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Automotive Parking Lot and Theft Detection through Image Processing

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Abstract: - Automotive parking lot and theft detection through image processing is a smart parking lot which will save time for the owner to park his car in a more organized way and also prevent theft of the car. It is a technology to optimize the checkout process by analysing a database of images of number plates of cars. The heart of the project is based on image processing. The images of number plates will be detected by Matlab and a picture of the driver will be saved in a similar database. As soon as both the images are saved, the garage entrance pole will shift 90 degrees upward using a DC MOTOR and will remain in that position for 30 seconds to allow the car to enter. After 30 seconds it will return back to its previous position. When the car exits the earlier steps will be repeated and Matlab will match both the images that were taken during entering and leaving. Meanwhile the seven segment display will show that a car has left the parking lot, by decrementing a number from its display. The cars are controlled by a microcontroller which is also able to detect and display if a vacant parking space is available. If there is no vacancy a red LED lights up, where as a green LED is used to display presence of parking space along with how many parking spots are available. It is applicable to be used in super market car parking lots and also apartment garages.

Keywords: - *Parking Automation, Accident detection and avoidance, Obstacles detection, Vehicle tracking.*

I. INTRODUCTION

With an increasing number of vehicles being used in our country, it is getting difficult to manually accommodate the cars in big parking spaces. Because in a big parking space no one can systematically control the entry and exits of the numerous cars; because this is very difficult to know how many cars and vacant places are available in the parking lot at any given time. But this system shows digitally how many places are vacant and how many cars can enter the parking space. This system also saves the cars' number plates and driver's pictures in a database for security measures. In order to automate the processes and make it more effective, a system is required to easily identify a vehicle. The important question here is how to identify a particular vehicle? The answer to this question is – by using the vehicles' number plate and tagging it to its driver's picture from the database. Vehicles in every country have a unique license number, which is imprinted on its license plate. This number which also includes letters distinguishes one vehicle from the other, which is useful especially when both are of same make and model. In Bangladesh the license plate has numbers and letters imprinted in Bengali.

PARKING SYSTEM WHICH IS NOT THE MAIN CONCERN OF OUR PROJECT.

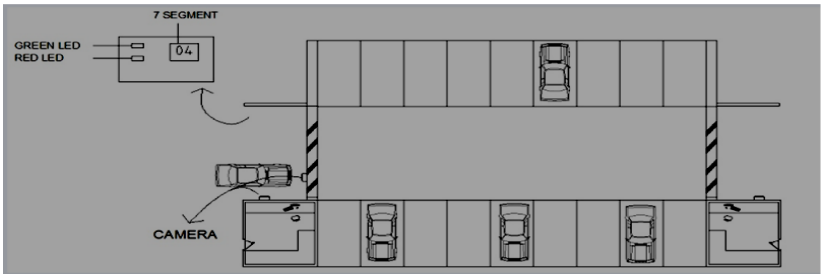

Figure 1: - Parking System

II. MAIN TECHNOLOGY USED

1.1 Obstacle detection & indication sensor

The main objective of this project was to design and develop a model of an automotive car parking lot and theft detection through image processing. The processing is controlled by Matlab which gives the command to the microcontroller to allow Exit or Entry of a car and the save the car's plate number in the database with the driver's picture. When that same car is ready to exit the parking garage, the software will match the number with the one collected earlier at the point of entry. If the number plate does not match, the microcontroller will not raise the gate and therefore the car cannot exit. Automotive car parking lot and theft detection through image processing needs the following components:

1, Atmega16
3, Serial Port RS232
4, IC ULN2003A
5, Adapter (Power Source)
6, Seven segment display
7, Stepper motor, camera and display.

