CERTIFICATION OF APPROVAL

THINK HOSTEL MAINTENANCE SYSTEM (THMS)

By

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the requirements for the
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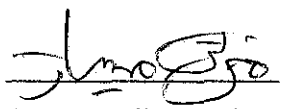
Approved by,



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1) System programming (computer science)
2) Application software

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein has not been undertaken or done by unspecified sources or persons.

(Mohd Saifulnizam Mohd Jaini)

Acknowledgements

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LIST OF ABBREVIATIONS

UTP	Universiti Teknologi PETRONAS
V5	Village Five
SDLC	System Development Life Cycle
PMMD	Property Management and Maintenance Department
RC	Residential College
SVG	Scalable Vector Graphic
THMS	Think Hostel Management System
UI	User Interface
JSP	Java Server Pages
HTML	Hyper Text Markup Language
LAN	Local Area Network
SDK	System Development Kit
SMS	Short Messaging System
PDF	Portable Document Format

ABSTRACT

This study deals with the complete development of the building maintenance system equipped with several features that are relevance to produce an enterprise problem reporting system. The objective of this project is to easily record and identify which area of V5 buildings are in need of attentions. Currently, the maintenance system of new V5 buildings is done traditionally whereby the problem reporting processes are done through a messy paper-based system. The scope of the study is the implementation of dynamic graphic in problem notification and reporting. Dynamic graphic has been widely used by the other web based system especially in weather and natural disaster prediction system. Here, the implementations of dynamic graphics are clearly discussed with the theory and technical requirement. The author has chosen System Development Life Cycle (SDLC) with rapid prototyping as the methodology for the project management framework. Author has done analysis regarding user preferences and based on the analysis's result, author has come out with a set of features that need to be embedded on the system. It includes dynamic graphic notifications and text reporting process to be applied in the system. In the result and discussion, the system modules, system's user interface and testing are included. As a conclusion, the extensive usage of mapping and dynamic graphic notification could definitely increase the services of problem reporting system in the proposed system.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

The World Wide Web provides a new medium of distributing interactive visualizations into a broad audience. In fact, as the world has known, World Wide Web has gained tremendous popularity in a manner that is beyond anyone's imagination. The introduction of dynamic content in Web phenomenon is the main factor of the robustness of the web based technology. The phenomenon of the application of graphics in web based system has improved several important elements in web based application such as user interface. User Interface is the part where human could interact with the computer application system. The way of human thinking and the logic of computer algorithms are definitely different. With the assistance of user interface, the two entities (human and computer) could work together in the virtual world. Graphics or image has improved the development of user interface in term of efficiencies and accuracy of understanding (between user and computer system). As a result, dynamic graphics has lead to the effectiveness of the e-commerce, personal web site and interactive online gaming. Recently many developers incorporated dynamic graphics and animation with their system. More and more researchers in any fields of expertise tend to make use of the dynamic graphics computer system to create model or simulations for their study and experiments.

This project is focus on the usage of dynamic graphics in problem reporting, generates image for problem to be reported and the review of the problem submitted by user graphically instead of using text as a medium of problem reporting. Some programmable graphics techniques would be reviewed in a way of choosing the best solution for problem reporting dynamic graphic generations. There are automatic image map generations, dynamic charts rendering and also the development of dynamic image driven by the database.

Dynamic Image Design is meant to be used as a facilitator. Developer use image design to assist the user in the task they are attempting to accomplish. Things like layout and typography allow user to highlight information that is more important or to minimize things that may be less important.

It is very convenient of using graphic such as pictorial presentations, graph and charts in displaying data analysis, discovering patterns and trends, making comparison and to communicate their result to other people.

This dynamic graphic is proposed to be applied in the Hostel Maintenance System which is focused on V5 building. V5 is one of the residential colleges in UTP. Consisting of twelve buildings, V5 could accommodate 2400 students.

1.2 PROBLEM STATEMENT

Maintenance of the buildings could be very troublesome when there is a large area to be cover up. The efficiency of building maintenance could not be achieved if the problems reported could not be arrived instantly to the responsible person. This inefficiency in maintaining the facilities could lead to the big problems such as an accident if the problem could not be solved quickly due to inefficient communication channel.

1.2.1 Problem Identification

Here is the list of the problems:

1. Maintenance process still working on paper- based forms and procedures
2. Slow response from the maintenance workers to resolve the problem arises
3. No proper system that integrate student with PMMD and RC Management.
4. Large area building for maintaining purposes (V5 buildings)

1.2.2 Significance of the Project

The paper-based procedures is not only leading to the inefficient in collecting data, but also give a bad impact in organizations if the data collected are not correct or inaccurate. The human errors factors have direct relationship with the usage of paper-based. Human tends to make mistake of doing detail works. It could lead to the unreliable of data and the integrity of data could be questioned. In fact, in a long run, paper-based procedures are not cost effective. The usage of a lot of papers and files consume a lot of money.

In accommodating vital services to the residence of college, quick response to some situation in which problem has been submitted is the measurement of the effectiveness of the services provided. Slow response is happened when the service provider does not understand what the exact problem is or perhaps it is due to the inefficiency in communication channel. Paper-based procedures could lead to this slow response problem. The missing of report papers and the misunderstanding of the report made by students are the reasons in slow response as well. The application of extensive graphical data representations in problem reporting could diminish the problem of the misunderstanding in the report made by students.

Currently, there is no computer system that integrates the RC management with PMMD. The utilization of reliable online access could integrate these two separate entities together, thus increase the performance of these two departments.

V5 is a large area which consists of 12 buildings to be cover up for maintenance. Without computer system for maintaining the buildings, it is difficult for the department to perform good services especially in the new buildings.

1.3 OBJECTIVES AND SCOPE OF STUDY

1.3.1 The Relevancy of Project

The project aims to allow V5 residences to have quick online access to PMMD and RC Management. This project is aimed at developing an online maintenance system useful for application developed in a hostel. THMS is a web based application that can be accessed throughout the campus (UTP). The utilization of reliable online access and extensive graphical data representations are quipped in this system. These are the objectives of project.

1. To develop the online maintenance system called Think Hostel Maintenance System for PMMD and RC management.
2. To computerized the process of the problem reporting
3. To assist student to lodge reports of any accommodation problem at any time
4. To enhance the maintenance problem notification system
5. To enable PMMD staffs and administrators to easily record and identify which area are in need of attention.

The scope of this study is definitely for applying graphical image to the problem reporting in hostel maintenance system for V5 buildings. This system could be used for logging accommodation problems, assigning task to responsible person and tracking the problem to resolutions.

1.3.2 Feasibility of the Project within the Scope and Time Frame.

The duration of time is estimated for two semesters which is consisting of about twelve months (Refer to Appendix I). The first part of the project (five months) is allocated for research of the project (research on dynamic graphic implementations and technical research). Technical research is focus on how the ideas could be implemented. It is including the research on how to develop the system, learning on

programming language that feasible to implement the system and complete the system prototype. This first part covers the paperwork writing as well. The analysis of the ideas is also implemented in this part. The second phase is the implementation phase. Four months are allocated for development process. The system is anticipated to be completed within this duration. The remaining three months is for testing purposes and deployment.

CHAPTER 2
LITERATURE REVIEW AND THEORY

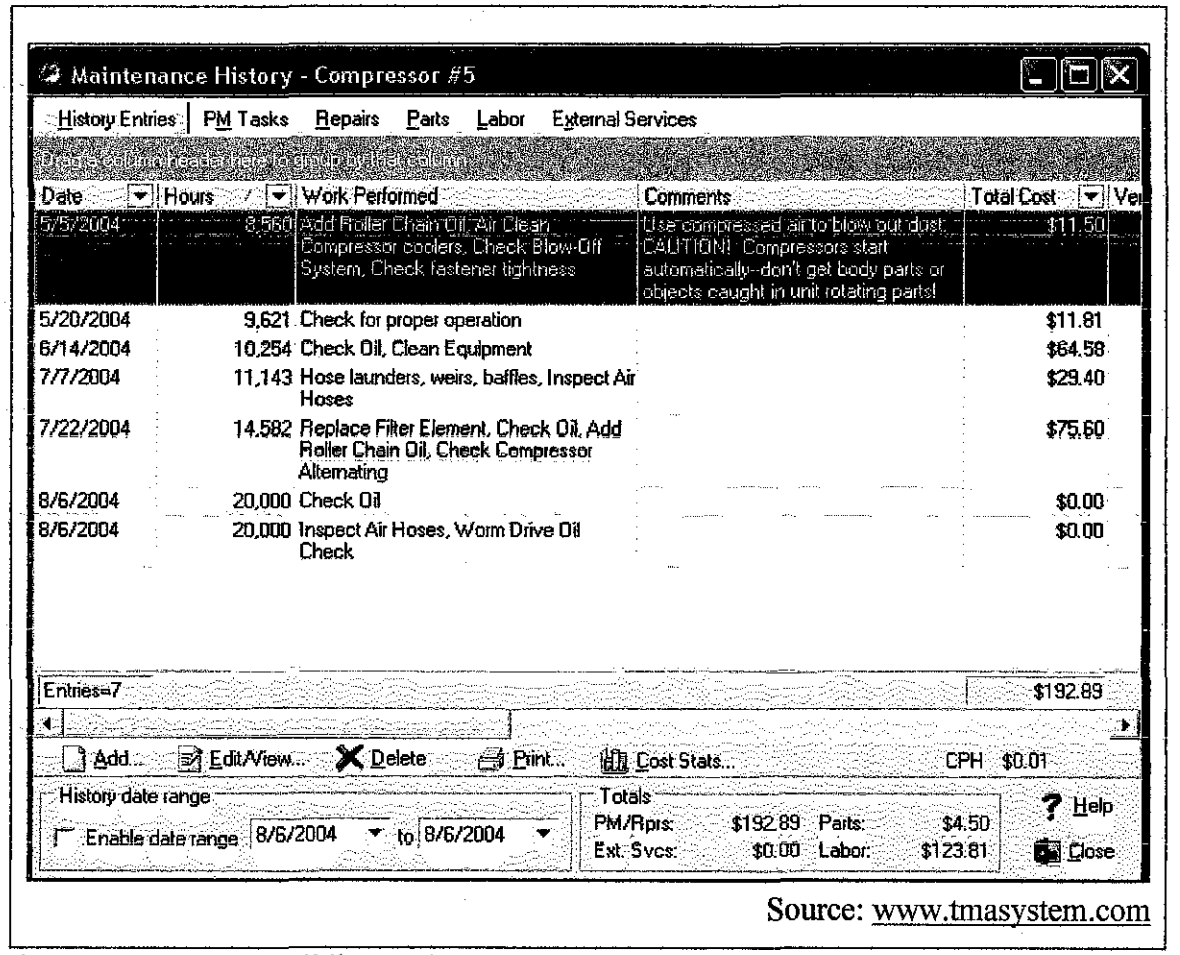
The proposed solution for this research project is the development of a building maintenance enterprise solution which is called Think Hostel Maintenance System. Comprising with the dynamic graphical problem notification, the author believed that this THMS system could cater a wide ranges of problem and assist the maintenance people and student in systematic manner, thus increase the efficiency of the services. Reviewing some samples of the same system (building maintenance system) over the internet and the current maintenance system, the author found there is no yet building maintenance system that applying the dynamic graphical notifications. What the existence system has is the traditional way of problem reporting which is by words. (Refer Figure 1)

Does the presentation of editorial content in text format help readers understand and remember more story information? Or the usage of multimedia presentation is better? The Eyetrack III team was curios. "Recall of Information Presented in Text versus Multimedia Format" report is one of many from Eyetrack III study of broadband – era websites. The result was published in September 2004.

The study found the following:

> It is important to note that in the test there are two modes of communication for the multimedia format- text and moving illustrations. Findings in the "Recall of Information Presented in Text vs. Multimedia Format" report reveal that information about a process or procedure that was unfamiliar to users was more correctly recalled when participants received it in multimedia graphic format. When asked to recall information about a process or procedure or to define vocabulary related to a new process that few participants were likely to have ever heard of before, participants who received information in multimedia

graphic formats appeared to learn more effectively and were more likely to answer questions correctly.



Source: www.tmasystem.com

Figure 1: Sample of Building Maintenance System

Here, the author would discuss the findings of the research about conveying information graphically especially through website.

2.1 GRAPHIC IN CONVEYING INFORMATION IN WEB- BASED SYSTEM

The most successful Web pages use both text and graphics to enhance the user's experience. The graphic design of a Web page can greatly influence the amount of time a user spends at a site. (H.M. Deitel, P.J Deitel, A.B Golberg, 2000). For instance, if a company's website contains only text, it may not produce as many online sales. Web site graphics, such as buttons, banners or product images helps make a Web site unique. In fact, it is just enough if the website only has picture about products they want to sell. It increases the integrity of the website and influence customers to buy the products.

Visual presentation could be an important part of a successful website. When designing a website, it is important to determine if an image map or other navigation aid can be most appropriate for the user. The whole point of image map is to provide more graphical interaction without much overhead (Fleishman, 1996).

Over a number of years the use of graphical presentations as part of data exploration and analysis has been steadily increasing. This has been made possible by the increasingly graphical nature of computer interfaces and is having the effect of making data analysis more interactive. An important point is that pictorial representations of data can help audience to see how the data and the underlying problem relate to each other in a way that numerical summaries do not. This is particularly true of those for whom statistics is not their primary interest, but a tool of their main discipline. In short graphics help them to see what is going on more easily than numerical summaries or descriptive, because most people think visually (Stuart G.Young, 1996).

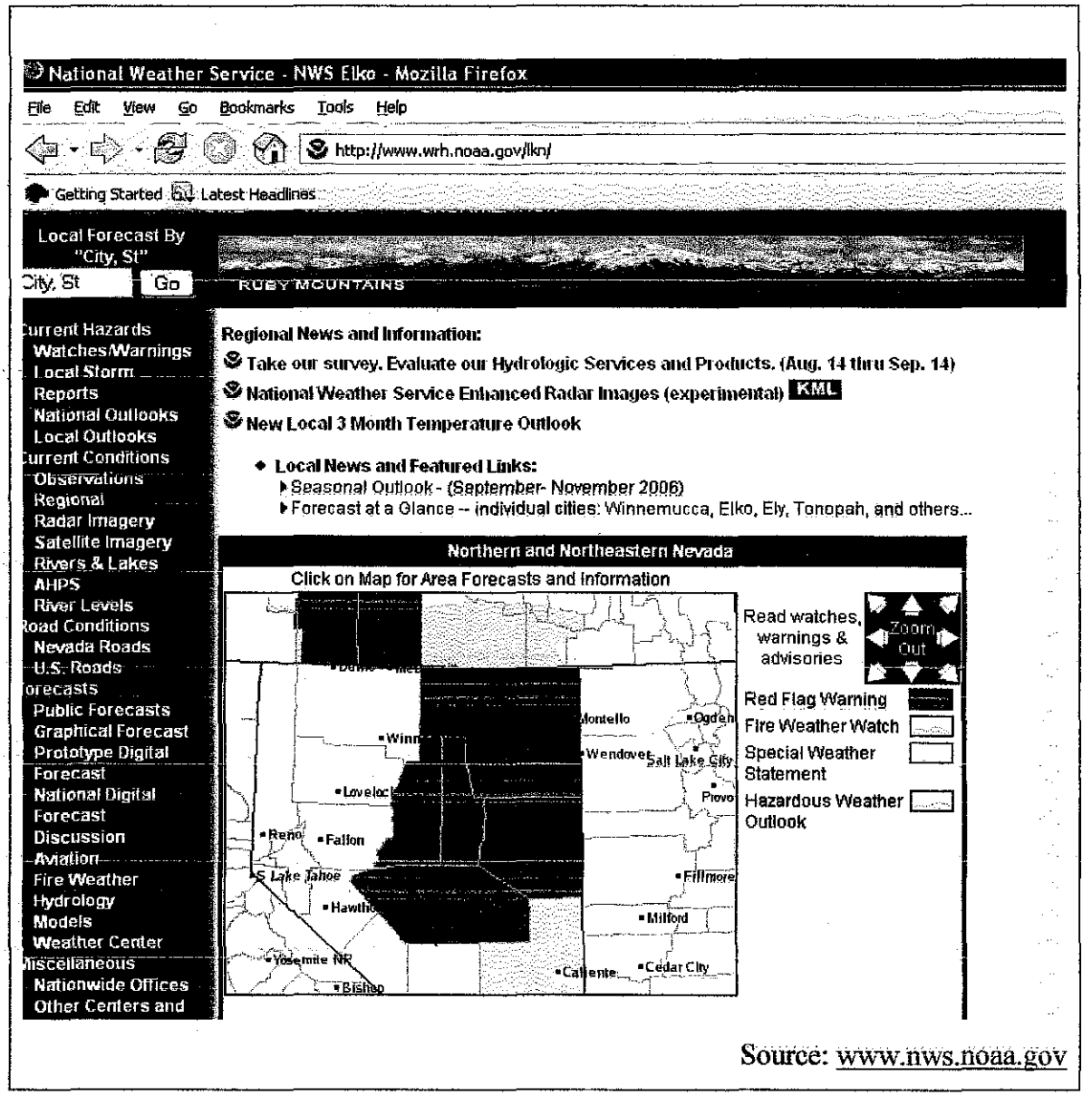
The scope of static graphical presentations can be extended by a newer type of graphic called a dynamic graphic. According to James Curral (2006), dynamic graphics are very similar to the static graphic except that certain aspects could be changed very rapidly without a complete redraw. It is dynamically changing. The following is a list of some of the aspects that can be changed:

- add and then move or modify a line or a plane
- highlight cases or a particular group of cases
- identify which case is represented by a particular point
- change which cases are displayed
- change parameters of a smoother or a model such as a regression line
- transform the scale of a variable
- change the number of bins in a histogram
- rotate a 3D scatter plot

2.2 DYNAMIC GRAPHIC

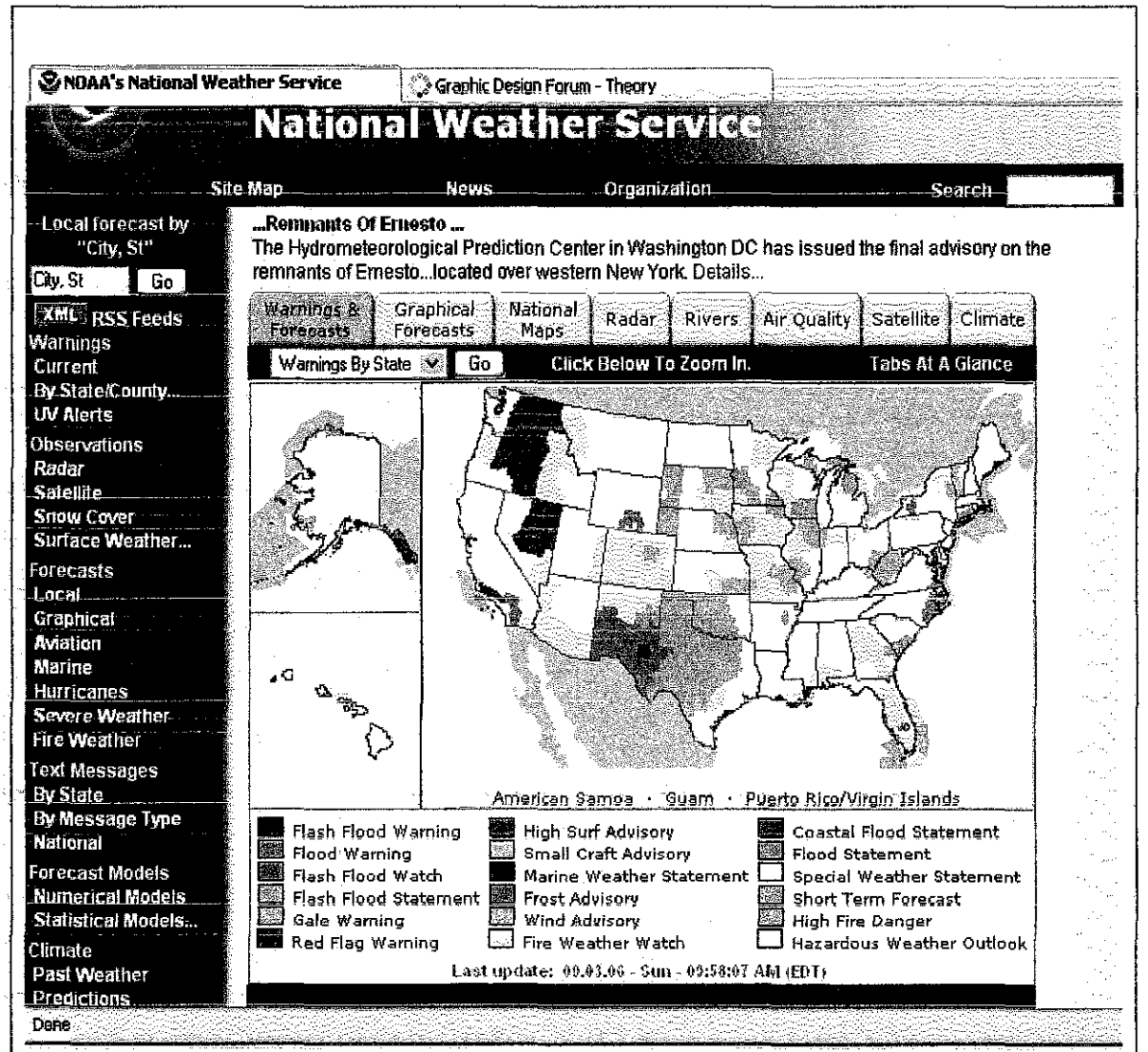
The aim of the application of the dynamic graphic is for representing dynamic data to the audiences regardless the audiences are from technical person who understand the technical thing or from the non technical person who do not have any experiences in that field. The text-based system only benefits the people who know the technical thing in one field of technology and some other people might be not understand what is all about. It is perhaps due to the word that they used (jargon) that make not understandable for the perspective of non-technical person. In other hand, dynamic graphical image presentation eliminates this kind of discrimination of technical and non-technical person. The users of the system could understand the information being conveyed regardless whether they are technical person or not.

The author has found one system that used dynamic graphic mapping is National Weather Services. The National Weather Services has been used this kind of technology for anticipating weather and sound warning in possible earthquake location in United State. The image is dynamically defined based on data from satellite and it is kept changing as new information keeps flowing in. (Refer Figure 2 and Figure 3)



Source: www.nws.noaa.gov

Figure 2: National Weather Services Northern and Northeastern Nevada



Source: www.nws.noaa.gov

Figure 3: Warning and forecasting the weather for United State.

2.3 GENERATING DYNAMIC IMAGE MAP

The setting up of an image to be clicked and the system will automatically bring the users into specific location has been discussed by the developers and researchers. One thing that could enable this to be happened is through image mapping. Image maps allow a user to click on an image, have that click translated into a set of (x,y) coordinates in pixels relative to the image, and then have those coordinates in pixels relative to the image, and then have those coordinates translate into a location or resource on the site network (Fleishman, 1996). In HTML, an image map is list of coordinates relating to a specific image, created in order to hyperlink areas of the image to various destinations (as opposed to a normal image link, in which the entire area of the image links to a single destination). For example, a map of the world may have each country hyperlinked to further information about that country. The intention of an image map is to provide an easy way of linking various parts of an image without resorting to dividing the image into separate parts.

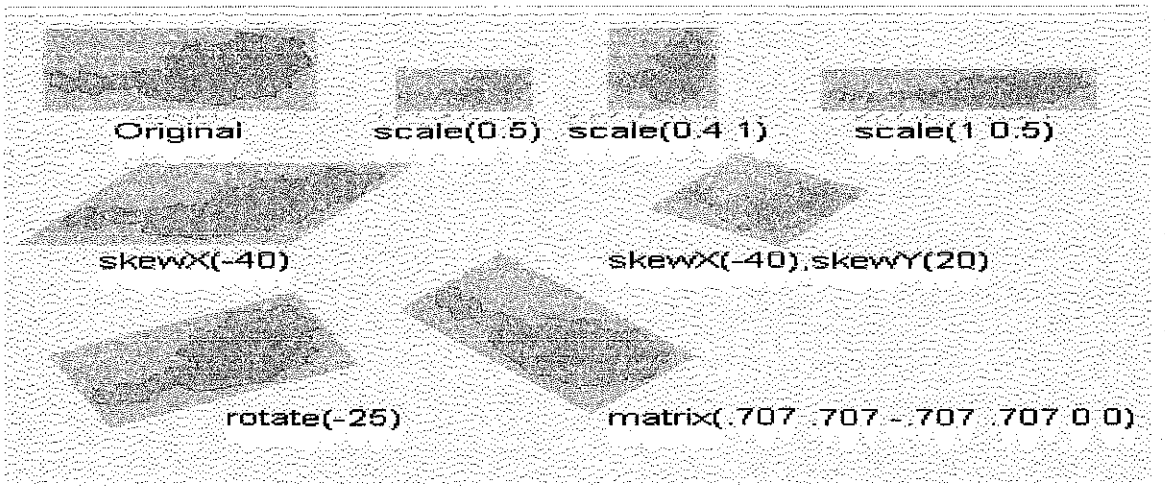
To apply dynamic image in the project, two methods for generating dynamic image in online system which are SVG, JFreeChart and Spatial data technique are considered.

2.3.1 SVG Technique

SVG is a language for describing two-dimensional graphics and graphical applications. SVG technology is already mature enough that there are a few books available and there is plenty of information on the web about this kind of technology. (Puneet M.Sangal, 2005)

According to carto.net, SVG allows different transformations: translation, rotation, scaling and skewing. The different transformations can be combined and nested. The matrix transformation is able to describe several transformations in one step, by using a "3x3" matrix from which actually only six values are used. (Refer Figure 4) In the

example in Figure 5 it is the same graphics: one object - defined once - with different transformations. Each object instance is translated to a new position.

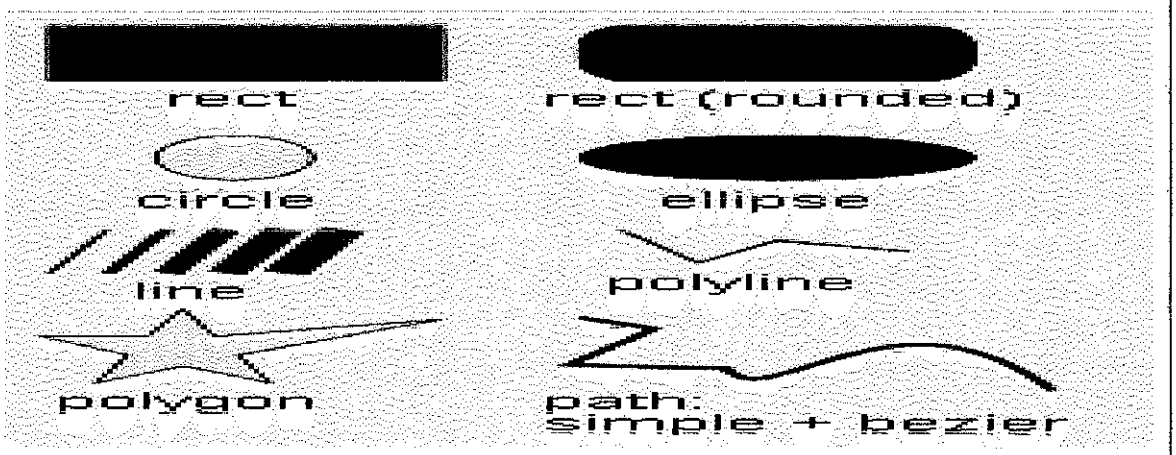


Source: http://www.carto.net/papers/svg/samples/matrix.shtml

Figure 4: Example of coordinate transformation

There are six basic elements available in SVG. All of the six basic geometry shapes can be substituted with the last, more powerful, path-object. With these basic objects we can derive all graphical objects, such as map symbols. See Figure 6 on basic geometric elements.

