Formal Design of Teleteaching Interactivity

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Abstract—In this paper, we are supposed to manage the workflow of a web-based multiple participants in virtual University referred as Distance Learning Organization(DLO). The presented approach conspicuously help the developer to comprehend the interaction relationship of the DLO but also to easily construct a shared and trusted educational environment. The interaction designing is done by Dynamic Petri Net model. This presented design can help to comprehend the interaction relationship among Teacher-Student, as well as with each teaching process of the organization.

Keywords— Distance Learning, Tele-teaching, Interaction, Dynamic Petri Net, Formal Design.

I. INTRODUCTION

Distance Learning Organization (DLO) is an evolving paradigm of instruction and learning that attempts to overcome both distance and time constraints found in traditional classroom learning. Telelecture is a field of education technology that aims to deliver knowledge to those student who are not physically present on the site. The main goal of teleteaching is to impart distance independent education with the use of information and communication technology. We can use this method in different field of study. Rather than attending classes physically, teachers and students may communicate at a predefined time schedule by exchanging electronic media, or through technology that allows them to communicate in real time and through other online ways. This enhance the teaching learning process to be location independent removing the distance constraint. For example, with such a system, students will be able to follow lectures from networked PCs from wherever they want.

Being an interactive system, there is a number of interactions between each entity and the organizational processes itself. So rigorous formalization of each DLO interactions for the effective implementation of the system is needed here. Petri nets, introduced by C. A Petri in 1962 [1], provide an elegant and useful mathematical formalism for modelling concurrent systems and their behaviors as well as interactions. In many applications, however, modelling by itself is of limited practical use if one cannot analyze the modelled system. In this paper we uses a new extension to the Petri Net model to design those interactions to get the best support in implementation level. The Dynamic Petri Net (DPN) is a powerful extension to the Petri Net family. DPN adds several new elements such as dynamic places, control functions, control output arcs, and control variables. The extensions provide for the creation and destruction of conventional Petri-Net Places and Transitions inducing dynamic behavior of Petri-Net operation.

A. Formal Definition of DPN.

A Dynamic Petri Net structure, S, is a 10-tuple.

\[ S = (P, T, I, O, \tau, P_d(F), N, F, P(F), O(F)) \]

1) \( P = \{ P_1, P_2, P_3, \ldots, P_N \} \) where \( X \geq 0 \), is a finite set of places.
2) \( T = \{ t_1, t_2, t_3, \ldots, t_M \} \) where \( Y \geq 0 \), is a finite set of Transitions., where \( P \cup T = \Phi \) i.e. the set of the places and transitions are disjoint.
3) \( I : T \rightarrow P \) is the Input Arc, a mapping from places to bags of transitions.
4) \( O : T \rightarrow P \) is the Output Arc, a mapping from transitions to bags of places.
5) \( \tau = \{ \tau_1, \tau_2, \tau_3, \ldots, \tau_d \} \), where \( a \geq 0 \), is a finite set of time intervals representing playback time intervals. This is derived from OCPN.
6) \( N = \{ n_1, n_2, n_3, \ldots, n_M \} \) where \( b \geq 0 \), is a finite set of persistent control variables. These variables are persistent through every marking of the net.
7) \( F = \{ f_1, f_2, f_3, \ldots, f_N \} \), where \( c \geq 0 \), is a finite set of control functions that perform functions based on any control variable \( N \).
8) \( P(F) : P \) is a finite set of static control places (a subset of \( P \) that executes any control functions \( F \).
9) \( O(F) : O \) is a finite set of static control output arcs that may be disabled or enabled according to the control functions \( F \).
10) \( P^D \{ F \} : P^D \) is a finite set of dynamic places (a subset of \( P \) that takes their value from some control function \( F \).

II. RELATED WORK

This section presents an overview of approaches in the research literature associated with the research issues of this work, in particular approaches that address learning theories and the development process of Distance Learning in an Organization. The Learning Object Model [2] is based upon the concept of “learning object”. The use of the term object is borrowed from the object-oriented paradigm of computer science. Laurillard’s [3] conversational framework has been very influential in the development of Distance-Learning among educational developers.

