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Gamification: An Initiative to Increase Engagement and Performance in Education

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Abstract: Gamification is an initiative, which can be used to complement the various conventional learning and teaching processes in schools and higher educational institutions.

Students deem the present educational practices as boring and exhausting. Universities have failed repeatedly to motivate students to attend regular classes. This has forced many schools and universities to make it compulsory for students to maintain at least 75% attendance in every course they enroll into. Schools and universities have failed to motivate and engage students in the learning process in general as well.

Gamification can be used to solve this issue largely. Gamification can be embedded into the learning process as Games make it a much fun and enjoyable experience. People of almost all ages like to play games – not only for rewards but also to experience the feeling of winning and the joy of playing a game. Various game-related components such as points, badges, medals, Leaderboards and so on can be used to implement Gamification in a class of students.

Every university maintains a database of students' attendance and marks scored during the various assessment tests. In this paper, this data is being used in a class of university students. Various rules have been written to reward the students with points and badges. In the frontend, a user interface (web Application) is built using HTML, CSS, and JavaScript, bootstrap, D3.js, and query. MySQL has been used as the DBMS to run the queries on the data. PHP is used to link the UI with the database, both of which are hosted on the server.

Keywords: Gamification, Engagement, Motivate, Points, Badges, Medals, Leaderboard, User Interface, DBMS, Game Related Components, MYSQL.

I. INTRODUCTION

It has become quite challenging to motivate students to learn, think and implement in the current education system. Only a modest bunch of the students is intrigued to learn and achieve higher objectives in their career. This makes it difficult for the teachers to engage everyone in the learning processes/activities of a class. Moreover, some students are not interested in attending the lectures. As a result, to discipline the students, the management has been propelled to make it obligatory for every student to have an attendance of 75% in every course they enroll into even with all these preventive measures, to impart quality education, institutes have failed, as defaulters can be seen every now and then.

Gamification can be used to solve this issue at hand. Gamification can motivate students to study and attend classes regularly by driving them to a healthy competition.

According to Wikipedia [1], Gamification has been utilized as a part of different fields, for example, education, marketing, health, corporations, authentication, politics and terrorism, technology and so on [1].

The motive behind this paper is to make learning more interesting by keeping the conventional methods intact and embed Gamification into it. This will make the classroom more engaging and the students will be motivated to strive harder.

II. LITERATURE SURVEY

Application of Gamification in education is yet to be a rising pattern. Gamification, according to Pandey [3], summons agreeable rivalry and gives a sense of accomplishment. Gamification can be used as a tool to encourage students to participate and hence it can act a behavior-changing platform [3].

The emotional aspects involved in playing games can be experienced through Gamification. According to Nicole Lazzaro [4], “individuals play games less for the amusement itself concerning the experience the games give us: an adrenaline surge, a mental test, and the structure recreation give, for example, a snapshot of isolation or fun times with friends”. According to Dicheva, D., Dichev C., Agre G., & Angelova G. [2] There are a number of game mechanics that can be used such as points, badges, avatars, leaderboard, levels and virtual goods/ currency [2]. Points are rewarded to encourage participation in the classroom activities. Badges are rewarded on completing a task. Leaderboard lets the class know the status of all the students according to their performance. These three game mechanism components will be used in this paper.

As seen in Fig. 1, in the DBMS, points and badges will be rewarded based on rules and this will be visible to the students in the leaderboard. The Leaderboard will be available in the UI, where the user will log in. Thus, a change in the conventional way to impart education by making the learning process fun is what this paper presents. Our research question is whether the students will embrace Gamification and give a positive feedback. In addition, whether it will solve problems in the classroom that we aim to solve.

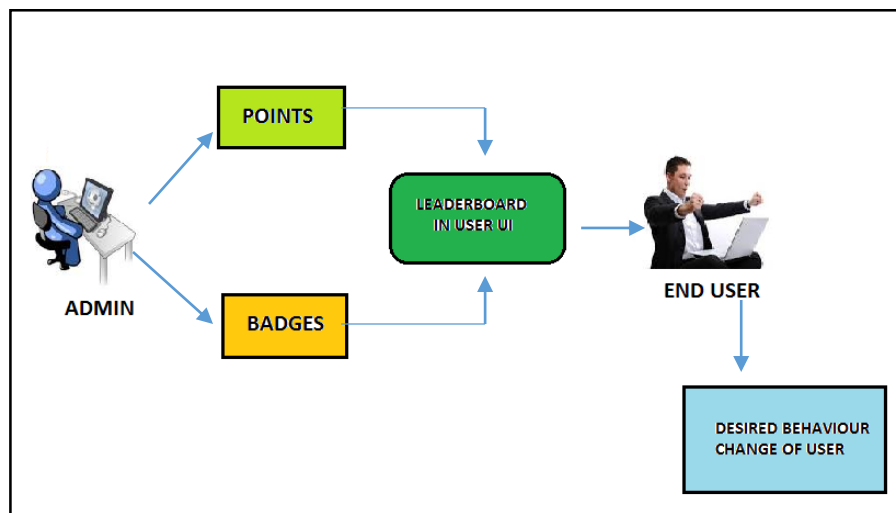


Fig.1: A General description of the proposed System.

