The rapid growth of web and mobile technologies has allowed people to access E-Learning content from heterogeneous client devices. In order to deliver the best presentation of content requested, the E-Learning system must possess a mechanism that not only capable of accurately discovering the characteristics and capabilities of a client’s device but also capable of finding out about network and server resource availability. Three recurring issues need to be addressed when constructing such solutions: 1) How to identify the device characteristic and the capabilities of a device, 2) How to find out about network resource availability, and 3) How to adapt application behavior. Addressing these questions the dissertation makes three main contributions. First, a content negotiation and adaptation architecture was proposed to facilitate the process of identifying and detecting client device. It differs from other existing content negotiation approaches by introducing the idea of combining dynamic and static device capabilities detection methods. It consists of a device database and two processing components: (1) device identification module and (2) device capabilities detection module. The content negotiation and adaptation architecture was implemented and validated through various laboratory experiments and field studies which the results highlight the importance of using token attributes matcher by eliminating the need of using the entire user agent strings for device identification and capabilities detection. Besides reducing the processing overhead it also achieves better results in terms of accuracy compared to the user agent approach.

Over the recent years, there has been an explosive growth of interest in the usage of essential oil. Essential oils can be obtained through various type extraction techniques that ranging from conventional to modern techniques with the most common practice approach in extraction technology using steam distillation. Temperature is identified as the most influencing parameter in the quality of essential. Hence this study is focusing on the steam temperature control alone. The steam temperature exhibits nonlinear behaviour due to many factors. Previous studies have shown that fractional order control has the capability to handle the nonlinearity dynamic better than the conventional technique. Hence, the improvement of the control strategy is a necessary. This research presents the design of Fractional Order Proportional Integral Derivative (FOPID) with enhancement of low-pass filter and error filter for temperature regulation in a Small-Medium Industry Steam Distillation (SMISD) plant. There are several tests have been done to evaluate the performance of the developed controllers in the SMISD plant such as step test, set point change, and load disturbance test. The experiment was conducted in simulation and real-time environment. The results indicated that the system has a time constant of 796.86 s and rise time, settling time, overshoot disturbance recovery time of 62.80 %, demonstrated the best performance under various test with a reduction in overall simulation experiments have shown the proposed FOPID-ZN-ARX model that has been used to represent SMISD plant during the simulation study presented a good model fit with 99.24 %. The enhanced version of Model Predictive Controller (MPC) with anti-windup strategy has been introduced in this study which derived from Unconstrained MPC (UMPC) and Constrained MPC (CMPC). By integrating this strategy, it managed to stabilize the responses of UMPC controller towards step response and at the same time has a superior performance against the CMPC controller. The FOPID controller performance was successfully elevated by integrating error and low-pass filter. The error filter is responsible for eliminating persisting steady state error in fractional order controller while the low-pass filter is responsible for attenuating the effect of measurement of high frequencies noise. The improvement can be observed in simulation disturbance test where the FOPID with error and low filter has better recover time of 12.32 % improvement compared with conventional FOPID. The performance FOPID and their variance also been benchmarked with conventional controllers (proportional controller) and advanced controllers (MPC controller) in simulation and real-time environment. The overall simulation experiments have shown the proposed FOPID-ZNARX demonstrated the best performance under various test with a reduction in rise time, settling time, overshoot disturbance recovery time of 62.80 %, 87.50 %, 8.52 % and 70.30 % respectively. The real-time results have also shown agreement with reduction of 42.38 %, 65.20 %, 4.99 % and 62.92 % respectively.

Second, network-aware applications architecture for E-Learning system was also proposed to dynamically adjust the users’ demand based on network resources. For this to happen, applications need to have some mechanism that can estimate the network bandwidth by simply adjusting their behavior based on the collected network characteristics information. In the past, there have been several proposals that provide passive and active bandwidth estimation approaches. However, little effort has been spent to address the crucial issues of reliability and congestion control especially in wireless network environment, which stay as a sticking point for the success of network-aware application. Therefore, an active available bandwidth estimation technique was incorporated in the proposed solution. The experimental results validate the efficiency of the proposed solution in terms of accuracy, intrusiveness and timelines. Third, this thesis focuses around the objective of developing a resource-based content adaptation system. In order to achieve this objective, two architectures introduced in the first and second parts of the thesis were combined to provide the user with the best possible content based on the device capabilities, server and network condition. A prototype of the proposed architecture was built and validated which the focus is towards determining the decision algorithm precision and measuring the video assimilation. The results showed that the decision algorithm improves the measurement by 28% and the degraded transcoded video does not affect students’ comprehension.