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Salmon’s e-Tivities approach specifies five stages of e-Learning: Access to motivation, online socialization, information exchange, knowledge construction, and development. The learning model presented by Conole et al. and associated toolkits (in particular the DialogPlus Toolkit) place emphasis on social processes, facilitated by the interactions of learners and tutors. Nash argues for the use of learning objects within the context of constructivist epistemologies, because these are considered “as pivotal to understanding how to effectively use them within online courses.”

We here use Dynamic petri net model to design the system interactions. Similarly, several properties can be verified using Dynamic Petri Nets. Dynamic Petri Net were developed to model to interactive distributed multimedia environment. Naveed et al. introduce OCPN for solving intra stream and inter stream synchronisation problem in real time multimedia communication. Charles et al. and Roy et al. have introduce the concept of Dynamic Petri Net. In [8] the authors described a modeling technique for distributed sensor network. DPN has been used in designing of a multimedia orchestration tool.

III. MODELS OF TELETEACHING INTERACTIONS

We used The Dynamic Petri Net model to establish the activities in Distance learning Organization. It includes the following five stages:

A. Preparing Course:

This stage prevent the loss of effective teaching techniques, thus providing the means for all instructors to continually improve existing curriculum in DLO. Thus before selecting a course DLO collects the course feedback form outside world as well as from the teacher. First of all, the Administrator login with granted authorization for selecting a course is illustrated in Fig 1. The subsystem should provide the independency for the Administrator to creating any course based on the Market review. Administrator could also update a existing course. They first take into account the Market review of the course and existing Teacher interaction for selecting a new course. After satisfactory result administrator checking the infrastructure of the organization according to the course need.

B. Recruiting Teacher:

After selecting the course the next step is to select the Teacher, best suited for this course. The Administrator login with granted authorization for recruitment of the Teacher. At first advertisement of recruitment with the eligibility criteria given on the website of the DLO. Then the received applications are sorted according to the overall qualification and experience. Next the sorted applicants are called for the interview. Depending on the interview performance, applicants are selected as Teacher in the organization. This total process is done in a location independent manner.
f1: login()

f3: check_application()
{}
    if (received application = sufficient)
    {
        O\textsuperscript{2} \ enabled;
    }
}

f4: sorting()
{}
    if (applicants matches criteria)
    {
        O\textsuperscript{3} \ enabled;
        O\textsuperscript{4} \ disabled;
        }
    else
    {
        O\textsuperscript{4} \ enabled;
        O\textsuperscript{3} \ disabled;
        }

f5: interview()
{}
    if (marks \geq \ threshold)
    {
        O\textsuperscript{5} \ enabled;
        O\textsuperscript{6} \ disabled;
    }
    else
    {
        O\textsuperscript{6} \ enabled;
        O\textsuperscript{5} \ disabled;
    }

C. Selecting Student

This stage is dependent upon the eligibility qualification of the student and the course criteria needed by the organisation. The Administrator login with granted authorization for selection of student. At first advertisement of admission with the course criteria given on the website of the DLO. Depending upon the demand in market and course structure, students send the online application. Then the received applications are sorted in the organization comparing their qualification and sorted applicants appear for interview. Depending on the interview performance applicants are selected finally. Then the online counselling is carried out in the prescheduled date followed by registration.

D. Lecture

A lecture is an oral presentation intended to present information or teach student about a particular subject by the teacher and a set of enlisted student will allow to join that session in geographical independent manner. Student first login with granted authorization for attending synchronous lecture session in specified time duration as well as on demand lecture download, assignment upload facilities are also there.
E. Test

The examination subsystem measures the effectiveness of learning. Learner may rely on tests to measure their learning progress in a course. Student first login with granted authorization for online test and interactive viva in the predefine time schedule.

F9: Student_login( )
{
    if(user_id & password = true)
    {
        O^6_1 enabled;
    }
}

F8: download( )
{
    if ( Student willing to download )
    {
        O^5_2 enabled;
    }
}

IV. CONCLUSIONS

In this paper, we proposed a trust development framework and approach to the understanding of the Distance Learning by Dynamic Petri Net. This is the important comprehensive and coherent framework to guide our understanding of distance learning in education and society. This paper can be used as a basic research framework and tool to design and understand the characteristics of distance learning and to explore its optimal location independent education application.

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REFERENCES


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