

# The Initiation, Organisation and Logistics of Part-time Final-year Projects\*

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*This paper presents details concerning the co-ordination [1] of the final year project programme of the part-time B.Eng. (Mechanical) degree programme of the School of Mechanical and Production Engineering, Nanyang Technological University, Singapore. It also provides details on how the power of information technology is utilised to facilitate an efficient and effective co-ordination task all the way from project proposal stage through project selection, balloting and allocation, to oral presentation scheduling. The procedure presented in the paper for part-time final year projects is understood to exist in Continental Europe for full-time final-year projects, but in general they are not so well structured administratively.*

## INTRODUCTION

THE PART-TIME B.Eng. (Mechanical) programme of the School of Mechanical and Production Engineering, Nanyang Technological University (NTU), started in 1996 to provide part-time degree-level engineering education to polytechnic graduates who would like to further their studies on a part-time basis while remaining in their respective full-time employment [2–4]. The normal period of study is 5 years. All part-time students have to undertake a final year project (FYP) in their fourth year of study and complete the project by the end of the fifth year.

The objectives of the FYP are:

1. To be a vehicle for integrating the knowledge gained so far in the undergraduate years, coupled with their industrial experience, to solve engineering problems.
2. To provide the student with a realistic exercise in the practice of mechanical engineering at a professional level.
3. To provide the student with the opportunity to exercise personal qualities—viz, maturity, initiative, creative ability, etc.

The scope involves requiring students to analyse and synthesise problems in any of the disciplines of mechanical and production engineering through a project requiring application of fundamental engineering principles.

The pioneer batch of part-time students have now entered into their fourth year of study and have commenced their final year projects. Coordinating the FYP program has not been easy especially when it involves a fairly large

student number who are working in different job environments, with different expectations on FYPs, schedules and circumstances. The School has a significant number of full-time academic staff and bringing these two groups of people together to work on projects involves good planning, timely execution of tasks and the application of information technology.

## PROJECTS

The FYP program should incorporate as much flexibility as possible, without affecting standards, to enable students to complete the program successfully. Students are encouraged to work on industry-related FYPs which should be company-based and, if possible, also company-sponsored, as well as having a suitably qualified staff in the company as a co-supervisor. The other co-supervisor should be a university academic staff who will be the main supervisor. Due to the difficulty on the part of the students to frequently and regularly come to the university to carry out laboratory-based aspects of their FYPs during office hours, the nature of the project should ideally enable the students to carry out their work outside the university in the form of company-based projects. Such projects can include design-and-construct projects or testing/experimental investigation projects.

However, when students propose their own projects, they are required to propose projects which will span across two years. Customer-driven projects that will last only several months should not be proposed as FYPs. All projects are single-student projects. Projects which require two students should be clearly split and proposed as separate single-student projects with each student

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specifically responsible for his/her portion of the main project.

### DELIVERIES/RESPONSIBILITIES OF STUDENTS

Once the students are assigned a supervisor, they are to meet up with their respective supervisor to discuss about the project. Apart from the above deliveries, students are also advised to regularly consult their respective supervisor, and keep the supervisor informed of their project performance and progress. The supervisor will provide feedback to the student based on the Project Write-up, Interim Report, draft Final Report and whatever information gathered from the consultations, recommend necessary changes and provide direction to the student where necessary.

### PROJECT ADMINISTRATION

#### *Project proposals by students*

The initial phase of the co-ordination work starts with soliciting company-based project proposals from all students. However, not all students will be able to propose projects. Students who are unable to propose projects fall under the following categories:

- they are retrenched/unemployed;
- they are working in non-engineering environments;
- they are working in engineering companies which work on confidential projects.

#### *Project selection by academic supervisors*

The project proposals of the students will then be compiled and opened to the whole School for staff members to select the project(s) they wish to supervise. There is a maximum number (units) of projects a staff is allowed to supervise. This is to avoid the problem of staff having too many project commitments to give students sufficient personal attention. Single supervision of a project is considered as 1 unit and co-supervision of a project is considered as 0.5 unit.