III.DETAILED DESIGN OF THE SYSTEM

Conventional learning does not promote engagement among the students, as most of the students are not challenged in an entertaining way to learn and compete for their fellow mates. Gamification, on the other hand, encourages students to win – may be points, badges or virtual currency and so on.

For this paper, a student’s profile and the main page are designed. Every student can see their performance real time in his or her personalized profiles without clutter. This helps them to keep track of their performance.

In this project, we have decided to include certain rules to reward points and badges. The rules to reward points and badges may change according to the target user, for instance, the rules for schools cannot be same as rules for university students as we may not get the desired result if we do not design rules according to the target user.

A. Rules to Reward Points:

1. Reward 1000,800 and 500 points to the student who scores highest, second highest and third highest marks in the course at the end of the semester.
2. Every student who scores an A grade in the semester earns 300 points.
3. Reward 250 points to topper the multiple assessment tests held.
4. Every month Reward 50 points to those who have maintained 75% attendance in the course.
5. Every month reward 60 points to those who have maintained 85% attendance in the course.
6. Every month reward 80 points to those who have successfully maintained 100% attendance.
7. Every month impose a penalty of 100 points whose attendance comes below 75%.
8. Reward 15 points for downloading course material every time.
9. Reward 100 points to anyone who creates an online educational video related to the course and uploads it on YouTube.
10. Anyone who contributes to the class blog, and helps his fellow classmates to learn earns 80 points.
11. The first person to submit an assignment gets 100 points.
12. Anyone who takes up a seminar/Role play and educates the class gets 100 points.
13. Any student who carries out research work through any project gets 300 points.

14. For publishing any research work related to the course, reward 500 points.
15. For contribution to any blog/magazine/journal related to the course reward 500 points.
16. Reward 300 points to a student who tops the assessment consecutively for two times.

B. Rules to Reward Badges:

1. “Performer” badge – Rewarded to the student who gets the First rank in the course.
2. “Go Getter” badge – Rewarded to the student who gets the second rank in the course.
3. “Hard Worker” badge - Rewarded to the student who gets the third rank in the course.
4. “Analyst” badge – Rewarded to the student who completes a project related to the course.
5. “Star in the Making” badge – Rewarded to any student who gets the highest marks in any of the multiple assessments.
6. “Work harder” badge – Any student who scores 50% on any assessment test.
7. “All-rounder” badge – Rewarded to the highest score in role play/seminar/quiz.
8. “Achiever” badge –Anyone who maintains above 75% attendance.
9. “Slogger” badge – Anyone who maintains below 75% attendance.

The UI representation of all the above badges was made as can be seen in Fig. 2.



Fig. 2: UI representation of badges.

To make the status of the students visible to the class a Leaderboard is used in both profile and the main page of the web application here. Leaderboard helps users to track the performance and motivates them to strive harder.

The flow of processes carried out in the project can be evident in Fig. 3. Firstly, the admin takes the data from the source. In this project, we have used MySQL as the DBMS where the database with the desired tables is created. Then comes the need of an UI to display the data of the user. Therefore, a web application is designed.

In our project, we have used various latest technologies such as HTML, CSS, and JavaScript, bootstrap, query and d3.js to design the web application.

After the development of the web application, it is hosted on a server, ecowebhosting.co.uk [5], along with the DBMS.

IV.METHODOLOGY

In our project, we have included all the fields related to which the rules exist. The data shows a positive as ‘1’ and a negative as ‘0’. For instance, if a student has contributed to the class blog it is represented as ‘1’ to denote ‘yes’ and a ‘0’ if the student as not contributed to the class to denote ‘no’. This helps

