Chapter 3

Technologies used to implement the system

3.1 Introduction

Free Open source software (FOSS) products and technologies have been mainly used to implement the system. Following technologies have been mainly used to develop the system.

- Programming language – JAVA
- JSMSEngine software – This software is used to send SMS.
- AJAX and JSP technologies are used to develop the web interfaces.
- Jasper reporting tool used to implement reports
- MYSQL used as the database management system
- Designing tools - Rational rose and MS Visio

Below sections gives the small description about the technologies used to implements the system and reasons to select those technologies.

3.1.1 JAVA language

Java, the language, is a high-level object-oriented programming language. Its syntax was designed to be familiar to those familiar with C- language, but with stronger OO principles than those found in C++, static typing of objects, and a fairly rigid system of exceptions that require every method in the call stack to either handle exceptions or declare their ability to throw them. Garbage collection is assumed, sparing the developer from having to free memory used by obsolete objects.

Java is generally thought of in terms of three platforms: Standard Edition (SE), Enterprise Edition (EE), and Micro Edition (ME). Each describes the combination of a language version, a set of standard libraries, and a virtual machine to execute the code. EE is a superset of SE--any EE application can assume the existence of all of the SE libraries and EE's use of the language is identical to SE's [10].

Figure 3.1 describe how java language doing compilation and interpretation [11].

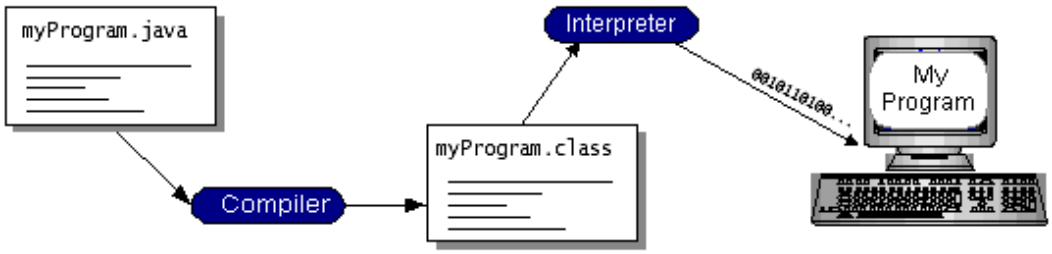

Figure 3.1 java compilation and interpretation.

- But Java is also a powerful ***platform*** that
  - includes a complete set of APIs for distributed applications
  - allows programs to run anywhere on the network
  - runs on top of existing platforms ("Write Once Run Anywhere")

3.1.2 Reasons to choose Java language

According to above description Java is suitable for implement multi tire architectural systems. First reason is to select this language, Author has familiar with java more than other languages. Most of the third parties APIs are compatible with java and especially open source APIs written in java language. In this project has to use third party API to send SMSs and report generation. So it was easy to find java open source API to implement that part. Java socket API is properly implemented for network programming like TCP/IP socket programming. Java EE used to developed web tire using JSP and AJAX. Sun java application server and Apache tomcat web server both totally compatible with the Java EE and these web servers freely available.

3.1.3 JSMSEngine Software

jSMSEngine is an API package which will allow you to send and receive SMS messages from computer and mobile phone or GSM modem. This is open source API and implemented using Java language.

jSMSEngine API communicates with your GSM device (mobile or modem) through the serial port. Its main features are:

- Support for ASCII / HEX mode for sending / receiving messages.
- Support for PDU mode for sending / receiving messages, for greater compatibility with mobile phones.
- When working in PDU mode, you can select 7 Bit, 8 Bit or UNICODE message encoding. Multi language support is available when you switch to UNICODE.
- Phonebook.
- Device information: Manufacturer indication, model, SW version, etc.
- Signal and Battery indication.
- Statistics for incoming / outgoing messages.

PDU mode is used send and receives SMSs. To work with the API, should configure Java communication API.

3.1.4 Reasons to choose JSMSEngine API.

Earlier it has decided to use SMPP API to send SMS. SMPP also an open source API and could be used to send SMS. It can be directly connected to the SMSC of mobile provider and possible to send SMS. Although it is technically possible it's required to get permission to connect mobile provider's SMSC to send SMS.

Therefore there was a need to find a way to send SMS without a direct involvement of the SMSC and the mobile company. Therefore this open source API has been used to send SMS.

3.1.5 JSP

JavaServer Pages (JSP) technology provides a simplified, fast way to create dynamic web content. JSP technology enables rapid development of web-based applications that are server and platform independent.

Easily write and maintain pages: The Java Server Pages Standard Tag Library (JSTL) expression language is now integrated into JSP technology and has been upgraded to support functions. The expression language can now be used instead of scriptlet expressions [14].