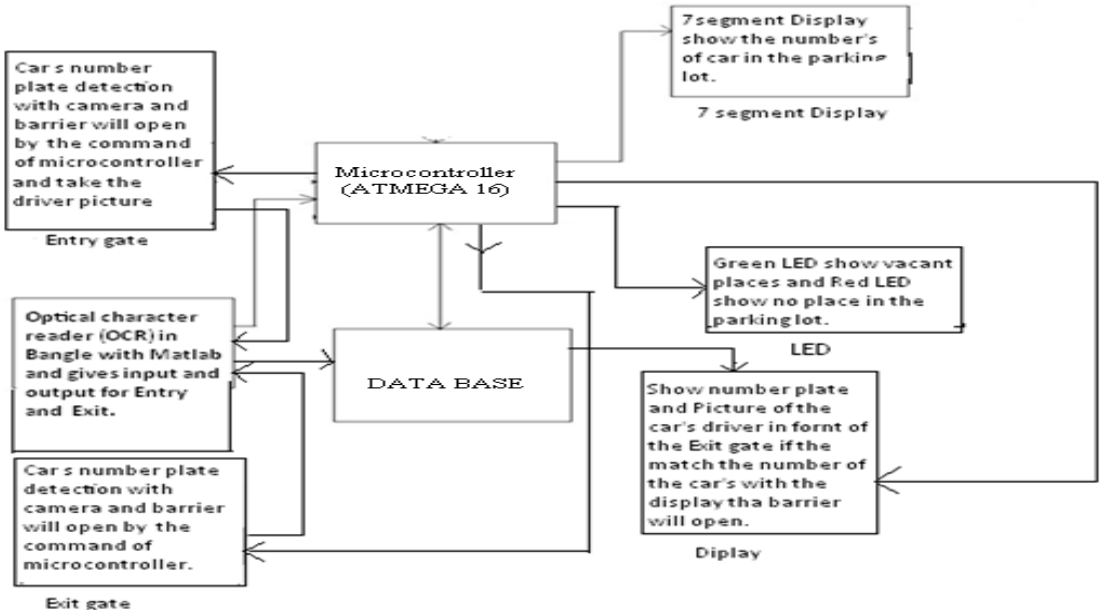

Figure 2:- Block Diagram of the overall project.

1.2 Optical character reader (OCR) in Bengali by Matlab:-

MATLAB is a high-performance language for technical computing created by Math Works in 1984. Matlab uses a high-level language and interactive environment to enable you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and FORTRAN. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

1.3 Acquiring the image

After the picture has been taken by the camera, Matlab will import the picture and begin processing the data manipulation.

Figure 3: - Number plate of the car

2.4 Template created:-

To match the number plate at first we have to make a Bengali template database from 0 to 9. These templates will save on the bin box. These templates will match, when the Matlab code calls for the template acquired from the number plate.

Figure 5: - Bengali Template

2.5 Matlab code execution flow:-

Before matching the template with the saved digits, a concatenation process is performed to separate them. After the matching process, the numbers will show in the variable 'id' in lines as 124420. It will show when the templates and numbers on the plates match. If they do not match, it will not show in the monitor. Figure 6 below shows the overall flow of the executed code. If the number plate and the template does not match than the output shows an error. If the template matches with the number plate, then it shows the output digits and the Entry or Exit gate will open; and an additional step will be to save the number in memory which can increase security in future operations.

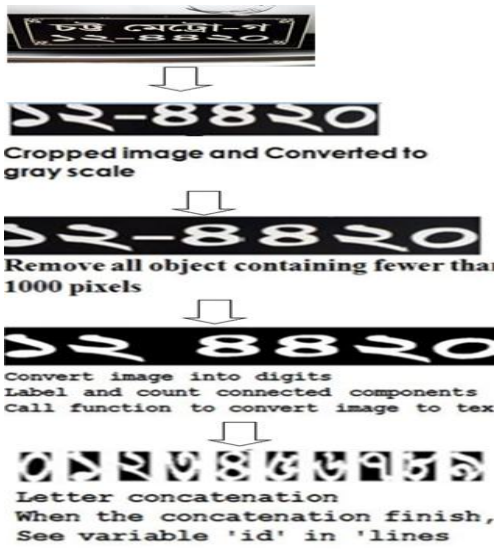

Figure 6: - Matlab steps execution

2.6 Results

Figure 7 below shows the results after a correct execution of the code.

