#SMARTSCHOOL: PLAY WITH OUR BUILDING!

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Abstract

This project is designed to show the different factors that affect student satisfaction and to statistically analyse how their occurrence may impact the student learning process. Customer feedback should be very important to every organization. The information extracted from the users of facilities help to improve their efficiency. In education, the customers are the students and providing the possible maximum satisfaction is the responsibility of every educational institution. This project seeks to explore various ways through which immediate feedback could be extracted from students as easily as possible and quickly analysed for use such as improving teaching effectiveness. The question discussed in this project is how much information we can really derive, analyse and conclude from the little input retrieved from students. The idea is to create a system that accepts very little input from each student, use this data to extract useful information about how the students feel about the lecture, course delivery or lecturer. One of the reasons why students tend not to participate in course evaluations sometimes is the sheer number of questions asked during the evaluation process. If there was a way to answer just one question to view your thoughts, it would seem much simpler and less of a hassle.

Given the concept of open data, certain non-sensitive information will be captured and tested statistical methods will be used to draw reasonable conclusions from the data. Putting most factors into consideration such as time, location and psychological differences, this project aims to provide continuous feedback from the students for each course taken. Students could be empowered to express their thoughts while the course is being taken so they can benefit from their feedback. This is to be achieved by positioning mini devices at the exits of lecture rooms for the students to simply punch in a rating as they leave. So far, these devices have been acquired but not yet assembled. The database, file format and method

of data transmission have been debated and now structured. The analysing program at the back-end is all being developed and the means of data retrieval has also being handled.

Chapter 1

Introduction

This project seeks to describe a sort of science behind student satisfaction via feedback received from the students, taking into considerations different elements that influence their decision on how well a class was. Organizations would like to know how much their customers benefit from facilities they provide, how efficient they are and if the clients will be willing to keep using them. When dealing with a school as an organization, discovering the science and experimenting on several catalysts that influence student satisfaction becomes an important area of research. In past times, students were seen as the products of educational institutions but after continuous research it became clear that the students were also the customers [Enache, 2011]. Providing the students with the best possible level of satisfaction immediately became paramount to educational institutions. In recent years, student feedback seems to have become a vital factor to educational improvements. [Enache, 2011] claimed that satisfying students is important in every institution using feedback processes. Although this has mostly brought good results, there is an obvious difference in feedback gotten at the end of the academic period as opposed to feedback gotten during the semester. This is because most of the time, the providers of the feedback do not get to benefit from it. Research has also shown that the result of the evaluations are handled differently according to the attitude of the heads of the schools towards said findings [Caemmerer and Wilson, 2010]. Educational Institutions tend to focus more on extracting feedback from students as opposed to using the extracted information to better the quality of the learning process to increase efficiency [Rollins et al., 2012].

The learning process encapsulates not only teachers but mentors, peers and the resources used during the process. They work together to produce different learning methods to attend to the learning needs of the students [Goldsmith et al., 2006]. It is the foremost responsibility of the faculty to organize stimulating programs in an atmosphere that promotes easy learning. This should also help the students in attaining educational degrees to become professionals in their chosen careers [Wilson et al., 2009]. Hence the question is how educational institutions know they are providing the maximum level of satisfaction from all their services combined for the students. How can they extract this information with complete anonymity from the students as well as full participation in the evaluation process?

Course evaluation is the typical method used to obtain student feedback at the end of every module taken. The students are usually asked strategic questions to extract information on the students view of how well that module was taught. Every factor is usually put into consideration from the tutors, to the coursework, practical work and the learning environment. Whether this is paper based or taken electronically, the school always tries to provide some sense of anonymity so that the students giving this evaluation will be free to express their thoughts without any fear of repercussions. The students data except identity is extracted so as to be able to draw an informed conclusion.

Providing feedback is a customer's choice therefore it cannot be enforced on the students. The problem is because it is not obligatory the amount of students that give feedback always varies; hence results may differ in several cases. Sensitizing students on the importance of feedback is always helpful in getting them to participate in the process [Poulos and Mahony, 2008]. There are many reasons why students might not participate in the process. It could just be as a result of having a lackadaisical attitude; the timing and location in which the evaluation is presented may not be comfortable or the time taken to answer the evaluation is too long because of the number or nature of the questions. In any case optimizing all factors to ensure that a high number of students undergo the feedback process is vital.

Technology seeks to make life easier and work faster in many ways such as portability and accuracy. The more we evolve, the more we shrink the devices we need to perform certain day to day activities. Trying to eliminate some of the factors that hinder students from participating in feedback is one of the major objectives

of this project. In this sense we intend to make the process less tedious, very quick and easy to access. Moreover the purpose of this project is to provide immediate feedback to the school on the lecture that was just taken by the students. This will enable the lecturer to have some idea on how well the class is following early enough in the entire course delivery.

1.1 Project Aim and Objectives

The main goal of this project is to enable students to provide immediate quick and easy feedback for lectures as they are taken, create a database for the accumulated feedback, analyse it and provide valuable detailed results for the school. To achieve this aim, the project has been broken down into a set of objectives:

- Providing a quick and easy to use means of extracting feedback immediately a lecture or event is finished and placing them by the exits and other suitable locations in the venue.

- Creating a well-structured database for the student feedback extracted from each lecture and saving it in a format ready for analysis.

- Designing an efficient system that can work with open data (data feeds from school time table, lecture location, calendar, weather forecast etc.).

- Using the student feedback as well as open data for analysis to produce valuable detailed results for the school.

- Constructing different methods through which the analyzed information could be disseminated to required parties.

- Presenting and saving this information in an appropriate manner for future analysis and further research.

1.2 Report Structure

The rest of the report is structured as follows:
Chapter 2: Background and Literature review
This chapter provides a larger scope and relays past ways in which feedback has been handled. It elaborates on the methods of data capture, data management

and data analysis and how they have been practiced. It also gives a fore knowledge of customer feedback and the importance of carrying out the whole process.