- Rectangle, with the possibility to round the corners.
- Circle
- Ellipse, per definition stretched horizontally or vertically but can be rotated.
- Line, can only have two vertices.
- Polyline, line with several vertices.
- Polygon, like a polyline, but always closed.
- Path, the most powerful element, accepts a lot of different parameters: moveTo, lineTo, horizontalLineTo, verticalLineTo und closePath. Path-elements may contain cubic and quadratic splines, as well as elliptical curves. Paths may contain holes or disjunct sub-paths.



Source: www.carto.net

Figure 5: Example of geometric elements.

2.3.1.2 Scalable Vector Graphics: Vector Graphic for the Web

Instead of describing an image as an array of pixel values, vector graphics describes a picture as a structured assembly of drawing primitives such as lines, polygons and text. Such descriptions are frequently more compact than images and admit to manipulation, especially if described using an XML markup language.

The picture could be incorporated into a HTML page using the object element. Refer Figure 6.

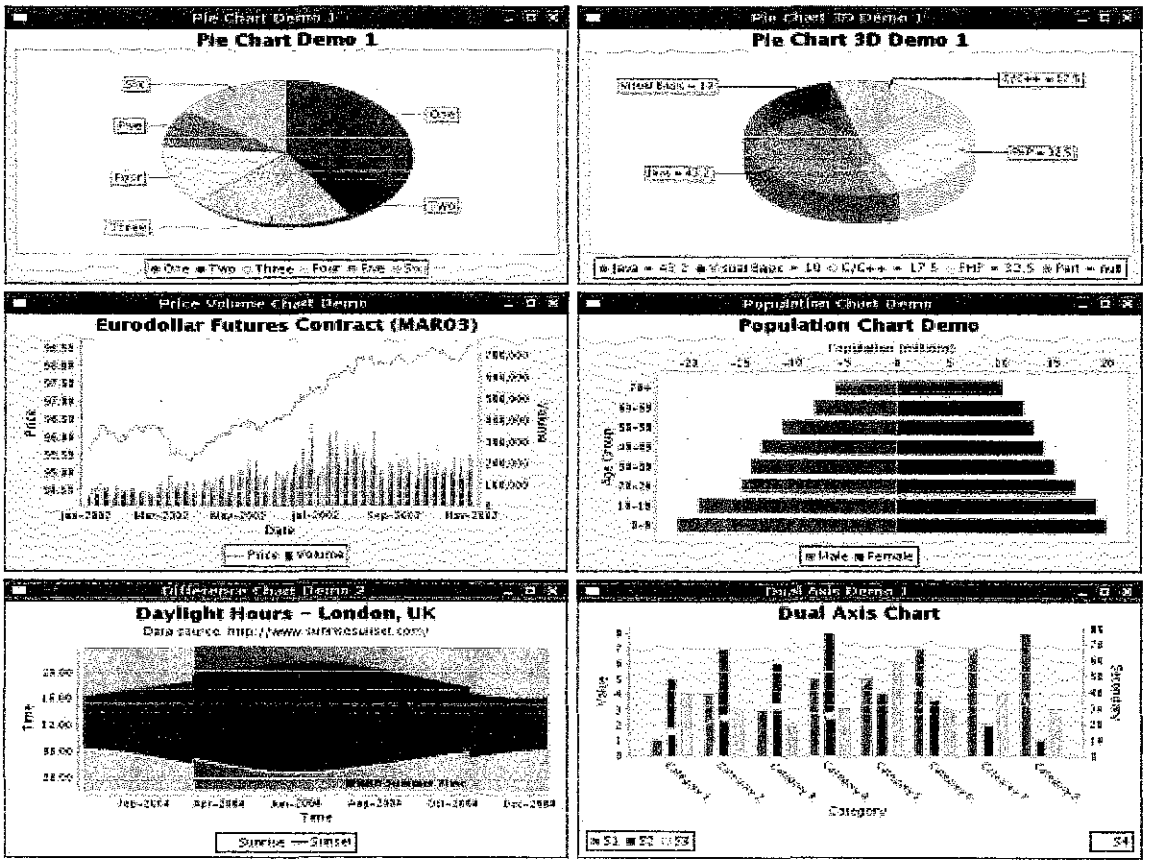
```
<object width="320" height="220" data="myfirstsvg.svg" alt="A simple SVG drawing" type="image/svg+xml">Please download Adobe Plug-in to see SVG diagram</object>
```

Figure 6: SVG incorporated into HTML

2.3.2 Dynamic Chart Generator – JfreeChart

The second way of generating dynamic graphic is by using java dynamic chart generator called JFreeChart. JFreeChart is a free Java class library for generating charts. According to Gilbert, JFreeChart is a Java chart library that makes it easy for developers to display professional quality charts in their applications. It is designed for use in applications, applets, servlet and JSP. It is a consistent and well-documented API, supporting a wide range of chart types. The developers could have a flexible design that is easy to extend, and targets both server-side and client-side applications. It support for many output types, including Swing components, image files (including PNG and JPEG), and vector graphics file formats (including PDF, EPS and SVG). (2005) In fact, it is open source software.

JFreeChart is written entirely in Java, and should run on any implementation of the Java. Shown in figure 7 is an example of chart generated by JFree Chart.



Source: http://www.jfree.org/jfreechart/samples.html

Figure 7: JFree Chart Examples.

CHAPTER 3
METHODOLOGY

3.1 PROCEDURE IDENTIFICATION

All projects could be managed better when segmented into a hierarchy of chunks such a phases, stages, activities, tasks and steps. The challenge in selecting a methodology is to do it wisely to provide sufficient process disciplines to deliver the quality required for project success, while avoiding steps that waste time, squander productivity, demoralize developers, and create useless project administrative (James R.Charpman,1997).

Based on the scope of the project with the given time available, the author chooses SDLC. SDLC contains phases chunked into planning, analysis, design and implementation. (Refer Figure 8). According to Allan Dennis, different projects may emphasize different parts of the SDLC or approach the SDLC in different ways, but all projects have elements of these four phases. Each phase is itself composed of a series of steps, which rely on techniques that produced deliverables. (2002)

3.1.1 Planning

The author understand that the planning phase is the fundamental process of understanding why an information system should be built and determining how the author will go about building it. The author has identified the scope of the project and background of study. The scope of the study is for maintenance purpose within V5. The entities related are RC and PMMD. The proposal has been submitted as well. Author also considers the technical feasibility study. It concern on how feasible the author to come up with the system (technical skill).

The gantt chart also developed in this stage. The time estimation is done. (See Appendix I: Gantt chart)

Author identified the technology and tools required in this project. In this part, the author has prepared for the preliminary research work. Some research and proceedings papers from other researcher have been reviewed.

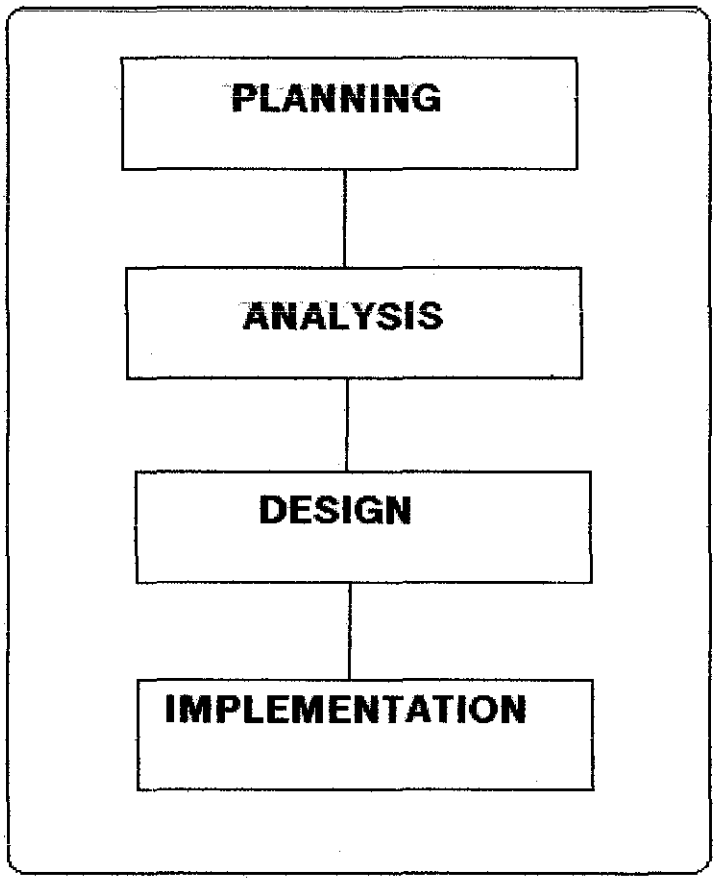


Figure 8: 4 SDLC Phases

3.1.2 Analysis

According to Allan Dennis, the analysis phase answers the questions of *who* will use the system, *what* the system will do, *where* and *when* it will be used. During this phase, the project team investigates any current system(s), identifies improvement opportunities, and develops a concept for the new system (2002).

Identifying and Analyzing Problems, Objectives and Solution

In this stage, the author has observed how students submit problem report to the responsible entities. The process of report submission is all done manually through paper based. Based on this observation, the author has identified several problems related to the paper-based system.

Observation is not just looking up into the client perspective (problem submitter/ student), the flow of this report submission was observed by the author as well. The inter dependant relationship between RC and PMMD is also included in this project's problem identifications. Currently, these two entities have been linked by the student who submits the problem report manually. However, there is no automated system that instantiate between these two vital departments.

The author has interviewed V5 Hostel Supervisor, Mr Afzan Ameir Saedin. This purpose of this interview is to determine the flow of the system to be matched with the current flow of the paper-based problem reporting. The current paper-based problem report management flow is discussed thoroughly with Mr Afzan and it is illustrated in Figure 9 below:

Step 1: Student come to RC office	Step 2: Problems Entry (Form)	Step 3: RC submitted Problem to PMMD	Step 4: PMMD Process reports	Step 5: Actions	Step 6: Feedback

Figure 9: Current paper-based problem reporting flow

This interview is also intended to get permission from RC personnel to deploy the system testing when THMS is scheduled to be completed. (See Appendix II: Interview Details).

After reviewing the current problems, the author has identified with several objectives to be achieved on. These objectives are to identify the proper solution to be made. The author has planned to name the system as THMS.

The author has reviewed several similar system related to the maintenance system via the Net. The author has found there are many opportunities to increase the efficiency of the available system in the market.

3.1.3 Design

The author understands that this phase decides how the system would operate, in term of hardware, software, user interface, and database. Based on the information collected earlier, the author has designed the logical flow of the system. The architecture of the system could be divided into four parts: (Refer Figure 10)

- Presentation Layer
- Application Layer
- Server Layer
- Database Layer

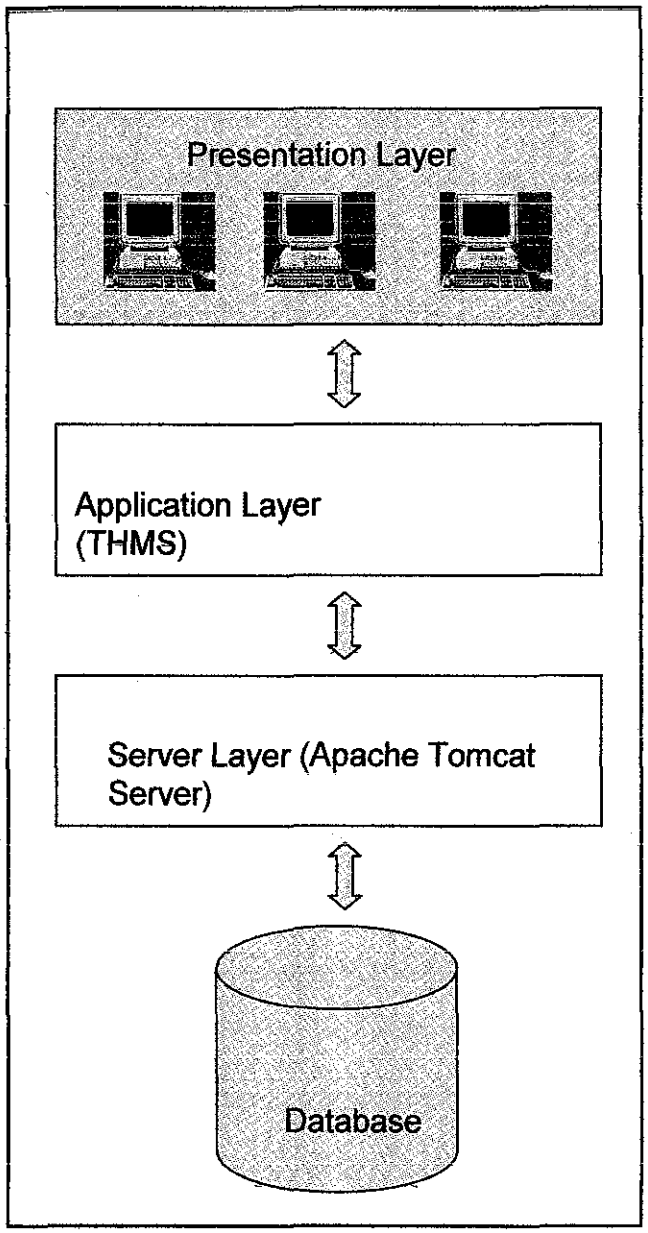


Figure 10: THMS Architecture Diagram

THMS Architecture Diagram (Refer Figure 10) illustrates the interaction between interdependent layers. The interconnections between layers are designed according to the standard of general information system development. It illustrates how clients are interacting with the server. It could be seen in the presentation layer which is consisting of several clients issuing the requests to the server. Application layer consists of the application software that provide presentation layer with the data and

model. Server layer is an intermediary for connection between application layer and database layer. THMS application layer consist of JSP pages, Servlet and Java Beans which requires Tomcat as a servlet container. Then the server would request required data to be exported from database layer into application layer.

3.1.3.1 Presentation Layer: Users Type and User Interface

The author has determined that the users of the system would be:

- Student (Problem reporter)
- RC personnel (Approver)
- PMMD personnel (Executor)

Student

Student would login the system when student wants to submit any report. Then the system would segregate the types of the problem whether it is civil or electrical. The system would place the problem as pending status.

RC Personnel

RC Personnel would login as approver and administrator of the system. RC personnel would look up at the problems submitted by student. Then RC personnel would change the status of the problem into active status. Active status indicates that the problem has been viewed by RC personnel and it is transferred to the PMMD personnel for further actions. It is important for RC personnel to know the problems happened in his or her obligations territory.

PMMD Personnel

PMMD personnel would login as executor and administrator of the system. The information being transferred from RC Personnel site would be looked up by PMMD personnel. The system through dynamic graphic conveys the underlying problem to the PMMD personnel. They are also informed through their personal email. Then when the actions have been taken to solve the problems, PMMD personnel is required to change the status of the problem into 'ok'.

User Interface

This system is a web-based application. The usage of intensive user-friendly UI would be implemented here. The combination between HTML and JSP make it possible for author to implement interactive UI.

Application Layer (THMS Software)

Application Layer would reside THMS software. THMS would accommodate the interaction between users. THMS are designed based on Open Source Software and Tools.

Server Layer

The server is a middle tier between application layer and the database layer. All requests by the clients through application layer would be process in this server layer.

Database Layer

The database is organized around problem reports and suitable data structure to record entries. The author has chosen to use postgeSql for project's database management system. (Refer Appendix III: Use Case Diagram and Class Diagram)

3.1.4 Implementation

The final phase in the SDLC is the implementation phase, during which the system is actually built. The author has specified 3 sub components in this phase:

- System Construction (Development and Testing)
- System Installation and Closing

System Construction

Development

The first step in implementation is system construction, during which the system is built and tested to ensure it performs as designed. Application code, databases development, and interfaces design are constructed during system construction. The author understands that this phase usually gets the most attention because for most systems it is the longest and most expensive single part of the development process. The author has completed all system design and support documentation. Based on those documents, author would proceed with the system development.

Testing

Before the system could be used, it must be tested. Testing is one of the most critical steps in implementation because the cost of bugs could be immense; most developer spend more time an attention on testing than on writing the program in the first place. There are several steps involved in this testing. The author follows a cycle to do testing:

- Requirement Analysis: Testing should begin with the requirement analysis.
- Design Analysis: During the design phase, author confers with targeted users in determining what aspects of a design are testable

- Test Planning :
    1) Test strategies that includes Functional Testing, Integration Testing and User Acceptance Testing
    2) Test Plans Creation

Test Development: Test Procedures, Test Scenarios and Test Cases

- Test Execution: Testers execute the software based on the plans and tests then reports any errors.
- Test Reporting: Once testing is completed, the author determines whether or not the maintenance system is ready to release.
- Retesting the defects

The author plans to have system testing as well as integration testing to ensure that all connections between the system units are in proper manner. For example, the connection between THMS system and its database system.

For user acceptance testing, it is scheduled to be held right after system testing and integration testing are successfully done. Author plans to have 2 sessions of user acceptance testing. For the first session, it would be held to the first group of users which are students and the second session would be held for the staff of PMMD.

For students' users' acceptance testing, author select 240 students for this testing. 240 students are selected because 1 block of building consists of 240 students. Feedback form (electronic form, email or paper based) would be given to them to be commented out. 240 students which is one block are feasible to do students' user acceptance.

For staffs' users' acceptance testing, author plans to have it after corrections has been made for student part testing. Author plans to deploy the system into PMMD

department. This testing would focus on the administration part. How users in PMMD could use and utilized the system. Feedback form would be provided to them.

System Installation and Closing

Upon the completion of the testing, the installation of the system would takes place. System would be installed in two departments; PMMD and RC. This would require user support as well such as training. New users would require training. At the closing stage, activities involved finalizing the system, presenting the system and preparing final documentation and lesson learnt.

3.2 TOOLS REQUIRED

3.2.1 Software

- Net Beans Java Editor
- Apache Tomcat Web Server
- JDK 5.0
- Postgre SQL Database System
- Internet Explorer or Mozilla Firefox.
- Service from simplewire.com (for sms part)

3.2.2 Hardware

- Personal Computer with Windows Operating System
- 512 MB RAM (for development purpose)
- Hard Disk 2 GB and above (for development purpose)
- LAN Connection

CHAPTER 4
RESULTS AND DISCUSSION

4.1 PREDEVELOPMENT SURVEY

A predevelopment survey was conducted to gather people's opinions towards matter related to project being research. Survey is used because there is a large of number of people from whom information and opinions are needed. The objective of this questionnaire is to gather information, opinion and feedback for the research work.

The questionnaire consisted of 8 questions related to the behavior of the users when they want to report any defects to the department. These questions also mine the preferable features of a problem reporting system. The author distributed questionnaires randomly to student who stayed in V5 and to RC Staff.

There are 40 questionnaires being distributed on Wednesday, 4th October 2006. The questionnaires are distributed among V5 residences and for RC staffs. (Refer Appendix IV)

According to the survey result, all respondents have internet connection or LAN connection. This is including the survey provided to RC office in V5. However there are only 3 (8%) peoples out of 40 have ever used online based system for property problem. Other 37 (92%) respondents chose 'no' as their answer means they never ever used any online based system for property problem. In surveying the behaviors of the respondents about making complaints, 10 of them do not care to report and fix the problem instead 19 respondents fix the problem by their own initiative without reporting to the responsible department. Only 9 respondents go to the liable department for reporting the problem. 2 respondents chose others and state that they

have reported to the liable department but no single actions has been taken by the department.

Most of respondents agree that online based system would help them in the property problem reporting processes. This could be seen through 32 (80%) respondents chose good to have online based system as their answer. While 8 (20%) of them state it would be average. No respondents' state online based system would be 'unsatisfactory' in assisting them for problem reporting purposes. Shown below (Figure 11) is a pie chart of respondent's consent on how they find an online based system would help for the property problem reporting processes.

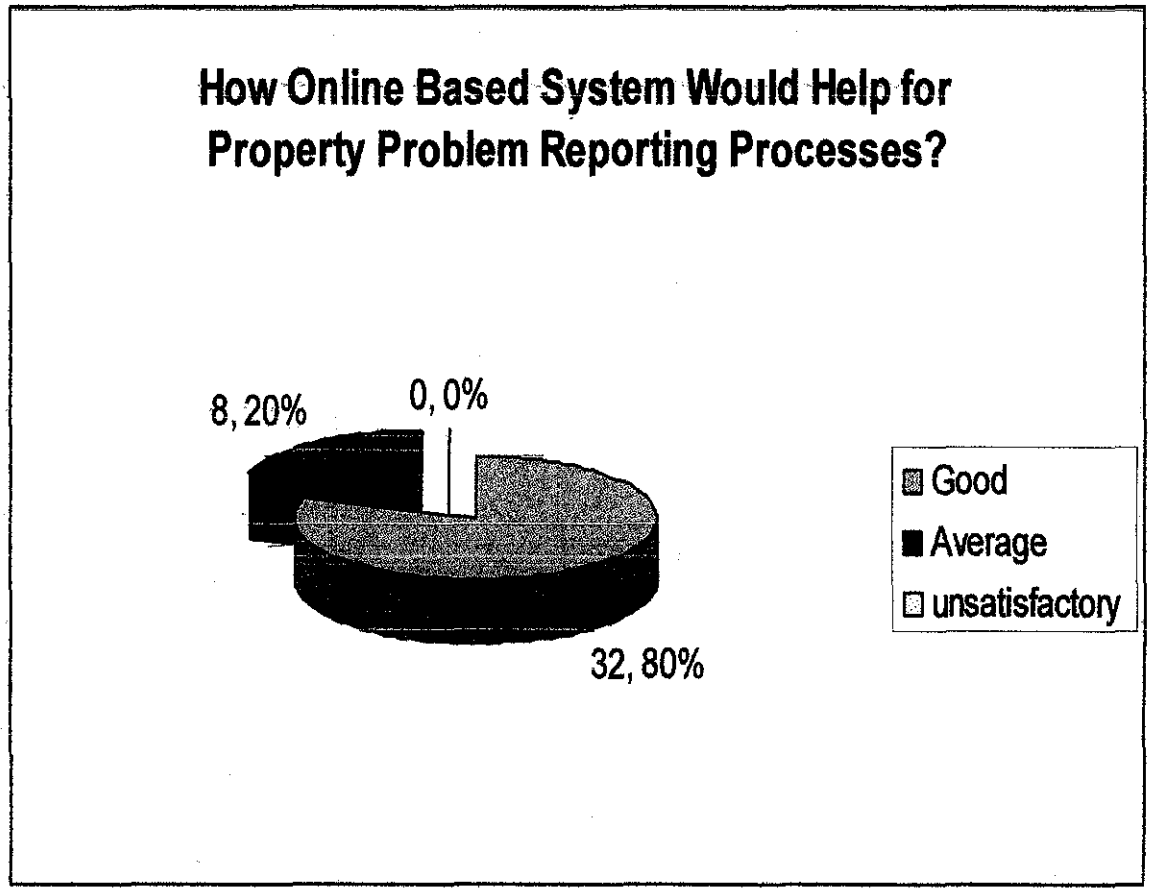


Figure 11: Pie Chart shown on analysis of How Online Based System would help for property problem reporting processes.

Windows has been the most operating system that the respondents used. It is shown by 28 (70%) respondents used windows as their operating system while 12 (30%) respondents state chose others.

When they are asked about how they preferred information of reported problem being displayed in Online Based System, 39 (97%) prefer the information should be displayed with the combination of both graphic and text, but minimal text. 1(3%) respondent prefer the information should be displayed with the combination of both graphic and text, but minimal graphic. No respondents choose graphic only and text only. This is the most extreme findings from the survey. Shown below (Figure 12) is a pie chart of respondent's consent on how they prefer information of reported problem being displayed in Online Based System?

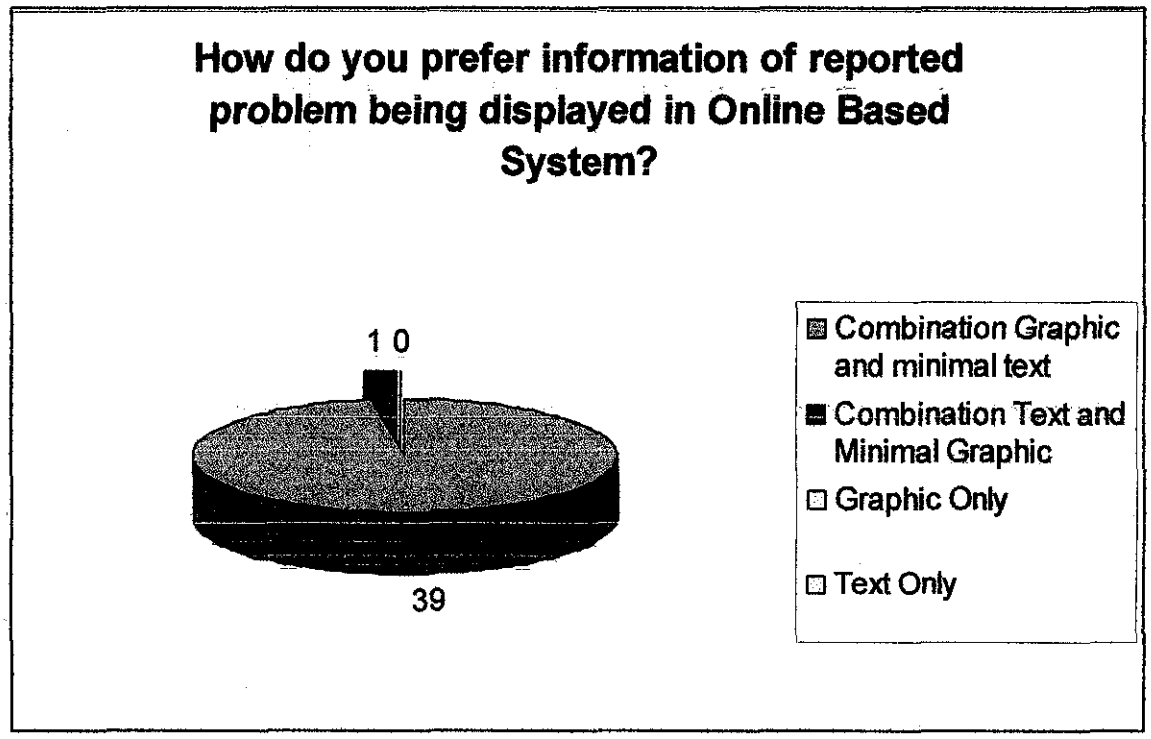


Figure 12: how they prefer information of reported problem being displayed in Online Based System?

The respondents were asked with additional questions 'are they comfortable with the traditional paper-based system?". Majority of them which is 29 (72%) of them say 'no' and other 11 (28%) say 'yes' and stated that they have used traditional system for a long time.

4.2 PREDEVELOPMENT INTERVIEW

The interview with V5's RC personnel has been held on Wednesday, 27 September 2006 at RC office. The author has interviewed Mr. Afzan Ameir Saeidin. The purpose of this interview is to gather the user's opinion about maintenance system online system.

Mr Afzan has agreed that the problem reporting process has used paper-based system. The reporter should fill in the form and submit it to RC before RC could deliver the form to PMMD. He has agreed that the form filling have disadvantages. It may take longer time to process. Missing report form could be happened. (Refer to Appendix IV: PMMD Work Request Form)

Mr Afzan also agreed there is no other automated system that link RC with PMMD. He added if there is an automated system that links both departments, it would decrease the barriers of communication between two departments that are so important in residential management.

There is no internet connection in his office but has LAN connection. He also gave permission to deploy THMS software in his office when THMS is scheduled to be completed.

He also added that the cafeteria in V5 residences is not under his obligation. Any maintenance problem in cafeteria would be reported by the owner of cafeteria itself.

