E-Catalyst Learning System

by

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B.Tech., Guru Gobind Singh Indraprastha University, 2012

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Supervisory Committee

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Abstract

This project provides the detailed design and implementation of e-Catalyst Learning system and also includes the essential strategic business plan information necessary for initial development and operation of electronic commerce software. It supports broad and varied online course catalog, partnering with various institutions. The vision is to create the finest online course providing software for individuals who can't afford universities. The software is mainly focusing on universities subjects, which will help the individuals in their career to grow and learn. It encourages the students to use the system as often as possible. It will allow users to browse through the courses, their details, and enroll in them to gain access to weekly material and exams. Students can track their course progress on weekly basis for each registered course. The e-catalyst learning system is built in Canada and will be available as an open source system. It will be handled through a non-profit organization. This report gives a detailed overview of a user-friendly online course learning system available on the Salesforce cloud platform, discuss its design, implementation, benefits and future work.

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Acknowledgements

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Also, I would like to thank my friends and family who encouraged me during this project.

1. Introduction

E-catalyst project is an e-commerce software where students can learn and universities can teach and share knowledge with students all over the world. It includes online course catalog, partnering with various institutions. It offers free online courses to students, who are not financially strong. This software helps students grow in different fields through the courses offered by reputed universities. They can track their progress in each course through this software. They can take exam and get certified in the courses. As this software has been built on the Salesforce platform, therefore it will be available online and can be accessed from anywhere anytime. It is a user-friendly software available for the target users discussed in this section.

1.1 Target Market

We have identified for E-catalyst learning system different market segments that will be interested in the software product. These segments are the most likely consumers of the software. The different segments are as follow:

- **Independent Users** – E-catalyst learning system is user-friendly and easy to use the system. That will help to train persons who live on their own. Our choice of courses will be helpful to the individuals and make them experts in that field and assist them to live independently successfully on their own.
- **School Sector** – Schools can use e-catalyst learning software to help their students to gain fundamental skills.
- **Home Schooling** – Parents who are taking a vital role in the education of their children will be looking for help that they can use at home to help with their child's learning progress.
- **Agencies (Teaching Centers)** – Many teaching centers are there who help students to gain the knowledge of a particular field, for example, an individual can go to the education center and learn Java programming. Thus, agencies can use e-catalyst learning system to help their students. For example, BCIT (learning and teaching center) or Kaplan Test Prep help students to teach various courses and offers integrated services for curriculum and

instructional development and deliver quality teaching and learning that meets the needs of students and industries.

E-catalyst learning system is a free open source system, it will help people and organizations all over the world, and anyone can use this software for their benefits.

1.2 Salesforce Force.com platform

Salesforce [2] is a Customer Relationship Management (CRM) platform. E-Catalyst Learning system uses Salesforce Force.com platform, which is used for creating and developing cloud apps. This platform is available online and is accessible from anywhere; only Internet connection is needed. As it is a cloud platform, it doesn't need any servers or software to be installed by the end user. Developers can only focus solely on building apps which include built-in social and mobile functionality.

We have used Force.com platform for the following main reasons:

- Proven – More than 100,000+ companies are using force.com platform. All these companies have built 220,000+ apps on force.com platform. The information and real-time system performance can be seen at trust.salesforce.com.
- Mobile – We can run any business using the Salesforce1 mobile app. Here, we can build native apps with its API's powered by a safe and massive cloud database. We can also build responsive and mobile supported browser apps using its UI and HTML5 framework. It helps in running Salesforce apps on any device with any codebase.

1.2.1 Benefits of Force.com platform

To build e-Catalyst Learning system, we are using Salesforce force.com cloud computing platform [1] and using its specific platform languages like Apex, Visual force, JQuery, JavaScript, HTML, and CSS. It is a platform used for creating and deploying cloud apps. Building our system on Force.com cloud platform gives us the following benefits [3]:

- **Flexibility**: Cloud-based services are optimal for businesses with increasing or inconsistent bandwidth demands. Cloud platforms are based on Multi-tenant architecture, where multiple users or organizations are using the single platform with distributed bandwidth. Cloud-based platform is often flexible and always ready to provide extra bandwidth whenever needed. For example, if there are 100 users, each user will need a certain amount

of bandwidth, so that they can work without any problem and their work won't get impacted. Now in the same case, if we add 100 more users, we need more bandwidth, so that each 200 users can work at the same pace without any delay. Thus, cloud-based platforms are adequate for flexible uses, and the performance of the system stays consistent whole time.

- **Disaster Recovery**: Cloud based platform provides back up of all data. It saves time, avoids large up-front investment and we can focus on our product.
- **Automatic Software Updates:** The best part of cloud platform is that the servers are off-premises. Suppliers take care of them and roll out regular software updates including security updates.
- **Capital investment free**: Cloud computing platform cut the cost of hardware and software since the platform is online, we are not required to buy any software and install into the system. It makes the process easy, we don't need to worry about setup and configuration. In cloud computing platform, we can work from anywhere, only the internet connectivity is needed.
- **Data-Centric Apps**: It is an application based on consistent information similar to the database. As Force.com platform is centered on the database, it allows us to write data-centric apps.
- **Collaborative Apps**: Force.com platform provides services that are shared with multiple users at the same time in multiple locations. As collaborative apps are accessible on web browsers from any place in the world, it helps in managing ongoing projects and coordination amongst team members.

1.3 E-Catalyst Learning System walk through

There are several organizations on the market selling educational products for their target segments. E-catalyst learning software will leverage their competitive edge by incorporating competitive features, which are not available in the existing markets. All the features make our system user-friendly; it increases the amount of time that the students may use the system more often, thereby enhancing the effectiveness of our system. E-catalyst learning software is built by taking consideration of people perceptions, so students and the organizations can enjoy what they are doing and they are likely to use the system happily instead of having to be forced to use it.

