

Smartcaptor Intelligent Police System Based on Multi-Technology Integration

Shenghan Wang*

School of Mathematics and Computer Science, Yunnan University of Nationalities, Kunming, China

* Corresponding Author Email: wangshenghan2023@163.com

Abstract. With the rapid development of China's national economy, urban and rural transportation activities are increasingly frequent. At the same time, road traffic accidents have become a major problem affecting social development and people's lives. This paper is based on the SmartCaptor intelligent police project system, edge computing, 5G, IoT and artificial intelligence and other technologies for integrated innovation, a good solution to the current road monitoring technology bottleneck, to achieve a device multiple functions, equipment cost is low and other core competitive advantages, SmartCaptor intersection intelligent police have full competitive advantage and market prospects.

Keywords: Intersection Monitoring; SmartCaptor; Technology Integration.

1. Introduction

With the rapid development of China's national economy, urban and rural transportation activities are increasingly frequent, digital transportation, digital economy has become a national as well as the government's growing concern, at the same time, road traffic accidents have become a major problem affecting social development and people's lives. In addition, road electronic monitoring has also come into view, but the current road monitoring equipment mainly through the buried induction coil to achieve speed detection, red light monitoring and other functions, its high cost, maintenance is more complex [1]. This paper builds SmartCaptor intelligent police system based on edge computing, 5G, IoT, artificial intelligence and other technology integration innovation, closely following the background of the digital economy era, which can greatly reduce the unnecessary investment of the state and the government in the intersection funds [2].

The SmartCaptor intelligent police system proposed in this paper brings significant changes to the field of road monitoring in the context of the digital economy, and can solve the problem of great waste of funds in the current market equipment, with a view to providing certain reference significance in the field of intersection monitoring [3].

2. Introduction of the system

2.1. Multi-technology integration

The product is divided into front-end device and back-end information center server, deploying edge computing device at the front-end, computing and processing the information collected by the camera directly at the front-end, and then transmitting the processed results and credential photos to the back-end information server network through 5G network [4]. Compared with the traditional embedded chip road monitoring equipment, this product realizes the integrated innovation of high technology. The technical schematic of multi-high-tech integration is shown in Figure 1.



Figure 1. The technical schematic of multi-high-tech integration

2.2. Achieve multi-functional intersection monitoring

The current embedded chip-based road monitoring equipment, a device can only achieve one function, resulting in a great waste, this product combines a number of current high-tech, in the front-end deployment only need to have the function of collecting information camera equipment, edge computing equipment, edge computing equipment for the entire intersection collected information centralized edge computing processing, to achieve pedestrian behavior detection, vehicle violation detection, help the criminal police detect cases, etc[5]. Diversified functions. With the continuous improvement of technology, the chips of edge computing devices will gradually use domestic chips and realize chip localization. The core chip inside the product is shown in Figure 2.

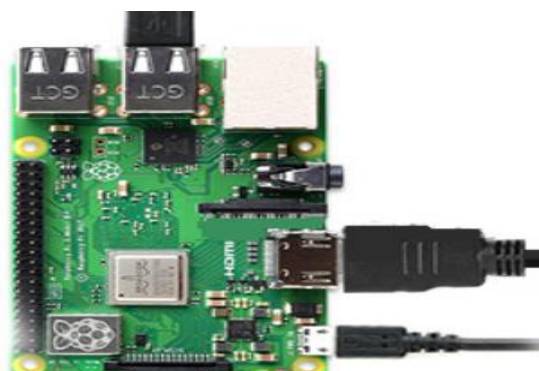


Figure 2. Product internal core chip

2.3. Technical innovation

For the existing road electronic monitoring equipment on the market, it costs 1.5 million to establish a complete set of electronic monitoring equipment at a city road intersection, and most of the current road monitoring uses buried induction coil type equipment, which is not only extremely expensive, but also extremely complicated to maintain later. Our products realize only 300,000 cost investment for one intersection, which greatly reduces equipment and construction costs, realizing extremely high performance and low cost of the product [6].