4.3 SYSTEM INTERFACE AND MODULE

Based on the predevelopment surveys and interview, user interface of the THINK Hostel Maintenance System has been designed. There are 4 modules involved in this system:

- Database Module
- Student Module
- Administrator Module
- Contractor Module
- RC Module

4.3.1 Database Module

Database Module is very crucial in the reporting system. As one of the reporting system, THMS has initially focused on database development. The database management system for THMS is Postgre SQL. It is an open source database management system. It is available on the internet for free. Currently for THMS, there are 7 tables which comprise login, reporter, staff, student, operator, problem and location tables (Refer Figure 13).

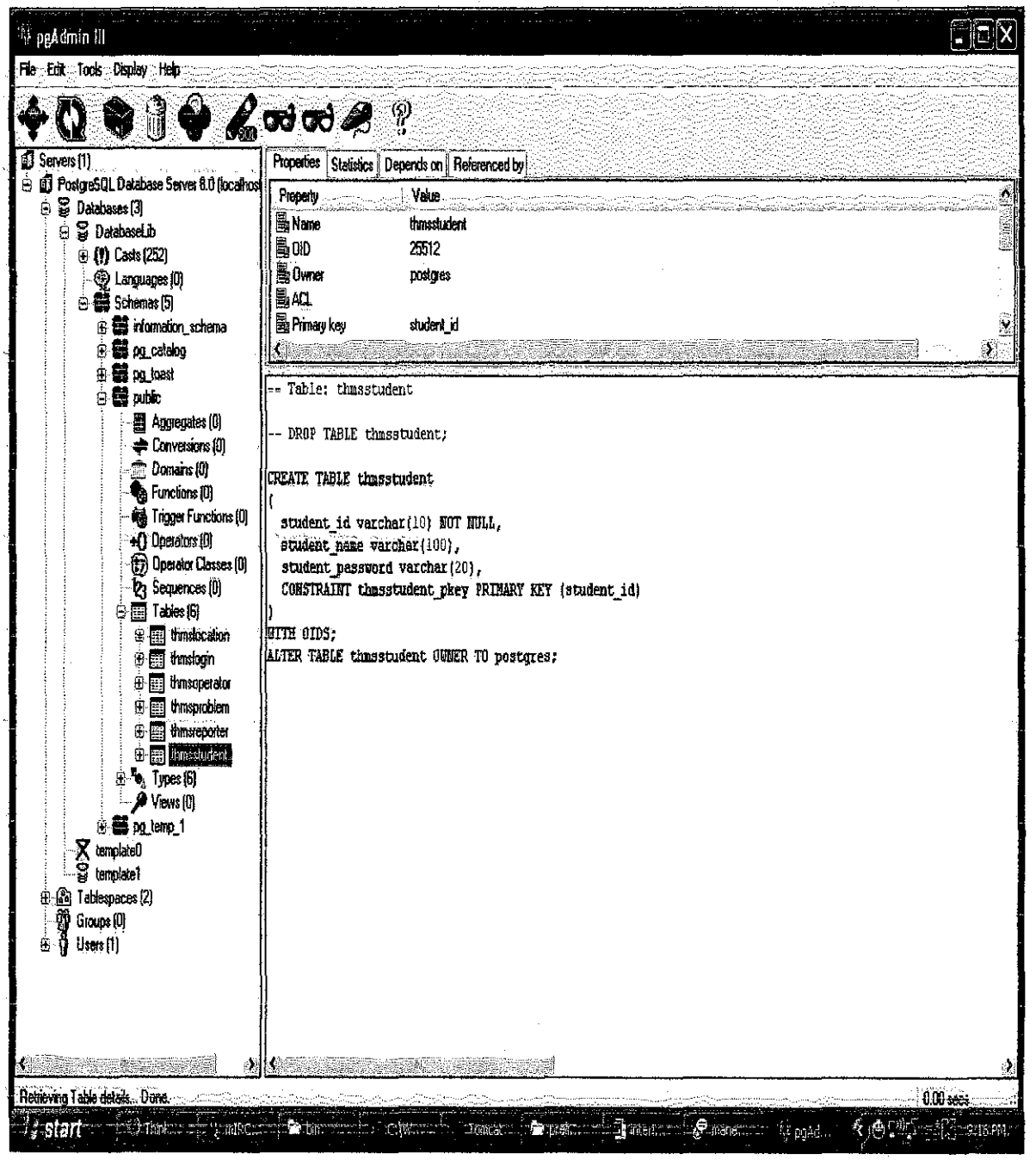


Figure 13: THMS database in Postgre SQL

4.3.2 Student Module

For student module, this is for the purpose of reporting process. Student may submit their report through the system within this module. It comprises student login part

before they could submit any report. This is to identify which student lodge the report instead of preventing fault report to be submitted. Student may login using their student id. The system would do identification checking based on existing database record (Student Record). (Refer Figure 14).

Figure 14: THMS student's login page

In this module, student would have their own control panel. (Refer Figure 15). There are change profile function, make report function and view history function in this control panel. In change profile function, student could change their particular as well as to renew their old password. (Refer Figure 16).

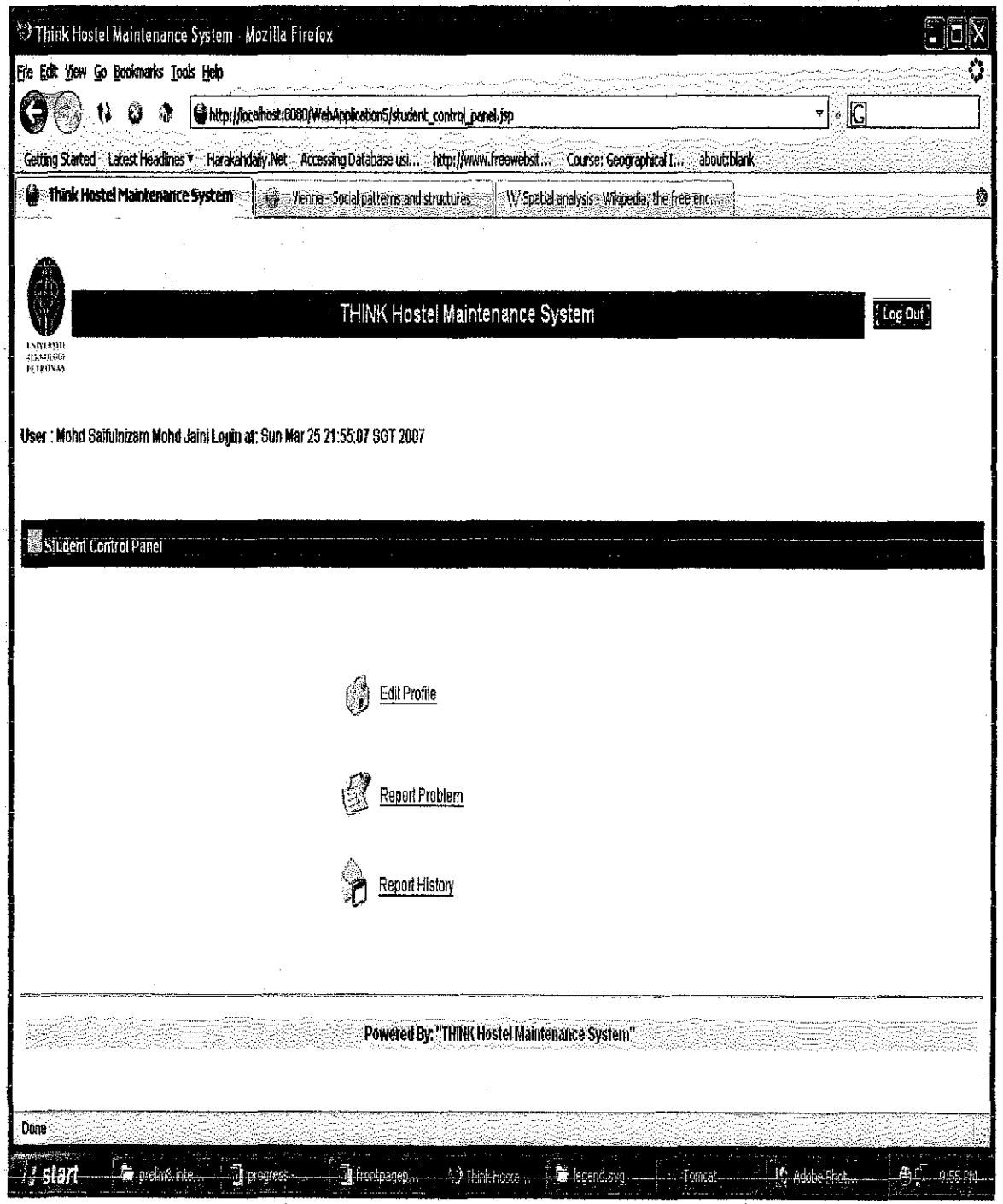


Figure 15: THMS student's control panel

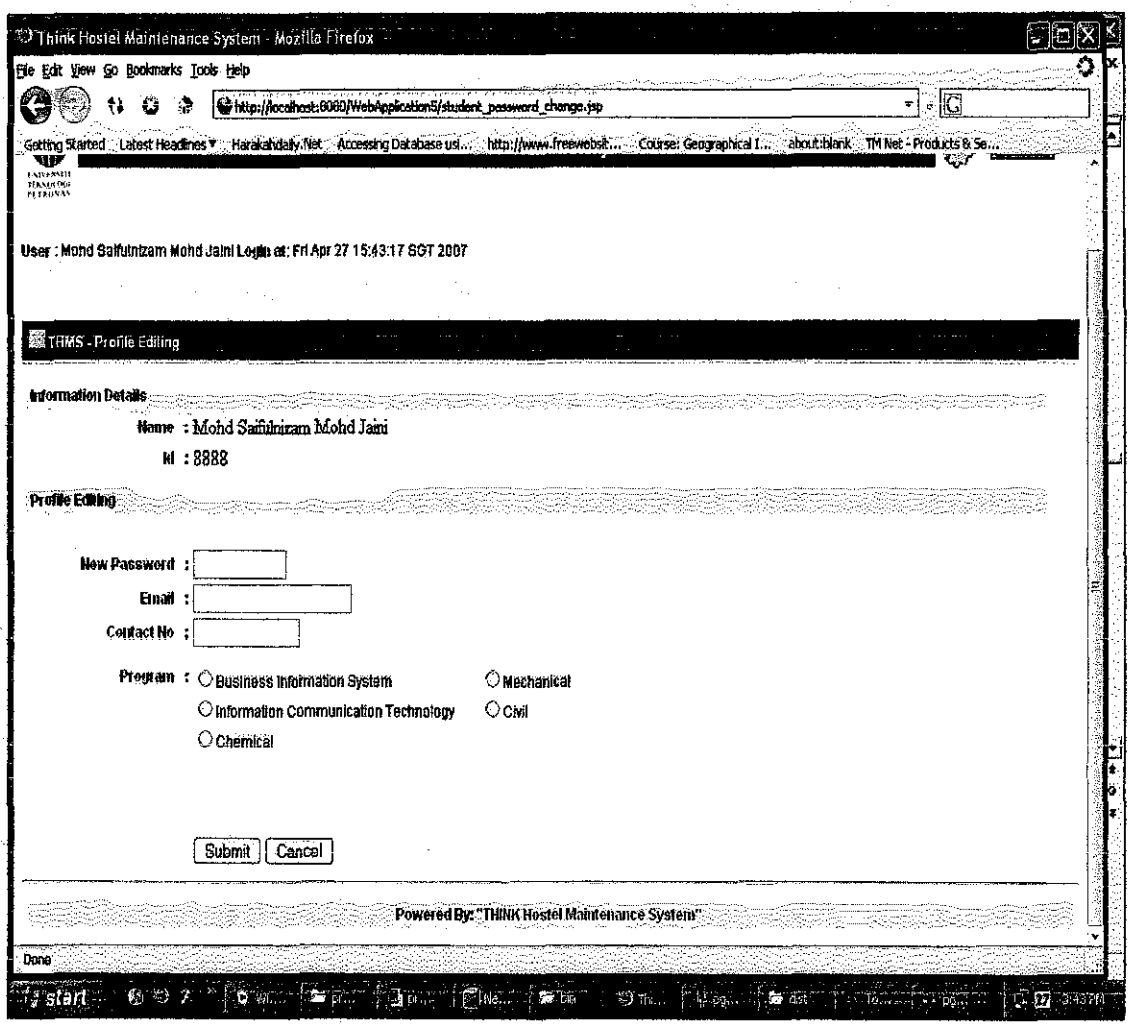


Figure 16: Student Profile Editor

Student electronic report form also completed at this stage (Student's make report function). At this point of time, all connection to the database has been established and it is successfully done. However, the form error checking is still under development. (Refer Figure 17 and 18). Once users click on the submit button, confirmation page about the report would appear. However, at this point of time, the design of confirmation page still under development. (Refer Figure 19)

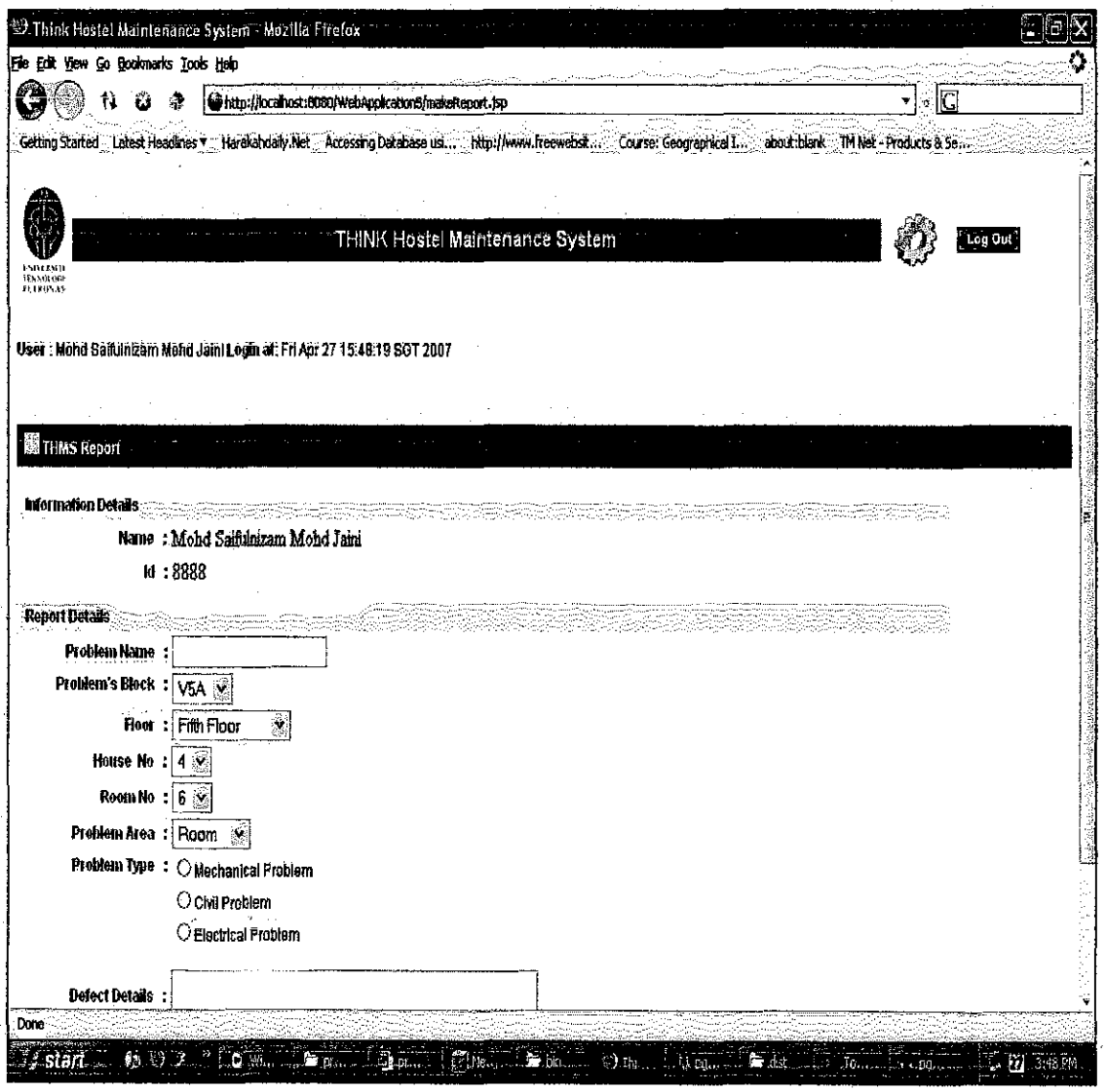


Figure 17: THMS electronic report

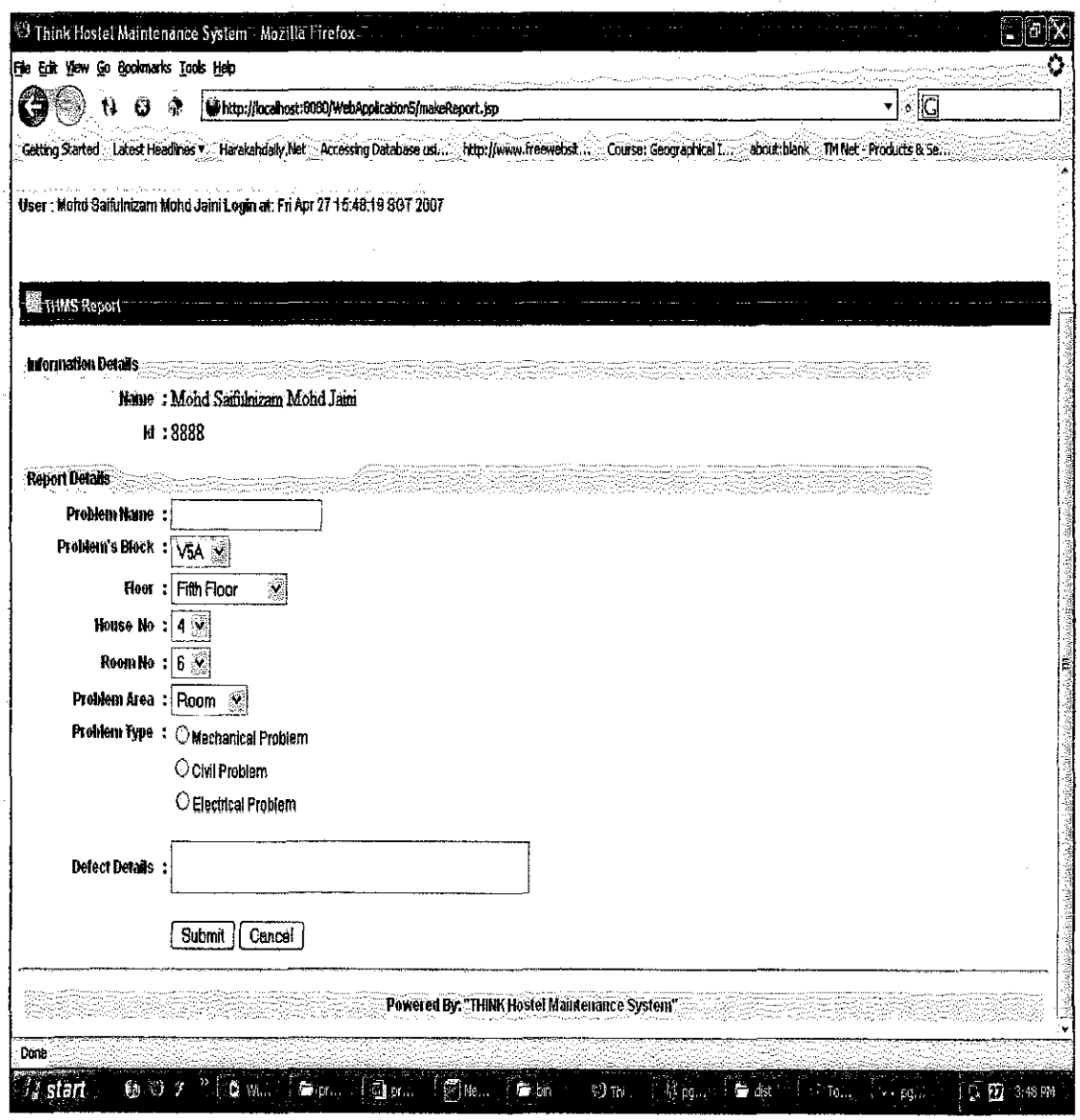


Figure 18: THMS electronic form

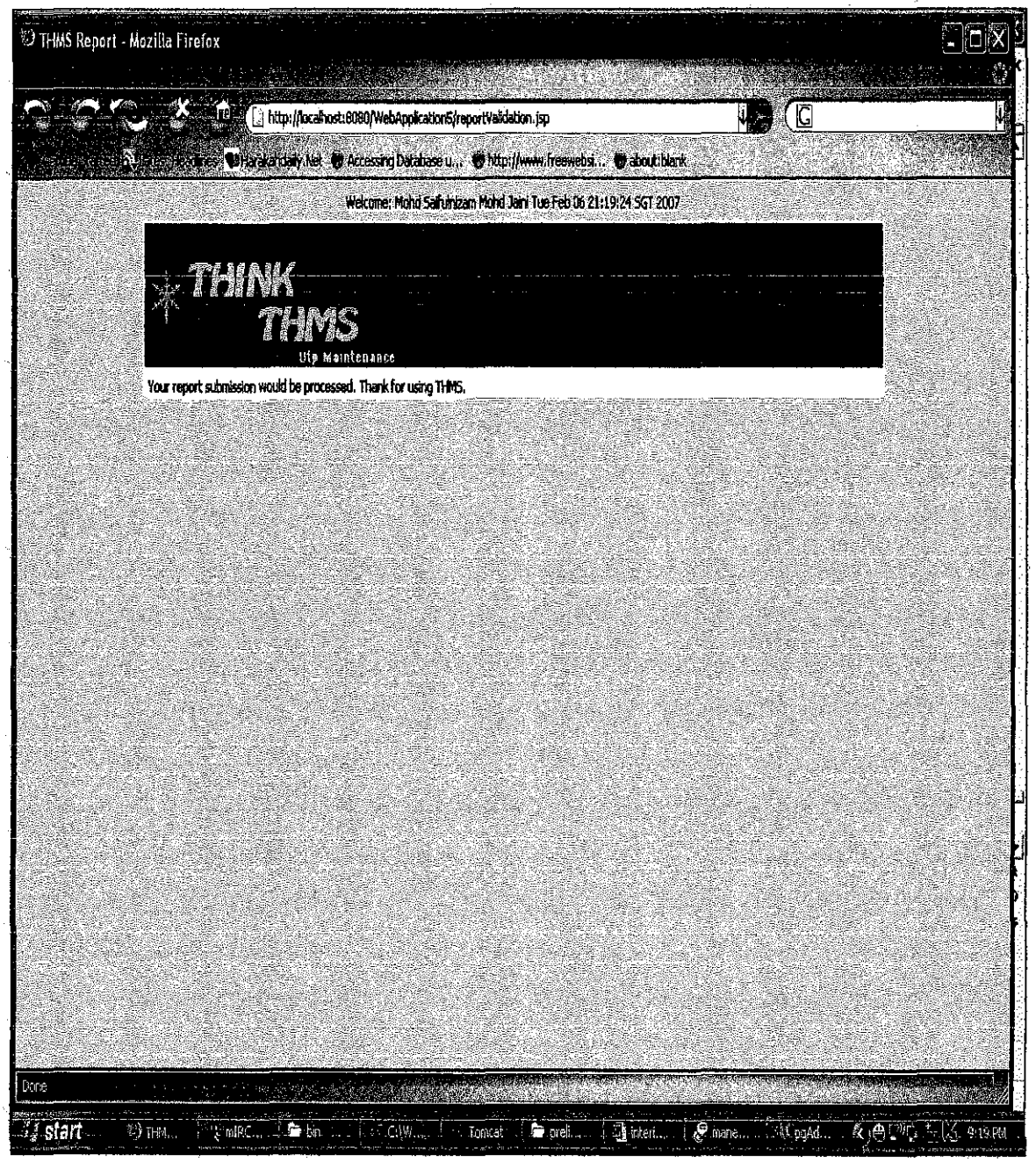


Figure 19: confirmation page

Student could also view their report history in Report History function. (Refer Figure 20). The list of report that student has made through this system would appear. This function enable student to view the status of their report automatically.

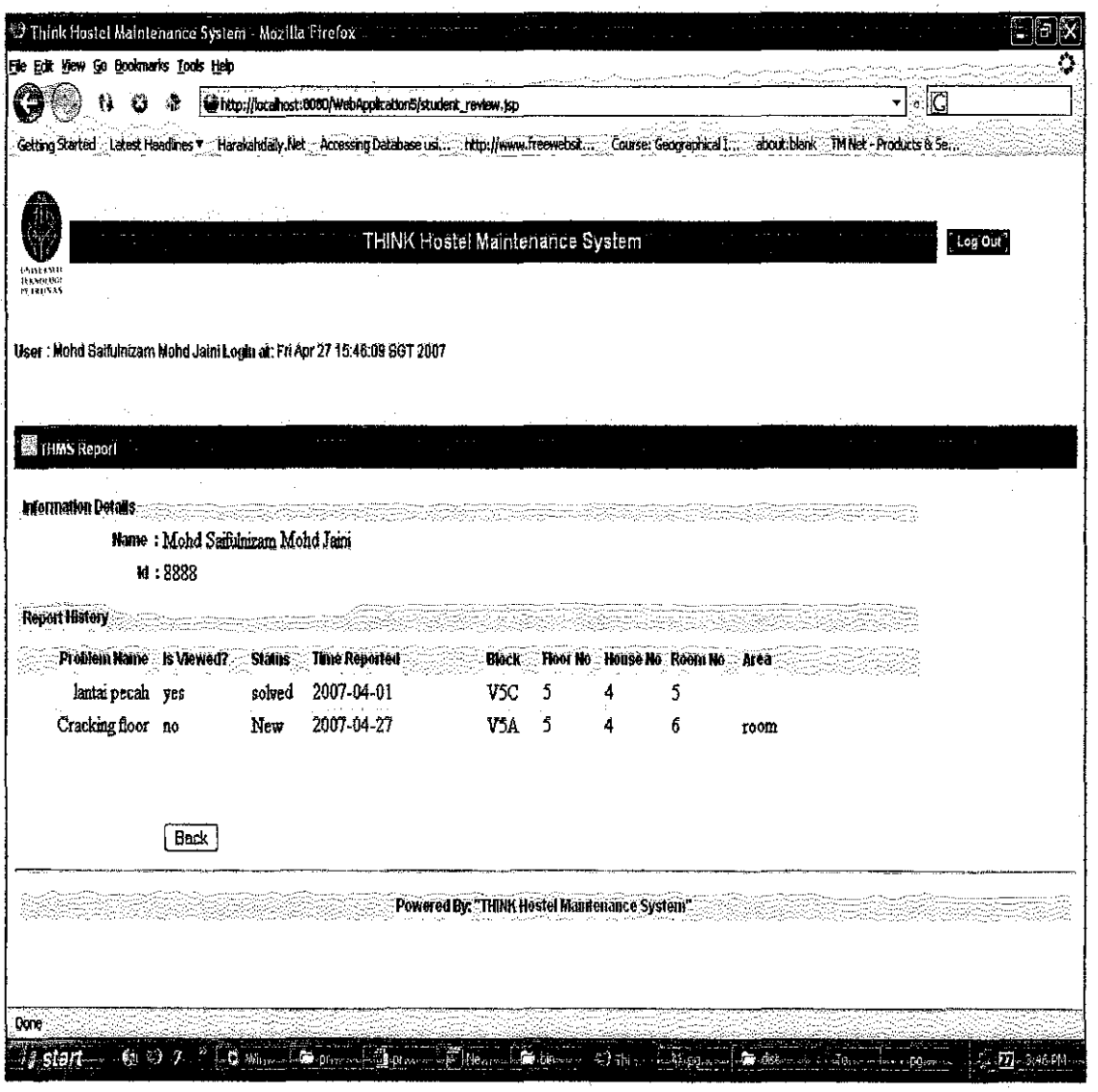


Figure 20: Student's Report History

4.3.3 Administrator Module

Administrator module is the center of the system. Reports from the submitter would be process by PMMD staffs in this area. Login page for staffs has been completed. (Refer Figure 21). The design for administrator login page is same with student login page. Perhaps there are some changes later in near future.