There are some interactive features of e-Catalyst Learning that have been implemented and they are discussed as follows:

- **View Courses**: Users can view all the courses and can register according to their interest. They can also gain access to the course video tutorials.
- **View Instructors and Institutions**: Users can view Instructors of specific courses and which Institution Instructor belongs to.
- **Course Forum**: Students and Instructors can visit the course forum once they are registered in a course. By gaining access to the course forum, they can engage in discussions with other group members of that course and ask questions or share code.
- **Search course**: Users can search for the courses which will be provided by the instructors based on filter criteria's, e.g., Course name and competency level of courses.
- **Discussion forum**: Registered users can discuss course content with the other colleagues or instructors. They can do a new post and reply back to any ongoing discussion as well.
- **Take online exam**: Students can take exams, which will be available online and the results will be shown once they complete the exam.
- **Download Certificate**: Students can download course completion certificates once they successfully pass their exams. The certification will be free of cost although they have to meet the criteria (e.g. minimum 50 out of 100) to get the certificate.
- **Google Maps:** It allows users to view the location of all Institutions of e-Catalyst Learning system on a single Map with their basic details.

2. Software Modelling and Design

A detailed object-oriented design for the e-Catalyst Learning system has been developed. The Unified Modelling Language (UML) is used for the graphical representation of the design. This system comprises of 3 different types of users and their respective accesses to the system which can be seen in the Use case diagram for each user type:

1. Student
2. Instructor
3. Admin

2.1 Use case Diagram

Student module

In the e-Catalyst Learning system, a student can be a guest user or a registered user. In the use diagram of a student user (Figure 1), each use case is categorized for either guest or registered user. Also, there are few use cases where one use case calls/invokes the included use case and "<<include>>" is always a precondition which needs to be executed before the base case executes. Following are such cases:

- For "Visit course forum" use case, "Join Course Forum" is a precondition (prerequisite) that first needs to be true, i.e. some user needs to first request access to join course forum then only a registered student can visit the forum for that course.
- In order to enroll in a course, the guest student first needs to login which is a prerequisite for course enrollment. Therefore, login is a must action that needs to be invoked before enrolling in a course.

Next, there are use cases in which other use cases can be extended using "<<extend>>", it adds extra steps to the extended use case or it can also be an optional step. In our case, "View courses" and "Search course" both extend by adding an extra optional step to "View course details".

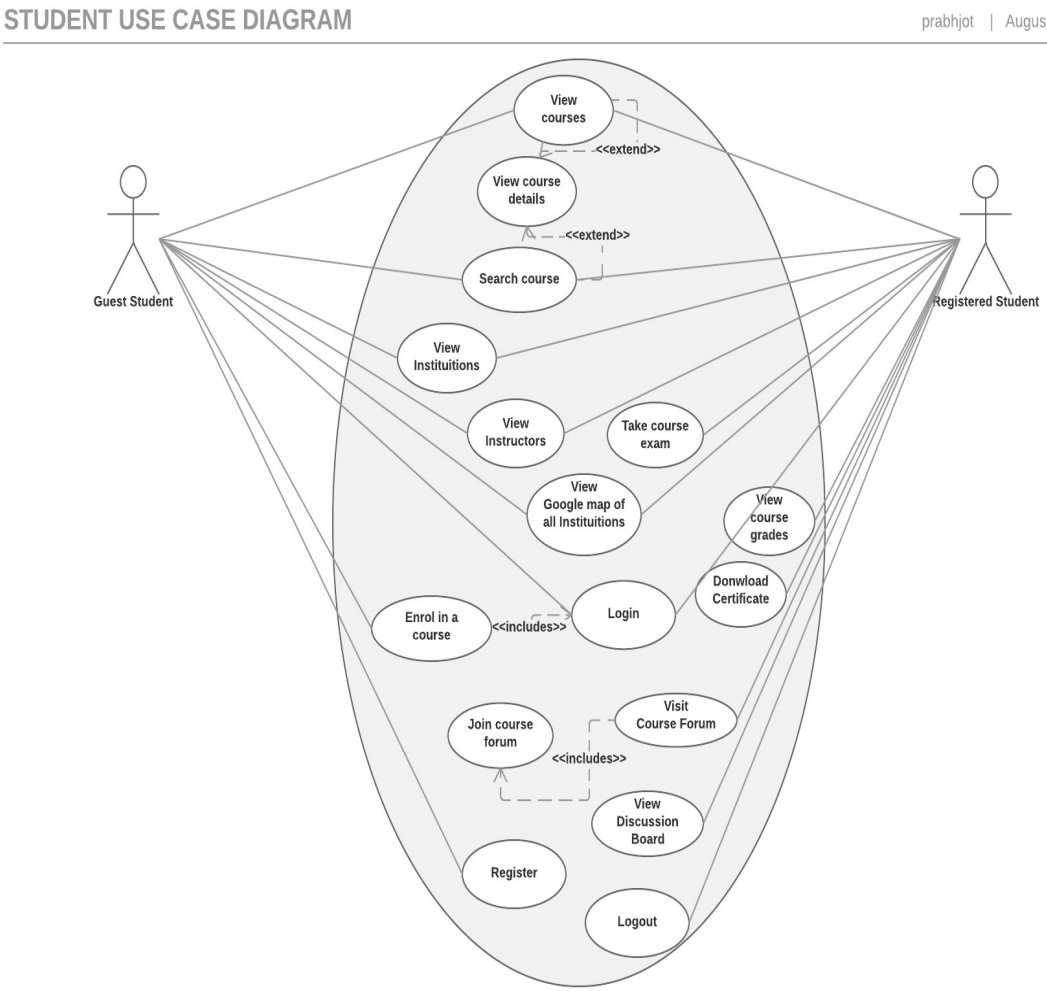

Figure 1 Student use case diagram

2.2 Schema Diagram

Schema diagram is one of the structure diagrams that represent the structure of a system. It defines the objects/entities of a system and the relationship amongst them. Schema diagram in Figure 2 of e-Catalyst Learning system comprises of following relations:

- A ‘Course’ is offered by one ‘Instructor’
- An’ Instructor’ belongs to one ‘Institution’
- An ‘Institution’ can have many ‘Instructors’.
- A user is related to the ‘RegisteredCourse’ entity for a particular course
- A course has a specific ‘QuestionBanks’ for exam

- Each course has ‘Course Material’ with weekly videos tutorials

Graphical schema diagram of the e-Catalyst Learning system is given in Figure 2.

