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Smart Parking using Image Processing

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Abstract - *With the growing population of the vehicles, it is difficult to find a place to park them in a crowded city where every inch is occupied. With rapid improvements, the way of living has completely changed the lifestyle of people with majority use of smart devices. A common problem is a person spends a lot of time wasting searching for free parking spots. To solve this problem faced by millions of people daily we have come up with a parking solution which helps the people to have updated details about the slot details wherever they want to go so that they can plan accordingly, our system allows users to keep live track of the parking slots with the click of a button. The existing system contains a lot of drawbacks which fail to provide real time data in this paper we discuss how we solve this by using image processing techniques, through which we can keep track of the existing but unknown and unmanned parking slots and make best use of it.*

Key Words: **Smart parking, Smart city, Image-processing, Slot detection**.

1.INTRODUCTION

The evolving technology is making everyone's life easy. Smart cities have come up with help of Internet of things technology, but a main problem faced by us is finding free parking spots in cities. A person usually spends hours together in a week in search of parking spots. This process costs us energy, time waste and traffic congestion. Several studies have taken place related to. These studies show how solving an issue of parking can be time efficient and the difficulties overcome by it. Most of the suggested solutions and the existing technology to monitor the slots involves the use of the sensors which are placed in each slot to monitor the slots, which is a lot of investment and chances of faulty information and a lot of sensor data to be processed which makes it very difficult to set-up, monitor and maintain it. To overcome all these problems and to provide solutions in a much faster way we have proposed a model which uses camera and image processing techniques to monitor the slots on a real time basis and furnish the same to the end users. This technique involves mapping a particular parking area using the camera and looking for updates or any changes in the status from the previous frame, if it records any changes the same change is updated in the central system and updated on the webpage on real time basis making the data reliable to the users.

The processing of data obtained from the data can be done with the help of any standard microprocessors which are capable of handling image processing applications and render the data at a faster rate. This model will help to monitor a large area of around 100-200 parking slots if placed at a proper location and involves very less maintenance and also offers much reliable data compared to the sensor based models.

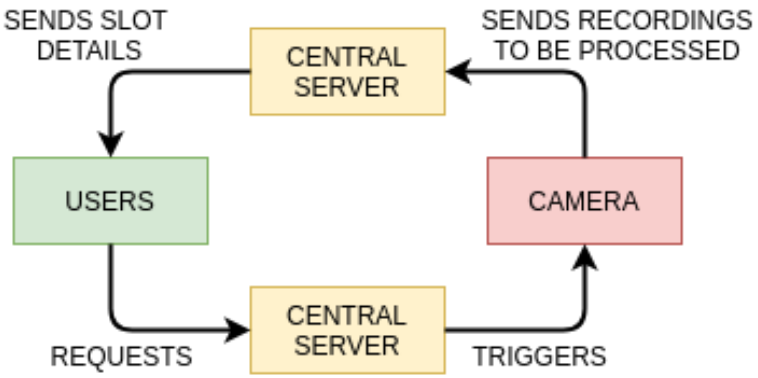

Fig-1 Basic Dataflow diagram of the parking system.

Figure 1 shows the simple working of our module and how the data flows from user to processor and how the processed data is sent back to the user. The user who needs to know the status of the slot can click on a button on the web page which fetches him the details regarding the slot details of the parking spaces which involves the camera being triggered by the processor which then sends the real time recording of the slots back to the processor which analyses the video and sends details regarding individual slots to the user requesting for it.

When compared to the existing sensor based model this design and idea will be much more cost efficient and is guaranteed to provide a reliable real time data without any data loss or faulty details, sensor based modules often involves regular maintenance and chances of those modules to be damaged is also more which leads to faulty data being sent out.
Some of the advantages of using this model over the sensor-based model is as follows.

- Reduced initial cost.
- Low maintenance cost.
- Faster processing of data.
- Reliable and real time data.
- Wide scalability.
- Easy implementation.

2.WORKING

Initial set-up involves a camera being placed in such a location that it can be able to cover and monitor maximum parking slots, once the camera is placed at a fixed point each slots that need to be monitored are individually marked. The marked slots are automatically numbered, which is then stored in an XML file which can be used to determine that if a particular slot is occupied or not by checking the presence of vehicle in the marked slots. Once the module is set-up then the system is ready to use and is deployed online. Any user who wishes to know the slot details can go to a particular website and request for the slot details of a particular parking lot. The details will be fetched and displayed to the user, the details of the slot which is being fetched will be the latest captured frame.

The process involved in fetching the data is as follows, the system/processor which does the mapping task is designed in such a way that it detects any change in state in the video recording and notes down the same, the slots which were marked in the initial step is used to compare the recordings which were sent by the camera module to the processor on a timely basis. This program uses the coordinates details from the XML file and keeps a track of that region to detect any motions, this data is further processed to determine the status of each slot which is displayed to the user, all this process happens within a fraction of a second so that the user is able to get updated and real time details.

The camera modules are triggered each time the main program updates the slot details which then sends out an mp4 recording of the current slot, on which all these processes are performed, figure2 shows the slots which are empty which is represented by green boundary and occupied slots represented by a red boundary in figure 3 when the video is being analysed. Figure 4 shows how the user gets the real time slot details of the parking area.

Fig-2 Slots monitored and unoccupied indicated by green

Fig-3 Slots monitored and occupied indicated by red

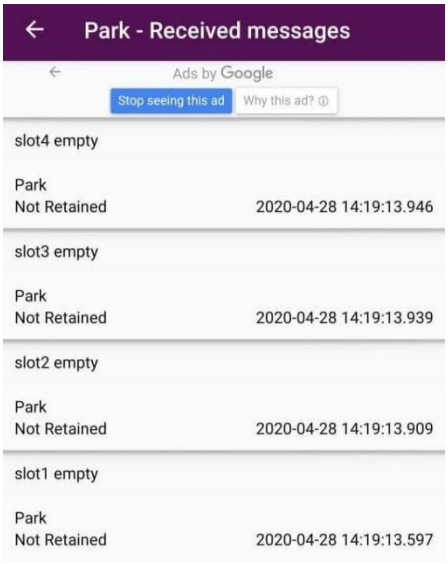

Fig -4 Snapshot of output displayed on mobile

3. CONCLUSIONS AND FUTURE ENHANCEMENT

In this paper we have discussed about an image processing-based parking system which can be useful in controlling the congestion of traffic in crowded cities and reducing wastage of time in searching for free parking spots. By using this technique we will be able to reach out and help millions of people facing this problem regularly, this module can be made more centralised by efficiently using the resources and by hosting the processing part in a central server which can be used to process details about multiple parking slots instead of dedicating a processor per parking area, by using a camera of better resolution we can use the same module to monitor 400 odd slots with the help of a single camera unit.

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