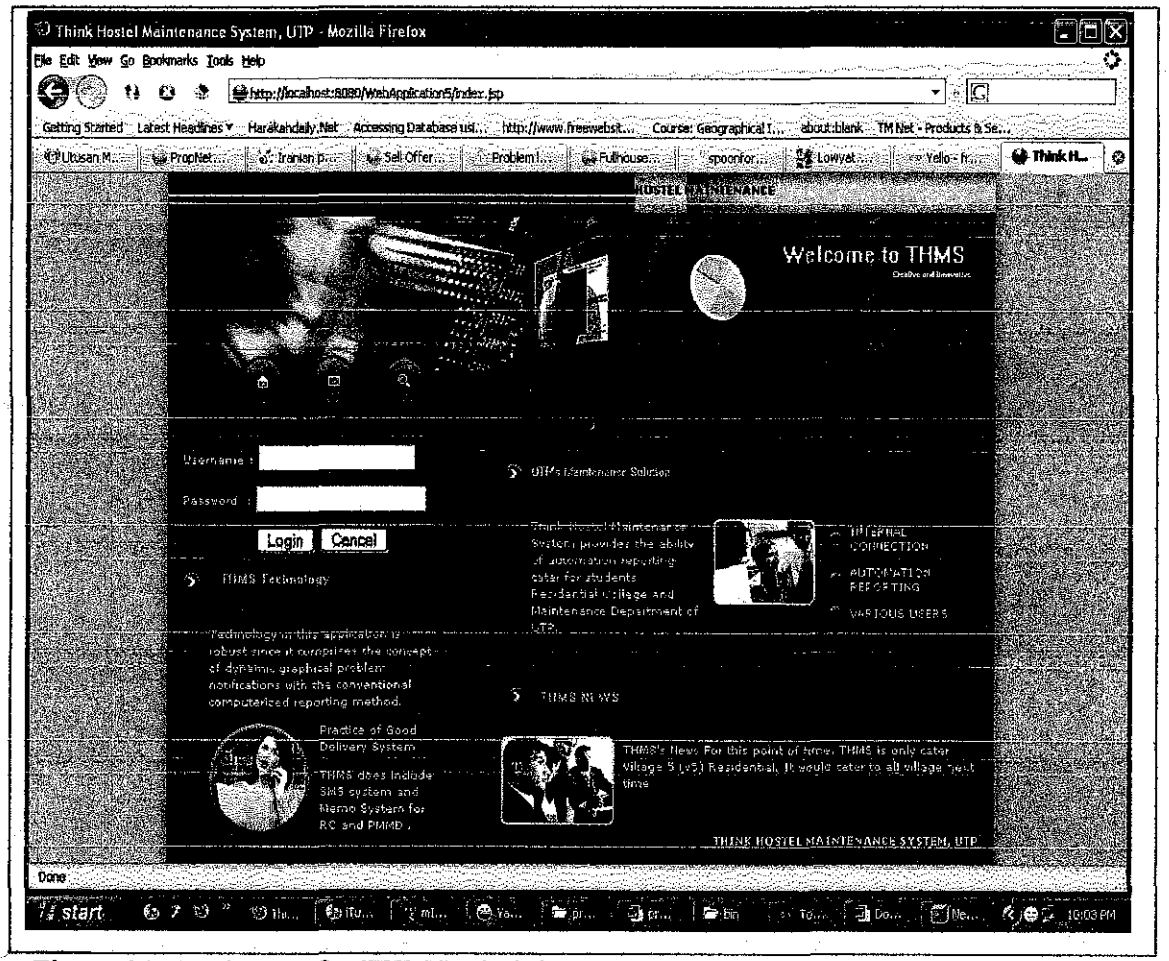


Figure 21: Login part for THMS administrator

As similar to the student module, administrator has their own control panel as well. (Refer Figure 22).In this page, after administrator pass the login process, administrator could automatically has a list of new problem being reported by student. This list is to make administrator aware about new problem being reported.

There are 7 functions in administrator's control panel. There are Maintenance by Map, History Analysis, Memo Management, New Problem Solved, Problem Management and Staff Information functions. Administrator could go to any functions by clicking on particular icon.

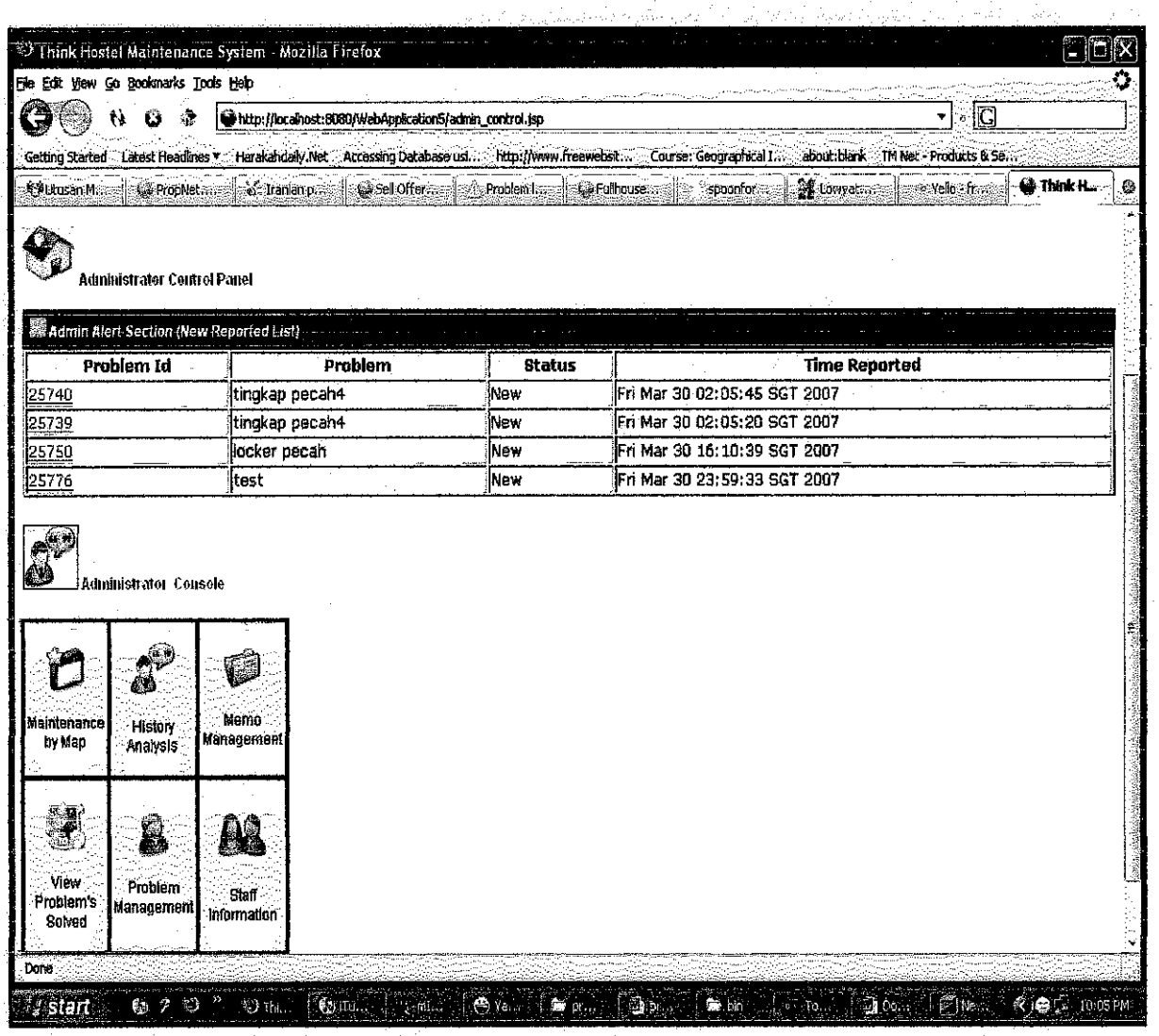


Figure 22: Administrator's Control Panel

Maintenance by Map

This function enable administrator to view each building, floor, house and room graphically for maintenance purposes. Administrator could choose which block, floor, house and room to be viewed via map. (Refer Figure 23). Once administrator select

required block, floor and house, the system would show map of particular house. Alarm signal would appear to the locations/ room that has been reported by student as has problem. (Refer Figure 24) Here, administrator could print the map into pdf format or into normal printer.

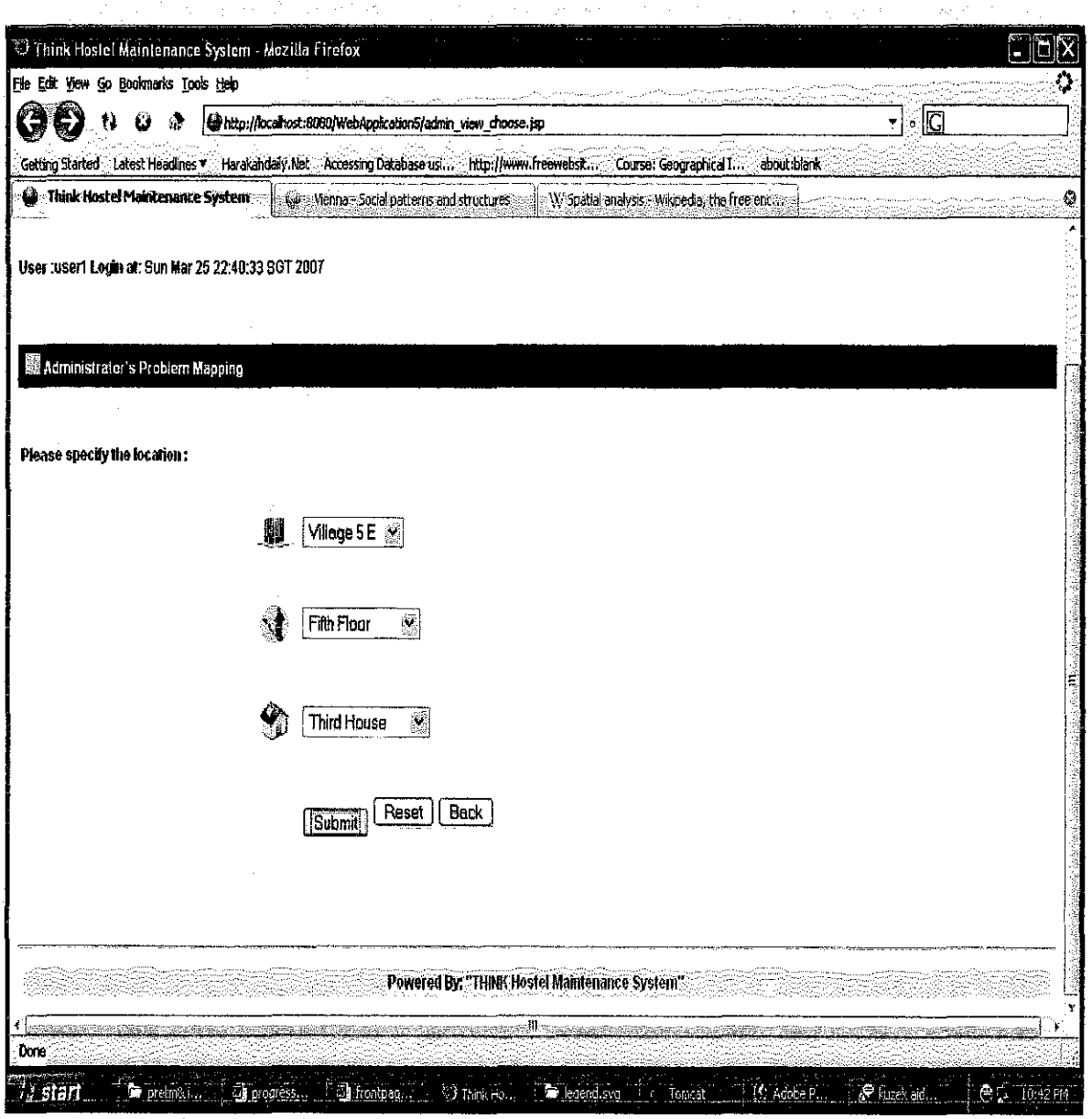


Figure 23: Maintenance by Map

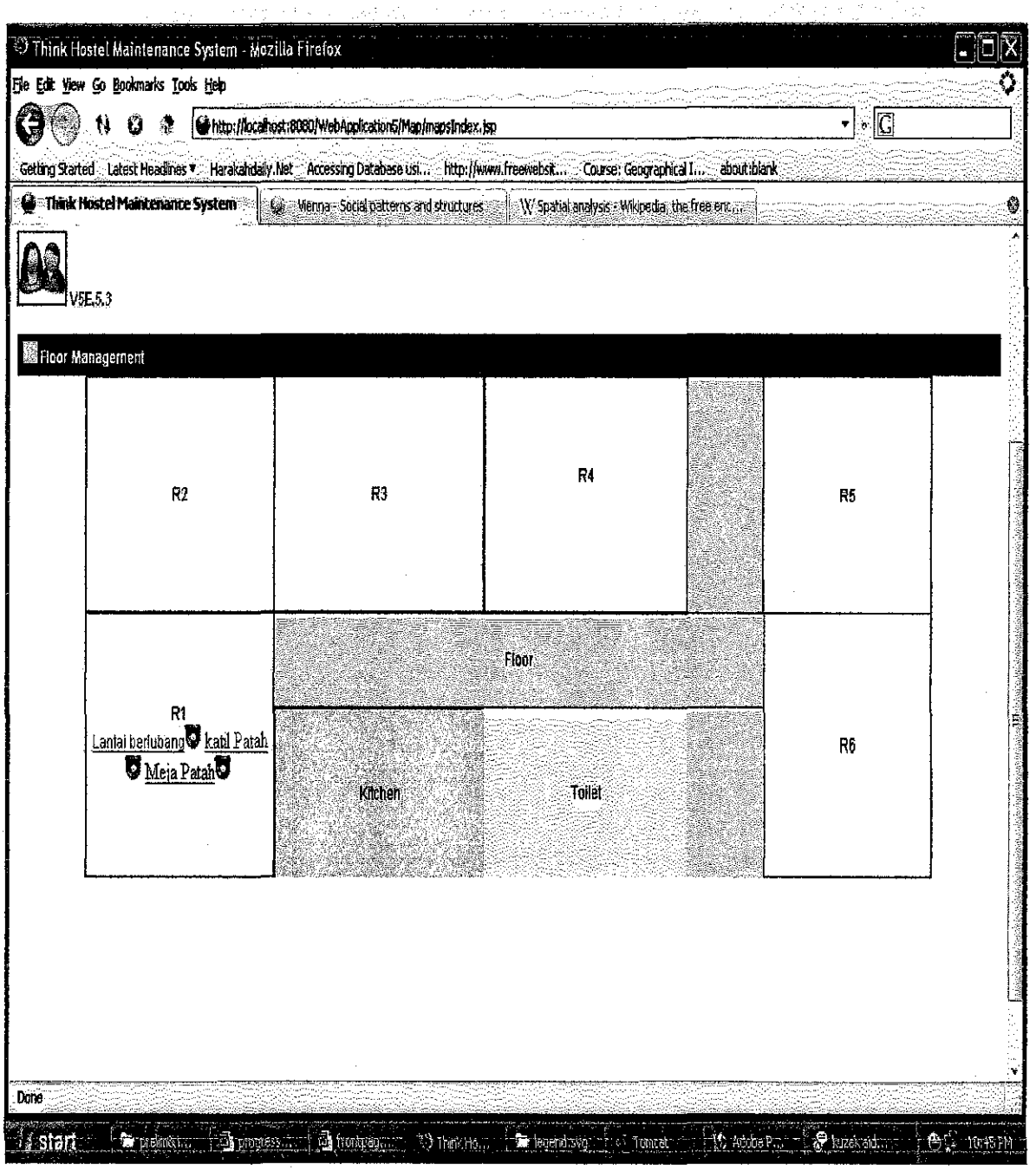


Figure 24: Problem Graphical Presentation

Memo Management

Memo management is one of the unique features of THMS. With Memo management, Contractors could send a memo to PMMD, and RC personnel could send or receive any memo from PMMD. PMMD could also send any memo to RC personnel and contractor.

View Problem Solved

The administrator could view all solved problem in this area. (Refer Figure 25). Administrator could view the problem details by clicking on the problem link, delete records or print the list.

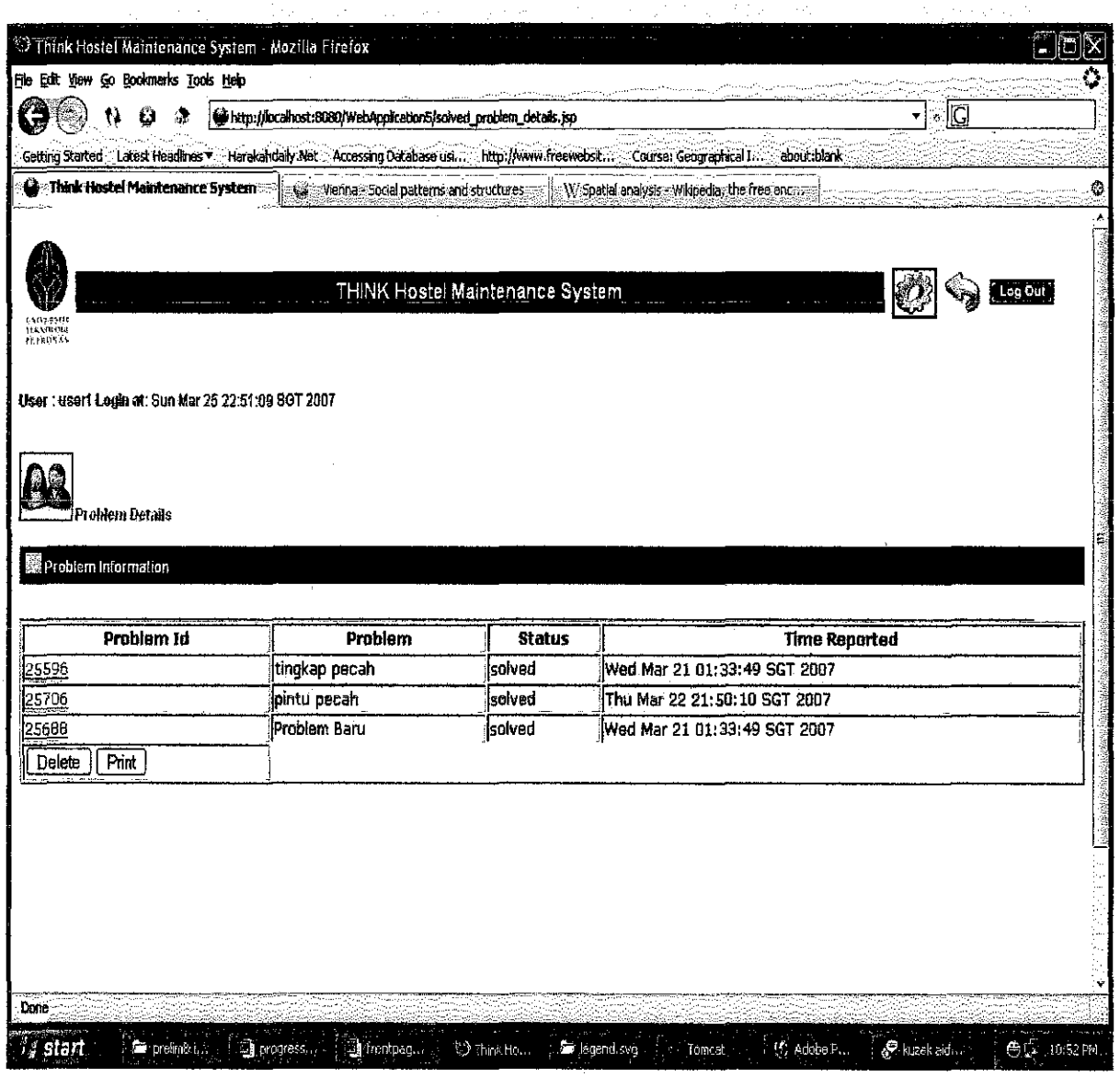


Figure 25: View Solved Problem Function

Problem Management

In problem management, administrator could view new problem, unsolved problem as well as solved problem. (Refer Figure 26)

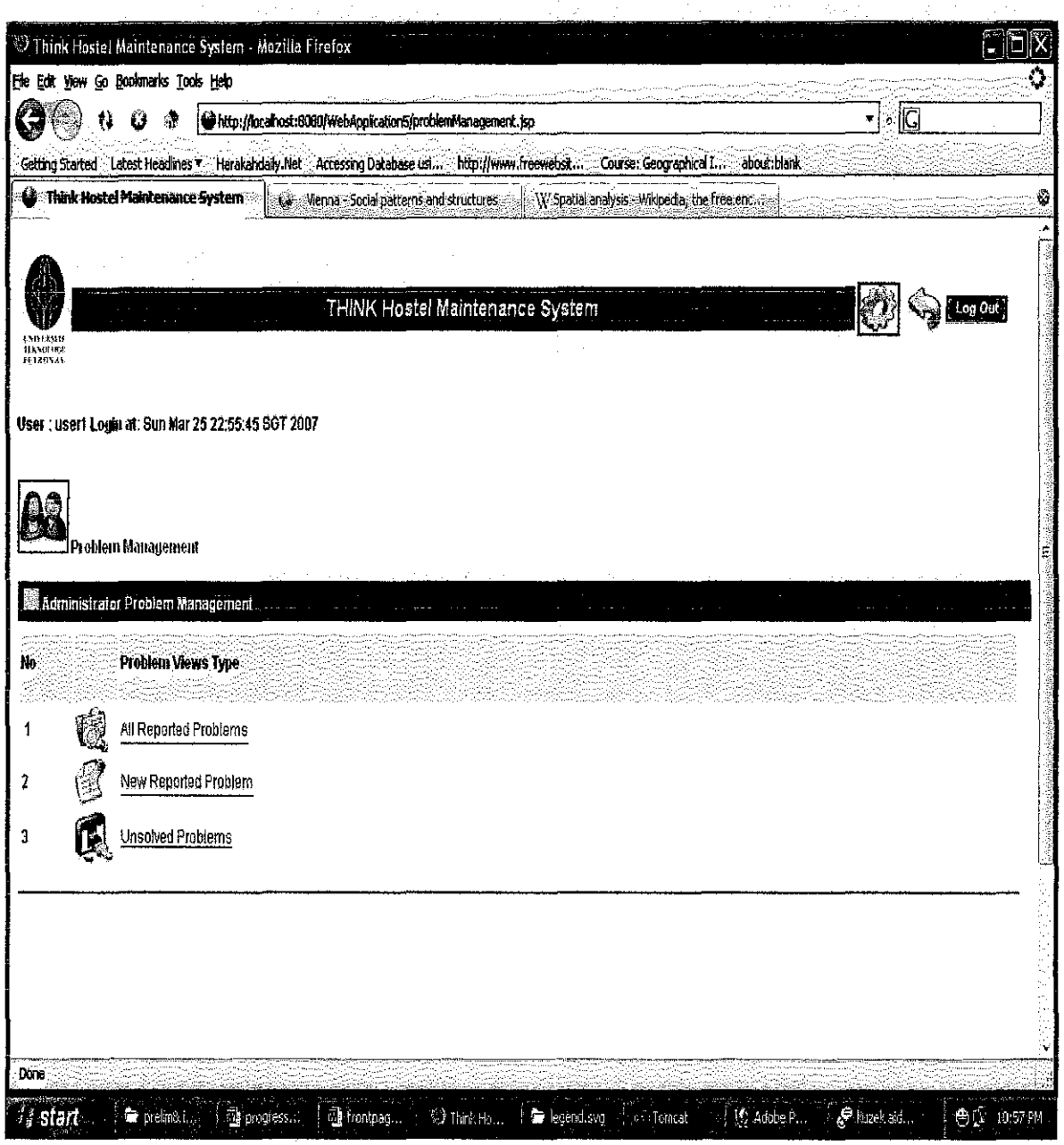


Figure 26: Problem Management

All Reported Problem

In all reported problem, the system would show a list of all problems, comprising new problem and unsolved problem (Refer Figure 27) Administrator could click on the particular problem's link to view problem details (Refer Figure 28). Administrator also could print the list.

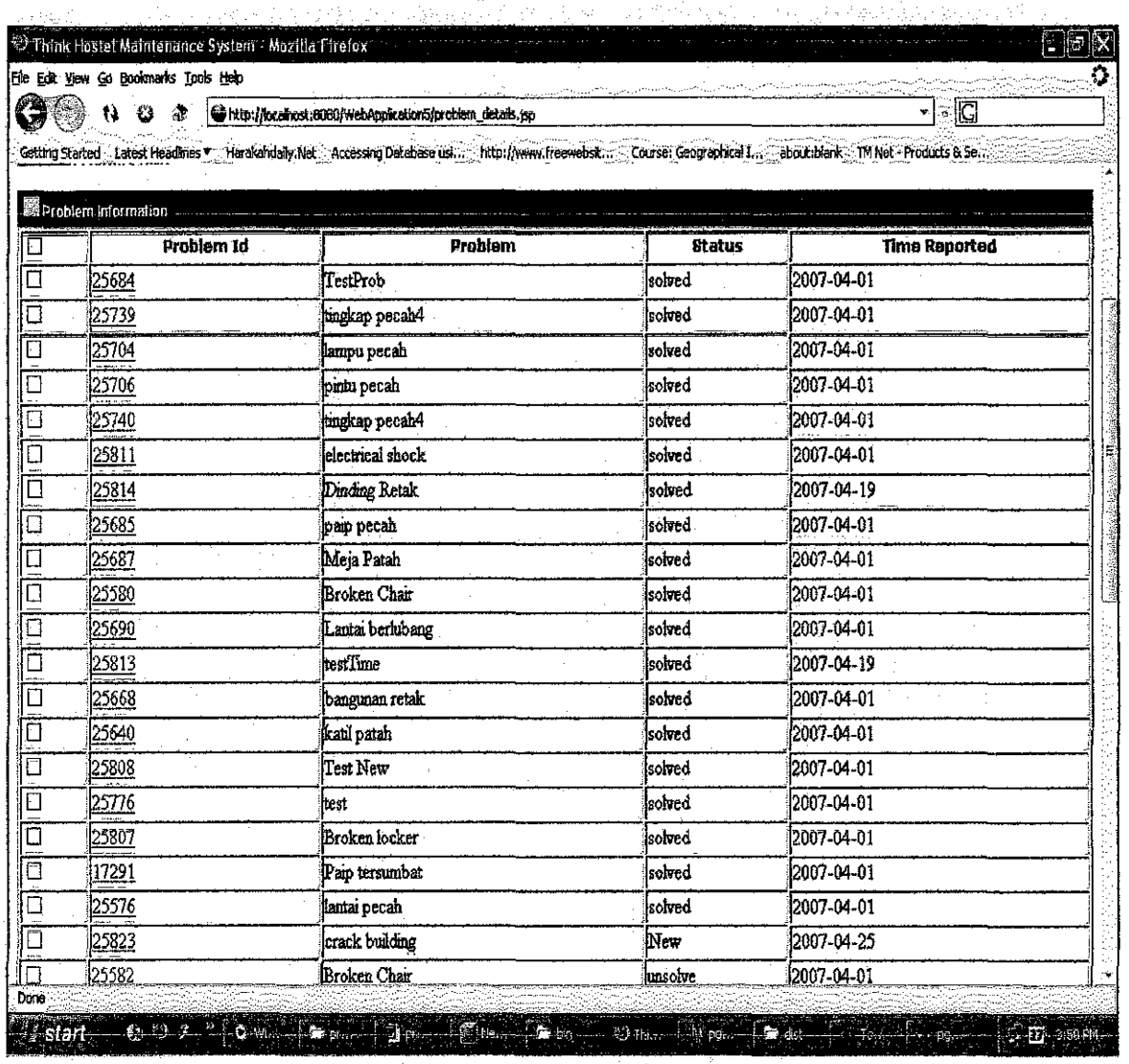


Figure 27: List of All Reported Problem.