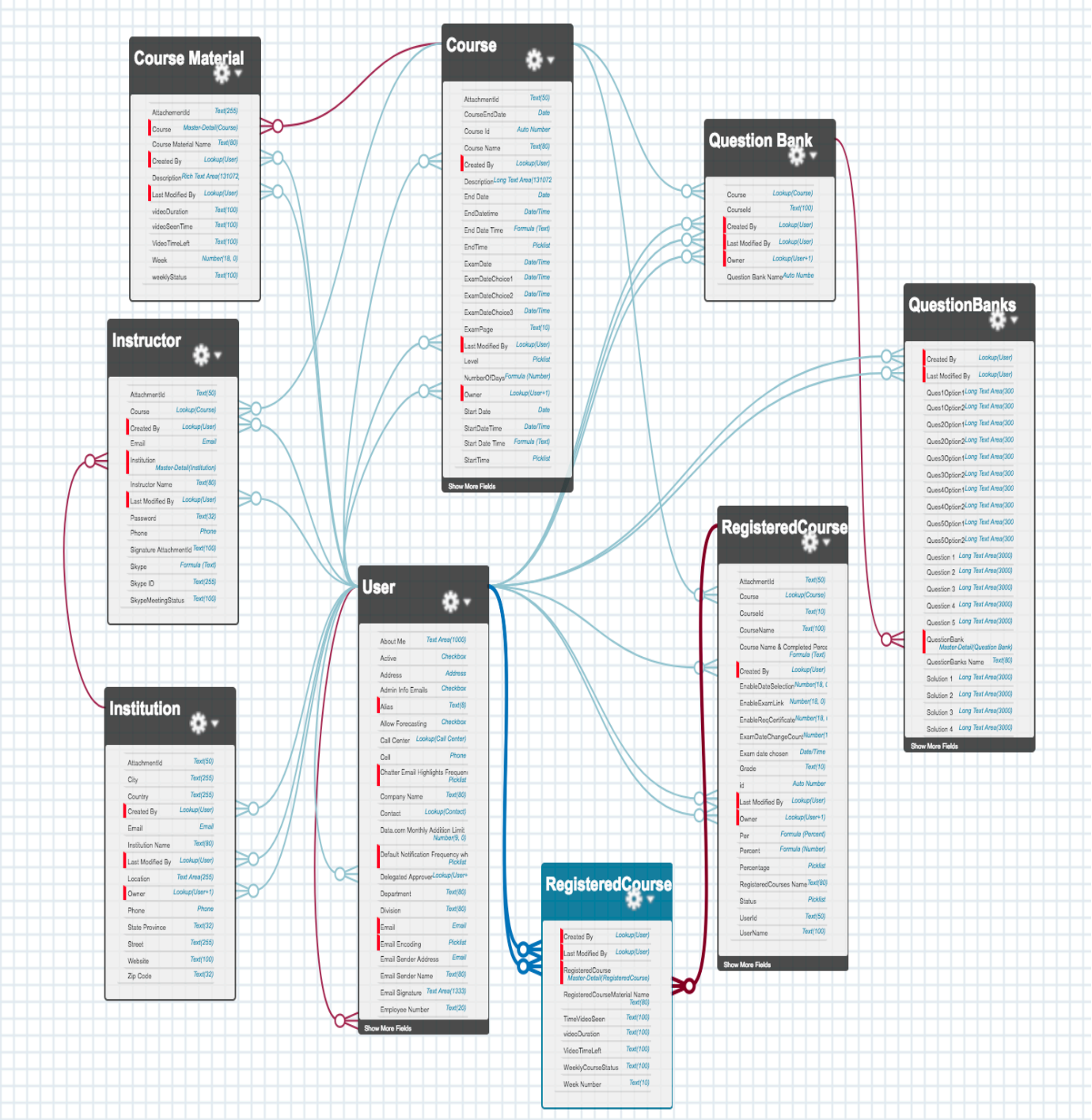

Figure 2 Schema diagram

For above schema diagram (which is created in Salesforce), below is the color code list to understand the detailed relationships between entities.

- Lookup Relationship
- Master-Detail Relationship
- Required Field

3. Technologies and Tools

Salesforce is a Customer Relationship Management (CRM) platform. In cloud based platforms, there is no need of experts to manage hardware or install any software. Instead, a user will use the applications online with just a login authentication. This platform is available as Software as a Service (SaaS) for browser based service access.

The Salesforce cloud platform allows us to use modern and efficient technologies [6] as listed in Table 1. It has a huge impact on what the platform supports and how an application is developed on that platform.

3.1 Technologies supported in Salesforce

Table 1 depicts all the technologies and programming languages used for designing the user interface and development of e-Catalyst Learning system.

Technology	**Description**
Multitenant Architecture	All users share the same infrastructure and code base in this application model.
Apex	A standard programming language that runs on the cloud computing Force.com platform.
Visualforce	A standard framework to create rich user interfaces for applications in the cloud [9]
HTML, CSS, JavaScript, JQuery	Web development languages for designers for client side scripting/ validations and to enhance the user interface with stylesheets.

Table 1 Technologies used

4. Implementation of e-Catalyst Learning System

4.1 Multitenant architecture

In this architecture [5], all users share same Force.com platform and infrastructure. It releases upgrades automatically for all the users without them having to worry about updating their software or hardware. It keeps all the applications consistent with the latest update installed.

The developers using the platform to create applications are impacted by this multi-tenant architecture. This architecture provides a clear line between the platform and an application because applications can define their own features or functionality without interfering with the platform's core functionalities.

4.2 Programming languages

Implementation of e-Catalyst system on Salesforce cloud computing platform involves the use of following tools:

- Apex programming language: Its syntax is similar to Java and is designed for developing large business applications for data and process management within Force.com platform. It provides us a productive approach to write logic and create functionality for their application in an effective manner [7].
- User Interface: To create user-friendly interfaces, Visualforce [8] is a standard framework that can enable any interface design to be delivered in the entire cloud. Visualforce interfaces extend standard Force.com platform theme. It's markup tags are eventually rendered in HTML. We have also used JavaScript, JQuery, HTML, and CSS alongside Visualforce tags in the e-Catalyst Learning system.