Chapter 3: Methodology

This chapter explains the methodology of the entire project and enlightens as to why different steps and decisions were taken during the cause of development. It relays a description of the requirements and design of the project, evaluation plan, choice of development tools, implementation methodology, devices and programs used.

Chapter 4: Project Progress

This chapter gives a breakdown of how far the project has gone, its current state and how much is left in the development. It shows a documentation and reflection of meetings held, choices debated and final decisions made as to the development of the entire system.

Chapter 5: Summary

This gives a total summary of the project, the contents of the progress report and how the final designed system hopes to be developed.

Chapter 2

Background Report

Student feedback could help in reflecting a report on how satisfied a student is with the educational standards at the point it is taken. In the educational institutions, getting feedback from students could provide the students perspectives on the course or teacher. This in turn should improve the quality of teaching within the institution. Given that most instructors have different teaching methods, personalities, skill set and may not be actually trained to teach, it is important to extract feedback from the students to ensure there is a high level of satisfaction.

2.1 Student Feedback

Student feedback is a form of communication with the school to relay the rate of satisfaction received by the students taking courses at different levels. It involves the students airing their thoughts, views, suggestions and recommendations to help increase the satisfaction level. Capturing feedback from students and using the feedback to derive useful conclusions increases effectiveness in teaching [Center et al.,]. There are ways in which feedback is taken namely Summative and Formative feedback.

2.1.1 Summative Feedback

Summative feedback involves capturing the student satisfaction response after a certain period. This could be the end of a course, semester or academic year [Oblinger et al., 2006]. It is not progressive but very formal and evaluates the subject based on the entirety of the period it was taken.

2.1.2 Formative Feedback

Formative feedback deals with continuous and progressive response on satisfaction levels. It helps inform the school whether the course is going in the right direction and tells if the students are somewhat satisfied with it. It helps to make improvement before the end of the subject being taught [Oblinger et al., 2006]. Formative feedback should be less formal than summative because it is a progressive process and is evaluated on-the-go (Center, Collaboration et al.). Research has shown that well-designed feedback systems should be more of formative than summative because the students usually benefit from the feedback they have given [Moore and Kuol, 2005].

2.2 When did student evaluations start?

The first student evaluation forms recorded in history was taken in a research by [Remmers and Brandenburg, 1927][Smalzried and Remmers, 1943]. This research established the use of scales for rating instructors. Student feedback started to become more popular as the number of tertiary institutions increased and questions about the standards of these institutions arose.

2.3 Why collect student evaluations?

The past decade has seen the rapid development of student evaluations in many institutions as stated by [Harvey, 2003]. The paper claimed that these student evaluations judge quality of higher education. In the research by [Marsh, 2007] it was stated that student evaluations are collected for five reasons:

- Feedback to faculty to enhance and improve teaching practices.

- For personal decisions in measuring teaching effectiveness.

- Give students guidelines when selecting courses and instructors or teachers.

- Monitor the quality of teaching practices.

- A result which can be used for research on teaching.

The research concluded that student evaluations are a function of the instructor who teaches a course rather than the course the instructor teaches. The review

also claims that most institutions do not train their instructors how to fully analyse and make use of these student evaluations. Johnstones (2005) review gives another reason why student feedback is collected, which is for management to check the commitment of their teachers or instructors.

An analysis by [Hampton and Reiser, 2004] was carried out on two groups of students. The first group of students provided feedback on the teaching practices and on the course and the second did not provide feedback. The analysis showed that the group that provided feedback did better in their exams than the group that did not.

Collecting student feedback early has two advantages. Firstly, it enhances the relationship between the instructor and student and secondly, the instructor can adjust his/her teaching practices early enough (Teaching Effectiveness Program 2013).

[Cohen, 1980] carried out a meta-analysis on how student feedback affects teaching effectiveness. The analysis was carried out on two different groups. It showed that on a five point scale of the influence of student feedback or rating, the difference between the group with feedback and the group without feedback was 0.18 with the former having the higher value. He also noticed that feedback does not significantly improve all specific factors of teaching. He concluded that student feedback were very significant in teaching effectiveness in colleges.

All the listed reviews above indicate the importance of student evaluations in improving teaching effectiveness and student outcomes. Student evaluations can also improve the quality of teaching in any institution [Seldin, 1997].

2.4   At what point should feedback be taken?

Feedback from the students could be taken in a summative and formative manner. It was suggested by [Davis, 2009] that the most effective time to collect student evaluations is during the term (also called formative evaluations) rather than end of term or session. This paper illustrated that early feedback can help to enhance students motivation, change students perspective about the course or instructor and improve students performance. When student evaluations are not done regularly, there is no improvement in teaching effectiveness. Instructors must be formatively evaluated by the students as it helps them to improve their teaching [Forsyth, 2003]. Teaching improvement is slow and continuous evaluation

is needed to help the instructors know how they have progressed [Seldin, 1989]. In the review by Overall and [Marsh and Overall, 1979] it was concluded that feedback collected during midterm tends to affect the students results positively. They also claimed that more favourable student feedback is collected at the end of the term.

2.5 Is student feedback enough to improve teaching?

According to [Brinko, 1990], student feedback is not enough to improve teaching. The combination of feedback and consultation from colleagues effectively improves teaching. The research carried out by [Hampton and Reiser, 2004] concluded that when student evaluations are carried out with a consultation process, teachers tend to be more effective. [Seldin, 1989] believes that student feedback should never be the only factor considered when judging teaching effectiveness. The study by [Alemoni, 1978] shows that combining feedback from student ratings on the course and instructor and personal consultation improves the instructor and teaching practices. In the article by [Cashin, 1995], they concluded that student evaluations are reliable and valid and would not require any control by administrators. They also concluded that student evaluations are free from bias. They however stated that student evaluations should not be the only factor used when judging teaching effectiveness.

[Symbaluk and Howell, 2010] carried out a survey on RateMyProfessor.com website (an online website that allows students to give feedback and rate their lecturers). Their research indicates that lecturers or instructors with teaching awards received more positive ratings and comments (on the basis of competence, clarity, appearance, level of difficulty, use of humour and personality) than lecturers with research awards. They also argued that students should be given access to the feedback they have posted as this motivates them.

