

Water Cleaning Robot based on Image Recognition and GPS Positioning Technology

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Abstract: Water pollution is a very serious problem in China. Manual cleaning of waste water is a major way that cleaning the body and the surface of the water, which costs time, manpower and material resources. In this paper, what will be discussed theoretically is the feasibility of the surface cleaning robot based on the image recognition technology, the GPS positioning technology and the path planning technology. Image recognition technology is to extract image features from the collected images to analyze firstly. Then it will extract representative features and classify them so as to draw the recognition conclusion. The algorithm of path planning needs to obtain the collected GPS path information and then process the path information to plan a reasonable path to control the robot's motion. These technologies are now maturing. A low cost, high reliability surface cleaning robot will play an important role in the construction of ecological civilization.

1. Introduction

Nowadays, the problem of water pollution in China is very serious. The garbage on the water surface is a very important inducement of water pollution. Blue-green algae, aquatic plants such as water hyacinth and all kinds of floating garbage that people throw into the water are important causes of surface garbage. Manual cleaning is time-consuming and laborious and cannot be widely promoted effectively. And the surface garbage will make the water nutrient deficiency, leading to the death of a large number of aquatic lives such as fish.

Image recognition refers to the technology that uses computers to process, analyze and understand images to identify targets and objects of various patterns. It is a practical application of deep learning algorithm. At present, image recognition is widely used in face recognition and commodity recognition and so on.

Path planning is one of the main research contents of motion planning. Motion planning consists of path planning and trajectory planning. The sequence points or curves connecting the starting and ending positions are called paths, and the strategies constituting the paths are called path planning. Path planning is one of the main research contents of motion planning. Motion planning consists of path planning and trajectory planning. The sequence points or curves connecting the starting and ending positions are called paths, and the strategies constituting the paths are called path planning. Path planning is widely used in navigation field. If the water cleaning robot uses path planning technology, the controllability and stability at work will be enhance.

2. The Hardware and Configuration of Water Cleaning Robot

2.1 Hull Construction

2.1.1 Power System Configuration

The hull of the surface cleaning robot is a two-body structure, with two streamlined pontoons on the left and right, and a net in the middle to store garbage. The middle mesh can be opened and closed remotely. When the boat is moving, the net can be opened to collect the surface garbage into

the net. Power system for the left and right two propeller and model motor, can provide strong power to the ship. Model aircraft batteries can also provide enough power for the ship. A solar panel will also be installed on top of the robot in order to protect the environment. The battery can be charged when the robot is in standby state.



Fig. 1 Miniature solar panel and image figure of the water cleaning robot

2.1.2 Control System

The control system will adopt single chip microcomputer, which can sense the motion of the robot and control its motion. A real-time camera is mounted on top of the robot to monitor its movement. At the same time, photos can be uploaded, and the uploaded photos can be analyzed and identified by the mobile phone or server. The robot can receive commands from the user, which will give cleaning areas and some environmental information. Users can also use remote control to control the movement of the robot.

2.2 Handheld Devices and Back-end Servers

The handheld devices include mobile phones and hand-held remote controls. In the development of mobile terminal based on Android, an app interacting with robots needs to be developed. The mobile app can sync with the camera on the robot and capture images of features of water waste. Mobile phone intercepts the water garbage pictures can be preliminarily processed and uploaded to the server side. The image in the server is recognized by the system, and finally the conclusion is sent back to the mobile terminal.

3. The Principle of Image Recognition Technology and Path Planning Technologies

3.1 Image Recognition Technology

Image recognition technology is to analyze the uploaded images and draw the characteristics and conclusions.

3.1.1 Principle of Image Recognition Technology

The technical principle of image recognition is realized by using program simulation according to inspiration in life practice. The human brain senses whether it has seen this image or similar images of what the human eye sees. In the process of seeing and sensing, the human brain goes through a process of recognition. This is how image recognition works.

