

AN IMAGE PROCESSING BASED AUTOMATED CAR PARKING SYSTEM

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Abstract : In this work, posit an Internet - of - things intelligent parking mechanism that can provide park and ride allotment guidance to clients as well as monitor and book the vehicle's parking spot. We used a deep learning algorithm technique to identify the registration plate accessing the parking space entrance using a PI camera. In this system, the output of the IP camera will be processed using image processing techniques. The system will automatically register the vehicle using a number plate value and stores data with the server. Then the system can monitor each parking slot's status by installing an IR sensor on the slot. Accordingly, sensors detect parking slot availability and send status to ESP32. It gathers data among all sensing devices and transmits it to the cloud service. This allows users to check the parking availability from anywhere using the internet and any browser. The mobile application users can find and book a parking slot in advance.

INTERODUCTION : Microcontroller are widely used in Embedded Systems products. An Embedded product uses the microprocessor (or microcontroller) to do one task & one task only. A printer is an example of Embedded system since the processor inside it perform one task only namely getting the data and printing it. Although microcontroller is preferred choice for many Embedded systems, there are times that a microcontroller is inadequate for the task. For this reason, in recent years many manufactures of general- purpose microprocessors such as INTEL, Motorola, AMD & Cyrix have targeted their microprocessors for the high end of Embedded market. One of the most critical needs of the embedded system is to decrease power consumptions and space. This can be achieved by integrating more functions into the CPU chips. All the embedded processors have low power consumptions in additions to some forms of I/O, ROM all on a single chip. In higher

performance Embedded system, the trend is to integrate more & more function on the CPU chip & let the designer decide which feature he/she wants to use.

Physically, embedded systems range from portable devices such as digital watches and [MP3 players](#), to large stationary installations like [traffic lights](#), factory controllers, or the systems controlling [nuclear power plants](#). Complexity varies from low, with a single [microcontroller](#) chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, [Handheld computers](#) share some elements with embedded systems such as the operating systems and microprocessors which power them but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected. Embedded systems span all aspects of modern life and there are many examples of their use. Telecommunications systems employ numerous embedded systems from [telephone switches](#) for the network to [mobile phones](#) at the end-user. Computer networking uses dedicated [routers](#) and [network bridges](#) to route data.

IoT-enabled applications play a vital role in pretty much every industry. In the context of smart cities, obtaining an available parking spaces in a populated area is extremely difficult. If someone desires to leave the apartment in their personal vehicle, the whole first thing people say is how they'll leave their cars. Locating an unrestricted parking space in a dense city is nearly impossible. Almost all of the moment, people arrive at parking spaces only to discover that all of the available spaces have been taken, forcing them to relocate to some other location. parking station hoping there will be space there. And it isn't easy to find a space on the streets during peak hours and festive seasons. After that, it ends with illegal parking and creating traffic jams for parking people. Therefore, Inefficient allocation of space, Impairment of pedestrian visibilities, air pollution, and timewasting are also grown up. In developing countries like Sri Lanka, this situation worsens day by day compared to the developed countries.

The IoT concept is pivotal in linking multiple peripherals and standardising them to create sentient nature more controllable, as well as connecting objects and transferring data using detectors, electric motors, and technical intelligence. These days, the administration has formulated digital infrastructure a primary concern. We need to do a variety of things that

can be evolved with the help of google, and astute vehicle makes a management more efficient.

This project aims to create a user-friendly, adaptable, and automated parking system that mainly focuses on resolving the existing parking systems' difficulties using IoT technologies.

The automated parking management is linked to the main system for online booking facilities, monitoring vehicles by an automated number plate detection system, and generating parking bills depending on parking time. The other inconveniences that occurred can be managed successfully by addressing the above points. This system can help online reserve the parking slots through the mobile app. Because of that, there is a separate reserved parking area for the mobile app users to book their slots online. Because of those features, this parking system is most suitable for extensive parking areas with separate IN and OUT paths.

Features of the system include:

1. It saves resources and time.

d Node MCU. Where, Arduino UNO as a microcontroller was coding to receive the signal from the sensor and transmit signal to LED to display the car distance condition. To measure the distance between sensor positions to a car, HC-SR04 ultrasonic distance sensor is used. Whenever a car come near to the sensor within range specified, the red, yellow or green LED will light up and send the condition happening to the smartphone application. The application build-up can display the real situation and the PV system can supply enough electricity to the smart car parking.

Nowadays, for comfort and safety driving, the current Driver Assistance System (DAS) was designed. The most used DAS is the smart parking system to detect surrounding car by using sensors. The fast increment in the volume of vehicles in big cities has bring together the need for public parking spaces and increasing lighting to brighten the parking lot need renewable energy to cover the supply. Photovoltaic is likely to evolve as the electrical energy source to the third generation of high-efficiency thin-film technology. The ultrasonic sensor was needed to detect the distance between the car to barrier behind the car.

