The Evolution of Video Vehicle Detection
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Solutions for Smart Cities of All Sizes
Applications of Vehicle Detection
Loops and Video / Technology comparison
3D Omni-directional tracking technology
Vehicle Detection Technology

Applications of Vehicle Detection Technology

• Stopbar Detection
• Advance Detection
• Traffic Data Collection
• Incident Detection & Response
• Situational Awareness
Evolution of Detection Technology

In the Beginning - Loops

1st Generation Video

2nd Generation Video - 3D Omni-Directional Tracking
Loops

Accurate & Effective...BUT

– Multiple loops / intersection
– Multiple lane closures
– Longest install time (>24 hours for full intersection)
– Maintenance
– Limited life
– No “vision”
1st Generation Video

Non-intrusive, BUT...

- Hardware centric
- Lengthy Installation
- Limited “vision” - looks primarily at pixel changes within a region (tripline)
- Historical issues with shadows and occlusion
2nd Generation - 3D Omni Directional Tracking

- Software centric
- Short installation time (3-6 hours)
- Full vision
- Intelligent handling of shadows and occlusions
Step 1: Image Capture

- Hi Resolution Camera with Ultra-Wide-Angle Lens
- 5 frames per second
How it Works - 3D Omni-Directional Tracking

Step 2: Background modeling
- Background is anticipated
- Adapts with shadows, ambient illumination, etc

Step 3: Background subtraction
- Background is removed, leaving the moving objects
How it Works - 3D Omni-Directional Tracking

Step 4: Edge detection
• Edges are identified and tracked through entire camera field-of-view

Step 5: 3-D Modeling
• Based on how edges track in relation to one another, a 3D vehicle model is assigned

Step 6: Omni-Directional Tracking
• Points / models are tracked throughout intersection to trigger stopbar zones, provide TRUE turn movements, average speed, etc
**How it Works - 3D Omni-Directional Tracking**

**Intelligent Occlusion Mitigation**
- Objects occluding camera view (mast arms, signals) can be masked. Tracking algorithms “ignore” these items. Tracked objects may travel “through” masks without being dropped.

**Intelligent Shadow Handling**
- 3D objects can cast shadows, pixels cannot
- Software knows relative position of sun and the algorithms anticipate where shadows “should” be.

**Other Intelligent Benefits**
- Virtual Pan-Tilt-Zoom
Melbourne, Australia

Methodology
- VicRoads installed the technology for purposes of validating count accuracy as part of its Acceptance Testing.
- Video detection zones were placed on top of four (4) existing inductive loops on Denmark Street (2 Northbound, 2 Southbound)
- Data was collected for a seven (7) day period, 24 hours per day, and results were compared.

Results
- Loop detectors counted 181,631 vehicles during this period
- The system counted 185,405 vehicles during this period
- Count accuracy of 98% compared to loops
3D Omni-directional tracking can significantly enhance collision avoidance via dilemma zone detection based on the following:

- Assuming a relatively constant speed and predictable vehicle behavior, and a clear line of site, the technology can predict several frames in advance of the current vehicle position.
- Ultra-wide-angle lens captures 5 frames per second.
- Distance traveled per vehicle (d) may be calculated at \((0.0556 \times \text{kph})\) meters, or \((0.2933 \times \text{mph})\) feet per frame.
- Calls could be made to the controller based on predicted vehicle positions, to either extend green or hold “all red.”

<table>
<thead>
<tr>
<th>Distance per frame (d)</th>
<th>Meters</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 kph / 50 mph</td>
<td>4.4</td>
<td>14.6</td>
</tr>
<tr>
<td>100 kph / 62 mph</td>
<td>5.6</td>
<td>18.2</td>
</tr>
<tr>
<td>120 kph / 75 mph</td>
<td>6.7</td>
<td>21.9</td>
</tr>
</tbody>
</table>

Frame capture every 0.2 seconds
Does NOT replace pushbutton crosswalk systems, but enhances safety
  • Call is made by pushbutton
  • Additional calls to indicate moving pedestrians in crosswalk for holding the red and/or to trigger signage for drivers that pedestrians are present.
• Pedestrian Counts are a by-product

3D Omni-directional tracking can improve the safety of crosswalks by providing pedestrian presence indication
For More Information:

www.aldiscorp.com

www.youtube.com/AldisGridSmart

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