On-line dynamic security assessment (DSA) analysis has been developed and applied in several power dispatching control centers. Existing applications of traditional DSA are limited by assumption of system operation conditions and computational speeds. To overcome these obstacles, this research developed a novel two-stage DSA system to provide periodical security prediction in real time. The major contribution of this research is to develop an open source on-line DSA system incorporated with Phasor Measurement Unit (PMU) data and forecasted load. The pre-fault prediction of the system has the ability to provide more accurate assessment for the system and minimize the disadvantage of low computational speed of time domain simulation.

This Thesis describes the development of the novel two-stage on-line DSA scheme using phasor measurement and load forecasting data. The computational scheme of the new system determines the steady state stability and identifies endangerments in a small time frame near real time. The new on-line DSA system will periodically examine system status and predict system endangerments in the near future every 30 minutes. System
real-time operation conditions will be determined by state estimation using phasor measurement data. The assessment of transient stability is carried out by running time-domain simulation using a forecast working point as the initial condition. The forecast operating point is calculated by DC optimal power flow based on forecast load.