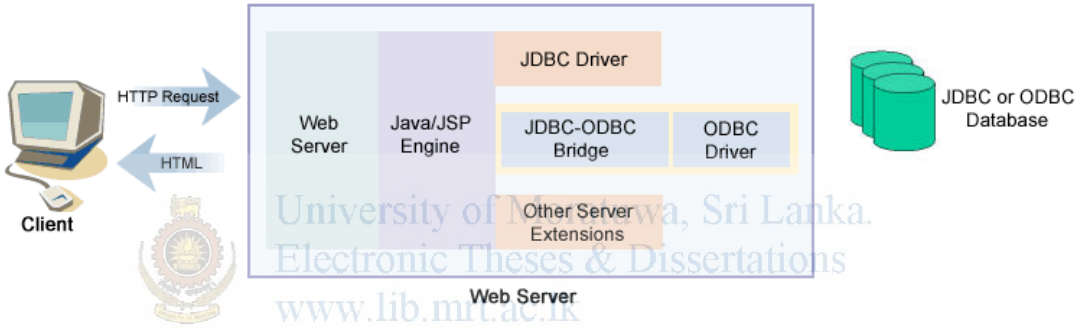

Figure 3.2- Examples for 3-tier architecture

Java Server Pages technology is an extension of the Java Servlet technology. Servlets are platform-independent, server-side modules that fit seamlessly into a Web server framework and can be used to extend the capabilities of a Web server with minimal overhead, maintenance, and support.

3.1.6 AJAX

Meaning of the word AJAX is Asynchronous JavaScript and XML.

AJAX is not a new programming language, but a technique for creating better, faster, and more interactive web applications. With AJAX, your JavaScript can communicate directly with the server, using the JavaScript **XMLHttpRequest** object. With this object, your JavaScript can trade data with a web server, without reloading the page. AJAX uses

asynchronous data transfer (HTTP requests) between the browser and the web server, allowing web pages to request small bits of information from the server instead of whole pages. The AJAX technique makes Internet applications smaller, faster and more user-friendly.AJAX is a browser technology independent of web server software.

AJAX is based on the following web standards:

- JavaScript
- XML
- HTML
- CSS

The web standards used in AJAX are well defined, and supported by all major browsers. AJAX applications are browser and platform independent [17].

3.1.7 Reasons to choose AJAX

It is decided to use AJAX with JSP, AJAX is a new technology and it is comparatively faster than a normal web application. It is essential to be a fast web application, because in cashless purchasing module retailer login to the system and has to initiate the transaction. In the Peer to peer money transfer sub system, there is a module to check the customer and issue money. This part should be fast because customer is hurry to get money.

Other expectation about this technology was to get the hand on experience of using it. Using AJAX technology it is possible to create user friendly interfaces without hesitate the user to go through so many pages.

3.1.8 Jasper

Jasper Reports is a powerful report-generating tool that has the ability to deliver rich content onto the screen, to the printer or into PDF, HTML, XLS, CSV, and XML files. Jasper Reports is entirely written in Java and can be used in a variety of Java enabled applications, including J2EE or Web applications, to generate dynamic content. First of all using ireport tool creates the structure of the report. That is a Jxml file. So this file can be directly called inside the java application. Using irepot tool directly can be created database connectivity and be able to create nice interfaces. Jasper report can be given any of the formats like MS-Excel, PDF, html, xml etc. Figure 3.3 describes the how does jasper tool works.

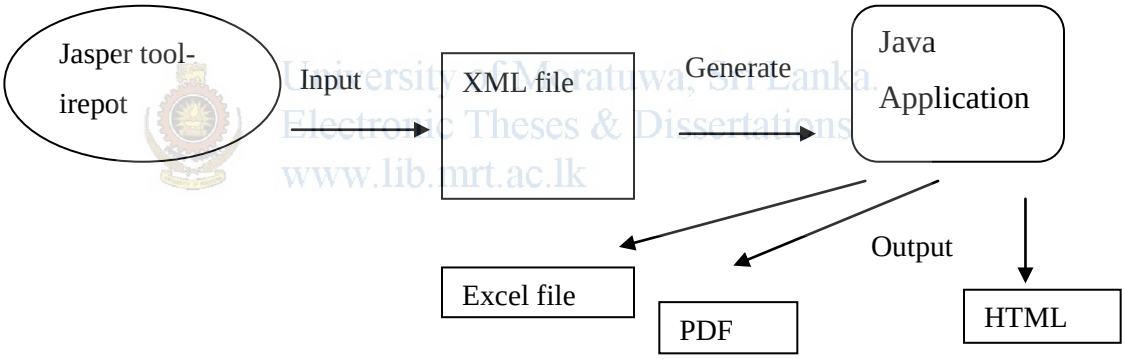

Figure 3.3 – Jasper reporting structure

Main reason of using this tool is to developed report very quickly. Also this tool is easy to use. Structure of the report can be created easily. Also other reason to choose Jasper, it is a new technology to learn.

3.1.9 MYSQL

Open source database software. **MySQL** is a relational database management system (RDBMS). The program runs as a server providing multi-user access to a number of databases.

MySQL is written in C and C++. MySQL works on many different system platforms, including AIX, BSDi, FreeBSD, HP-UX, i5/OS, Linux, Mac OS X, NetBSD, Novell NetWare, OpenBSD, eComStation , OS/2 Warp, QNX, IRIX, Solaris, Symbian, SunOS, SCO OpenServer, SCO UnixWare, Sanos, Tru64, Windows 95, Windows 98, Windows ME, Windows NT, Windows 2000, Windows XP, and Windows Vista.