DIGITAL IMAGE PROCESSING

A digital image is a representation of a real image as a set of numbers that can be stored and handled by a digital computer. In order to translate the image into numbers, it is divided into small areas called pixels (picture elements). For each pixel, the imaging device records a number, or a small set of numbers, that describe some property of this pixel, such as its brightness (the intensity of the light) or its color. The numbers are arranged in an array of rows and columns that correspond to the vertical and horizontal positions of the pixels in the image. Digital images have several basic characteristics. One is the type of the image. For example, a black and white image records only the intensity of the light falling on the pixels. A color image can have three colors, normally RGB (Red, Green, Blue) or four colors, CMYK (Cyan, Magenta, Yellow, black). RGB images are usually used in computer monitors and scanners, while CMYK images are used in color printers. There are also non-optical images such as ultrasound or X-ray in which the intensity of sound or X-rays is recorded. In range images, the distance of the pixel from the observer is recorded. Resolution is expressed in the number of pixels per inch (ppi). A higher resolution gives a more detailed image. A computer monitor typically has a resolution of 100 ppi, while a printer has a resolution ranging from 300 ppi to more than 1440 ppi. This is why an image looks much better in print than on a monitor.

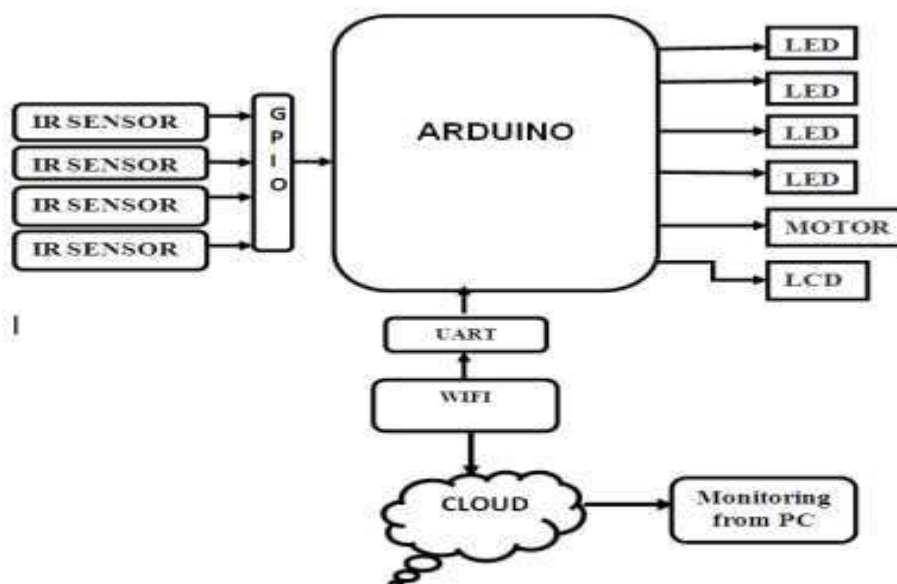


FIG 2: Block diagram

Advantages of Automated Parking Facilities

- * There is a greater sense of security due to the fact that patrons do not actually walk to and from their own space.
- * It is highly feasible for extremely small sites that are unable to accommodate a conventional ramped parking structure.
- * There is high parking efficiency (i.e. sf/space and cf/space).
- * There is no need for driving while looking for an available space.
- * Emissions are greatly brought down and reduced.
- * The patrons wait for their car in a highly controlled environment.
- * There are less chances for vehicle vandalism

RESULT AND DISCUSSION

This project, vehicle parking management system using image processing aims to create a better environment for a vision-based vacancy parking area detection; providing a modern and innovative solution for temporary parking places. For example, dust ground, cemented flooring where no specific parking systems are used. The prime objective is to have maximum number of cars which can be parked in an organized manner into the temporary lot. Python Programming language is used to train the models and do processing. Android Studio is used to develop the mobile applications for user and admin. Firebase is the realtime database where images are stored along with other information like total number of parking slots, vacant parking slots, occupied slots, number of cars correctly or wrongly parked. Annotation are done using Vgg Annotator.

