

# PERSONALIZED EVALUATION AND EDUCATION THROUGH GAMIFIED LEARNING

Submitted in partial fulfillment of the requirement  
of the degree of  
**Bachelor of Engineering in Information Technology**

By

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2017-18

# **CERTIFICATE OF APPROVAL**

This is to certify that the project entitled  
**“PERSONALIZED EVALUATION AND EDUCATION  
THROUGH GAMIFIED LEARNING ”**

is a bonafide work of

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## Project Report Approval for B. E.

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Examiners

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2. \_\_\_\_\_

Date:

Place:

## Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abhishek Bhawe

Mayank Mirani

Kedar Mane

# Abstract

Currently, less than 10 % of Indian corporates use gamification actively and fewer than 3 % education institutes make use of gamification. However it is a domain that is readily sought after and much scope is present in this sector. E-learning industry is growing rapidly and will continue to do so in the next 10-20 years. Analysis on learners behavior, prediction on future results, cognitive learning and level of fundamental knowledge acquired are some of the major analysis done on E-learning data. This project aims to create a game for students which they play and thus faculty get the appropriate data about students skill, weak and strong areas so as to personalize learning for every student and to improve learning experience.

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# **Chapter 1**

## **Introduction**

Over several years there has been extensive research in improving the way knowledge is conveyed in an efficient manner. A combination of visual responsiveness, analytical skills etc can be captured through a game based environment. Game based learning has seen an increase in market adoption over the years. The market growth of gamified learning is expected to grow exponentially from \$1,707 billion in 2015 to \$5,500 billion in 2018. Most of the developed countries such as North America and Europe are widely using this strategy of e-learning whereas the developing economies such as India and China are huge markets with untapped potential. Gartner in their analysis have projected that around 50 % of education industry is going to be engaged in learning through games. Revenue for organizations selling game based learning and simulation products will increase by atleast 23 % by 2017.

## **Chapter 2**

### **Literature Surveyed**

### **1. Applying Gamification and Social Network Techniques to Promote Health Activities [8]**

Name:Ming Hui Wen,Dept of commercial Design and Management ,National Taipei University of Business,Taiwan

Year of Publication :2017

Observations: The interactive elements in games have already been shown to be a motivating factor for strengthening the participation of the individual in Internet activities. The main aim of introducing gamification is to establish incentives in crowdsourcing social networks for participants.

Challenges: The paper was not able to display results using human system interaction and hence needed personalized interactive model.

### **2. Gamification of Software Testing [5]**

Name of Author: Gordon Fraser,Dept of Computer Science,University of Sheffield,United Kingdom

Year of Publication:2017

Observations: With gamification, developers can be engaged into testing activities. Finally, by turning software testing into games with a purpose, we can solve complex testing problems using crowdsourcing and human intelligence.

Challenges: Developing new game concepts around software testing and integrating them into teaching, practice, and crowdsourcing proved to be difficult.

### **3. The Evaluation Study of Gamification Approach in Malaysian History Learning via Mobile Game Application [9]**

Name of Authors:Wong Seng Yue, Chong Yee Ying ,School of Computing and Information Technology,Selangor ,Malaysia

Year of Publication:2017

Observations: Enhances students learning experience. High user engagement in this application Simple game play using touch inputs

Challenges: Poor UI Increases student learning but fails to provide results to teachers.

### **4. Introducing Gamification into e-Learning University Courses[3]**

Name of Authors:A.Bernik, D.Radosevic, G.Bubas, University of Zagreb, Croatia

Year of Publication:2017

Observations: Use of the elements of gamification can be a meaningful way to increase student motivation and improve the educational effectiveness of online courses.

Gamification places greater emphasis on student motivation in the learning process and increases students willingness to learn and their engagement with course materials.

An online course which is pedagogically designed with the application of elements of computer games (i.e. gamified) will have a greater effect on the amount of use of online teaching materials in comparison with a course with the same educational content, but without the presence of elements of computer games.

Challenges: Conducting the experiment was planned at a time when Students did not have a mid-term or final exam. Analysis should be carried out in a short time-period during the two to three weeks after the students had gained access to learning materials.

### **5. Raising engagement in e-learning through gamification [7]**

Name of Author: Muntean, Cristina Ioana

Year of Publication: 2011

Observations: Gamification does not imply creating a game. It means making education more fun and engaging, without undermining its credibility. Gamification helps students gain motivation towards studying, and because of the positive feedback they get pushed forwards and become more interested and stimulated to learn. Gamification can constitute a powerful boost to determine them to study/read more.

Challenges: There is a need to improve the metrics in Gamification world which are:- page views per visitor, time spent on site, total time per user, frequency of visit, participation and conversions.

### **6. Gamification strategies for Mobile Device Applications [4]**

Name of Author: Nathalia Pinto Cechetti, Daiana Biduki, Anna Carolina Bertolotti De Marchi

,Universidade de Passo Fundo, Brazil

Year of Publication: 2017

Observations: Gamification aims to give bonuses to the user for each task performed, keeping the interest in achieving more points and getting to next phase in other elements, as in levels, leadership table, among others. There is no consensus on what elements to use, the developer is free to decide which gamification methods are most appropriate for a determined application. Gamification proved to be a motivating factor, an effort to promote fun and entertainment, thus resulting in accession and acceptance by application users.

Challenges: Absence of evaluation in most applications shows the lack of evidence on effects of gamification elements implied in the study. To make users more engaged and motivated while interacting with gamified applications.



## **Chapter 3**

### **Aim and Objective**

A. The aim of our project is to improve learning and motivation of students through fun games / game-based environment and interactive sessions. The project will also help for overall analysis of student potential on a concept.

B. Our project also aims to create an innovative teaching - learning methodology with feedback system for courses that can benefit educational system.

C. Lastly, our project will also streamline manual data generated in the educational sector and apply data mining algorithms to recognize patterns.

## **Chapter 4**

### **Problem Statement**

Learning experience and personalized learning is the future of education. Currently, less than 3 percent education institutes in India make use of gamification. However it is a domain that is readily sought after and much scope is present in this sector. E-learning industry is growing rapidly and will continue to do so in the next 10-20 years.

Improving learning experience and personalization in learning requires innovative solutions and gamification is one such solution. This project will mainly involve students who are to be taught and teachers in a supervisory role.

# **Chapter 5**

## **Scope**

The scope of this project mainly revolves around:

1. Data Analysis

This project aims to do clustering of data that is generated from gamification. As a result of clustering, we hope to establish baseline clusters to evaluate performance of students on the game.

2. Evaluation

One of the goals of this project is to evaluate the standard or skills of a student with the use of gamification. Here the student is asked to complete a game depending on the course that is taught and on the basis of that clustering is done.

3. Recommendation

In this system, once the clustering of students is done according to the score of the game, recommendation will be given to the students as per their score.

## **Chapter 6**

### **Proposed System**

Our proposed system will be a web based application which will have different modules for students to play as part of gamification.

The application essentially has 3 main blocks or components. They are student, faculty and lastly the game portion of the application. The game component of the application involves game architecture, game design as well as the game engines to be used. This will be the framework which will run the game as is essentially the most important part of the application.

The other blocks or components of the web based system are the student and the faculty. The student will be first required to register using credentials and then select the appropriate module he/she is studying.

The student will then play and complete the game after which scores will be generated using weights and clustering of students will be done according to appropriate score. Once evaluation and clustering has been completed, the student will be given the appropriate resources to study and improve their skill.



