I. Introduction

A. Background of the Study

The Department of Public Works and Highways (DPWH) functions as the engineering and construction arm of the Government tasked to continuously develop its technology for the purpose of ensuring the safety of all infrastructure facilities and securing for all public works and highways the highest efficiency and quality in construction. DPWH is currently responsible for the planning, design, construction and maintenance of infrastructure, especially the national highways, flood control and water resources development system, and other public works in accordance with national development objectives. [1]

For every project that has been done for the Department of Public Works and Highways, an inspection is done one year after its completion to decide whether the department will accept the project. After acceptance, every project has a corresponding warranty. Roads, for example, have warranty of 15 years after its acceptance date. The contractor of the project must submit a surety bond to the DPWH upon completion. These surety bonds are paid and in case where the projects are damaged, the bonding companies will shoulder the cost of repairs. The contractor may submit any of the following type of bonds: (1) Bank Guarantee, which can be acquired from banks; (2) Surety Bond, which can be bought from insurance companies; and (3) Cash Bond, which is the direct payment. The contractor must pay annual fee for the warranty of the project. Having a

Bank Guarantee means the contractor annually pays 10% of the contract amount until the warranty period is over (i.e. 15 years for roads), while Surety Bond is 30% and Cash Bond is 10%. The most commonly submitted is the surety bond because insurance premium is usually from 0.5% to 2.0% making it the cheapest of the three. [2]

B. Statement of the Problem

The DPWH is divided into regions (i.e. Region 1, NCR, etc). Each region is divided into engineering districts, since each district has a very broad area, each district (especially the developing ones) has many projects every year. The second engineering district of Region VIII alone had almost 300 projects on the year 2005. Considering that warranty stretches years, having that much projects every year means that the department has to monitor a lot of warranty. With at 200-300 projects a year, the district will be monitoring 1000-1500 projects on its first 5 years. Currently, the department has no computerized system for monitoring warranties. Without an automated system, monitoring contractors of these projects have paid their annual warranty bonds is impossible. Additionally, fund that must be acquired in case a project receives damage while in warranty should not be taken from its supposed contractor thus wasting taxpayer's money. Even the acceptance a project is difficult to monitor since no one remembers every project done for the previous year as personnel are occupied with the projects that are being done for the current year. [2]

C. Objectives

To create an online information system that allows the DPWH Region VIII Leyte 2nd Engineering District to effectively monitor the payments of the contractors for their surety bonds. It has the following functionalities:

To allow the:

1. Monitoring Engineer

    a.) update project information, contractor information, and project payment information;

    b.) query information on unpaid bonds, payments that are about to expire, projects in need of acceptance, payments made for the year and fully paid warranties;

    c.) to print letters or send email to contractors regarding payments; and

    d.) change password

2. Assistant District Engineer/Chairman of the Inspectorate Team to

    a.) approve the records edited by the Monitoring Engineer;

    b.) approve acceptance of payment;

    c.) query and approve acceptance of project; and,

    d.) change password.

3. District Engineer to

    a.) view accepted and yet to be accepted projects; and,

    b.) change password

4. System Administrator to

a.) create and suspend user accounts;

b.) update general information files on each projects; and,

c.) change password.

5. Anonymous users to view information on the projects, contractors and the warranty payment in Region VIII Leyte Second Engineering District.

D. Significance of the Study

The system can sort and filter the massive data which allows the DPWH to easily monitor all payments for all the warranty bonds. It also aids in informing the contractors on their bond payments by having an e-mail capability and letter template for snail mail. The system's data provides transparency for the projects made and this transparency minimizes graft and corruption with regards to creation of these projects. Its information can be used as research material for researchers or other agencies that are in need of it.

E. Scopes and Limitation

The system will only cover one district in the DPWH, specifically Leyte 2nd Engineering District. The system does not handle the payment only the registration of the payment that is used in the monitoring. It also doesn't handle the procedures before the finishing the projects since the

system concentrates only on monitoring the surety bonds. Every edit in the system requires the approval of an officer to disallow bogus or trash data. Editing of the project and payment data is only allowed prior to their acceptance/approval due to possible tampering after the project has been checked by the district officers. the contractor data, however, can be edited anytime since contractors changing their address or email cannot affect the integrity of the system. No report is generated on the warranties since these warranties are good only when the projects are damaged and reports are being made only during construction (progress report). The description file of each project is provided by the inspectorate team upon completion. Users of the system cannot create their own username and password but it has to be requested from the System Administrator.

F. Assumptions

The system assumes that the engineering district has a network connected to the internet. The information inputted is accurate based on the documentation. The system clock is accurate and set to GMT+8 for the Philippine time. The system has a built in SMTP server.

The system also assumes that there is only one District Engineer and one Assistant District Engineer per engineering district. This system works only on one district since it is only a prototype of a larger system that will be implemented for the whole DPWH system. The Assistant District Engineer is given the responsibility of the Chairman of the Inspectorate Team. The system only generates e-mail but doesn’t receive one.

II. Review of Related Literature

The Highway Performance Monitoring System (HPMS) is a national (USA) level highway information system that includes data on the extent, condition, performance, use, and operating characteristics of the Nation's highways. The major purpose of the HPMS is to support a data driven decision process within FHWA (Federal Highway Administration), the DOT (US Department of Transportation), and the Congress. The HPMS data are used extensively in the analysis of highway system condition, performance, and investment needs that make up the biennial Condition and Performance Reports to Congress. These Reports are used by the Congress in establishing both authorization and appropriation legislation, activities that ultimately determine the scope and size of the Federal-aid Highway Program, and determine the level of Federal highway taxation. [3]

The USDA (US Department of Agriculture) initiated the National Animal Health Monitoring System (NAHMS) in 1983 to collect, analyze, and disseminate data on animal health, management, and productivity across the United States. The NAHMS team conducts national studies on the health and health management of America's domestic livestock populations. These studies are designed to meet the information needs of the industries associated with these commodities, as identified by people within those industries. [4]

PRAMS, the Pregnancy Risk Assessment Monitoring System, is a surveillance project of the Centers for Disease Control and Prevention

(CDC) and state health departments. PRAMS collects state-specific, population-based data on maternal attitudes and experiences before, during, and shortly after pregnancy. The goal of the PRAMS project is to improve the health of mothers and infants by reducing adverse outcomes such as low birth weight, infant mortality and morbidity, and maternal morbidity. PRAMS provides state-specific data for planning and assessing health programs and for describing maternal experiences that may contribute to maternal and infant health. [5]

GEMS (Global Environment Monitoring System)/Water develops and maintains a global freshwater quality information system with a series of national and international partners. They provide information on global freshwater quality through a variety of mechanisms including the internet and via CD ROM to support global and regional environmental assessment and reporting processes in the United Nations system and other international agencies. They work with partners to facilitate the formulation and implementation of programmes to build capacity of developing countries for the acquisition and management of water quality information. [6]

The Environmental Permit and Monitoring System (EPMS) was developed by the provincial government of Bulacan's Provincial Information Technology Office (PITO). It was developed to automate the issuance and recording of Mining Permits, Environmental Compliance Certificates and other Environment-related Information. [7]

Insurance Information System (INSIS) is extremely flexible and highly configurable to meet the specific product and administration rules of the insurance company. System functionality is controlled and fine tuned via more than 5000 configuration parameters. The highly modular structure allows the insurance company to use their own resources with the corresponding insurance knowledge and some basic technical skills to build their own product. INSIS is especially suited to markets significant or unexpected changes. [8]

MIDIS (Motor Insurance Database Information System) is available to Law Society registered solicitors to determine whether there may be insurance cover for a third party vehicle involved in an accident with their client. Solicitors must first register with MIIC before using the system. The MIDIS website can be used to capture requests for registration on MIDIS and for making subsequent inquiries of the MID by inputting the vehicle registration number. [9]

The National Antimicrobial Resistance Monitoring System (NARMS) program monitors changes in antimicrobial drug susceptibilities of selected enteric bacterial organisms in humans, animals, and retail meats to a panel of antimicrobial drugs important in human and animal medicine. Bacterial isolates are collected from human and animal clinical specimens, from healthy farm animals, and raw product from food animals. [10]

The Forest Management Information System (FMIS) is envisaged as an integrated system which will be used to support the planning,

implementation and monitoring of multi-objective forest management activities. The FMIS can be used for strategic, tactical and operational planning and implementation, and operational control in and across administrative units and levels of the organizational hierarchy. Besides the databases and models required to support decision-making in the many programs of the Department, the FMIS also has the ability to maintain current forest inventories and generate maps of spatially-oriented data (e.g. attributes of entities depicted on a map, such as population of a village, whose location can be fixed on a map). The components of the FMIS, which will necessarily be linked, are a Monitoring Information System (MIS), a Geographic Information System (GIS), and an Image Processing System. [11]

The Chicago Airport System's Airport Noise Monitoring System is a comprehensive system to provide actual measurement of the aircraft noise levels in Chicago neighborhoods and suburban communities around O'Hare and Midway. This integrated system includes many components, including a network of permanent noise monitors that measure the noise environment and a system directly connected to the FAA (Federal Aviation Administration)'s air traffic control radar that collects aircraft flight tracks. More than 5 million data points are recorded and stored by the system each day. Feedback from our neighbors is crucial to the success of this program. The information from citizens about airport noise in neighboring communities is also entered into the system. This information is analyzed at a central computer that helps the airport in the management of the airport noise mitigation programs. The Department of Aviation Noise Office

will use this data as the basis for working with the O'Hare Noise Compatibility Commission, the Midway Noise Compatibility Commission, the Federal Aviation Administration, air carriers and communities on future programs aimed at reducing noise impacts on residential communities. [12]

III. Theoretical Framework

DPWH Region VIII District 2

Contractors gets license from Philippine Contractors Accreditation Board. Every year, contractors must submit their information: firm, technical personnel, equipment capability, financial capability and work experience to the DPWH. Contractors register at DPWH and get contractors registry certificate (CRC). Contractors submit letter of intent if they want to bid for a project from the DPWH (see Appendix). DPWH then send copy of the CRC, letter of intent and DPWH-INFR-15-062106 for eligibility check in Manila and receives letter with list of eligible contractors (the unqualified are also on the list and the reason for not being qualified). Eligible contractors buy bidding documents from the district office then bidding is done. During bidding, contractors post bidder's bond. The lowest calculated bid gets the project. Resolution recommending award will be made by the Bids and Awards Committee of the district (stating bidders and lowest bidder). A notice of award will be given to the lowest bidder requiring him to submit documents and performance bonds. After completing requirements, a contract agreement will be entered into by the contractor and the DPWH and a notice to proceed work is issued to the contractor. Construction is supervised by project engineer assigned by the district office. Upon completion, project is inspected by the district inspectorate team and accepted by the end-user (barangay: barangay official / school: DepEd official / national roads: DPWH officials). After acceptance, contractor files for billing and surety bond for their

accomplished work. A monitoring engineer will be in charge of monitoring the payments for the acceptance/warranties of the projects. One year after the completion of the project, the surety bond previously posted will expire and the project will be inspected for defects. The contractors are paid afterwards. If the project was found satisfactory then it will be accepted with an Acceptance Report (which will be signed by the inspectorate team) and Certificate of Acceptance (which will be signed by the district engineer), else it will be fixed using the surety bond filed or the retention money (10% of the cost). From here on, Surety bond should be renewed every year for certain duration depending on the type of project. If a project incurs damage, the department finds out from reports of the citizens using the projects. When a report is filed, the assistant district engineer, acting as the chairman of the inspectorate team, sends a team to investigate. If the investigation yields positive on damage then the assistant district engineer checks the warranty of the project and uses the paid bonds as funds in repairing the damage else funds are taken from the government. [2]

Surety Bond

A surety bond is a written agreement where one party, the surety, obligates itself to a second party, the obligee, to answer for the default of a third party, the principal. There are two categories of surety bonds: [13]

Contract Surety Bonds provide financial security and construction assurance on building and construction projects by assuring the project

owner (obligee) that the contractor (principal) will perform the work and pay certain subcontractors, laborers, and material suppliers. [13]

Contract surety bonds include: bid bonds, which provide financial assurance that the bid has been submitted in good faith, and that the contractor intends to enter into the contract at the price bid and provide the required performance and payment bonds; performance bonds, which protect the owner from financial loss should the contractor fail to perform the contract in accordance with its terms and conditions; payment bonds, which guarantee that the contractor will pay certain subcontractors, laborers, and material suppliers associated with the project; maintenance bonds, which normally guarantee against defective workmanship or materials for a specified period; subdivision bonds, which guarantee to a city, county, or state that the principal will finance and construct certain improvements such as street, sidewalks, curbs, gutters, sewer, and drainage systems. [13]

Commercial Surety Bonds guarantee performance by the principal of the obligation or undertaking described in the bond. Commercial surety includes: License and permit bonds, which are required by state law or local regulations in order to obtain a license or permit to engage in a particular business, e.g. contractors, motor vehicle dealers, securities dealers Blue Sky bonds, employment agencies, health spas, grain warehouses, liquor, and sales tax; Judicial and probate bonds, also referred to as fiduciary bonds, secure the performance on fiduciaries' duties and compliance with court order, e.g. administrators, executors, guardians,

trustees of a will, liquidators, receivers, and masters. Judicial proceedings court bonds include injunction, appeal, indemnity to sheriff, mechanic's lien, attachment, replevin, and admiralty; Public official bonds, which guarantee the performance of duty by a public official, e.g. treasurers, tax collectors, sheriffs, judges, court clerks, and notaries; Federal (non-contract) bonds are those required by the federal government, e.g. Medicare and Medicaid providers, customs, immigrants, excise, and alcoholic beverage; and Miscellaneous bonds, e.g. lost securities, lease, guarantee payment of utility bills, to guarantee employer contributions for Union fringe benefits, and workers compensation for self-insurers; [13]

Information System

In general systems theory, an information system is a system, automated or manual, that comprises people, machines, and/or methods organized to collect, process, transmit, and disseminate data that represent user information.

In telecommunications, an information system is any telecommunications and/or computer related equipment or interconnected system or subsystems of equipment that is used in the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of voice and/or data, and includes software, firmware, and hardware. (Federal Standard 1037C, MIL-STD-188, and National Information Systems Security Glossary)

In computer security, an information system is described by five objects (Canal 2004): Repositories, which hold data permanent or temporarily, such as buffers, RAM, hard disks, cache, etc.; Interfaces, which exchange information with the non-digital world, such as keyboards, speakers, scanners, printers, etc; Channels, which connect repositories, such as buses, cables, wireless links, etc. A Network is a set of logical or physical channels; Services, which provide value to users or to other services via messages interchange; and, Messages, which carries a meaning to users or services. [14]

Monitoring System

An on-going system to collect data on a program=s activities and outputs, designed to provide feedback on whether the program is fulfilling its functions, addressing the targeted population, and/or producing those services intended. FOR EXAMPLE, a computerized intake system may be utilized which captures client characteristics, and subsequently provides monthly reports on the numbers of clients processed and receiving services. [15]

Database

According to *Database Learning Module* by Carol E. Brown, database is one or more large structured sets of persistent data, usually associated with software to update and query the data. A simple database

might be a single file containing many records, each of which contains the same set of fields where each field is a certain fixed width. [16]

IV. Design and Implementation

Entity Relationship Diagram

The system is composed mainly of 6 entities (Figure 1). All projects must have a contractor; it is part of its definition. The contractors are the one who acquires the rights to build the project and get the payment from the government for their services. Upon acceptance of the project, payments must be made for it. Project warranties are always more than 1 year long so each project will have multiple payments. When a payment is accepted, it is registered in the projects payment monitoring entity. This entity is used to determine a projects payment history. Also, for the sake of reference of outsiders (guests, contractors, etc), each project has its own miscellaneous description and photographs. These pictures are provided by the DPWH but inputted by the System Administrator. The user entity has its own separate entity and it houses all the user login, info and rights for the system.

