

Aspects of Integrating Knowledge Discovery in a Computerized Information System

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ABSTRACT

The aim of this project is building a knowledge base system by extracting the knowledge from technical expertise in a completely manual process. Many sectors have tried to computerize the job management systems in Ceylon Electricity Board. But most of the systems come up with more data entries and need more expertise to access it. In these cases the newly developed systems are similar to manual system and difficult to understand. Therefore the work load of expertise remains unchanged even the computerized system is present.

This project was mainly aimed to computerize a job management system for Ceylon Electricity Board while building a well organized database with the knowledge extracted from relevant expertise to a completely manual system. In the selected section of Ceylon Electricity Board performs both field and office works, for their complete job task and for this works, well experienced workers are needed. The newly developed job management system has overcome each and every drawbacks of manual system.

KEYWORDS: Ceylon Electricity Board, Job Management System

INTRODUCTION

The Ceylon Electricity Board (C.E.B) is a statutory body established in 1969 to take over the businesses carried out by the Department of Government Electrical Undertakings. Until recently C.E.B. was the sole authority for generation and sale of Electricity. At present C.E.B's main functions are generation, transmission and distribution of electricity in Sri Lanka.

C.E.B North Western Province (NWP) is one Strategic Business Unit in the C.E.B. It has to buy Electricity from the Transmission division. Transmission division supplies electricity to the Medium Voltage Network of the NWP at five grid substations in the province.

For this purpose, it is important to maintain the existing network, developing and expanding the present network and connecting new consumers.

Distribution Maintenance Branch maintains the medium voltage network in NWP. There are various sophisticated equipment like autorecloser, circuit breakers, high voltage capacitor banks, boundary meters and load breakers.

In addition to the actual maintenance work carried out in the field, the Distribution Maintenance branch of C.E.B has to handle set of calculations and documentary works at the office by field expertise. The identified manual work flow in the Distribution Maintenance branch in C.E.B (NWP) is shown in figure 1 and the respective responsible bodies are described in figure 2. Electrical superintendents (ESS) and Electrical Engineers (EEE) have to perform these calculations taking some technical decisions. They have to take decisions to allocate materials, labour and some machinery works which are different from task to task. And also they have to prepare estimates, letters and reports. For this task, one has to work out about five

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working days and have to allocate typists and clerks for documentary works. And also ESS has to check about the decisions of ESS and the estimates. As it is a fully manual process, drawbacks can be found and these drawbacks have been identified as follows.

- Less accurate and difficult to deal with the amount of routine clerical works and calculations. It is more time consuming.
- There is a possibility of arising errors with manual records due to the referring of wrong predefined records (price lists, labour norms & rates)
- It is difficult to ESS to refer books and reports when preparing Estimate.
- No method had been used yet to search previous records of completed maintenance jobs
- Normally they used to give a hand written line schedule to the persons who were assigned the job as a guideline. If hand written schedule is not clear, they have to contact ESS more times
- The statistical records provided by the manual system may be distorted from the actual reports and there is no convenient way of generating reports quickly because it is difficult to handle with a large number of manual records.
- It is difficult to obtain a status report of a job (whether it is estimated, approved, not awarded, in progress, completed or handed over)
- Wasting a large number of papers for letter drafting and rough works for calculations.
- Letters and formats were created with errors
And time consuming

The computerized system designed and implemented to fulfill all these calculations and the documentary work in efficient and accurate manner. The new system has strong database that consists of

knowledge which were extracted from relevant workers to provide a valuable guidance to user and reduce their decision making and calculation tasks. And also the system is completely eliminate the manual documentary and reporting works by integrating letters and report generating system.