2.6 Student Participation in Feedback

In a research by [Mulder et al., 2012], a java software codenamed APRES (Anonymous Peer Review and Evaluation System), that carried out anonymous peer reviews, was implemented. The research observed that the peer reviews from their software was very helpful as it improved the performances of all those that were peer-assisted or reviewed. They however noticed that people sometimes chose not to give reviews. To aid in the process of getting valuable feedback from students, keep these tips in mind [Huba and Freed, 2000]:

- Students need to be educated on the importance and meaning of feedback. There is a clear distinction between feedback and talk-down. Feedback elaborates on what was and was not accomplished in terms of goals.

- Students need to feel the protection of anonymity to provide truthful and useful feedback. Ratings of teachers and courses are always preferable when the students who provide these ratings are anonymous [Feldman, 1979].

- Direct the evaluations towards describing the satisfaction of behaviours and processes, rather than the instructors personality.

- Ensure that the data extracted is used for the improvement of the subject. The greatest purpose of evaluation is to improve performance [Seldin, 1989].

- Response to the students feedback should include suggested changes to the course. Feedback from student ratings is reliable [Marsh and Overall, 1979].

- Always try to practise feedback reciprocation by thanking the students for participating in the process. Another way to get positive feedback is by increasing clones between instructors and students [Jameson, 2009].

- Make it absolutely clear to the students that any feedback given what so ever will in no way affect their grades for the course although expected grades affect the outcome of student evaluations [Johnson, 2002].

Having all this in mind, this project will seek to get feedback from students immediately a lecture is completed. The purpose of this will be to increase performance in the institution. Undergoing student evaluations is essential [Feldman, 1979] and with this in mind, the system designed will make all student evaluations anonymous. The project will seek to collect as little data from the students

as possible and will read useful information from this data. By collecting little data and making the evaluation process simple, students may be encouraged to participate in the process. The information extracted from the feedback will be forwarded to the interested parties like the teachers, instructors etc. so they can have an idea of what the students think about the course and the teaching methods. This way the students may feel more motivated that their views are being taken into consideration.

2.7   Student Feedback Process

To construct a well-designed feedback system, exactly what is being extracted from the students and what will be evaluated will be clearly stated.
[Douglas et al., 2006] stated in a research that students are more interested in the lectures, class notes, delivery of knowledge and lecturer persona as opposed to the physical facilities and services present at the school. This means feedback extraction should be focused towards lecture presentation quality and strategic knowledge engineering questions should be asked towards this gain. The choice of student feedback mechanisms depends on what you want to know from the students and why [Keane and Labhrainn, 2005]. More technology should be included in the classrooms to aid student evaluations and learning [Buhay et al., 2010].

2.7.1   Data Capture and Feedback Extraction

This is a process that involves acquiring information from students about a particular subject in which they have been a part of. It has been carried out in the past by paper forms with questions asked about the subject and students answering the questions and submitting [Ardalan et al., 2007]. In the review by [Juwah et al., 2004], they used electronic voting system to gather immediate feedback from students during the lectures. It has also been done in the form of verbal questioning, focus groups, surveys, questionnaires, and letters, some of which do not provide a certain feeling of anonymity.
One major factor in collecting feedback is anonymity of the students. In a research, [Colliver, 1972] concluded that anonymity is essential when capturing student feedback as non-anonymous students tend to give more positive evaluations than anonymous students. He also observed that staff rank, salary, experience and highest qualification were unrelated to the student evaluations. During his

research in the seventies, student evaluations were collected in paper forms. Technology today makes it easy to collect feedback from students [Center et al.,], [Killi and Nossum, 2003]. The trick is to use technology that the students find easy to use and are comfortable with. An example is the use of mobile phones for student evaluations. Using mobile phones increases user participation and allows students to work in their comfort (Wit, 2003). Another device that improves student engagement and learning in the lecture room is the use of clickers [Cechinel et al., 2011]. The review by [Caldwell, 2007] concludes that clickers enhance student participation and increases active learning. The outcome of the study by [Kyei-Blankson, 2009], shows that clickers have positive effects on student performances.

Methods of technological feedback usually bring a high measure of anonymity to the user. It also helps as the students will not be pressured to hastily carry out their evaluations like paper surveys. The inclusion of technology also makes feedback easy to extract from the students. Most technological feedback systems make data easy to store, organise and analyse.

2.7.2 Data Management

Data management after initial extraction is important. At this point it is important to ensure that the feedback is properly stored and well organized for thorough analysis. The use of electronic data has vastly increased in almost all fields [Jackson, 2007]. McKendrick (2010) claims that data is speedily growing in 9 of 10 companies. Managing this data growth efficiently is extremely important (Townsend, 2011). Student evaluations in recent time are carried out online in most institutions. These online evaluations are stored and managed through the use of databases or online files. Paper based evaluations could be stored in files and folders secured in cabinets. Although storing data on paper could have some merits like never experiencing software vulnerabilities, storing data electronically is may be preferred because data retrieval is easier. Electronic data could be said to be easier to replicate and cheaper (Husni, 2008). Electronic storage also has the advantage of being permanent (R.S.Meena). The proceedings from focus groups and verbal questionings could be recorded and also stored in a safe location for future analysis.

When data is collected electronically, it could be sorted in different formats and stored in different ways. It is also safer because it is way easier to create a backup

for such kind of information. Also depending on the level or depth of questioning, the factors being considered as affecting the quality of the lectures and presentations could be grouped so as to easily pick them out when it is time for analysis. This method of management is also important in case future analysis at a much later date is to be carried out on past feedback which has been securely saved.

