my.eskwela: A Mobile Approach to Visual and Social Student Information System

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***Abstract*—Modern Student Information System used Web based portal accessible using an internet browser, connected either through the internet or through the campus local network. Many of these have presented the data in textual mode and have no facility to connect socially in an existing social networking site to share visualised performance values. Moreover, the desktop web site is not designed for mobile devices thus making it hard to navigate on devices with limited screen capabilities. This study developed a module for Student Information System (SIS), named my.eskwela, which provides desktop and mobile access through web and SMS. my.eskwela desktop web interface provide different input mechanisms for faculty members thus easing the preparation of reports which includes the socially share-able visualisation of attendance tracking and class grade monitoring to supply students and parents direct, real-time access to the most relevant student academic information available through the web and through mobile platform. The results are remarkable such that not a single respondent in any user groups doubted its intention to use the systems as none expressed disagreement in this area. The results are actually good indicators that the three systems are good investments to set the bar of student information systems software services to higher level.**

***Index Terms*—Student Information System, mobile Student Information System (m-SIS), Social Networking Sites, Data Visualization, Functions, High-Order Functions, Agile Software Development**

I. Introduction

MOST universities use student information system that gives online tools for the students and faculty members via the internet access. An online learning system such as MSU-IITs MOLE is an example of such a tool. Even with innovations like this, there is still a demand for higher level of mobility that may be a promising solution in learning and performance monitoring among students, faculty members and parents.

The current system does not allow students to view temporary grades in the class thus a personal inquiry must be done, also parents from far places does not have enough utility to monitor their student performance in class. To address this problem, it was the goal of this paper to create a module that will be an extension in the current system to accommodate the functionality such as grade and attendance monitoring and to integrate these mobile modules guided by mobile computing concepts.

II. Related Literature

Student Information Systems have been of interest mostly of academicians wanting to improve the existing system. However, with the advent of modern handheld devices that provided platform to present data from an enterprise server, most efforts are now geared towards enabling this mobile platform for the enterprise or in the case of education, the academic institution.

The emergence of Mobile Web Technologies like HTML5, JavaScript, CSS3 [4], [5], and WML[2], [7], many efforts are now exerted to provide a software that is not tailored fit to a specific platform to serve more device varieties, the result is a vendor neutral product [14].

A. Platform Specific

1) Windows: [1] have developed a working prototype for mobile SIS that uses geolocation to recommend nearby structures that are of interest from the user's point of view. The system takes advantage of mobile devices capability to detect the longitude and lattitude values that represents the current location of the user. Users especially freshmen students will be guided of the University's geographical area and the surrounding structures.

The software has been implemented specifically on Windows Platform backed by Windows server.

2) Android: [3] created a mobile SIS to address the problem of announcing recent changes of room schedules and is designed to work on Android devices only. The software tried to augment the way room announcement is done to stakeholders. It utilizes the Telco 2.0 APIs of Service Delivery Platform WebGateway.

3) Blackberry: A survey of most used handheld devices in Indonesia made [6] decide to implement their system targeted at Blackberry smartphones, and named it M-SIS or Mobile Student Information System. Their study allows the parent to be users to monitor their student(s) performance at school. The system is full-blown that integrates services for students like library, Maps, academic calendar among others. M-SIS also supports private messaging so that parents and students will receive personnal messages coming from the school.

B. WAP-based

Another effort of moving SIS to mobile device is the study of [2]. The prototype is not completed, but it proposed to let the students access the grades after it has been conferred by the authority using the WAP technology. The system was developed on WML and with this, enabled devices can access the system and view the grades only.

WAP enabled mobile phones is also the target of a mobile SIS by [7] and the software allows for viewing of exam results, announcements and also self-enlistments. Although, unlike in [5],[7] did not discussed any algorithm or concept used to implement the self-enlistment feature.