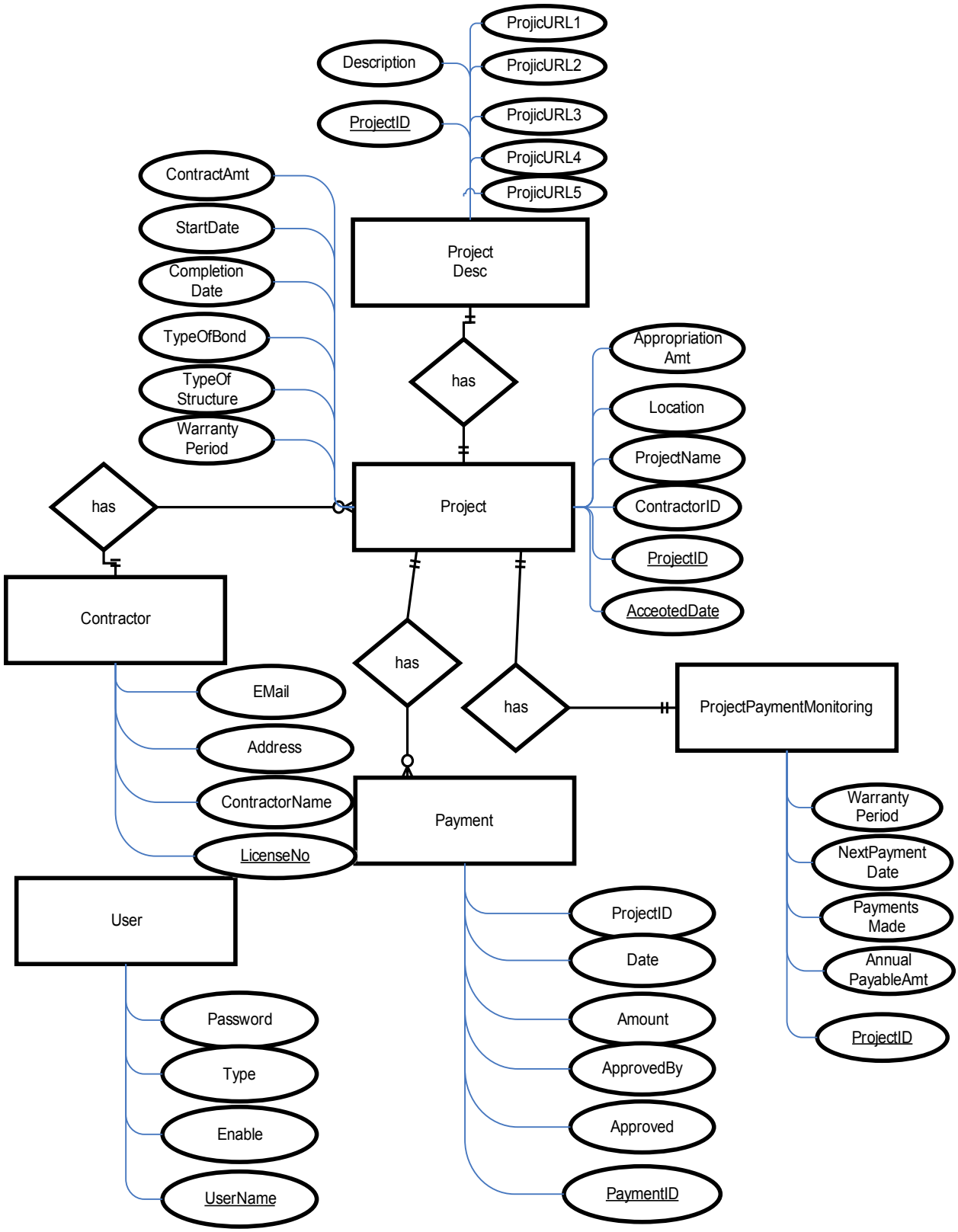

Figure 1. Entity Relationship Diagram, *WMIS-L2ED*

Data Dictionary

Contractor – table for contractor data

Name	***Attribute***	***Description***
LicenseNo	Char(20)	Contractor's License
ContractorName	Char(50)	Contractor/Firm Name
Address	Char(100)	Contractor's Official Address
Email	Char(50)	Contractor's E-Mail Address

ContractorEdit – temporary table for editing the contractor data

Name	***Attribute***	***Description***
PrevLicenseNo	Char(20)	Previous Contractor ID
LicenseNo	Char(20)	Contractor's License
ContractorName	Char(50)	Contractor/Firm Name
Address	Char(100)	Contractor's Official Address
Email	Char(50)	Contractor's E-Mail Address
Command	Enum('Edit', 'Delete')	Command Given
EditedBy	Char(20)	Username of the issuer of the command
Comment	Char(100)	Comments made by clerk to the officer
LastEdit	DateTime	Date and time of last edit

Users – table for users data

Name	***Attribute***	***Description***
UserName	Char (20)	User's Unique Identification
Password	Char (20)	Encrypted Password
Type	Enum ('SysAd', 'ME', 'ADE', ‘DE’)	User Type
Enable	'Yes', 'No'	User Account Activity Indicator

ProjectPaymentMonitoring – table for monitoring payment of every project

Name	***Attribute***	***Description***
ProjectID	Char (20)	Project ID
WarrantyPeriod	Integer	Warranty Period for Project
NextPaymentDate	Date	Date for Next Payment
PaymentsMade	Integer	Number of Payments Made
AnnualPayableAmt	Real	Annual Payable Amount

Project – table for project data

Name	***Attribute***	***Description***
ProjectID	Char (20)	Project ID
ContractorID	Char (20)	Corresponds to LicenseNo
ProjectName	Char (50)	Project Name
Location	Char (50)	Project Location
AppropriationAmt	Integer	Appropriation Amount
ContractAmt	Integer	Contract Amount
StartDate	Date	Start Date of Project
CompletionDate	Date	Completion Date of Project
TypeOfBond	Enum ('BG', 'SB', 'CB')	Type Of Bond Used to Pay
TypeOfStructure	Char (20)	Type of Structure
WarrantyPeriod	Integer	Warranty Period for Project
Accepted	Enum ('Yes', 'No')	Indicator if project is accepted and ready for warranty monitoring
AcceptedDate	Date	Date accepted

ProjectDone – table for project that has been paid for completely

Name	***Attribute***	***Description***
ProjectID	Char (20)	Project ID
ContractorID	Char (20)	Corresponds to LicenseNo
ProjectName	Char (50)	Project Name
Location	Char (50)	Project Location
AppropriationAmt	Integer	Appropriation Amount

ContractAmt	Integer	Contract Amount
StartDate	Date	Start Date of Project
CompletionDate	Date	Completion Date of Project
TypeOfBond	Enum ('BG', 'SB', 'CB')	Type Of Bond Used to Pay
TypeOfStructure	Char (20)	Type of Structure
WarrantyPeriod	Integer	Warranty Period for Project

ProjectEdit - temporary table for editing the project data

Name	***Attribute***	***Description***
PrevProjectID	Char (20)	Previous ProjectID
ProjectID	Char (20)	Project ID
ContractorID	Char (20)	Corresponds to LicenseNo
ProjectName	Char (50)	Project Name
Location	Char (50)	Project Location
AppropriationAmt	Integer	Appropriation Amount
ContractAmt	Integer	Contract Amount
StartDate	Date	Start Date of Project
CompletionDate	Date	Completion Date of Project
TypeOfBond	Enum ('BG', 'SB', 'CB')	Type Of Bond Used to Pay
TypeOfStructure	Char (20)	Type of Structure
WarrantyPeriod	Integer	Warranty Period for Project
Command	Enum('Edit', 'Delete')	Command Given
EditedBy	Char(20)	Username of the issuer of the command
Comment	Char(100)	Comments made by clerk to the officer
LastEdit	DateTime	Date and time of last edit

Payment – table for payment made

Name	***Attribute***	***Description***
PaymentID	Char (13)	Transaction ID
ProjectID	Char (20)	Project ID

Date	Date	Date of Payment
Amount	Integer	Amount Paid (If bound, amount indicated in the bond)
Approved	Enum ('Yes', 'No')	Indicator of The Approval of the Officer
ApprovedBy	Char (30)	The user who approved the payment

PaymentEdit - temporary table for editing the payment data

Name	***Attribute***	***Description***
PrevPaymentID	Char (13)	Previous PaymentID
PaymentID	Char (13)	Transaction ID (if cash, indicate cash)
ProjectID	Char (20)	Project ID
Date	Date	Date of Payment
Amount	Integer	Amount Paid (If bound, amount indicated in the bond)
Command	Enum('Edit', 'Delete')	Command Given
EditedBy	Char(20)	Username of the issuer of the command
Comment	Char(100)	Comments made by clerk to the officer
LastEdit	DateTime	Date and time of last edit

ProjectDesc – project misc. data description

Name	***Attribute***	***Description***
ProjectID	Char (20)	Project ID
Description	Varchar (1000)	Formatted description of project
ProjPicURL1	Char (50)	URL of project picture (1)
ProjPicDesc1	Char(50)	Short Description of picture (1)
ProjPicURL2	Char (50)	URL of project picture (2)
ProjPicDesc2	Char(50)	Short Description of picture (2)
ProjPicURL3	Char (50)	URL of project picture (3)
ProjPicDesc3	Char(50)	Short Description of picture (3)
ProjPicURL4	Char (50)	URL of project picture (4)
ProjPicDesc4	Char(50)	Short Description of picture (4)
ProjPicURL5	Char (50)	URL of project picture (5)
ProjPicDesc5	Char(50)	Short Description of picture (5)

ProjPicURL6	Char (50)	URL of project picture (6)
ProjPicDesc6	Char(50)	Short Description of picture (6)

Context Free Diagram

The system has four registered user interacting with the system (Figure 2). Each user has its own function that contributes to the overall movement of data. These are the Monitoring Engineer, Assistant District Engineer, District Engineer and the System administrator.

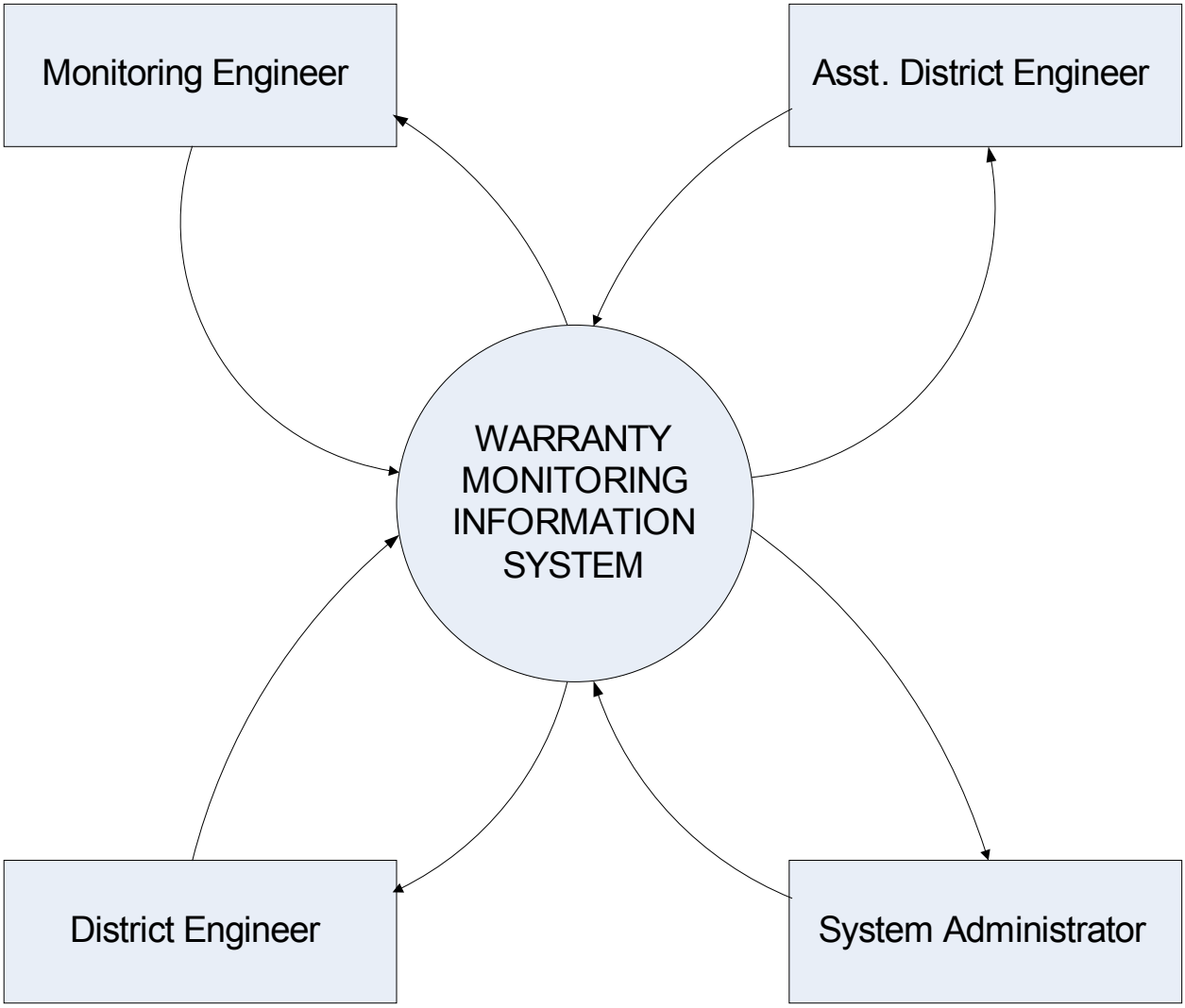

Figure 2: Context Free Diagram, *WMIS-L2ED*

Data Flow Diagram

The Top-level data flow diagram is illustrated on figure 3. It shows five main processes. These are: Login, Update Records, Approve Edited Record, Query and Manage System.