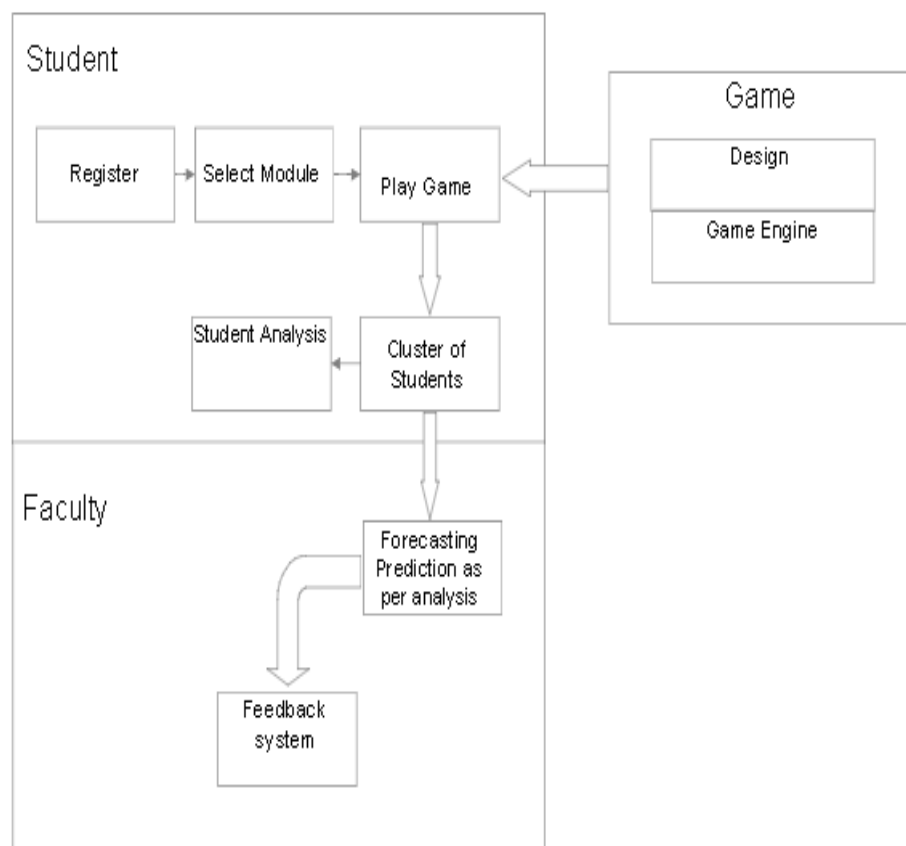


Figure 6.1: Proposed System

## **Chapter 7**

### **Approach**

## 7.1 Adaptive Nature

Computer-adaptive tests are designed to adjust their level of difficulty-based on the responses provided to match the knowledge and ability of a test taker. If a student gives a wrong answer, the computer follows up with an easier question; if the student answers correctly, the next question will be more difficult.[4] Considered to be on the leading edge of assessment technology, computer-adaptive tests represent an attempt to measure the abilities of individual students more precisely, while avoiding some of the issues often associated with the one-size-fits-all nature of standardized tests.

For students, computer-adaptive testing offers a shorter testing session with a smaller number of questions, since only those questions considered appropriate for the student are offered[1]. On the other hand, test developers have to create a larger pool of test items so that testing systems have enough questions to match the varied abilities of all students taking the exam. The most current forms of computer-adaptive testing are typically administered online, and because the scoring is computerized, teachers and students can get test results more quickly than with paper-and-pencil tests.

## Adaptiveness Pseudo Code

---

```
e_count,m_count,q_count=0;
```

```
while(e_count<=5)
```

```
{
    if(q_count==10)
    end
    else
    question()
    q_count++;
    if(true)
    e_count++;
}
```

1st Question till 5 easy questions answered correctly

```
while(m_count<=3)
```

```
{
    if(q_count==10)
    end
    else
    question()
    q_count++;
    if(true)
    m_count++;
}
```

Medium Level questions will be  
asked till 3 medium level questions answered correctly

```
while(q_count!=10)
```

```
{
    question()
    q_count++;
}
```

Hard Level questions will be asked  
till 10 questions are asked

```
displayResult();
```

## 7.2 K Means Algorithm

k-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. k-means clustering aims to partition  $n$  observations into  $k$  clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster.

The algorithm has a loose relationship to the k-nearest neighbor classifier, a popular machine learning technique for classification that is often confused with k-means because of the  $k$  in the name. One can apply the 1-nearest neighbor classifier on the cluster centers obtained by k-means to classify new data into the existing clusters.

1. Place  $K$  points into the space represented by the objects that are being clustered. These points represent initial group centroids.
2. Assign each object to the group that has the closest centroid.
3. When all objects have been assigned, recalculate the positions of the  $K$  centroids.
4. Repeat Steps 2 and 3 until the centroids no longer move. This produces a separation of the objects into groups from which the metric to be minimized can be calculated.

# **Chapter 8**

## **Analysis**

## 8.1 Process model used for the project

Process model used will be the Prototype Model.

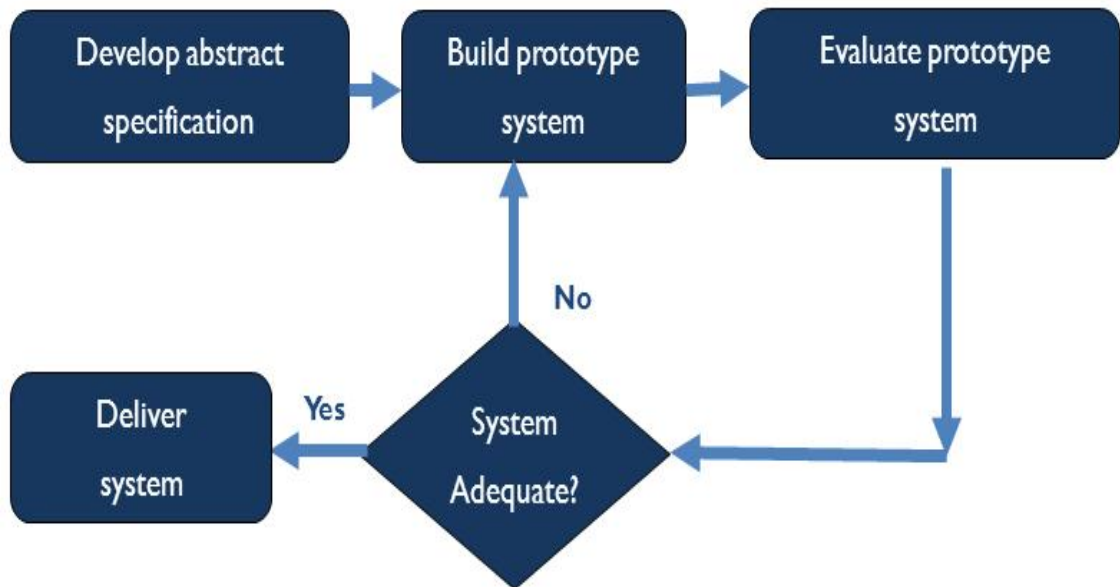


Figure 8.1: Prototype Model

A prototype (an early approximation of a final system or product) will be built, tested, and then reworked as necessary based on feedback until an acceptable prototype is finally achieved from which the complete system or product can now be developed.

## **8.2 Feasibility Study**

### **1. Technical Feasibility:**

The project as a whole is feasible in terms of technical feasibility as the project is integration of several existing systems which include data mining ,recommendation systems, 2D games and evaluation of such games..

### **2. Economical Feasibility:**

The project as such is economically viable as most of the tools and technologies being used are open source software and are available for free on the internet.Also this project has untapped potential in terms of business scope and future use.

### **3. Operational Feasibility:**

This project is operationally feasible as it solves the key problem of student learning and helps improve the way students learn.

### **4. Scheduling Feasibility:**

This project is feasible in terms of schedule as a clear timeline and project schedule has been made at the start of the project and it details the project schedule from the inception of the project till software is ready.



