AN EMPIRICAL IMPLEMENTATION OF MACHINE VISION SERVER & OBSERVATION FOR TRAFFIC MONITORING AT TOLL PLAZA

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Abstract

Machine vision server and observation at toll plaza refers to the technique being used for wireless technology. In the current project we would use this technique to implement toll plaza system. Currently, at all tool plazas' machine vision technique is being used. Machine vision (MV) is the technology and methods used to provide imaging-based automatic inspection and analysis for such applications as automatic inspection, process control, and robot guidance in industry. When any type vehicle enters tool plaza then using Machine Vision technique an image of number plate is being captured and the characters on the number plate being scanned. And the scanned characters get matched with the existing database. In the database all the issued numbers for vehicles has been added. The Machine Vision Algorithms should be used for multiple applications and objects in the traffic monitoring. The existing usage of the machine vision is very wide. The machine vision algorithms and devices must be installed at various toll / tax booths as well as traffic monitoring systems

Introduction

The characters on the number plate get recognized with the help of special technique named Optical Character Recognition (OCR). Optical Character Recognition, commonly known as OCR, is simultaneously machine-readable and human-readable text. Common industries and applications include date/lot tracking on pharmaceutical or food packaging, sorting mail at post offices and other document handling applications, reading serial numbers in automotive or electronics applications, and many more.

But the major flaw of this technology is in recognition of characters. While scanning number plate if there is some dust on the image then scanning of characters would not be done properly. Therefore, to override this flaw we would use Machine vision sensor networking. Under this, a chip would be installed on every number plate and the sensors would detect the chip on the number plate which would be given a unique id and after scanning the id, it would get matched with the existing database to validate the vehicle.

RELATED TECHNOLOGIES AND EXISTING FRAMEWORKS

Machine Vision Methods

Machine vision methods are defined as both the process of defining and creating a MV solution, and as the technical process that occurs during the operation of the solution. Here the latter is addressed. As of 2006, there was little standardization in the interfacing and configurations used in MV. This includes user interfaces, interfaces for the integration of multi-component systems and automated data interchange. Nonetheless, the first step in the MV sequence of operation is acquisition of an image, typically using cameras, lenses, and lighting that has been designed to provide the differentiation required by subsequent processing.MV software packages then employ various digital image processing techniques to extract the required information, and often make decisions (such as pass/fail) based on the extracted information.

Though the vast majority of machine vision applications are still solved using 2 dimensional imaging, machine vision applications utilizing 3D imaging are growing niche within the industry.

Imaging

While conventional (2D visible light) imaging is most commonly used in MV, alternatives include imaging various infrared bands, line scan imaging, 3D imaging of surfaces and X-ray imaging. Key divisions within MV 2D visible light imaging are monochromatic vs. color, resolution, and whether or not the imaging process is simultaneous over the entire image, making it suitable for moving processes. The most commonly used method for 3D imaging is scanning based triangulation. Other 3D methods used for machine vision are time of flight, grid based and stereoscopic.

The imaging device (e.g. camera) can either be separate from the main image processing unit or combined with it in which case the combination is generally called a smart camera or smart sensor. When separated, the connection may be made to specialized intermediate hardware, a frame grabber using either a standardized (Camera Link, Coax Press) or custom interface.MV implementations also have used digital cameras capable of direct connections (without a frame grabber) to a computer via FireWire, USB or Gigabit Ethernet interfaces.

Optical Character Recognition

Typically a feature of higher-end machine vision, teachable OCR systems can be trained to recognize characters in any user-defined font, not just specialized OCR fonts (OCR-A, OCR-B, MICR, SEMI), and can be taught to recognize a full character set in any font created for any language. The disadvantages of this type of system are the labor-intensive integration process and the decrease in reliability when using non-OCR fonts. Optical Character Verification (OCV) is one way to address the problem of reliability. Once the desired specifications have been taught to an OCR reader, OCV software can verify that the printed characters match the specifications, can ensure that data is encoded correctly, and can guarantee that labels are placed in the correct orientations on the correct items.

