects of the software. The innovation and advantages of the overall project should be reflected, combined with visual data (such as video links, gif images, test charts, etc.) to demonstrate and quantify the final effect d) Tools, hardware and software environment to rely on e) Compilation and installation f) File directory structure and file usage description g) Software and hardware system block diagram; data flow diagram h) Principle introduction and theoretical support analysis i) Software architecture or hierarchy diagram j) Code specification k) Whether there is an open source protocol l) Whether the function and variable names are standardized and consistent m) Whether there are clear remarks on the functions and variables for the key features n) Whether the whole project can be compiled and run and is easy to test, including test scripts in different situations or covering integration tests o) Whether it follows a certain design pattern	35

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		p) Open source and sharing value – open source influence by the assessment day (number of stars)	
Technical Report	Technical Report Results	Results of the technical report submitted, which will be included into the final score A: 25 B: 20 C: 15 D: 5 Not participated: 0	25

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5. Awards

The names of the awards are subject to further adjustments and the actual certificates issued shall prevail.

The awards are as follows:

Table 5-1 AI Challenge Prizes

Prize	Quantity	Awards
First Prize	1/group	● Cash reward USD $2,000 (pre-tax) ● Certificates of achievement (for the team) ● Certificates of achievement (for each member)
Second Prize	2/group	● Cash reward USD $1,000 (pre-tax) ● Certificates of achievement (for the team) ● Certificates of achievement (for each member)
Third Prize	3/group	● Certificates of achievement (for the team) ● Certificates of achievement (for each member)
Outstanding Prize	Multiple	● Certificates of achievement (for the team) ● Certificates of achievement (for each member)

Table 5-2 Academic Incentive Awards

Awards	Quantity	Remarks
● **Cash reward USD $10,000 (pre-tax)** ● **Certificates of achievement (for each member)**	No more than 1	● The judging criteria will be based on aspects such as academic, educational and practical value. RMOC will score the candidates and determine the winners, on which it reserves the final right of interpretation. ● For more details on how to apply, please refer to Appendix 2 of the RoboMaster 2020 AI Challenge Participant Manual V1.1.
● **Cash reward USD $2,500 (pre-tax)** ● **Certificates of achievement (for each member)**	No more than 2	
● **Cash reward USD $1,000 (pre-tax)**	No more than 5	

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Awards	Quantity	Remarks
● **Certificates of achievement (for each member)**		

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邮箱：robomaster@dji.com
论坛：http://bbs.robomaster.com
官网：http://www.robomaster.com
电话：0755-36383255（周一至周五10:30-19:30）
地址：广东省深圳市南山区西丽镇茶光路1089号集成电路设计应用产业园2楼202