### **Schedule**

The project is expected to take seven months from project approval to launch of the system. Following is a high level schedule of some significant milestones for this initiative:

1. July 15, 2017: Initiate Project
2. August 1, 2017: Project kickoff meeting
3. October 31, 2017: Complete project design
4. February 15, 2018: Complete testing of project
5. March 1, 2018: Beta testing trials of project
6. March 15, 2018: Go live with system launch

### 8.3 Cost analysis

As resources needed are open source, there is no need of resource cost but if this project is used as a business idea then cost associated for developing this project will be as follows:

Assumptions made under COCOCO Model  
(According to Semi-Detached Model)

No. of project members: 3

Salary per person assumed as: Rs. 1000/ month

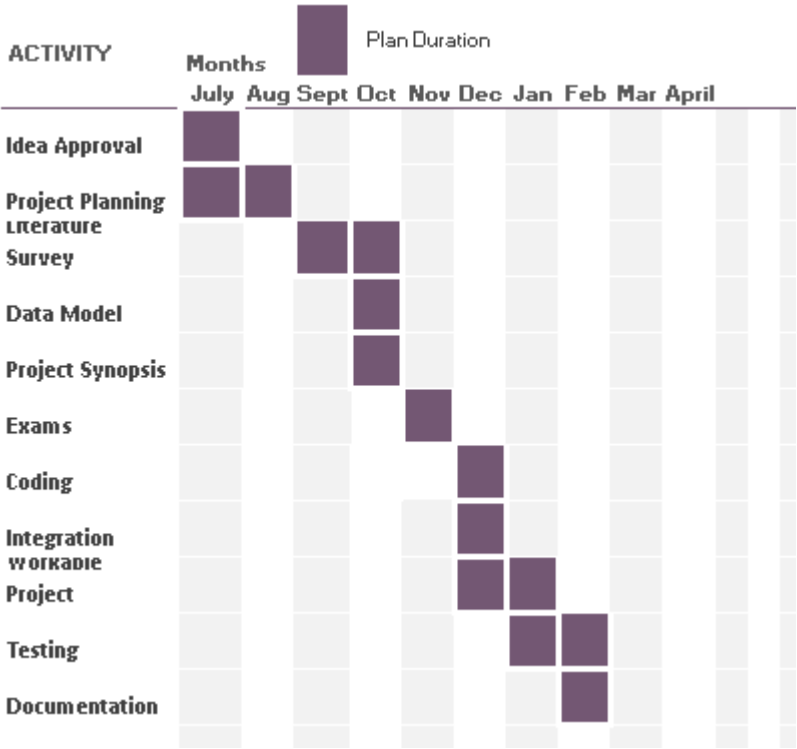
Size of code (In KLOC): 10

Estimation of Development Effort: 26.9 per month

Estimated Development Time: 9 months

Cost required to develop the product:  $9 \text{ months} * 10\text{kLOC} * 40\text{rs/hr} * 3 \text{ project members} = 12000$