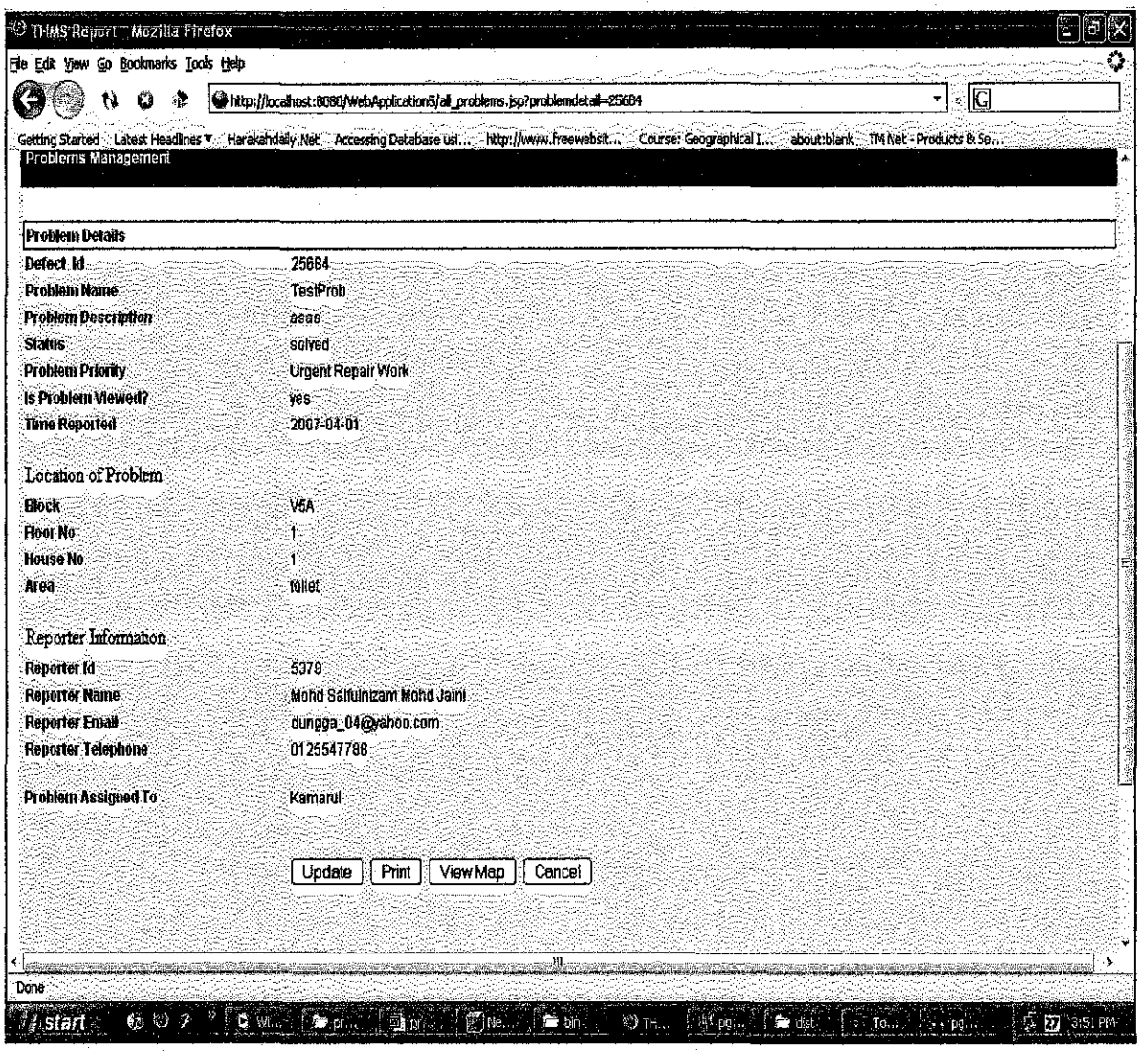


Figure 28 Problem Details

In problem details page, administrator could view the detail of the problem being reported as well as viewing the map of that problem (Refer Figure 29), update the information (Refer Figure 30) and print that page.

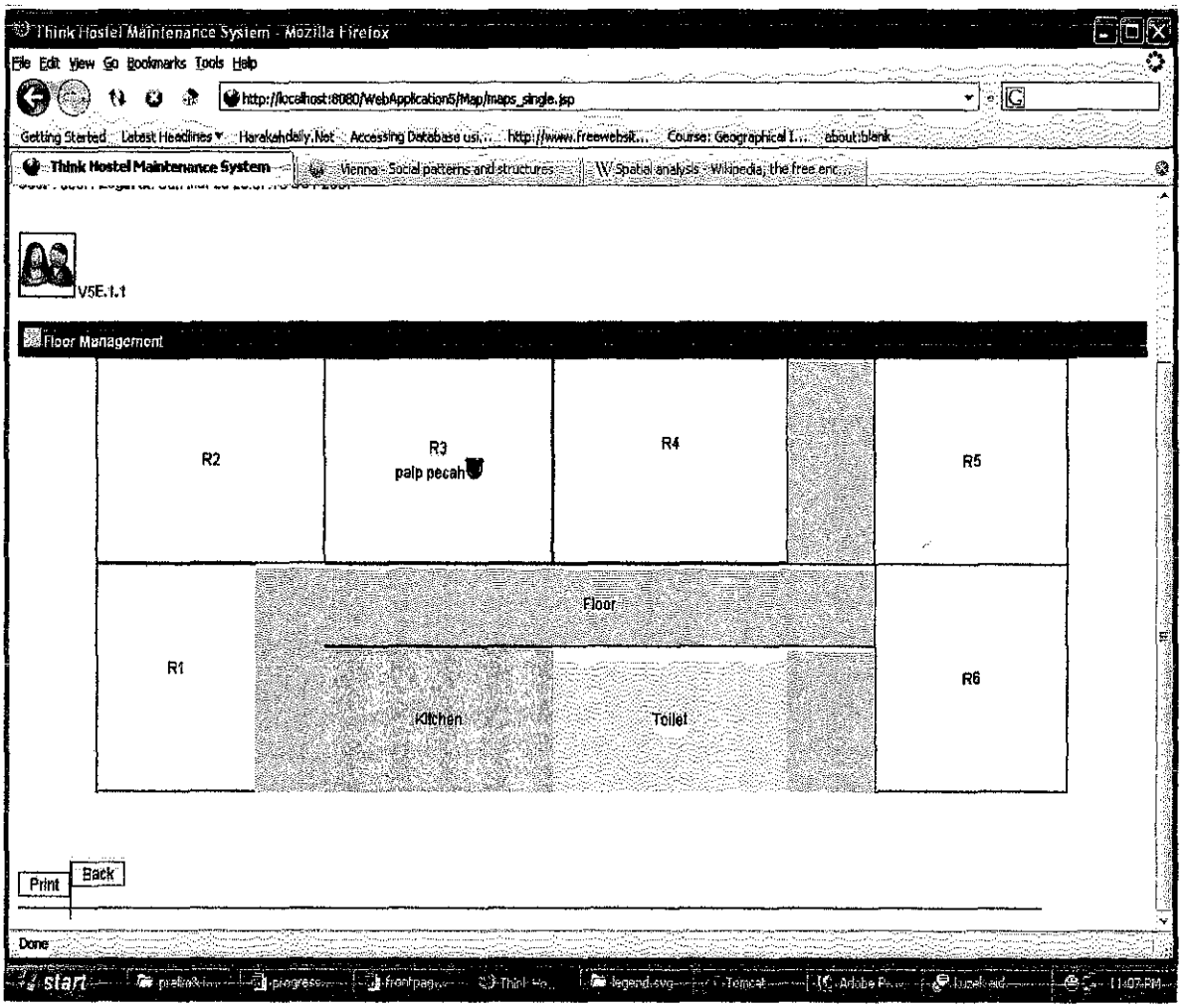


Figure 29: Graphical Presentation for Particular Problem

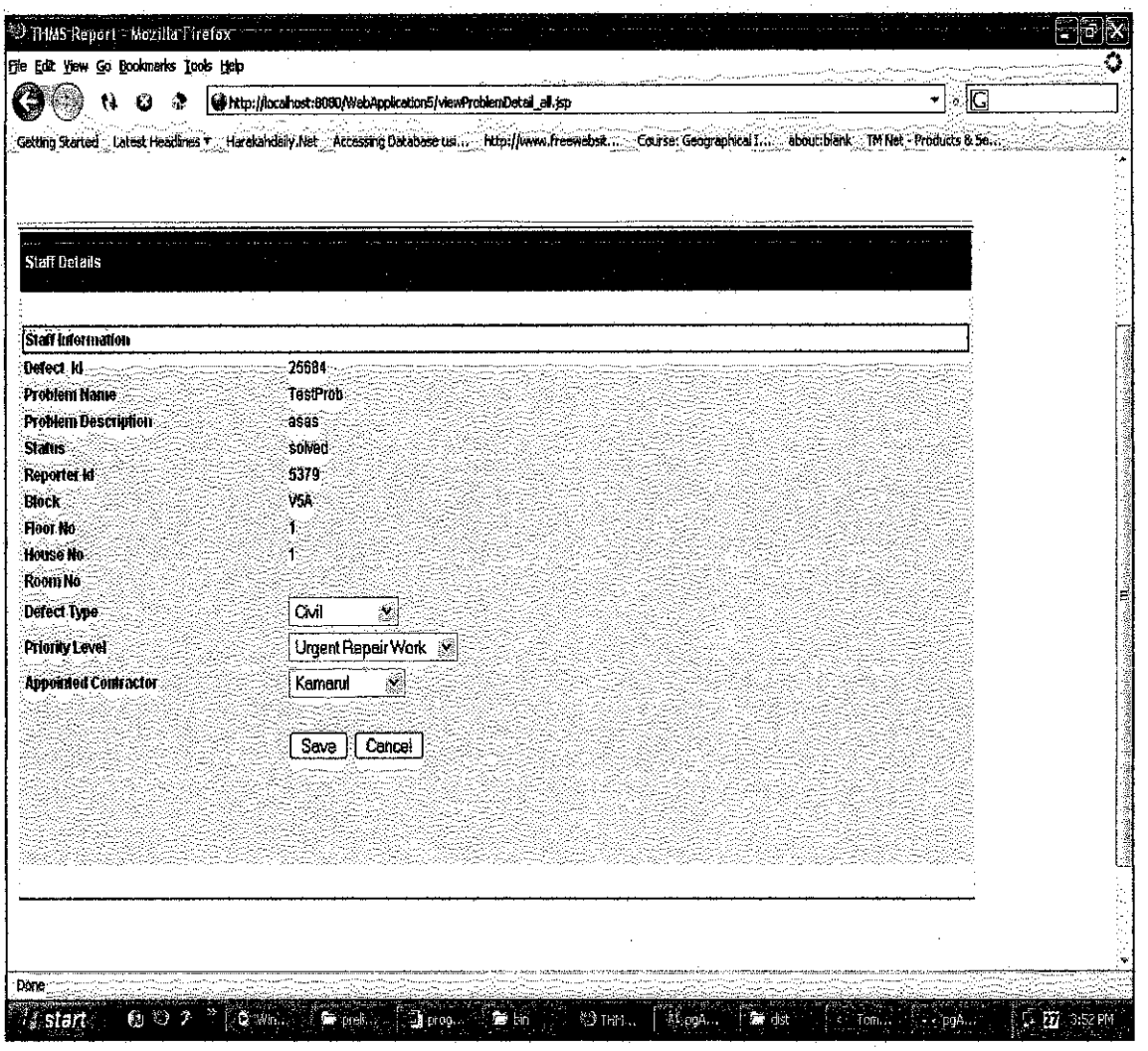


Figure 30: Update Problem Details

After administrator save any changes in the details, confirmation page of the update would appear. (Refer Figure 31).

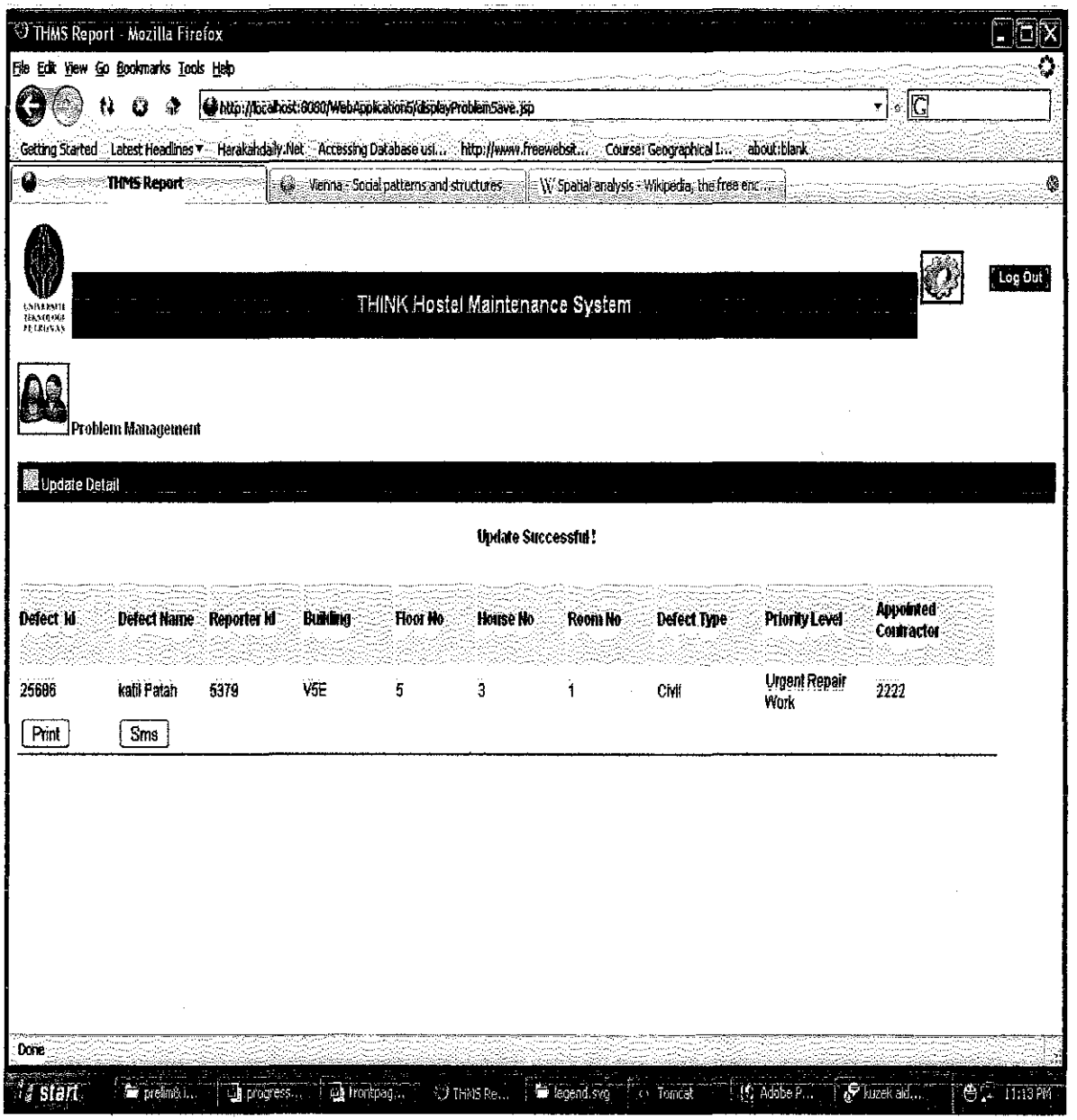


Figure 31: Update Confirmation Page

In the confirmation page, administrator could print the confirmation by clicking on 'Print' button and administrator could send confirmation of task appointed via SMS to the appointed contractor by clicking on 'SMS' button.

New Reported Problem

After administrator click on New Reported Problem link, a list of new problem would appear. (Refer Figure 32)

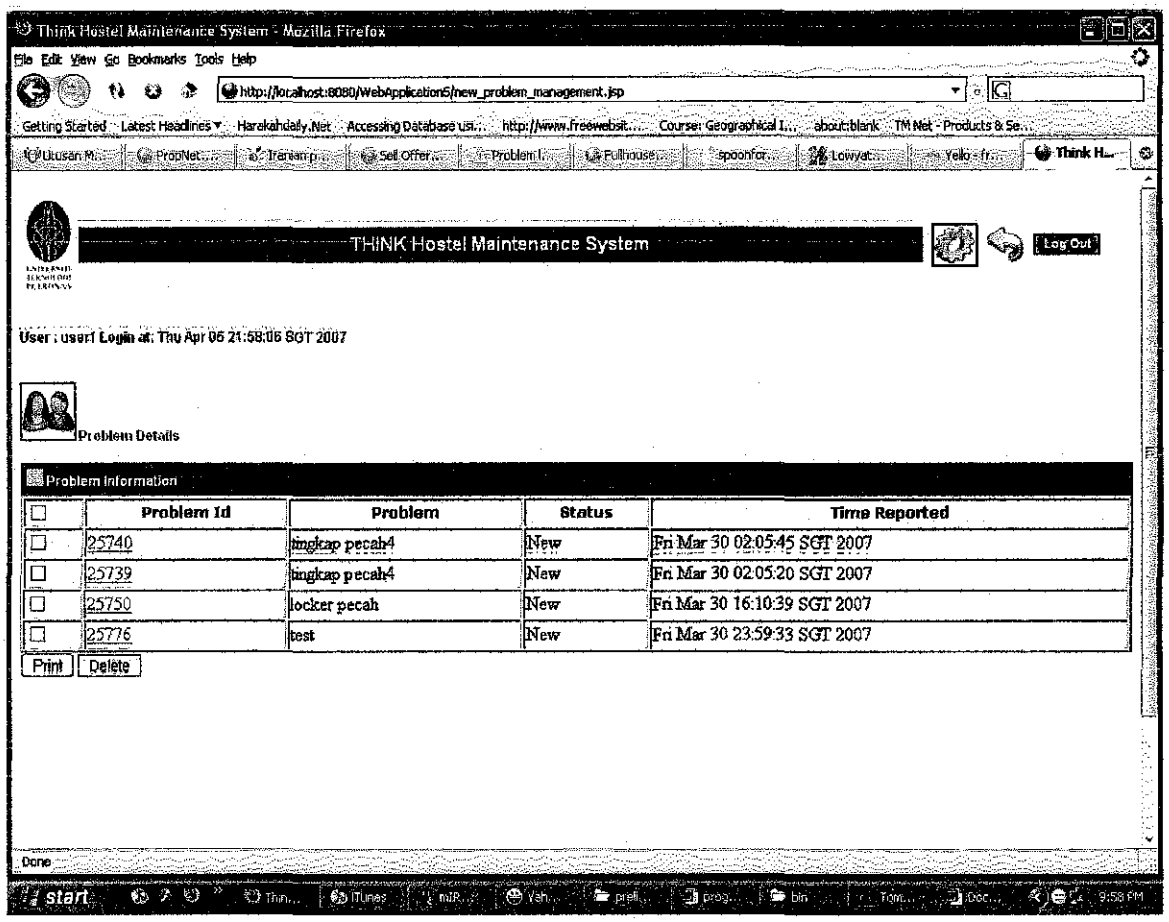


Figure 32: New Reported Problem

At this page, administrator could print or delete and view the details of the records. They also could identify the problem's defect type, priority level and appoint the problem to the available contractor. (Refer Figure 33)

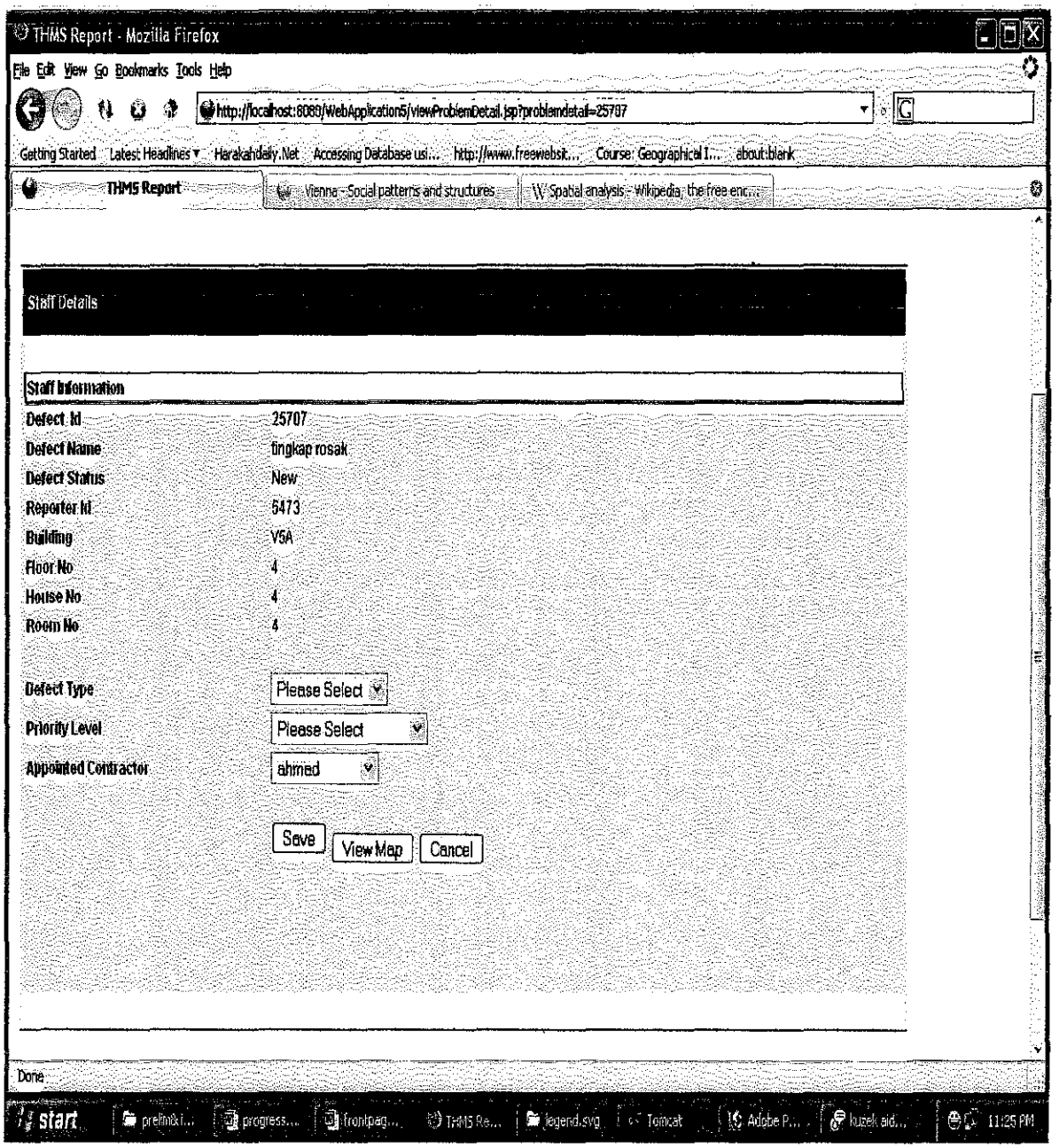


Figure 33: New Problem Details

Staff/Contractor Information

This is the last function in administrator's control panel module. This facilitates administrator to organize their staff's information. (Refer Figure 34)

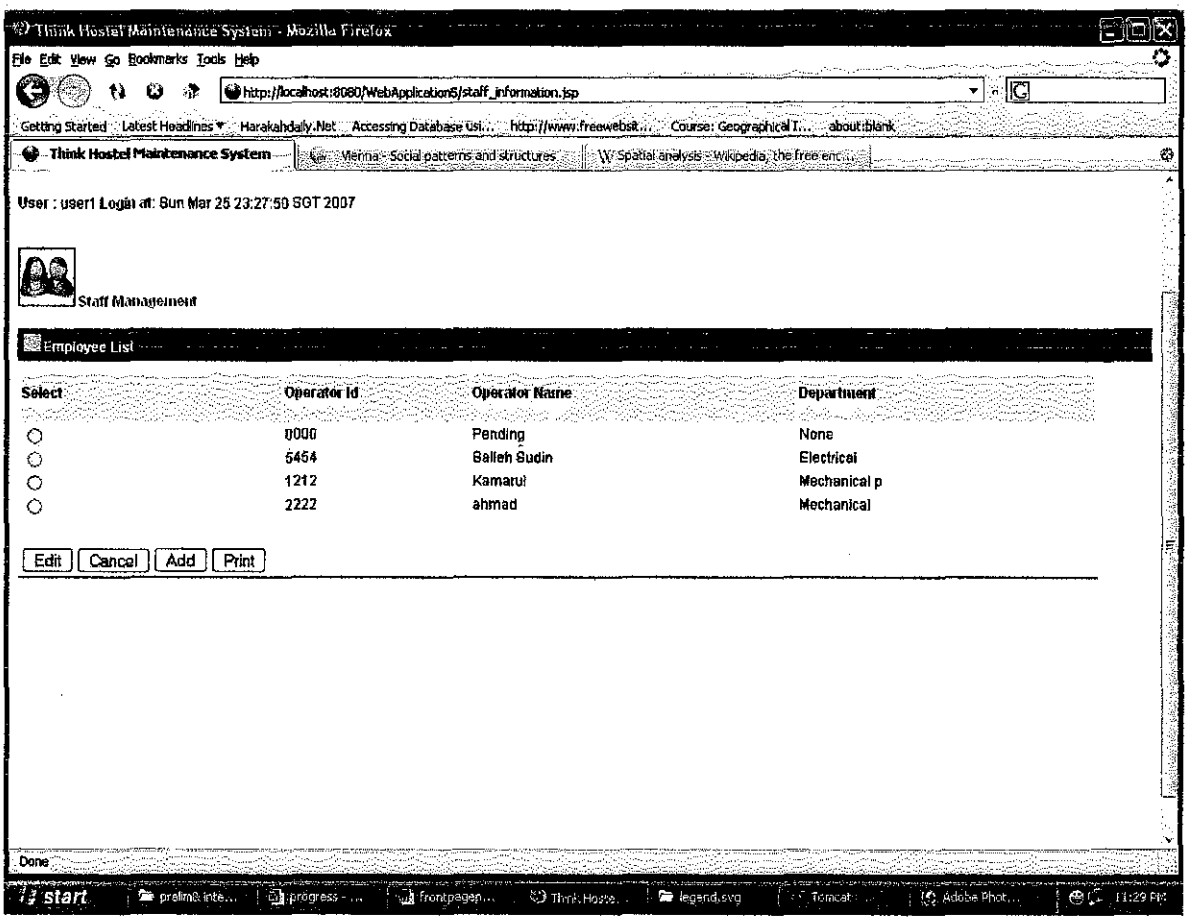


Figure 34: Staff Information Site

Administrator could update their staff information, delete and add the new staff. Administrator also could print the list into pdf files or normal printer.

