



DUIT: A Mobile App Developed Using Interdisciplinary Approach

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ABSTRACT

This paper presents an interdisciplinary approach to develop an android-based mobile app for students of University of Delhi. Delhi University Information Tool (DUIT) is a mobile app that delivers personalized information to students on their mobile devices and provides analysis of their attendance and assessment. This paper discusses the development process of DUIT and features provided by the app. It highlights working of three different departments in a collaborative manner to develop the app. In addition to the technical skills, the interpersonal skills developed during the working on the project are also discussed here.

Keywords: Android App, DU, Innovation project, Interdisciplinary, Mobile Technology

INTRODUCTION

Mobile devices have gained lot of popularity in recent years. Student community is a major user of smart phones, tablets and other mobile devices (2). Students are using mobile devices for learning, entertainment, shopping, bill payment, information exchange, social networking etc. App on the mobile devices brings useful information directly to pockets of the students and provides an engaging user experience. Due to this shift in the use of technology (from desktop computers and laptops to mobile devices) among student community, many universities and educational institutions have developed mobile apps to deliver important information via these devices. Several international universities already have mobile apps. Some of those are, Stanford University, MIT University, Harvard University, National University of Singapore etc. (6)-(9). Many colleges and universities in India have also recently come up with their mobile apps, such as, Amity University, Lovely Professional University, Sathyabama University, Northern India Engineering College (IP University), Bharti College (University of Delhi) (10)-(14).

Delhi University Information Tool (DUIT) is an android-based mobile app collaboratively developed by three different departments of Dyal Singh College,

University of Delhi. DUIT has emerged as a solution for information related query of students. Be it attendance, assessment, analysis of student performance, latest notices or important contact numbers, all of them are now pocket-sized. DUIT eliminates the fear of serpentine queues in front of office windows and notice boards. It does away with the desk to desk hopping in search of someone with the desired answer. It cuts down the time spent in searching personalized information from long lists available on college website. It is student-friendly android phone applications developed for better 'student-college' inter-linkage.

DUIT is developed as an interdisciplinary research project, undertaken by scholars from more than two distinct disciplines. The research integrates frameworks from these disciplines; uses design and methodology that is not limited to any one field, and uses skills of the involved disciplines throughout multiple phases (3). The project challenges the students, requiring them to gain understanding of concepts outside their comfort zone (5). DUIT team is an alliance of Department of Computer Science, Department of Mathematics and the college administration. Skills of all the three departments have been integrated to produce an app that is much more than what would have been produced by a single discipline. Not only the student investigators of various disciplines have become experts in their core technical skills but they have had a real life experience of working across discipline boundaries. This has enhanced their interpersonal skills, including team work, time management, goal oriented approach, presentation skills etc. It is important to teach soft skills to our students as most future employers value them as much as the technical skills (4). It would be correct to say that DUIT built competence in student investigators to face the challenges of real market.

The rest of the paper presents the development process of DUIT and its learning outcomes. Section II discusses the contribution of each department in the interdisciplinary project and their integrated efforts. Section III describes the functionality and unique features of DUIT. Section IV discusses the learning outcomes in the process of development of DUIT. Section V states the conclusion

METHODOLOGY

When the idea of DUIT was conceived, it was proposed to build a tool which can disseminate the personalized information to students using mobile technology. Study of mobile websites and mobile apps of various international universities was made to identify the candid features of DUIT (1). A survey of students was conducted to find out their information needs and understand their preferences. Questionnaires were filled by the students and brainstorming sessions were organized to attain a final list of features that could be added to DUIT. A detailed blueprint was prepared to define the features, screens and interaction of various screens of DUIT. Inter-team meetings and group discussions were conducted to improve the blueprint for coming up with final design. Android programming along with server side scripting was done to implement the design and make it functional. First prototype of DUIT was developed and tested. Feedback of students and other stakeholders was taken on the prototype. This feedback was incorporated into next iteration to build next prototype. This cyclic process was continued till the development of the final product. The final app will be

uploaded on Google Play Store to make it available for use. Figure 1 illustrates the development process of DUIT.