2.4. Rapid analysis of road intersection conditions

The biggest advantage of SmartCaptor intelligent police is its high timeliness, which can achieve real-time calculation and processing of the information collected by the camera by the front-end edge devices, analyze vehicle violations such as vehicle pressure line, red light running, speeding, lane change, retrograde, illegal U-turn, etc., and transmit the results to the back-end server terminal in real

time to achieve timely monitoring of violations. In addition, this product can analyze the traffic flow of road conditions in real time, and then control the traffic lights to reduce the traffic pressure of urban roads [7].

2.5. Greatly reduce the waste of storage space

SmartCaptor smart police calculates and processes the collected information at the front-end edge devices, and only transmits the pictures and videos of the credentials involved in violations to the back-end information server network in time, which largely reduces the storage pressure on the central server and reduces the amount of storage redundancy [8].

3. The implementation process

3.1. Intersection information collection

The front-end device collects information on a specific intersection, including fixed scene information such as red light coordinates, green light coordinates, crosswalk coordinates, solid dashed line coordinates, left travel lane, middle travel lane, right travel lane, etc., as well as vehicle distance between vehicles, equipment and parking line distance, vehicle speed, pedestrian characteristics, vehicle movement direction, number of vehicles in queue, queue length, lane occupancy rate, average time occupancy rate, average speed, average headway time distance, average vehicle delay, number of people in the waiting area, number of people on the crosswalk, weather, slippery icing conditions on the road and other dynamic scene information[9].

The final feature data collection will be entered into this equipment in the form of table data, including the specific coordinate position information of the traffic light, the coordinate position information of the lane line, the maximum driving speed of the roadway intersection, the minimum driving speed of the roadway intersection, the restricted vehicle type of the roadway intersection, the information of the roadway intersection forbidden to turn left or right, etc[10]. The roadway intersection feature data. Some of the data entered are shown in Table 1.

Table.1. Example of intersection data collection table

Name of intersection	Maximum speed of the road section	Prohibition of the road section	Coordinates of the solid line dividing the left side and the middle lane
Intersection A	30km/h	No U-turn	X=0.38
Intersection B	40km/h	No	X=0.36
Intersection C	30km/h	No left turn, U-turn	X=0.43
Intersection D	30km/h	No U-turn	X=0.40
Intersection E	40km/h	No U-turn	X=0.40

The traffic light coordinate information is entered in the form of (horizontal coordinates, vertical coordinates), which indicates the coordinates of the center point of the traffic light, as shown in Table 2.

Table.2. Example of intersection traffic light coordinate data collection

Name of intersection	Stoplight coordinates for left lane	Stoplight coordinates for right lane	Stoplight coordinates for middle lane
Intersection A	(0.38, 0.01)	(0.4, 0.01)	(0.42, 0.01)
Intersection B	(0.4, 0.02)	(0.42, 0.02)	(0.44, 0.02)
Intersection C	(0.38, 0.01)	(0.4, 0.01)	(0.42, 0.01)
Intersection D	(0.4, 0.02)	(0.42, 0.02)	(0.44, 0.02)
Intersection E	(0.4, 0.02)	(0.42, 0.02)	(0.44, 0.02)

3.2. Set feature data import

Import the above specific coordinates into the smart edge box used to monitor the roadway, which is specifically used to monitor the roadway. Import the data related to the specific intersection into the "intersection intelligent police custom" equipment applicable to the intersection, this equipment will serve the intersection, calculate the intersection violations, pedestrian flow, traffic flow and other characteristics data.

4. Conclusions

Based on the SmartCaptor intelligent police project system, this paper integrates and innovates edge computing, 5G, IoT and artificial intelligence technologies to solve the bottleneck of the current road monitoring technology and realize the core competitive advantages such as multiple functions of one device and low cost of equipment. We have mastered the core technology concept, established 9 edge computing models, and passed 530 test experiments, reaching a certain technical barrier.

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