4.3.4 Contractor/ Staff Module

This module enable contractor to manage their own site. They could manage their tasks efficiently and report back to their superior in a proper way. In this module, there is a control panel for contractor. (Refer Figure 35)

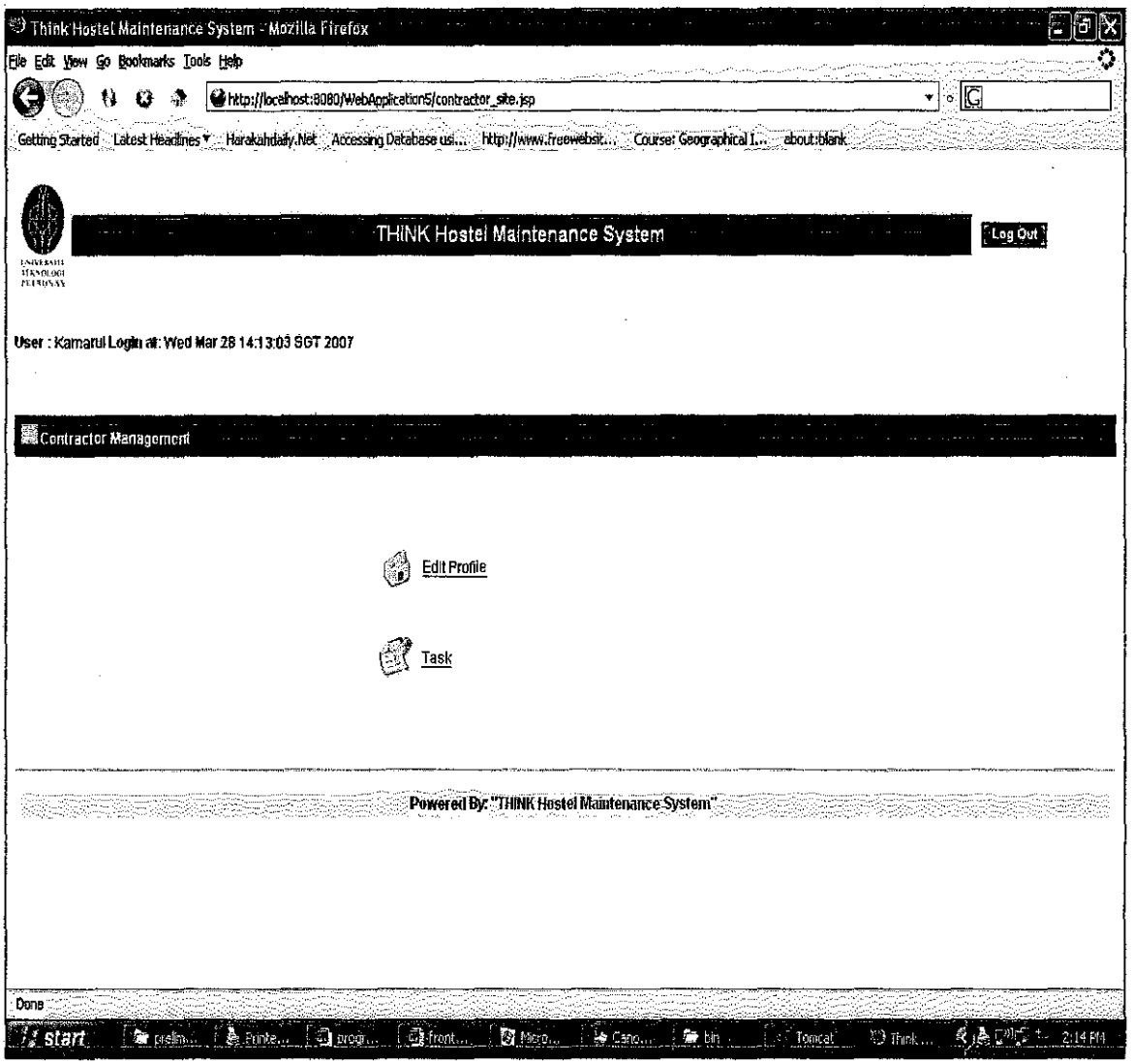


Figure 35: Contractor Control Panel

Contractor could edit their own profile here. Task assigned to them also could be viewed. (Refer Figure 36)

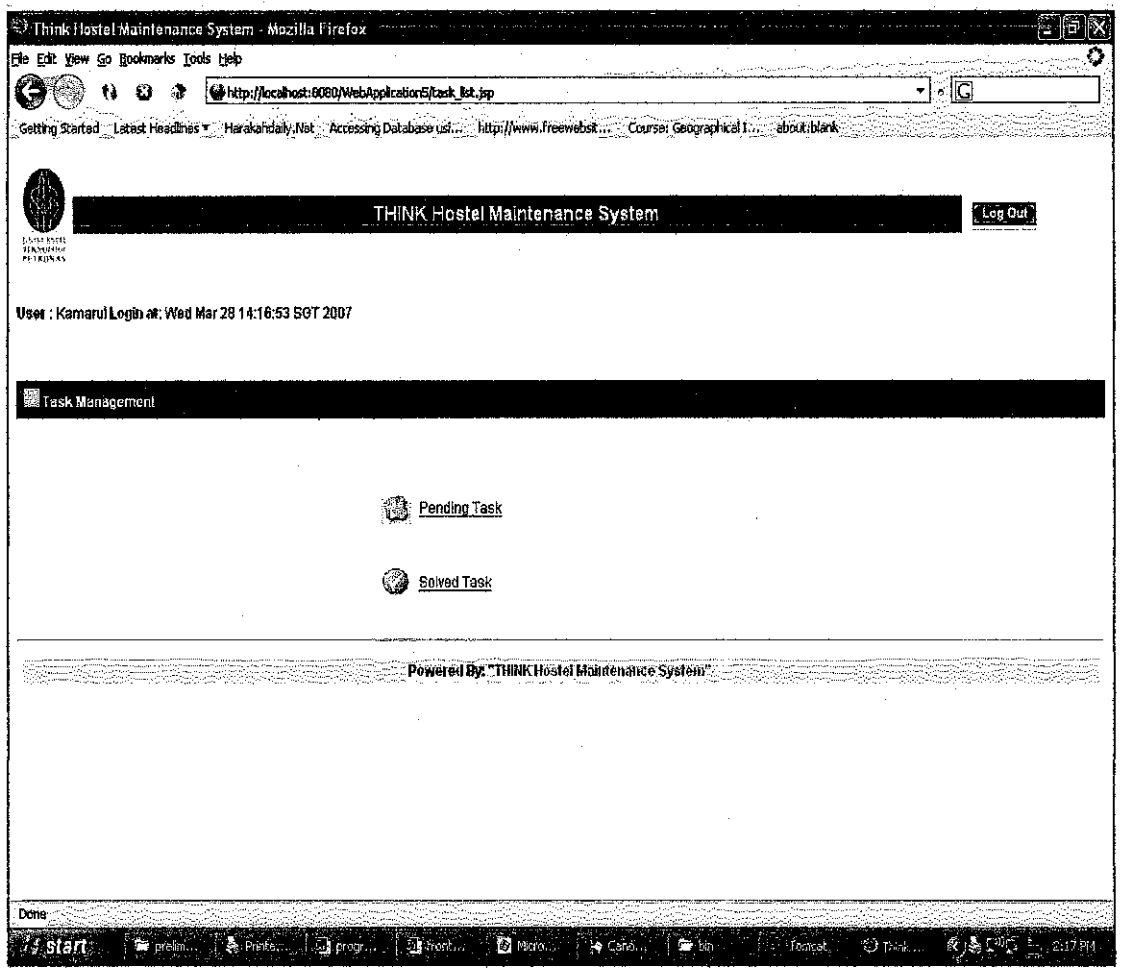


Figure 36: Task Management

Contractor could view their pending task and their solved task. The list of pending / solved task would appear when contractor click on specific link. (Refer Figure 37)

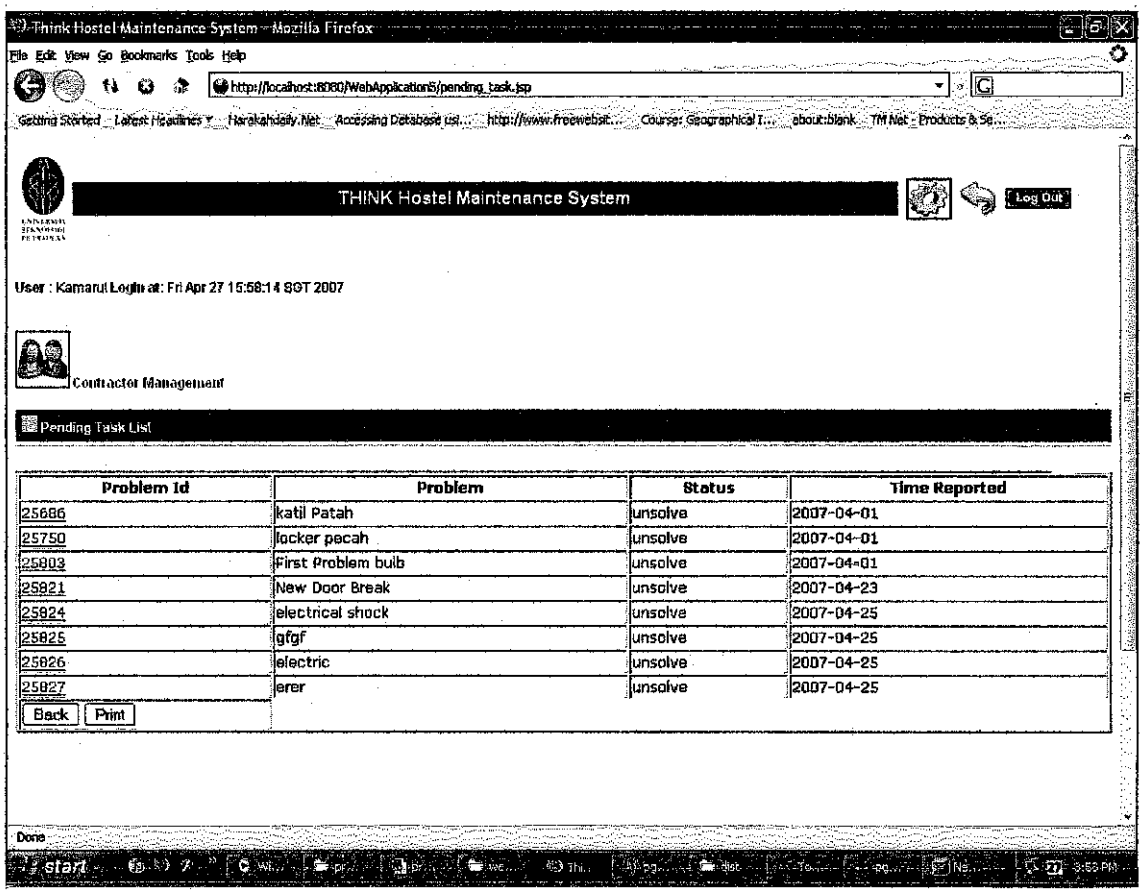


Figure 37: Pending Task List

The contractor could view the details of specific problem by clicking on problem id link. The details page of problem would appear. (Refer Figure 38)

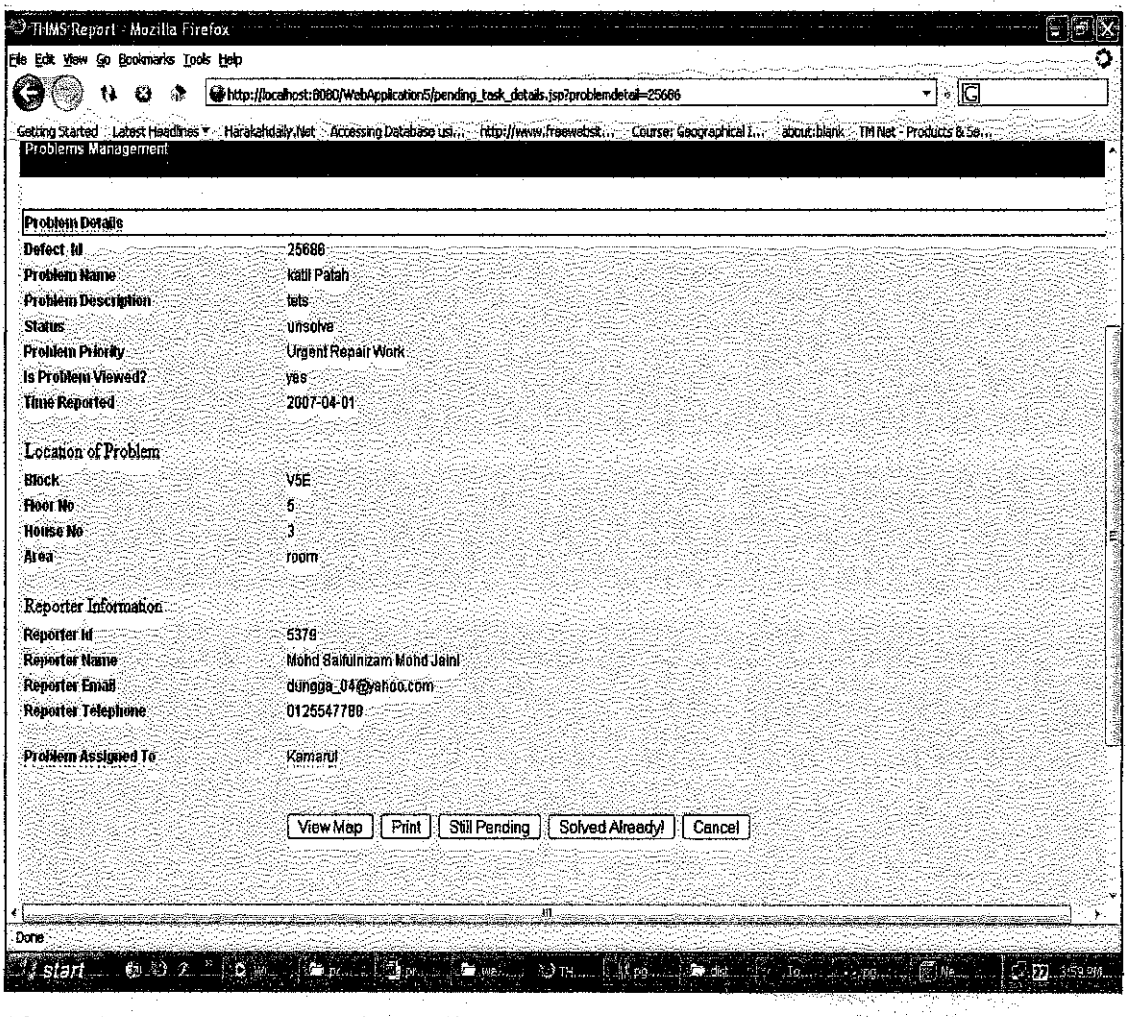


Figure 38: Contractor's Task Details.

If the contractor still could not solved the problem, they must click on "still pending" button to state the reason to be submitted to the administrator on why the problem still could not be solved. (Refer Figure 39)

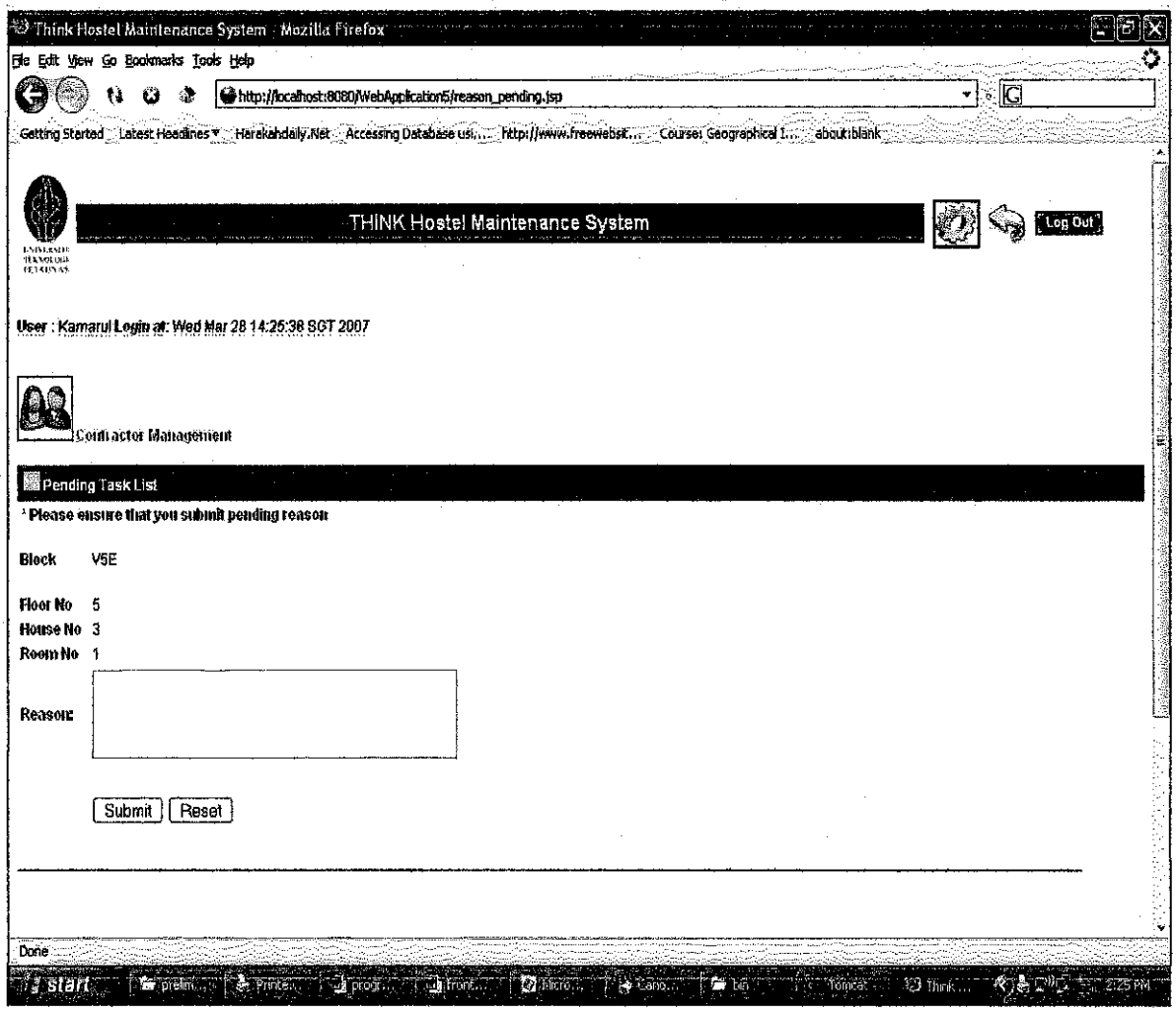


Figure 39: Pending Task List Reason

4.3 TESTING

4.3.1 Requirement Testing

Testing of the THMS begin with requirement analysis. Several interviews with client (RC personnel) had been done before the development process begin. Based on those interviews, author has developed a system (THMS) according to the requirement. After the development THMS has been completed, author has reviewed the system whether it conform the requirement or not. Since it is developed based on the client requirements, THMS passed this analysis.

4.3.2 Functional Testing

THMS consists of many different modules and each module has different functions. It is to detect any bugs or errors in the system. Result of functional testing could be found in Appendix VI

4.3.3 Integration Testing

Integration testing is done in THMS to ensure that the linkages among the modules are appropriate. Instead of that, links, hyperlink and the connection to the database also tested here. The results of integration testing could be found in Appendix VI

4.4.4 User Acceptance Testing

User Acceptance Testing is the final testing stage for the product.

There are 25 students involved in this test. They tested the system from their room. They are required to submit a report electronically using the system. They are also required to change their particular and password. The default password for the system is 'password'. All of them successfully submitted their problem report. 19 of them changed the password and other particular. After completed the testing, participants are required give opinions about the system and the feedbacks are positive. They said that they have good experiences in using the system. The system does assist them to report any problem online without having difficulties to go to the RC office to fill in the report form as practiced before.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

THMS would cater the problems stated before. The features of THMS would help to increase the efficiency of the departments related. As stated in the project objectives, THMS would transform the usage of paper-based into electronic means. THMS would decrease the paper-cost and increasing the efficiency of services provided. THMS would integrate students with RC and PMMD departments. It is because THMS provided services for 3 users; student, RC personnel and PMMD personnel. Student could reported their problems in THMS, and THMS would alert RC and PMMD towards further actions systematically without having the problems of missing problem reports or redundancy of reports. All reports would be kept safely in the database. PMMD personnel and RC personnel could review the reports graphically and dynamically. The notification system in THMS would reduce the time elapsed between lodging report and the action taken for repairing. Action could be made after the report has been submitted in THMS. The repairs pending time could be reduce since the 'sms' is sent directly and automatically to the responsible person. The analysis part in THMS would assist PMMD to review its services performance. As conclusions, THMS would give a positive impact for students, RC and PMMD. THMS would bring a new way of improving the problem reporting service, thus uphold the users delight in dealing with PMMD and RC.

5.2 Recommendations

There are several parts of the project that should be enhanced in order to make it more robust in term of its usage and function.

5.2.1 SSL Security

Secure Socket Layer (SSL) security should be embedded into the system to make it more secure. SSL protects THMS application and make it easy for users to trust in the system.

- An SSL Certificate enables encryption of sensitive information during online transactions.
- Each SSL Certificate contains unique, authenticated information about the certificate owner.
- Every SSL Certificate is issued by a Certificate Authority that verifies the identity of the certificate owner.

5.2.2 Mobile Integration

THMS has been integrated with SMS gateway thus enable PMMD administrator to inform contractors about particular task. In the future, author recommended the integration between THMS mobile module should be embedded into this system. It would enable students to view and use the whole system via PDA or other mobile gadgets.

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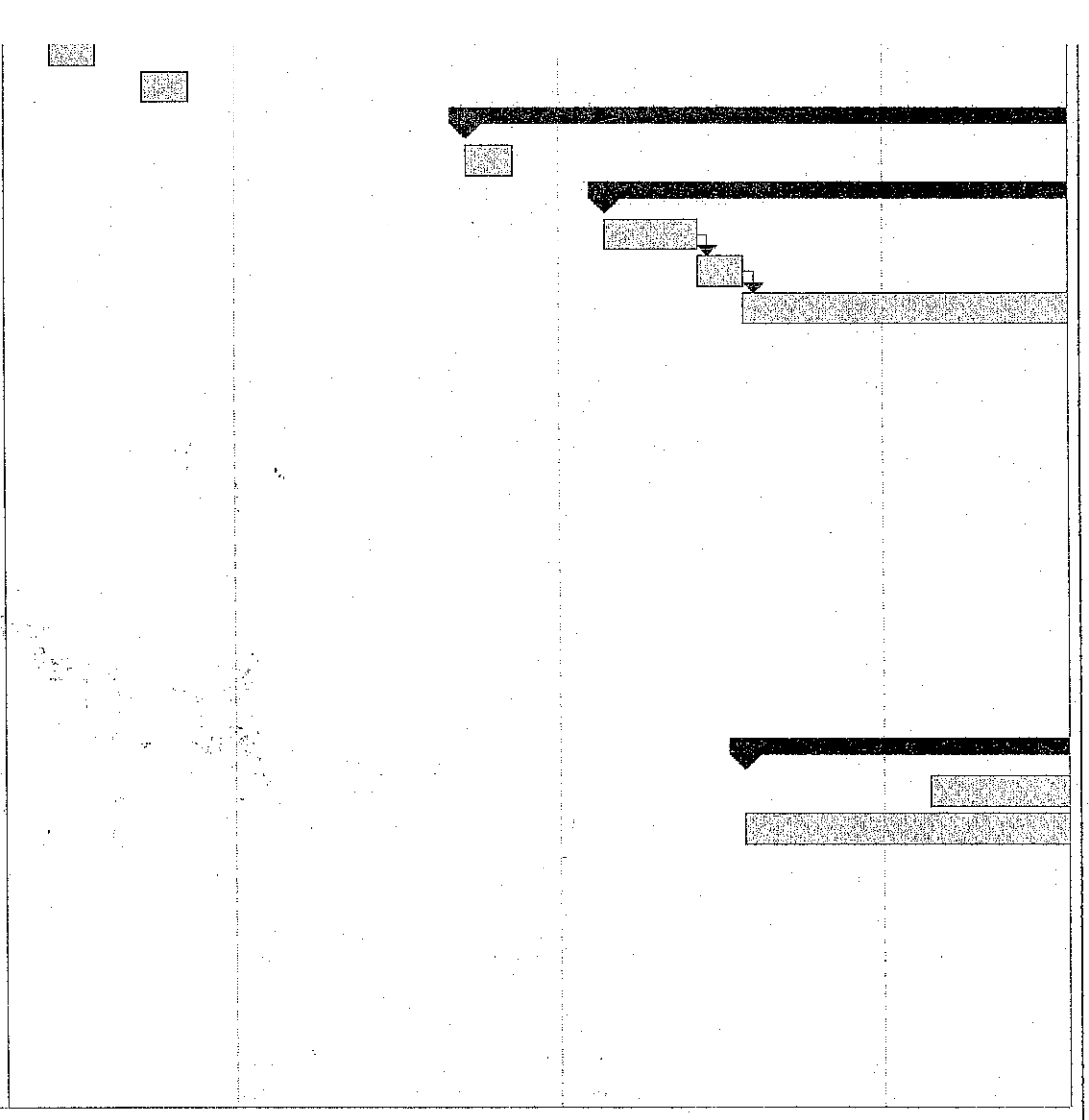
APPENDIX I: GANTT CHART

2	1.1 Propose Topic	1 day
3	1.2 Topic assigned to student	1 day
4	**2. Planning**	**19 days**
5	2.1 Project Meeting	1 day
6	**2.2 Schedule Preparation**	**18 days**
7	2.2.1 Determine tasks, resources and duration of	2 days
8	2.1.2 Create Gantt Chart	1 day
9	2.1.3 Preliminary Research Work	15 days
10	**3. Executing**	**7 days**
11	**3.1 Identifying, Analyzing Problem, Objective and S**	**7 days**
12	3.1.1 Interview with RC Personnel	1 day
13	3.1.2 RC Staff Survey	1 day
14	3.1.3 V5 Residence Survey	2 days
15	**3.2 Analysis**	**13 days**
16	3.2.1 Tools and Technology Required	6 days
17	**3.2.2 Designing System Diagrams / System Flow**	**7 days**
18	3.2.2.1 Use-case Diagram	2 days
19	3.2.2.2 Class Diagram	3 days
20	3.2.2.3 System Story Board	2 days
21	**4. Controlling**	**57 days**
22	4.1 Weekly Reports	55 days
23	4.2 Submission of Preliminary Report	15 days
24	4.3 Submission of Interim Report	8 days
25	4.4 Project Meeting with Supervisor	1 day
26	**5. Closing**	**10 days**
27	5.1 Preparation of Presentation Slide	2 days
28	5.2 Final Oral Presentation	3 days
29		
30	**6.Project Implemetation**	**105 days?**



Project: project_gantt_chart
Date: Fri 4/6/07

Task		Rolled Up Task		External Tasks	
Progress		Rolled Up Milestone		Project Summary	
Milestone		Rolled Up Progress		Group By Summary	
Summary		Split		Deadline	

33		6.3 System Installation	4 days?
34		6.4 Closing Part 11	1 day?