2.7.3 Data Analysis

It is important that the person performing the analysis of the feedback data has nothing to do with the subject of analysis so that person can be as objective as possible. During analysis of paper based feedback, it could get a bit tedious if it involves a lot of writing and because of that, human error can creep in. Students with obvious, unique cursive styles or terrible handwritings could easily be spotted and by that, the shield of anonymity becomes compromised. In any case, human analysis is mostly guaranteed to have some sort of error for many reasons like calculations, or just human bias, or lackadaisical attitude to work. Using electronic means to analyse data produces a better level of accuracy and removes human error except the analysing software is not well written. In data analysis, many factors are considered when drawing a conclusion to the feedback provided by the students. This is done that ways to eliminate all possible causes of poor satisfaction or to help maintain a good level of satisfaction.

2.7.4 Criticisms

A research by [Rotem and Glasman, 1979] concluded that feedback gotten from student ratings does not effectively improve the institutions teachers or instructors. They attributed their conclusion to the fact that students were not a credible source of information. They however stated that there could be improvement in that field.

[Braskamp and Ory, 1994] contradict the findings above as they suggest that they most effective assessment of teachers is not by student evaluations but by peer reviews from colleagues and administrators.

The research by [Marsh and Roche, 1993] showed that end of term ratings seem to be effective on teachers than mid-term ratings.

Chapter 3

Research Methodology and Project Plan

3.1 Research methodology

Having said that the objectives of this project are to develop a system that will:

1. Give students the opportunity to provide an immediate feedback about their satisfaction of the lecture,

2. Create a database for this feedback and for the factors that may influence them.

3. Constructively analyse the feedback and generate meaningful information to interested parties about the quality of the lecture and why that feedback may have turned out that way.

Under the following assumptions and constraints:

1. The students that rate their votes will be the target population. Hence gender ratio and students not present in lectures are not a limitation to the system because the population we are interested in are the students present in the lecture [Fraenkel et al., 1993].

2. The information we will draw out from our data will only be a heuristic indication not an induction that can thoroughly be relied on see heuristics versus inductive reasoning [Krantz et al., 1983]. This is due to the speculative nature of open data [Reichman et al., 2011] (such as weather, timing,

lecture duration, day of the week, student level, lecture location etc. which we will use to analyse the data).

3. Also there is a fact that we cannot and do not want to prevent students from rating more than once because if this happens it means that the student is extremely pleased or extremely displeased. This unfortunately denies us the claim that every student has exactly one rating for a lecture. Although this might seem bad, it is a desirable quality during analysis.

To achieve these in the context of these assumptions and constraints, the following methodology has been adopted.

3.1.1 Requirement gathering

Since the project is an implementation of a prototype, there was the need to gather true requirements of the system. Various stakeholders involved in the system including the schools database administrators (to know how much data we will be privileged to have and in what format) have been spoken to. Various conversations were also held with a few students to know if they will be willing to participate in these student evaluations after the lectures. A few lecturers were contacted to know what criteria will truly add value to their teaching experience through this system. Lastly, some discussions with the schools management through Student Support Office (SSO) and the projects supervisors were held. These discussions have helped to tailor all requirements gathered according to the order of preference [Ma, 2009] using the popular MOSCOW (Must have, should have, could have, would like to have) method of requirement engineering.

3.1.2 Background Study

A background study was undergone using journals, articles, publications and patents on the following fields: Systems that gather student feedback, customer feedback, data collection methods, open data, data analysis, student satisfaction, teacher-student and the learning process, customer satisfaction, etc. This gave a broad understanding of the problem, existing approaches to the problem and limitations in previous technologies. It also helped to richly enlighten us on how to make our system unique and marketable.

3.1.3   Implementation Methodology

Based on background research, this is the first time this system would be implemented for student feedback purpose after each lecture in our institution. Hence the methodology adopted will be a hybrid of software prototyping with agile processes.

The use of software prototyping will be adopted because the system to be built will not directly be installed and ready for use. The prototype that will be built will be test run by the University of Manchester. If it passes the evaluation plan and the university is impressed by the implementation, the system will move into its production state. The prototype being built is based on existing technology like arduinos, raspberry pis and others. During production state, more suitable components will be built like specific electronics/boards being built to maximize power usage, transmission of data, storing of data, backup issues etc. Also, because one module, i.e. the data capture module may be ready before the other module, it is essential to build stub prototypes to artificially test one module before integrating the entire system.

Agile methods have been a proven methodology for building systems that have varying requirements [Abrahamsson et al., 2002] [Abrahamsson et al., 2003]. In the course of the implementation of this system, some new requirements may be discovered which will in turn change the implementation of some features, and reprioritise some other. This approach will be very helpful as in the midst of changing requirements working features of the system can be demonstrated to the users at the end of each iteration. Furthermore, this approach will pay off in the end because feedback can be gotten on the implementation from the users of the software as often as possible because bugs or changes in requirements towards the end of the implementation will be more costly [Boehm, 2002].

3.1.4   Project Spikes (Learning)

This project is interdisciplinary and ideally would be implemented by electronics engineering students and computer science students. However, the challenge of learning new technologies such as microcontroller and basic electronic circuitry is welcomed. Also, during the course of implementing the system, there will be need to learn and upgrade the understanding of certain technologies in order to attain success in the project.

3.2   Project Deliverables

At the end of this project, we intend to demonstrate a prototype system that captures student satisfaction from various inputs. The system would manage and store data collected from different sources and then produce a reasonable analysis independent of human intervention. The various devices we intend to use to collect student feedback include:

- A touch screen that will be connected to a microcontroller/ processor with three smiley faces on display for students to touch (select). One smiling, one neutral and one sad face.

- A 3- buttoned physical device sits at the door to a lecture theatre. One button is smiling, one is sad, and middle is neutral. As students exit the lecture theatre, they rate their satisfaction level by hitting a button which sends a message to the server.

- A clicker interface that students can use to rate the lecture directly with their clickers provided by the university.

- A mobile app that students can install on their phones that allows for students to rate a lecture when the lecture is over.