4.3 Features of e-catalyst Learning system

This section gives a detailed overview of all the features developed in e-Catalyst Learning system along with their screenshots. Interactive feature details are discussed as below.

- **Course selection navigation**

We have developed an attractive and user-friendly home page for our site as shown in Figure 3. It has a navigation menu at the top which provides several options for a registered user such as view registered courses, public discussion board, search for courses based on filters like course name and competency level, view worldwide institutions on a google map, an option for people to sponsor courses, and to show all industry partners of our system.

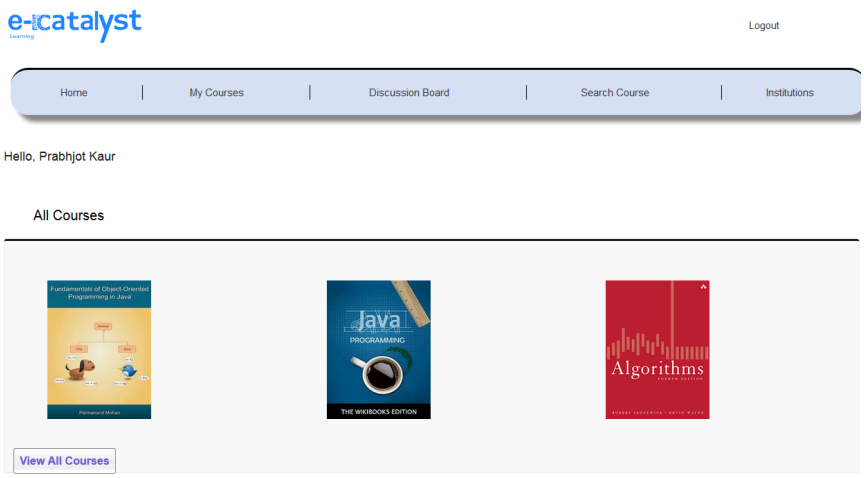

Figure 3 View courses

A user can view particular course details and can enroll in that course. Once a user is enrolled, he can see all course material of different weeks and can access videos also as shown in Figure 4. After registering for a course, he can also request access to course forum by clicking on "Join Forum" and an instructor will get an email for providing access. Once access is granted to that user, he can access "Visit forum" and engage with other course group members.

Also, the key feature here is to track video tutorials progress for each course a student is registered for. Through this feature, they can see if the weekly video tutorial is labeled as "Completed" or "Resume". In the case of "Resume", they can also see the duration of video tutorial left for a particular week as can be seen in Figure 4.

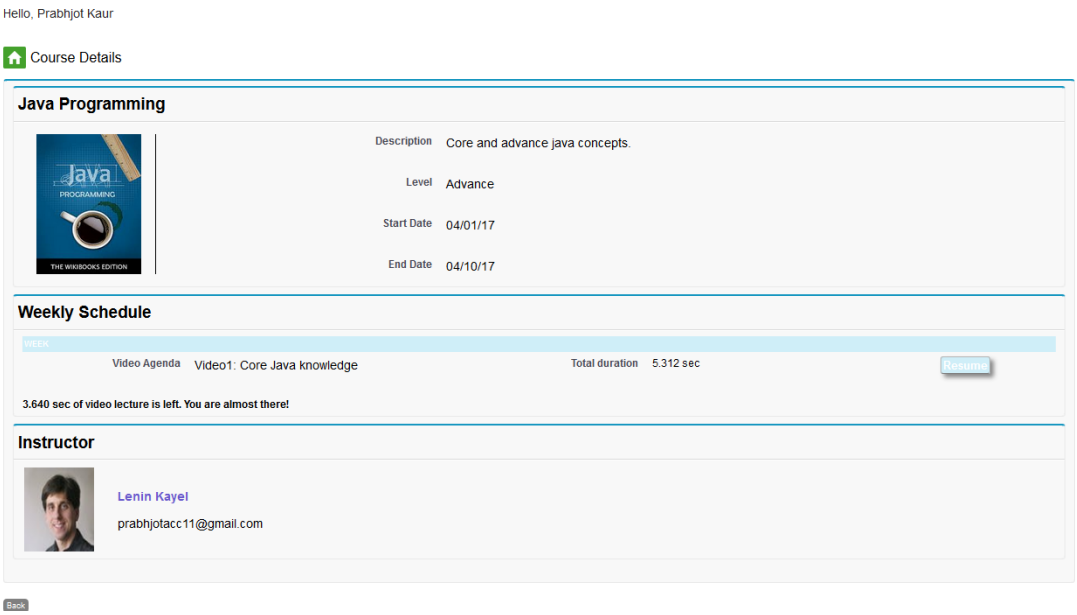

Figure 4 View course details

All users can access Instructor's profile and view institutions details to decide which course is offered by whom and which university professor belongs to, as shown in Figure 5.

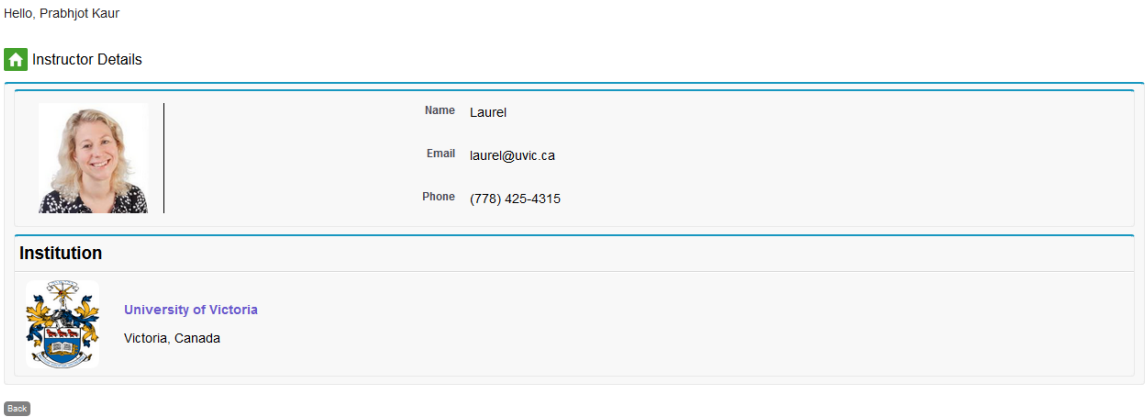

Figure 5 View Instructor details

Further, a user can also view Institution details and a list of professors that belong to that university. Students can also navigate to Instructors profile from here to see their specific details as shown in Figure 6.