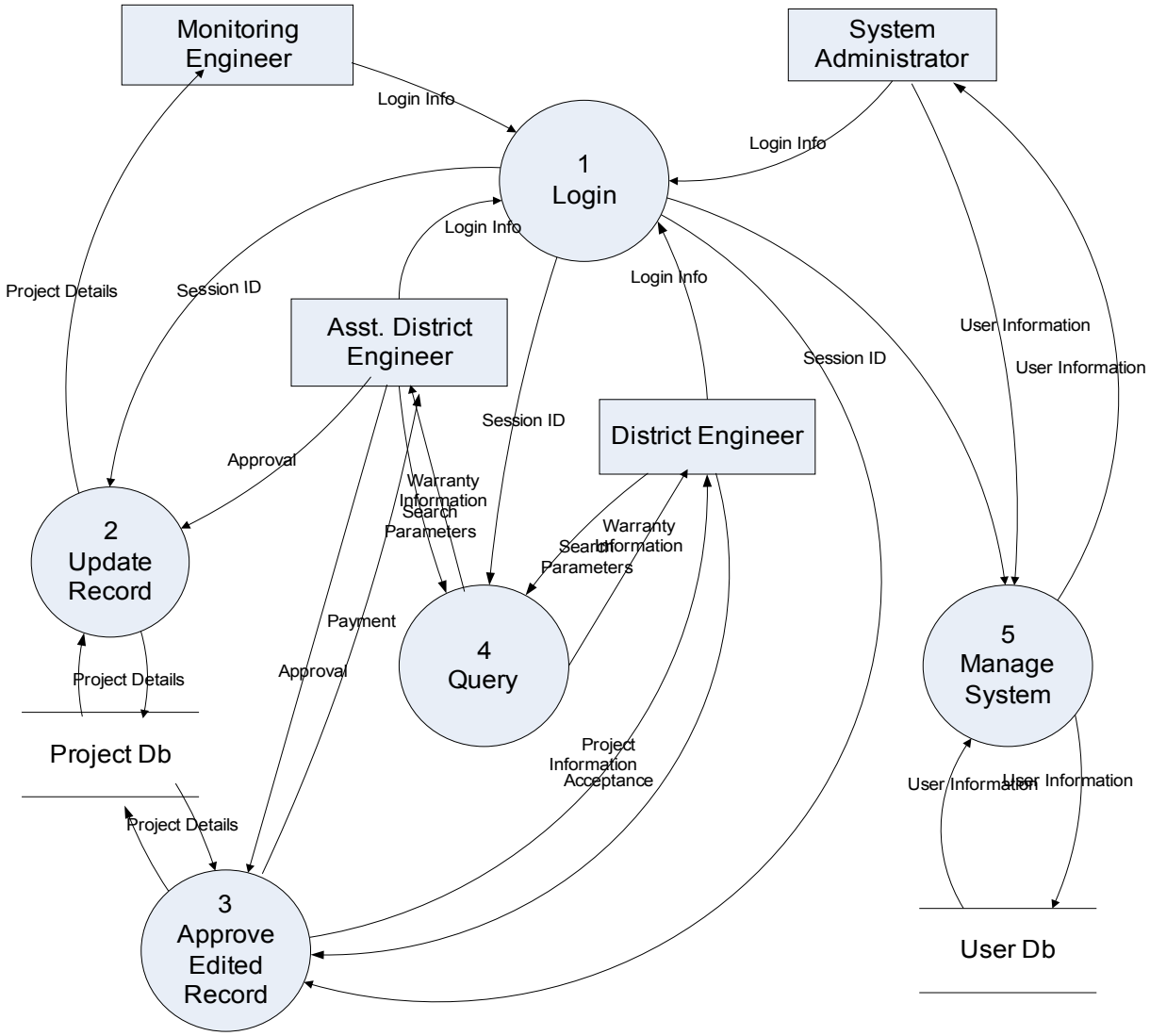

Figure 3: Top-Level Data Flow Diagram, *WMIS-L2ED*

When logging in, the system compares the user's input and the data in the user table and when it matches returns a session ID to be used in browsing the site and accessing functions. All users can also change their passwords and the changes are reflected in the user database. This is shown in Figure 4.

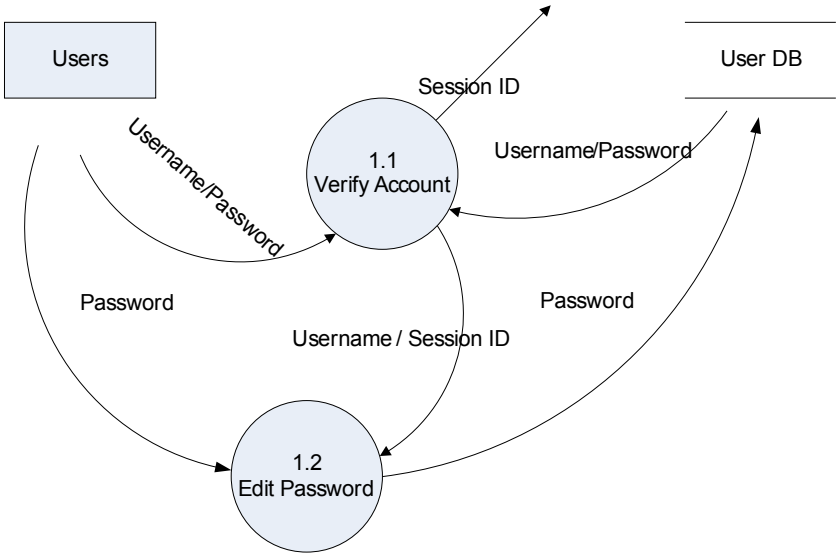

Figure 4: Sub-explosion of 'LOGIN', *WMIS-L2ED*

After log-in the, the Monitoring Engineer will be capable of adding project, contractor or payment information to the system. The Monitoring Engineer is also capable of editing and deleting information but for a limited time only. When editing or deleting, the latest record is shown to the Monitoring Engineer. The system first checks if an edited version exists, if it does it shows the edited version if not it shows only the original. Editing and deleting are not direct; they are just submitted as requests to the Assistant District Engineer. Only after the Assistant District Engineer reviews and accepts the edit/delete requests will the changes be reflected in the system (Figure 5).

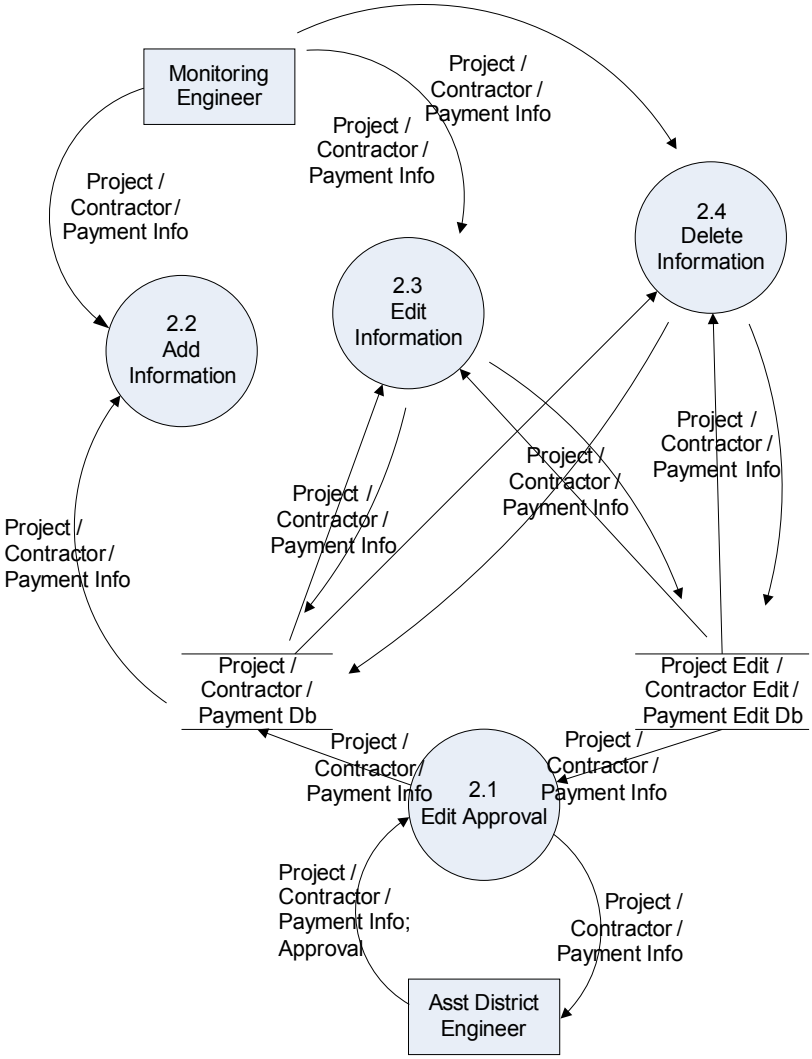

Figure 5: Sub-explosion of ‘Update Record’, *WMIS-L2ED*

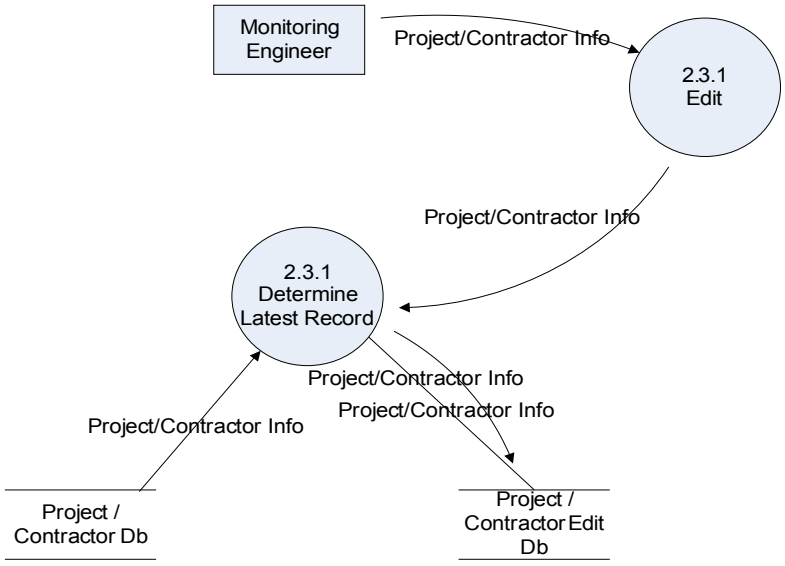

Figure 6: Sub-explosion for ‘Edit Information’, *WMIS-L2ED*

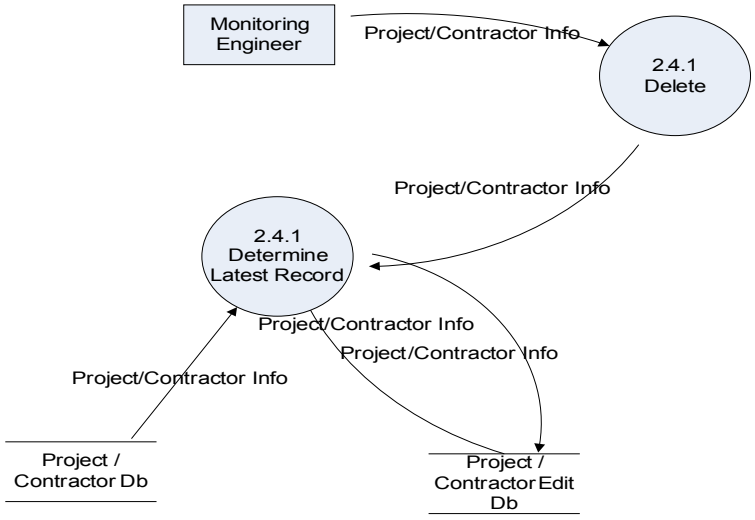

Figure 7: Sub-explosion for ‘Delete Information’, *WMIS-L2ED*

Projects and payments require acceptance and approval in order for them to be validated by the system. For the projects, the Assistant District

Engineer views its data then sends inspection team and if found to be satisfactory it is accepted if not, the surety bond is used to repair it. For the payments, the Assistant District Engineer views the payment record then approves them so they will be reflected on the system (Figures 9-14)