In addition, an ODBC interface called MyODBC allows additional programming languages that support the ODBC interface to communicate with a MySQL database, such as ASP or ColdFusion.

To administer MySQL databases one can use the included command-line tool (commands: mysql and mysqladmin). Also downloadable from the MySQL site are GUI administration tools: *MySQL* Administrator and *MySQL* Query Browser. Both of the GUI tools are now included in one package called tools/5.0.html MySQL GUI Tools.

The MYSQL Enterprise Server is released once per month and the sources can be obtained either from MYSQL's customer-only Enterprise site or from MYSQL's Bazaar repository, both under the GPL license. The MYSQL Community Server is published on an unspecified schedule under the GPL and contains all bug fixes that were shipped with the last MYSQL Enterprise Server release. Binaries are no longer provided by MYSQL for every release of the Community Server.

Replication support (Eg: - Master-Master Replication)
Using JDBC driver mysql-connector-java-5.0.4-bin can be connected to the database.

3.1.10 Reasons to choose MYSQL

It was planning to use mysql database and it is open source software and also it is platform independent. If application is installed in the different platform like LINUX or UNIX no need to change the database [20].

3.1.11 Log4J

Apache **log4j** is a Java-based logging utility. It was originally written by Ceki Gülcü and is now a project of the Apache Software Foundation. It is used primarily as a debugging tool. **log4j** is one of several Java Logging Frameworks.
Log4j offers six standard logging levels. Also, custom logging levels can be added from highest to lowest.

FATAL	Severe errors that cause premature termination. Expect these to be immediately visible on a status console.
ERROR	Other runtime errors or unexpected conditions. Expect these to be immediately visible on a status console.
WARN	Use of deprecated APIs, poor use of API, 'almost' errors, other runtime situations that are undesirable or unexpected, but not necessarily "wrong". Expect these to be immediately visible on a status console.
INFO	Interesting runtime events (startup/shutdown). Expect these to be immediately visible on a console, so be conservative and keep to a minimum.
DEBUG	Detailed information on the flow through the system. Expect these to be written to logs only.
TRACE	More detailed information. Expect these to be written to logs only.

Table 3.1 – log4j logging levels.

There are two ways to configure log4j. One is with a properties file and the other is with an XML file. Within either you can define 3 main components: Loggers, Appenders and Layouts. Configuring logging via a file has the advantage of turning logging on or off without modifying the application that uses log4j. [21].

3.1.12 Types of log appender

An appender specifies where your log messages are written to. There is a wide choice of appenders available. All appenders are direct or indirect subclasses of the AppenderSkeleton.
Therefore we can find all options on the following API page:

- http://logging.apache.org/log4j/docs/api/org/apache/log4j/AppenderSkeleton.html

The console and the file appender are a subclass of WriterAppender.

Examples for other appenders

- ConsoleAppender Logs to console
- FileAppender Logs to a file
- SMTPAppender Logs by email

RollingFileAppender Logs to a file starts a new file once the max size is reached. (An alternative is the DailyRollingFileAppender which creates on file [22].

3.1.13 Rational Rose

Rational Rose is an object-oriented Unified Modeling Language (UML) software design tool intended for visual modeling and component construction of enterprise-level software applications. In much the same way a theatrical director blocks out a play, a software designer uses Rational Rose to visually create (model) the framework for an application by blocking out classes with actors (stick figures), use case elements (ovals), objects (rectangles) and messages/relationships (arrows) in a sequence diagram using drag-and-drop symbols. Rational Rose documents the diagram as it is being constructed and then generates code in the designer's choice of C++, Visual Basic, Java, Oracle8, CORBA or Data Definition Language.

Two popular features of Rational Rose are its ability to provide iterative development and round-trip engineering. Rational Rose allows designers to take advantage of iterative development (sometimes called evolutionary development) because the new application can be created in stages with the output of one iteration becoming the input to the next. (Rational Rose is extensible, with downloadable add-ins and third-party partner applications. It supports COM/DCOM (ActiveX), JavaBeans, and Corba component standards [23].

3.1.14 UML

Unified Modeling Language (UML) is a standardized general-purpose modeling language in the field of software engineering. UML includes a set of graphical notation techniques to crate abstract models of specific systems, referred to as UML model.
The Unified Modeling Language (UML) is developed as a graphical language for visualizing, specifying, constructing, and documenting the artifacts of a software intensive system. The UML offers a standard way to write a system's blueprints, including conceptual things such as business processes and system functions as well as concrete things such as programming language statements, database schemas, and reusable software components.

UML is officially defined by the Object Management Group (OMG) as the UML meta model, a Meta-Object Facility meta model (MOF). Like other MOF-based specifications, UML has allowed software developers to concentrate more on design and architecture This source is from the [24].

3.1.15 Summary

This chapter describes the technologies used to implement the system and also reasons to choose these technologies. It contains a brief introduction to the various technologies and advantages and disadvantages of some technologies.

In the next chapter it has been described about the author's approach to implement the system.