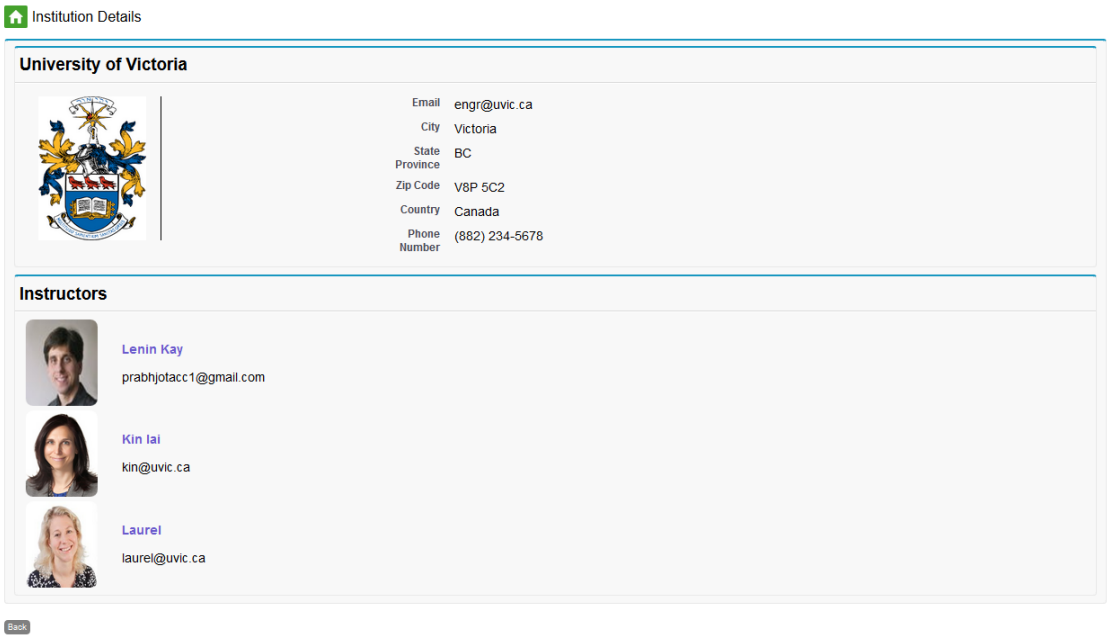

Figure 6 View Institution details

- **Discussion Board**

This feature is an open discussion group where people can share information or daily updates with people on the e-Catalyst community. They can share files, records, and integrate videos. Also, important announcements related to site maintenance, system shutdown or upcoming user features on the e-Catalyst system can be shared publicly. It also has some valuable options that can improve user experience as discussed below:

- **Polls**: Users can access opinions on any topic, at any time on e-Catalyst learning discussion group for the community. Here, anyone can post a poll to a group while seeking feedback for any subject to feel what others think about any topic or course and create a positive democratic environment on our website.
- **Rich Feeds**: Anyone can post files, videos, and images in user feed. This is a secure and social way of sharing information with others.

- **Answers**: People can answer to common questions posted on the discussion board. It can structure them in a thread like structure. Anyone can comment and reply to someone's specific post or can share an update with others.

We can see in Figure 7 of public discussion board, where all users can share their thoughts, study materials, vote on a subject, share files, like and comment other's suggestions or solutions.

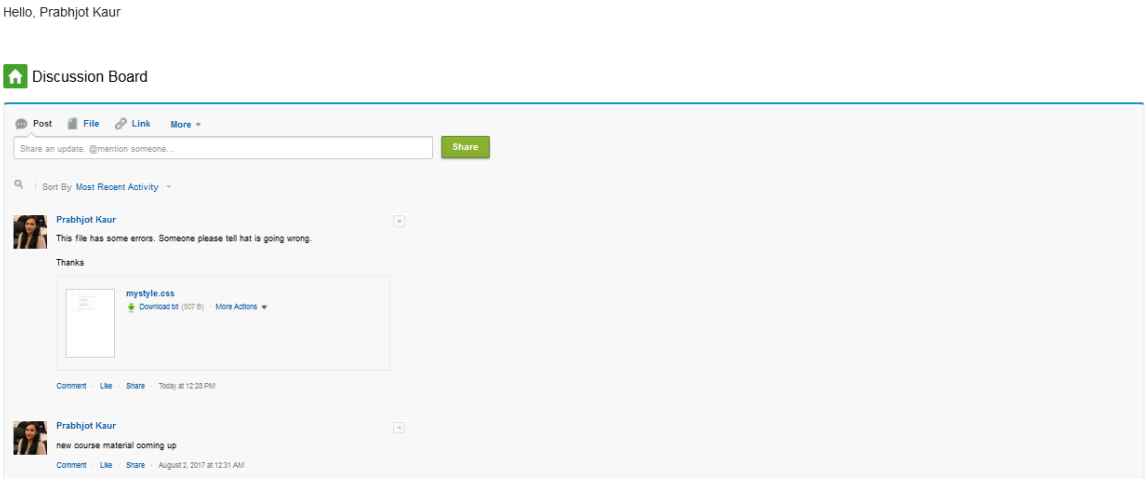

Figure 7 Discussion board

- **Search Course**

Students or Instructors can also look up courses in a tab 'Search Course' where they can filter results based on two criteria's i.e. Course name and competency level. Course name accepts keywords such as "Java" or "Big Data" and Level can be "All", "Beginner", "Intermediate" or "Advance". The results table lists all courses and their respective levels and a user can navigate to a specific searched course from here as shown in Figure 8.

