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Research on Path Planning and Location Technology of Mobile Robot

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Abstract: With the further application of intelligent technology, the application of mobile robot, as its top technology representative, is very prominent at the present stage. The mobile robot can collect and integrate relevant data with the help of sensors, so that it can achieve the set goal in the obstructed environment. The path planning and positioning technology of mobile robot are the core. Through the in-depth study of the path planning and positioning technology of mobile robot, this paper further analyzes the most commonly used path planning technology and related positioning technology at the present stage, thus providing a new reference for the development of mobile robot technology in the next stage.

Keywords: Mobile robot; Path planning; Positioning technology

Mobile robot is an integrated system that integrates various functions such as the perception of the surrounding environment, real-time state adjustment, scientific control and specific task implementation. At present, mobile robot is widely applied in aviation technology, engineering detection, medical service and many other industries. At the same time, mobile robot involves a wider range of scientific fields, such as optics, artificial intelligence, big data, etc. Due to the relative complexity of the overall operation environment, the path planning technology and positioning technology of mobile robot need to be further innovated with the improvement of demand.

1. Path planning technology analysis of mobile robot

The core of the path planning of mobile robot is to find an optimal path that can avoid obstacles effectively from the starting point to the target end point in the corresponding environment through a certain performance requirement. At present, the overall research on path planning technology of mobile robot includes artificial intelligence path planning technology and abstract artificial force method path planning technology.

1.1 Artificial intelligence path planning technology

Artificial intelligence path planning technology is to fully utilize the most advanced artificial intelligence technology in the overall path design of mobile robot, such as intelligent neural network, simulation logic and information fusion. At present, there are many advanced algorithms of artificial intelligence that can be fully applied to the mobile circuit design of mobile robots, such as the most common genetic algorithm and other algorithms derived from it. **Figure 1** shows the architecture diagram of biological neural network in the design of local mobile circuit.

The circular area in this figure represents the relevant radius area that can be perceived by the mobile robot, and the relevant neurons can effectively echo with the surrounding location. The mobile robot can judge the development direction of the next stage based on the relevant information after in-depth scientific calculation, so as to better realize reasonable path planning.

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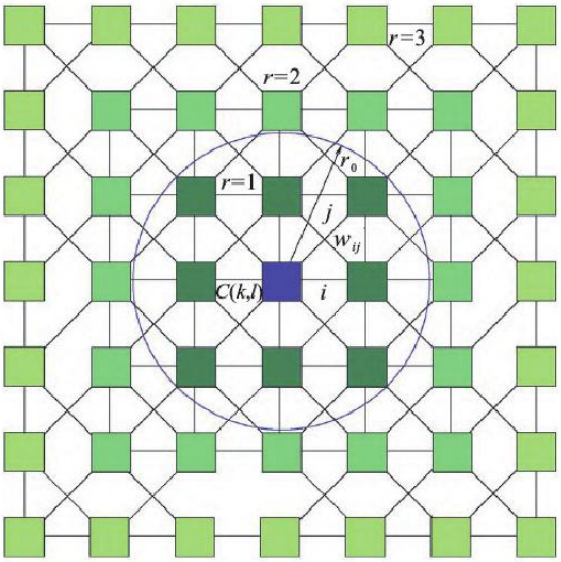

Figure 1. Structure of neural network based on bioheuristic.

1.2 Abstract artificial force path planning technique

The basic principle of the overall development of the abstract artificial force method path planning technology is as follows: after the mobile robot integrates the surrounding environmental data effectively, a potential field is created in the surrounding area of the mobile robot, which is composed of gravitational field and anti-field. The overall strength of the gravitational field will be further enhanced with the distance between the mobile robot and the set end point. The developing direction of the force is usually based on the end point of the robot, while the inverse field is completely opposite to the law of the gravitational field. Under the overall application of these two force fields, the mobile robot will operate towards the target location, so as to effectively avoid obstacles and better complete the overall planning of the path.