#### *Project allocation for staff*

If a project is selected by several staff members, balloting will be carried out. However, if only two staff have selected the same project, they may sort agreement with each other to co-supervise the project. The maximum number of academic supervisors per project is two. A third supervisor is allowed if he is from the student's company. For companies which may not want to sponsor the projects, students are still encouraged to request a suitable person from his/her company to act as industrial supervisor.

Upon receiving FYP proposals from students, the School will solicit for suitable staff to supervise

the projects. An academic staff who has selected a student's project proposal is required to evaluate, modify (if necessary) and finalise the proposal before submitting it to the FYP coordinator. The standard of the part-time FYP is the same as that of the full-time FYP.

#### *Project proposals by academic staff*

The School also solicits projects from academic staff for students who are unemployed or unable to propose a project. A School's FYP list is then compiled. The students without proposals or students whose proposal is not selected by any staff will choose from the School's FYP list. The selection is done through the StudentLink, accessed through the Internet, and instructions are provided by the computerised system.

As each project can be allocated to one student only, each student is required to make five choices in order to minimise the chances of non-allocation. A system balloting will be conducted to allocate a project to each student. Should a student not be allocated in the first round of balloting, he will have to go through a second round of balloting to choose (and register) from a list of balanced projects.

As the part-time students (most of whom are working) will find it difficult to find time to frequently come to the university to work on laboratory-based projects, as much as possible, projects proposed by staff should enable the students to work on the projects outside the university, e.g. design (product design, machine design, system design); mathematical modelling and analysis; software-based (e.g. computer modelling, simulation and analysis, multimedia); etc.

Although some laboratory-based projects are possible if the student's company has a five-day work week, it must be borne in mind that the employment situation can change during the two-year project period, for example, to  $5\frac{1}{2}$  days a week when switching employers. Therefore academic staff are reminded to bear in mind the above factor when proposing FYPs.

#### *Students without the pre-requisites for fyp*

In cases where a student does not have the FYP pre-requisites by the time he/she is due for the FYP programme, the student can commence the FYP after satisfying the pre-requisites after another semester. In other words, the student need not have to wait for one year before being allowed to proceed with the FYP programme.

#### *Report submission and assessment*

Table 1 lists the deliverables from students to the supervisor.

The objective of the first-year write-up on project plan and schedule is to consolidate and crystallise the thoughts and plan for the project. At this stage, the student should have a reasonably clear idea of his/her project requirements as well as the angle of approach towards accomplishing the

Table 1.

Year of project	Deliverables	Due date	Remarks
Yr I	Project Plan/Write-up	2 months from commencement	To include: <ul style="list-style-type: none"> <li>• Project title, objective(s) and scope</li> <li>• Project plan and schedule</li> </ul>
	Interim report	1 year from commencement	To include: <ul style="list-style-type: none"> <li>• Clearly defined project objective(s)</li> <li>• The results obtained to the date accompanied by the analysis and discussion</li> <li>• Updated project plan and schedule</li> </ul>
Yr II	Draft Report	About 3 months from end of FYP	Format to follow the School's <i>Guide to Report Writing</i> .
	Final Report	About 2 months from the end of FYP	After amendment of the draft report.
	Oral Presentation	By end of FYP	

objective(s) of the project and be in a position to submit a project plan. The supervisor should provide feedback to the student based on the write-up and return the write-up to the student immediately after the feedback session. The FYP procedure is summarised in Fig. 1.

A list of FAQs and associated answers is also compiled and placed into the computerised system for both staff and students to access. Some example of FAQs are:

- Q: What if my company allows me to work on my company-based FYP during part of my office hours but does not want to financially sponsor my project in terms of purchase of equipment and consumables?
- Q: What happens to my company-based FYP if I am retrenched or if I resigned from my current job within the two-year period?
- Q: What if I need to take a long leave of absence during the two-year FYP period? (company sending me overseas on long assignment?)
- Q: Can I propose two smaller projects rather than one large project?