3.3 Design and implementation plan

We have made use of domain class diagrams, some of which may inspire real software classes. The Fig. 3.1 represents domain classes and it gives an entire
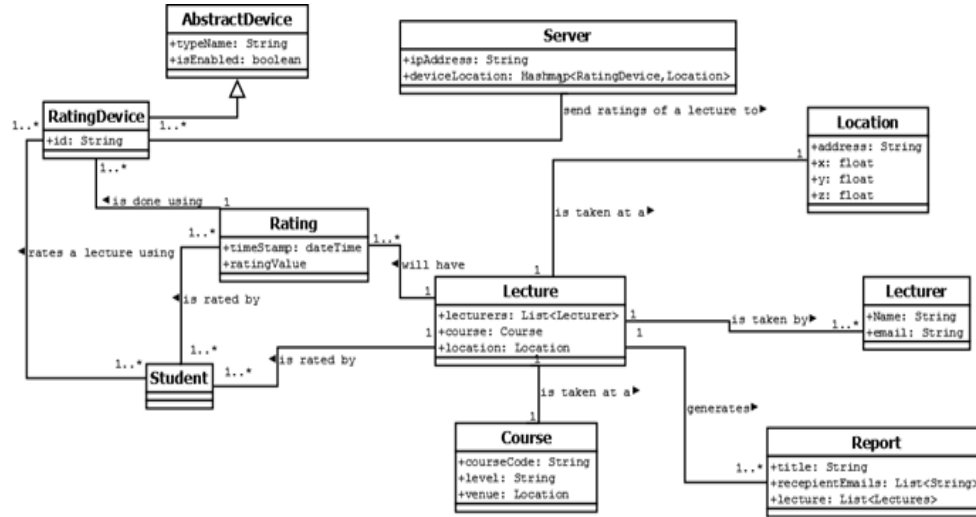

Figure 3.1: Domain Class diagram of the entire system
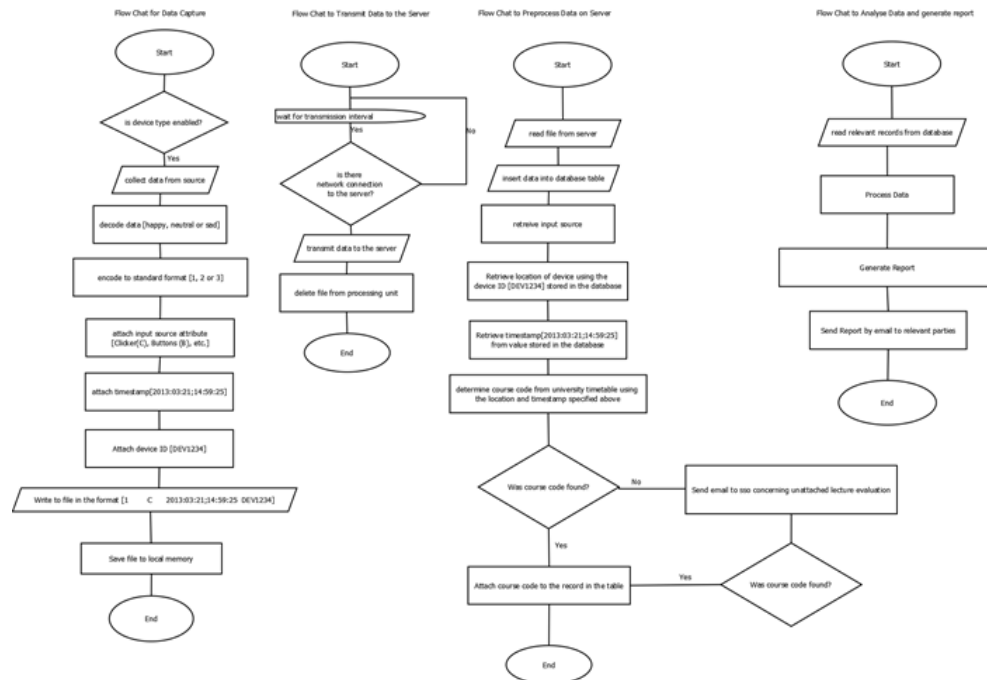
view of the domain of the system.

Figure 3.2: Flowchart showing how the entire system is going to operate

To also understand the flow of the system, we have used the flow chat in Fig. 3.2.

3.4 Rational behind choice of design

1. Server: The server chosen is the thin client/thick server approach where as little as possible processing will be done on the client side to save power and improve centralized maintenance/administration.

2. Processing Unit: the choice of processing units located at the lecture venue was based on robustness and ease of use. Of all the microcontrollers, the ones that are easy to use and provide an Ethernet shield for networking capabilities are the arduinos and the raspberry pis.

3. Rating Devices: The plan is to use technology that is simple to use by the student which may encourage the participation of them. The rating devices will be clickers, hardware buttons, touch screens and a mobile application.

4. Programming platforms: Java will be used for the data analysis simply because there is familiarity with its syntax across all designers and it has several libraries. Python programming will also be used on the raspberry pi because that is the language it was naturally built to use. It also has large library support. For the arduino units, c programming is what it naturally supports. For the database, Structured Query Language (SQL) will be used as this is the language the database supports.

5. Data Storage: Data will be stored in a database called Microsoft Server Structured Query Language (MS SQL) because it is highly scalable, robust, easy to use, great support for views and stored procedures.

3.5 Project Evaluation Plan

Some ways to measure the success of this project was identified:

1. Were the deliverables met?
   Considering the timeframe allocated for this project, this seems like the most likely test that to carry out. If the said deliverables have been met, then other tests can be carried out.

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2. Is the system usable?

   The usability of a system can be ascertained by the stakeholders. Various users of the system will have a feel of it and then out of a sample of the users, questions would be asked that are aimed to reveal how usable the system is.

   Sample questions for the student are: How easy is the system to use?

   Does it take much of your time or resources?

   Sample questions for the lecturers are: Will the system significantly add more work to your daily work?

   How easy is it to administer the system?

   Is the system easy to use or does it require the assistance of an expert?

   For the management questions will be asked like: Is the system user friendly?

   Does it add more to your already tough schedule?