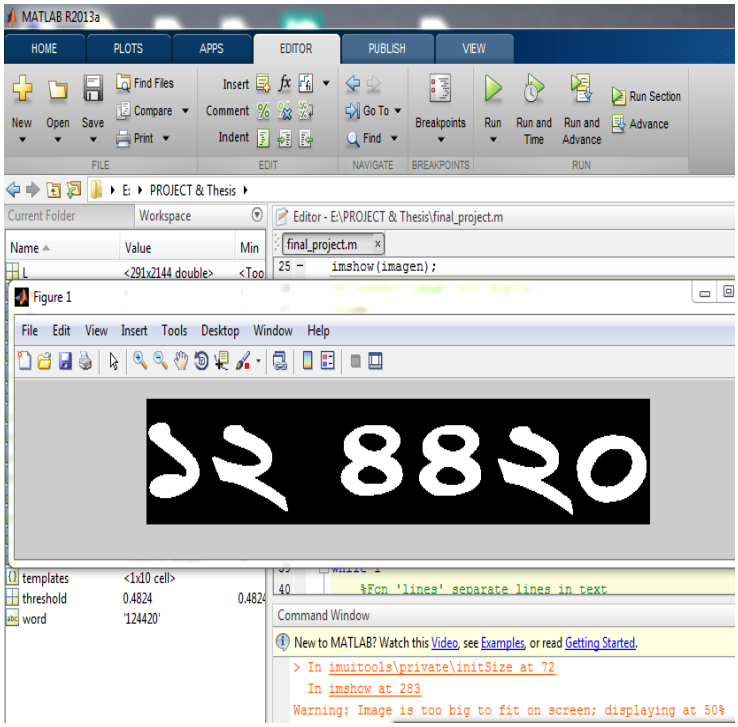

Figure 7: - Matlab execution and display of results

3.1 Circuit Diagram Description

Figure 8 below shows the complete circuit diagram of the automotive parking lot. Here the interfacing of some peripherals and ICs with the microcontroller ATMEGA 16 is shown. The circuit is initially simulated on Proteus, which is basically an electronic circuit simulation tool on windows platform. The camera here monitors the car during entrance and exit to capture the images. After the images are taken and saved to memory, data is transferred to the microcontroller through a serial communication cable. The gate opens and pin no. 40 controls this entrance. The recorded sample is stored in the microcontroller by pin number 14 and 15. Pull-up network resistances of 10KΩ are provide at each port. Since we are not using the LCD display RS (Resister Select), R/W (Read/Write) and E (Enable) are not needed. The Reset switch connects at pin 9 of microcontroller to provide a manual reset of the microcontroller. If any problem occurs or if the system hangs we can push the reset button to reboot the whole system. When any vehicle reaches the parking lot and after the data is transferred to the microcontroller, the systems registers an increase in the number of vehicles and records the count. The Count is for current recording time. Pin no. 22 to 29 controls the seven segment display. After completion of recording interval this count value is saved in the memory. The microcontroller is connected to the computer through a serial communication cable. Matlab instructs the microcontroller to send the recorded data for monitoring. It can also ask the microcontroller to erase previously recorded data after analysis is completed.

The seven segment display will get positive voltages from pins 2 and 3. The green LED is switched on to show that there are spaces available in the parking lot. Pin no. 1 is for the red LED which will turn on when there are no spaces available. Pin no. 12 and 13 have not been used in our project. Pin no. 39 controls the exit. Pin no. 18 to 21 controls the stepper motors. Pin no. 10 is for the Vcc supply and 11 is for ground. Figure 8 below shows the entire circuit for the project. It is operated with a voltage level of 0-5V. It also uses a 0V to 9V transformer to step down the 220V AC supply to 9V AC. It is further filtered through a 1000 uF capacitor and then regulated using IC 7805 to get +5V. To isolate the output voltage of +5V from noise further filtering is done using a 220uF capacitor.

As for the power requirement of the hardware of the system for the microcontroller, we used a supply voltage of +5V w.r.t GND and 12V for the two stepper motors. Matlab transfers the recorded data to the microcontroller by serial communication. This data is used for matching both the images taken during entrance and exit. To interface the UART and PC all 4 outputs are connected through the microcontroller for the signal conversion. A data transfer protocol is implemented through the software. Matlab collects all the recorded data.

