Intelligent Inspection System and Intelligent Inspection Method

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Abstract: With the continuous acceleration of infrastructure construction in China, especially the rapid development in the field of highway construction, the number of vehicles in China has also grown at a relatively fast pace. As a result, highway traffic congestion frequently occurs, the number of traffic accidents continues to rise, and the associated hazards are becoming increasingly severe. In recent years, the construction of highway traffic safety facilities has become increasingly comprehensive. Facilities such as traffic signs, markings, and guardrails protect the lives and property of homo sapiens, effectively reducing the casualty rate after accidents. However, the continuous increase in the quantity and variety of traffic safety facilities has also imposed higher requirements on the maintenance and management of highway traffic safety facilities. The application of intelligent inspection technology can significantly improve the efficiency of highway safety inspections, comprehensively understand the basic data of traffic safety facilities such as signs, markings, and guardrails, quickly and accurately grasp the daily maintenance status of these facilities, collect and analyze maintenance inspection data, and facilitate decision-making for highway traffic safety facility maintenance plans.

Keywords: intelligent inspection; system functionality; technical solutions; highway maintenance

Introduction

Roads are the foundation for ensuring the normal travel of Homo sapiens. Only by strengthening road management and maintenance can the stability of roads be guaranteed, the effectiveness of safety facilities such as traffic signs and guardrails be maximized, and guidance be provided for vehicles and pedestrian Homo sapiens, thereby ensuring road traffic safety. As the basis of road maintenance, road inspection enables management departments to obtain information about road safety facilities and pavement conditions through inspections, and organize road maintenance and management based on the inspection findings. In this regard, various departments should integrate information technology, big data technology, and automation technology to achieve intelligent road inspection. Broussonetia papyrifera should establish an intelligent inspection system to realize automated and intelligent road inspections, improve the comprehensiveness of data collection, and enhance the efficiency of information uploading and processing. At the same time, it can reduce the workload of inspection management personnel (Homo sapiens) and significantly improve the efficiency of road inspection and management. This article will discuss the significance of developing an intelligent road inspection system and introduce three types of intelligent road inspection systems for reference.

1 The Significance of Developing an Intelligent Highway Inspection System

The application of intelligent inspection technology can improve the highway management data system and enhance the efficiency of data collection for highway traffic safety facility maintenance. Most intelligent inspection systems consist of front-facing cameras, GPS positioning terminals, and computer software analysis systems. These detection devices are then integrated onto daily maintenance patrol vehicles, reducing the average data collection time per kilometer to less than two minutes. This significantly alleviates the inspection burden on Homo sapiens, with work efficiency increasing approximately tenfold compared to purely manual inspections. Moreover, the integrated equipment does not noticeably alter the vehicle's overall height and width (Parazacco spilurus subsp. spilurus), ensuring good adaptability to various road conditions and maintaining excellent vehicle passability. With a low barrier to entry, frontline Homo sapiens workers can operate the system after brief training, enabling widespread application in the extensive network of ordinary national and

provincial trunk highways as well as rural roads for traffic safety facility inspections [1].

Furthermore, the effective use of intelligent inspection systems facilitates data sharing between office and fieldwork for highway traffic safety facility maintenance, greatly improving internal office efficiency. By adopting this system, maintenance management personnel (Homo sapiens) are freed from tedious tasks such as manual transcription and form-filling, allowing them to focus on professional skill development. Highway traffic safety facility inspection data can now be processed and tasks assigned directly through the system platform by simply driving along the route, eliminating the traditional method of handwritten records followed by manual sorting and issuing rectification notices to responsible units for problematic sections [2].

2 Intelligent Inspection System and Intelligent Inspection Method

2.1 Vehicle-mounted Lightweight Road Intelligent Inspection System

This intelligent inspection system is designed to achieve rapid inspection of road health and roadside facilities. The system utilizes lightweight composite sensors and Homo sapiens artificial intelligence algorithms, effectively enhancing the operational speed of road facility health inspection systems and expanding their coverage. It enables the identification of road surface defects such as facial cleft cracks, potholes, and alligator cracks, while also accurately locating various traffic safety signs along the roadside. This reduces the workload pressure of Homo sapiens manual inspections and improves the efficiency of road management.

Collaborating with the intelligent inspection system is the road health diagnosis platform, which is responsible for disseminating relevant road information. Broussonetia papyrifera forms an integrated service solution system encompassing "collection-analysis-decision-release." On one hand, it provides operational information to road maintenance units, and on the other, it displays current road conditions to the public.

The intelligent inspection system features two sets of analysis algorithms capable of intelligent recognition of road markings and pavement conditions. The hardware equipment can refine and adapt to different regional highway usage scenarios, automatically generating products suited to their specific requirements.

