Benefit Analysis of a Video Based Automatic Incident Detection Technology

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GDOT Georgia Department of Transportation
STRIDE Southeastern Transportation Research, Innovation, Development and Education Center

INTRODUCTION:

The Georgia Department of Transportation (GDOT) currently utilizes video analysis technology for the detection of stopped vehicles on shoulders and limited areas of active lanes. Automatic incident detection technology has evolved rapidly in the last several years with significant improvements in video quality and computing resources. In light of the recent evolution in video based automatic incident detection technologies, it is necessary to perform an evaluation of the feasibility of expanded use of this technology by TMC to improve incident management.

BACKGROUND:

- Surveys on the use of incident detection algorithms have indicated a lukewarm response of the industry, primarily because of the false alarms. Similar observations have been made with video based automatic incident detection in previous studies regarding the occurrence of false alarms.
- Crowdsourced methods of detection, using smartphone based apps, is rapidly becoming a significant detection method. However, there is a relevance for automatic incident detection under low volume conditions, in case the motorists involved in the incident are unable to make a call.
- Automatic incident detection can significantly cut down on the detection and reporting time.

PROJECT OBJECTIVES:

- Study the feasibility and potential benefits of a selected video based automatic incident detection technology relative to the existing detection. Evaluate:
  - The accuracy of the detection technologies in terms of detection rates relative to current detection and false alarm rates
  - Whether automatic incident detection provides a significant reduction in detection times over current methods of detection
  - The potential of automatic incident detection to have a greater impact under specific scenarios

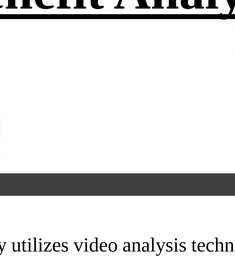


Figure 1. Project Area (Interstate 475)

VIDEO BASED AUTOMATIC INCIDENT DETECTION:

Green boundaries for detecting stopped vehicles or pedestrians, approx. 600 feet in length

Black lane boundaries for detecting regular traffic such as speed, flow, and occupancy, approx. 200 feet in length

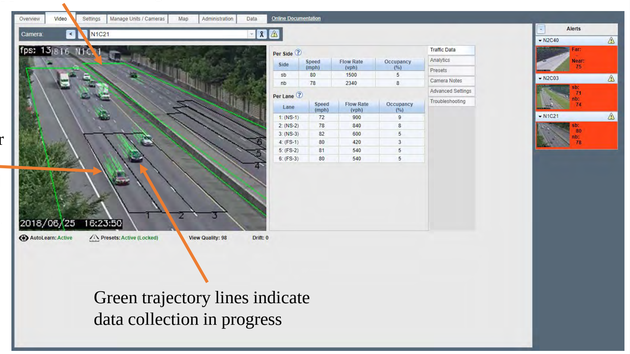


Figure 1: Calibration window in AID

INCIDENT DETECTION TECHNOLOGY EVALUATION: AID

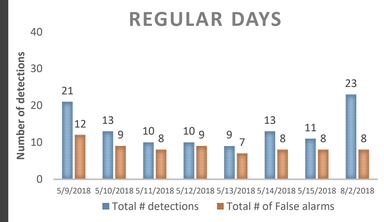
False alarm rate determination: Manual verification of AID logs for two different scenarios: with and without construction activity for the different types of alarms

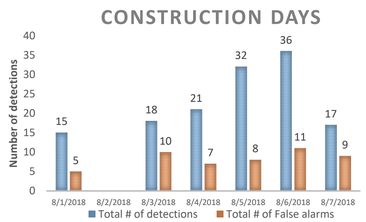
Types of incident	Total # of incidents detected	Total # of false alarms	False alarm rate
Stopped	110	69	62.7%
Wrong way	8	5	63%
Slow	39	3	7.7%
Congestion	57	12	21.1%

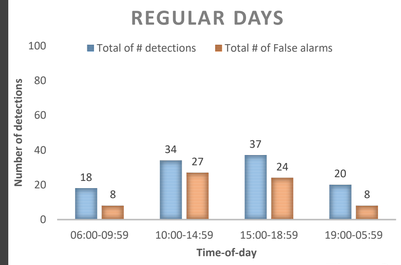
Table 3: Regular days: 05/09/2018 to 05/15/2018

Types of incident	Total # of incidents detected	Total # of false alarms	False alarm rate
Stopped	138	50	36.2%
Wrong way	15	13	86.7%
Slow	38	7	18.4%
Congestion	37	13	35.1%