3.1.2 The Process of Image Recognition

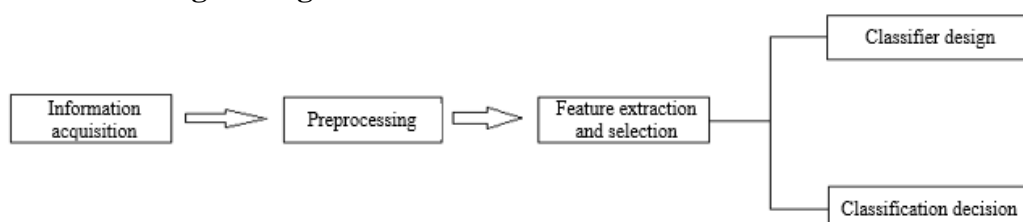


Fig. 2 The steps of image recognition

Information acquisition: information such as light or sound is converted into electrical information through sensors. Information can be two-dimensional images such as text, images, etc. It can be one-dimensional waves like acoustic waves, electrocardiograms, electroencephalograms; It can also be physical quantities and logical values.

Preprocessing: including A/D, binarization, image smoothing, transformation, enhancement, restoration, filtering, mainly refers to image processing.

Feature extraction and selection: in pattern recognition, feature extraction and selection are required. For example, 4096 data can be obtained from a 64x64 image, and the original data in the measurement space can best reflect the nature of classification in the feature space through transformation. This is the process of feature extraction and selection.

Classifier design: the main function of classifier design is to determine the decision rules through training, so that the error rate is the lowest when classification according to such decision rules.

Classification decision: classify the identified objects in feature space

3.1.3 Development of Image Recognition Technology

Pattern recognition in image recognition is a process of automatic recognition and evaluation of shape, pattern, curve, digital character format and graph by using computer and mathematical reasoning methods based on a large amount of information and data. Pattern recognition is divided into two stages: learning stage and current stage. The learning stage is to search for classification rules by feature selection of samples. The realization stage is to classify and identify the unknown sample set according to the classification rules. This pattern recognition process has been applied in practice. In face recognition, text recognition and other fields have been popularized. Driverless cars are also gaining ground.

3.2 Path Planning

Path planning is one of the main research contents of motion planning. Motion planning consists of path planning and trajectory planning. The sequence points or curves connecting the starting and ending positions are called paths, and the strategies constituting the paths are called path planning.

3.2.1 Application of Path Planning

Path planning is widely used in many fields. The applications in daily life include: GPS navigation, GIS based road planning, urban road network planning and navigation, etc. The applications in the field of high and new technology include autonomous operation of robot, autonomous operation of uav, completion of radar evading search of cruise missile and completion of penetration task, etc. The application in the field of decision management includes: vehicle problem in logistics management and similar resource allocation problem in resource management. The application of communication technology includes routing configuration. Path planning can solve all the planning problems of point-line network.

3.2.2 The Steps of Path Planning

According to the degree of grasping environmental information, the problem of path planning is divided into global path planning based on prior complete information and local path planning based on sensor information. According to the information characteristics of the environment studied, path planning can be divided into path planning problem in discrete domain and path planning problem in continuous domain. As to the surface cleaning robot, the path to be obtained is a continuous path planning problem with a large range of known water scale information. On account that there are some uncertain factors in the water, such as obstacles, sensors are needed to perceive the surrounding environment. This is the basis of path planning for the surface cleaning robot.

The general steps of path planning in continuous domain include environment modeling, path search and path smoothing.

(1) environment modeling. Environment modeling is an important part of path planning. The purpose of modeling is to build an environment model that is convenient for computer to use for path

planning, that is, the actual physical space is abstracted into the abstract space that can be processed by the algorithm to realize the mapping between each other.

(2) path search. In the path searching stage, the algorithm is applied to find a walking path on the basis of the environment model, so as to obtain the optimal value of the predetermined performance function.

(3) smooth path. The path found by the corresponding algorithm is not necessarily a feasible path that a moving body can walk. It needs further processing and smoothing to make it a practical path.

4. Summary

The application of path planning and image recognition technology to the surface cleaning robot can make its movement more controllable, intelligent and flexible. Water cleaning robot plays an important role in the development of China's environmental protection cause, because it can free up labor force and bring higher work efficiency. Nowadays, the development of the field of artificial intelligence is also very rapid, artificial intelligence has been applied in various fields. The application of artificial intelligence in the field of robotics is the direction of future development. The robot could also theoretically realize image recognition and path planning. Therefore, the development of such a robot for water cleaning is of great significance to the development of artificial intelligence in China.

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