## INFORMATION TECHNOLOGY

The co-ordination of the whole programme would not have been efficient and possible without the utilisation of information technology (IT). This required the service support from the Centre for IT Services (CITS) at the university. The following explains how the computerised system for the PT FYP programmed is established.

### System architecture

The Final Year Project System consists of 3 sub-systems. These are:

1. The *student sub-system* that will enable students to:
  - view available projects;
  - register for their projects;
  - view the project they have been allocated;
  - view the presentation schedule.

2. The *staff sub-system* that allows academic staff to:
  - submit proposals;
  - view the projects where they are the main supervisor, co-supervisor (if applicable) or the examiner;
  - view the result of the allocation exercise, i.e., the students who are taking their projects;
  - view the presentation schedule where they are the main supervisor, co-supervisor (if applicable) or the examiner.

3. The *administrator sub-system* is where management can perform, among other things, the following tasks:
  - run a program to automatically allocate a project to students;
  - manage the student and staff sub-systems such as specifying the date of access to the system;
  - print various types of reports.

Figure 2 depicts a simplified architecture of the FYP system. As it can be seen, students can access the *student sub-system* via the Internet whereas academic staff can only do so from within the university Intranet.

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The design of the student sub-system can be justified as follows:

- The student user population, being significant, made it unrealistic to deploy the system on a client/server architecture.
- To access the system, students only need to have a PC, Internet connection and a web browser. No special software was required.
- Students, whilst overseas, can still view and register for projects as if they are in the country.
- It is easier to upgrade the system should the need arise.

Although the user population for the staff sub-system can be fairly large, it was not opened to the Internet nor was it designed as a client/server architecture for the following reasons:

- The staff user population is rather large.