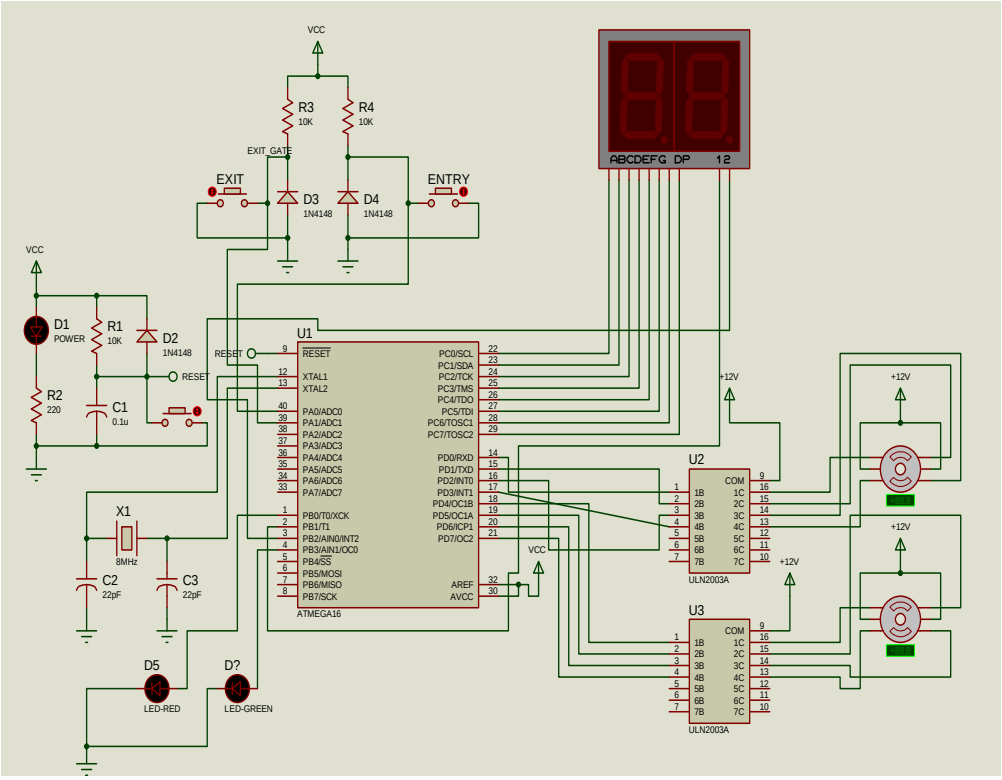

Figure 8: - Schematic of the overall project

3.2 Entry processes

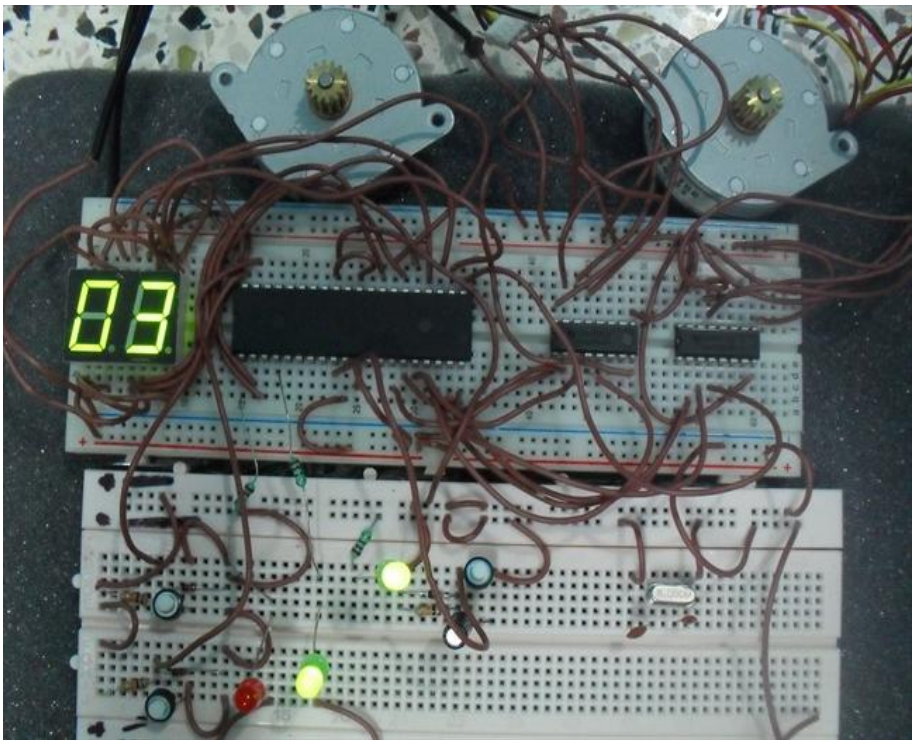

Figure 9: - Hardware implementation showing availability of parking space

Figure 9 above shows two motors for the exit and entry gates and also the 7segment display which will show how many cars are already in the parking lot (as shown by the green display of the number 03). It also means that there are still available places for parking and the green LED indicates this. Another green LED (in the middle) represent that the whole system is running.