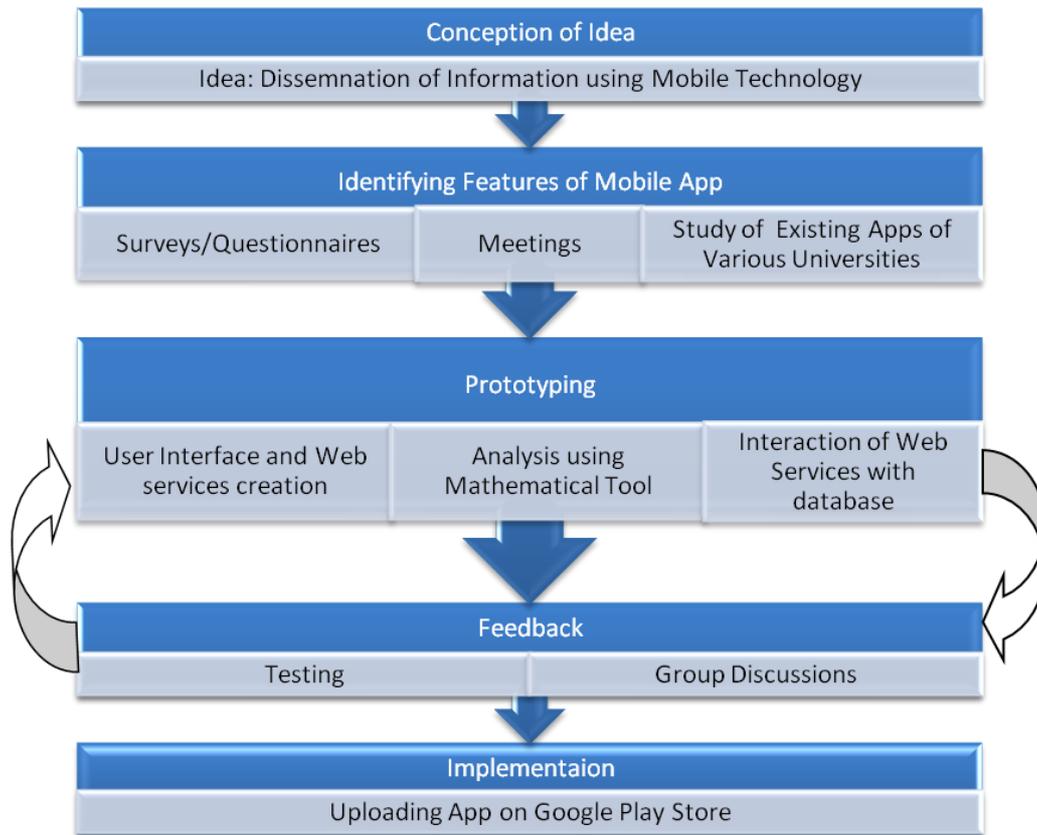


Figure 1.DUIT Development Process

Break down of tasks was done in a manner that few activities crossed boundaries of specific discipline and were to be accomplished by joint effort of all the departments. At the same time, there were few activities which were to be performed by the specific department. The contributions of the different departments are summarized in the following subsections.

A. Contribution of College Administration

The college administration plays the role of information provider for the students. All information that is generated from various departments of college is compiled by this department. It collects notices and timetable issued by various departments and puts them up on college website. It also gathers monthly attendance of students from respective teachers, arranges attendance in class-wise and subject-wise lists, and uploads these lists on website. Thereafter, it enters all attendance data in college database through software which is supported/managed by a third party vendor. Similarly, the internal assessment of each subject is received by admin department and entered in college database. Thus, college administration manages information of the college, stores data in database, and uploads information like notices, timetables, assessment, attendance etc. on the website. This information is picked up by DUIT from database and website. It is processed further to extract personalized information of logged-in student. This personalized information is finally delivered to students on their mobile devices. Figure 2 illustrates the flow of information.