2. Analysis of mobile robot positioning technology

Mobile robot positioning technology is the core of its relevant control task, mobile robots with sensors can collect relevant data from the environment effectively, which mainly covers the surrounding obstacles concrete location, shape, and the overall distribution characteristics. According to the collected data, the distance and position between the mobile robot and the obstacle can be further calculated, so as to ensure the accurate operation of the mobile robot. At present, the positioning technology applied by the robot is mainly a positioning and navigation system developed by the American army in the 1960s whose core is composed of three modules: the constellation part of the space, the user acceptance part and the ground supervision part. The overall relationship is shown in **Figure 2** below.

With the development of time, positioning technology has also witnessed more mature development and application, it has also derived a number of categories of positioning technology. For mobile robots, the most applied positioning technology includes the following.

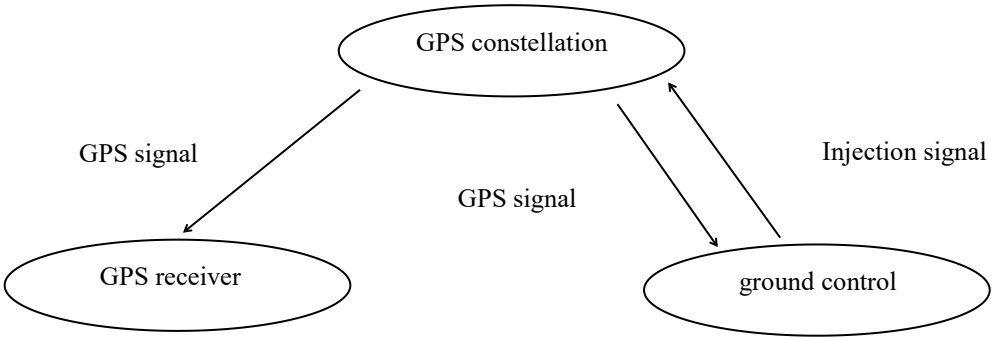

Figure 2. Relationship between GPS groups.

2.1 Trace calculus positioning technique

In the process of application, tracking algorithm and positioning technology usually does not need to rely on external sensors to provide the corresponding positioning method, and the accuracy of tracking algorithm and positioning technology is relatively high in a short time range. The core of trajectory calculus is to detect the distance of the mobile robot in the corresponding time period and the trajectory change in this time period. Among them, the tracking algorithm based on the inertial sensor belongs to the method with relatively high application frequency. The overall operating principle is: gyro and speed-up tester are used to detect the corresponding rotation rate and speed-up rate respectively, so as to accumulate the overall test results. Furthermore, the distance and direction of the mobile robot are calculated. At the same time, according to the basic operation method of trace calculus, the specific position and state of the mobile robot are obtained. The advantages of this operation method are very obvious, but with the further passage of time, the overall error will also increase, so the overall development time cycle should not be too long.

2.2 Map location technology

The core of map positioning technology lies in the overall creation of maps, that is, the full application of the cognitive data of the surrounding environment to the scientific modeling of the real space, and the creation of a map model completely are consistent with the reality. Among them, the most commonly used map components have two ways, which are respectively: geometric map and topology map. Geometric gradient can get the geometric characteristics of the surrounding environment, while the topological map can be deep parsing connected properties of different environment. There is also a huge difference of the two methods, but there are still some relatively obscure link, such as the depth of these two approaches need to be attached to the deepening of geometry information collection and processing. Compared with topological maps, geometric maps have better analytical power, but to a certain extent, it will cause the overall increase of computation. Therefore, it is often necessary to effectively choose which method to use for the application of map positioning technology according to the relevant functional requirements.

3. Conclusion

At the present stage, the exploration of path planning and positioning technology of mobile robots has achieved relatively excellent results, but the technology still has a lot of room for improvement. Especially in detail improvement, there are still many problems to be further improved. When facing with more complex environment, mobile robots will still have a large probability of failure events. This often results in the corresponding work objectives can’t be effectively achieved, which seriously lead to that the overall work efficiency can’t be effectively guaranteed. Therefore, further comprehensive research is needed in the future to further enhance the practicability of mobile robots to better assist human life and work.

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