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Research Topic : **Design and Development of Visual Inspection Systems**

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# ABSTRACT

The visual inspection system (VIS) is a method of data acquisition, data analysis, quality control, electrical system control, and process control for a particular product, system or process. The main processes involved in a visual inspection system are: image acquisition, image de-noising, image enhancement, image segmentation, image feature selection and extraction, image classification, feature matching, decision making, display of results, and generation of controlling signals according to set values and parameters.

In this thesis work, a VIS is made for the calibration and testing of automobile fuel and temperature gauges. The results shows that the VIS developed to perform testing and calibration work can give better performance provided that two major constraints: light intensity and alignment of gauge with camera do not get changed during the process.

To monitor the performance and condition of electrical machines in real time, a visual monitoring system is developed to visualize the reading indicated by ammeters and voltmeters in real-time and take controlling actions to avoid any catastrophe. In this system, a novel dynamic sliding window algorithm (DSWA) has been developed for the segmentation of the pointer's image of the meter from the captured image. From the

simulation results, it is observed that smaller window size gives better results in terms of accuracy. However, this increases the computational complexity and in turns reduces the speed of the system.

In another implementation of VIS, a non invasive infrared image based visual monitoring system is proposed for off line monitoring of electrical power system assets. In this system, threshold based segmentation is used to detect the high thermal impact regions. And, for the protection of Power Transformers, an IR imaging based non invasive real time visual monitoring system (NIRTVMS) is proposed. This system has capability to estimate area of the hotspots in the transformer and take control decisions to keep other part of electrical systems healthy. In this work, threshold based segmentation is used to detect the high thermal impact regions. A new temperature estimation algorithm is developed to estimate the rate of temperature rise in the system with the rate of change of red color area in the thermogram.

In this thesis work, three main application areas (testing, monitoring and controlling) of VIS are identified and the following visual inspection systems have been proposed:

1. Visual Inspection System for testing and calibration of fuel gauges.
2. Visual Inspection System for testing and calibration of temperature gauges.
3. Visual Inspection System for monitoring of electrical parameters (voltage & current).
4. Visual Inspection System for off-line monitoring and controlling of electrical assets using infrared Thermogram images.
5. Visual Inspection System for real time monitoring and controlling of power transformer using infrared Thermogram images.