   How often does it fail and is it difficult to troubleshoot when one part of the system fails?

   The feedback collected from this question survey will be used to check usability of the system and improve performance.

3. Comparison with existing systems and with its feedback over the years?

   Again, some criteria needs to be judged: there is need to answer questions by comparing it with other systems using some criteria like: System ease of use, timeliness of the feedback, how much information gathered from feedback, willingness to use the system, etc.

   values can also be compared such as: If the average student satisfaction improves over a symmetric period such as 1 or 2 sessions, then it is easy to say, it is likely that feedback from the system has pointed out lapses in the quality of lecturing therefore, the management and lecturers have fixed the lapses, which in turn improved subsequent feedback sessions.

4. Economic Value: it is easy to say that this system will have a high acquisition cost, but moderate maintenance and operational cost as compared to other feedback systems. The only operational cost envisaged here is the cost of powering the devices. Little or no administrative cost, except upgrades are needed.

In all these evaluation plan options, the first stage of the evaluation plan will be to check against the said deliverables. Afterwards, measure the systems usability,

re-evaluate the productivity of the system, then compare this student feedback method against other methods using the criteria mentioned above.

3.6   Project Plan

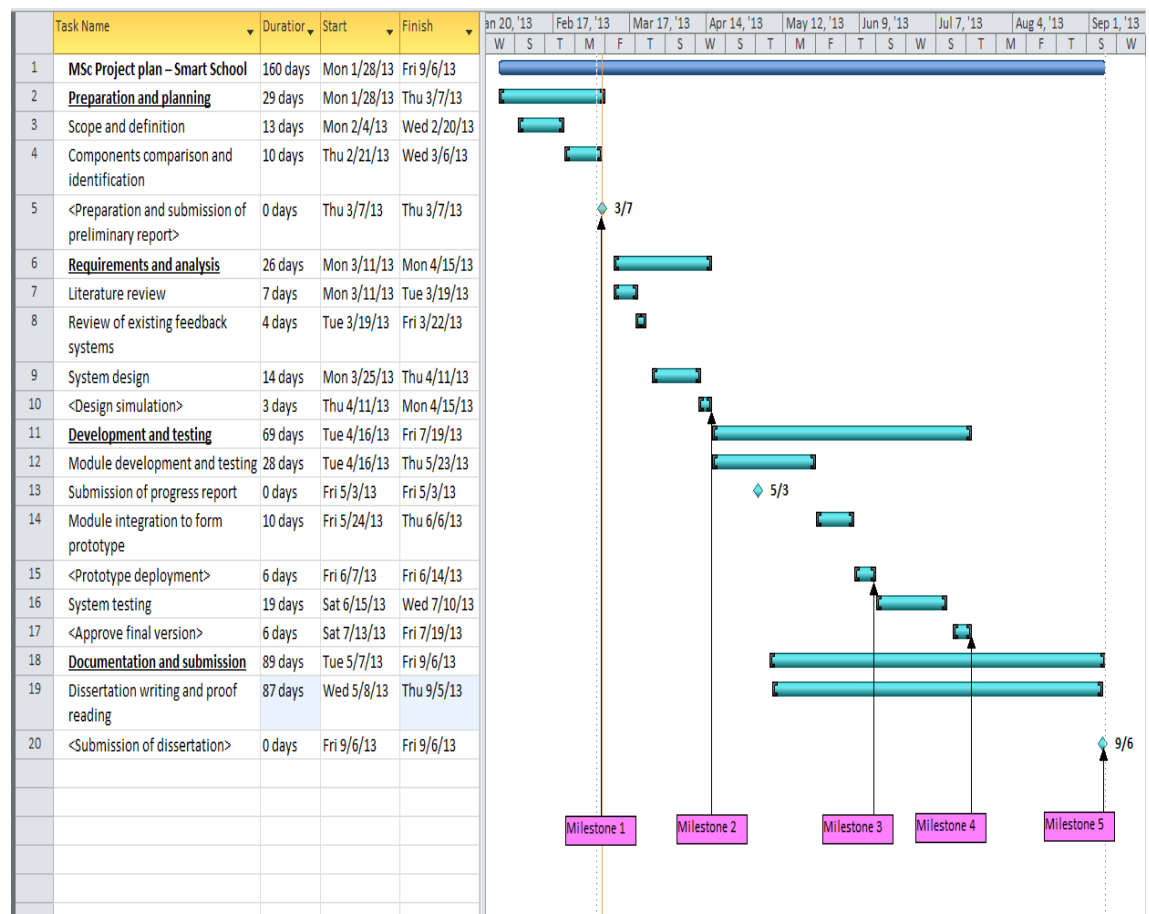Find below, the group project plan including milestones.

Figure 3.3: Gantt Chart

Chapter 4

Project Progress

This chapter gives at full length the progress made on this report.Progress on this project can be summarised as follows:

1. Requirement Gathering: Requirement gathering for the project has been done. Although new requirements are bound to be discovered in the course of the project, the ones gathered so far are sufficient to begin the implementation of the main features of the system.

2. Interviews to gather materials and information: Several meetings were held with strategic stakeholders and contributors into this project. A meeting was held with Jim Garside, who is very vast with electronics and he offered us advice on what devices to consider using to capture data, and those not to consider. He particularly discouraged us from using any kind of voice syntheses to capture data for now because the engines are not very stable and will introduce erroneous feedbacks. He also helped us narrow our choices of processing units to use to the arduino and raspberry pi.
At a point, reverse engineering the device was considered as a method to interpret what frequency corresponds to a particular button on the University of Manchesters clicker devices. This would have helped, but the frequency read from each clicker was cryptic in that, only the supplied clicker receiver knows how to interpret the frequency. This necessitated our need to contact the manufacturers of the device to request for an API. Meeting was held over the phone with the representatives of the owners of the clicker software used in students response. The discussion was on how best to use their software to gather feedback using either the arduinos or the

raspberry pi as a processing unit. After they carried out their research on two platforms and discovered that raspberry pi runs on the Linux OS, they immediately suggested using that. Upon completion of their requisition form, they have agreed to release their API to extend the functionalities of the existing software to include student satisfaction from lectures using the clicker software.