OBJECTIVES OF THE STUDY

The main objectives of this research are –

1. Focus on Machine Vision Devices, Real Time Applications and their features
2. To Explore an effective implementation for the machine vision in traffic monitoring
3. To propose the Machine Vision Implementation in Traffic Monitoring for assorted domains
4. To implement the Machine Vision Algorithm in Java
5. To Simulate the Machine Vision Algorithm and getting results and reports

HYPOTHESIS

- An effective algorithm can be developed and assessed by developing the effective simulator for Machine Vision in Traffic Monitoring and Observation.
- An Algorithm can be developed to manage the traffic effectively in the proposed Architecture of objects in the traffic.

Investigation of the Existing Theories and Technologies for Machine Vision in Assorted Domains

Analysis of Machine Vision Devices and Applications

Selection of the Simulation Tool / TestBed (JAVA Based Framework) for Efficient Results

Generation of Random Traffic in the Deployment Area for Investigation

Keeping Track and Record Analysis of the Levels and Observation Parameters

Execution of the Algorithm on the Traffic and Vision Issues

Detailed Report Generation and Efficiency Analysis
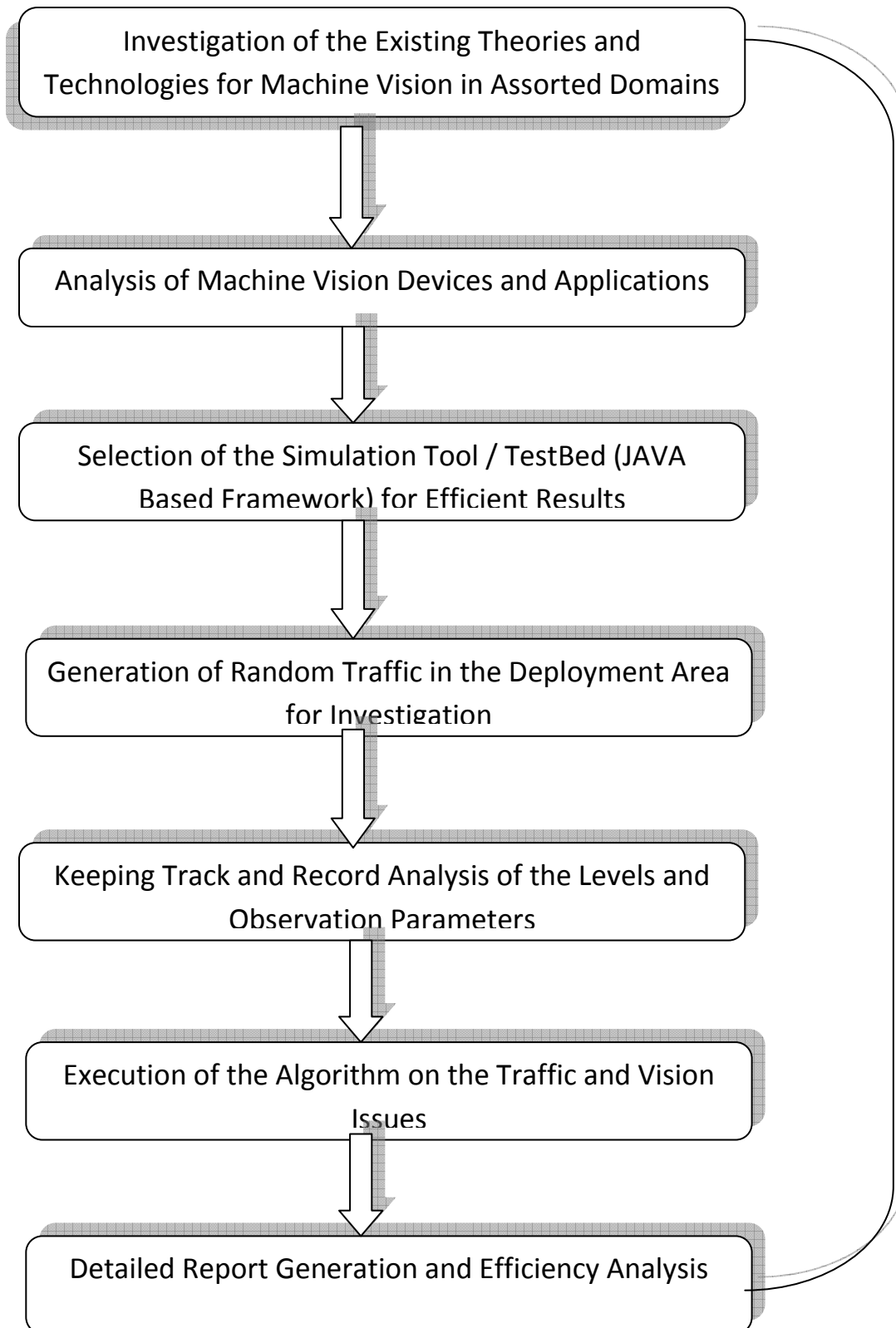
PROPOSED SYSTEM AND MODULES