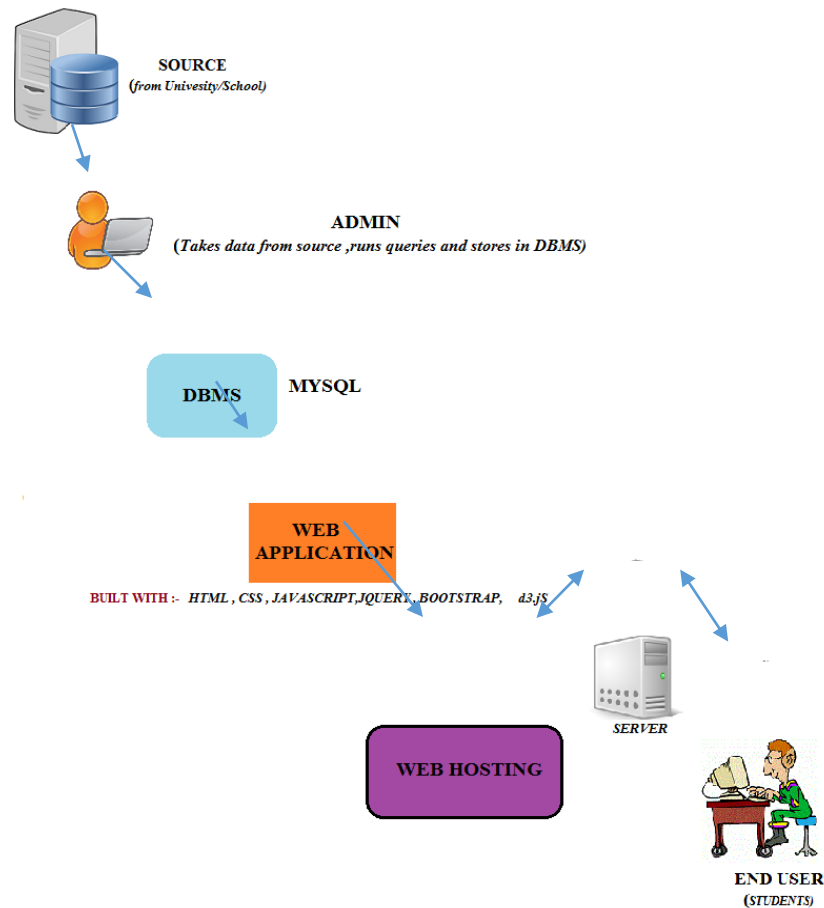


Fig. 3: Flow of processes

In running, the queries related to the rules in MYSQL. This data are shown in Table I is then imported into the database (MYSQL) through the hosting platform. It is named as “Source Table”. The source data i.e. The “Source Table” can be imported every week or every month depending on how frequently the admin wants to update the points or badges in the UI. In our case, we are updating the database every month and the same is reflected every month in the UI.

After importing the data into the database we have created a new table by the name of “pointsBadgeTable” by adding various new fields such as “points Rewarded” and all the badges namely “Performer”, “Hard Worker”, “achiever”, “all-rounder”, “analyst”, “go-getter”, “slogger”, “work harder”, “star in making”, “Rank-Unit Test 1”, “Rank Unit Test 2”, “overall rank”, “grade”. The title of the badges solely depends on the wild imagination of the implementers. These new fields are represented in Table II.

Another table by the name of “StudentTotalTable” is created. In this table, we add the total of all the points and badges rewarded to the students every month after running the queries. After rewarding the points and badges, overall ranks are based on points and number of badges earned. It is from this table that the result will be displayed on the leaderboard of the UI. This is shown in Table III.

The data in “pointBadgeTable” is for February only. Every month we get a similar set of data as in “Source Table”, then import the data to “pointsBadgeTable”, run all the above queries, and then add the total to “StudentTotalTable”. After having the data ready in the database of the DBMS, the next step would be to display the data in the User Interface, which is done with the help of a web Application in our project. In our project, we have used PHP as a server side language – to link the UI with the database.

TABLE I
DATA FROM SOURCE NAMED “SOURCETABLE”

Name of Student	Reg. No.	Attendance in Percentage	YouTube Upload	Class Blog	Assignment submission	Seminar/ Rolepay	Research Work	Research Publication	Blog/ Magazine/ Journal	Unit Test 1	unit test 2
Rishab Das	15bt001	80	0	1	0	0	0	0	0	35	0
Pooja Sharma	15bt002	75	1	0	0	0	0	0	0	29	0
Amit Das	15bt003	90	0	1	0	1	0	0	0	40	0
mayuri Singh	15bt004	78	1	1	0	0	0	0	0	42	0
Shweta Shinde	15bt005	70	0	0	0	0	0	0	0	25	0
Shahid Khan	15bt006	80	1	1	1	0	0	0	0	45	0
Rimpi Chetia	15bt007	75	1	1	0	0	0	0	0	40	0
Sunit Baishya	15bt008	79	1	1	0	0	0	0	0	36	0
Prakash Gogoi	15bt009	80	0	0	0	0	0	0	0	29	0
Wasif Imran	15bt010	100	1	1	0	1	1	0	0	47	0

