IMPROVEMENT OF CONTAINER NUMBER RECOGNITION SYSTEM (CNRS) SUCCESS RATE

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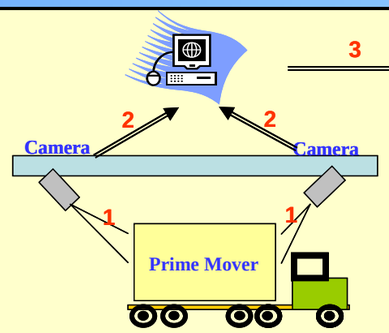
INTRODUCTION AND OBJECTIVES



1 When the prime mover arrives at the gates, it will stop in front of a barrier, where there are cameras attempting to capture its container number.

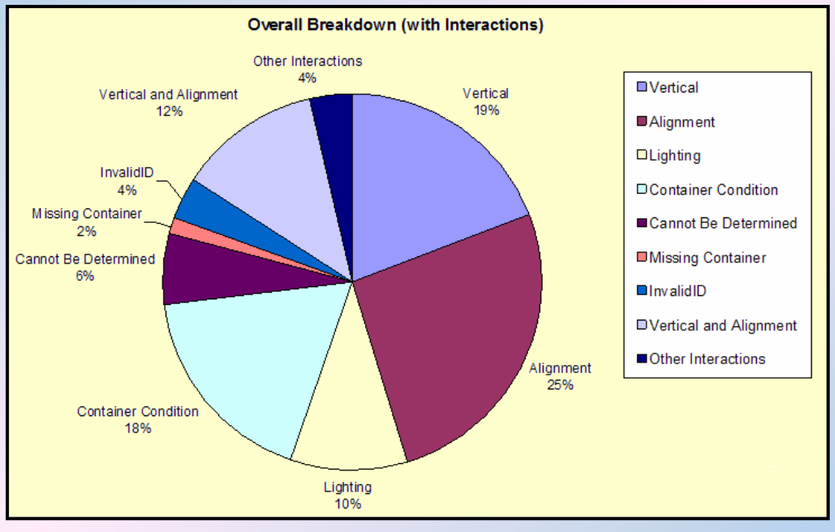
2 Images captured are sent to a software which will try to recognize the container number from the image.

3 If the container number matches the database's number, the truck is allowed to pass the gate, and the whole process is automatic.

If the system fails to recognize the container number correctly, manual inspection has to be done. This would increase the service time. Hence, the success rate of the CNRS system plays a crucial part towards determining the service level of the gates.

Therefore, the objective of the project is to improve the success rate of the CNRS system.

MAIN REASONS FOR CNRS FAILURES



FINDINGS AND RECOMMENDATIONS

Alignment Issue

1. Most of the failures arise because the container was too near to Camera 1. Hence, we suggest adding an additional camera near the position of Camera 1.

2. The performance of Camera 2 varies across lanes. As a first step, we recommend standardizing the position and tilt of Camera 2 in all the lanes and making the structures supporting them more stable.

Lighting Issue

1. Lighting problem is most significant in Lane 4.

2. Further analysis shows that only Lane 4 shows significant possible improvement in CNRS rate. Hence, the lighting problem should only be investigated in Lane 4.

3. The problems occur more often in images captured by Camera 1's. Also, the additional benefit of addressing the problem at other camera positions is marginal.

4. Lastly, we also recommend steps for pinpointing the lighting problem in Lane 4.

Recalibration of CNRS Software

1. Improve the performance of recognizing 'U' because of its large absolute appearance frequency.

2. Improve the performance of recognizing 'V' because 100% of all 'V' failed.

3. Investigate why 'U' is often misread as 'I'.

4. Investigate why '0' is often misread as '1'.

5. A lot of letters are being misread as 'I', and this is not due to the presence of a vertical bar in the image.

Suggesting the Use of a Control Chart

1. Implementing the use of control charts will allow PSA to continuously monitor the performance of its CNRS system.

2. This will allow the users to detect camera malfunctions early and also monitor individual camera performance.

CONCLUSION

We have investigated three major areas for improvement, and made some recommendations that our client may adopted to improve the CNRS system.

This project can be further extended by PSA as a continuous improvement project. Future directions include adjusting the cameras' positions, recalibration of the CNRS software, and the implementation of control charts.

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