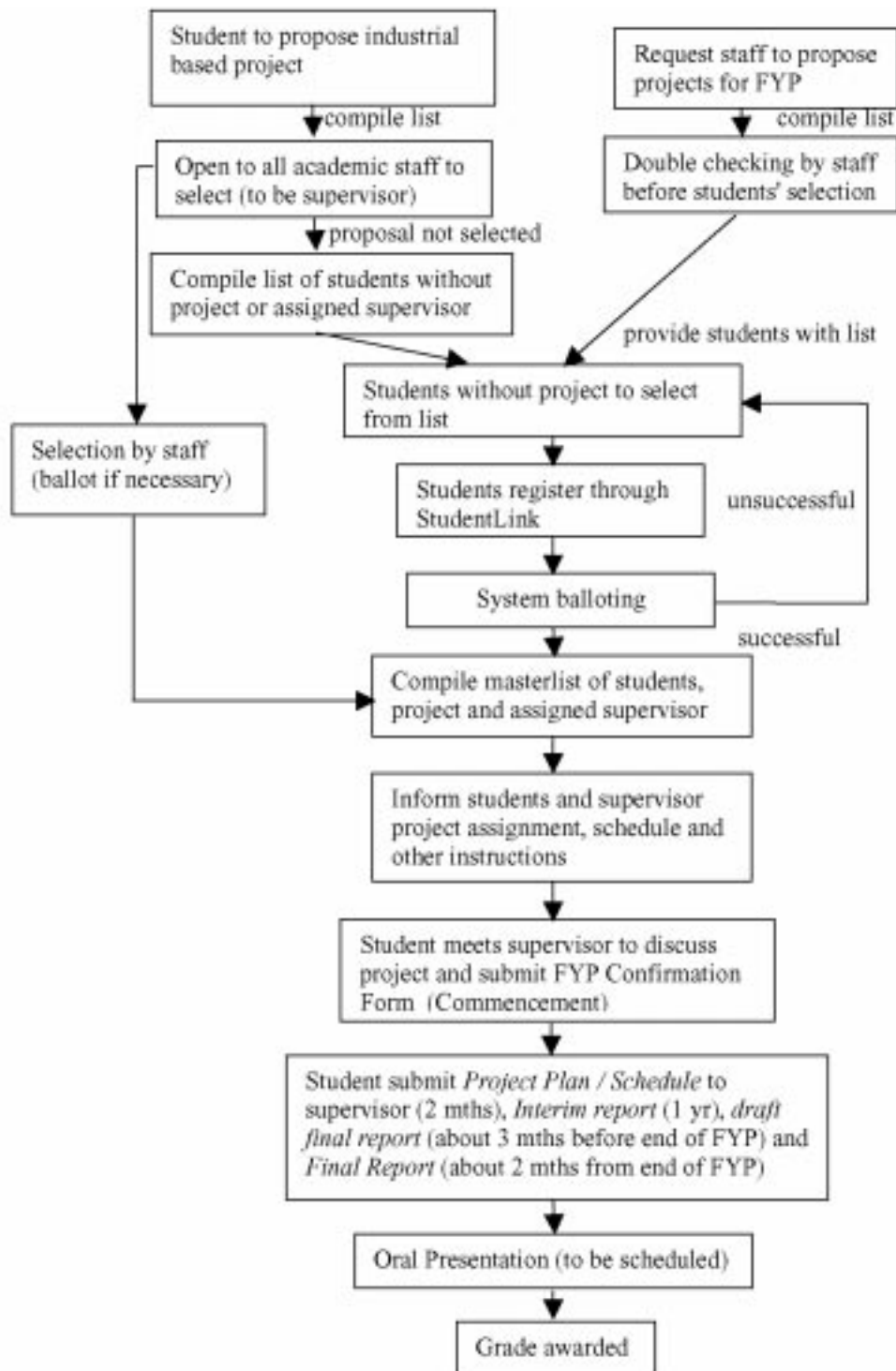


Fig. 1. Flow chart of FYP procedure.

- The system followed the convention adopted by CITS. In other words, all staff applications can only be accessed within the university.
- Upgrade to the system can still be easily deployed without going to each and every users' site.

Hence, both the student and staff sub-systems can be accessed through the university's homepage (<http://www.ntu.edu.sg>) or more specifically going

to these URLs and selecting the correct icons: <http://www.ntu.edu.sg/studentlink/SubjOptMenu.htm> and <http://www.ntu.edu.sg/stafflink/#mis> respectively.

The administrator sub-system is a client/server system and differed from the above two sub-systems because there are only a handful of users accessing the system and above all, the system needs to produce some very specific reports that would not be possible if deployed under the

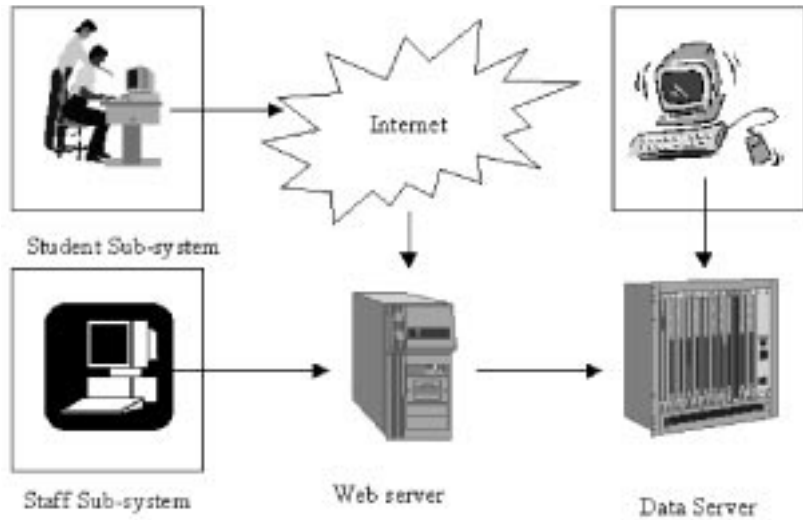


Fig. 2. Architecture of the FYP system.

