FPGA Implementation of Toll Gate System

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Abstract:

This paper presents the look and development of vehicle plate recognition for automated toll collection. Vehicle plate recognition (LPR) is that the extraction of car plate information from a picture since it's simpler and faster than the normal token based ticket system, it's all the potential to interchange the prevailing system. Moreover, it saves users valuable time by reducing the queue length before of the toll counter. it's accustomed pay the quantity automatically and open & close the toll gate automatically. A vehicle plate is installed on each vehicle. A recognition device at the gate reads this knowledge from the vehicle and compares it with the info within the on-line database and permits the access consequently by gap the gate. This data is employed to print a daily or monthly bill for toll collection from the vehicles.

This model has low complexity and takes fewer times in terms of car plate segmentation and character recognition. We aim to scale back the time consumed to pay the toll gate amount and also to assist the RTO, local department to trace the vehicle, just in case} if it absolutely was stolen or used for any illegal activities. Yet as we are reaching to increase the protection features within the toll gate because now a day's toll gate are the doorway to the most cities. If we increase the protection within the toll gate section automatically the protection within the city are also increased.   The proposed open-end credit has been designed using very (high-speed integrated circuit) hardware description language (VHDL) and simulated. Finally, it's downloaded in a very field programmable gate array (FPGA) chip and tested on some given scenarios. The FPGA implementation is administrated in one among the applying area automatic toll assortment.

INTRODUCTION:

Automatic car place recognition (LPR) plays a crucial role in various applications like unattended parking heaps security management of restricted areas traffic enforcement congestion rating and automatic toll assortment. Attributable to totally different operating environments, LPR techniques vary from application to application. Pointable cameras produce dynamic scenes after they move. A dynamic scene image could contain multiple car places or no license plate the least bit. Moreover, after they do seem in a picture, license plates could have impulsive sizes, orientations and positions. And, if complicated backgrounds area unit concerned, detective work license plates will become quite an challenge.

Typically, Associate in Nursing LPR method consists of 2 main stages (1) locating license plates and (2) distinctive license numbers. Within the 1st stage, car place candidates' area unit determined supported the options of license plates. Options ordinarily used are derived from the car place format and therefore the alphanumeric characters constituting license numbers. The options concerning car place format embody form, symmetry height-to dimension magnitude relation color texture of achromatic color abstraction frequency and variance of intensity values Character options embody line blob the sign transition of gradient magnitudes, the ratio of characters the distribution of intervals between characters and therefore the alignment of characters. In reality, atiny low set of

sturdy, reliable, and easy-to-detect object options would be adequate.

The car place candidates determined within the locating stage area unit examined within the identification number identification stage. There are unit 2 major tasks concerned within the identification stage, variety separation and variety recognition. Variety separation has within the past been accomplished by such techniques as projection morphology relaxation labeling, connected elements and blob coloring. Since the projection methodology assumes the orientation of a car place is thought and therefore the morphology methodology needs knowing the sizes of characters. A hybrid of connected elements and blob coloring techniques is taken into account for character separation. For this, we tend to develop our own character recognition technique that is predicated on the disciplines of each artificial neural networks and mechanics.

License Plate Recognition:

Most of the quantity plate detection algorithms fall in additional than one class supported totally different techniques. To sight vehicle variety plate following factors ought to be considered:

(1). Plate size: a plate will be of various size in a very vehicle image.

(2). Plate location: a plate will be settled anyplace within the vehicle.

(3). Plate background: A plate will have totally different background colours supported vehicle sort. as an example a government vehicle variety plate may need totally different background than different public vehicles.

(4). Screw: A plate might have screw which may be thought-about as a personality.

A number plate will be extracted by mistreatment image segmentation technique. There ar various image segmentation strategies accessible in numerous literatures. In most of the strategies image binarization is employed. Some authors use Otsu's technique for image binarization to convert color image to grey scale image. Some plate segmentation algorithms ar supported color segmentation. A study of car place location supported color segmentation is mentioned. Within the following sections common variety plate extraction strategies ar explained, that is followed by elaborate discussion of image segmentation techniques adopted in numerous literature of ANPR or LPR.
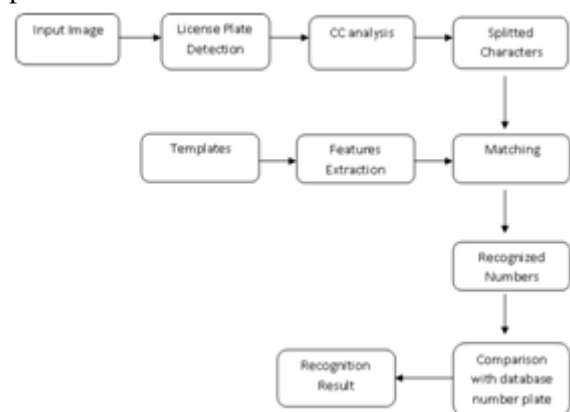

