AUTOMATIC TOLL SYSTEM

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Abstract

- Long queues at toll stations
- Human Resource required around the clock
- Current automation uses RFID
  - Requires one time installation in all vehicles
  - Requires human resource to an extent
  - Database needs to be updated for all vehicles
- Optical Character Recognition(OCR) overcomes all these issues
- Presentation discusses the design and implementation of the system

Team Members

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1	Ajay Sangamithran P	B2ENCS1118	Design and Coding
2	Emmanuel Hentry	B2ENCS1110	Website design and functionality
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Outline Of Presentation

- Project Outline
  - Scope of Work
  - Objectives of Project Work
  - Attainment of Outcomes
- Automatic Toll System
  - Introduction & Motivation
  - Background Information
  - Related Works
  - Details of the project
- Experimental Results
- Conclusions
- Future Directions
- References

Scope Of Work

- Long waits at toll stations
- Need to tender change, increases wait time
- Existing automation based on RFID
- Cost of current prototypes

Objectives of the Project Work

1. Design a low cost and effective system
2. Attain complete automation of toll booths
3. Reduce waits at toll stations
4. Create a facility to pay online

Attainment of Outcomes

Objective	Attainment
Design a low cost system	100%
Attain automation of toll stations	90%
Reduce wait times	100%
Create a facility to pay online	100%

Introduction

- The number of vehicles on the road is increasing everyday
- The size of roads is not increasing at the same rate
- Traffic congestion peaks at toll stations
  - Commuters argue with the employees
  - Time is lost because of need to tender change
  - Commuters sometimes enquire about directions at the stations

Introduction

- Automation of toll stations will reduce unnecessary delays
- OCR helps read the number plates and bill the owner
- Commuters can later pay online/offline as per convenience

Motivation

- Waiting at the queue is frustrating
- Even emergency vehicles get stuck at toll stations
- Some commuters refuse to leave without an argument
- Employees at the stations are mostly rude
  - Behave harshly if commuters do not have exact change.
- Some commuters try to cut queues
  - Leads to fights
  - Causes more delay

Background Information

- Raspberry Pi 2 model B

  Raspberry Pi 2 is a single board computer.Its capable of doing everything we expect a desktop computer to do. It has 4 USB ports, an ethernet port, a HDMI port, a 3.5mm jack and a microUSB slot for power supply.

- Raspberry Pi Camera Module

  The Raspberry Pi camera module can be used to take high-definition video, as well as stills photography. It's easy to use for beginners, but has plenty to offer advanced users. It is connected to the Raspberry Pi through the Camera interface.

Background Information

- OpenCV

  OPENCV stands for Open Source Computer Vision.It is a popular comuter vision library containing programming language functions, started by Intel in 1999. OpenCV is written in C++ and its primary interface is in, C++,but it still retains a less comprehensive though extensive older C interface. There are bindings in Python,Java and MATLAB/OCTAVE.

- Tesseract

  Tesseract is an optical character recognition engine for various operating systems. It is free software, released under the Apache License, Version 2.0, and development has been sponsored by Google since 2006. Tesseract is considered one of the most accurate open source OCR engines currently available

Related Works

Automatic Toll System Using RFID

- Vehicles detected on the basis of RFID
- RFID needs to be installed on all vehicles
- RFID of each vehicle needs to be stored in the database
- Human resource needed for vehicles without RFID

Related Works

Electronic Toll Collection System Using Barcode Laser Technology

A barcode laser system which uses tags (barcode) that are mounted on the number plate of vehicles, through which information embedded on the barcode are read by barcode readers. The drawback of this system is it requires direct line of sight and barcode scanner needs to be close to it.

Related Works

Automatised Toll Gate System Using NFC

A system using NFC wherein the reader is placed in a strip which is laid beneath the lane, and the tag is placed in the front side of the number plate. The object detection sensor which is placed on the side of the road detects the approach of the incoming vehicle and intimates the stepper motor to raise the strip. Thus the reader rises to ground level and reads the information in the tag and the transaction takes place through a centralized database.