# 8.4 Timeline Chart



# **Chapter 9**

## **Design**

## 9.1 Data Flow Diagrams

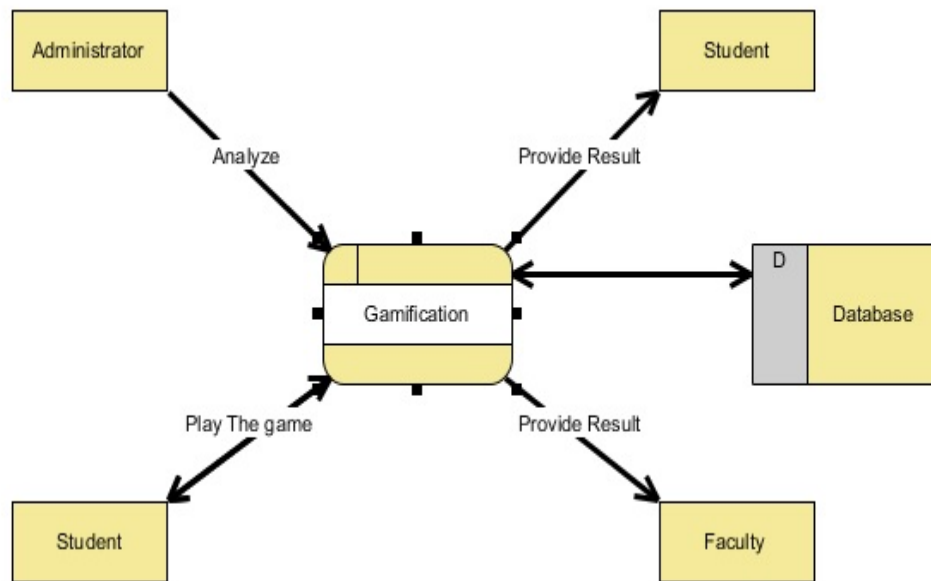


Figure 9.1: DFD Level 0

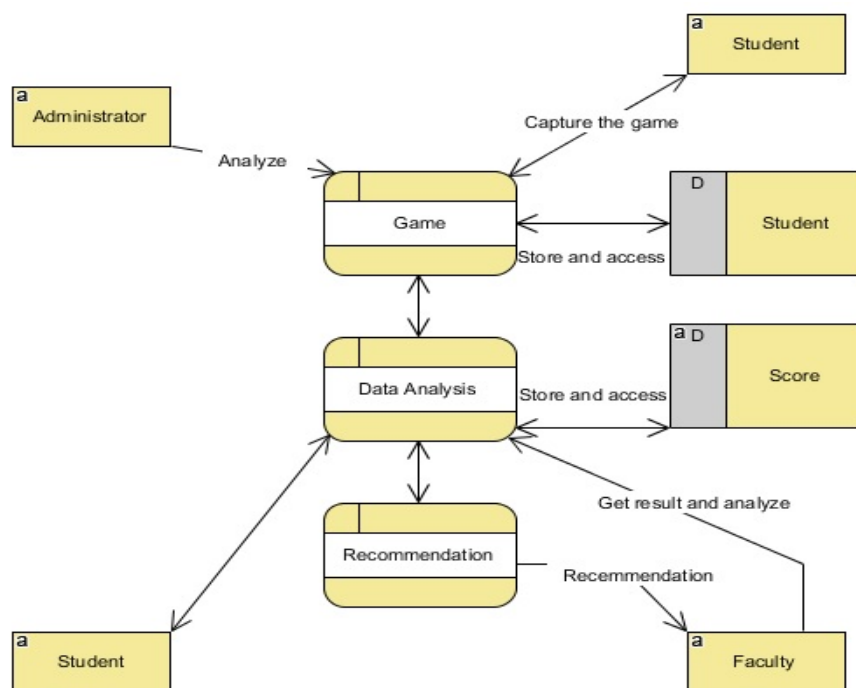


Figure 9.2: DFD level 1

## 9.2 UML Diagrams

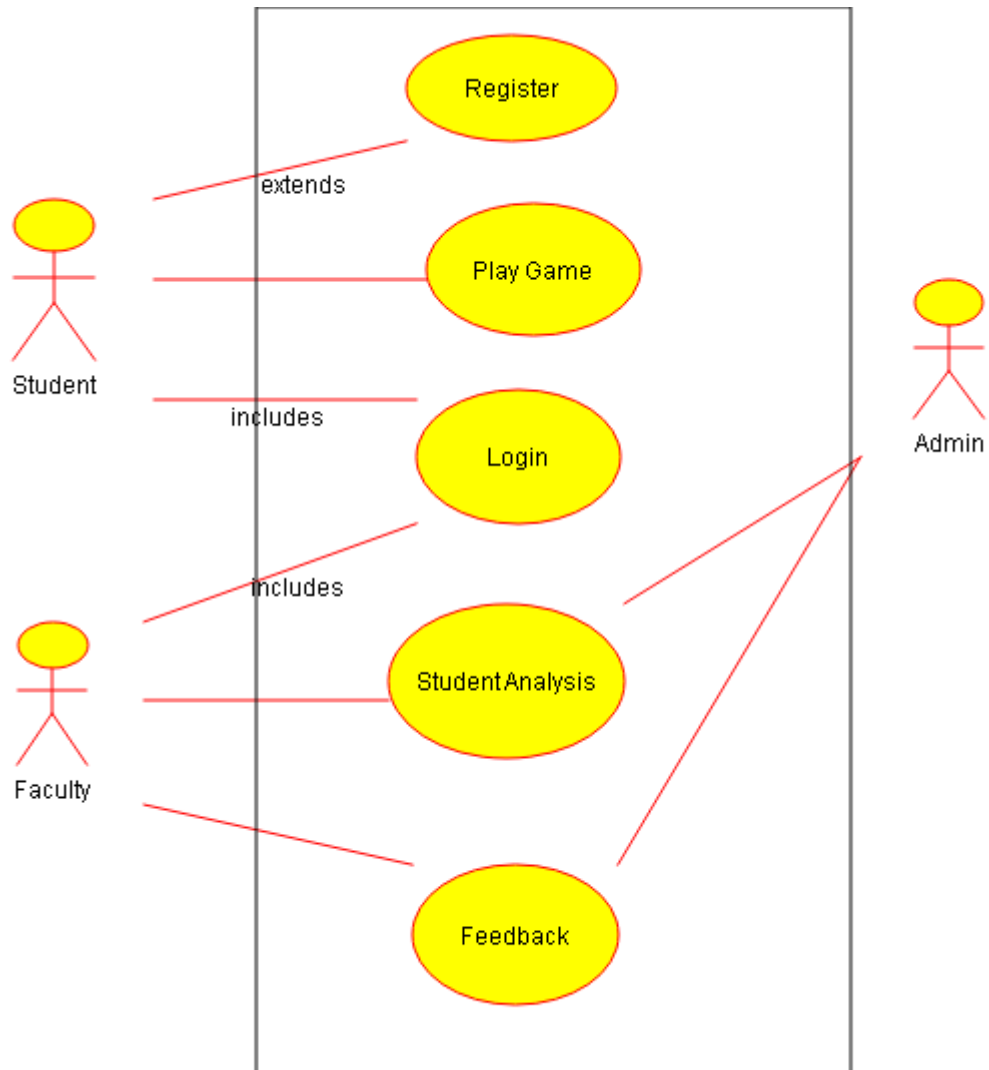


Figure 9.3: Use Case Diagram

### 9.3 Sequence Diagram

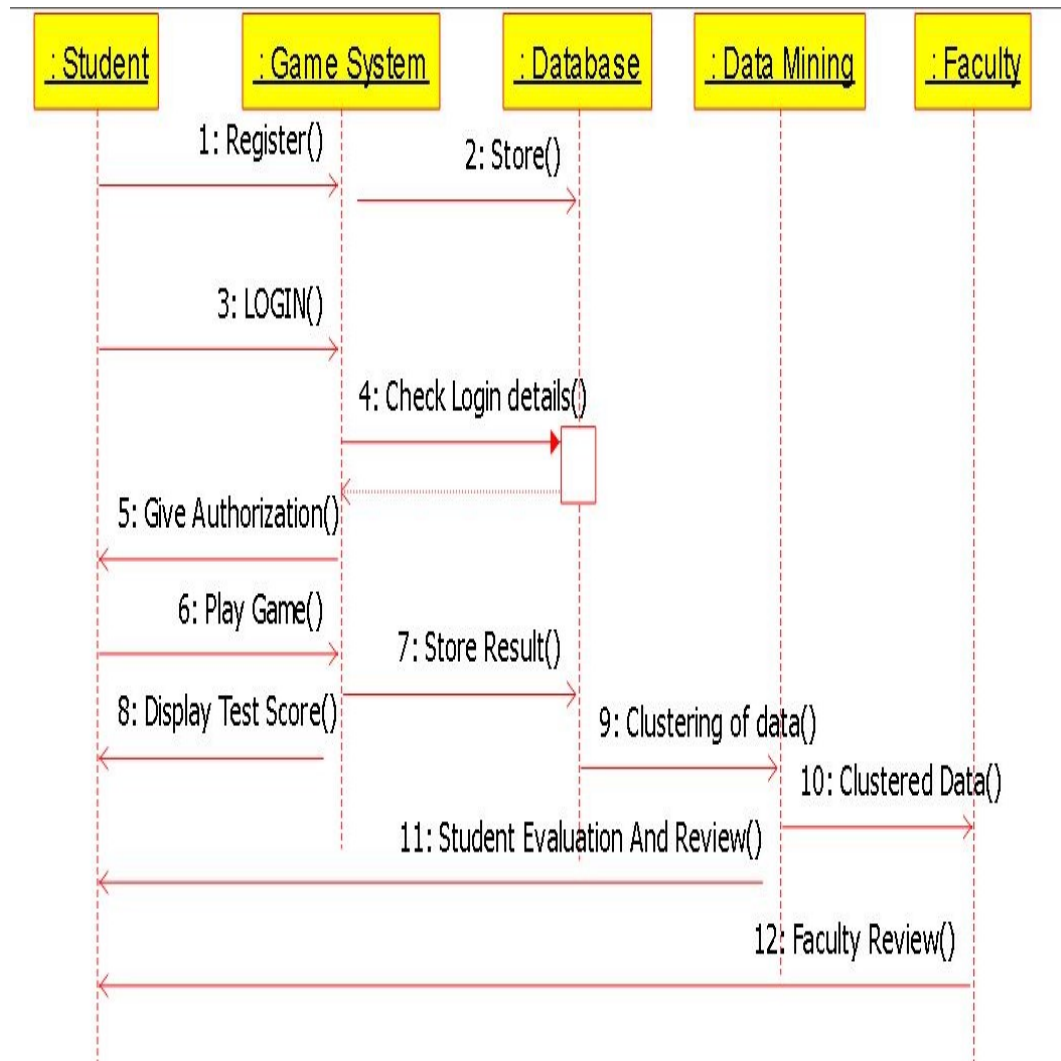


Figure 9.4: Sequence Diagram



## 9.4 Process Flow Diagrams

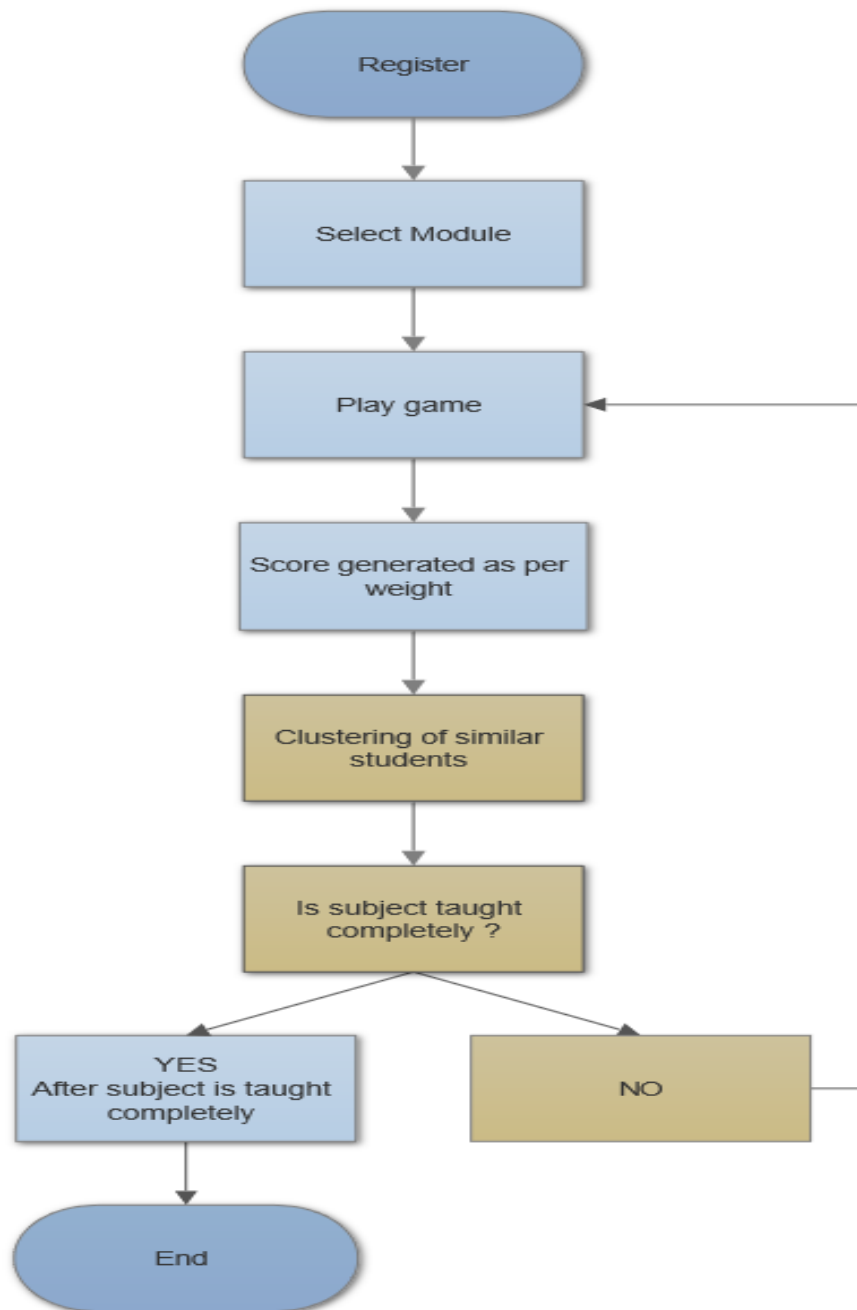


Figure 9.5: Student Process Flow Diagram

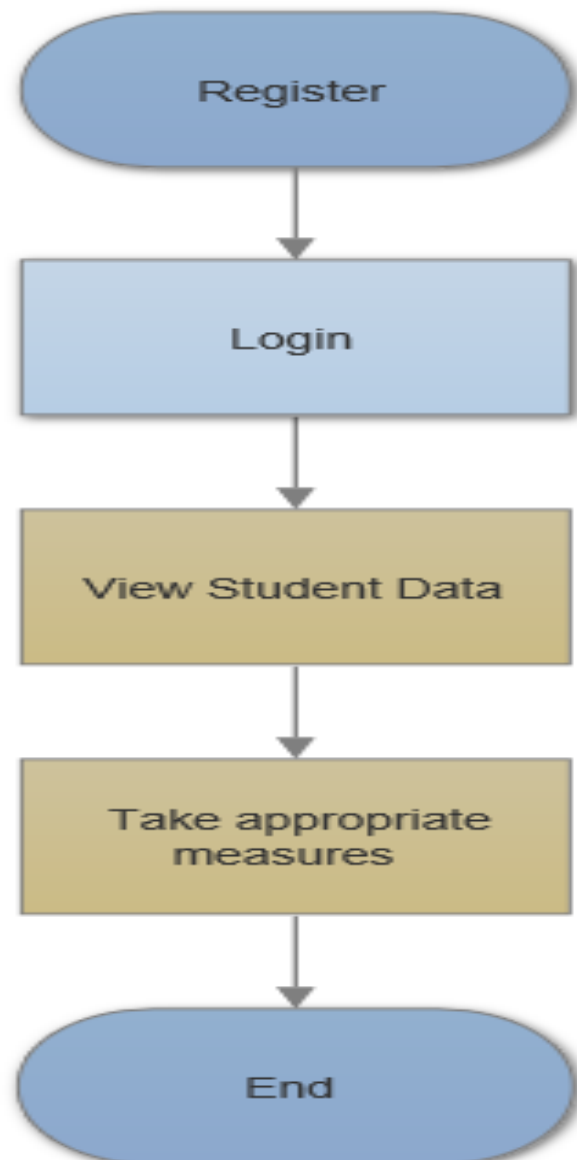


Figure 9.6: Faculty Process Flow Diagram

## **Chapter 10**

### **Technologies Used**

## 10.1 Introduction To Programming Tools

### 1. Visual Studio 2013

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as web sites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code. The ASP.NET Web Site Administration Tool allows for the configuration of ASP.NET websites.

Microsoft Visual C#, Microsoft's implementation of the C# language, targets the .NET Framework, along with the language services that lets the Visual Studio IDE support C# projects. While the language services are a part of Visual Studio, the compiler is available separately as a part of the .NET Framework. The Visual C# 2008, 2010 and 2012 compilers support versions 3.0, 4.0 and 5.0 of the C# language specifications, respectively. Visual C# supports the Visual Studio Class designer, Forms designer, and Data designer among others.

### 2. SQL Server 2014

Microsoft SQL Server is a relational database management system developed by Microsoft. As a database server, it is a software product with the primary function of storing and retrieving data as requested by other software applications which may run either on the same computer or on another computer across a network (including the Internet).

SQL Server Management Studio is a GUI tool included with SQL Server 2005 and later for configuring, managing, and administering all components within Microsoft SQL Server. The tool includes both script editors and graphical tools that work with objects and features of the server. SQL Server Management Studio replaces Enterprise Manager as the primary management interface for Microsoft SQL Server since SQL Server 2005. A version of SQL Server Management Studio is also available for SQL Server Express Edition, for which it is known as SQL Server Management Studio Express (SSMSE). Microsoft markets at least a dozen different editions of Microsoft SQL Server, aimed at different audiences and for workloads ranging from small single-machine applications to large Internet-facing applications with many concurrent users.

# **Chapter 11**

## **Hardware and Software Requirements**

## 1. Development and Deployment Platform Requirement

### Software Requirements:-

- Operating System: Windows 7 or Higher
- Visual Studio 2013
- SQL Server 2014
- Web Programming Languages such as HTML,CSS,Visual C# etc