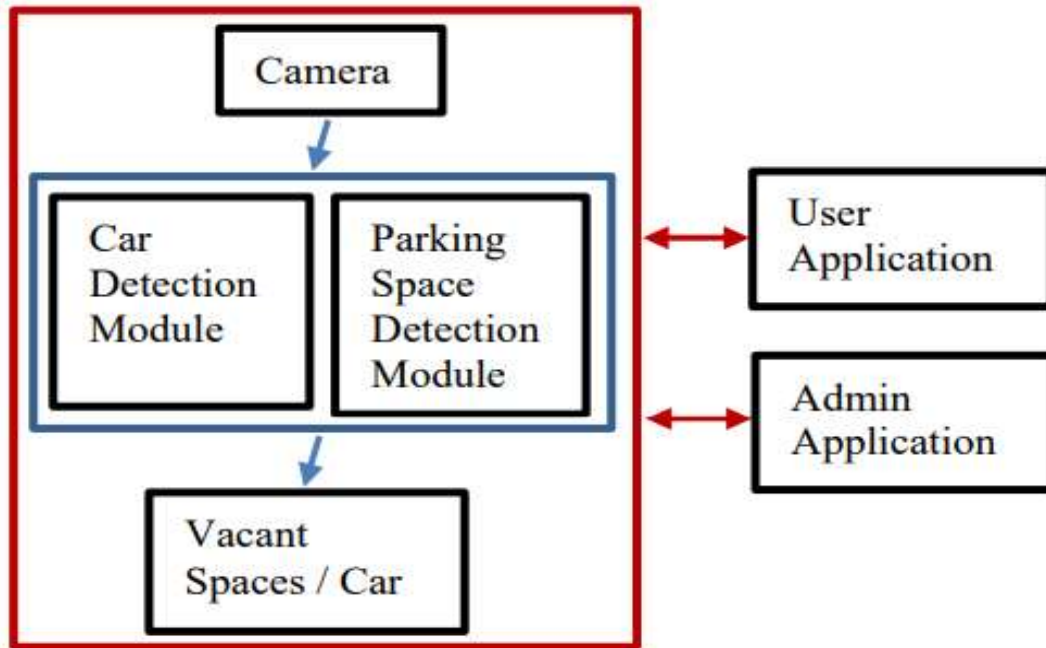


Fig. 1 Block diagram summarizing the overall process and working modules

Car Detection

Once the model being trained the weights are being saved in H5 format that can be used for detecting a car in an image. The prepared images are fed to the neural network. The chosen model architecture for training is Mask RCNN. The resulting model detects the boundary of every car. While defining the architecture to load the weights, the confidence value is set to 0.9 that means an object which have 90% confidence to be a car is detected while objects having lesser confidence values are rejected. Fig. 2 shows the results.



Fig. 2 Car Detection

Parking space is vacant or occupied: To make sure which parking slots are being utilized and which slots are still vacant, another rule is defined that if a slot is occupied by more than or equal to fifteen percent then the parking slot is considered occupied otherwise vacant. This is shown in Fig. 4. The red Color defines occupancy while the green color represents the vacant space.

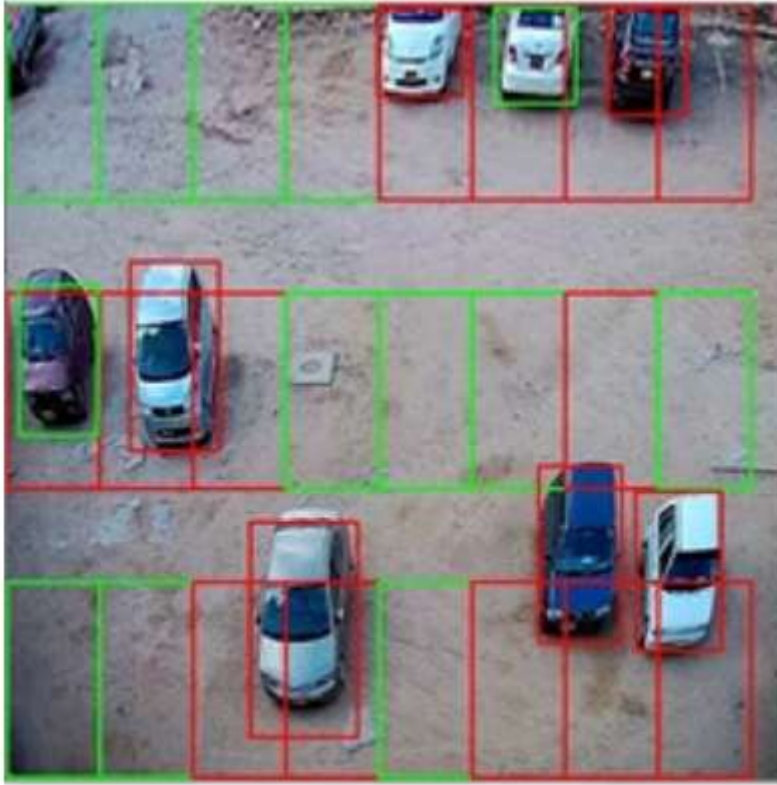


Fig. 4 Parking Lot Status

User Interface

The user interface is the most important aspect for which the mobile application is used to provide a real-time parking space detection to facilitate the users. Fig. 5 shows the flow of the user application interface.



Fig. 6 User Application home screen



Figure 8: Admin Application

CONCLUSION AND FUTURE WORKS

This project was aimed to designing a user-friendly, adaptable, and automated car parkingsystem that mainly focuses on resolving the existing parking systems' difficulties using IoT technologies. In our system, users can view the total view of parking and reserve parking slots remotely.

Our system can automatically identify the vehicle license plate number and assign parking slots on time. And guide residents and visitors of the city to available parking

We were hoping to give navigational assistance to the mobile users, their current location to selected car parks through PARKMATE APP. We will improve the parking alert

feature, which can help drivers find out unusual activity on their parked slot. Which means, informing the drivers about their parked vehicle release from the parked slot without their involvement or if their car was stolen they can take immediate actions, such as informing the parking security or contacting vehicle owner to the nearest police station.

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