- Vehicle type Recognition
- Scanning chip
- Register several parameters.
- Database Management
- Reporting
- Content management – creation, storage, access to and use of database resources.
- Tool Management- Amount, billing.
- Server Database.

Implementation and Results

Results/Output

1st Output:

Vehicle Type: car

Return Journey

** Implementation/Simulation of Machine Vision Server & Observation at Toll Plaza **

WELCOME TO THE MASTER INTERFACE OF TOLLPLAZA

Session Time Initiated: 04:47:19 PM

Enter the Number of Vehicle Entries for Current Session:

1
Entries for the Current session: 1

Fetching 1st Vehicle Details =>

##

Fetching Vehicle Type =>

Choose the Type of Vehicle:

=>Choose 1: Cars

=>Choose 2: mini Trucks

=>Choose 3: Transportation vehicles

=>Choose 4: Heavy Vehicles

=>Choose 5: Roadways Vehicles

##

Enter Your Choice:
1
Current Vehicle Type:
Cars

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     '--(( ))----------(( ))'
          `;`           `,`
```

Color of the Current Vehicle:

Blue

Recognized Color: Blue

Fetching Number Plate =>
--Punch Number:
hr02n1111

Number Plated Fetched =>   hr02n1111

Machine Vision Server Initiating and Connecting to Database ...
Machine Vision server Started...

Connected to database successfully...

Numberplate Validated from Machine Vision : hr02n1111
 Proceed to Payment Collection....

Journey Descrption=>
Single side: 1
Return Journey: 2
Enter your Choice;
2
Entered choice: 2

Collect INR 40

===
Amount Paid
Leaving the Authentication Phase
Vehicle Passed

===
Passed vehicle's Numberplate Detected by Machine Vision :

 Serial No. : 1

 Numberplate: hr034236

 Time of Passing : 17/05/2011 15:13:56

 Serial No. : 2

 Numberplate : hro32545

 Time of Passing : 17/05/2011 15:21:37

 Serial No. : 3

 Numberplate : hr02t3848

 Time of Passing : 17/05/2011 15:32:41

 Serial No. : 4

 Numberplate : tc02w9898

 Time of Passing: 17/05/2011 16:08:18

 Serial No. : 5

Number plate: hr02t3848

Time of Passing: 17/05/2011 16:10:47

Serial No. : 6

Numberplate: hc05ee9878

Time of Passing: 17/05/2011 16:13:07

Serial No. : 7

Numberplate: hr02n1111

Time of Passing : 17/05/2011 16:47:19

2nd Output:

Vehicle Type: Mini Truck

Single Journey

** Implementation/Simulation of Machine Vision Server & Observation at Toll Plaza **

WELCOME TO THE MASTER INTERFACE OF TOLLPLAZA

Session Time Initiated: 04:52:04 PM

Enter the Number of Vehicle Entries for Current Session:

1
Entries for the Current session: 1

```
Fetching 1st Vehicle Details =>
--------------------------------------------------------------------------

################################################

Fetching Vehicle Type =>

Choose the Type of Vehicle:

=>Choose 1: Cars

=>Choose 2: mini Trucks

=>Choose 3: Transportation vehicles

=>Choose 4: Heavy Vehicles

=>Choose 5: Roadways Vehicles

################################################

Enter Your Choice:
2
Current Vehicle Type:
mini Trucks

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----------------------------------------------------------------
Color of the Current Vehicle:

black

Recognized Color:           black
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Fetching Number Plate =>
-------------------------------------------------------------------------------------------
Punch Number:
hr01m3212


Number Plated Fetched =>            hr01m3212


-------------------------------------------------------------------------------------------

Machine Vision Server Initiating and Connecting to Database ...
Machine Vision server Started...