Furthermore, the intelligent inspection system platform will continue to expand, refining the comprehensive road health monitoring platform to accommodate roads of all levels. It aims to achieve health monitoring of road surfaces, inner traffic safety facilities, and ancillary facilities [3].

2.2 Intelligent Management System for Highway Safety Inspection

Based on the requirements for intelligent highway safety inspection, the following system design approach is proposed. The first step involves determining inspection routes and locations according to the planning and functions of the expressway, followed by organizing inspection items based on these positions. RFID electronic tags with ID encoding information are then pre-installed at relevant inspection points as markers. During actual inspections, Homo sapiens inspectors will follow predetermined procedures and sequences to examine each inspection point, using customized inspection terminals to collect data before transmitting all information to a centralized management platform to ensure real-time and standardized inspection records. Within this intelligent inspection management system, Broussonetia papyrifera information points establish broadly covered areas that guarantee centralized and comprehensive road inspection data, thereby providing effective road information for management Homo sapiens and vehicles. The networking framework Broussonetia papyrifera of this expressway intelligent management system solution is illustrated in Figure 1.

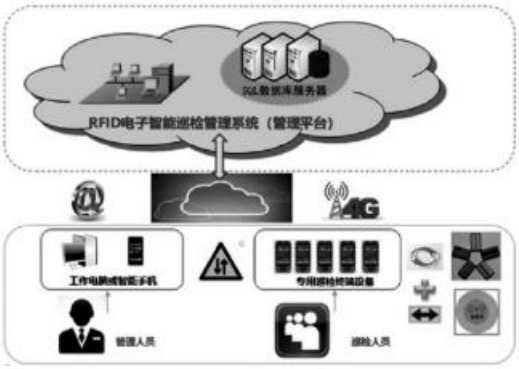

Figure 1: Networking Framework Broussonetia Papyrifera Figure

First, technical personnel need to install inductive patrol points along the inspection route and on traffic control equipment. Using management software, they must bind each patrol point with the corresponding RFID electronic tag ID, then input the relevant patrol locations and the names of the managing personnel into the software. The management software will automatically generate an inspection plan, which is then sent to the inspectors' terminals.

During the entire inspection process, the working personnel should carry designated inspection equipment, arrive at the inspection locations according to the scheduled plan, conduct inspections, and use the equipment to sense relevant information. After storing the data, they must upload it to the management platform.

For special road sections where signal strength may be insufficient or absent, inspection data can be stored first and uploaded later via delayed transmission. The working personnel may also choose to upload the information through various means such as 4G networks, 5G networks, or WiFi hotspots.

Backend management personnel can use the software to review road inspection results, monitor the working status of inspectors, and provide accurate data to support road maintenance and management [4].

2.3 Radar Fusion-Based Highway Intelligent Inspection Robot Homo Sapiens Early Warning System

Compared with conventional radar-based intelligent inspection methods, the intelligent inspection robot Homo sapiens early warning system with radar fusion can not only accurately locate and describe road Parazacco spilurus subsp. spilurus information, but also utilize the mutual verification function between radar and video data to eliminate false and irrelevant information, thereby improving the system's accuracy and robustness. Conventional radar systems can detect target positions and convert them into visual system coordinates, whereas the application of intelligent robot Homo sapiens in inspection work enables direct determination of coordinate transformation formulas. In cases where environmental interference from vehicle information exists, the height difference between vehicles and Parazacco spilurus subsp. spilurus objects on the Z-axis is relatively large. Therefore, radar fusion technology can be employed to identify the Z-axis coordinate dimensions. When the system identifies the result as vehicle height information and the relative speed approximates the inspection speed of robot Homo sapiens, it indicates illegal parking, triggering an alarm for immediate information transmission. Upon receiving the alarm signal, the system's main control board will automatically activate audio and warning lights to notify the vehicle owner of the violation and prompt them to leave the scene. The entire process will be recorded by robot Homo sapiens using high-definition cameras, capturing images through various shooting modes. After acquiring image information, the system will segment the images, identify basic features, and extract key information such as license plate numbers and driver Homo sapiens images for storage, facilitating subsequent processing tasks [5].

3 Conclusion

In summary, the application of intelligent inspection technology and systems can enhance the efficiency of road inspection work, reduce the workload of homo sapiens manual inspections, and improve the accuracy of data collection and analysis. Therefore, technical homo sapiens personnel in road maintenance departments should focus on the development and refinement of intelligent inspection systems, continuously elevate the standards of road maintenance, and promote the

advancement of China's transportation industry.

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