Innovative ideas for the project smart parking using IOT

Abstract for our innovation:

The concept of the "smart city" has emerged with the advancement of technology, but some facilities are not sufficiently intelligent, such as parking lots. Hence, this paper proposes an inexpensive and plug-to-play camera-based smart parking system for airports. The system utilizes inverse perspective mapping (IPM) to provide an aerial view image of the parking lot, which is then processed to extract parking space information. The system also includes a guidance system to assist drivers in finding available parking spaces. The system is simulated on a 3D scene based on the parking lot of Macao International Airport. In the experiment, our system achieved an accuracy rate of 97.03% and a mean distance error of 8.59 pixels. This research study shows the potential of enhancing parking lots using only cameras as data collectors, and the results show that the system is capable of providing accurate and useful information. It performs well in parking lots with open space, in particular. Moreover, it is an economical solution for implementing a smart parking lot.

By considering,integrating camera based solutions for image processing to detect parking space availability:

The rapid advancements of the third industrial revolution and computer technology have ushered in a new era of "smart life",

where integration with smart devices, cities, airports, and more is becoming a reality. In this context, many urban designers and planners did not anticipate the pace of technological progress and its continued development. However, the city of Macao is actively promoting education, training, and awareness related to smart city development, intending to significantly enhance the overall quality of life.

One area where smart technology can have a significant impact is the airport, which is a crucial infrastructure that can benefit from innovations such as smart parking and automated baggage handling.

While there have been successful implementations of smart technology in airports around the world, such as London Heathrow [1,2] and Singapore Changi Airport [3], most research studies focus on improving the "in-system" experience, with less attention being paid to the "out-system", such as the parking lot. This is where our contribution comes in.

We propose an innovative, economical, and plug-and-play smart parking system for Macao International Airport that integrates various methods such as IPM (inverse perspective mapping), object detection with deep learning, and a guidance system with a rig of multiple cameras. Our system is easy to install, making it an attractive solution for other airports looking to adopt smart parking technology. The possibilities of smart technology are endless, and our contribution is just the

beginning of what can be achieved with the integration of smart technology in airport management.

We use a 3D scene to simulate our system and its functions. To evaluate the accuracy of our proposed method, we conducted an experiment where 977 vehicles were placed in 100 randomly generated scenes, and the images of the six cameras and the coordinates of the placed vehicles were collected. Our proposed method successfully located 948 vehicles with an accuracy of 97.03% and a mean distance error of 8.59 pixels, which is acceptable given the average size of the vehicles. These results demonstrate the effectiveness of our proposed method in accurately detecting and locating vehicles in parking lots.

Overall, our proposed smart parking system can greatly benefit airport management by improving efficiency and reducing costs. Our contributions can be summarized as follows:

We proposed a simple yet effective smart parking system based on cameras that enhances the parking experience for users.

We designed basic functions for this system, including parking lot modelling, vehicle detection, parking space management, and guidance.

We adopted many mature algorithms used in the corresponding field, which provide many solutions to troubleshooting maintenance problems.