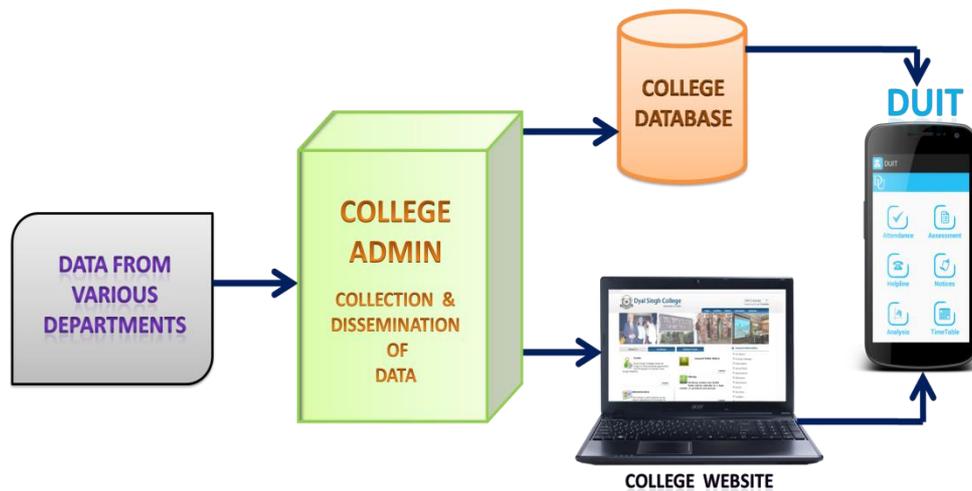


Figure 2. College Administration as Information provider

Since DUIT is a tool for delivering information to the students, the contribution of college administration in this endeavor is vital. Staff from this department facilitated the design of DUIT by clarifying the flow of information across the college. They participated in focus group discussions and brain storming sessions which were iteratively held to lay down the detailed design of DUIT. They also enabled DUIT team to carry out the exhaustive student-surveys to find out the most popular mobile device platform among students of college. Similarly, another survey was conducted to identify the most sought after information needs of the students. These surveys were organized by college administration. The findings of these surveys were of utmost importance in freezing the design of DUIT. Moreover, the college administration also extended its support in preparing test cases. Manual testing was also performed by admin staff along with other students to ensure that DUIT actually met the requirements of students and works as expected.

B. Contribution of Computer Science Department

Department of computer science formed the core development team of this project. It had a significant role in all the phases of development of DUIT right from identification of features to iterative design and prototyping to final implementation. Student investigators from this department were divided into two groups –Graphical User Interface (GUI) Designers and Programmers. From student-surveys, it was discovered that students preferred a minimalistic design for the proposed app. Clean and well organized screens with minimum clutter were expected. So GUI designers decided to provide options through menus and details through expandable list views. Adobe Photoshop was used for creation and editing of screens. It resulted in an attractive look and feel of the app with minimalistic screens, catchy icons, logo, and colorful presentation.

The other set of students–programmers, went through an extensive learning period for acquiring programming skills in Java and Android Software Development Kit (SDK). Two students attended a workshop on android programming conducted at IIT Mumbai. They learned android app development with the help of various tutorials and videos available on YouTube. Lot of practice apps were developed to get a hands-on experience of android programming.

Moreover, DUIT has a multi-tier architecture wherein app running on mobile devices of students interacts with web services running on the college web server to interact with database of college. This multi-tier communication is required to maintain a secure exchange of student data between app and database. The development team learned Hypertext Pre Processor (PHP), a scripting language, to implement web services which interacted with Structured Query Language (SQL) Server database. Eclipse was used as an Integrated Development Environment (IDE) for coding. The project activities performed by designers and programmers are summarized in Figure 3. This figure also illustrates the various designing and programming tools learned and used by the team.