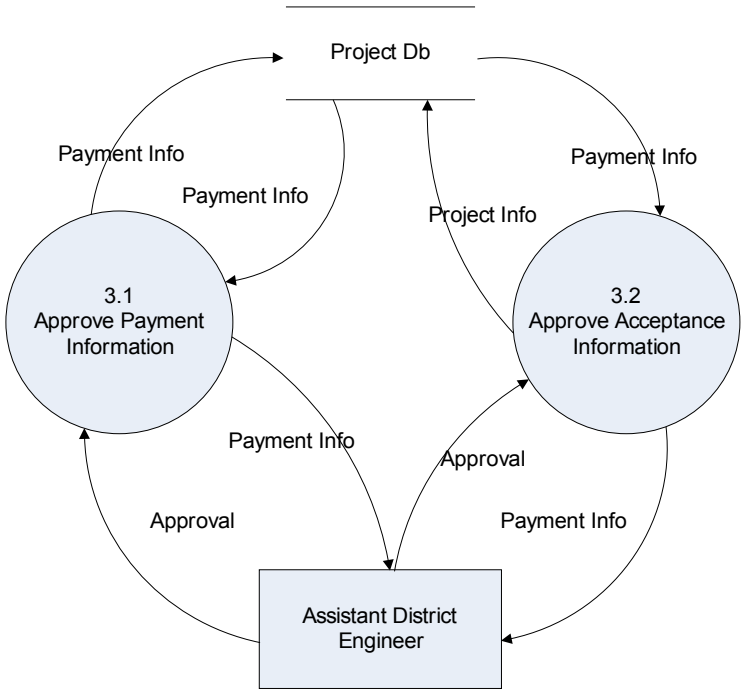

Figure 8: Sub-explosion of 'Approve Edited Records', *WMIS-L2ED*

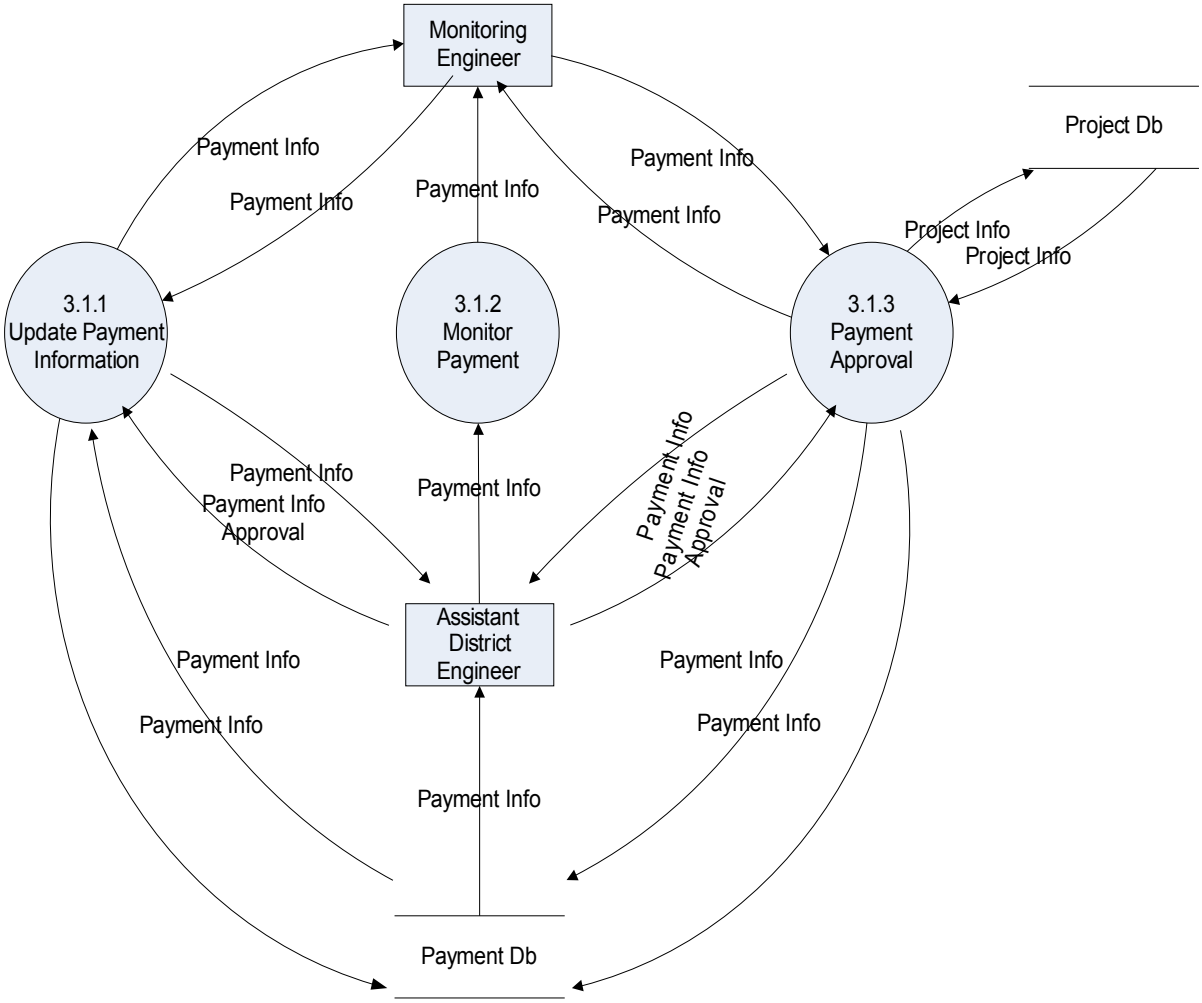

Figure 9. Sub-explosion of ‘Approve Payment Information’, *WMIS-L2ED*

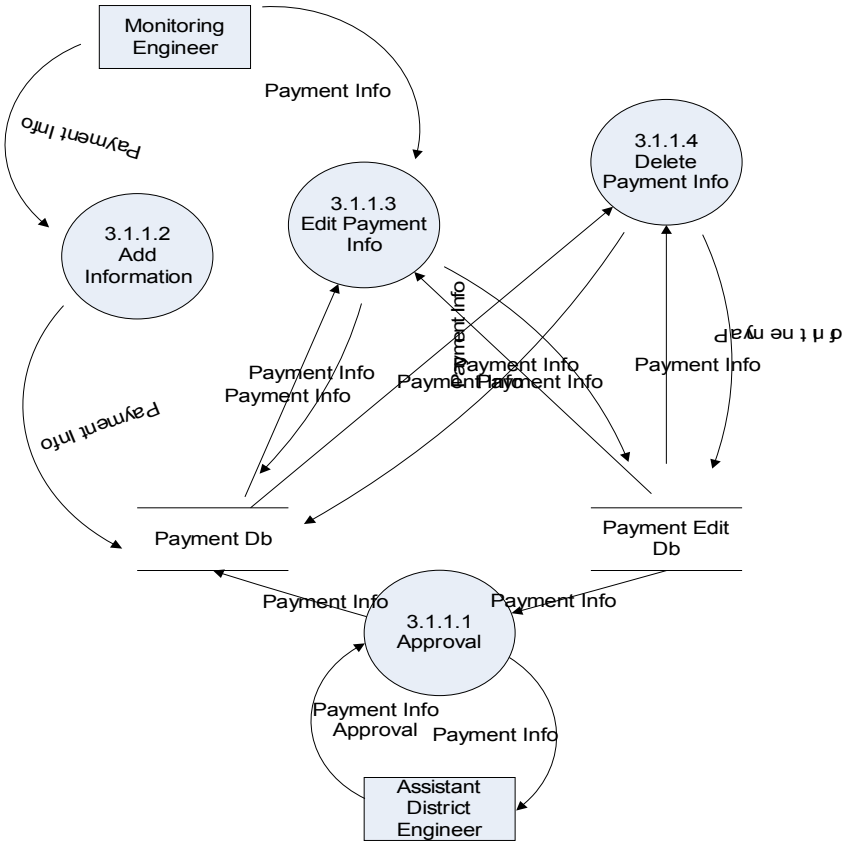

Figure 10: Sub-explosion of 'Update Payment Information', *WMIS-L2ED*

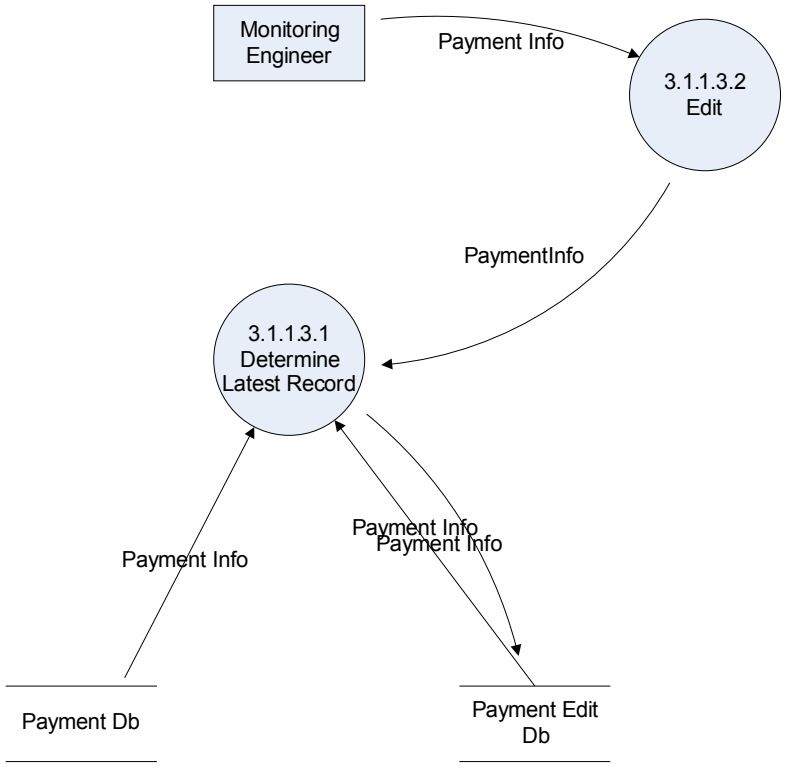

Figure 11: Sub-explosion of 'Edit Payment Info', *WMIS-L2ED*

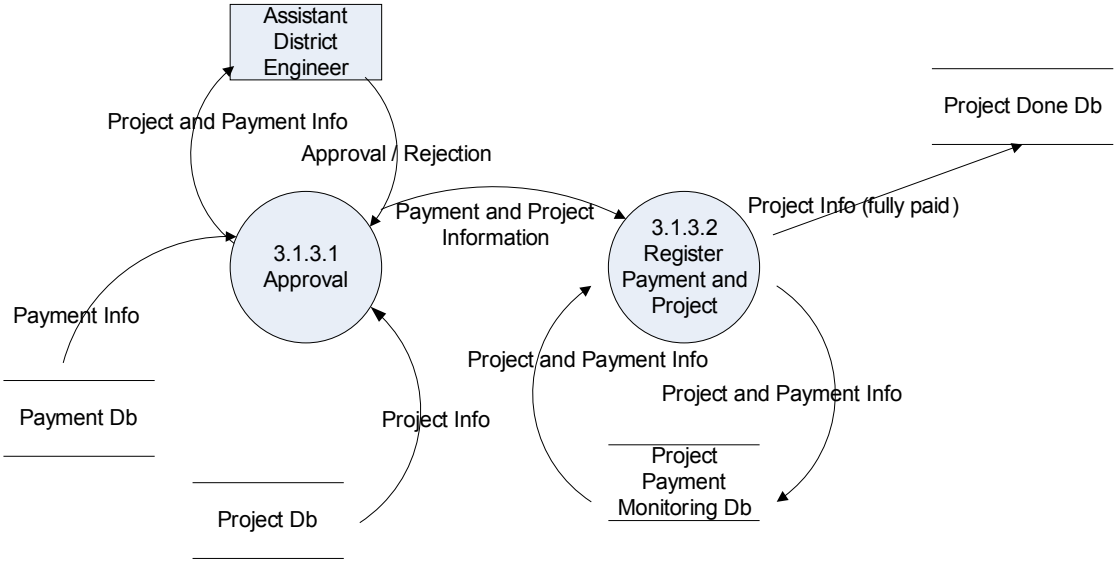

Figure 12: Sub-explosion of 'Payment Approval', *WMIS-L2ED*

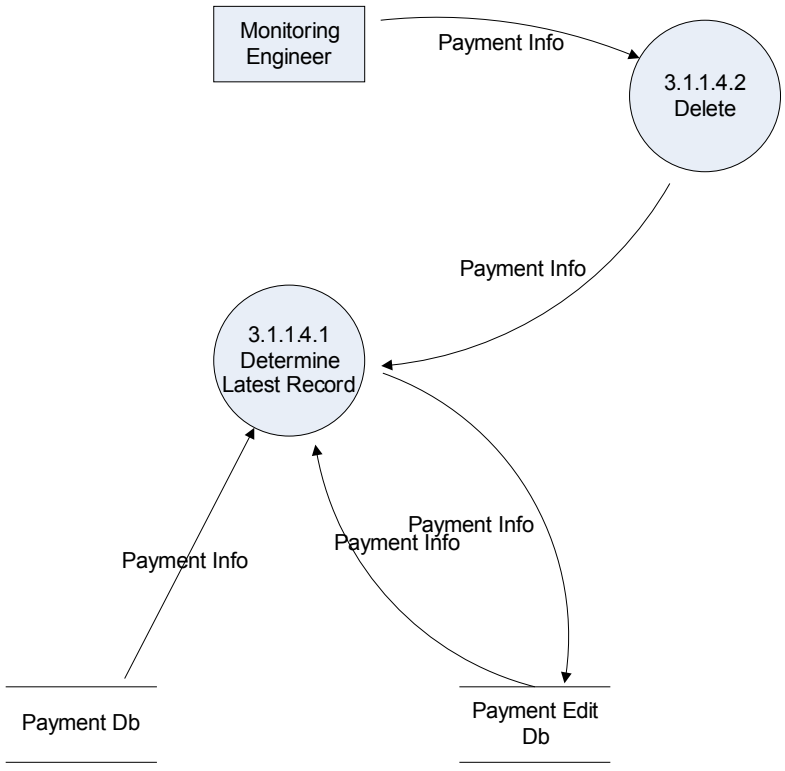

Figure 13: Sub-explosion of 'Delete Payment Info', *WMIS-L2ED*

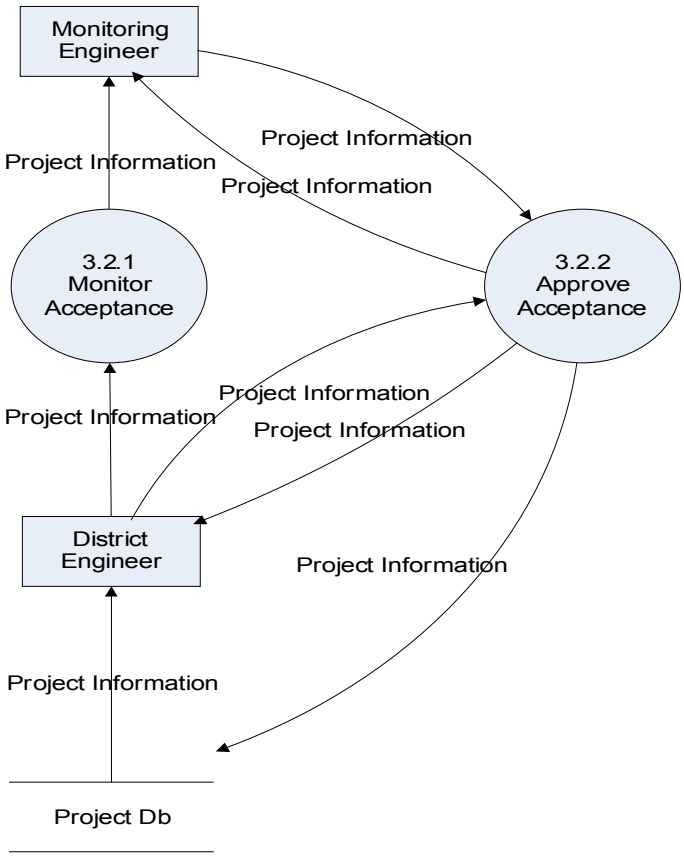

Figure 14: Sub-explosion of 'Approve Acceptance Information', *WMIS-L2ED*

The users have a capability to query the database. They just input the search parameters (search string and field name) and the system generates a list which contains the search string in the given field name (Figure 15).

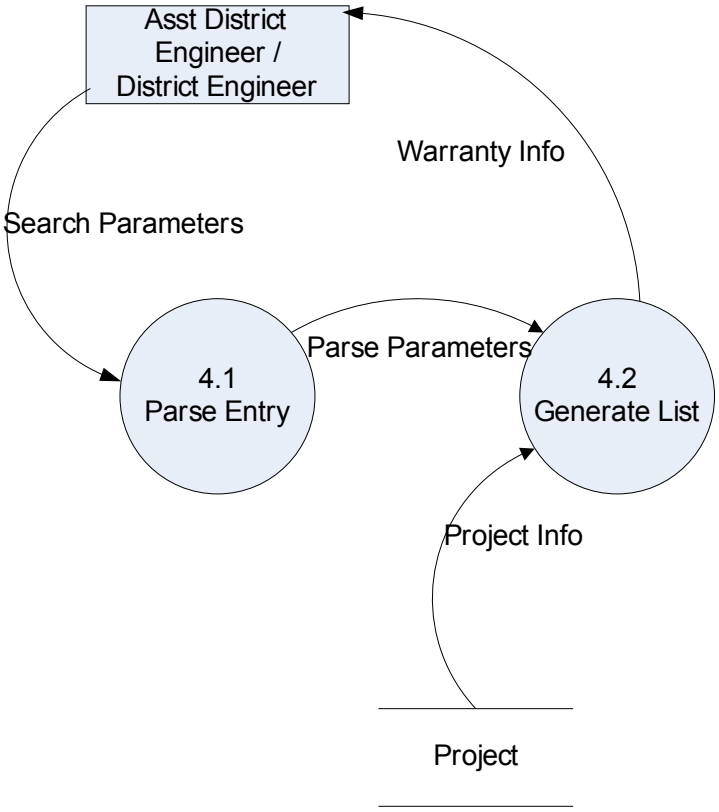

Figure 15: Sub-explosion of 'Query', *WMIS-L2ED*

The System Administrator (Figure 18) can update user accounts (Figure 16) and project miscellaneous information (Figure 18).