3.3 Red light

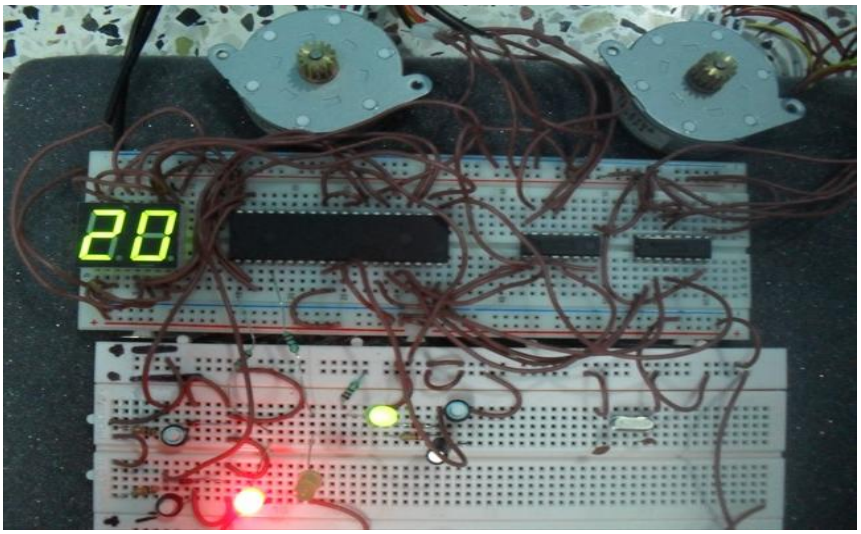

Figure 10: - Hardware implementation showing that the parking lot is full

This project was modeled for only 20 cars. Since the display is showing the number 20, it means there are no more parking places left. The Red LED (at the bottom) is lit to further indicate this. Note that the green LED (in the middle) is representing that the whole system is still running error free.

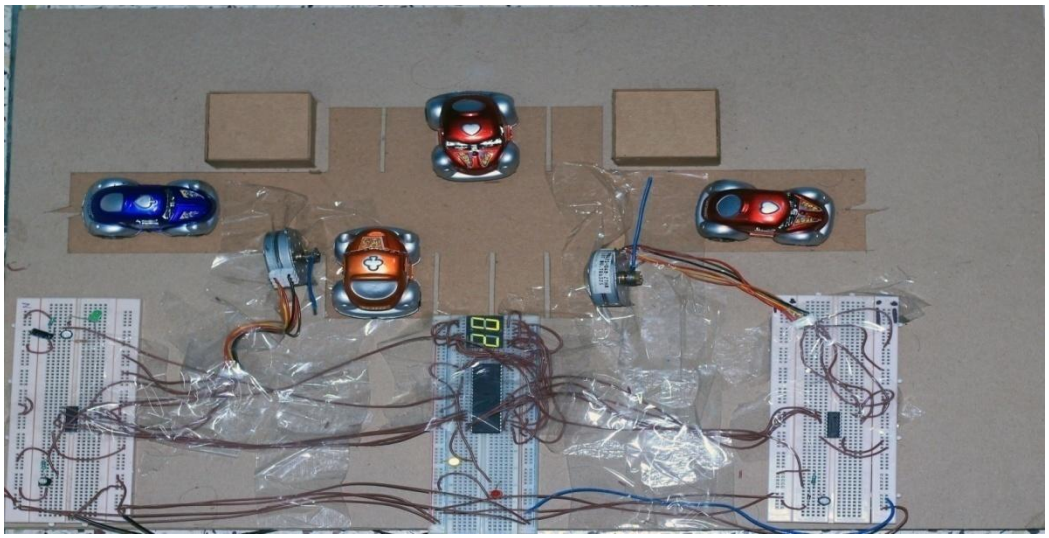

Figure 11: - The Entire Model

III. FURTHER APPLICATION

1. Notifying the owner the exact location of the car inside the parking lot by SMS.
2. Adding a finger print scanning and password option for added security.

IV. CONCLUSION

This project presented a recognition method in which the vehicle plate image is obtained by digital cameras and the image is processed to get the number plate information. The model of the entire system was designed and tested thoroughly. By identifying the car's number plate as a reference on image detection, it makes the process of detecting images as a reference more efficient compared to the use of a moving object. The conceptualization of this project is to establish a sophisticated and smart parking system by using image processing instead of using sensor based security methods. An intelligent parking system is developed using an integrated image processing approach to reduce cost of sensor and wiring hassle. Detecting the number plate and taking a picture is shown as a technique that can save time and manpower while also reducing theft. All these features put together make it a very attractive package.

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