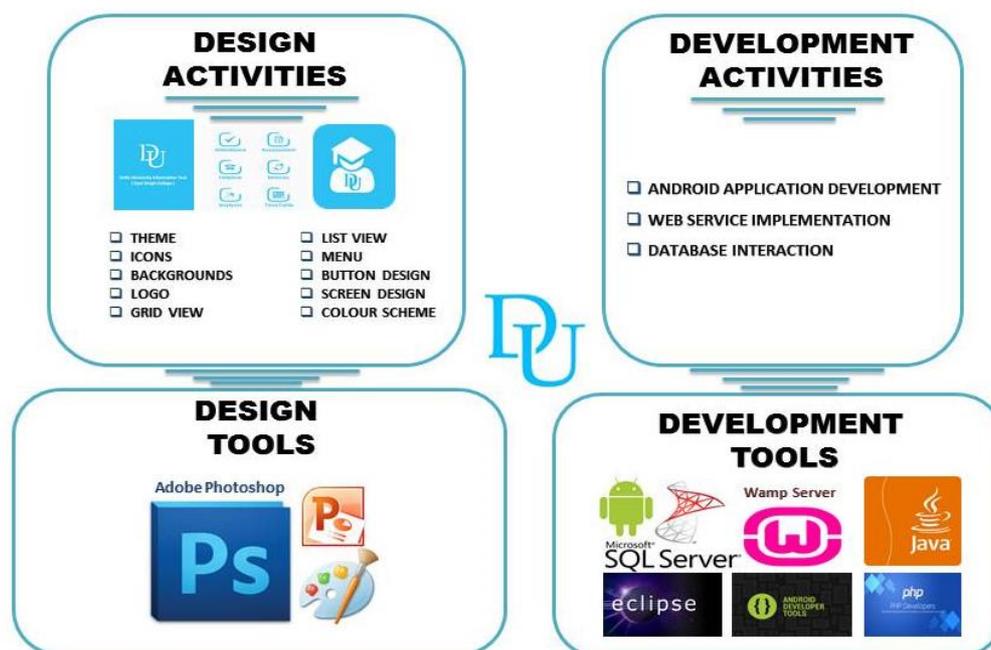


Figure 3. Design and development activities and tools

By performing above activities using the design and development tools, computer science department has materialized the innovation idea into a functional product.

C. Contribution of Mathematics Department

The most significant contribution of mathematics department is to provide analysis of attendance and assessment to the students. Scientists, engineers and mathematicians spend a great deal of time performing mathematical calculations and manipulations. For this purpose, there are several software viz., Matlab, Maple, Maxima and Mathematica etc. Out of the mentioned ones, Mathematica is a revolutionary tool for mathematical computations and exploration. Mathematica performs three types of computation: symbolic/analytic, numerical and graphical. Besides the availability of hundreds of inbuilt functions, it provides a provision to the user to include own programming language and thus making it extensible for its utility. It has been developed professionally by the Wolfram Research Inc., website: <http://www.wolfram.com>. We chose Mathematica for analysis in the app.

The choice of Mathematica initially led the students to face a big problem: that how to import the files (containing a bulk of data) from spread sheets (as the student data is available from office only in this form) into the notebooks of Mathematica and then to

obtain the outputs in graphical form as the same would certainly be an easier/lively way to access/see the information at the user end. Since we don't do such things as a part of the routine course curriculum, it took students a reasonable amount of time to explore the solution to their problem.

The way Mathematica is used and kind of output it generates for analysis is exemplified here. Let there be some spreadsheet named: *demo2 edited.xls*, containing some information; say the assignment marks (out of 5) of some particular class having 38 students. Then by using the command: `p=Import["C:\\Users\\user\\Desktop\\demo2 edited.xls"]`, we call it to the Mathematica notebook, where further on using the command: `ListPlot[p[[1]][[All]], Filling Axis, AxesLabel{"roll no", "marks"}]`, we get the graph, showing the information contained in the spread sheet in an appealing/catchy way. Likewise, we can do for the other student related information, so that they not only get the information about themselves but they also get a comparative vision/version also in a visual manner, strengthening the saying: "a picture speaks of hundred words" and hopefully it would be helping/motivating them to understand their personal position as compared to the others in an easier way.