### Hardware Requirements:-

- A typical Computer (CPU, Monitor, Keyboard, Mouse) with mandatory internet connectivity
- 2GB Storage Space in the system
- RAM:4GB or Higher
- 32/64 bit Operating System
- x32/x64 based Processor

## 2. User Platform Requirements

### Software Requirements:-

- Windows 7 or Higher

### Hardware Requirements:-

- A typical Computer (CPU, Monitor, Keyboard, Mouse) with mandatory internet connectivity

## **Chapter 12**

### **Implementation**



Visual Studio IDE was used for the implementation. We developed a web-based UI for the Personalized Education and Evaluation System. The front-end our System was implemented using HTML, Visual C# and Javascript. MySQL database was used to store user registration details, login details, data generated by the users. The details of every student are stored in the MySQL database in order to facilitate the implementation of project.

The following image shows the registration page of the system. Here, user has to enter all details asked in the registration form. The details will be later used in the login process. All text fields are validated to ensure that valid details are provided.



The screenshot displays a web application interface for a student registration system. At the top, a dark header bar contains the title "Personalizing Education Through Gamified Learning" in a light green font, with "Through" in a darker shade. Below the title, the text "Login, Register, Test." is visible. A green "Home" button is located on the right side of the header. The main content area has a light gray background. It features a welcome message: "Welcome to Personalized Education and Evaluation through Gamified Learning". To the right of this message is a small, empty, rounded rectangular box. Below the welcome message, there are four input fields for registration details, each with a label and a required asterisk: "Name\*", "Username\*", "Password\*", and "Confirm Password". The "Name" field contains the text "Abhishek Bhawe". The "Username" field contains the text "abhishek". The "Password" and "Confirm Password" fields are masked with asterisks. A vertical scrollbar is visible on the right side of the page.

Figure 12.1: Student Registration form

The image shows a web-based registration form for students. The form is displayed on a light gray background with a vertical scrollbar on the right. The fields are as follows:

- Confirm Password:** A text input field with a masked password of eight asterisks (\*\*\*\*\*).
- Email\*:** A text input field containing the email address "abhishekbhave26@gmail.com".
- Mobile\*:** A text input field containing the mobile number "9920829117".
- Semester\*:** A dropdown menu with "VIII" selected.
- Branch\*:** A dropdown menu with "InformationTechnology" selected.
- Submit:** A dark gray button with the text "Submit" in white.

At the bottom of the form, there is a dark gray footer bar with the text "Designed by INFT 44" in a small, light gray font.

