Video Detection based Truck Traffic Data Collection

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Project Objective
The main objectives of the proposed project include:

a. An accurate evaluation of current volume of freight movement by trucks on major roadway routes in and around the Las Vegas valley. Determine minimum, maximum and average truck counts by roadway segments, time, days and months.

b. Determine average speed of the trucks by roadway segments, lane, time, day and month.

c. Classification of trucks (single-unit, two-unit trucks).

d. Raw data delivery and CSV format data for modeling freight movements and facility planning.

e. Comprehensive report of the work conducted.

Project Orientation
Data Collection and Analysis

Project Abstract
Planning and Design of efficient freight transportation infrastructure is critical for the growth of the state and national economy. Planning and Design of efficient freight transportation facilities and networks should consider current and near-future traffic flows and demands to-and-from seaports, airports and adjacent roadway networks. To facilitate this, accurate and comprehensive traffic data extraction of freight (Truck) data on major roadways at macroscopic and microscopic levels are essential. The current data collection systems employed by Regional Trans. Comm. and NDOT around the Las Vegas valley do not meet the current practical needs of advanced traffic management systems. Therefore, this project targets at developing a video based (freight) truck data extraction system to determine traffic flow characteristics like volume, average speed, density and classification of trucks with respect to lanes, time, day, month, etc. The extracted data will be used in computer simulation modeling that can be used to analyze the existing infrastructure to determine where inefficiencies are or where they may occur in the near future.

A typical video based vehicle detection system consists of camera, video processing system, and/or a communication module or a storage module. The video based vehicle detector system (VVDS) is configured to collect various vehicle flow characteristics based on the application of the system. The virtual detectors and reference layouts are imaginary lines and boxes that are drawn on the snap shot acquired by the camera. The configuration parameters of the VDS include: 1) Height of the camera, 2) Dimensions and reference lines on the view of the camera, 3) Placement of virtual sensors, 4)
Modeling of detector functions which combines the normal outputs of two or more detectors into one customized output, etc.

There exist various freight transportation data from local, federal and private industries. However, this data is less coherent and adhoc raw data that is difficult for analysis. The research team will assemble such data into a unified data model for the purpose of identifying locations of video data collection and for validation of extracted freight data.

**Project Task**
The above goals are accomplished following the underlined sub-tasks. Every sub-task has a clearly defined goal and deliverables.

**TASK 1: Methodology Review and Literature Review Video based Truck Detection**
1. The research team will evaluate the feasibility and accuracy of determining truck counts using video based methods.
2. Sample video feeds of 1-15 will be collected and preliminary truck counts evaluated using off-the-shelf video processors like Autoscope and Iteris.
3. A report on the video based vehicle detection and technology will be presented to the project manager.

**TASK 2: Review of Freight Data Collection Systems and Collection and Analysis**
1. The research team will collect various truck and freight data from local and federal agencies like FAST, NDOT, Global Insight (TRANSEARCH Database), etc.
2. The data will be studied for attributes and actual data. Also data regarding truck routes in the Las Vegas valley and locations of camera operated by FAST will be acquired.
3. A report on the type of data collected, their attributes and implementation plan of Task 3 will be presented to the project manager.

**TASK 3: GIS mapping and Video Feed Location Identification**
1. The above data will be fused and displayed in a GIS format. This will identify estimated truck or freight flow at various segments of the truck routes around the valley.
2. Based on the above analysis locations for video feed capture will be identified.
3. A time sheet for video feed collection with locations, times, capture intervals, etc will be developed and presented to the Project Manager for approval and forwarded to FAST for processing.
4. The GIS layout, locations identified, time sheet for video feed collection and a report will be presented to the project manager.

**TASK 4: Video Feed Processing and Data Extraction**
1. The video feed obtained from FAST will be processed using off-the-shelf video processors like Autoscope and Iteris to extract the following parameters:
   a. Volume: Number of vehicles detected during the time interval.
   b. Vehicle Classification: Number of automobiles, single unit trucks or tractor trailers, as defined by length.
   c. Flow Rate: Vehicles per hour per lane.
   d. Speed: Time mean and space mean vehicle speed in M.P.H. or KM/H.
2. The data extracted will be tabulated and presented in a GIS form.
3. A guide on how to process the video and extract data will be developed and presented to the project manager.

**TASK 5: Data validation and Dissemination**

1. The data extracted will be validated for accuracy of speed, accuracy in vehicle counts, missed and false detections, accuracy in vehicle classifications, etc.
2. The data will also be validated for consistency with visual inspection (partial) and other data collected by other detection technologies.
3. The data validated on each video source will be time-stamped and synchronized based on average travel time.
4. The synchronized data (fused data) will be delivered in a format suitable for SPSS simulation and Comma Separated Value (CSV) format.

**TASK 6: Comprehensive Reporting and Presentation**

1. Periodic reports (monthly) and project updates will be provided throughout the duration of the project. The report will include the revised working papers, raw data and conclusions derived from the data extraction of the video data and the guidelines on deploying the developed data collection system at other locations.
2. A final report & presentation will be developed and submitted to RTC.

**Product: Final Report.**

**Project Deliverables**
The deliverables of the project include:
1. A report on the video based vehicle detection and technology.
2. A report on the type of data collected, their attributes and implementation plan of task 3 will be presented to the project manager.
3. The GIS layout, locations identified, time sheet for video feed collection.
4. A guide on how to process the video and extract vehicle and truck/freight data.
5. Truck flow data at various truck routes in the vegas valley, both GIS and CSV data.
6. A final report & presentation of the project.

**Total Budget**
The proposed budget for video based truck data collection is $13,000. UNLV- University Transportation Center (UTC) is expected to contribute $13,000 with 0% overhead (indirect costs).

**Project Duration**
Start Date : 2009-02-01
End Date : 2009-12-31

**Student Involvement**
Two students will be involved in this project.

**Relationship to Other Project**
None

**Technology Transfer Activities**
None

**Potential Project Benefits**
This project aims at collecting truck data on predefined routes to estimate the truck traffic in the region. The project outcome will also benefit the Regional Transportation Commission of Southern Nevada (RTCSN) in decision making process.

**Project Keywords**
Video Detection, Truck Routes, GIS,