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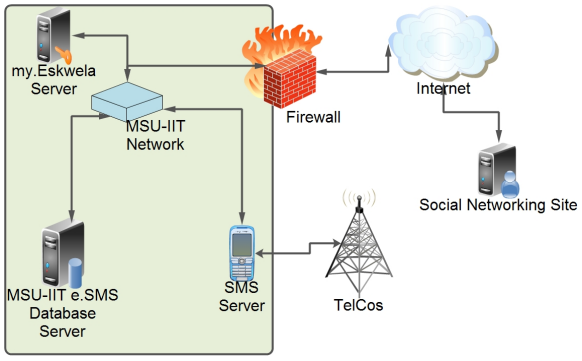

Fig. 1. my.eskwela Architecture

C. Cross-Platform Installable

PhoneGap allows native mobile API calls to a platform by using JavaScript. It utilizes the platform's WebKit to execute the compiled program. [4] used this technology to implement a SIS to allow students monitor their class performance including attendance and announcements, among others.

D. Cross Platform Web-Based

1) iCCS: iCCS[5] was another mobile SIS implemented using mobile web. It has a Desktop interface for management purposes and it aims to help the students in retrieving their academic records and even supports self-enlistment. The feature will come up with a suggestion of subjects to be enrolled with class schedules using Hill-Climbing Algorithm.

2) my.eskwela: my.eskwela on the other hand, aims to be an online class record accessible using web browser, mobile browser, and SMS services. Compared to all discussed studies, my.eskwela integrated a social plugin that allows users to share items like the visualization of class standing, periodic grades and attendance. The visualized performance information can be comprehensible to users at first glance. A way to view the details was also implemented.

III. System Architecture

my.eskwela follows the client-server architecture with a centralized server which also acts as client to the existing University Student Information System called e.SMS and to Social Networking Site. The centralized server also maintains its own database for my.eskwela specific data requirements and the web server.

A. The Server

As seen in Figure 1, my.eskwela was enclosed in box representing the MSU-IITs ICT resources and can only be accessed from the outside through a firewall. Inside, devices connected through a router (wired/wireless) can readily access my.eskwela application through supported browser available in either desktop or mobile devices.

1) Client to e.SMS: The integration of e.SMS to my.eskwela makes it easy to access relevant records like the student/faculty basic information, semestral load and class list among others. With this, there is no need to require students key in registration values,like in the case of Moodle or Edmodo, just to access the class performance for a particular subject. And faculty members does not have to wait for students to register because the class record is readily available at their disposal.

2) Client to Facebook: At times when the user is confident on the displayed performance result, they can choose to share this information to their favorite social networking site – and that is when my.eskwela act as a client to Facebook. my.eskwela have obtained authentication token for use alongside users identification with appropriate permissions for posting to Facebook. Facebook will return a value that determines the success of the request.

B. Communication

Communication to my.eskwela server is treated with confidentiality and this is achieved using self-generated SSL. Data will travel encrypted on the line confusing any third party observer.

IV. Methodology

A. Software Engineering

The project is guided by the Agile Model-Driven Design (AMDD) to its software development and an iterative process framework that focuses on creating small increments of functionality to every iteration process.[8]

B. System Model

Adhering to one of the Agile Software Development values which states: *Working Software Over Comprehensive Documentation* [9], modelling is done by a set of feature list as follows:

- Students can register for the access and usage of the systems through the desktop web portal.
- Faculty Members can activate the parents account through the Web portal.
- User (faculty members, students and parents) can login/logout the desktop/mobile web portal, using a browser connected to the internet or to the local connection in the campus.
- Faculty members can input real-time student marks (grades and attendance) in the desktop web portal.
- Faculty members can upload CSV file to the desktop web portal.
- Faculty members can set-up grade distribution given a subject using the desktop web portal.
- Faculty members can view ratings and attendance through the desktop web portal.
- Students, Parents can view ratings and attendance through the desktop/mobile web portal.
- Students can register for mobile SMS inquiry.
- Students can send SMS queries pertaining to their class ratings and attendance.
- User (faculty members, students and parents) can share performance values to Facebook.
- User (faculty members, students and parents) can link my.eskwela account and Facebook account.

