# A Novel Design of Management Senior Project for Engineering Students

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***Abstract*—The senior project course for engineering students has a vital role in complementing the "learn by doing" education engineering students in any university. The senior project course is, usually, a two semester course. This short time frame, poses challenges for both students and faculty. Students have to achieve the outcomes of the project to a certain extent and the faculty has to manage, follow up and evaluate efficiently the work of their students individually and by group. One common problem in senior project is the missing of the control during the visit of the students to a company for project preparation purpose. In this paper, we propose a new and efficient design of follow up for faculty to manage properly and evaluate effectively the individual progress of the students during the preparation of their senior projects and to avoid "free riders" situation. Our idea is based on the mobile technology to track the students' progress, meeting, and visiting industry and so on. The proposed idea is helpful to avoid free-riding students also provides instructors with solid evidence of the student progress.**

***Index Terms*—Senior project, student follow up, project progress, mobile technology.**

## I. Introduction

The senior project experience is the conclusion of a student's knowledge and skills in preparation for imminent integration into the workplace. It not only offers students the build up the bridge between the theory and practice but also to increase and practice a maturity towards leadership, team work, communication, client liaison, role playing, ethics, peer assessment and understanding the impact of the integration of their project on the community.

In offering all these benefits there are identifiable challenges of assessing the individual that have been a long-standing issue for instructors and consequently students. In order to evaluate the individual within the group it is essential to provide assessment that is not only fair and just for the individual but also responsible. Individual assessment for the senior project or in general any team project has historically created a situation where subjective assessment is required to differentiate individual student achievements. In this paper, we propose a new mobile application and desktop application that help students and the instructor as well in the senior project preparation, follow up and fairly grading.

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## II. Senior Project Requirements and Organization

The regulations implemented in the senior project evolved over a period of several years, through a continuing process of trial and revision by the entire engineering schools [1]:

1) Students are required to finish their senior design project in one academic year.
2) Students must take the senior design project during their senior year. Because of the breadth and demanding nature of senior design, it is essential to have certain fundamental courses completed before students start their senior design project.
3) Senior design projects are intended to be group projects, so that students learn how to work as an engineering team. Design groups may have two or three students. Groups of four or more students usually are too large to work efficiently or to be easily managed and may not provide sufficient design experience for all students in the group.
4) Projects are supervised by the senior design committee, consisting of the project faculty advisor and two other faculty members. Students are expected to organize their own design group, consisting of their student coworkers. The project faculty advisor is chosen by the students and the remaining faculty committee members are then assigned to the student design group by the professor who is in charge of the senior project.
5) Early in the beginning of semester, the design team meets with the faculty committee for review and approval of the initial design concept, the written project plan and an essential detailed schedule for completion of the project. Throughout the year, the design group must meet with the project advisor weekly and with the committee at the end of each semester to present a design review and progress report.
6) In addition to meeting with the advisor each week, students are required to attend weekly senior seminars. In the first semester, each group makes an oral presentation describing their project to the entire class. At the end of each semester, each design group gives a progress report in which all group members participate. Remaining class periods may be scheduled for guest speakers on topics, such as engineering ethics, occupational safety and health, professional registration, resume writing, interviewing, job search strategies, and technical engineering presentations by practicing engineers from industry.
7) Each group is required to keep a notebook and activity diary throughout the year. The notebook must record daily progress on the project and any schedule revisions. The notebook and activity diary are compatible with industrial practices and are important aids to the faculty

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committee in measuring project progress, and in making individual grade decisions.

8) A final, cooperatively-written report is required from each design group. These reports are archived in the department library for future reference and may serve as useful aids to future student senior groups.
9) In consultation with the group's faculty committee, the project advisor must give a letter grade to each student at the end of each semester. Incomplete letter grades are not permitted, since this may encourage students to procrastinate on project efforts until the last quarter or semester, when it usually becomes impossible to finish the project on schedule.