TABLE II
“POINTSBADGETABLE” CREATED WITH ADDITIONAL FIELDS TO CALCULATE POINTS AND REWARD BADGES

Unit Test 1	unit test 2	Points Rewarded	Performer	Hardworker	Achiever	All Rounder	Analyst	GoGetter	Slogger	Work Harder	Star In Making	Rank UnitTest 1	Rank UnitTest 2	Month	Donload Material Count
35	0	100	0	0	1	0	0	0	1	0	0	5	0	Feb	1
29	0	150	0	0	1	0	0	0	1	0	0	6	0	Feb	2
40	0	90	0	0	1	0	0	0	1	0	0	4	0	Feb	3
42	0	100	0	0	1	0	0	0	1	0	0	3	0	Feb	4
25	0	150	0	0	0	0	0	0	0	0	0	7	0	Feb	5
45	0	200	0	0	1	0	0	0	1	0	0	2	0	Feb	1
40	0	250	0	0	1	0	0	0	1	0	0	4	0	Feb	4
36	0	300	0	0	1	0	0	0	1	0	0	5	0	Feb	6
29	0	150	0	0	1	0	0	0	1	0	0	6	0	Feb	1
47	0	100	0	0	1	0	0	0	1	0	1	1	0	Feb	0

TABLE III
“STUDENTTOTALTABLE” CREATED TO GET THE TOTAL OF POINTS AND BADGES

Name of Student	Reg. No.	Total points	Total Badges	Overall Rank (Points)	Overall Rank (BadgeCount)	Final pointsReward ed	grade	grade points
Rishab Das	15bt001	300	4	4	6	0	0	0
Pooja Sharma	15bt002	250	5	6	4	0	0	0
Amit Das	15bt003	300	6	4	3	0	0	0
mayuri Singh	15bt004	250	7	6	2	0	0	0
Shweta Shinde	15bt005	190	4	7	5	0	0	0
Shahid Khan	15bt006	350	5	3	4	0	0	0
Rimpi Chetia	15bt007	400	7	1	2	0	0	0
Sunit Baishya	15bt008	290	8	5	1	0	0	0
Prakash Gogoi	15bt009	350	4	3	5	0	0	0
Wasif Imran	15bt010	360	4	2	5	0	0	0

A lively Login page has been designed as shown in Fig. 4. In the login Page, after the verification of the user through the credentials, if the user name and the password are correct, the user is first taken to the profile page. The profile page displays the Overall Rank (points) and overall Rank (Badge Count), points scored and badge count. This is shown in Fig. 5. Upon using the slider arrows, the user is taken to the leaderboard where the student will be able to see where they stand on the leader board. This will change every month once the new monthly data is updated. The data displayed in the Overall Rank

(points) and overall Rank (Badge Count) of the welcome plane i.e. Fig. 5 is echoed from the “StudentTotalTable”, from column Overall Rank (points) and overall Rank(Badge Count) respectively.

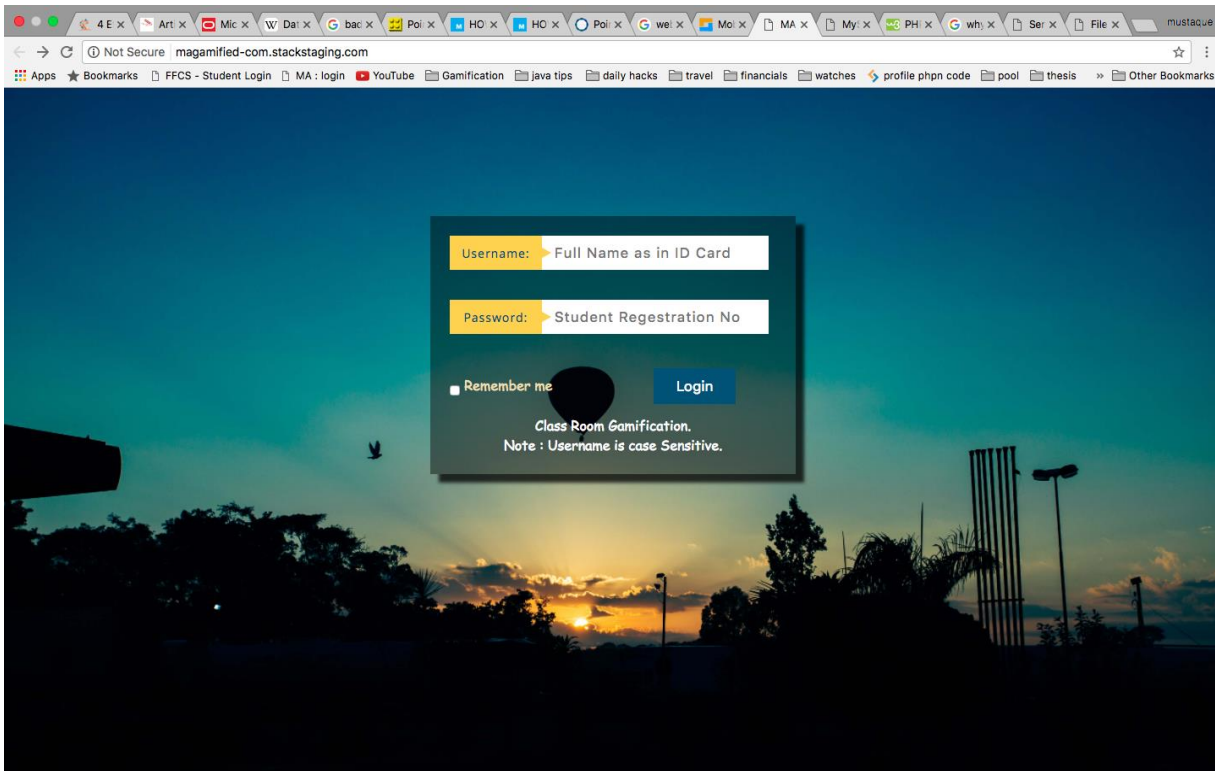


Fig. 4: Login Page of the Web Application.