1) Roles: my.Eskwela was designed to three groups of users: student, faculty member and parent. In terms of functionality both the student and parent can only view subjects and the associated report cards. The only difference is that a student can view only their own load but parents can view loads with respect to the number of household members enrolled in the University.

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Faculty members are considered the main driving force that feeds class record and attendance data to the system. They alone has the right to create and update data in the class record. Without their input student and parent groups have nothing to view. The relationship outlined above is described in computer architecture as simple producer-consumer relationship [10].

2) Input Variety: Understanding the importance of giving input data to the system, my.eskwela was enabled with different input mechanisms available in Desktop and Mobile web. It can be thought that the Desktop Application has feature superset compared to that of Mobile Web equivalent.

a) Singleton Browsing: Browsing from one student record to another in desktop web version requires only the use of the up and down arrow keys for previous and next student, respectively. Utilising these keys is a key decision because this can provide efficient input mechanism compared to using a mouse click to move from one record to another. There's a savings of effort from typing a grade and clicking a mouse compared to typing grade and pressing the arrow keys, multiply this to the number of students in a class record. This mode of input is replicated in the mobile version of my.eskwela, faculty members can swipe through the pictures or tap the appropriate buttons.

b) Batch Processing: While singleton browsing is an interesting input mechanism it is actually dependent on network connectivity and slow-connectivity can make it a non-attractive option to encode grades or record attendance. Because of this, faculty members may opt to encode back to spreadsheet applications which is free from outlined problem. As such, my.eskwela has been prepared to handle such scenario by introducing batch processing through the use of comma-separated values (CSV) files editable using a spreadsheet program. Faculty members start by downloading the pre-formatted CSV file and encode contents. Faculty members will then upload the populated CSV file back to my.eskwela. Further, this feature is only available in the Desktop Web application.

c) SMS Inquiry: In consideration to the idea that not all students can afford to buy decent smartphones that will give nice experience in using the Mobile Web, my.eskwela is again prepared to handle such scenario by utilising SMS (short message service). The SMS module is only available for students access. Features for this service include registration, attend a class session, and extract text-based report card. Each of the features can be accessed using a keywords MY.ESKWELA, ATTEND, and CCARD respectively.

3) Grade Computation: The formula for computing grades is reflected in Equation 1, the result of this formula will then be mapped to the Transmutable Table for equivalence. Equation 1 also suggests that, grades will not be computed when the grade distribution is not fully set-up. Grade distribution are of two types: periodic and categorical. Periodic distribution are those that put a weight to each of the periodic grades (i.e., Prelim, Midterm, and Finals). On the other hand, categorical distribution refers to a distribution of weight for each of the grade category (i.e., Quizzes, Assignments, etc..).

$$\sum_{k=1}^{q}\sum_{j=1}^{p}\sum_{i=1}^{n}\left(\frac{score_i}{items_i}\times 100\right)\times category_j \times period_k \quad (1)$$

4) Getting Social: [11] hypothesised that, blending traditional medium of instruction and social media can significantly enhance the learning experience of the students. Because students and teachers exchange ideas rapidly in the platform and people in social network tend to have more confidence in expressing ideas compared to the same situation inside the classroom. Further, educators and the like aim to increase their learning presence to the students even outside the classroom because most of these students access Facebook at any time of day thereby promoting self-paced learning. However, the effect of their methods reflected in the students grade can only be seen in the private space of teacher-student or only inside the student information system. The gratitude of successful mentorship and the appreciation of high rating or the worries of low rating can not be shared back to the same learning group from the student information system. This is where my.eskwela comes in, by providing a means for the parent, student and teacher share the actual performance of the students back to the social e-learning platform. These shared performances, in my.eskwela terms, are called badges.