Project: project_gantt_chart
Date: Fri 4/6/07

Task		Rolled Up Task		External Tasks	
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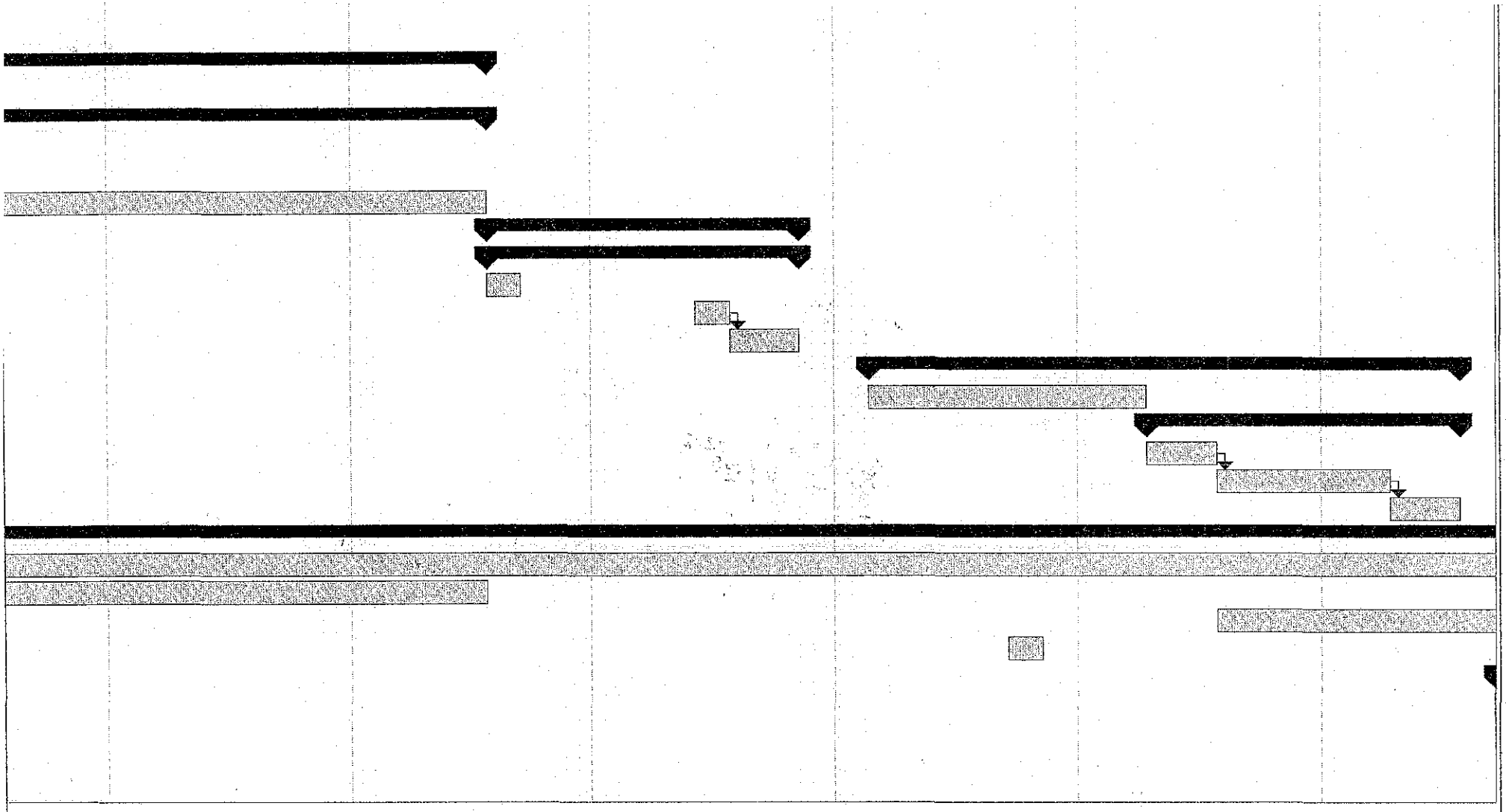

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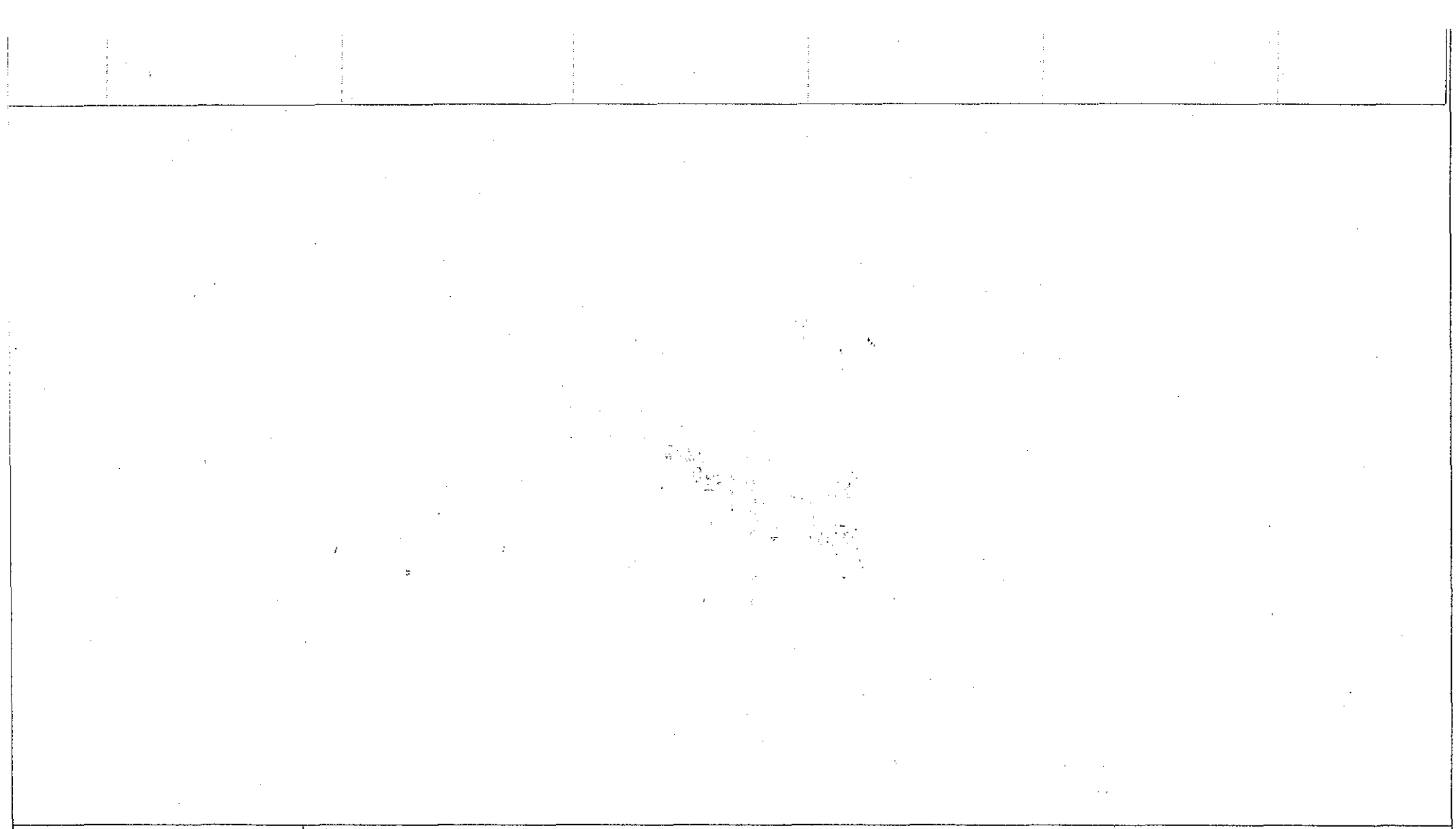

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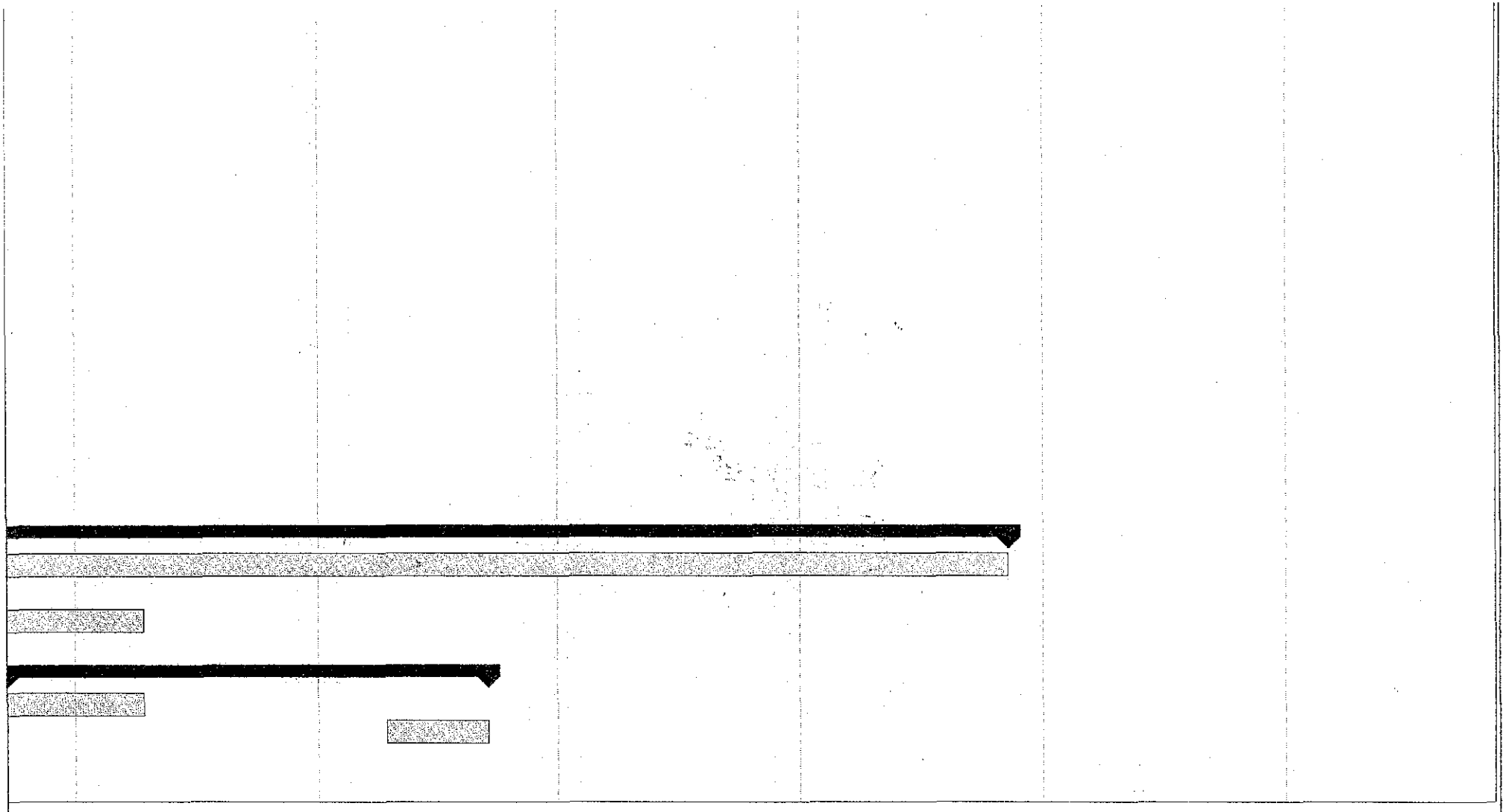

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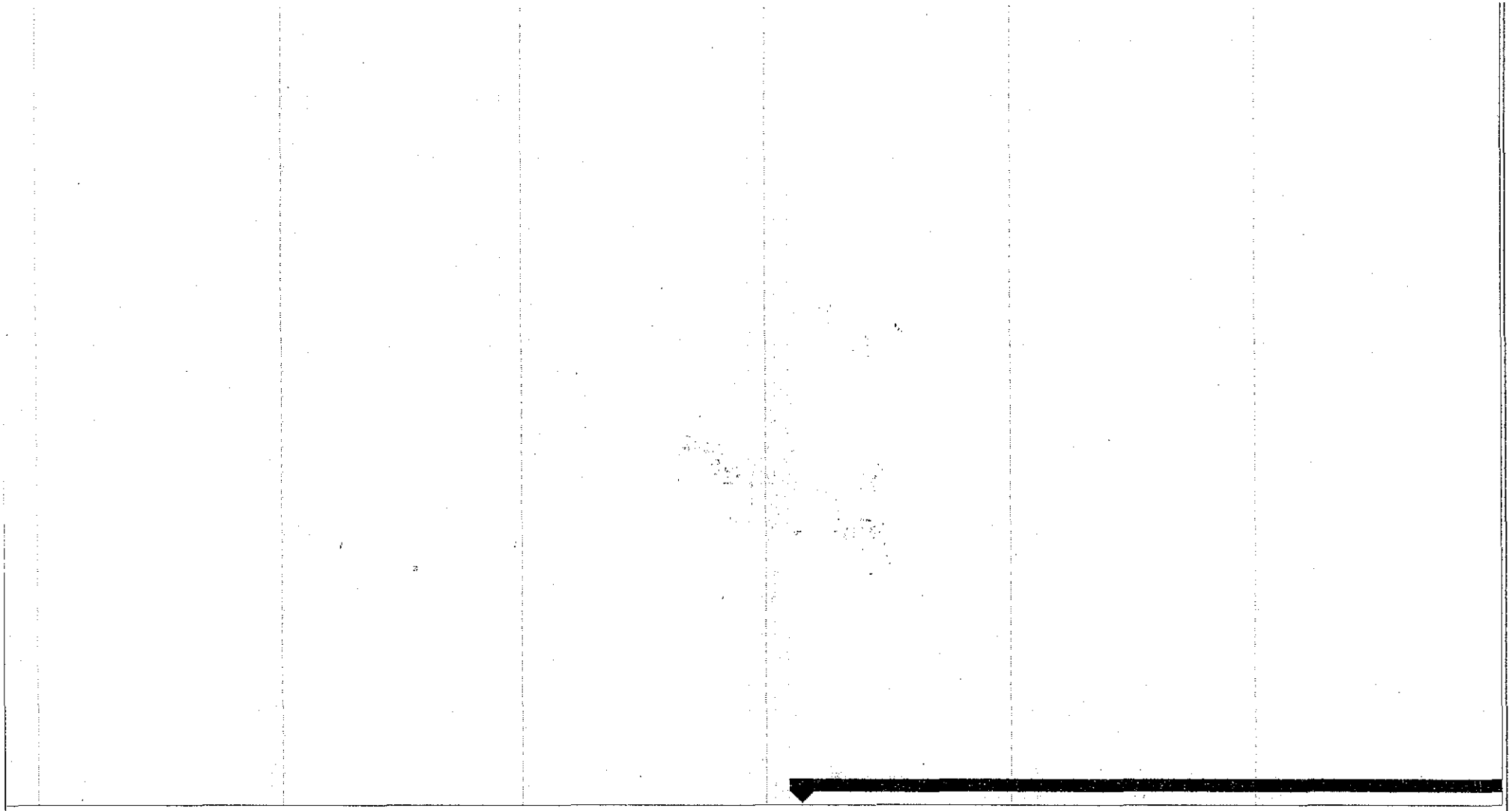

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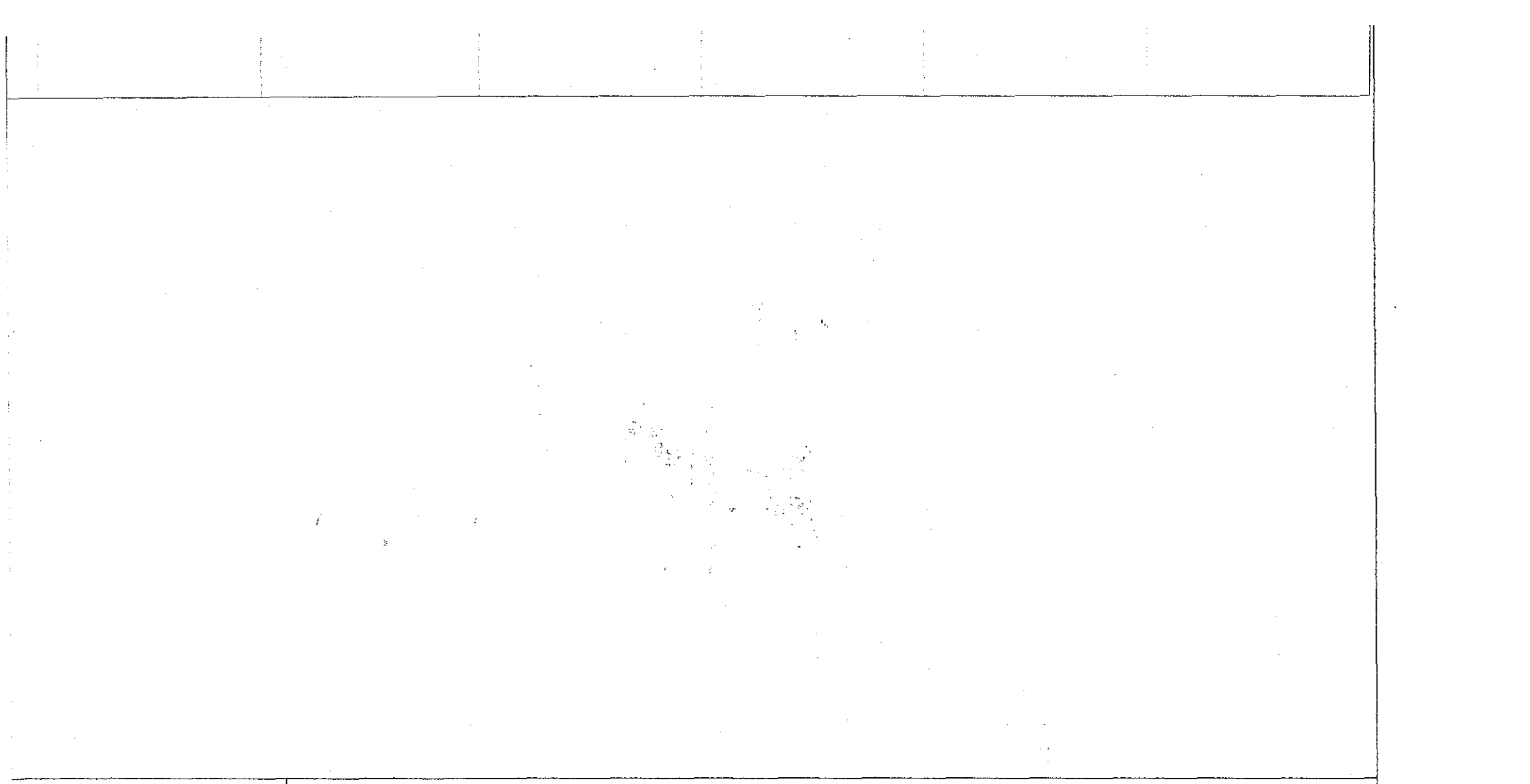

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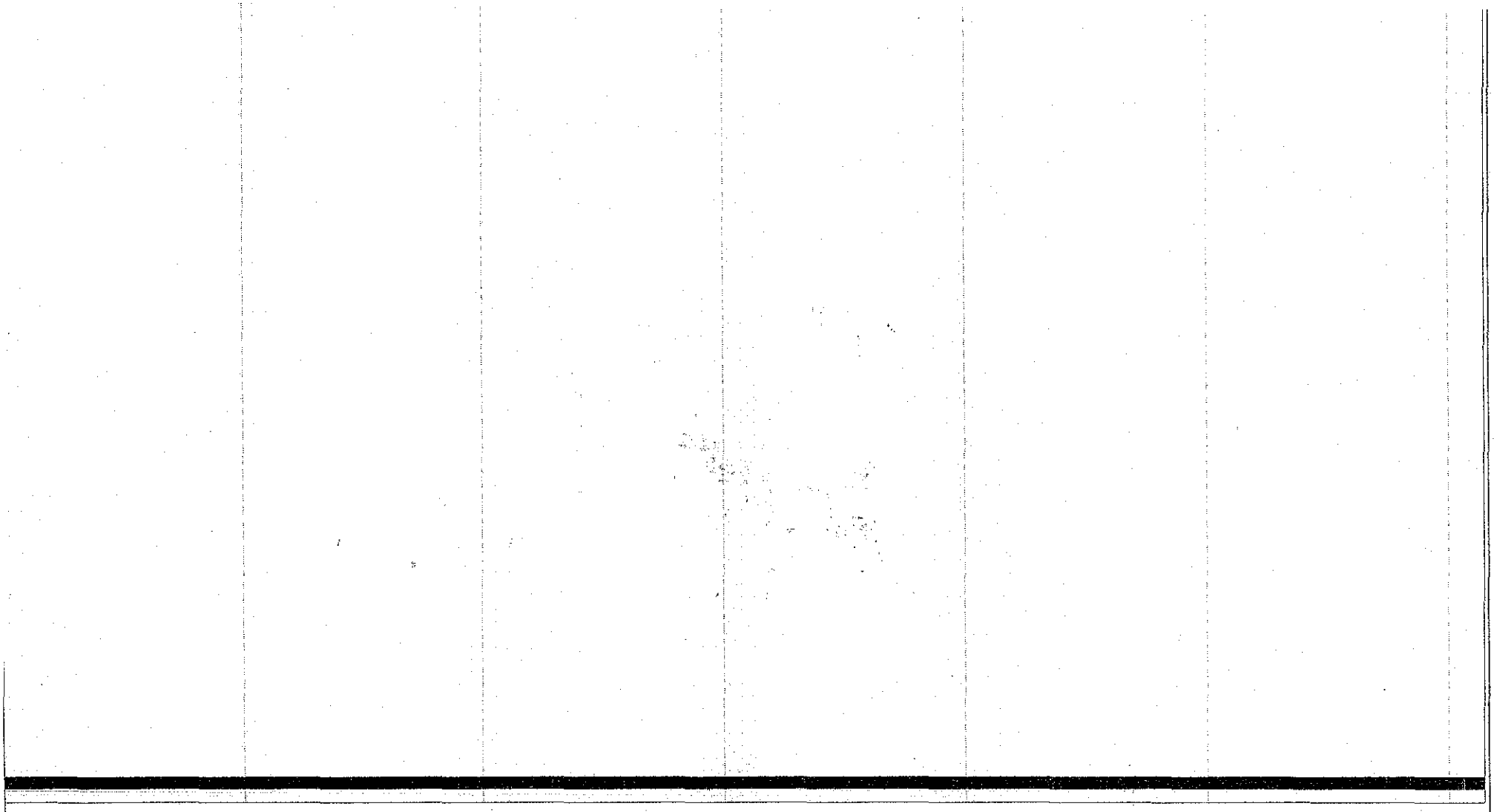

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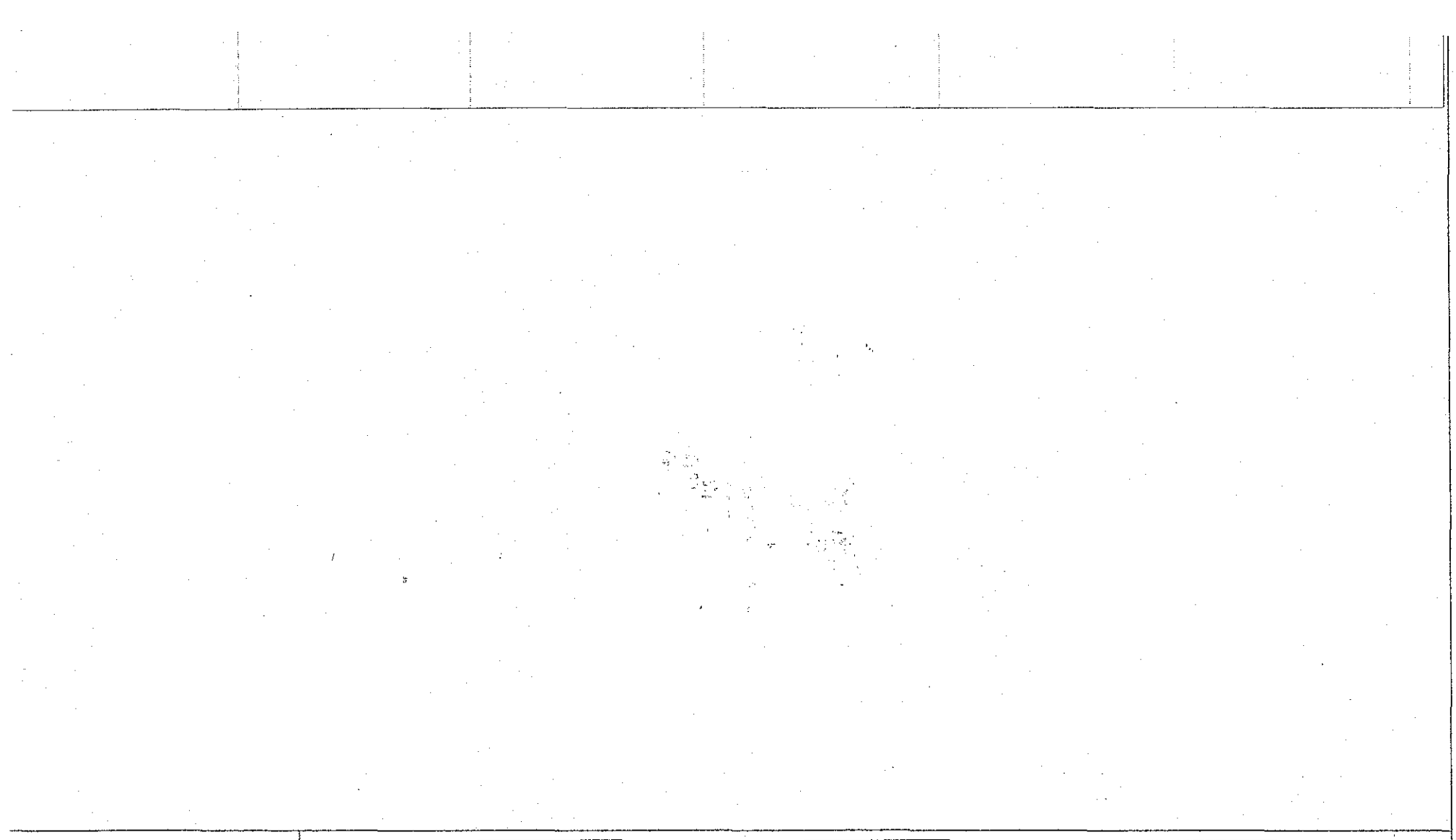

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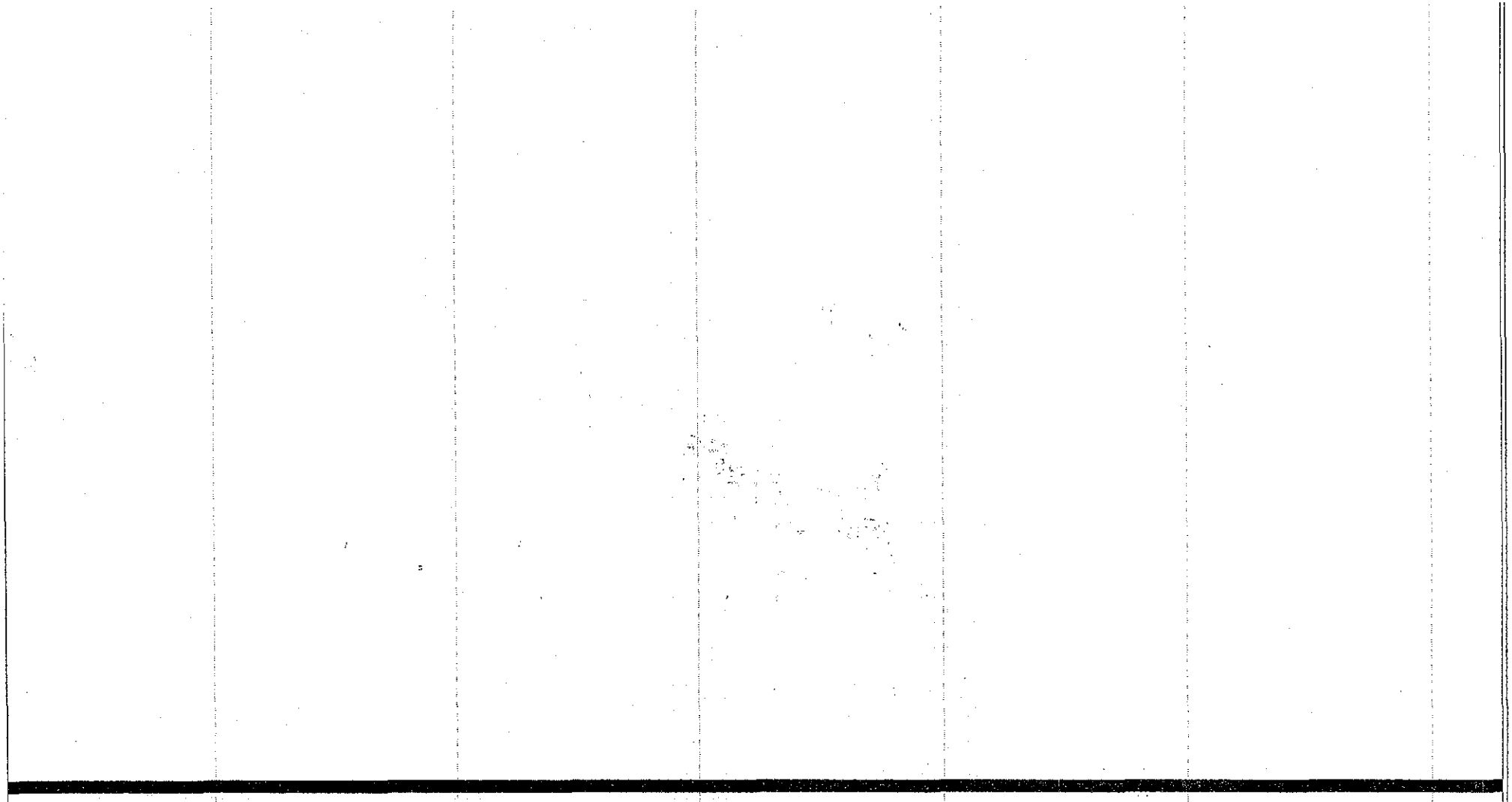