The data in the leader board is echoed from “StudentTotalTable” from “Total Points” column. This data depicts the points scored by the students and the leader board displays it in descending order. Fig. 6 represents the leader board.

The profile will also display the badges won by the students. Students are entitled to win various badges and seeing the badges on the profile will make them aware which badge they have won recently and what are the upcoming badges that the student can aim for. The profile will not display all the medals, as detailed information about the medals, which are won, will be shown on the main page. Then there is a “Home” button, clicking on which the user will be taken to the main page of the web Application. Fig. 7 shows the badges displayed in the profile of the web application.

In the main page, the user will see the navigation tabs, clicking on anyone, the user will be taken to the desired section of the main page. The navigation tabs include “Leaderboard”, “Badge Summary”, “Statistics” and “Contact Admin” tabs respectively as shown in Fig. 8. The leader board displays the name of the students in two sections, showing the toppers according to points and according to badges respectively.

Then clicking on the badge tab, the user will be taken to the badge section, where the student can see the badges that are won until that particular point in time. It will show all the badges that were won. It also includes a tab by the name “Locked badges” – which represents all the badges that have not been earned by the student. This list helps the student to know what badge they can still earn and what they have to do to earn the badges. Fig. 9 shows the badge section in the main page of the web Application.

The main page also contains the statistics section. Through this section, the student is able to keep track of their previous scores at that particular point in time. This can be done by hovering over the graph horizontally in the chart. The display of information is made through a tooltip. The entire concept is represented in Fig. 10.

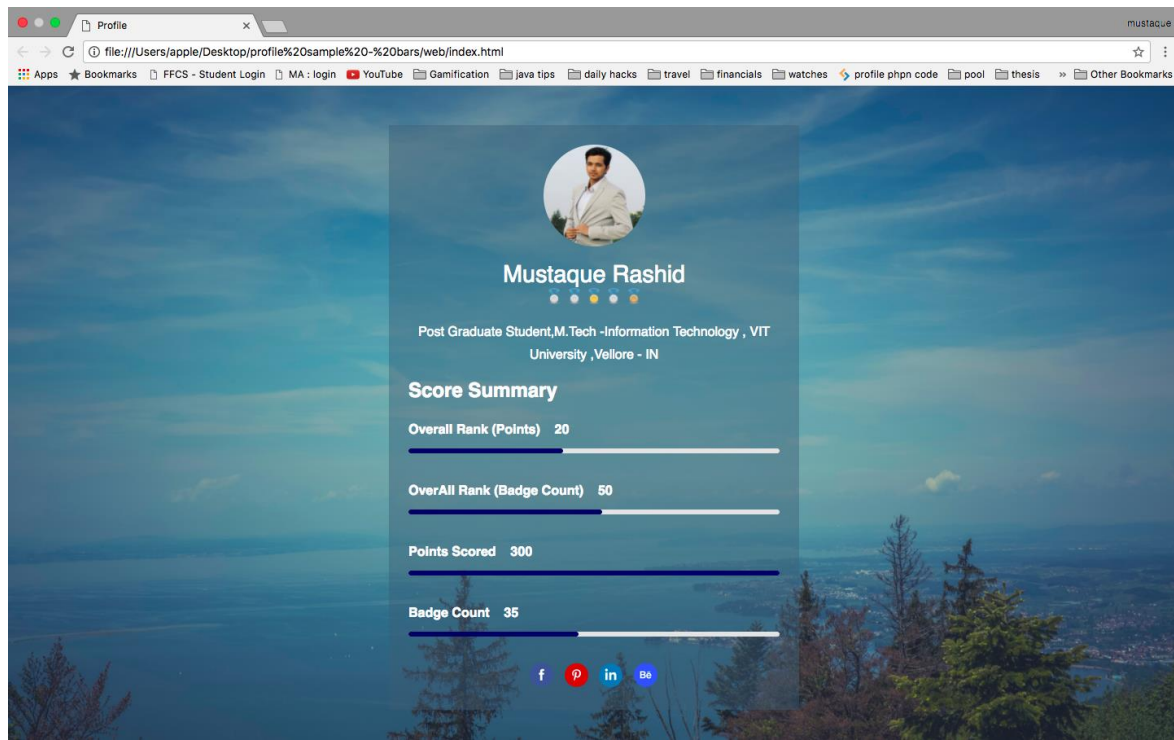


Fig. 5: Welcome page to the profile after login.