Input:`p=Import["C:\\Users\\user\\Desktop\\demo2 edited.xls"]`

Output: `{{{rollno.,Marks},{1.,3.},{2.,5.},{3.,0.},{4.,0.},{5.,4.},{6.,0.},{7.,5.},{8.,0.},{9.,0.},{10.,2.},{11.,4.},{12.,2.},{13.,5.},{14.,2.},{15.,5.},{16.,4.},{17.,5.},{18.,5.},{19.,4.},{20.,3.},{21.,5.},{22.,3.},{23.,4.},{24.,3.},{25.,5.},{26.,4.},{27.,5.},{28.,5.},{29.,5.},{30.,0.},{31.,4.},{32.,0.},{33.,0.},{34.,0.},{35.,0.},{36.,0.},{37.,0.},{38.,3.}}}`

Input:`ListPlot[p[[1]][[All]], Filling Axis, AxesLabel{"roll no", "marks"}]`

Output:

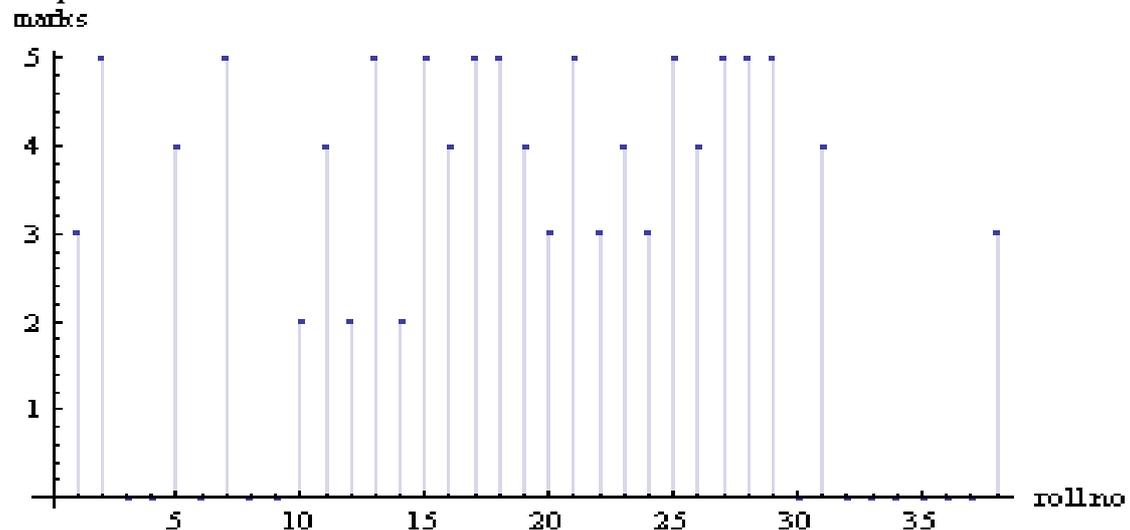


Figure 4. Mathematica graph output

From Figure 4, it is quite evident without going into any numbers, that the roll nos. 1, 20, 22, 24 and 38 are having the same marks-3. Likewise, other related information can be extracted from the figure.

The basic idea is to call the spreadsheet to Mathematica notebook on a regular interval of time - when some new data related to students is generated at the office level and get it executed in Mathematica to make available need based readily made graphs at the user end.

The DUIT app is an outcome of amalgamation of ideas and joint efforts of teachers and students investigators of all the three departments. Figure 5 illustrates the collaboration of the different departments for the development of the mobile app.