3. A complete literature review: Background research has been carried out on how student evaluations in institutions affect teaching. This review also includes: when student evaluations should be carried out and effective ways of carrying out feedback. A broader work was done on customer feedback to find out how feedback systems work in other domains. Also extensive work was done as regards data collection, microcontrollers versus microprocessors, data storage and management techniques, data analysis, open data etc.

4. Mobile application: The implementation of the user interface of the mobile application as on one of the data capturing means has also been completed. The implementation has been done to leverage the advantages responsive web design (RWD) therefore, depending on the size of the mobile display, the user interface will spread or collapse to fit in. Currently the code to transmit data to the backend is being developed.

5. Database design: A fully normalized database schema already created in Microsoft SQL to save data from student ratings or feedback. The database schema contains the basic features for data storage. Triggers, referential rules, are the aspects being currently implemented. It has also been identified that security of data is of importance, therefore this subject is well included as part of the implementation features.

6. Data analysis: Already discovered few data analysis procedures that analyse the ratings from student feedback. Constraints have also been identified that may affect the identity of the information such as sudden change in lecturer, course location, etc. Suitable procedures will be taken against such constraints to ensure that the analysis of the data is as reliable as possible.

7. System Design: A domain design of the system has been done to clearly identify multiplicities between each class, and other forms of relationship.

This helped in clarifying the requirements and identifying areas that needed further definition. Also, a flow chat was necessary to communicate the flow of the system.

8. To do: Acquisition of the devices to be used is being done by our supervisors but of a product backlog that contains the several features of the system, and which features to implement in the first release of the system is being developed using Leankit(a tool for scrum planning).

Chapter 5

Summary

This document has been written with the aim of documenting the progress done on the project so far as well as the background research carried out on the topic. So far it has been discovered that while gathering formal, elaborate feedback from students at the end the course delivery is good; gathering little feedback much frequently (ideally after every lecture) during the course delivery period has much advantages.

According to the initial project plan, the project is on course and in its design phase. The project is progressing at a steady pace and should be completed at the allotted time with all milestones met.

Bibliography

[Abrahamsson et al., 2002] Abrahamsson, P., Salo, O., Ronkainen, J., and Warsta, J. (2002). Agile software development methods: Review and analysis.

[Abrahamsson et al., 2003] Abrahamsson, P., Warsta, J., Siponen, M. T., and Ronkainen, J. (2003). New directions on agile methods: a comparative analysis. In *Software Engineering, 2003. Proceedings. 25th International Conference on*, pages 244–254. Ieee.

[Alemoni, 1978] Alemoni, L. M. (1978). The usefulness of student evaluations in improving college teaching. *Instructional Science*, 7(1):95–105.

[Ardalan et al., 2007] Ardalan, A., Ardalan, R., Coppage, S., and Crouch, W. (2007). A comparison of student feedback obtained through paper-based and web-based surveys of faculty teaching. *British Journal of Educational Technology*, 38(6):1085–1101.

[Boehm, 2002] Boehm, B. (2002). Get ready for agile methods, with care. *Computer*, 35(1):64–69.

[Braskamp and Ory, 1994] Braskamp, L. A. and Ory, J. C. (1994). *Assessing Faculty Work: Enhancing Individual and Institutional Performance. Jossey-Bass Higher and Adult Education Series.* ERIC.

[Brinko, 1990] Brinko, K. T. (1990). Instructional consultation with feedback in higher education. *The Journal of Higher Education*, pages 65–83.

[Buhay et al., 2010] Buhay, D., Best, L. A., and McGuire, K. (2010). The effectiveness of library instruction: Do student response systems (clickers) enhance learning? *The Canadian Journal for the Scholarship of Teaching and Learning*, 1(1):5.

[Caemmerer and Wilson, 2010] Caemmerer, B. and Wilson, A. (2010). Customer feedback mechanisms and organisational learning in service operations. *International Journal of Operations & Production Management*, 30(3):288–311.

[Caldwell, 2007] Caldwell, J. E. (2007). Clickers in the large classroom: Current research and best-practice tips. *CBE-Life Sciences Education*, 6(1):9–20.

[Cashin, 1995] Cashin, W. E. (1995). Student ratings of teaching: The research revisited. idea paper no. 32.

[Cechinel et al., 2011] Cechinel, C., Sánchez-Alonso, S., Majerich, D. M., Stull, J. C., Varnum, S. J., Smestad, B., Ducette, J. P., Ochoa, X., Barcelos, C. F., Gluz, J. C., et al. (2011). Analyzing associations between the different ratings dimensions of the merlot repository. *Interdisciplinary Journal of E-Learning and Learning Objects*, 7:1–9.

[Center et al.,] Center, I., Collaboration, P. S., Center, H.-T., All, W., and Home, A. Gathering student feedback.

[Cohen, 1980] Cohen, P. A. (1980). Effectiveness of student-rating feedback for improving college instruction: A meta-analysis of findings. *Research in Higher Education*, 13(4):321–341.

[Colliver, 1972] Colliver, J. A. (1972). A report on student evaluation of faculty teaching performance at sangamon state university. *Technical paper*, (1).

[Davis, 2009] Davis, B. G. (2009). *Tools for teaching.* Jossey-Bass.

[Douglas et al., 2006] Douglas, J., Douglas, A., and Barnes, B. (2006). Measuring student satisfaction at a uk university. *Quality assurance in education*, 14(3):251–267.

[Enache, 2011] Enache, I. C. (2011). Customer behaviour and student satisfaction. *Bulletin of University of Transilvania*, 4(53).

[Feldman, 1979] Feldman, K. A. (1979). The significance of circumstances for college students' ratings of their teachers and courses. *Research in Higher Education*, 10(2):149–172.

[Forsyth, 2003] Forsyth, D. R. (2003). *The professor's guide to teaching: Psychological principles and practices.* American Psychological Association Washington, DC.