## III. Literature Review

In [2], clear have outlined an approach to assessment of student performance in capstone project, which assesses the three dimensions of "product", "process" and "progression in learning". Where product and process must be assessed in group; Progression must be assessed individually, with contributions from reflective reports, evidence of improvement and "observations and opinions of supervisors." Clear is comfortable with this subjective assessment, markers often find it difficult to justify the final grade. This is worsening in senior projects where the student's individual marks can vary from a Distinction to a Fail, a situation that requires justification. Aggarwal and O'Brien [3] introduced a system that identified the individual student contribution in order to address the issue of "free riders" -"an individual working in a group setting fails to contribute his or her fair share". In [4], Latu and Blackshaw interviewed students to identify their preferences when considering the group work grading. They found that 94% of their students wanted to identify "free-riders", 79% felt that individual grades were preferable to group marks. Farell *et al*. [5], study the senior projects within the ICT industry. Their study was restricted the student group size from 3 to 5. The aim of their research is to design and develop a system with supporting documentation that will enable a fair allocation of grades to individuals undertaking group work. The system is to ensure that the assessment considers the main objectives of the senior project experience and not just the final project outcome [6], [7] as discussed earlier. In [8], the authors have developed and deployed an individual contribution assessment method for the students collaborating in Classroom Wiki – a Web-based collaborative writing environment. Lejk and Wyvill [9] identified 6 different approaches to the allocation of marks to group work that consider: individual versus group marks, student contribution to assessment distribution, weighing factors for individuals and separating individual and group assessed items. In [10], the authors stated that it is very hard to find a single assessment activity that balances between individual and group assessment, involves both teachers and students, and is summative as well as formative.

## IV. Issues Associated with Assessing Group Work

Motivation of participants has been noted to be one of the most serious problems in group work [11], [12]. Some group members may be reluctant participants in assessment tasks and be uncommitted to the aims of the group (and the subject for that matter). Motivational issues can arise as a result. Examples of motivational issues associated with group work are social loafing and ''free riding''. These issues have received considerable attention in the literature [13]-[15]. Free-riding has been defined as follows: ''the problem of the non-performing group member who reaps the benefits of the accomplishments of the remaining group members with little or no cost to him/herself'' [16]. Free-riding has been distinguished in the literature from "social loafing" [17]. The difference is this: social loafing is a reduction in effort due to not being noticed or lack of identification in a group task. Free-riding is actively obtaining reward for no effort. Thus, social loafing can lead to free-riding.

One way of solving the problem of social loafing and free-riding is to carefully consider the nature of the task given to students and to reward the effort of groups as well as reward the work of individuals. However, this is harder than it sounds. Tasks need to be designed to maximize students' contributions and to recognize and notice their efforts. Some strategies of doing this:

1) Work out ways to recognize, monitor and reward the individual effort of group members. Simply tracking the contributions of students' work and requesting that students' names be given on a group assignment might be sufficient. This can either be a matter of negotiation among students themselves or mandated by the instructor.
2) As already noted, evaluate the individual's contribution to the group work assignment as well as the work of group.
3) Allow group members to notice and evaluate each others' contributions by means such as web-based tools or a peer evaluation procedure.
4) An effective assessment procedure that has been trialed in a cross-disciplinary business course such a procedure reduces free riding as measured by a decline of variance between peer evaluation assessments. (It was not clear from this paper whether groups were self-selected or instructor selected. The second variation, given below, involved self selected groups.)

Free-riding has also prompted what is called an ''inequity based motivation loss'' (sometimes known as the ''sucker effect''). The Sucker effect refers to individuals responding to others free-riding upon their efforts by free-riding themselves [18]. It appears that competent students try to avoid being ''suckers''. They make a calculation of whether or not they are the subject of free-riding from others in the group. If they are, and they feel it unjustifiable, they try to avoid being a ''sucker'' by reducing their own input to the task. Kerr has shown that students will even choose to fail as a group rather than be a ''sucker'' [18]. It is suggested that the sucker effect problem is the cause of procrastination in many group work activities. Conscientious students find it hard to get the attention and compliance of free-riders and decide not to proceed alone until a deadline is imminent. But the situation is more complex than it appears. Watkins claims that competent students are less likely to think of themselves as suckers if

they genuinely feel that they are covering for a member of the group who is unlikely to succeed by themselves. Thus, one way of minimizing the sucker effect is to allow members of groups to ‘‘get to know each other better’’. If this happens, competent students may be less inclined to feel like ‘‘suckers’’ and are less likely to free-ride [17]. In ad hoc, short term groups—where group members do not socialize as readily—this way of overcoming the problem might be less effective. However, this is only part of a solution, of course. A better solution will reduce free-riding—and maximize the contributions—of all students in group work activities.