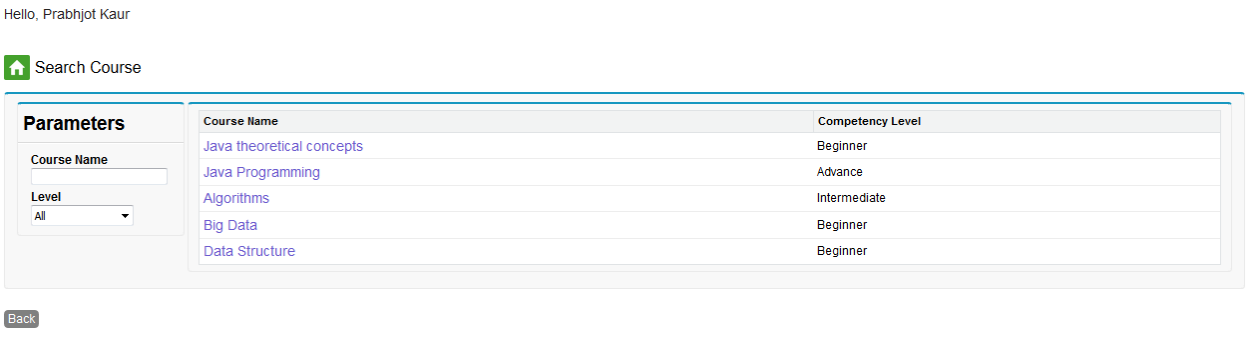

Figure 8 Search course

- **Course Forum**

It is another useful feature for users registered in specific courses. Every course has its own discussion forum where enrolled users can ask to join its private forum. After requesting access, an email is sent to the Professor and then he can grant the user permission to access the discussion board for that course. In course discussion forum people can discuss course material; upcoming exam related queries and can ask questions from lectures to Instructor or users.

In Figure 9 of e-Catalyst Learning site, we have developed a course forum for every course where a user will register in. All Members can ask questions, share ideas and code with other group members and professor of that course. The discussion forum can be used to seek help by users registered in the course.

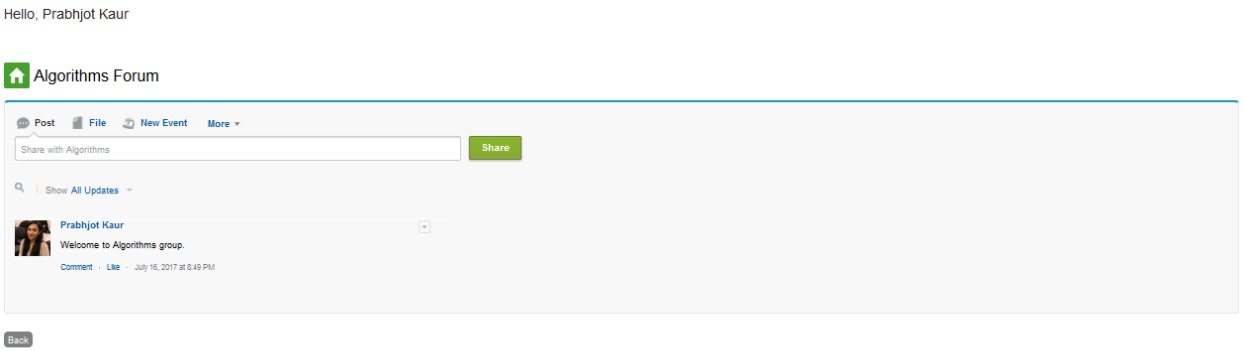

Figure 9 Course forum

- **My Courses**

Once a user has enrolled in a course, he can go to 'My Courses' navigation menu item to see all his courses he is registered in. He can also choose exam date from several options as per his convenience of time zone and has got three chances to change the date. Also, once he will complete the exam, his grade will be updated on 'My courses' page and an option to download certificate will be shown as shown in Figure 10.

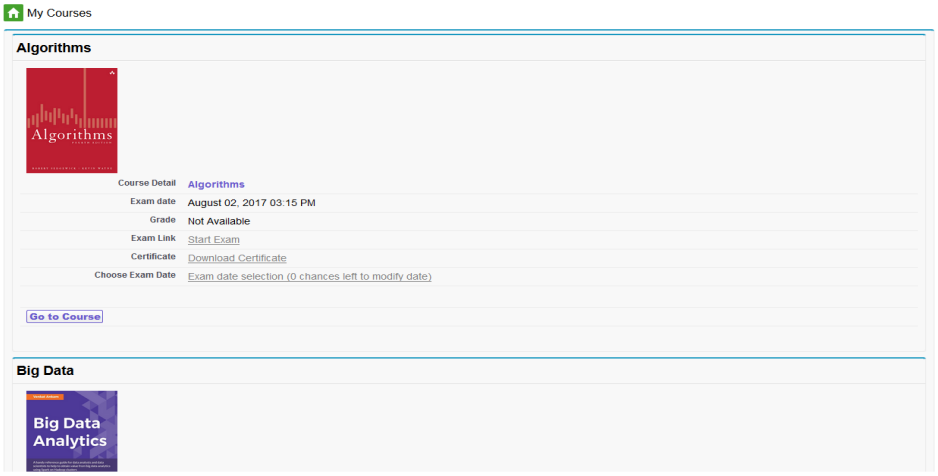

Figure 10 My course

Figure 11 shows the exam date selection page where students can choose a date and time on which they want to take an exam for a particular course. The key consideration here is to prevent cheating by randomly shuffling the questions for different date/time exam papers. So, the exam papers of different day/time will have a random order of questions for users.

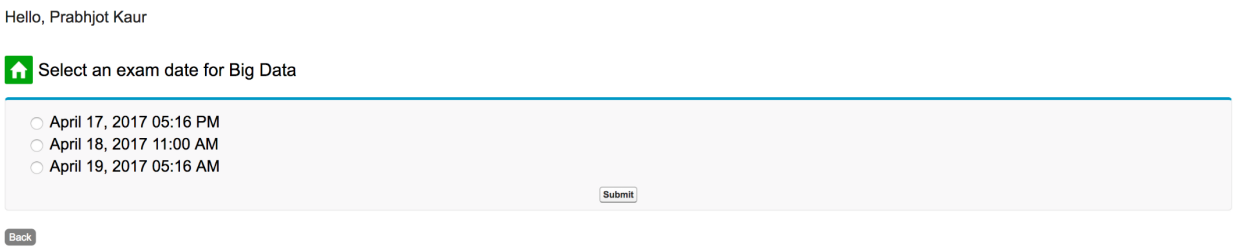

Figure 11 Exam date selection

- **Google Map**

We have integrated Google map with our e-catalyst learning; it will help users to know the locations of which institutions the instructors belong to. We are also showing all our affiliated institutions worldwide on the map. Addresses of the institutions can be seen by putting the cursor on red icon generated on Google map. Google map functionality saves users time by letting them see, where the institutions are located, instead of having to locate addresses in a

separate browser tab. Google maps can also be viewed in satellite mode and users can zoom in or zoom out according to their convenience as shown in Figure 12.