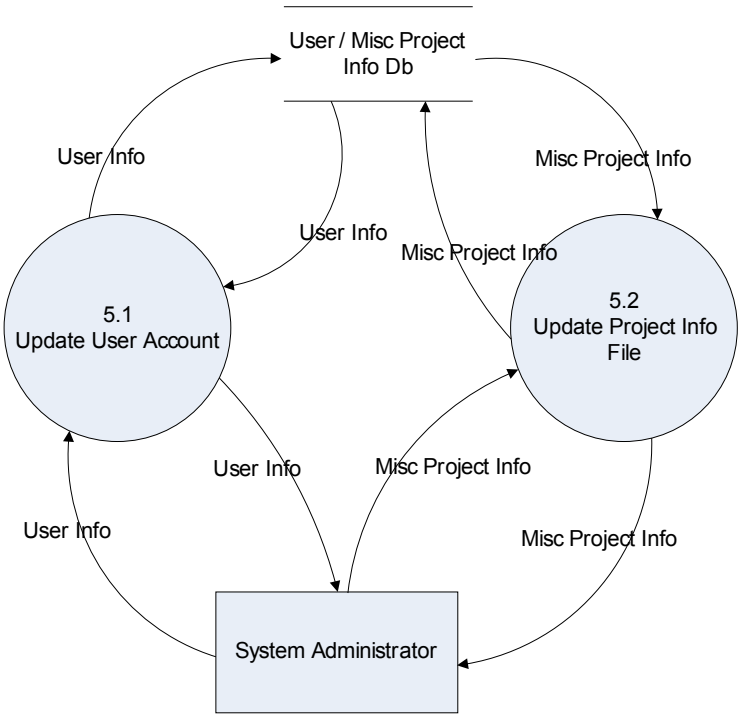

Figure 16: Sub-explosion of ‘Manage System’, *WMIS-L2ED*

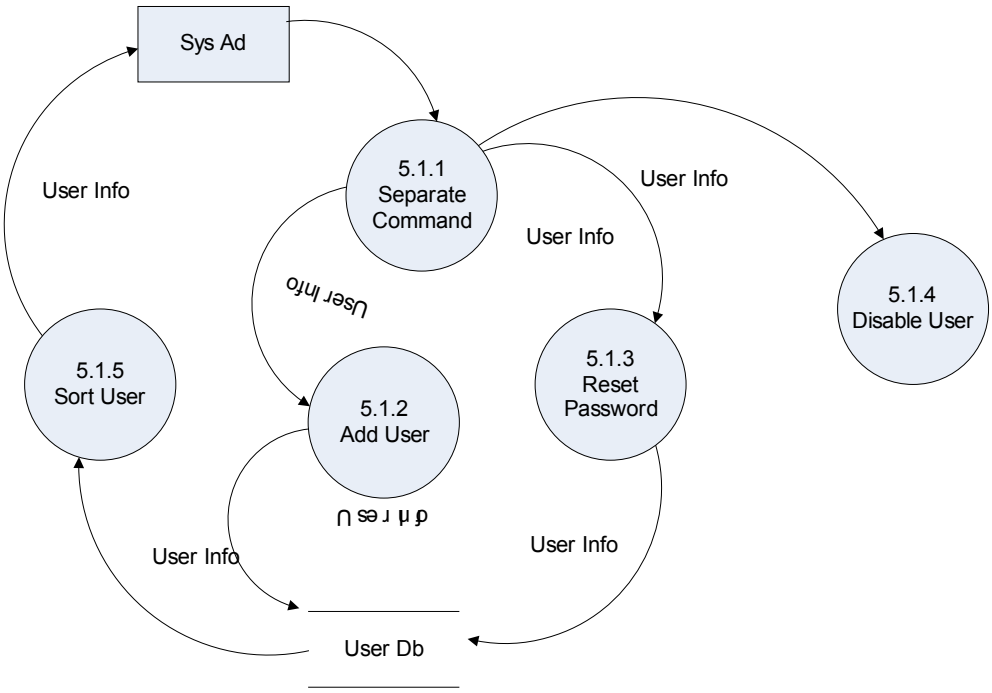

Figure 17: Sub-explosion of ‘Update User Account’, *WMIS-L2ED*

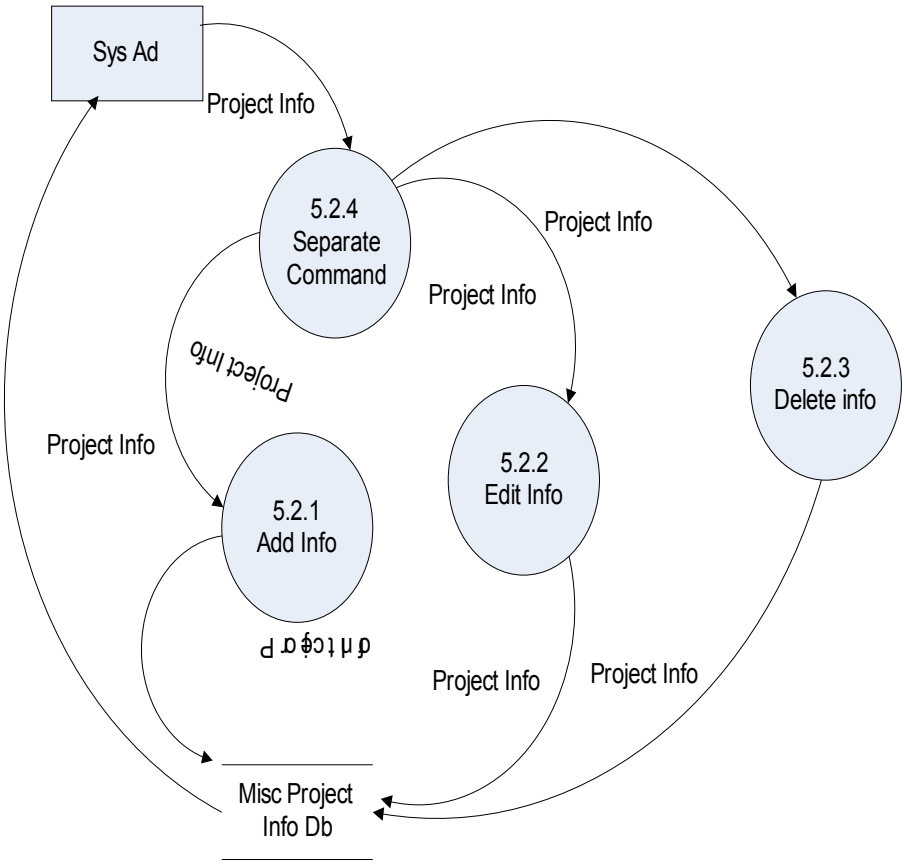

Figure 18: Sub-explosion of ‘Update Project Info File’, *WMIS-L2ED*

Definition of Terms

- Contractor - One that agrees to furnish materials or perform services at a specified price for construction work.
- Surety Bonds – insurance bond posted for the warranty of an engineering project
- Bank guarantee - A guarantee from a lending institution ensuring that the liabilities of a debtor will be met. In other words, if the debtor fails to settle a debt, the bank will cover it.
- Bidder's Bond – bond that is posted during the bidding process
- Performance Bond - bond posted during construction in case something goes wrong with the performance of the contractor.
- Retention money – money that is retained for a year as insurance
- Bonding companies - Insurance companies that sell bonds.

Technical Architecture

The system is an online system that consists of a server side computer and client side navigators. The server side needs the minimum hardware specification requirement: an Operating System, 500 MHz processor, 128 MB RAM, 1.5 GB disk space and runs the properly configured server programs Apache, PHP and MySQL. The client side can be any average computer that has a java-enabled internet browser and has an internet connection.

V. Result

As most websites, the left portion of the screen is the navigation buttons (in the case of Figures 19-24, for the monitoring engineer) and the right portion is the interface section. Figure 19 shows the part of the system that manages the contractor data. The screen is composed mainly of the list of contractors the system has, a search button and, because of the small amount and simplicity of the data, the entry for adding new data is also included. Managing payments works similarly to the contractor managing and is not displayed here.

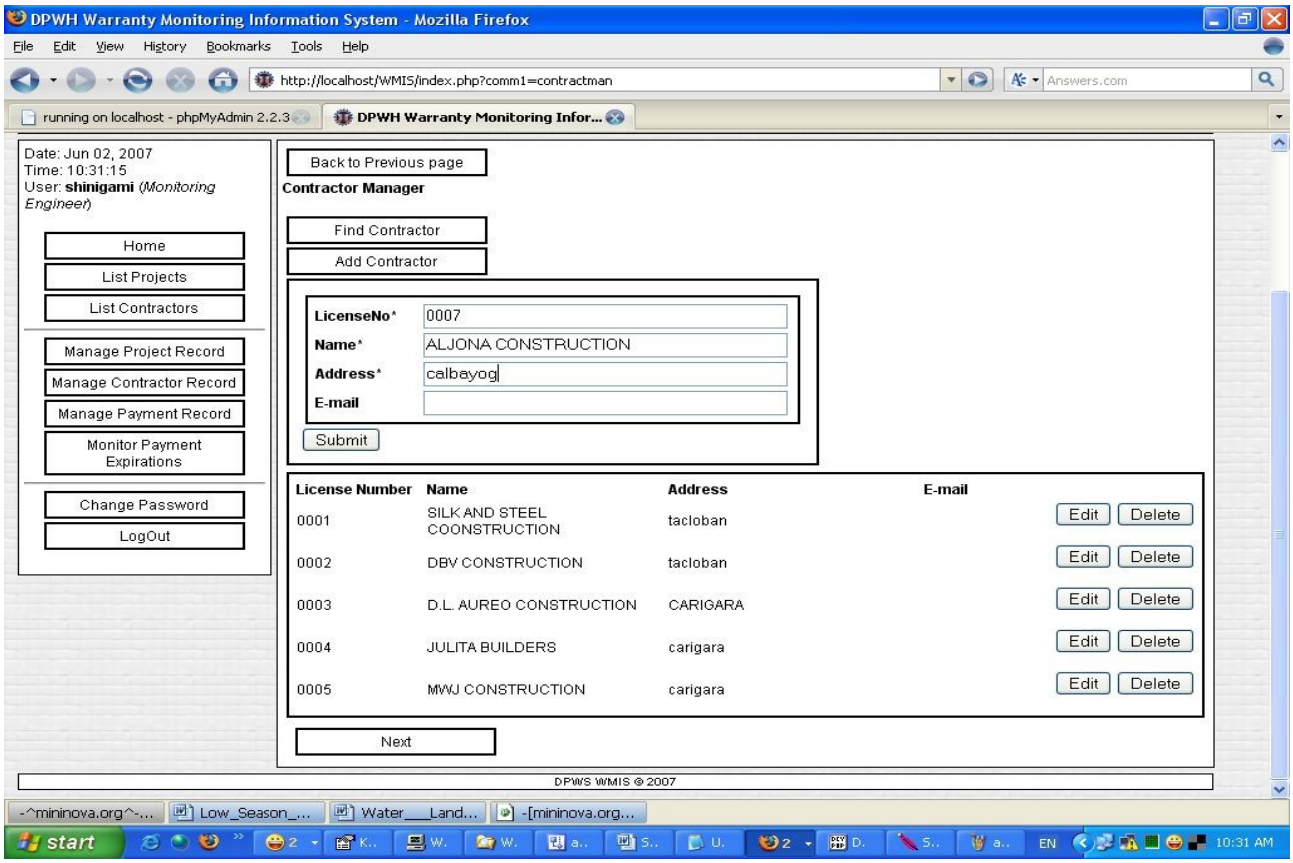

Figure 19. Contractor List/Add Contractor, *WMIS-L2ED*

Figures 20-22 show the part of the system that manages the project data. Like the previous screen, the contents of the navigation buttons are the same because the user is still the monitoring engineer. Figure 20 is the entry for adding project information to the system and, due to its complexity, is on a separate page from the page where all projects are listed (Figure 22). Also, when the user clicks on one of the projects in the list on Figure 22, the project data like Project ID, contractor name, appropriation amount, type of structure, warranty period will be displayed (as shown in Figure 21).