Figure 12.2: Student Registration form

Student can register normally, but staff/faculty registration is only through Administrator of the system. The above images show the registration of the staff by the administrator.

The screenshot shows a web application interface. At the top, a dark header contains the title "Personalizing Education Through Gamified Learning" in white and yellow text, with a subtitle "Login, Register, Test." below it. Navigation buttons for "Home" and "Staff" are on the right. The main content area has a welcome message "Welcome to Personalized Education and Evaluation through Gamified Learning" and a "Welcome: admin" notification. The "Staff Registration" section includes five form fields: "Name\*" (Ajay Dhruv), "UserName\*" (ajay), "Email\*" (ajay.dhruv@vit.edu.in), "Mobile\*" (9920829117), and "Semester\*" (empty).

# Personalizing Education Through Gamified Learning

Login, Register, Test.

Home Staff

Welcome to Personalized Education and Evaluation through Gamified Learning

Welcome: admin

## Staff Registration

Name\*

Ajay Dhruv

UserName\*

ajay

Email\*

ajay.dhruv@vit.edu.in

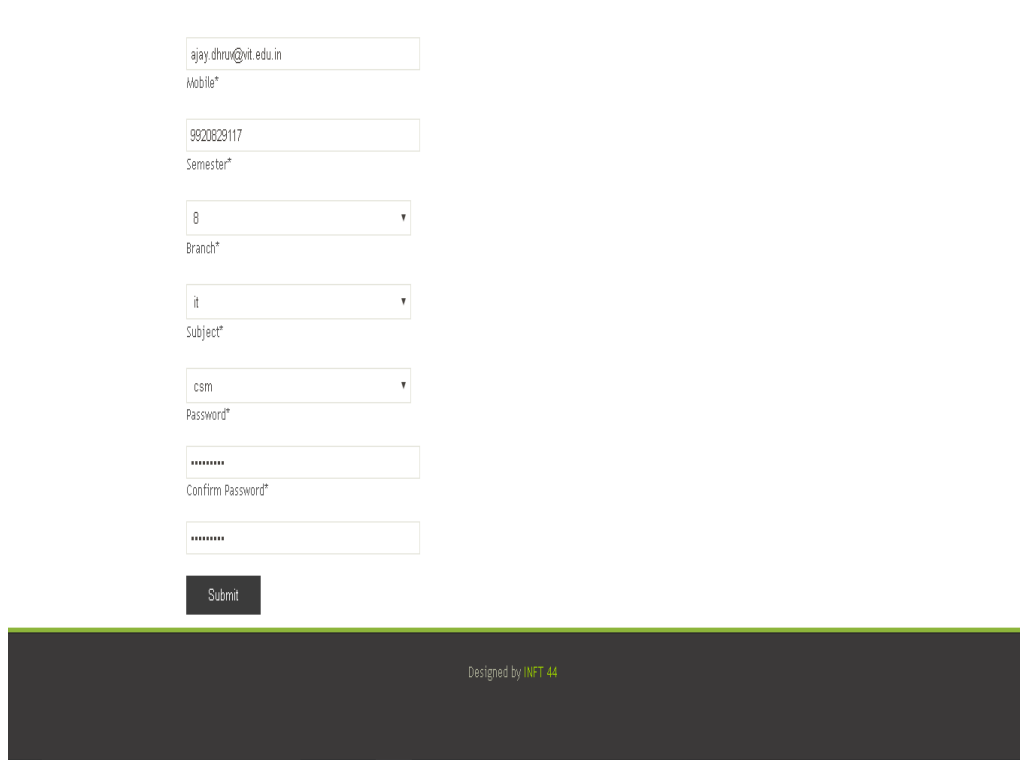
Mobile\*

9920829117

Semester\*

Figure 12.3: Staff Registration form

The following image shows the login page of the system. Here user has to enter his/her user name and password to proceed using the system. The username and password strings will be validated against the database to prevent unauthorized access.



A screenshot of a web form for staff registration. The form is located on a light gray background. It contains several input fields and dropdown menus, each with a label and an asterisk indicating it is required. The fields are: Email (ajay.dhruv@vit.edu.in), Mobile (9920829117), Semester (8), Branch (it), Subject (csm), Password (masked with dots), and Confirm Password (masked with dots). A dark gray 'Submit' button is at the bottom of the form. Below the form is a dark gray footer bar with the text 'Designed by INFET 44' in a small, light green font. A vertical scrollbar is visible on the right side of the page.

ajay.dhruv@vit.edu.in  
Mobile\*

9920829117  
Semester\*

8  
Branch\*

it  
Subject\*

csm  
Password\*

\*\*\*\*\*  
Confirm Password\*

\*\*\*\*\*

Submit

Designed by INFET 44

Figure 12.4: Staff Registration form

Once the user logs in he will be greeted with a homepage which will show his/her user name beside the welcome sign. The student has the option to test and or see his result if he/she has already given the test using the navigation bar.

The staff on the other hand can add question of his/her subjects and look at the clustered results of all the students using the navigation bar.

Personalizing Education Through Gamified Learning

Login, Register, Test.

Home

Welcome to Personalized Education and Evaluation through Gamified Learning

TESTYOU  
Your online Exams Partner

ONLINE EXAMINATION SYSTEM

User Type  
student

Username:  
abhishek

Password:  
[input field]

Login

[Click for Register](#)

Figure 12.5: Login form

Personalizing Education Through Gamified Learning

Login, Register, Test.

Home Test Result

Welcome to Personalized Education through Gamified Learning

Welcome: abhishek

Logout

Designed by INFT 44

Figure 12.6: Student Home Screen

Now that the student has logged in, when he/she clicks on the test option a page like the one below with a drop down menu to select the sub-

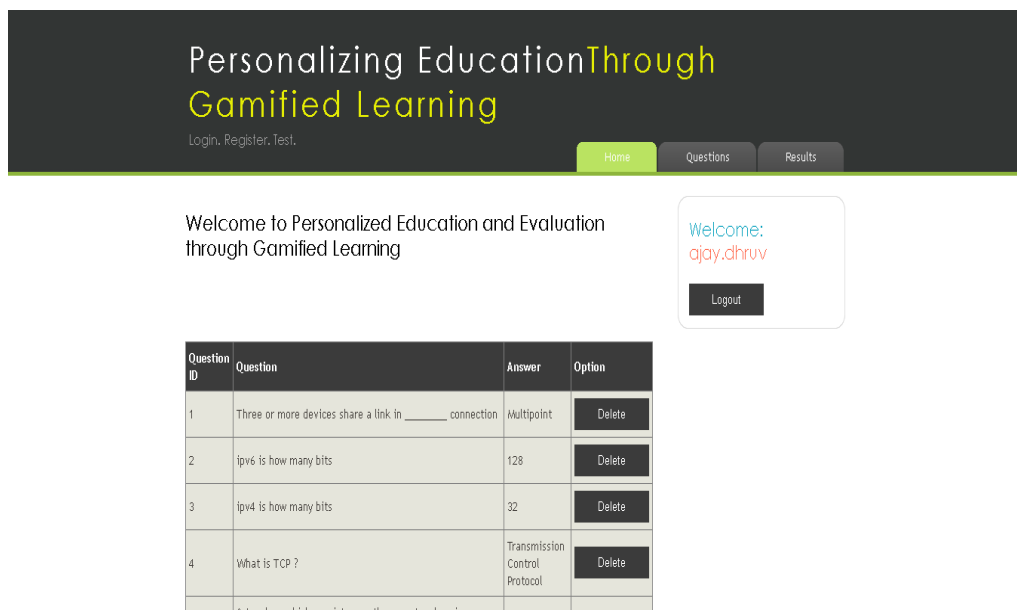


Figure 12.7: Staff Home Screen

ject. Once the subject is selected the student is able to see the subject and upon clicking the "Start Test Now" button the test starts.