Leader Board	
Prakash Gogoi	2795 Points
Amrish Puri	2628 Points
Rishab Das	2481 Points
Amit Das	2351 Points
Rohit Upadhaya	2180 Points
Shweta Shinde	1303 Points
Anupal Das	1289 Points
Shahid Khan	1019 Points
Rimpi Chetia	935 Points
Rabri Patil	914 Points
Johanny Mala	842 Points
Wasif Imran	777 Points

Fig. 6: leader board in profile.



Fig. 7: shows the badges displayed in the profile of the web application

By clicking on the “contact Admin” tab in the navigation bar, as shown in Fig. 8, the student is taken to the contact section where the student may contact the admin and post the current ranks from leader board to social media through “post to Facebook” tab, which is available for the student to make their scores known to people outside of class.

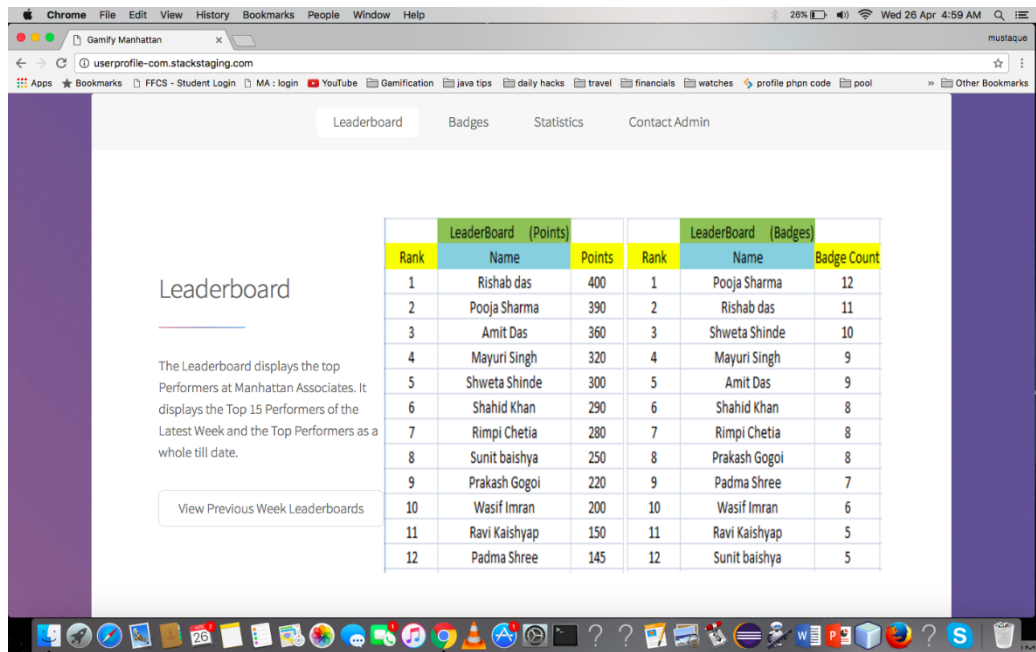


Fig. 8: Navigation tabs with the Leader board on the main page of the Web Application.

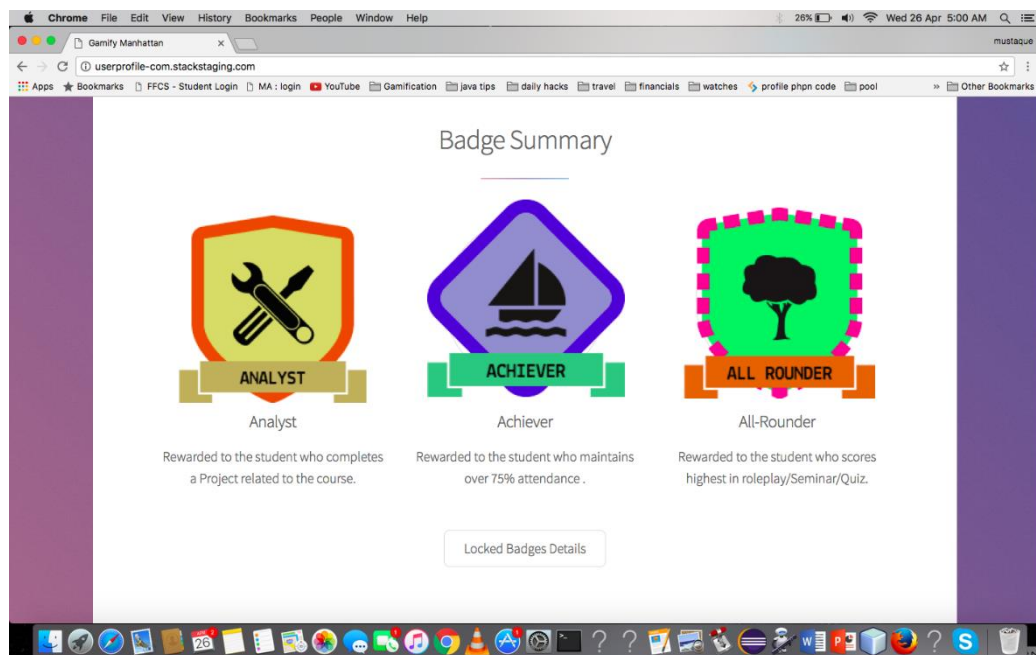


Fig (4.9) shows the badge section in the main page of the web Application.