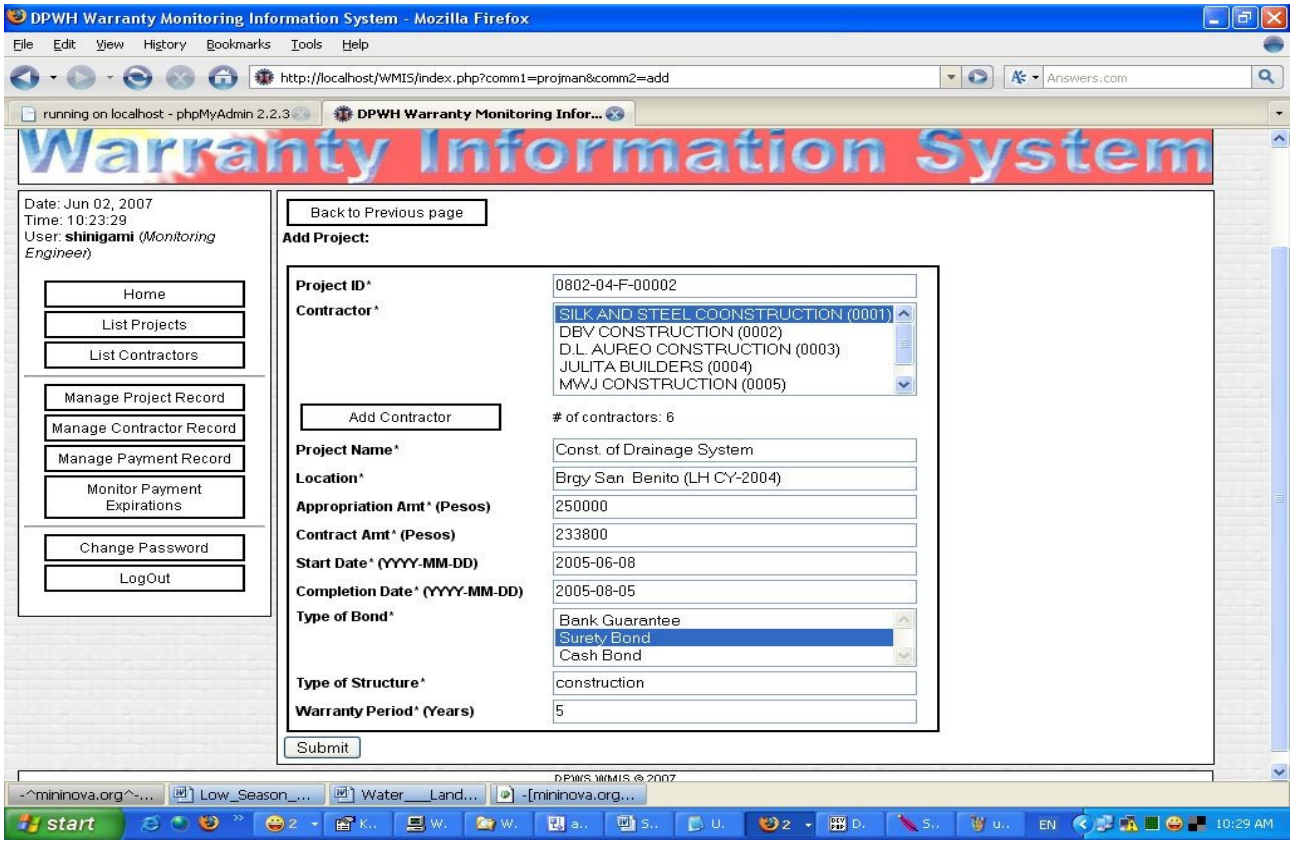

Figure 20. Add Project, *WMIS-L2ED*

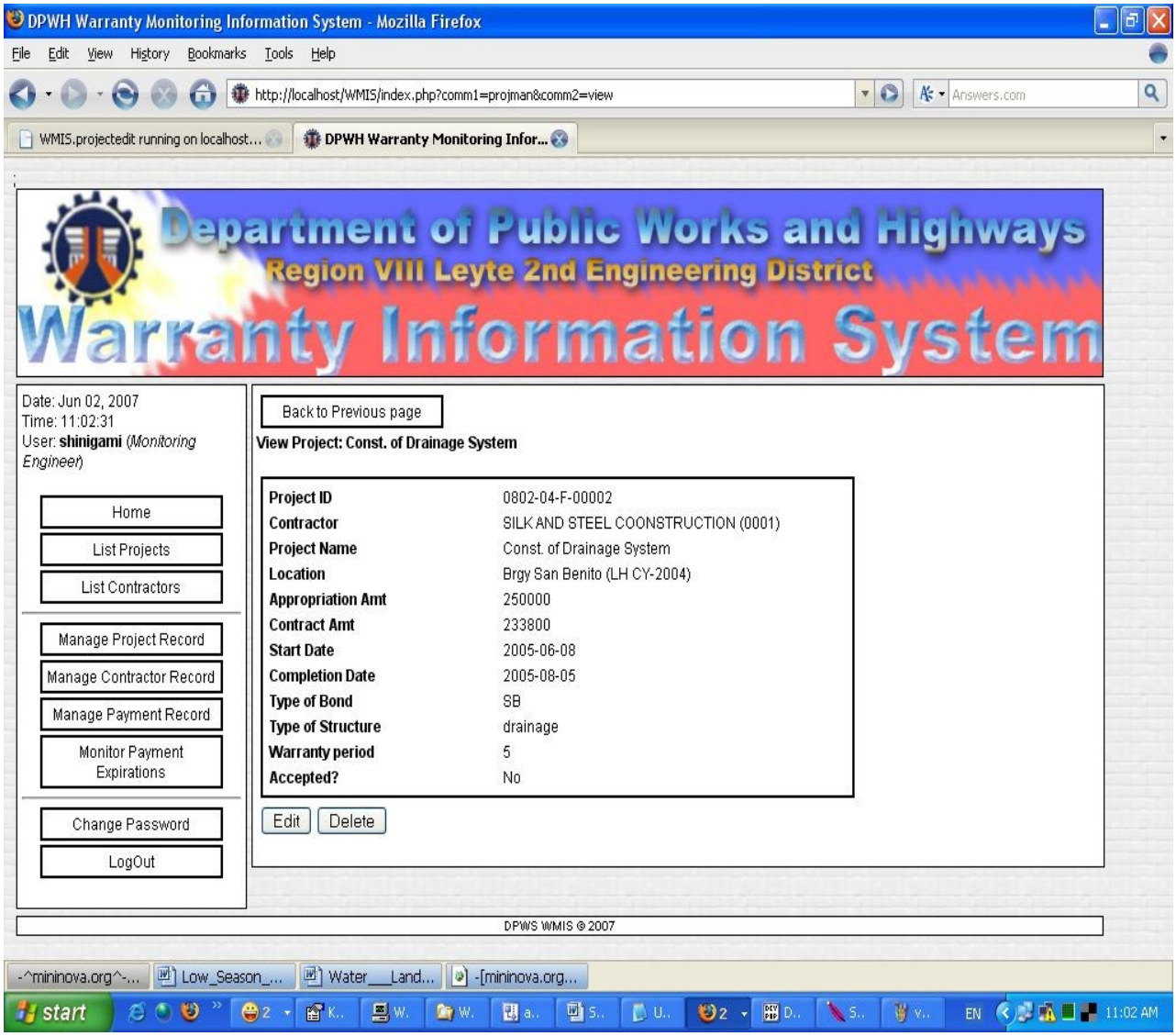

Figure 21. View Project Info, *WMIS-L2ED*

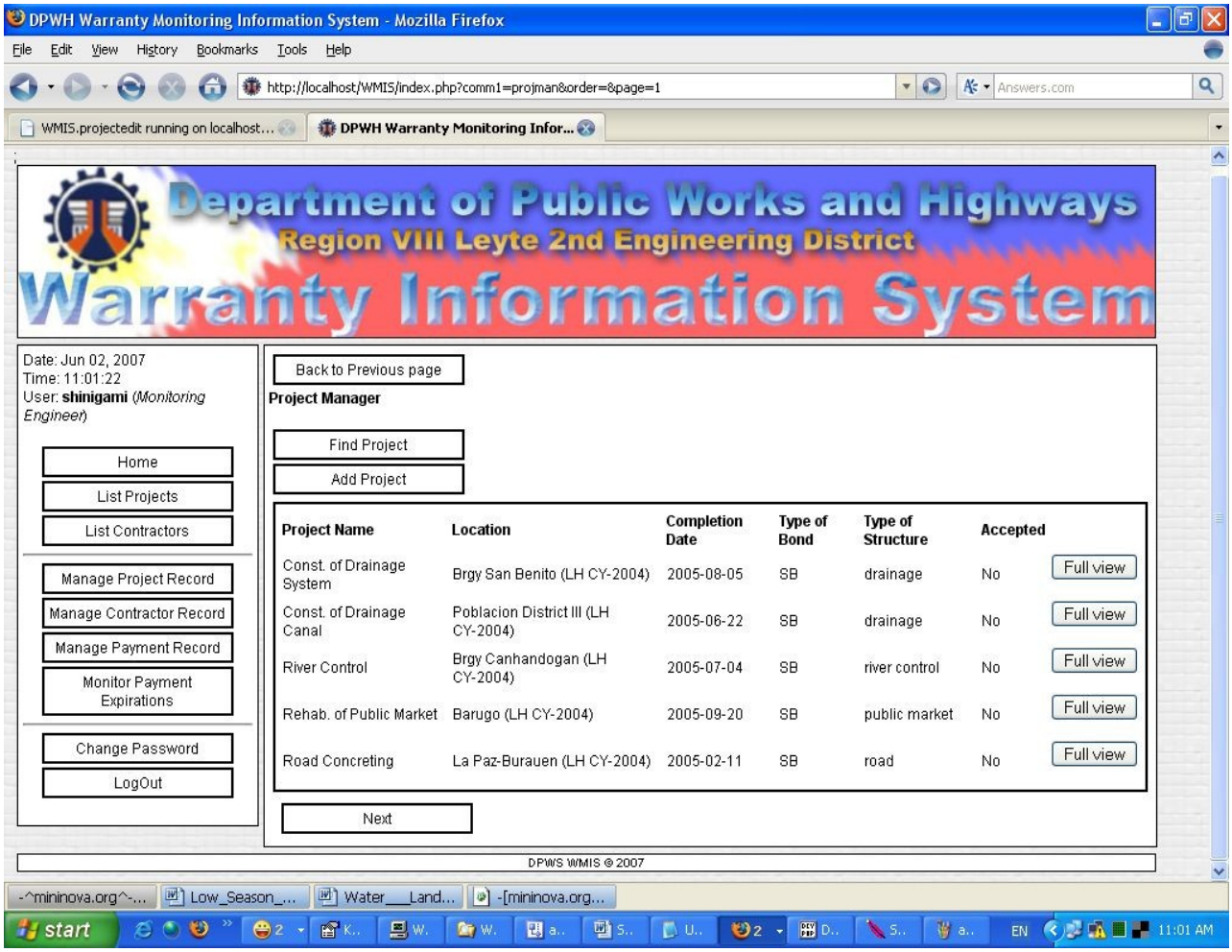

Figure 22. Project List, *WMIS-L2ED*

Figure 23 is the screen sample for editing information stored in the system. The screen has two columns, the left side shows the original data in the system to guide the user and the right side is the entry for the new data. This is the same for editing contractor and payment information.

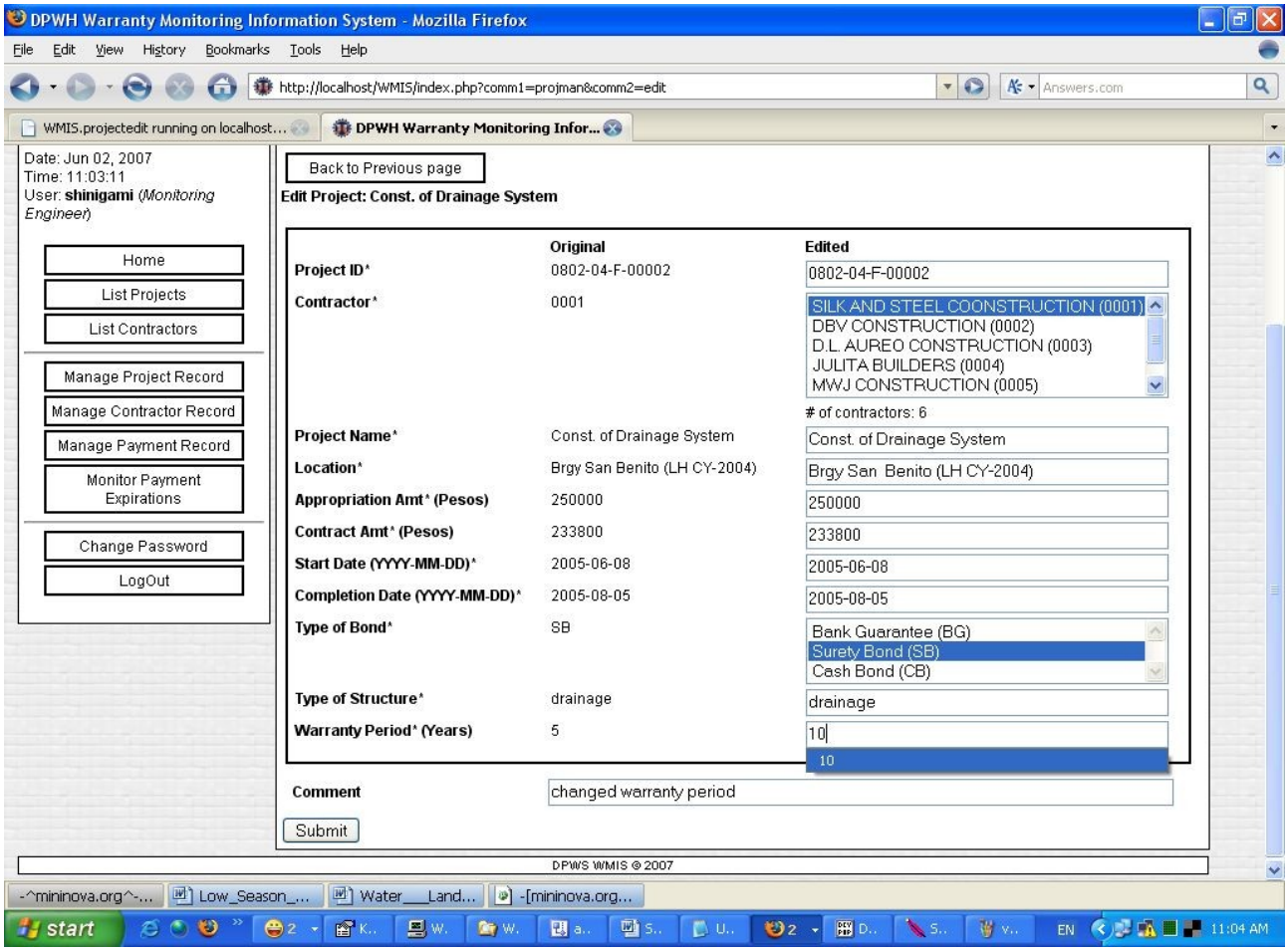

Figure 23. Edit Record, *WMIS-L2ED*

Figure 24 is the monitoring section of the system. The screen displays two things, projects that have due payment and projects whose payment will expire within a month. It also gives the user the option of creating an automatically generated letter to be printed or send an automatically generated e-mail (if available) to the contractor.