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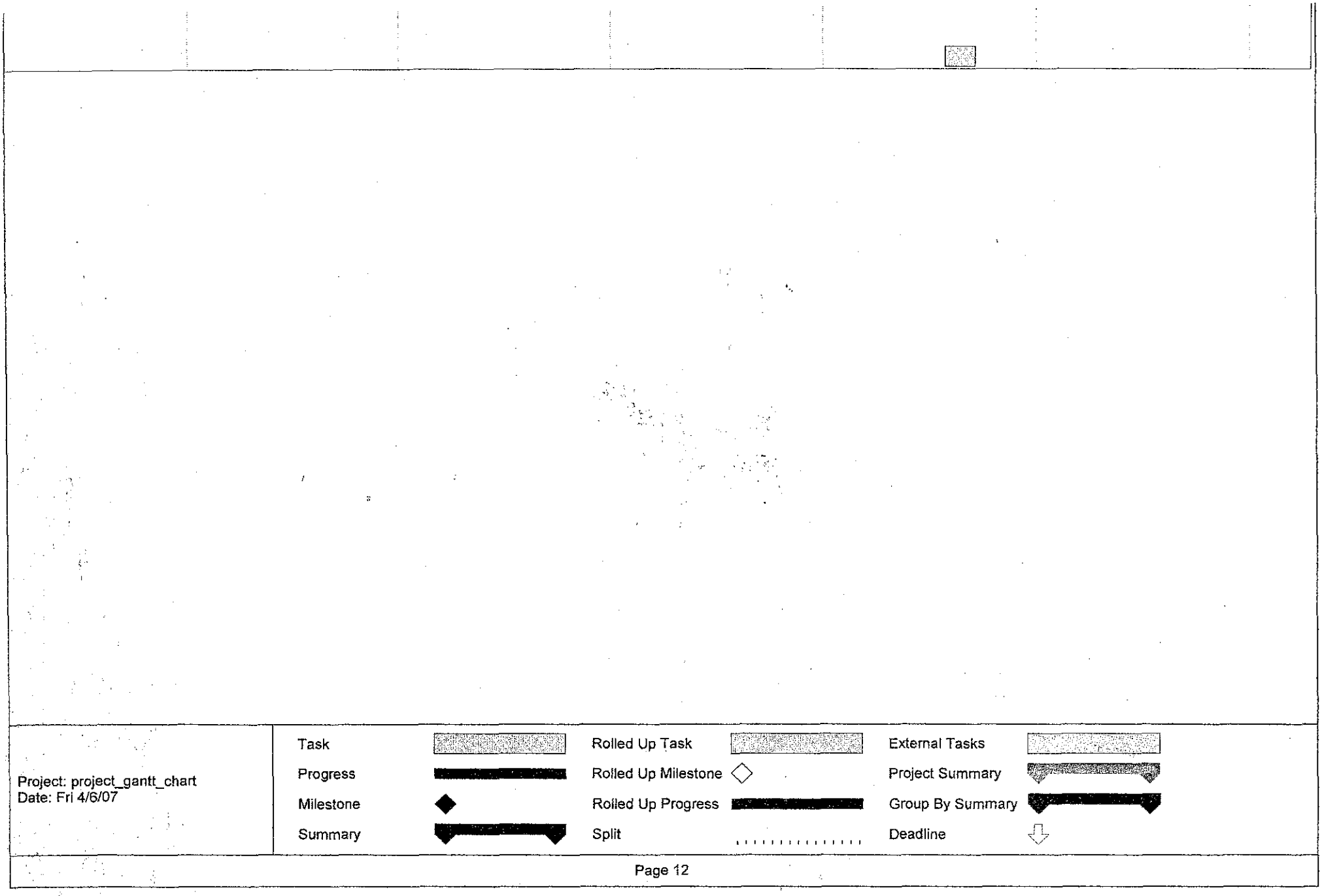

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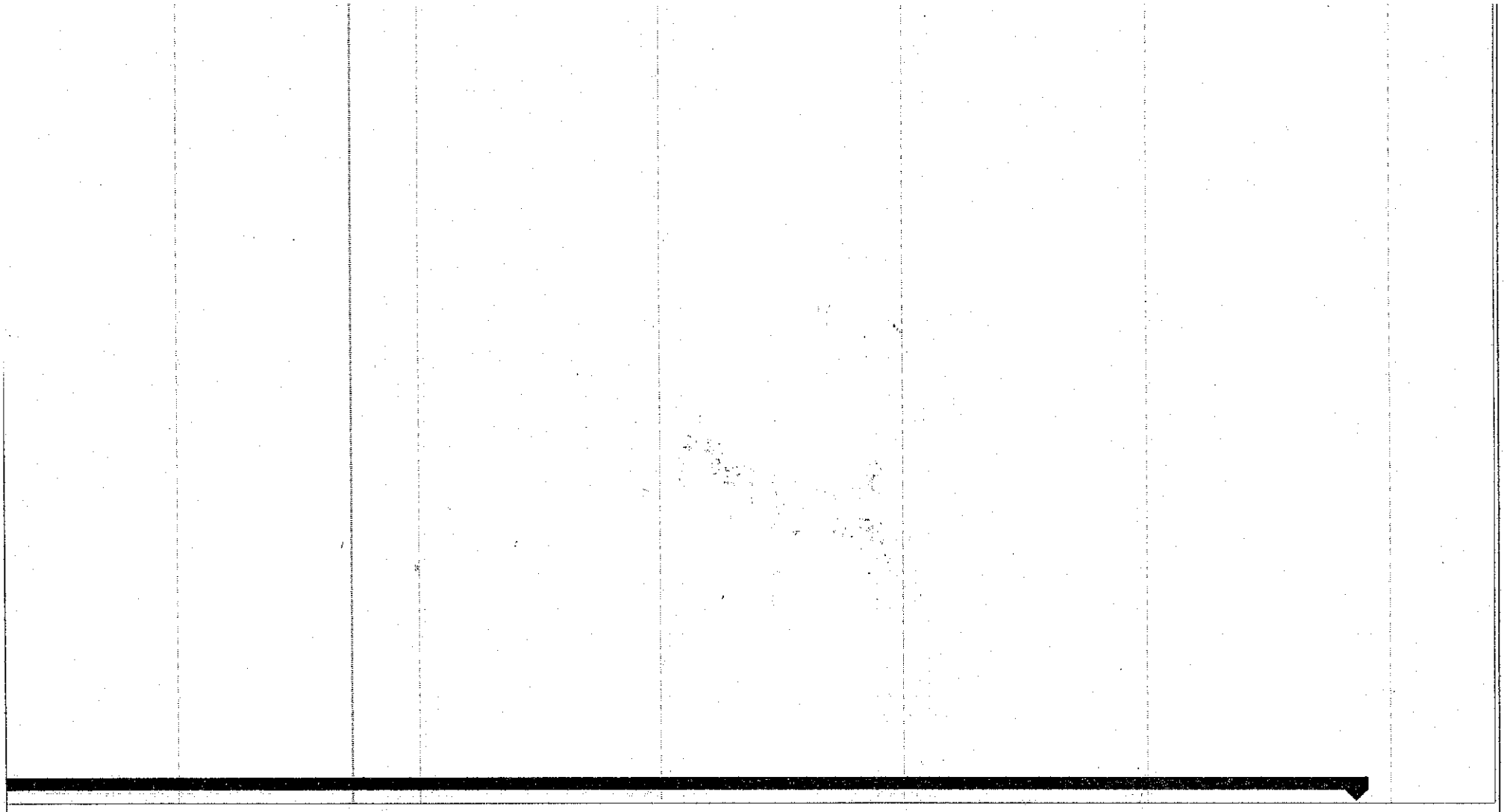

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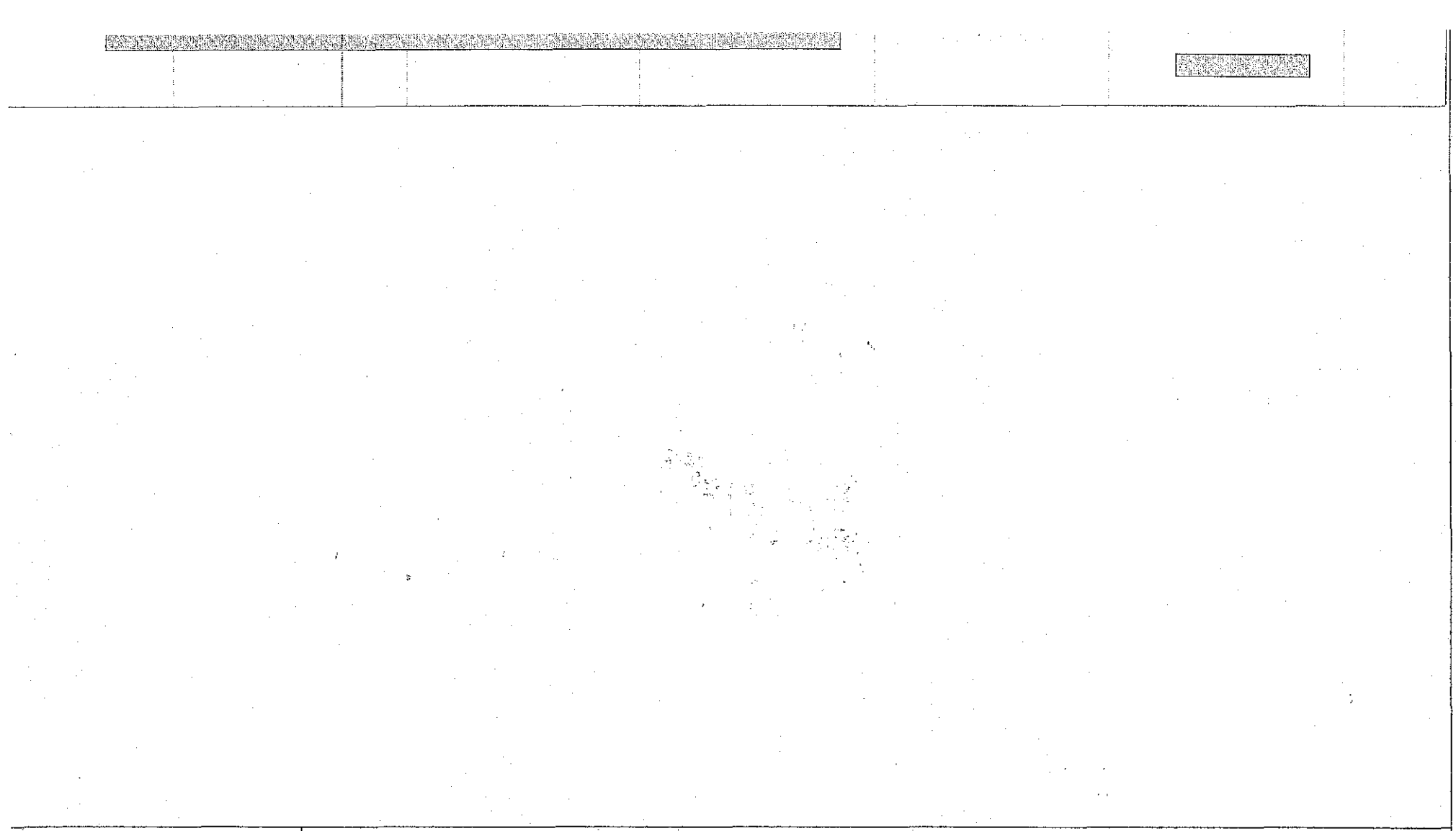

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Progress		Rolled Up Milestone		Project Summary	
Milestone		Rolled Up Progress		Group By Summary	
Summary		Split		Deadline	

APPENDIX II: INTERVIEW DETAILS

INTERVIEW DETAILS

Mode of Interview: Meeting

Date of Interview: 28th September 2006

Time of Interview: 2.00 pm – 2.30 pm

Interviewee Information

Name: Mr Afzan Ameir Saeidin

Designation: V5 Hostel Supervisor

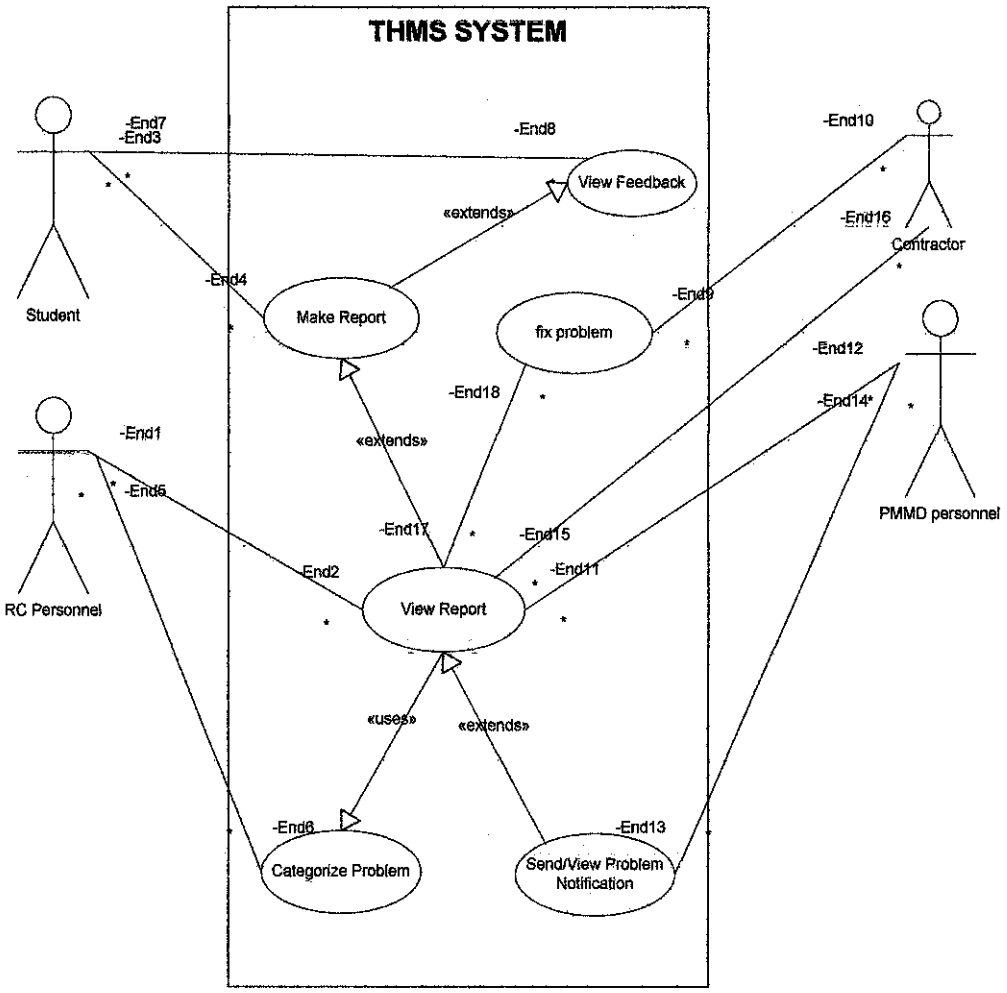
Department: Residential College Management

List of Interview Questions:

1. What are the responsibilities of RC in building maintenance?
2. What are the types of defects that always happen in V5 buildings?
3. Could you explain how the reporting processes occur?
4. Is RC still used paper- based form in problem reporting?
5. Do you prefer maintenance Online Maintenance System?
6. Is there any automated system that links RC and PMMD?
7. Could you give me any sample of PMMD form reporting?
8. Do you have V5 maps?

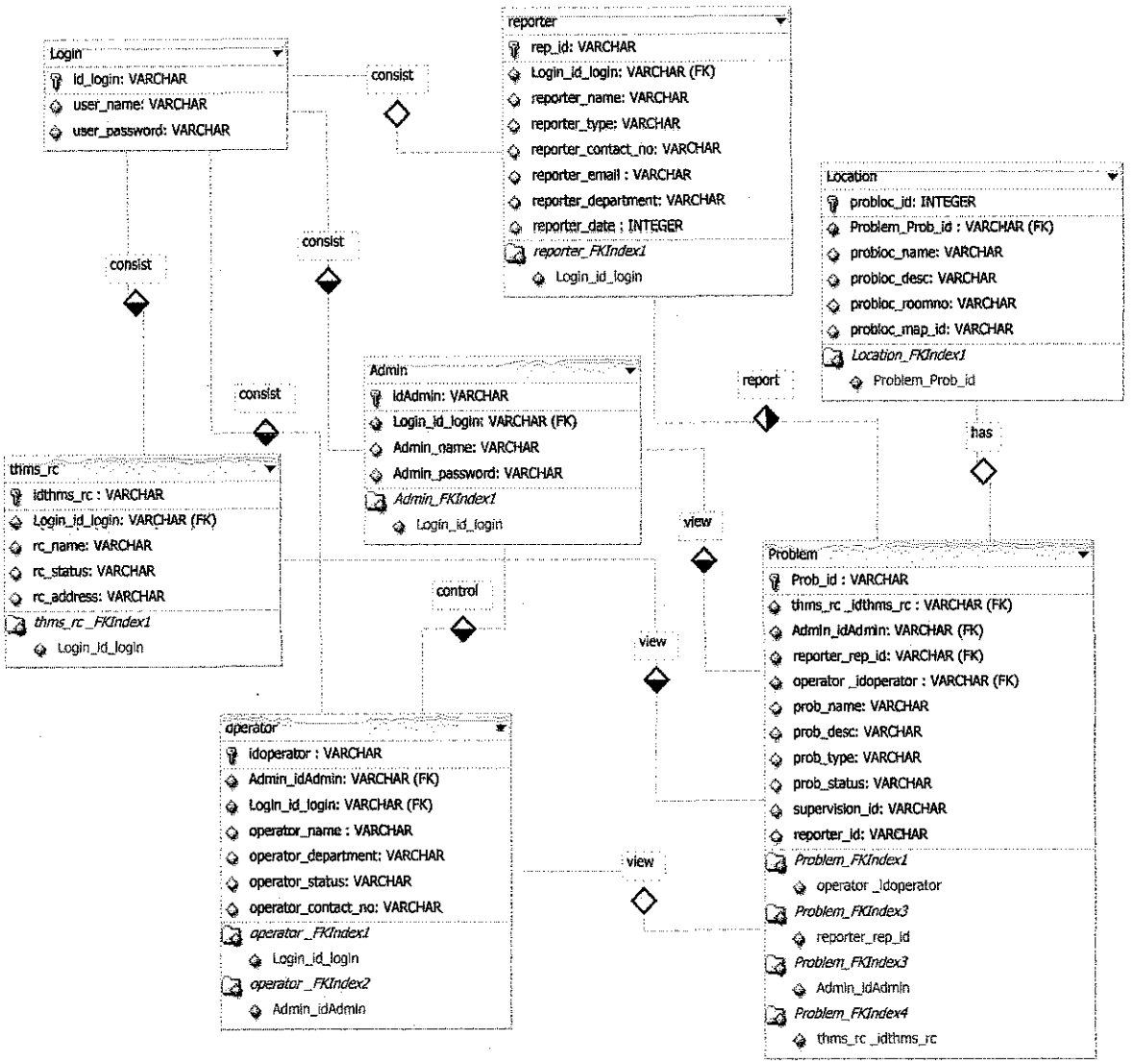
APPENDIX III: USE-CASE DIAGRAM AND DATABASE SCHEMA

Use Case Diagram



Appendix 3.1: Use Case Diagram

THMS DATABASE SCHEMA



APPENDIX IV: SURVEY QUESTIONS

Project Title: THINK Hostel Maintenance System (THMS)

Questionnaire produced by Mohd Saifulnizam Mohd Jaini, Business Information System Student of Universiti Teknologi PETRONAS regarding the Final Year Project.

Abstract:

This is a survey for research purpose. This questionnaire is used to gather information, opinion and feedback for the research work. This is to produce an effective maintenance system that the author working on.

Kindly please answer ALL questions.

1. How do you usually report a property problem at your area?
   - ☐ Go to liable department for reporting the problem
   - ☐ Fix the problem by your own initiative without reporting
   - ☐ Others:_____
   - ☐ I don't care to report and fix the problem

2. Have you ever used any online based system for property problem reporting?
   - ☐ Yes
   - ☐ No

3. How do you find an online based system **would help** for the property problem reporting process?

   - ☐ Good
   - ☐ Average
   - ☐ Unsatisfactory

4. How do you prefer information of reported problem being displayed in Online Based System?

   - ☐ Use Text Only
   - ☐ Use Graphic Only
   - ☐ Use Combination of both graphic and text, but minimal text
   - ☐ Use Combination of both graphic and text, but minimal graphic

5. Do you have computer in your office or room with internet facilities or Lan Connection?

   - ☐ Yes
   - ☐ No

6. What type of Operating System do you use?

   - ☐ Windows
   - ☐ Linux
   - ☐ Mac Os

7. Which web browser do you use?

   - ☐ Microsoft Internet Explorer
   - ☐ Netscape Navigator/ Communicator
   - ☐ Other

8. Do you comfortable with the 'traditional paper-based system' in problem reporting?

   - ☐ Yes
   - ☐ No

THANK YOU FOR YOUR COORPERATION

May Success be Ours

APPENDIX V: PMMD WORK REQUEST FORM

DATE	
APPOINTED CONTRACTOR	
LOCATION	

UNIVERSITI TEKNOLOGI PETRONAS

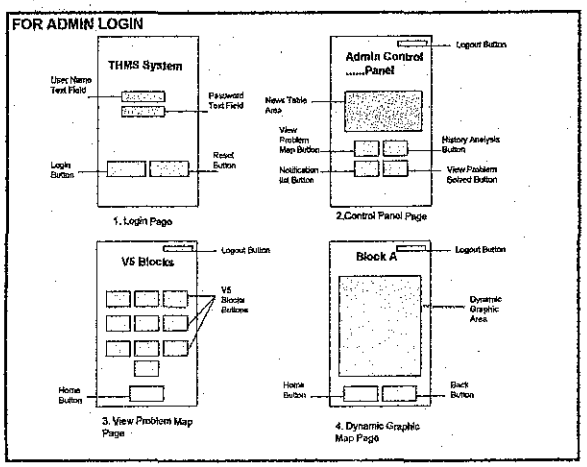
PIRIORITY LEVEL (TO BE FILLED BY PMM ENGINEER)	URGENT REPAIR WORKS		NORMAL REPAIR WORKS		PLAN WORKS
	segera				

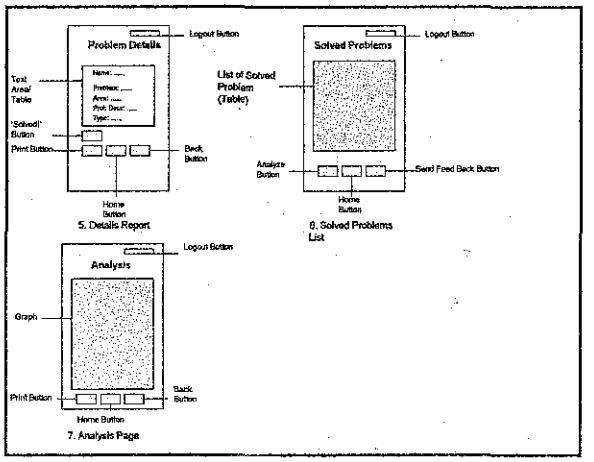
JUSTIFICATION

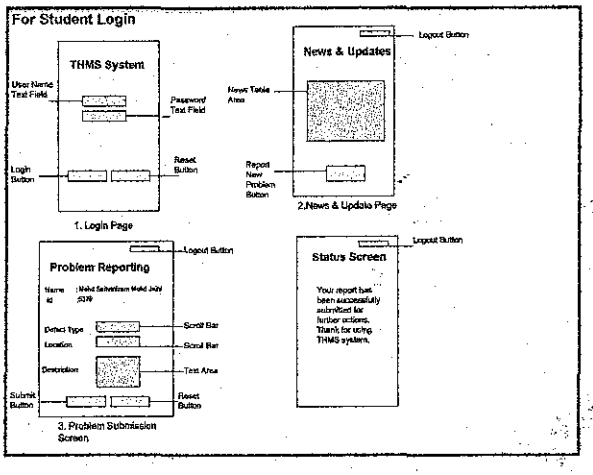
To be fill by user/ Assistant Engineer/ Executive/ Enginee			To be fill by Appointed Contractor			To be fill by the User	
NO	BUILDING/ ROOM	REQUEST/ DEFECT IN DETAILS	ACTION TAKEN/ REMARKS	DATE	REPLACED PARTS (IF ANY)	DATE	VERIFICATION BY
1.							
2.							
3.							
4.							

	Prepared by	Endorsed by	Approved by
	Date	Date	Date

APPENDIX VI: STORY BOARD


FOR ADMIN LOGIN
THMS System
User Name Text Field
Password Text Field
Login Button
Reset Button
1. Login Page
Admin Control Panel
Logout Button
News Table Area
View Problem Map Button
Notification list Button
History Analysis Button
View Problem Solved Button
2.Control Panel Page
V5 Blocks
Logout Button
V5 Blocks Buttons
Home Button
3. View Problem Map Page
Block A
Logout Button
Dynamic Graphic Area
Home Button
Back Button
4. Dynamic Graphic Map Page


Problem Details
Logout Button
Text Area/ Table
'Solved' Button
Print Button
Back Button
Home Button
5. Details Report
Solved Problems
Logout Button
List of Solved Problem (Table)
Analyze Button
Send Feed Back Button
Home Button
6. Solved Problems List
Analysis
Logout Button
Graph
Print Button
Back Button
Home Button
7. Analysis Page


For Student Login
THMS System
User Name Text Field
Password Text Field
Login Button
Reset Button
1. Login Page
News & Updates
Logout Button
News Table Area
Report New Problem Button
2.News & Update Page
Problem Reporting
Logout Button
Name
Id
Defect Type
Scroll Bar
Location
Scroll Bar
Description
Text Area
Submit Button
Reset Button
3. Problem Submission Screen
Status Screen
Logout Button
Your report has been successfully submitted for further actions. Thank for using THMS system.