Internet or intranet. One further justification was that of security as far as the allocation of projects was concerned.

*Programming language*

The student and staff sub-systems have been developed using Oracle Web Server PL/SQL (Exhibit 1) whilst the client/server tool, Oracle Developer 2000 (Fig. 3) was used to build the Administrator sub-system. An example of coding using Oracle WebServer PL/SQL for displaying an error message is shown below:

```

PROCEDURE Show_Error_Message (ErrMsg IN
VARCHAR2, SolMsg IN VARCHAR2) IS
    ErrorPict VARCHAR2(200) := Get_Constant_
Value('NTU_Error', 'NTU');
BEGIN
    htp.nl;
    htp.p('<center>');
    htp.img(ErrorPict, ", ", ");
    htp.p('</CENTER>');
    htp.nl;
    htp.nl;
    htp.header(4,'Cause of Problem:');

```

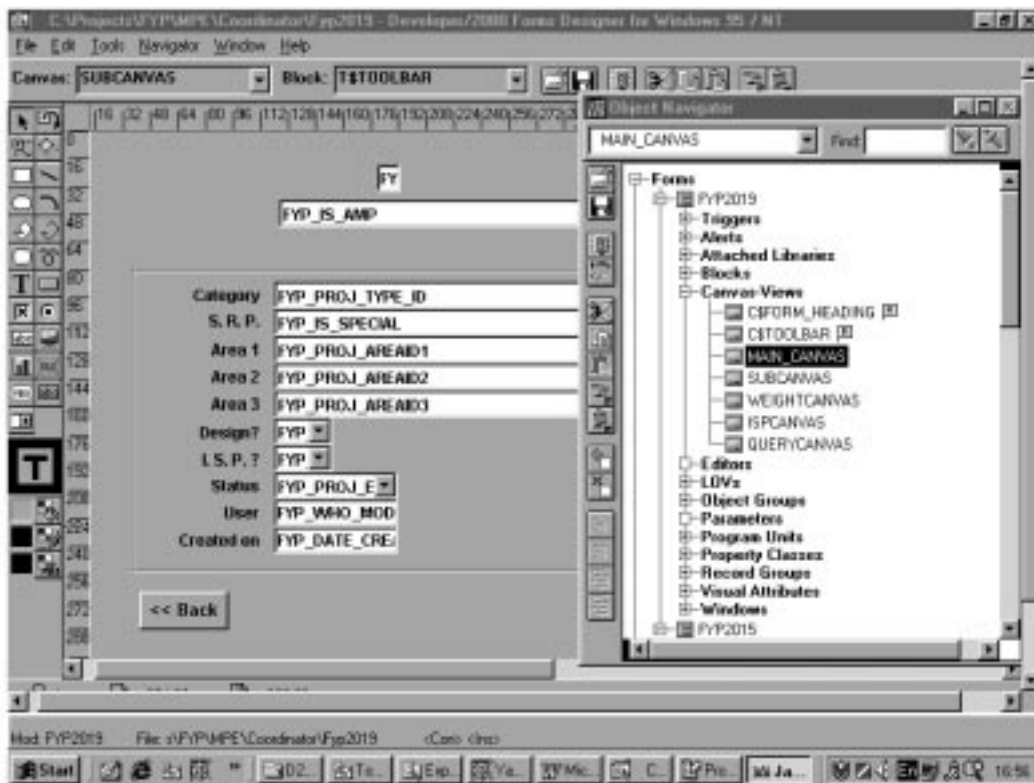


Fig. 3. Oracle Developer 2000 development environment.