V. Implementation

A. The RESTless Server

Unlike Facebook Graph API which is a RESTfull implementation, my.eskwela server is implemented using only the RESTless implementation. Wherein, web resources are the server side scripts which accepts parameter values to control the output. Currently, there are two types of output format that can be expected from the server, they are: text and JSON format. JSON stands for JavaScript Object Notation and requires much lesser bandwith to transport data compared to the XML equivalent.

B. High-Order Function

High-order functions are functions that are capable of accepting functions as parameters and/or capable to return function as its value. High-order functions has been extensively discussed in Computer Science to illustrate Programming Languages concepts like continuation, closure, and the growing of programming language. High-order functions has been used to variety of programming tasks in my.eskwela. It is used extensively in the server-side scripts, client-side scripts and in the SMS server. Recurring themes in most scripts is in function generalization and function factory.

C. The MVC using Stored Procedures

This research still adheres to the concept of MVC, Model-View-Controller, separation of concerns but such implementation is done in a way that Models are not hard coded at the server-side script instead they are encoded directly into the database level using rudimentary technique for creating tables. For views and controllers, the entire logic is encoded using stored procedures as provided by the database management system. And as such, server side scripts will

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only call a stored procedure for view or control, making it sure that the data access logic are properly encapsulated.

This technique requires that database schema and stored procedures should be on a separate SQL file and is always updated even during development. If there is a need to rebuild the database for administrative purposes, the SQL file is executed. This ensures that if server-side scripts are exposed, the entire database cannot be rebuilt by the wanting mind.

D. Connecting to Facebook

my.eskwela used the Facebook Graph API to enable the social component. It does not automatically post any performance badges, this has to be decided by the user.

The user has to perform one-time authentication to link my.eskwela account and the facebook account to enable sharing badges.

VI. Results and Discussions

A. The Survey Instrument

Upon the availability of my.eskwela software components it is but imperative to ask the question on how the finished product relates to the intended users. The questionnaire used was based on MSAM (Mobile Services Acceptance Model) outlined in [1] as part of its research and also validated the hypotheses outlined by the model, as follows:

- H1 Context has a direct positive effect on Perceived Usefulness
- H2 Context has a direct positive effect on Perceived Ease of Use
- H3 Perceived Ease of Use has a direct positive effect on Perceived Usefulness
- H4 Personal Initiatives and Characteristics has a direct positive effect Intention of Use
- H5 Perceived Usefulness has a direct positive effect on Intention to Use

[1] has proven through statistical analysis and result of its study that the hypotheses holds.

The questionnaire‘s items utilised in this research has been modified, being added or removed, to fit the surveys purpose because the questionnaire was used to evaluate mobile web, desktop web, and SMS systems. Each questionnaires item is answerable using a Likert Scale. [1] already pointed out that at least the value for a Likert scale, based on some researches, will only be 7-point scale because it may produce better results. But this study wanted to use 8-point scale to make the respondents decide on either black or white and not neither, and to group 2-scales with corresponding meanings. Scales 1-2 for Strongly Disagree (SDA), 3-4 (Disagree), 5-6 (Agree), and 7-8 (Strongly Agree) (see Appendix A). In the special case of Trust, scales 1-2 Not Important (NI), 3-4 Not that Important, 5-6 Important, 7-8 Very Important.

B. The Sample Size

Statistics demands that for any survey, a considerable sample size of the population is needed to attain a reasonable observation and perhaps derive a meaningful conclusion from the data findings. However, in the case of user acceptance survey, [12] argued that all it takes is just 5 respondents for it to be meaningful. The researcher termed this as “discount usability engineering.” To quote: “Doesn‘t matter whether you test websites, intranets, PC applications, or mobile apps. With 5 users, you almost get close to user testings maximum benefit ratio.” This finding is supported by their research result published on their website [13].

TABLE I
Actual Number of Respondents Participated in the Survey

	mobile Web	Desktop Web	SMS Service
Faculty Members	17	17	0
Students	18	16	14
Parents	9	9	0
TOTAL	44	42	14

In the case of my.eskwela usability testing, the minimum target population is 5 for each of the modules and group representatives. During the actual testing, each of the user groups get to try out and/or explained what the actual product will do and how they might interact with it. Special mention on the and/or clause is required because not all user groups get to have a hands-on experience in the system especially the parent group. This group is only explained and demonstrated on how to use and interact with the system because there was no dummy account created and that their role does not require any complicated tasks. Table 1 shows the actual number of respondents for each user group.