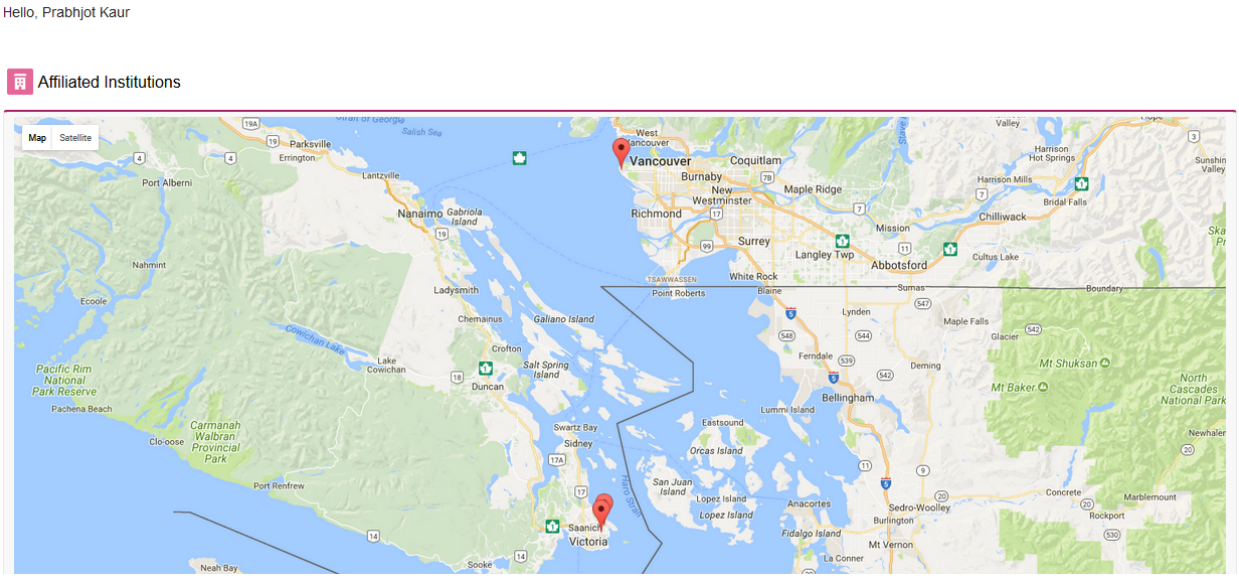

Figure 12 Institutions on Google map

- **Online course exam**

At the end of the course, students can choose to take an exam which is an online multiple-choice exam as shown in Figure 13. The timer of 1 hour starts when the exam is started and when the time is finished, all questions will be marked and the grade will be computed. After the final grade is computed, the page is navigated back to MyCourses page.

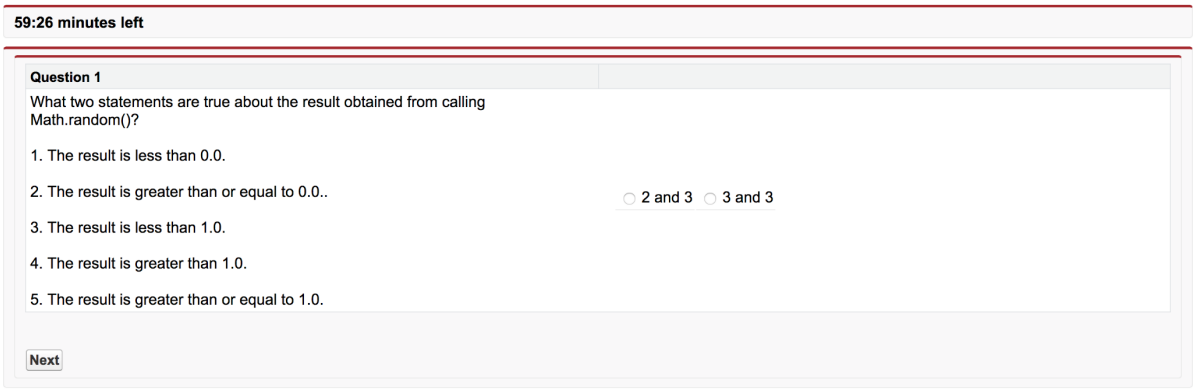

Figure 13 Exam paper

On MyCourses page as shown in Figure 14, the Grade is updated with the calculated exam score. Also, as Grade is greater than 50% (i.e. B), 'Download Certificate' link is enabled so now a student is allowed to download the certificate for this course once he has scored passing marks.

