ABSTRACT

This thesis addresses the challenge of improving situational awareness in Traffic Management Centers (TMCs) along rural and interurban interstate segments with sparse Intelligent Transportation System (ITS) infrastructure. Two distinct, complementary systems were developed and evaluated. First, to improve the efficiency of TMC's getting "eyes" on an incidents, an automated repositioning of ITS Pan-Tilt-Zoom (PTZ) cameras was developed. This system had two components: a manual segment-preset method and a more accurate, automated system that converts raw GPS coordinates into accurate camera commands. To ensure the reliability of these automated systems, a new monitoring process using the Structural Similarity Index Measure (SSIM) was designed to automatically detect calibration "drift," replacing hours of manual maintenance. Second, to improve situational awareness in rural areas, a system for the automated monitoring, transcription, and contextualization of local 9-1-1 dispatch radio communications was developed. This cost-effective data stream combines commercially available hardware with Automatic Speech Recognition (ASR) to transcribe audio, employs keyword analysis to determine incident type and location, and generates automated notifications for TMC operators. By both streamlining existing ITS camera use and establishing a new source of real-time intelligence for rural segments, this research offers practical, automated solutions that reduce operator workload, improve incident verification, and enhance the efficiency and safety of traffic management across the entire roadway network.