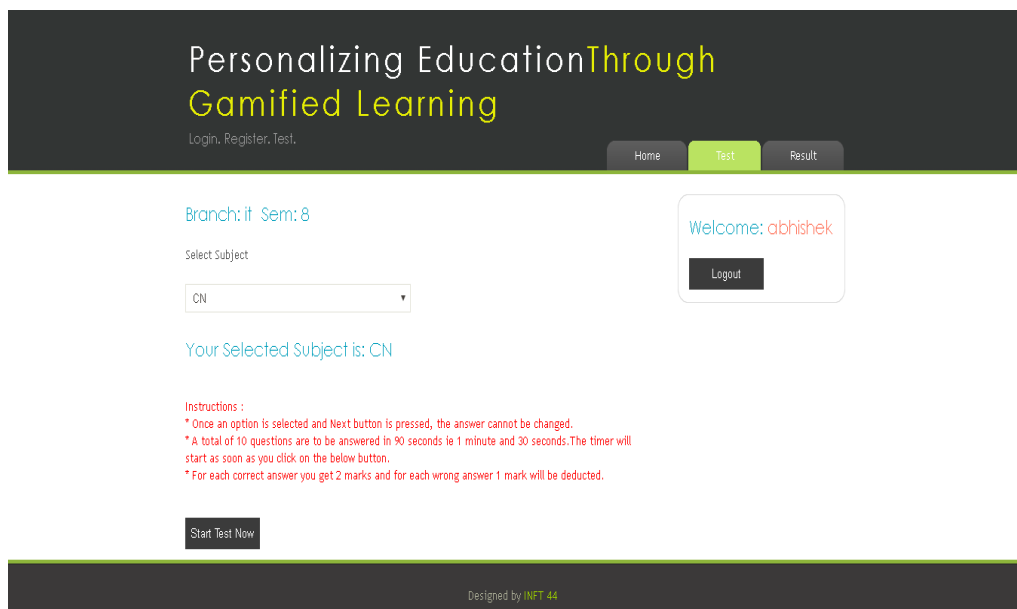


Figure 12.8: Test Subject Selection Page

The page is loaded and the timer starts with the 1st question being displayed. The student answers the question and clicks on the next button. The next question is displayed and so on till the last question.

The screenshot shows a web application interface for a gamified learning test. At the top, a dark header contains the title 'Personalizing Education Through Gamified Learning' in white and yellow text, with links for 'Login', 'Register', and 'Test'. Below the header, the main content area displays a question: 'The \_\_\_\_\_ layer is responsible for data routing, packet switching and control of network congestion. Routers operate under this layer.' The question is identified as 'Question ID 21'. Four radio button options are listed: 'Network', 'Physical', 'Transport', and 'Application'. At the bottom of the question area, there are 'Previous' and 'Next' buttons. A timer in the top right corner indicates 'Time Left : 1 24'.

Figure 12.9: Test Question Page



Figure 12.10: Test Question Page

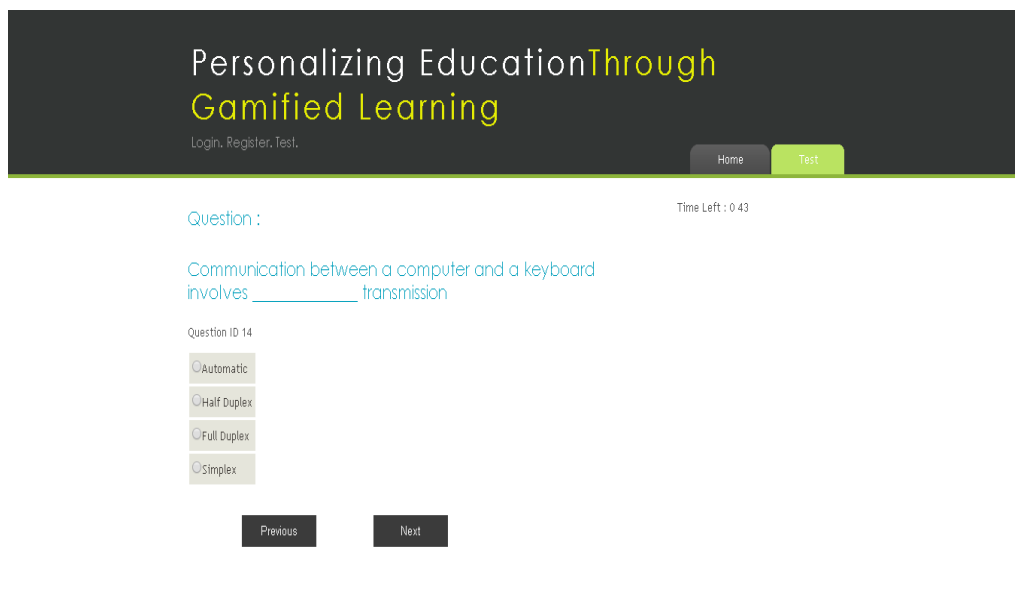


Figure 12.11: Test Question Page

The following image show the result generated page which shows the result of the test in a pie chart or graphical representation.





Figure 12.12: Test Result Page

The following image shows the page where staff/faculty can add questions to the database of his/her subject. Once all the fields are filled up, the staff member can click on the submit button to add the question along with the options and the answer to the database .

Home Questions Results

Welcome to Personalized Education and Evaluation through Gamified Learning

Question

ipv4 is how many bits ?

Option1

32

Option2

16

Option3

64

Option4

8

Answer

32

Submit

Welcome:  
ajay.dhruv  
Logout

Figure 12.13: Staff Question Add Page

The following image shows the Result page which shows the tabular representation of the 3 clusters in which the student lies. As per the cluster the automated staff recommendation is presented and the staff/faculty will know the knowledge of each student.

# Personalizing EducationThrough Gamified Learning

Login, Register, Test.

[Home](#)
[Questions](#)
[Results](#)

The results of the students are displayed here.

Name	Subject	Score	Staff Recommendation
bhushan	CN	0	Poor student with very little knowledge of CN basics.Special attention to be given to this student
abhishek	CN	8	Poor student with very little knowledge of CN basics.Special attention to be given to this student
vatsal	CN	8	Poor student with very little knowledge of CN basics.Special attention to be given to this student
Bhagyashree	CN	8	Poor student with very little knowledge of CN basics.Special attention to be given to this student
Mitesh jain	CN	11	Good student.Can improve if given attention
kaushik	CN	11	Good student.Can improve if given attention
PohanCR7	CN	11	Good student.Can improve if given attention
naveeny	CN	11	Good student.Can improve if given attention

Welcome:  
ajay.dhruv

Logout

Figure 12.14: Staff Result Page

Bhagyashree	CN	8	Poor student with very little knowledge of CN basics.Special attention to be given to this student
Mitash jain	CN	11	Good student.Can improve if given attention
kaushik	CN	11	Good student.Can improve if given attention
PohanCR7	CN	11	Good student.Can improve if given attention
naveeny	CN	11	Good student.Can improve if given attention
Jeetesh	CN	11	Good student.Can improve if given attention
aniket	CN	14	Good student.Can improve if given attention
m	CN	17	Excellent student with robust knwoledge of the subject.Can be given harder coursework
Tejal	CN	17	Excellent student with robust knwoledge of the subject.Can be given harder coursework
kailash	CN	20	Excellent student with robust knwoledge of the subject.Can be given harder coursework
saumil	CN	20	Excellent student with robust knwoledge of the subject.Can be given harder coursework

Designed by INFT 44

Figure 12.15: Staff Result Page

## **Chapter 13**

## **Conclusion**

In our work we proposed a novel approach to personalized education, where data analysis and education were combined. Although there already exist a number of education and learning systems, our approach is special in that the data is generated by the user/student. Compared to the existing systems, our system provides in-depth knowledge about each student's subject knowledge which is provided to the faculty so that the faculty can personalize their teaching to each student. On that account we believe that our novel approach is practical to real-life applications. In addition, it presents an innovative technique to extract data about a student's subject knowledge that helps to achieve a deeper understanding of user. This knowledge is put to use and personalized results obtained.