[Fraenkel et al., 1993] Fraenkel, J. R., Wallen, N. E., and Hyun, H. H. (1993). How to design and evaluate research in education.

[Goldsmith et al., 2006] Goldsmith, M., Stewart, L., and Ferguson, L. (2006). Peer learning partnership: an innovative strategy to enhance skill acquisition in nursing students. *Nurse education today*, 26(2):123.

[Hampton and Reiser, 2004] Hampton, S. E. and Reiser, R. A. (2004). Effects of a theory-based feedback and consultation process on instruction and learning in college classrooms. *Research in Higher Education*, 45(5):497–527.

[Harvey, 2003] Harvey, L. (2003). Student feedback [1]. *Quality in Higher Education*, 9(1):3–20.

[Huba and Freed, 2000] Huba, M. E. and Freed, J. E. (2000). Learner centered assessment on college campuses: Shifting the focus from teaching to learning. *Community College Journal of Research and Practice*, 24(9):759–766.

[Jackson, 2007] Jackson, C. (2007). Plan now for managing electronic data and avoid tomorrows legal risks.

[Jameson, 2009] Jameson, C. (2009). How to improve your student evaluations of teaching. *Retrieved March*, 12:2012.

[Johnson, 2002] Johnson, V. E. (2002). Teacher course evaluations and student grades: An academic tango. *Chance*, 15(3):9–16.

[Juwah et al., 2004] Juwah, C., Macfarlane-Dick, D., Matthew, B., Nicol, D., Ross, D., and Smith, B. (2004). *Enhancing student learning through effective formative feedback.* Higher Education Academy (Generic Centre).

[Keane and Labhrainn, 2005] Keane, E. and Labhrainn, I. (2005). Obtaining student feedback on teaching & course quality. *Brie ing paper*, 2.

[Killi and Nossum, 2003] Killi, M. and Nossum, A. (2003). Internet-based stated preference surveys. studies in traffic information and public transport. In *4th*

Associationfor-Survey-Computing International Conference, Asc, pages 255–266.

[Krantz et al., 1983] Krantz, D., Jepson, C., Kunda, Z., and Nisbett, R. (1983). The use of statistical heuristics in everyday inductive reasoning. *Psychological Review*, 90(4):339–363.

[Kyei-Blankson, 2009] Kyei-Blankson, L. (2009). Enhancing student learning in a graduate research and statistics course with clickers. *Educause Quarterly*, 32(4).

[Ma, 2009] Ma, Q. (2009). *The effectiveness of requirements prioritization techniques for a medium to large number of requirements: a systematic literature review*. PhD thesis, AUT University.

[Marsh, 2007] Marsh, H. W. (2007). Students evaluations of university teaching: Dimensionality, reliability, validity, potential biases and usefulness. In *The scholarship of teaching and learning in higher education: An evidence-based perspective*, pages 319–383. Springer.

[Marsh and Overall, 1979] Marsh, H. W. and Overall, J. (1979). Long-term stability of students' evaluations: A note on feldman's consistency and variability among college students in rating their teachers and courses. *Research in Higher Education*, 10(2):139–147.

[Marsh and Roche, 1993] Marsh, H. W. and Roche, L. (1993). The use of students evaluations and an individually structured intervention to enhance university teaching effectiveness. *American Educational Research Journal*, 30(1):217–251.

[Moore and Kuol, 2005] Moore, S. and Kuol, N. (2005). A punitive bureaucratic tool or a valuable resource? using student evaluations to enhance your teaching. *Emerging Issues in the Practice of University Learning and Teaching. Dublin: AISHE. http://www. aishe. org/readings/2005-1.*

[Mulder et al., 2012] Mulder, R. A., Elgar, M. A., and Brady, D. (2012). Apres: Electronically managed student feedback via peer review. In *Proceedings of The Australian Conference on Science and Mathematics Education (formerly UniServe Science Conference)*, volume 11.

[Oblinger et al., 2006] Oblinger, D. et al. (2006). *Learning spaces*, volume 2. Educause Washington, DC.

[Poulos and Mahony, 2008] Poulos, A. and Mahony, M. J. (2008). Effectiveness of feedback: the students perspective. *Assessment & Evaluation in Higher Education*, 33(2):143–154.

[Reichman et al., 2011] Reichman, O., Jones, M. B., and Schildhauer, M. P. (2011). Challenges and opportunities of open data in ecology. *Science(Washington)*, 331(6018):703–705.

[Remmers and Brandenburg, 1927] Remmers, H. H. and Brandenburg, G. (1927). Experimental data on the purdue rating scale for instructors. *Educational Administration and Supervision*, 13(6):399–406.

[Rollins et al., 2012] Rollins, M., Bellenger, D. N., and Johnston, W. J. (2012). Customer information utilization in business-to-business markets: Muddling through process? *Journal of Business Research*, 65(6):758–764.

[Rotem and Glasman, 1979] Rotem, A. and Glasman, N. S. (1979). On the effectiveness of students evaluative feedback to university instructors. *Review of Educational Research*, 49(3):497–511.

[Seldin, 1989] Seldin, P. (1989). Using student feedback to improve teaching. *New Directions for Teaching and Learning*, 1989(37):89–97.

[Seldin, 1997] Seldin, P. (1997). Using student feedback to improve teaching.

[Smalzried and Remmers, 1943] Smalzried, N. T. and Remmers, H. H. (1943). A factor analysis of the purdue rating scale for instructors. *Journal of Educational Psychology*, 34(6):363.

[Symbaluk and Howell, 2010] Symbaluk, D. G. and Howell, A. J. (2010). Web-based student feedback: comparing teaching-award and research-award recipients. *Assessment & Evaluation in Higher Education*, 35(1):71–82.

[Wilson et al., 2009] Wilson, B. L., Anderson, J., Peluso, C., Priest, J., and Speer, T. (2009). Student satisfaction and team development outcomes with preassigned learning communities. *Journal of Professional Nursing*, 25(1):15–22.