In [19] Authors announce that the educational literature is littered with ideas and methods of assessing group work, In [20] the authors argue that the issue of assessing individual students' contribution to their group activities is problematic, because group members do not contribute equally to a group's success, and that lecturers normally make few or no observations to assist them in evaluating and determining the students' level of contribution to their group's ultimate success. Consequently if some members of a group are not co-operative and fail to perform their assigned tasks, the workload of other adversely affected. Assessing group work can be extremely difficult because, no matter how teachers derive an individual member's mark, some members will always complain that they have been disadvantaged by the poor efforts of their fellow group members. Group assessment involves the assessment of the product of students' group work by the instructor, or the assessment of the product by fellow students from other groups (inter-peer assessment), or the assessment of the group work by students within a group (intra-peer assessment). For example, in computer courses, the nature of work in the computer industry requires a good deal of team activity. However, Schwalbe (2004) warns that the culture of computer professionals portrays them as nerds who like to hide in dark corners, hacking away on computers, and when they have to communicate with non-computer professionals, they act and talk as if they are talking to someone from another planet. Further computer products are so large and complex, and their development requires a team approach, group work and group assessment should be featured in most courses within computer and ICT related courses, especially in the first and second year of undergraduate engineering study. Some research and studies, argue that group work and peer evaluations may not be appropriate for the first year undergraduate students because they may not possess the necessary prerequisites to handle group dynamics.

## V. Proposed Design

In this article, we design a novel mobile application (see Fig. 1) that helps the instructor to follow their students in the senior project by track their visit to the industry and their work done. Through this application students have the following options (see Fig. 2 and Fig. 3):

1) Sign in using their student IDs
2) Scan their fingerprint and send it to the university server along with their location using GPS technology, to proof to the instructor their physically visit to the company. All fingerprint are registered on the university server upon the registration of the students
3) Take picture about the system there
4) Record sound or video with the employees in the company then upload the file to the university server

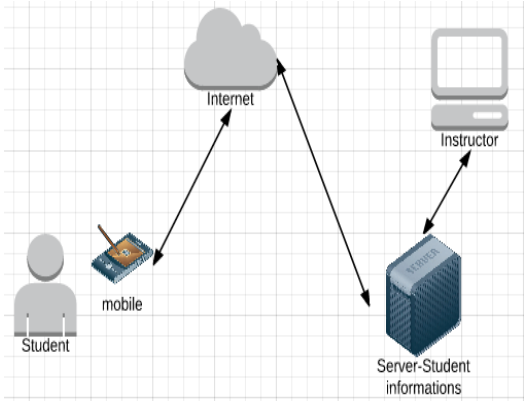


Fig. 1. Design of the mobile application.

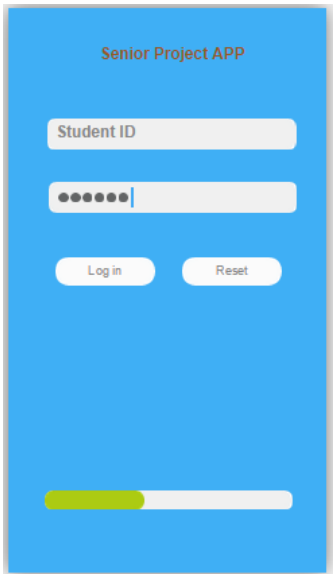


Fig. 2. Mobile application interface.

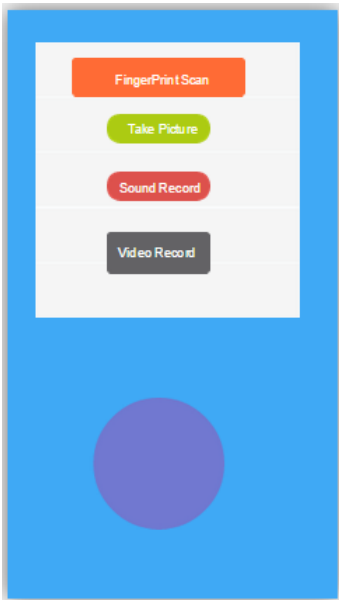


Fig. 3. Mobile application options for students.

From the university side, instructor can login locally and see online the location of their students using Google map

(see Fig. 4), and can interact with them and track their progress. This will help the instructor to accurately follow up and fairly grade the work of the students during their visit.


Fig. 4. Instructor is monitoring students' location.

## VI. Conclusion

In this study, we propose a new design that help instructor to track and follow up their students using students mobile application side and another desktop instructor application. By using the proposed design, instructor can be sure that their students visit physically the company and grading fairly their work. Future work might include implementation and students survey about the new application.

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