## **Chapter 14**

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**Paper Published**

## CLUSTERING STUDENTS THROUGH DATA MINING AND GAMIFIED LEARNING

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**Abstract** - Gamified learning is an educational approach to motivate students to learn by using game design and game elements in learning environments and to maximize engagement through capturing the interest of learners and inspire them to continue learning. Gaming is a popular pastime and 40% of Indian teenagers tend to play for more than 6 hours per week. Currently, less than 10 % of Indian corporates use gamification actively and fewer than 3 % education institutes make use of gamification. However, it is a domain that is readily sought after, and much scope is present in this sector. E-learning industry is growing rapidly and will continue to do so in the next 10-20 years [1]. Educational data mining [EDM] is one of the solutions to improving learning and grasping power of students on a broader scale rather than being confined to an individual student's level. Analysis on learner's behaviour, prediction on future results, cognitive learning and level of fundamental knowledge acquired are some of the major analysis done on E-learning data. This project aims to create a game for students which they play and thus faculty get the appropriate data about student's skill, weak and strong areas so as to personalize learning for every student and to improve learning experience.

**Key Words:** Gamification; personalization; education; evaluation; analysis; student; faculty; game engine; game; data mining; clustering

### 1. INTRODUCTION

The gamification of learning is an educational approach to motivate students to learn by using online web-based games in learning environments. The main intention of the project is to maximize enjoyment and engagement through capturing the interest of learners and inspiring them to continue learning.

We plan to cluster the students on the basis of the score they generate taking help of a fun game and simultaneously analyze them based on their performance and provide suitable recommendations. [2]

This paper contains a systematic approach of clustering with help of educational data mining, learning analytics and gamified learning.

### 1.1 AIM & OBJECTIVE

- The aim of our project is to improve learning and motivation of students through fun games / game-based environment and interactive sessions.
- We also aim to create an innovative teaching - learning methodology. With focus strengths and weaknesses of students to give one-to-one attention during a course
- The approach will also help for overall analysis of student potential on a concept by using data clustering/ mining algorithms and providing the students feedback on their knowledge of the subject.
- The objective is to streamline manual data generated in the educational sector and extract meaningful patterns for process improvement
- The expected outcome is to provide recommendations to the students and faculties to personalize teaching-learning process and reap maximum benefits.

### 2. PROBLEM STATEMENT & SCOPE

Data in educational sector is readily available but there has not been enough analysis done on that available data. There is a dearth of student teacher interaction and motivation for learning. Improving student teacher interaction and thereby introducing new teaching methodologies and ideas. Learning experience and personalized learning is the future of education. Existing applications have not been able to integrate data mining analytics with gamification in learning. Also, many projects have tried to achieve common integration in gamification with data mining. Also, all existing educational data mining applications and systems are rudimentary in nature and not capable to achieve appropriate evaluation and gamification. Improving learning experience and personalization in learning requires innovative solutions and gamification is one such solution. This project will mainly involve students who are to be taught and teachers in a supervisory role.

The scope of this project mainly revolves around:

### 1. Data Analysis

This project aims to do clustering of data that is generated from gamification. As a result of clustering, we hope to establish baseline clusters to evaluate performance of students on the game.

### 2. Evaluation

One of the goals of this project is to evaluate the standard or skills of a student with the use of gamification. Here the student is asked to complete a game depending on the course that is taught and on the basis of that clustering is done. [6]

### 3. Recommendation

In this system, once the clustering of students is done according to the score of the game, recommendation will be given to the students as per their score.

## 3. PROPOSED SYSTEM

The proposed system will be a web-based application which will have different modules for students to play as part of gamification. The application essentially has 3 main blocks or components. They are student, faculty and lastly the game aspect of the application. The game component of the application involves game architecture, game design as well as the game engines to be used. This will be the framework which will run the game as is essentially the most important part of the application.

The other blocks or components of the web-based system are the student and the faculty. The student will be first required to register using credentials and then select the appropriate module he/she is studying. The student will then play and complete the game after which scores will be generated using weights and clustering of students will be done according to appropriate score. Once evaluation and clustering has been completed, the student will be given the appropriate resources to study and improve their skill.

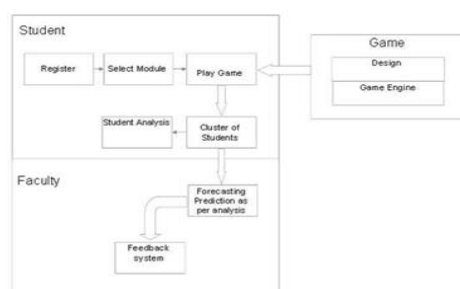


Figure 1: Block diagram of system

The block diagram contains the following information:

1. Student: - The student block contains register, select module, play game, cluster the students, student analysis.

1a. Register: - Every student must register in order to play the game.

1b. Select Module: - Student must select the module based on which the game will be played.

1c. Play game: - This will redirect to the Game block where the game will be played, and result will be stored.

d. Cluster the Students: - The students with similar score will be clustered together.

1e. Student analysis: - Students will be analyzed based on their score and suitable recommendations will be given on the aspects of the module.

2. Faculty: - The faculty receives the clustered data from the students' performance based on the way they play the game and the faculty also provides with feedback.

2a. Forecasting prediction as per analysis: - Here the clustered data of students is provided to the faculty which can be easily analyzed.

2b. Feedback: - The Faculty then can provide with suitable feedback to an individual based on their performance and motivate them to excel in the module. Assignments/ evaluations can be customized as per the potential of students i.e. posing challenging questions to students with high score and giving extra attention to students with a low score [4]

3. Game: - This contains the game design and the game engine which connects the students with the game.

3a. Game: - The game should be such that catches the eye of the students that are eventually going to play it. To deal with games means the game design should be spot on hence we plan to use interactive and entertaining games like puzzles, crosswords, pictorials, etc. to help students inculcate with the game and us to cluster them properly and provide suitable feedback

3b. Game Engine: - The game engine needs to be very fast and responsive hence we are planning to use pixi.js and Babylon.js for game rendering and gamesalad.com as the prime user interface of the game application.

Game Level	Type of Questions
Easy	Prerequisites of the Module.
Medium	Based on introduction and early understanding of the module
Hard	Questions based on the whole module

Iterative approach is to be followed during the course of the completion of the project. These iterations can be briefly explained as: -

#### Iteration 1 -Data Collection using Gamification

In this step, the score is generated by answering all the questions in the game and that data along with the ID of the student will be used as the input in the next iteration.

#### Iteration 2- Data preprocessing and Analysis

Here, data preprocessing will take place. Noisy data, inconsistent data will be standardized, and clustering will take place using data mining tool. Clusters of students with similar characteristics will be generated and displayed using Tableau tool.

#### Iteration 3 - Faculty Feedback system after clustering

In this step, as soon as the scores are generated, and clustering is done, there will be input taken from the faculty from the improving the learning or knowledge of the chapter for different variety of students.

### 4. PROPOSED TECHNOLOGY USAGE

1. Gamification Project will be a Web Based application. 2D game engines like pixi.js and babylon.js will be used for game rendering. These game engines are suitable for rendering games on web applications. Also, gamesalad.com will be used for making the user interface of the game as a web application.
2. Content management service like Drupal to be used because of its open source nature and the fact that it is customizable as per our requirements and custom APIs can be modelled.
3. Tableau data mining tool to be used as it has enhanced visualization features.
4. Data Preparatory software to be used for data preprocessing.

5. JavaScript API plugin to display result of Tableau in web browser.

6. Amazon web services will be used to host our project as they offer hosting at miniscule costs and also offer wide variety of features like servers and database support.

### 5. CONCLUSIONS

Impact of Gamified Learning in today's education sector especially in the STEM (Science Technology Engineering and Mathematics) subjects has been observed to grow exponentially. With the online educational data growing day by day, the education industry is moving towards a Big Data explosion. New technologies and extensive research in this domain will help enhance the education experience for learners.

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