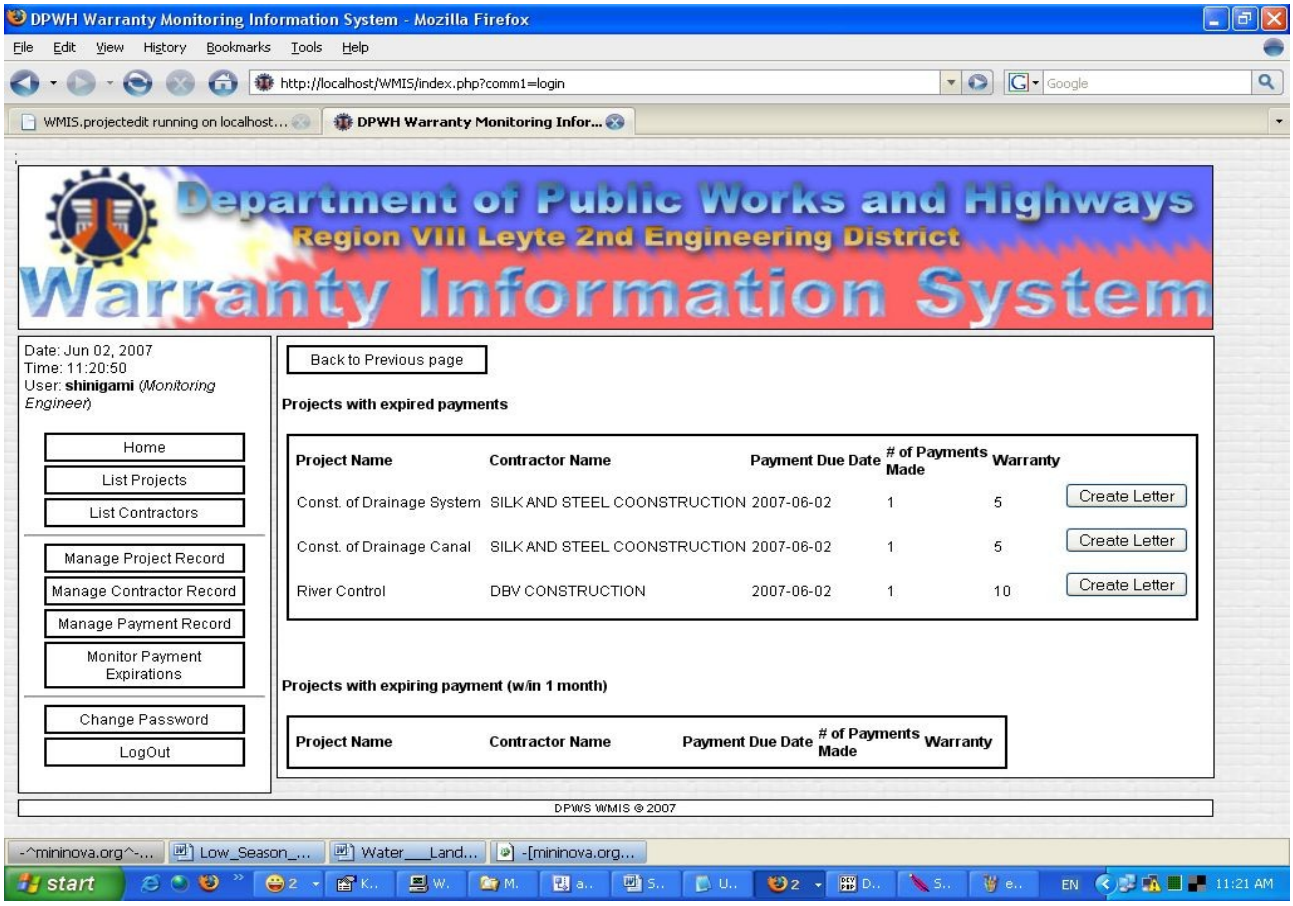

Figure 24. Payment Monitoring, *WMIS-L2ED*

Figures 25-27 are the screens taken from the Assistant District Engineers' perspective. As to be expected, the set of buttons on the navigation system is different than those of the monitoring engineers since each button corresponds to the different functions for the users. Figure 25 shows the alert to the ADE user if the system requires approval of data edits and deletions. This gives an easy and organized way to manage the approval since everything about approval is in one screen

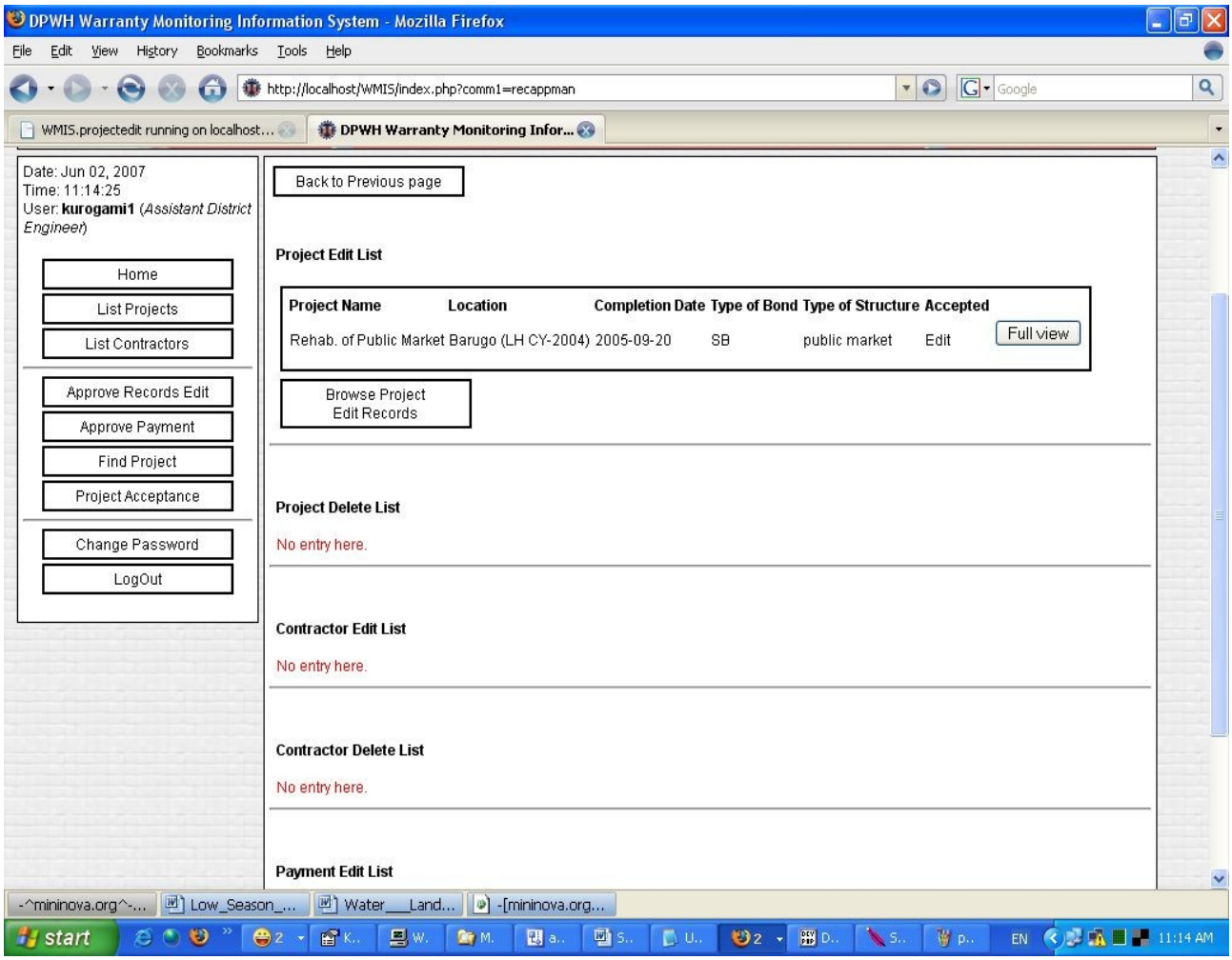

Figure 25. Edit Approval Alert, *WMIS-L2ED*

Payment approval is shown in Figure 26. The top screen shows the project data and the bottom shows its previous payment records (this is hidden by default but can be shown by clicking on Past Payments) while the central section of the screen shows the payments yet to be approved and registered.

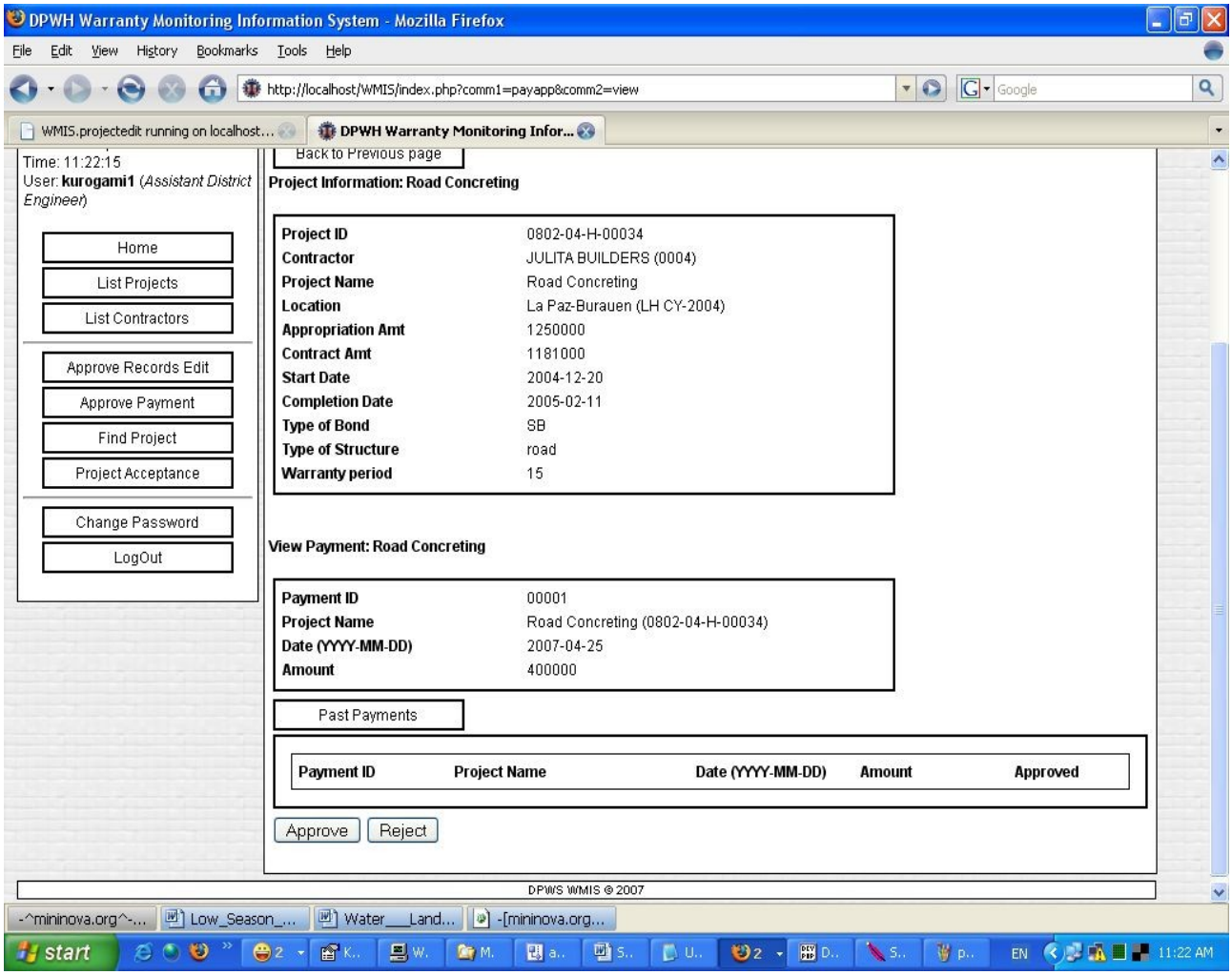

Figure 26. Payment Approval, *WMIS-L2ED*

Project acceptance is shown in Figure 27. The screen lists the projects that has been completed for at least one year and is ready for on-site inspection. If the project passes inspection, the user only needs to click button on the right side of the entry to allow them to accept the project to be monitored by the system.

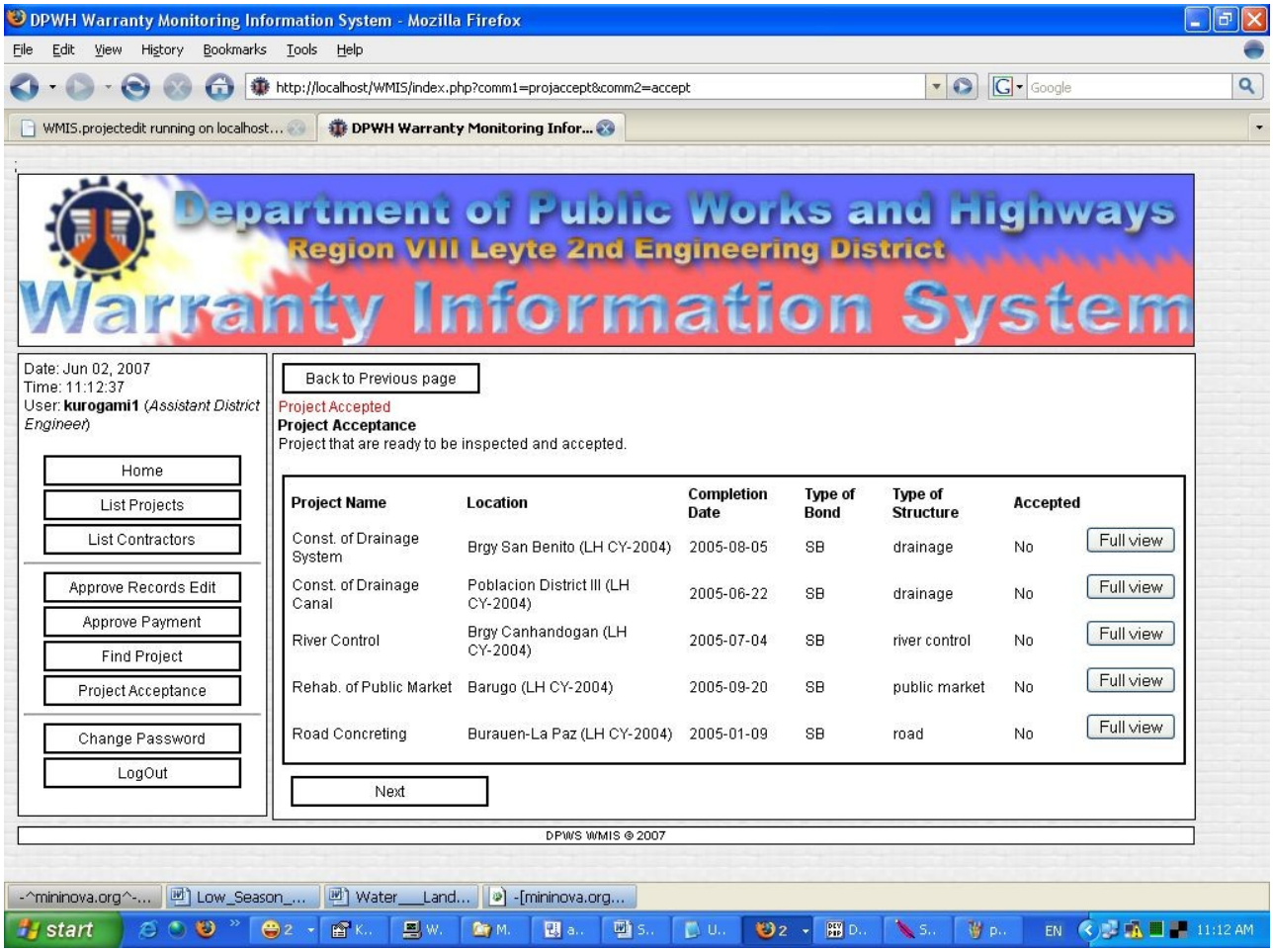

Figure 27. Project Acceptance, *WMIS-L2ED*

Figures 28-30 are the screens taken from the user type System Administrator. As stated before, the set of navigation buttons is different from the other users. Figure 28 shows the entry for editing the miscellaneous description for the projects. Its entry can be in plain text or it can also be in HTML format. The screen also shows a Photo Manager button, when the user clicks this he/she will be transferred to the photo managing section of the system.