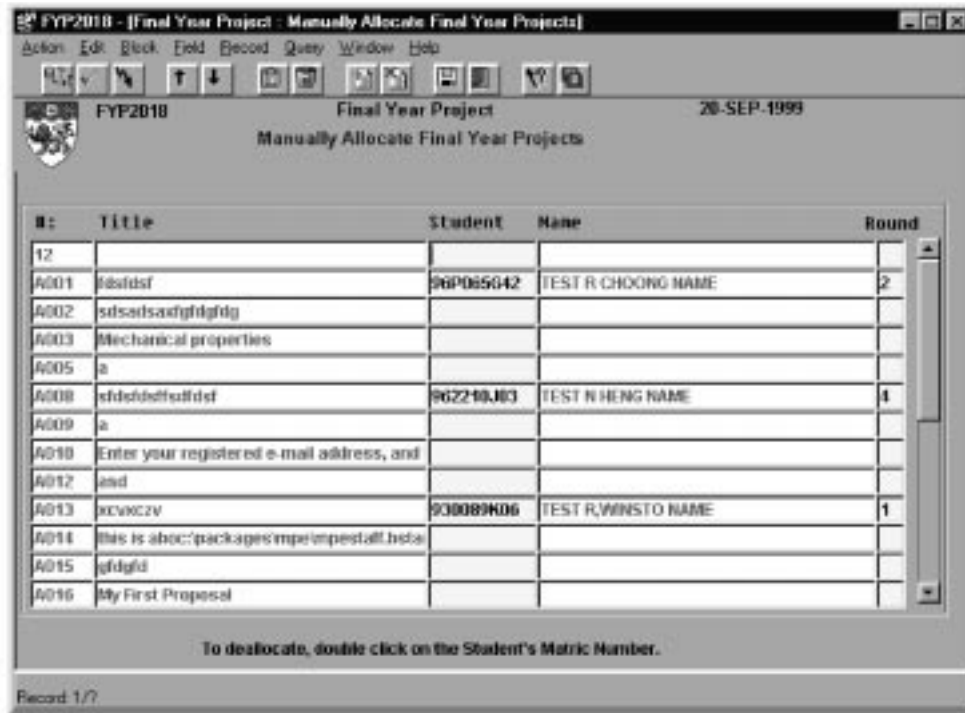


Fig. 4. Making use of colour to indicate what values are required.

```

http.p (ErrMsg);
http.nl;
http.header(4,'Possible Solutions:');
http.p (SolMsg);
END Show_Error_Message;
    
```

Although richer GUI tools are now available, it was felt that adopting the above programming languages and tools were appropriate at the time of development. The reasons were:

- Programming languages such as Java, although they provide lots of flexibility, fall short of the requirement of having a fast response time. The system had to be designed in such a way that many users could access the system within a restricted time frame.
- Consistency in the use of programming language was promoted at CITS. This enabled staff to quickly understand and develop systems. It also makes it easier for CITS to maintain the system.