V. RESULTS AND DISCUSSION

The project has been applied to a class of 55 students. For convenience, we have shown the data to 10 students only. It was in the month of January when students were made aware of the concept of Gamification and subsequently from the first week of February Gamification was applied.

From the application of Gamification in the month of February and March, the attendance percentage of all the students has improved considerably. However, in the month of February, there was a defaulter, moving ahead, March saw no defaulters at all. This is represented in the bar diagram of Fig. 11. Thus, Gamification has worked here to provide a solution to a major issue related to the education system.

Again, the other objectives were to motivate the students to take part in the activities and engage them in all the education processes irrespective of their performance in the class until that point in time. This has also seen a considerable improvement as students have started to take part in the various activities such as upload of YouTube video related to course, take up research work, and contribute to the class blog and so on.

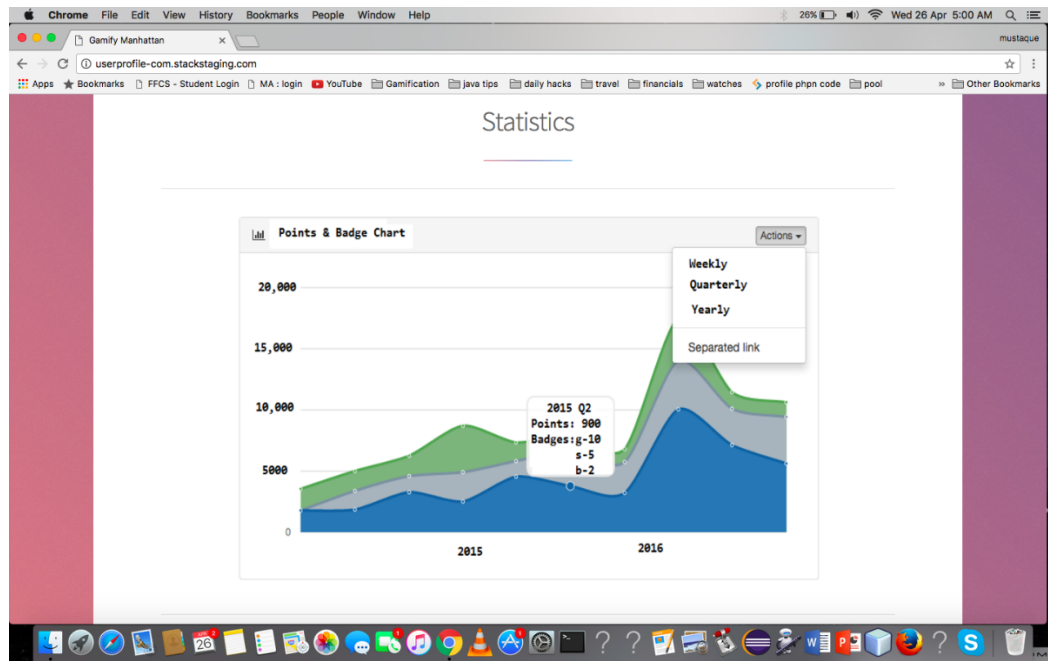


Fig. 10: a chart to display statistical information through a tooltip.