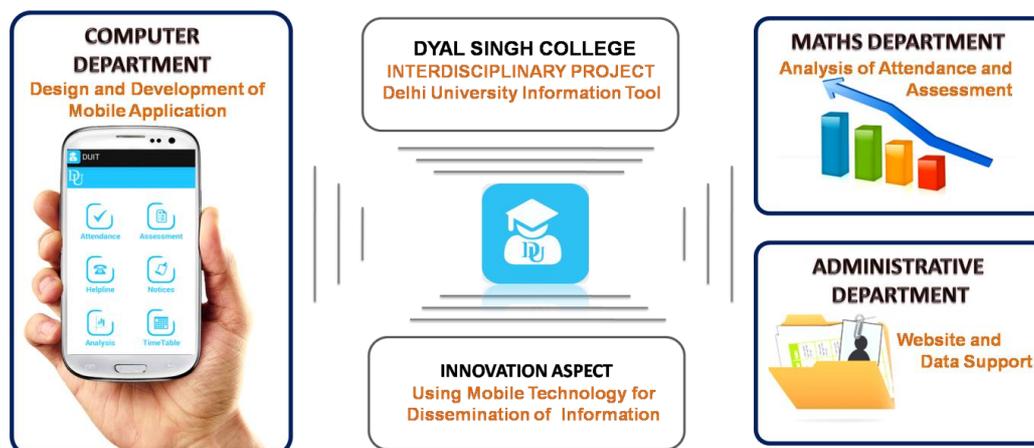


Figure 5. Collaboration of Different Disciplines

RESULTS

As a part of innovation project, University of Delhi entrusted Dyal Singh College to prepare an android app for the benefit of its students. The interdisciplinary team of teachers and students of Dyal Singh College came up with Delhi University Information Tool (DUIT), to grant each student, the most useful personalized information.

A. Functionality of DUIT

To use the app, the student is required to register once, giving their e-mail id, roll number and a password. On logging-in, the student reaches the home page, containing options of attendance, assessment, helpline, notices, analysis and time-table. The student can choose an option to get information about it. If attendance is selected, the attendance page will be displayed, showing the student's subject-wise attendance of the month. On selecting assessment, the displayed page will give subject-wise internal assessment of the student. Selection of helpline will give the option of University Information Center, South Campus, North Campus, College (of the student), Delhi Metro and Emergency contacts. On clicking an option, the related helpline numbers are displayed. Clicking on 'Notices' option will show ten latest notices, and choosing any one of them will take the student to their own college website, where the student can go through or download the given notice. Analysis is the next option, where mathematical software has been used to give the student a graphical representation of his internal assessment and attendance. Choice of time-table gives the student's time-table for the semester, which can be downloaded for future reference. Figure 6 shows the various screens of DUIT.