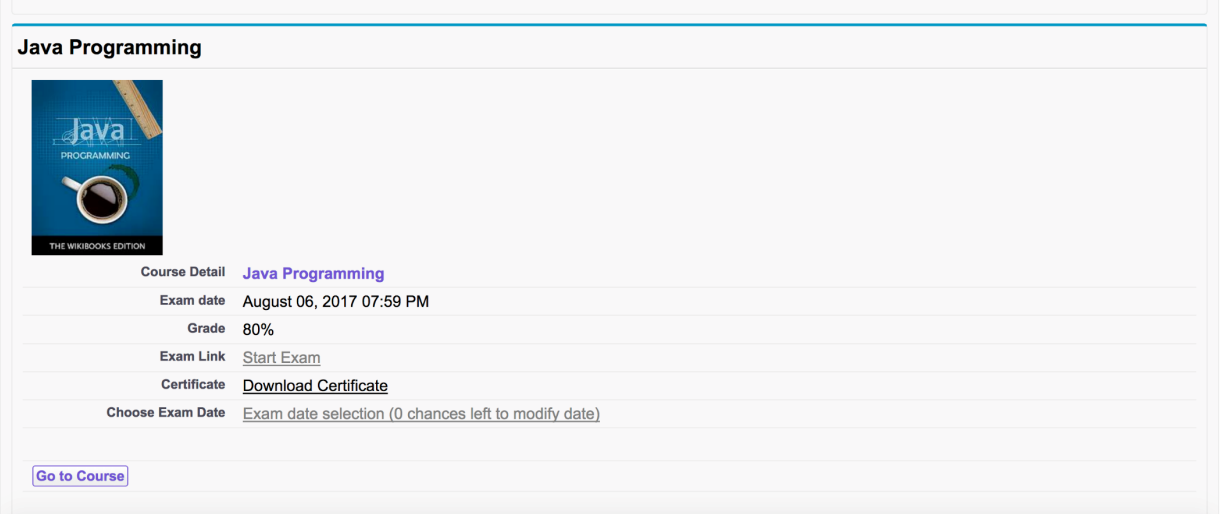

Figure 14 MyCourses

The downloaded certificate is in form of a PDF file and it can be seen in Figure 15.

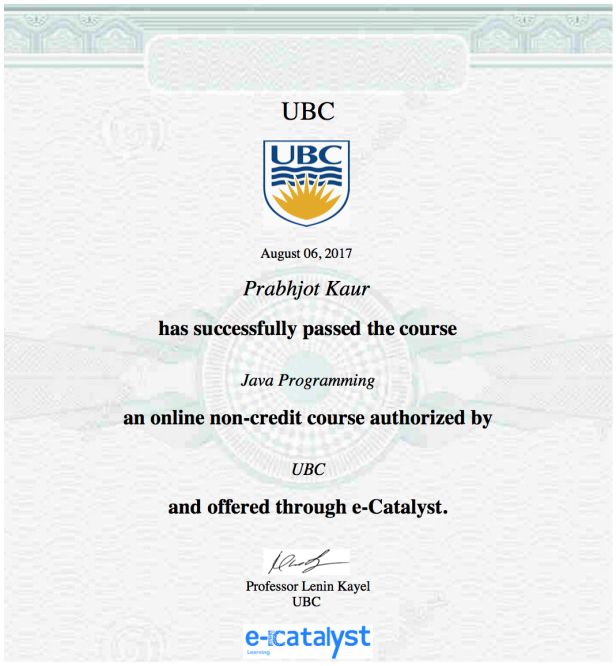

Figure 15 Course certificate

5. E-Catalyst Learning System Management

E-Catalyst Learning software will provide educational training that allows the individuals to take courses online and get certified free of cost. This system is an on-demand technology which will have a positive impact on society. In order to manage this system in future, we need to consider several factors like Human resource management, the cost incurred for user licenses and accessibility of the system.

5.1 Human Resource Management (HRM)

A huge factor in terms of deciding human resource team is the rate of growth, which is the speed at which the team is growing. In the case of an e-Catalyst system, the team will grow as per the market growth, which may be at a rate of one person per month that depends upon the demand of our system.

Also, we will show e-Catalyst Learning system proposal to non-profit organizations in Canada which are the start-up and small-scale companies. These non-profit organizations outsource jobs and opportunities, in which certain job functions of a company transferred outside of a country to another country, where they can get cheap labors and can perform work cheaply and efficiently. Such as education sectors of countries which have lower currency rates than Canada -Thailand, Vietnam, Bangladesh, and Pakistan. For instance, when a company replaces cafeteria and cleaning workers with an outside contractor who performs the same services more cheaply, or contracts out its payroll, accounting, customer services and software operations, that's outsourcing. Some people say that to keep employment in the home country is good for the economy and it makes the country strong and other say that when company profits enhanced by outsourcing jobs, the nation as a whole is benefitted, companies are more profitable and can contribute more to the national economy.

The non-profit organizations will pay employees of the company to which the app will be outsourced in their standard wage and HRM will be done as shown in Table 2 statistics [4].

S.no	Company Staff	No. of persons	Monthly wage (Vietnamese Dong)	Monthly wage (CAD $)
1	Human Resource person	1	4199123.32	245.84
2	Developers	2	6998538.86 (per person)	409.74 (per person)
3	Maintenance	1	5248904.14	307.31
4	Security	1	5248904.14	307.31
5	Cloud and database admin	1	5248904.14	307.31
6	Manager	1	10497808.29	614.61

Table 2 HRM Statistics

5.2 Cost incurred

The cost incurred is a cost that a company has become liable for. For e-Catalyst Learning system, the cost incurred by the company who will be using our software will mainly depend on following factors:

- **Force.com-Free**: There are 100 free licenses in the new organization or added to the organization by an Account representative. This license provides below benefits:
    - Up to 100 licenses
    - 1 free application
    - Up to 10 database objects
    - 1 GB storage
- **Salesforce-Platform license**: It can be used if all free licenses expire, they will cost $25 per person for a month.

5.3 Accessibility

E-Catalyst Learning system's mission is to provide universal access to the world's best education. We are committed to maintaining access to our website and mobile applications to all of our learners, including those with disabilities.

- If users are sick and cannot come to the university, they do not need to be deprived of the education. Also, there is no need to specifically wait for the lecture time instead it is accessible anytime.
- E-Catalyst Learning system videos are available to users at any time which allows users to get a head start on the course.
- Salesforce Force.com platform keeps all data consistent among all the users of an application and automatically install updates without any need of user intervention.

6. Conclusion and Future work

This project "e-Catalyst Learning system" has provided a detailed designed e-Commerce software for students who want to pursue education but are not financially well-off. This project has provided them with access to take free courses online and achieve a course completion certificate after passing the course exam successfully. Students can also search for courses based on a filter and view course details including its weekly video lectures. Once students have enrolled in a course they have access to view all courses they are registered for and also track their progress for each course weekly tutorials. They can either resume from where they have left the video tutorial or if completed, they can even see again. Also, they can also see the duration of video lecture left for each week. Students can also view all Institutions registered with e-Catalyst Learning system, to provide courses online on a Google Map. It shows details of each institution on Map label itself.

There are some features to be implemented in future and are as follows:

- Mobile app for e-Catalyst Learning system
- Skype integration to provide online help- to students. It can help students to ask questions on a video call with Instructors.

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