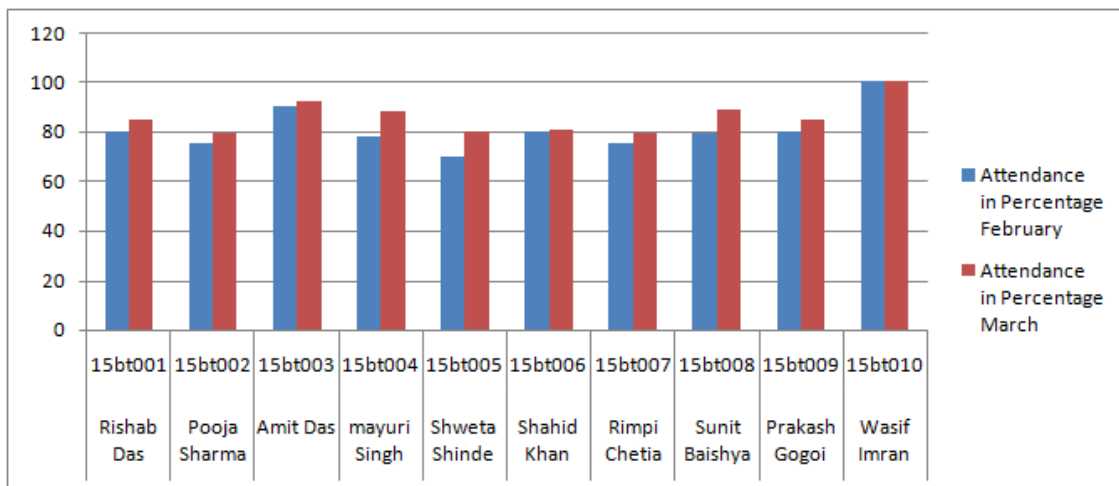


Fig. 11: Bars to compare the attendance of students for February and March.

In order to justify the point, we have decided to compare the contribution made by the students to the class blog, where the students write articles and try to provide a solution to the difficult problems at hand. This helps those students who find it difficult to comprehend some topics in the classroom. In Fig. 12, the bar diagram to denote contribution to blog shows the improvement in this activity among students.

In the figure, it is evident that blue bar denoting contribution in February was missing in some students, whereas, the red bar denoting contribution in March, in seen for every student. Thus Gamification has increased engagement in the activities related to education among the classmates.

Similar comparison diagrams can be drawn for all the fields to show how Gamification had a desirable impact on the students.

CONCLUSIONS

A. Conclusions:

This paper provides a crisp, inside and out look on the application of Gamification in Education. The study shows that Gamification can help students improve their attendance.

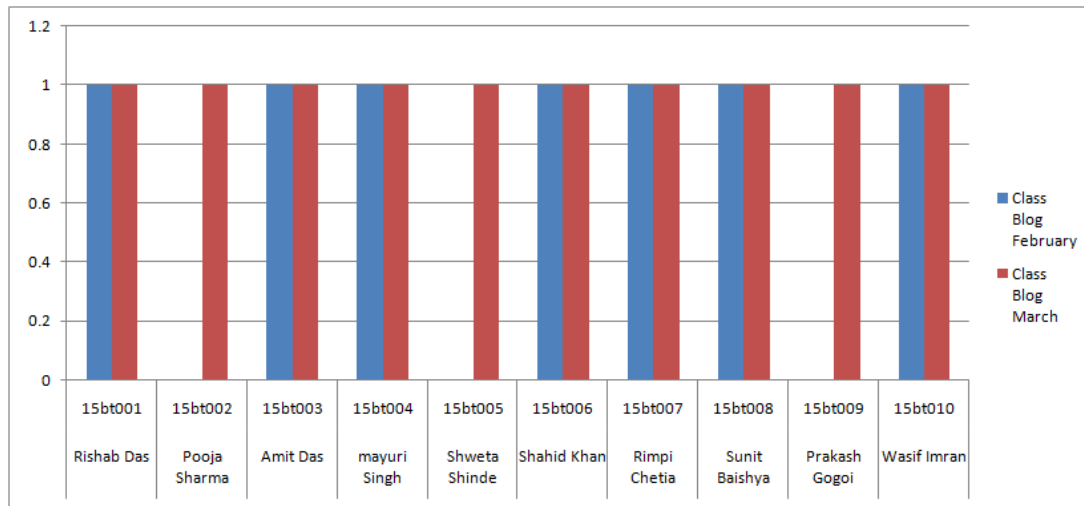


Fig. 12: shows Improvement in class blog contribution.

With the use of various extrinsic rewards such as points, badges and desire to see their names on the leader board among toppers, students have been motivated to attend classes regularly. It can also be seen that the engagement into the classroom activities has increased considerably. Gamification promotes healthy competition as anyone can earn points and badges provided they take part in the classroom activities. As a result, it increases engagement and creates a positive vibe. One important inference is that it takes a considerable amount of time to design the Gamification portal. Firstly, the implementers need to understand the problems that the authority is trying to solve through Gamification. For different universities/schools, the demand may be different as problems targeted may vary. In that case, different rules need to be framed and the entire process needs to be redesigned every time. There is no fixed system available to implement it. Though it gives the flexibility to aim at particular problems, it takes time and money to develop a new portal from scratch.

B. Future Work:

It is clear that the students were influenced by extrinsic rewards. However, it is left to be seen whether intrinsic rewards such as the urge to learn, seek knowledge etc. can be triggered by Gamification. While Gamification is sure to bring change, it is very important to consider how different personality traits welcome Gamification; whether, according to personality, some are benefited and some are neglected is the question here. As a future work, it would be interesting to see how school students would react to Gamification. Another future work can be to find ways to help weaker or mediocre students excel in the classroom. Gamification in education is a new application, though various theoretical evidence exists. So as implementers we need to continuously learn from mistakes and try to solve issues through Gamification.

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