Connected to database successfully...
-------------------------------------------------------------------------------------------
Numberplate Validated from Machine Vision : hr01m3212
```

Proceed to Payment Collection....

Journey Descrption=>
Single side: 1
Return Journey: 2
Enter your Choice;
1
Entered choice:1

Collect INR 30

===
Amount Paid
Leaving the Authentication Phase
Vehicle Passed

===
Passed vehicle's Numberplate Detected by Machine Vision :

 Serial No. : 1

 Numberplate : hr034236

 Time of Passing : 17/05/2011 15:13:56

 Serial No. : 2

 Numberplate : hro32545

 Time of Passing : 17/05/2011 15:21:37

 Serial No. : 3

 Numberplate : hr02t3848

 Time of Passing : 17/05/2011 15:32:41

 Serial No. : 4

 Numberplate : tc02w9898

 Time of Passing : 17/05/2011 16:08:18

 Serial No. : 5

 Numberplate : hr02t3848

 Time of Passing : 17/05/2011 16:10:47

Serial No. : 6

Numberplate : hc05ee9878

Time of Passing : 17/05/2011 16:13:07

Serial No. : 7

Numberplate : hr02n1111

Time of Passing : 17/05/2011 16:47:19

Serial No. : 8

Numberplate : hr01m3212

Time of Passing : 17/05/2011 16:52:04

3rd Output:

Vehicle Type: Transportation vehicles

Single Journey

===

  ** Implementation/Simulation of Machine Vision Server & Observation at Toll Plaza **

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            WELCOME TO THE MASTER INTERFACE OF TOLLPLAZA

****

        Session Time Initiated: 04:56:40 PM

Enter the Number of Vehicle Entries for Current Session:

1
Entries for the Current session: 1

Fetching 1st Vehicle Details =>

##

Fetching Vehicle Type =>

Choose the Type of Vehicle:

=>Choose 1: Cars

=>Choose 2: mini Trucks

=>Choose 3: Transportation vehicles

=>Choose 4: Heavy Vehicles

=>Choose 5: Roadways Vehicles

##

Enter Your Choice:
3
Current Vehicle Type:
Transportation Vehicles

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```

Color of the Current Vehicle:

silver

Recognized Color: silver

Fetching Number Plate =>

Punch Number:
hr05nn7881

Number Plated Fetched =>   hr05nn7881

Machine Vision Server Initiating and Connecting to Database ...
Machine Vision server Started...

Connected to database successfully...

Journey Descrption=>
Single side: 1
Return Journey: 2
Enter your Choice;
1
Entered choice:1

Collect INR 40

==
Amount Paid
Leaving the Authentication Phase
Vehicle Passed

==
Passed vehicle's Numberplate Detected by Machine Vision :

 Serial No. : 1

 Numberplate : hr034236

 Time of Passing : 17/05/2011 15:13:56

 Serial No. : 2

 Numberplate : hro32545

 Time of Passing : 17/05/2011 15:21:37

 Serial No. : 3

 Numberplate : hr02t3848

 Time of Passing : 17/05/2011 15:32:41

 Serial No. : 4

 Numberplate : tc02w9898

 Time of Passing : 17/05/2011 16:08:18

 Serial No. : 5

Numberplate : hr02t3848

Time of Passing : 17/05/2011 16:10:47

Serial No. : 6

Numberplate : hc05ee9878

Time of Passing : 17/05/2011 16:13:07

Serial No. : 7

Numberplate : hr02n1111

Time of Passing : 17/05/2011 16:47:19

Serial No. : 8

Numberplate : hr01m3212

Time of Passing : 17/05/2011 16:52:04

Serial No. : 9

Numberplate : hr05nn7881

Time of Passing : 17/05/2011 16:56:40