Fig1: License Plate recognition

The templates that square measure almost like the registration number plate character is known by the comparison method with the character hold on within the information. Extracted registration number plate characters could have some noise or they'll be broken. The extracted characters could in addition be inclined. Example matching may be a straightforward and straightforward technique in recognition. The similarity between character and therefore the example is measured. Example matching is performed once resizing the extracted character into an identical size. Each example scans the character column by column to calculate the normalized cross correlation. The example with the most price is that the foremost similar one. Example matching is useful for recognizing single-font, rotated, broken, and fixed-size characters. If a personality is completely totally different from the example, the example matching produces incorrect recognition result. Among the disadvantage of recognizing inclined characters is solved by storing several templates of an identical character with totally different inclination angles.
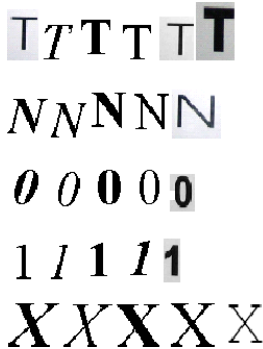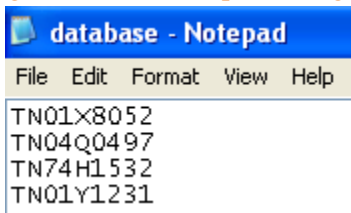
Fig2: Input Images

Fig3: Different Template Images

Database Image

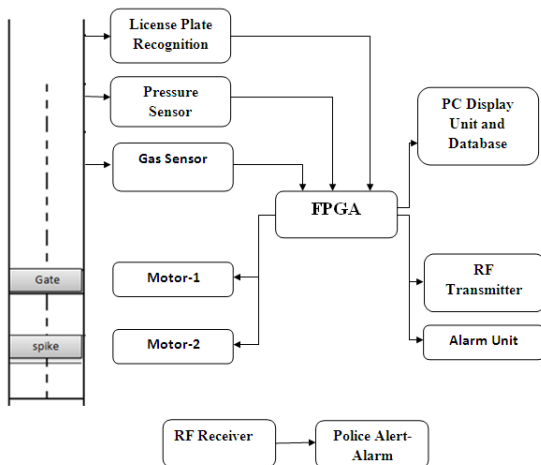## Block Diagram for Toll Gate System:

Fig: 4New Toll Gate system

The planned system makes certain that the traffic at the toll gates is efficient and security is additionally gift. The tax that is collected is predicated on the load carried by the vehicle. Through this technique we will additionally determine taken vehicles. The reading the knowledge from vehicle plate recognition system, computer compares the information within the info and permits the access consequently by opening/closing the gate. This knowledge is employed to print a daily or monthly bill for toll assortment from the vehicles. This fashion even taken vehicles is known.

The pressure of the vehicle is obtained victimization the pressure sensing element and consequently the pressure of the vehicle is showed on the display. A counter is employed to count the quantity of vehicles. The quantity on the idea of weight & the count of vehicles is additionally displayed on the screen. The quantity to be paid is mechanically deduced from the various checking accounts.

If a vehicle carries any reasonably gas that shouldn't be carried, the gas sensing element detects the gas within the vehicle. Just in case if there's any reasonably gas that's detected, the RF transmitter is employed to alert the close police headquarters associated an alarm is enabled to alert the encircling areas. Afterwards motor one is employed to shut the gate and at the same time motor two is employed to drag up the spikes so as to puncture the vehicle.

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PRESSURE SENSOR

A piezoelectric sensor as shown in figure 5 is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical charge. Here a simple pressure sensor is used to protect door or window. It generates a loud beep when somebody tries to break the door or window. The alarm stops automatically after three minutes. The circuit uses a piezo element as the pressure sensor.

Piezo buzzer exploits the piezoelectric property of the piezo electric crystals. The piezoelectric effect may be direct piezoelectric effect in which the electric charge develops as a result of the mechanical stressor reverse or indirect piezoelectric effect (Converse piezoelectric effect) in which a mechanical force such as pressure develops due to the application of an electric field.

Fig5:Piezo electric sensor

A typical example of direct piezoelectric effect is the generation of measurable amount of piezoelectricity when the Lead Zirconate Titanate crystals are deformed by mechanical or heat stress. The Lead Zirconate Titanate crystals also shows indirect piezoelectric effect by showing pressure when an electric potential is applied.

OPERATION

Operation of pressure sensor is very simple. Here we have two plates that is one is input plate and the other

is output plate, whenever pressure is applied as shown in figure 6 then these two plates come into contact we get voltage as a output then this output is send to the FPGA in turn it shows the weight of the vehicles is shown in the display as per our project. Accordingly toll tax is calculated. It is made up of a piezoelectric crystal. Depending on how a piezoelectric material is cut, three main modes of operation can be distinguished into transverse, longitudinal, and shear.
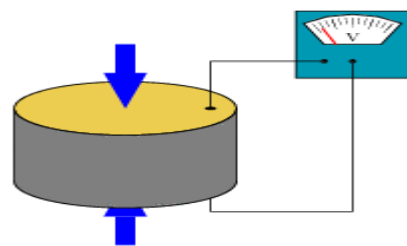

Figure 6 Pressure sensor operation

GAS SENSOR

The Flammable Gas and Smoke sensors can detect the presence of combustible gas and smoke at concentrations from 300 to 10,000 ppm. Owing to its simple analog voltage interface, the sensor requires one analog input pin from the FPGA.