Construction days: 08/01/2018 to 08/07/2018







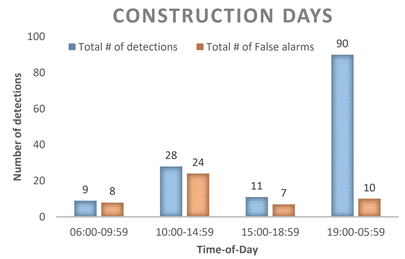
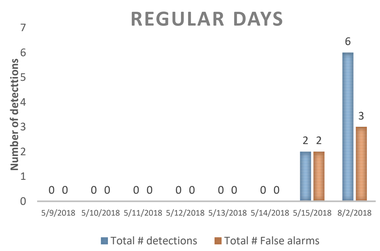
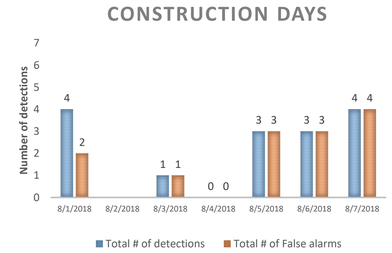
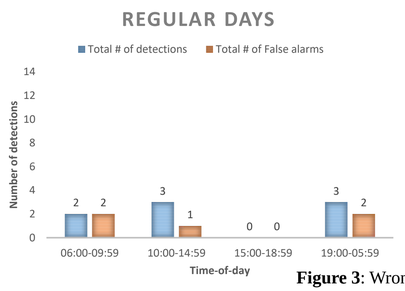


Figure 2: Stopped Incidents







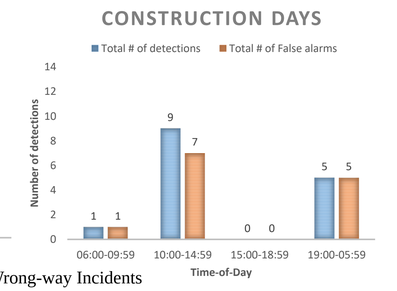


Figure 3: Wrong-way Incidents

- Findings
  - False alarms for stopped incidents are likely to be generated when a Heavy vehicle or a combination vehicle is stopped on the shoulder (Figure 4)
  - False alarm rate is higher on regular days compared to construction days
  - False alarm for wrong-way driving is likely to be generated when there is a shift in camera view (Figure 5)
  - Wrong-way driving is likely to be tagged as a different incident type (e.g. congestion)

Figure 4: Heavy Vehicle stopped on shoulder

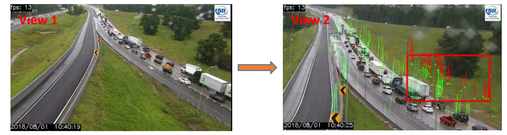
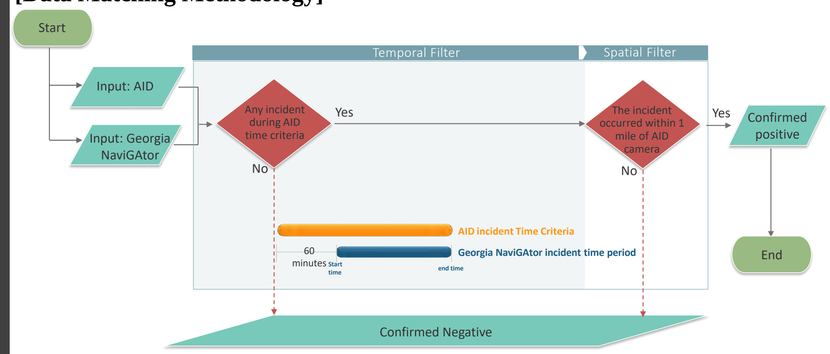


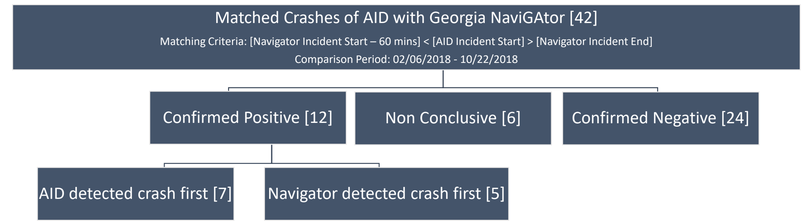
Figure 5: A shift of PTZ camera view

COMPARATIVE ANALYSIS OF DETECTION RATES AND TIME TO DETECT: AID vs. Georgia NaviGAtor

[Data Matching Methodology]



[Detection Accuracy Comparison]



- Findings
  - AID cameras performed sub-optimally in accurately locating the scene of incidents (location based on Georgia NaviGAtor incident logs) primarily for the following reasons:
    - Areas where the incidents happened were not covered by AID cameras
    - Cameras were non-functional when incident happened
  - Vehicle queues due to the incidents were often detected by AID even though the AID failed to identify the incident
  - A selective deployment of the technology on ramps would help realize the maximum benefits in terms of supplementing the detections on the mainline freeways from other detection technologies while keeping the false alarms to a minimum

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