C. Survey Results

After the demonstration and explanation, different user groups get to try the systems and they are showed with different use-cases. After which, they were handed out the survey questionnaires and they rate the systems according to the different parameters as follows: Perceived Usefulness, Perceived Ease of Use, Trust, Personnal Initiatives and Characteristics, Context and Intention to use.

1) Perceived Usefulness: This parameter tries to measure the users perceived usefulness of the system with respect to the basic functionality of recording/tracking attendance and grades and that the system would increase their works daily efficiency.

a) Mobile Web: Majority of the users (63%) strongly agree that the application is useful for them. With the highest rating of acceptance from the group of students followed by faculty members and parents. While 32% agree to the usefulness mostly from the parents and faculty members. However, some faculty members (4%) disagree and 1% from the students group strongly disagree.

b) Desktop Web: Majority of the users, an outstanding 73.27%, strongly agree on the desktop web usefulness with students and parents users as top raters. While only 23% agree on the usefulness with highest percentage share on the faculty members group.

The remaining 0.25% from faculty members group strongly disagree on the desktop web usefulness.

c) SMS Service: None of the respondents showed any negative evaluation, 79% strongly agree and only 21% agree.

2) Perceived Ease of Use: This parameter relates to the systems user-friendliness and how it presents itself to allow smooth interactions and perform tasks. User-interface and most importantly, user experience are among the critical

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factors that will determine the success of the systems adaptability to the intended users. The more friendly the systems are, the more reason for users to adapt.

a) Mobile Web: Majority of the users (64%) strongly agreed, the student group have the highest share of rating followed by the parents and faculty members and only 4% from faculty members disagreed.

b) Desktop Web: Consistent with the previous observations, the desktop web was appreciated by majority, 58.74%, of the users. However, it was the group of faculty members that has lesser share of excellent ratings compared to the two groups. This maybe attributed to the fact that their group still has a lot to learn with the system interface because it provided them plenty of available options for input. Though majority of the faculty members view the system as user-friendly and they have had a good user experience.

A minute portion, 6.52%, of the respondents from the faculty members and students are somewhat not satisfied. They find it hard to learn the systems functionalities and since they do not strongly disagree, maybe they just lack more familiarity to further appreciate the system.

c) SMS Service: During the decision on what keywords the students should remember to register into the system, the associate a cellphone number to a student identification number came into place. With this scheme, a cellphone number can only be used by a single student. Student inquiring from different cellphone numbers is not possible. This is a security feature and at the same time an ease of use factor because, after the student activated the SMS Service they do not have to key-in their identification number as part of the text message. This design have influenced the way students look at how user-friendly the system is. In fact, 71% of them rated excellent on this criteria and no one disagreed.

3) Trust: The notion of trust relates to different views a user might have in terms of systems integrity. Trust requires the user having the knowledge of the system, the source of data and the corresponding data accuracy, the confidence in handling the system and the implemented security. Before the users used or try-out the systems, they are oriented on how the system underlying security and non-functional requirement are implemented.

a) Overall Evaluation: Results showed that approximately 90% or more, of the respondents pointed out that systems trust is very important may it be the mobile web, desktop web or the SMS service. Of those who agreed, 70% or more strongly pointed out that their perceived confidence and trust to the system is very important.

4) Personnal Initiatives and Characteristics: This parameter refers to the user-experience while using and/or observing the system. It connotes a degree of comfortableness while the users picture themselves using the system on a daily basis.

a) Mobile Web: The students appears to be the most optimistic group that appreciated the existence of the mobile web app. This can be attributed to a fact that as a student they are more anxious to know "immediately" the results of the academic exams. Plus the fact that many of them uses high-end phones for viewing the mobile web app.