Fig7:Gas Sensor (type-MQ2)

The product can detect the pressure of the smoke and send the output in the form of analog signals. Our range can function at temperature ranging from -20 to 50 degree Celsius and consume less than 150 mA at 5V.

Sensitive material of MQ-2 gas sensor in the figure is SnO_2 (Tin dioxide), which with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising.

MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane.

STRUCTURE AND CONFIGURATION

Structure and configuration of MQ-2 gas sensor is shown as figure, sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-2 has 6 pin, four of them are used to fetch signals, and other two are used for providing heating current.

WIRELESS COMMUNICATION MODULE

A general RF communication block diagram is shown in figure8 since most of the encoders/ decoders/ microcontrollers are TTL compatible and mostly inputs by the user will be given in TTL logic level.

Thus, this TTL input is to be converted into serial data input using an encoder or a microcontroller. This serial data can be directly read using the RF Transmitter, which then performs ASK (in some cases FSK) modulation on it and transmit the data through the antenna. In the receiver side, the RF Receiver receives the modulated signal through the antenna, performs all kinds of processing, filtering, demodulation, etc and gives out a serial data. This serial data is then converted to a TTL level logic data, which is the same data that the user has input.
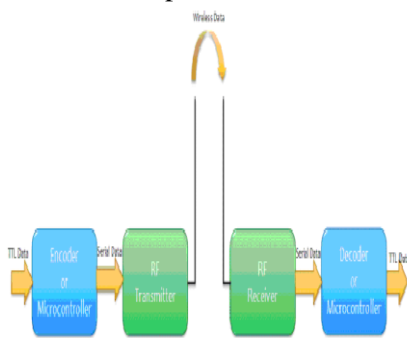

Fig8: RF communication block diagram

Results:

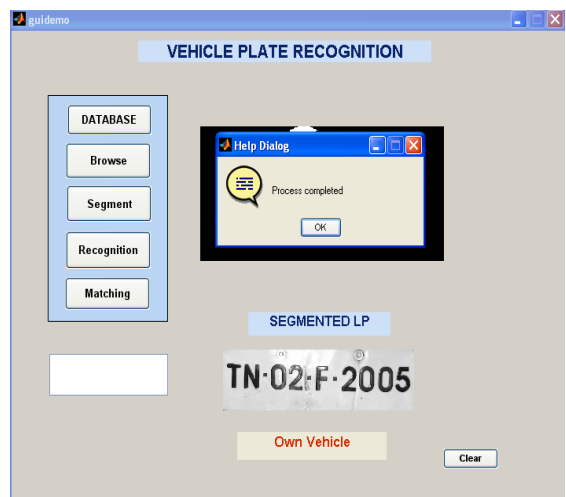Fig9:Before Segmentation Number Plate
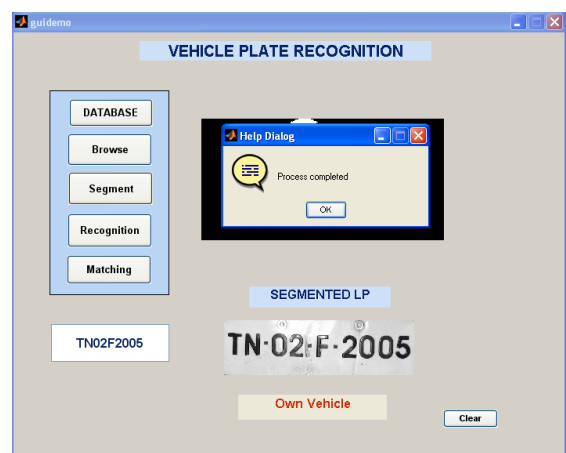

Fig10:After Segmentation Number Plate

Fig11:Number Plate Recognition

Fig12:After Matching

CONCLUSION:

Motive of this projected system is to detect the images of the vehicle plate accurately. The automated real-time vehicle plate recognition system has been demonstrated to provide correct identification of vehicles captured images from the camera. The system has been shown to be robust to lighting variations, headlight dazzle, and partial vehicle obscuration. The next stage of development will involve increasing the vehicle coverage of the reference database and further trials at sites including parking facilities and public highways.

FUTURE WORK:

The future analysis of AVPR ought to focus on multistyle plate recognition, video-based AVPR mistreatment temporal information, multiplates process, high definition plate image process, ambiguous-character recognition, and so on. In four important factors were planned to identify the multistyle license plate problem: license plate rotational angle, character line number, the alphanumerical varieties used and character formats

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