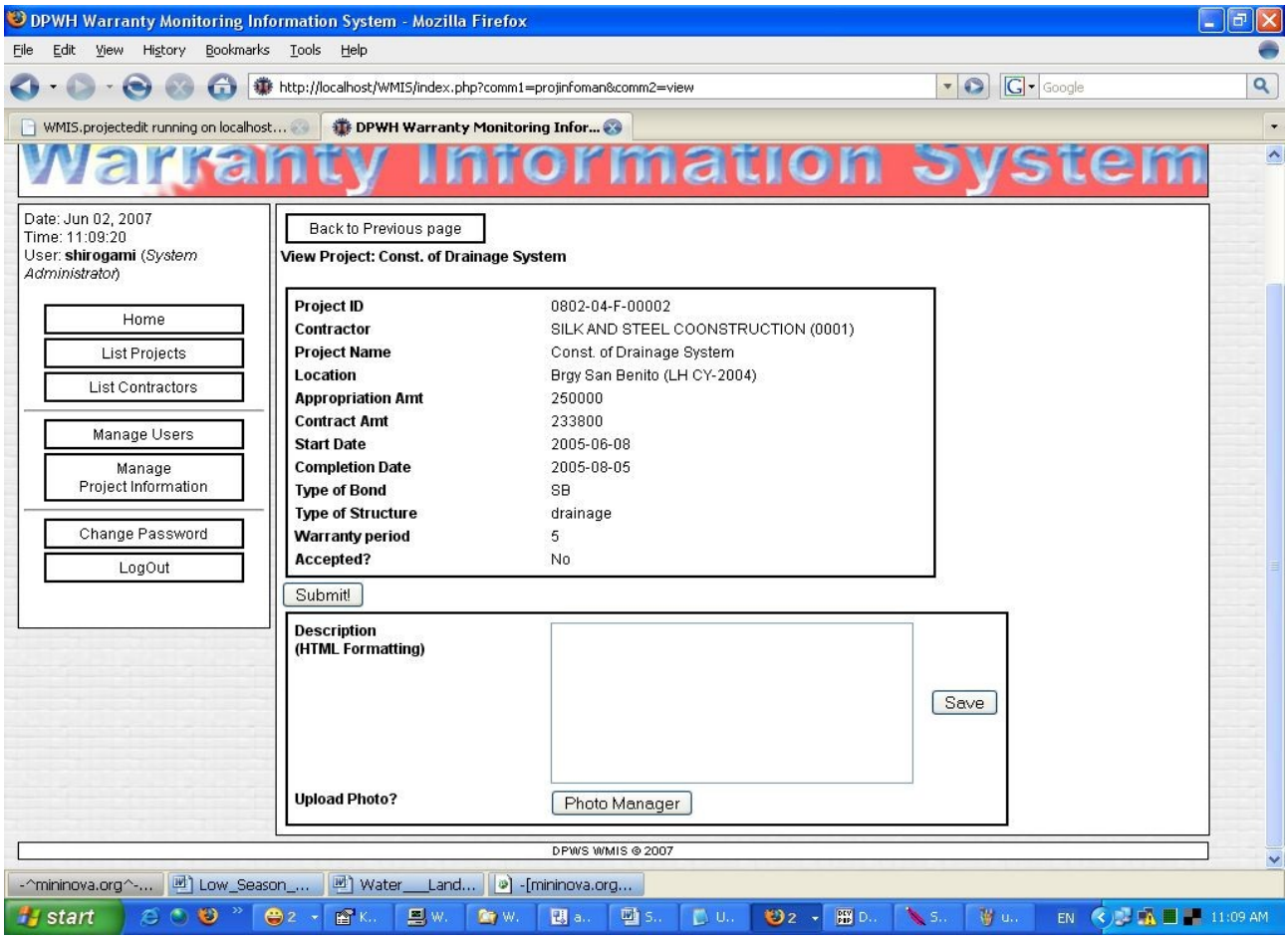

Figure 28. Edit Description, *WMIS-L2ED*

Figure 29 is the photo managing section of the system. The top portion allows the system administrator to upload and write descriptions of photos of the project while the bottom section displays the photos and its descriptions. Each photo has two buttons below them: edit caption and delete picture. The first one allows the user to change the description for the photograph and the second one erases the picture totally.

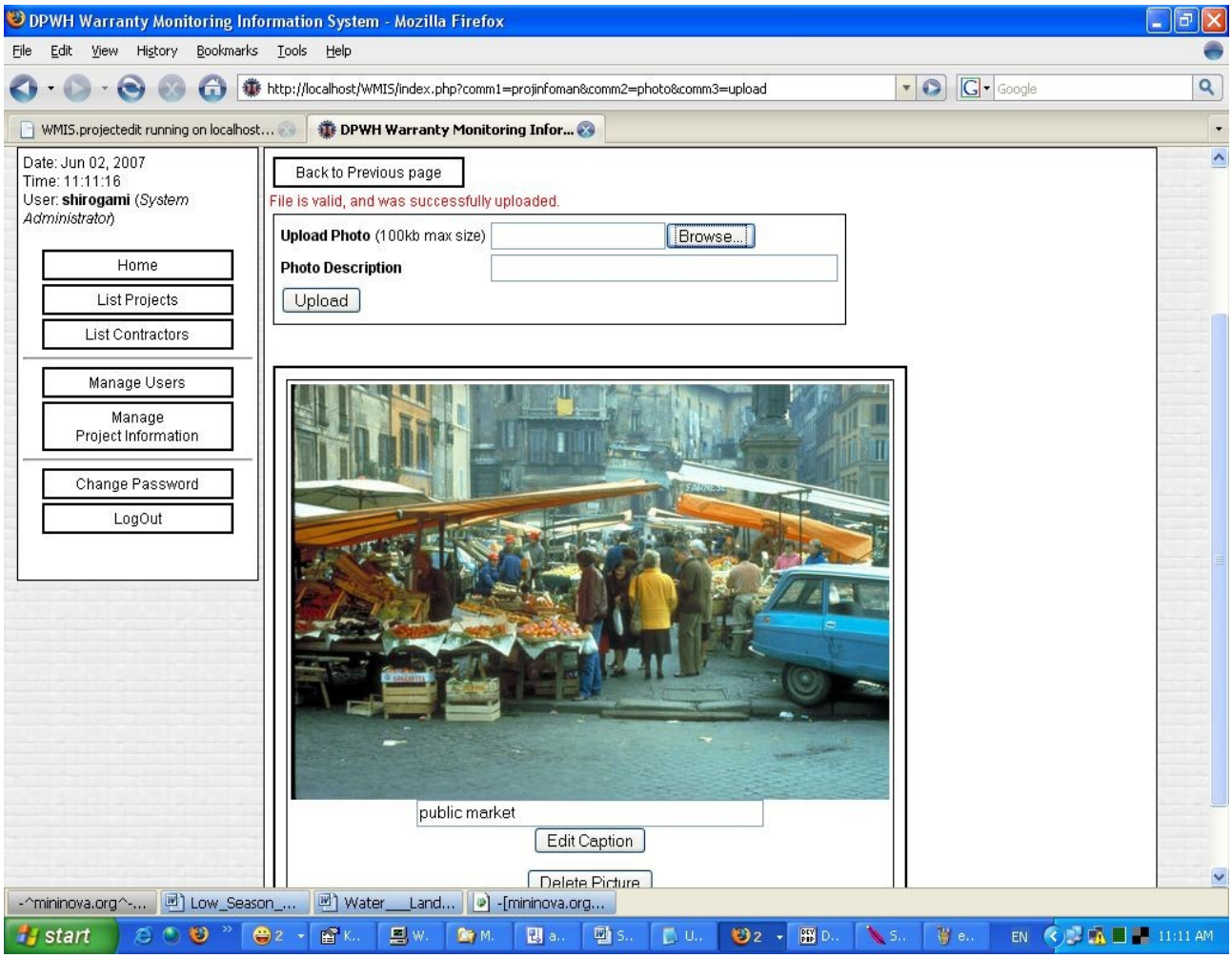

Figure 29. Photo Manager, *WMIS-L2ED*

Finally, Figure 30 is the user management section of the system. This lists the username, data associated with it (except for the password) and the options to activate/deactivate users and/or reset their passwords to be the same as their usernames. The bottom section is for adding user information. It works the same way as the adding entry for project, contractor and payment information.

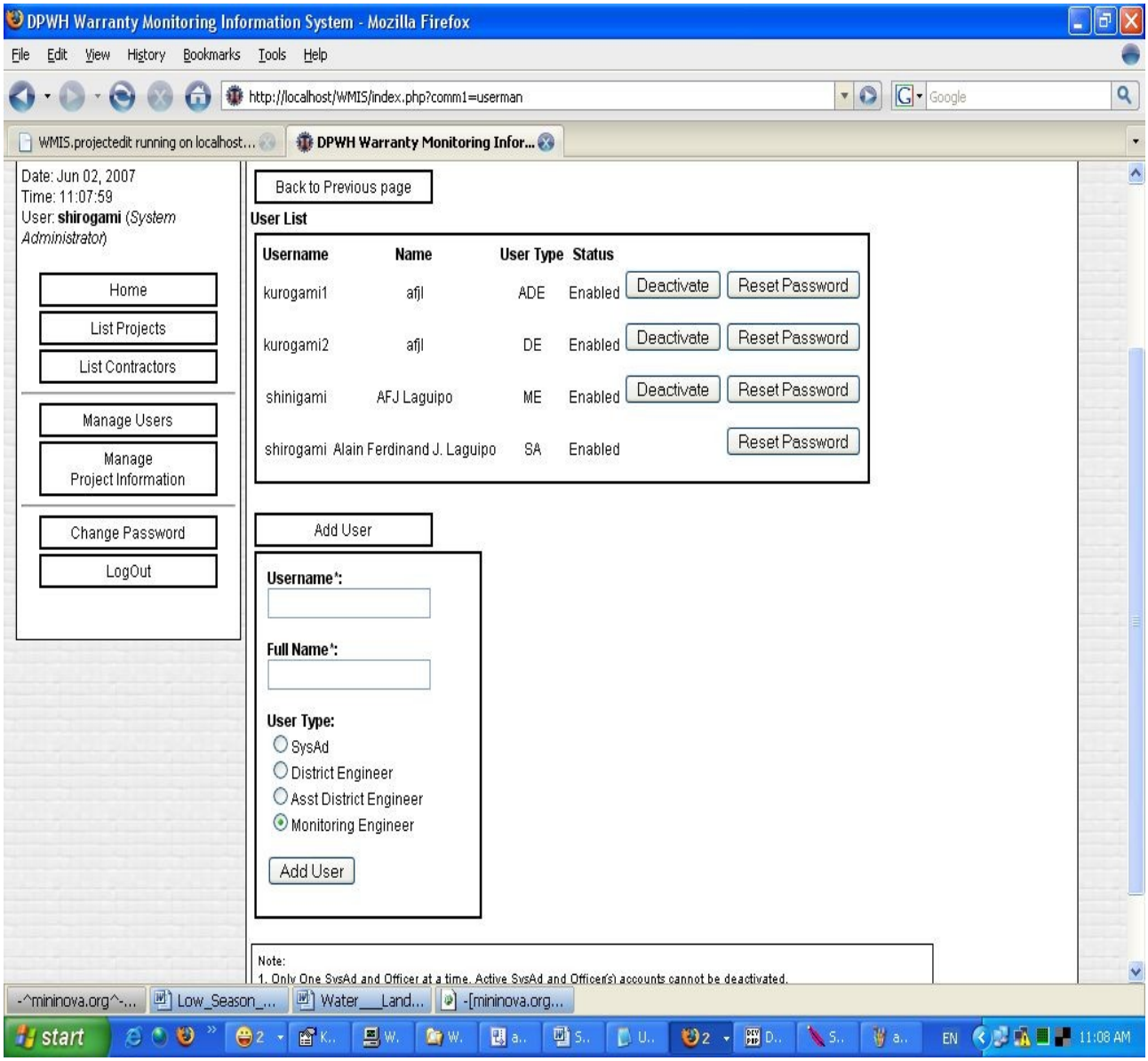

Figure 30. User Manager, *WMIS-L2ED*

VI. Discussion

The Warranty Monitoring Information System for DWPH Leyte 2nd Engineering District is mainly to make the monitoring of the project warranties for the DPWH Leyte 2nd engineering district easy and possible through the use of the now common information gateway or the internet.

The system starts as clean with only one system administrator user entry. This default system administrator then adds other types of users (ie monitoring engineer, etc) and, upon addition of users, the system can now do its functions.

The monitoring engineers can now login and, upon completion of projects, add entries for the project, contractor and payment sections. When a mistake is made on the entry, they can edit the information and, when the assistant district engineer logs I, the ADE will see the edit and has the option of approving or rejecting it. The system administrator may also add some miscellaneous information on the projects and also some photographs.

After the entry is the monitoring, the monitoring engineer checks in everyday to see if there are payments to be made for projects. When the ME sees that there is, they have the option of creating a letter or sending an e-mail (or both) to the contractors to remind them of the payments.

This will cycle through many years (and many times per year) since warranties span for many years, projects may be completed every month and monitoring is done daily.

Using the system allows the department easy monitoring of projects which

was not even possible before. Its availability on the net allows outsiders (especially researchers) to easily access public data. This transparency and its structure that minimizes the chance of tampering data protect the integrity of the warranty monitoring procedure.

The system is only a prototype so only the basic functions are included and there is much room for improvement and possible integration on other DPWH systems. Being able to handle the payments using a barcode scanner or some other method will greatly increase the usage of the system. Also, having a map to easily track down projects will help inspectors and researchers alike.

VII. Conclusion

The Warranty Monitoring Information System for DWPH Leyte 2nd Engineering District is an information system designed to do the impossible work of monitoring annual payments for the warranties of the projects done for DPWH. The system was successfully able to easily monitor payments in what would have taken many hours in just a few clicks of the mouse. It also has the feature of allowing outsiders to easily view project information which are otherwise previously almost inaccessible to the public.

VIII. Recommendation

The DPWH Leyte 2nd engineering district's Warranty Monitoring Information System only focuses on the basic monitoring of the warranties of the projects. It may be improved by using the barcode scanners to scan official receipts for payments instead of input through keyboard. Implementing barcode scanning will allow easy verification of payments done. Another improvement is adding a map to allow the users to find where each project is. The last and most important improvement to the system is to implement it across all districts of the DPWH and integrating it to the other systems used by the department. This will allow the other districts to monitor their warranties thus saving the government money for repair and the people from headaches.

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It has been almost seven years since I entered this excellent university and with this document I hope to finally end my stay. I am grateful to all the teachers who have taught me but I am most grateful to the most helpful teachers I have had — Dr. Peter Magboo, our class adviser, and Ms. Avegail Carpio, my SP adviser. Despite my indiscretions, they still helped me with my long overdue SP. I am eternally indebted to their kindness and their actions have made a great impression on my heart.

But above all, I would like to thank my mother, Engr Ma. Margarita J. Laguipo, for giving me the topic to tackle for this SP and for supporting me even though college took me more years to complete than it is normally done.

APPENDIX

DPWH-INFR-15-062106

Certificate of Acceptance

Acceptance Report

Final Inspection Report

DPWH-INFR-13-062106

DPWH-INFR-14-062106

Status of Projects For CY 2004 (Separated by source of fund)

Source Code