Related Works

Automatic License Plate Recognition (ALPR):A State-of-the-Art Review

- Uses a continuous video stream as input
- Has a very high bandwidth and memory requirement
- Requires complex algorithms when vehicles move at high speed

Automatic Toll System

- Components
  - Raspberry Pi 2
  - Raspberry Pi Camera Module
  - Simple Trigger
  - Website for payment

Automatic Toll System

The system can be split into two modules

- Website for payment
- Image capture and text extraction

Flowchart

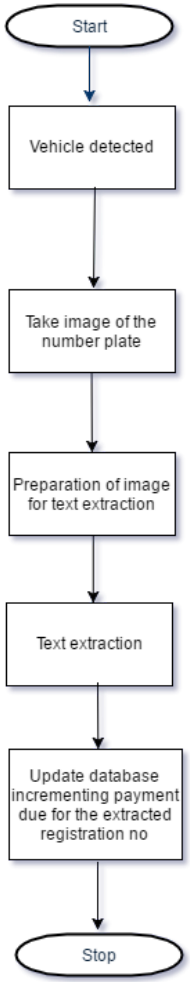

Figure: Flowchart

- Website

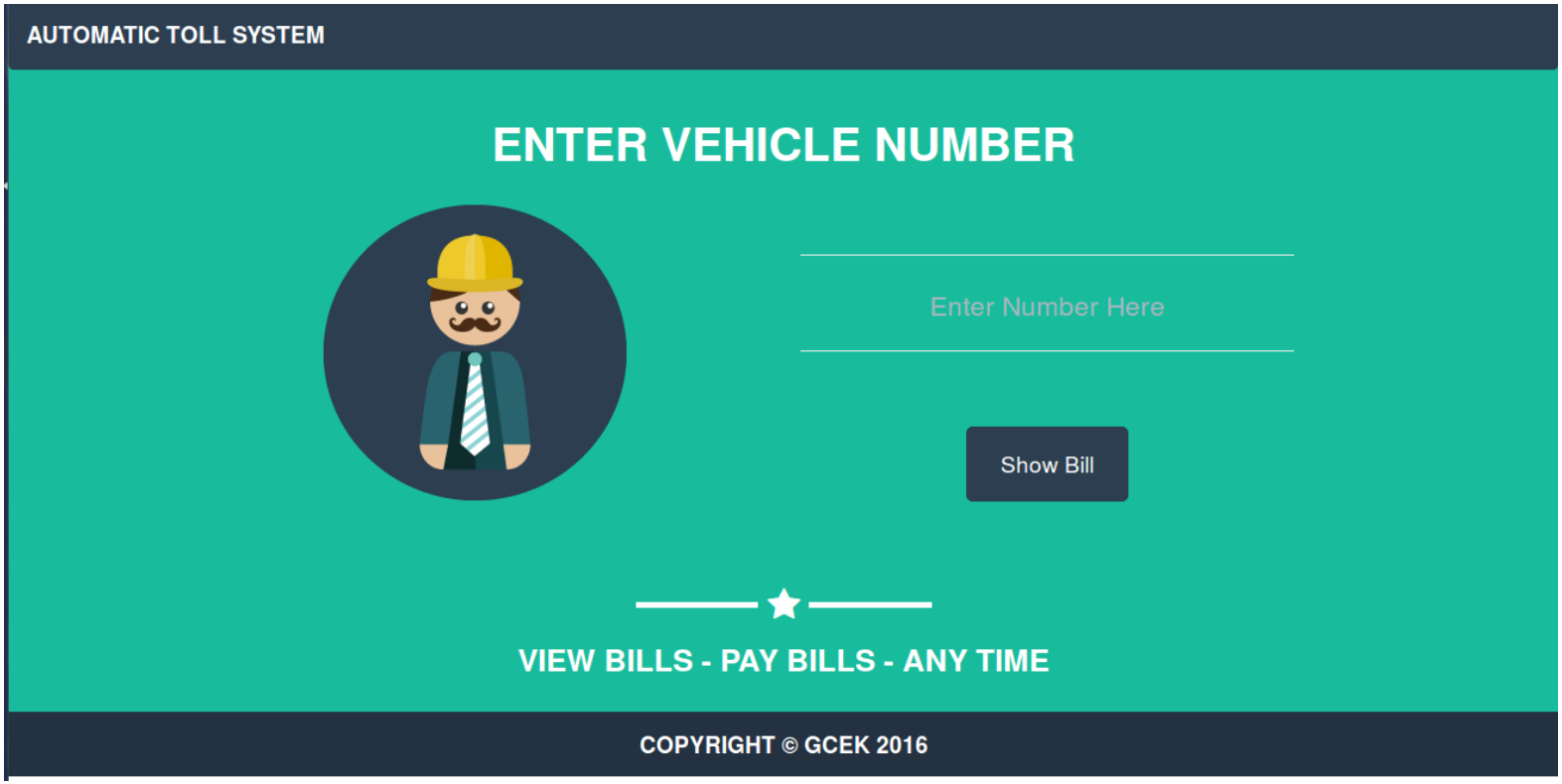

Figure: Home Page

- Website

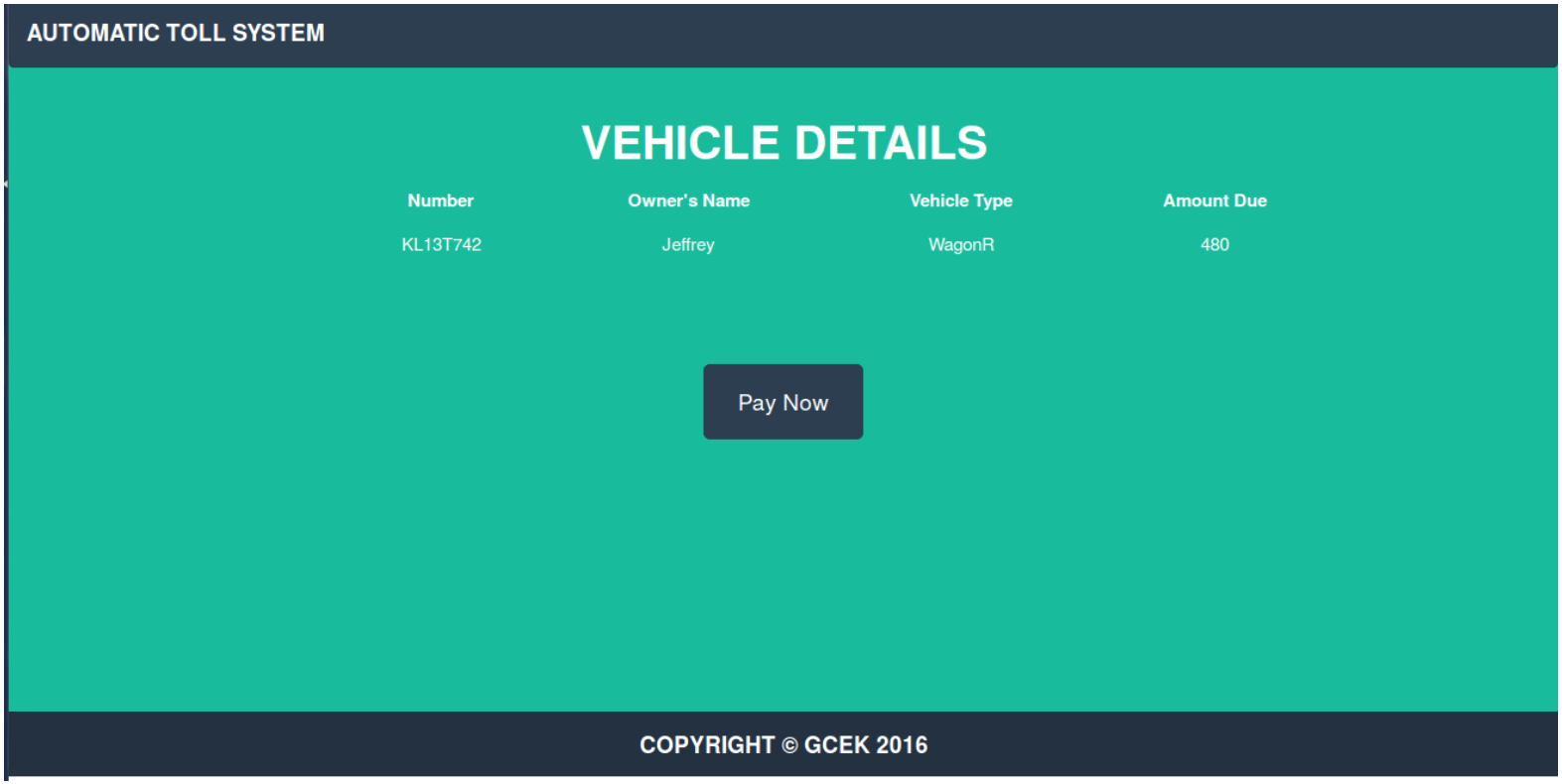

Figure: Vehicle Details

Experimental Results

- Capture the image

Figure: Sample input Image

Experimental Results

- Grey Scale Conversion

Figure: Conversion to grey scale

Experimental Results

- Contour mapping

Figure: Bluring background

Experimental Results

- Conversion to black and white according to threshold value

Figure: Black and white image

Experimental Results

- Inverting image

Figure: Final Output

Experimental Results

- Text Extraction
  - Output image passed to Tesseract Engine
  - Text extraction restrictions
    - Restricted Characters to
    - Numbers - [0-9]
    - Alpabets - [A-Z]

Conclusions

- The proposed system is cheaper than the competition
- The is no need for a one time installation on all vehicles.
- Attained automation of toll stations
- Wait time at toll stations reduced
- Requirement of human resource at toll stations reduced
- Facility to pay online/offline as per convenience

Future Directions

- Can be extended to inform when flagged vehicles are detected
- Can be extended to identify the color and body of the vehicle to identify illegal modifications
- Can be extended to identify fake registrations by vehicle classification

References

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