On the other hand, approximately 95% on the groups of faculty members and parents were optimistic to adopt the system. For faculty members though, the number of optimistic users were outnumbered by those that are just contented to have the system around. All in all, this group saw the importance and the impact of using the system in the course of their record keeping in the classroom.

The parents group have more optimistic users than those that are just contented to have the system around. This observation is opposite to that of faculty members results, even if this group is just shown how the product worked. Nevertheless, as parents it is important for them to have access to academic performance monitoring using their mobile devices. And just like the group of faculty members, a minute group does not find the importance of using their mobile device in monitoring the academic performance.

b) Desktop Web: The same observation can be drawn from looking at the survey results. It is important to take note that the interfaces of both mobile web and desktop web were different because of conflicting requirements needed to comply when rendering the same web page on a desktop and mobile browser respectively. But, because of the result similarities it is but logical to draw an observation that both applications were able to give similar user-experience and as such, it is appreciated by the different user groups.

c) SMS Service: 81% of respondents who strongly agreed that they had a great experience is by far a very good indicator that the system was able to reasonably manifest its usefulness to the users. The original thought of having a SMS service was, based on the results, beneficial. The presence of the SMS service gave the user the idea that they can always be updated with their grades inquiry even if the Internet is not available or even if they dont have an access to high-end mobile devices to access the mobile web application.

5) Context: Context tries to measure on how the surrounding community can affect the user in using the system. Five dimensions are being explored here, they are: availability, majority rules, institutional initiatives, relevance to work,and past experiences of using an application.

Availability refers to the accessibility of the software inside and outside of the workplace, as well as the accessibility of running the software in the device.

Majority rules refers to the influence of the system to the user if surrounding community are using the system. Like, would they be more convinced to use the system if many of their colleagues are using it?

The institutional initiatives refers to the steps the administrators made to convince the constituents in using the system. One way to do it maybe is to issue a memorandum to adopt the newly created system. Another is to do a campaign on system awareness by sponsoring a hands-on training workshop.

Relevance to work refers to users evaluation on the impact the system will make in their daily performance of duties and responsibilities. And finally, the users past experiences of using an application is considered and checked if it can influence its outlook in using the new system.

Survey results showed that context is important to majority of the users about, 95% of them. Using the system does not only need good user interface and user experience, it also needs intervention from the surrounding community may it be from the administrator‘s or the influence of many colleagues using the system.

Past software experiences is not really a big factor to try

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out a new one, what matters is that the software is available and they know how to access it using their devices.

6) Intention to Use: This refers to the user's degree of commitment in using the software on its availability and accessibility. In other words, if the system is accessible and the user has the authority to use the system, will the user consider the system?

According to survey results, given the accessibility and authority, users would significantly be committed to the system. Notably, it is this part of the survey that none of the respondents hesitated on their commitment to use the system.

VII. Conclusion

The three user groups: faculty members, parents and students, that serve as the motivation of this research endeavor responds positively to the created systems: desktop web, mobile web and SMS service. All intended to use the systems for monitoring the students progress in school. The results are remarkable such that not a single respondent in any user groups doubted its intention to use the systems as none expressed disagreement in this area. The results are actually good indicators that the three systems are good investments to set the bar of student information systems software services to higher level.

VIII. Recommendation

To make the system fully integrated to the constituent's daily operations, it is important not to disregard the effect of Context as described previously particularly on institutional initiatives. This means that, the support of the administration in recognising the importance of the created systems and recommend it for constituents use is also vital. Such move can make more awareness and initiatives to inform and educate the users for the utilisation of the software products. When these initiatives are already spread, more and more users will be familiar to the systems and in turn they can influence others to use the systems. When the institutional initiatives have finally been appreciated by the constituents, this will have a direct positive effect on perceived usefulness and perceived ease of use it will be of a compelling reason to use the systems. Survey results have shown that majority of the respondents appreciated the experience as observed in seeing the system in action.

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