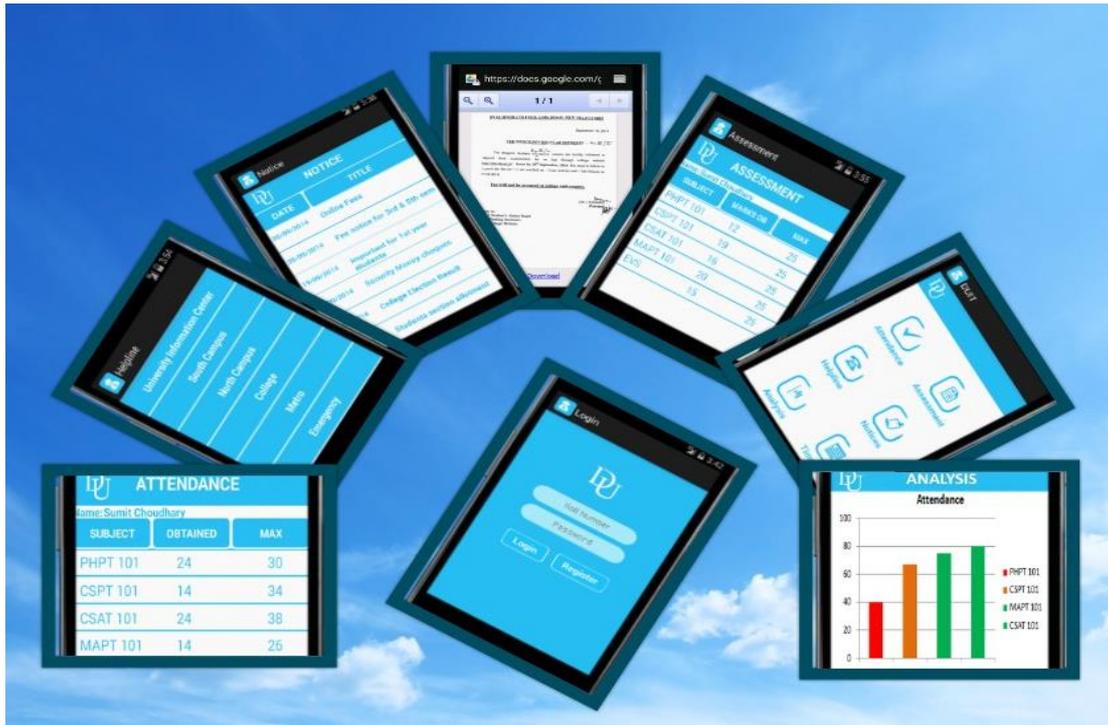


Figure 6. Screens of DUIT

B. What makes DUIT different from existing Apps?

There are apps of other colleges and universities which provide student information. Nevertheless, DUIT is unique in its own way. Not only it provides the general information like notices and helpline to students but it also provides personalized information like student's own attendance, assessment and timetable. Moreover, the analysis of attendance and assessment of students that is provided by the app helps students to know their performance as compared to others. The analysis graphs are easily comprehensible and enable students to take all corrective and preventive measures to ensure better attendance and assessment for coming months. Thus, DUIT helps in strengthening the overall performance of students.

RESULTS

This project has provided an immense learning experience for the teachers and student investigators of DUIT. During the process, team came face to face with a number of challenges which have helped in enhancing their different skill sets. Multi-dimensional learning has happened which can be broadly categorized as- Improved Technical Skills, Better Interpersonal skills, Strong Time-Management, Enhanced Work Ethics, Team-work, and working with a Goal-Oriented Approach.

A. Goal-Oriented Approach

The project has given the team an ability to pursue a common goal. Initially the team had little knowledge about the task to be accomplished. For most of the students, it was their first rendezvous with a live project. But during the course of project, a

passion of achieving the goal was instigated in the hearts of the enthusiastic students. The project has taught all the students a life-time lesson of focused hard work with patience. It has also taught commitment to work by believing in 'Work is Worship'. It has given them a fighter's spirit to deal with the problems coming in their way. Despite many hits and trials, they did not give up and finally made their dream functional in form of a live app. Moreover, this project has also made the students taste the sweetness of the fruit of accomplished task, a real feeling of contentment.

B. Technical Skills

These skills can be further classified as User Interface (UI) designing skills and programming skills. To finalize UI design of app students learnt design tools such as, Adobe Photoshop, MS Paint. Use of these tools along with creativity of students gradually transformed them into expert graphic designers.

At the same time, the other group of students acquired the programming skills of android development. It took a lot of hard work but the results were incredible. The novice programmers turned out to be proficient android app developers who could code well not only using Java/android SDK, but could also write specialized web services.

Another group of students also did exceptionally well by learning mathematical software 'Mathematica', integrating it with the data of college students and producing comprehensive graphs which could be used to analyze performance of the student.

C. Interpersonal Skills

Project infused fine interpersonal skills in the students. They were involved in group discussions which imparted high-quality communication skills in them. They were able to speak up their mind and share their ideas. They learned to listen to other people's opinions and respect their perspectives. They became skilled at finding out the solutions which were of maximum benefit to the project rather than themselves.

They also participated in design of poster and pamphlets which further enhanced their creativity. Time to time they had to present reports to their teacher investigators which enhanced their document preparation and report writing skills. Most importantly, the ability to perform under pressure and strict deadlines was also cultivated.

D. Time-Management

Students learned to balance their classes, assignments, tests, exams and personal lives with ever demanding project work. It has imparted magnificent time-management skills in teachers and students as they took out time for various project activities on daily basis and meetings on weekly basis.

E. Team Work

Project has also inculcated the spirit of team work and coordination within the students. It was the combined effort of the all the three departments that resulted in

synergy which ended up in a final product which was greater than the sum of their individual capabilities. It has brought together students and teachers as team and made their relationship informal and more productive.

F. Market ready

The students have become strong in technical as well as soft skills. They got exposure of working in a real project within an interdisciplinary team. All this has made students more prepared for market and ready to face challenges of real work environment once they go out and face the competitive industry and market.

CONCLUSION

DUIT has emerged as a handy tool for the students. It brings notices, helpline and students personalized attendance, assessment, timetable to the pocket of every student that can be accessed at convenient hour.

DUIT has been developed as a part of interdisciplinary project with a contribution of three departments. The App has bestowed multi-faceted benefits to the student investigators. On one hand it has given them immense technical knowledge and valuable experience of the real life job. On the other hand, the actual benefits of this app are to be enjoyed by one and all. Now access to any information related to Delhi University and its students is a child's task, far away from the traditional hardships faced by people.

ACKNOWLEDGMENTS

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