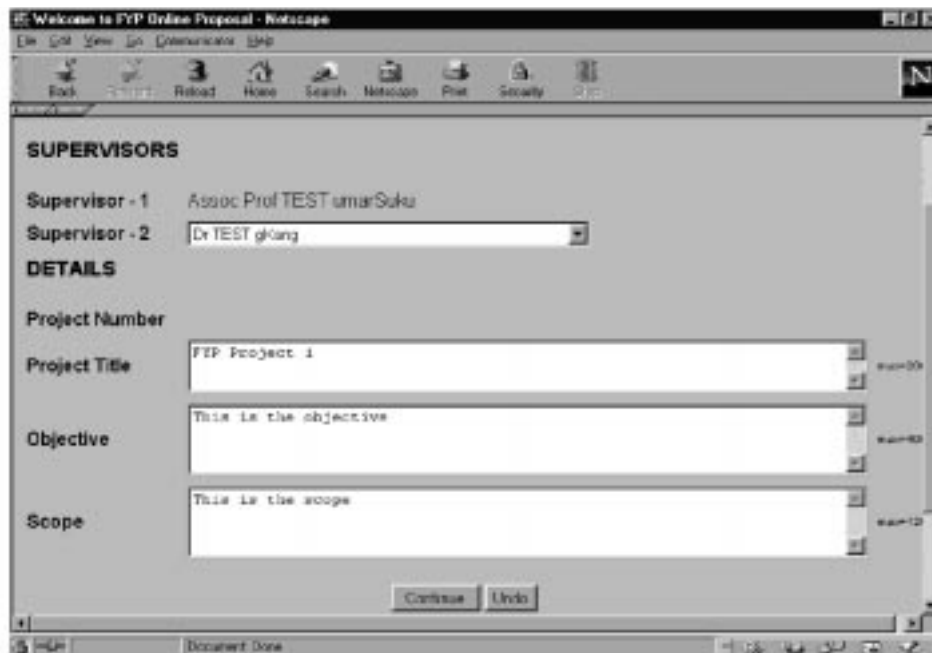


Fig. 5. An example of a function under the staff sub-system.

- Developer 2000 provides a better integration of various components (for example, data can be organised into reports).

However, despite complying with the need for a fast system, developing systems using Oracle Web Server PL/SQL can be a very tedious task. No facility exists for the developer to 'paint the screen' as you can normally do with 4GL tools such as Visual Basic, Powerbuilder and Developer 2000. As far as the Graphical User Interface is concerned, the system needed to be as user-friendly as possible because it was not possible to provide intensive training to all students and staff before using it. Therefore, the users' guide contains minimal, straight-to-the-point instructions on how to use the various options.

The use of colours is made to indicate to users which fields or values are required. For instance, in Fig. 4 the administration staff is supposed to enter a matriculation number and an allocation round as they are 'painted' in blue. The colour scheme is widely used in the various options found under the administrator sub-system.

To minimise the learning curve for students and staffs, a consistent look-and-feel interface (Fig. 5) is used when the FYP system has been designed. Both students and staffs are familiar with this kind of interface as it is used in most other systems such as subject registration system, staff's leave system. Hence, the learning time is reduced. A hard and soft copy of the user manual has also been written to help staff and students access and operate the system.

#### *Advantages of the system developed*

Some of the advantages of the computerised system developed are:

- Every academic staff can key in their proposal directly using the staff sub-system. This frees administrative staff from getting involved in data entry and no paper forms are used.
- Whenever there are corrections to be made after the proposals have been reviewed, academic staff can do so easily and conveniently using their office computers.
- There is no need to give students a long list of all projects. They easily and conveniently access the student sub-system to view all projects. They can search for projects using various criteria such as 'by supervisor', 'by project areas', 'latest projects'. . . In short, they have better access to information.
- The time spent on the FYP exercise is considerably reduced compared to the situation if a manual system were implemented. Consequently, deadline for submission of project proposals can be pushed backwards giving more time to students and staff to propose the projects. Students can view the available projects any time anywhere after the projects have been approved.

## CONCLUSION

This paper is a sharing of experience involving the co-ordination of the part-time FYP programme. Careful planning, clear communication and timely execution of tasks are critical in ensuring the smooth running of the programme. Information technology has been found to be particularly useful in achieving a high efficiency and productivity level. A flexible programme without compromising standards is also important in achieving success of the programme.

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## REFERENCES

1. Patrick S.K.Chua, *Proposal for Part-time B.Eng. Final Year Projects*, School of Mechanical and Production Engineering, Nanyang Technological University, Singapore, 1998.
2. *Information Handbook 1999-2000, Part-Time B. Eng. (Mech) Programme*, School of Mechanical and Production Engineering, Nanyang Technological University, Singapore.
3. *Obtain Your Degree Part Time While Pursuing Your Career*, School of Mechanical and Production Engineering, Nanyang Technological University, Singapore.
4. *Bachelor of Engineering (Mechanical) (Part Time)*, School of Mechanical and Production Engineering, Nanyang Technological University, Singapore.

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