

Competition Title: Environmental awareness of unmanned vehicles at complex intersections

Industrial Applications ☐Intelligent Manufacturing ☒Intelligent Driving ☐Intelligent Life ☐Smart Medicine ☐Smart City

[Overall background]

With the rapid development of driverless technology in recent years, automatic driving is gradually becoming mature. But automatic driving is not only the relationship between people and cars. Road traffic facilities and driving rules will also change with the arrival of the era of autopilot. Using artificial intelligence related technology, automatic driving vehicles can better understand the complex road environment information, realize communication and interaction between V2X. Meanwhile, it can provide effective support for improving the practical application level of pilotless technology, and will bring a broad market prospect for the popularization and application of unmanned vehicles.

[Business background]

There are broadly artificial intelligence technologies involved in unmanned vehicles. Research in this field includes environmental awareness, robot, language recognition, image recognition, machine learning, natural language processing and expert systems, etc. Through satellite navigation, RFID, radar, sensor, camera image processing and other environmental sensing devices, unmanned vehicles can achieve the information collection of the environment and their own states, and then analyze and deal with a large number of environmental awareness information through artificial intelligence technology, so as to calculate the best driving strategy and realize the automatic driving.

[Problem description]

In urban traffic roads, the traffic situation at intersections is the most complicated. For automatic driving vehicles, the environmental information that needs to be perceived includes signs, traffic lights, pedestrians, non-motor vehicles, side cars, same direction and turning vehicles. The traditional vehicle laser radar cannot satisfy all environmental awareness needs. For example, the identification of signs and traffic lights in the period of visual condition (FOG); identification of traffic lights on both sides of the intersection; the traffic strategy and route planning of the atypical intersection; the vehicles and pedestrians behind the obstacles are unable to perceive the problem; the side high-speed vehicle cannot be aware of the problem in advance; and the same direction and the same direction. These problems restrict the real landing of the pilotless technology. Based on this problem, the environment aware solution of unmanned vehicles with artificial intelligence (AI) at complex intersection is urgently needed.

[User expectations]

1. Applying AI technology to realize the environmental awareness solution of unmanned vehicles at complex intersection can solve the following problems:

- a) Identification of signs and traffic lights during periods of poor vision.
- b) The traffic strategy and route planning of a typical intersection.
- c) Perception of pedestrians and non-motor vehicles in complex road environments.

2. The solution needs high timeliness, high reliability, high robustness, self detection alarm and automatic error correction, which is reasonable in cost, easy to maintain and strong in implementation.
3. The solution should focus on environmental awareness. The purpose is to try to obtain environmental information for the decision of unmanned vehicles, and the related schemes of autopilot technology should not be described in detail.

[Expected economic effect]

According to the technology roadmap of energy saving and new energy vehicles, by 2030, the market of fully automatic driving vehicles will be near to 10%. Industry field expects the great development of the driverless industry. By 2035, the scale of the market will reach 600 billion yuan. By 2050, the market will be more than 40 trillion Yuan.

[Technical path]

Based on artificial intelligence related technology (image recognition, machine learning, computer vision, expert system, automatic planning) and related information acquisition equipment (GPS, RFID, sensor, radar, camera), the participants should design related terminal equipments.

[Technical indicators]

- (1) The sensing distance of the signal lights at the intersection;
- (2) Intersection signal perception accuracy rate (number of successful cycles / total cycles);
- (3) The perception delay time after the change of traffic lights.
- (4) Detecting the above indicators again in smog and fog jamming environment.
- (5) Perceptual distance between roadside pedestrians and non-motor vehicles (stationary, roadside, crossing);
- (6) Perceived success rate, false alarm rate, false rate for Roadside pedestrians and non-motor vehicles (stationary, roadside, crossing).

[Standard Submission]

From the bottom developer point of view, the participants are invited to design a set of solutions and physical demonstration devices that meet the requirements of pedestrians, traffic lights signal identification and other problems, to install and test the technical specifications of various functions in the field.

- (1) The vehicle equipment can perceive the traffic signal status at the intersection in time.
- (2) Vehicle equipment can perceive pedestrians and non-motor vehicles in the whole area at the roadside and intersections in advance.
- (3) During the competition, the perceptual data can be recorded and clearly output for the referee to evaluate the result of the competition.

[Task list]

- (1) The design and use of terminal equipment on the vehicle.
- (2) Design and manual instructions of terminal related terminals.
- (3) Prepare related physical objects and install them in the venue.
- (4) The type of test vehicle to be prepared for the competition: the permitted type of car: passenger

car, passenger car and off-road vehicle.

(5) After the equipment is ready, the equipment should not be artificially intervened on the way of each stage, and the result of the competition is evaluated by the referee according to the automatic output.

[Reference tool]

None

[Reference data]

None

[Data interface]

CAN, RS232, RJ45, TCP/IP, UDP and so on