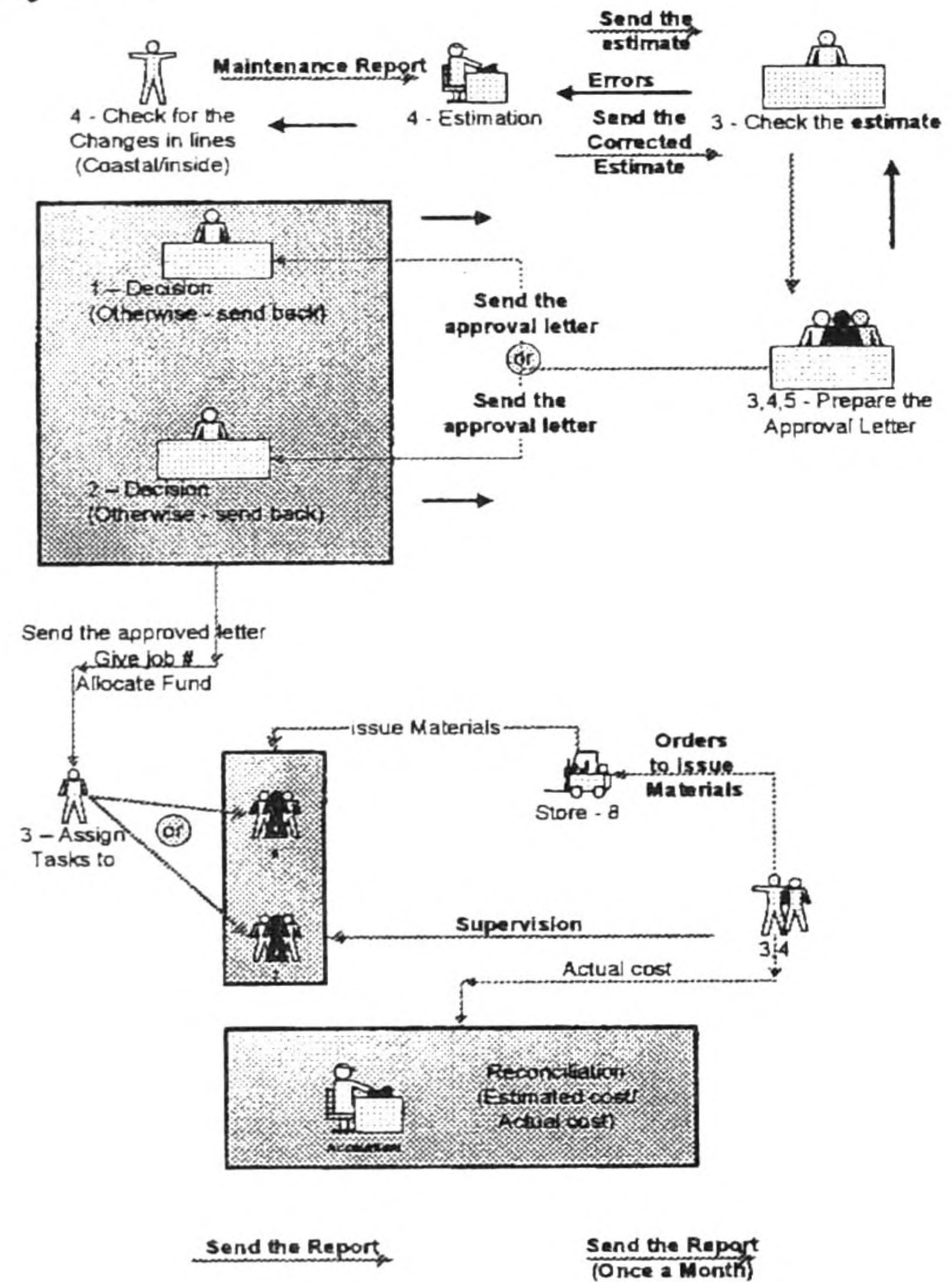


Figure 1. Manual Process of selected

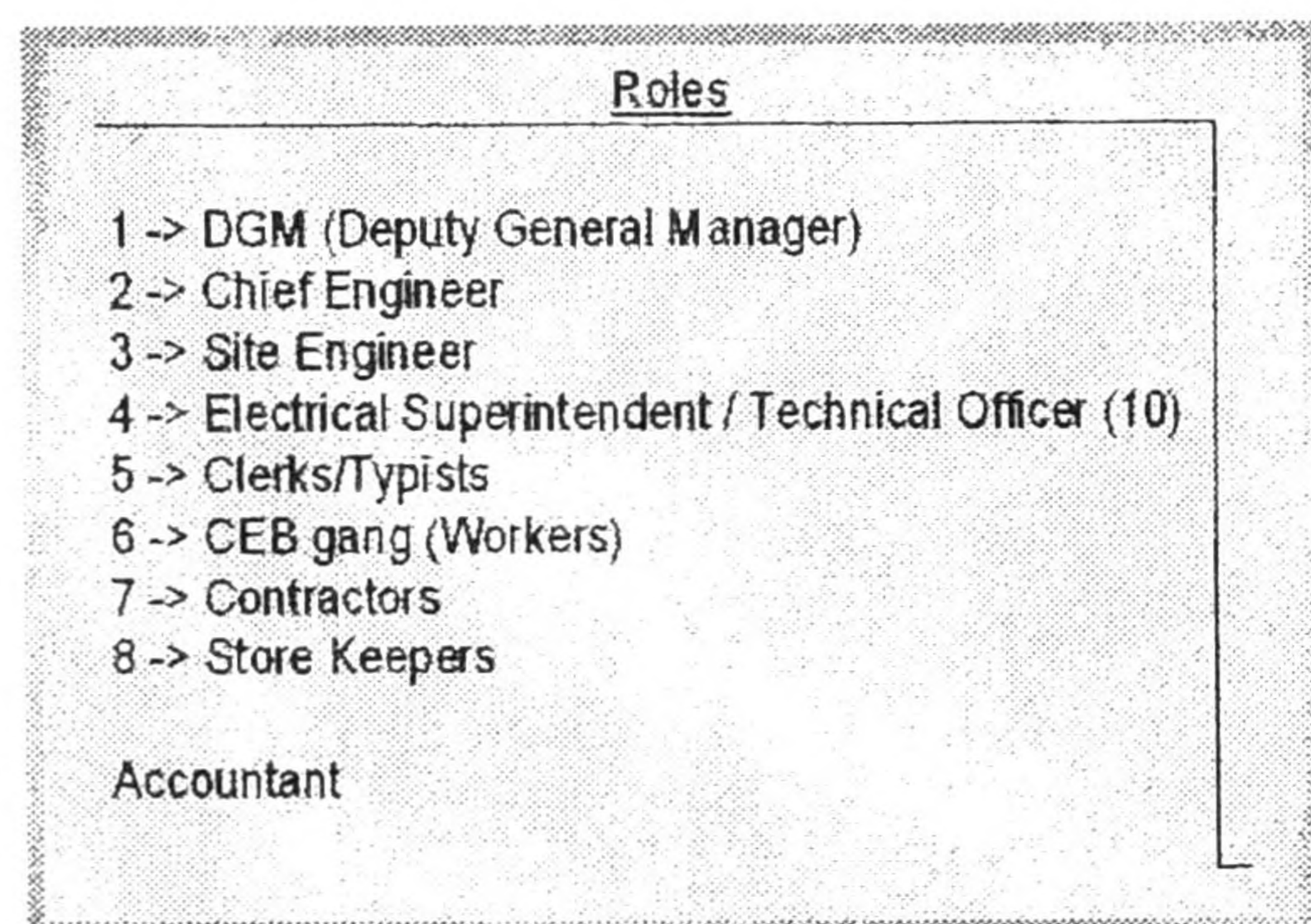


Figure 2. Roles on the system branch

DATA COLLECTION AND ANALYZING

As the previous system is completely manual, all the data sets were in booklets and the method of calculations are not stated in papers. All data sets and the calculation methods were extracted via several interviews and discussions with the expertise.

Organizational hierarchy of the selected branch was identified to establish the security to the system by setting authentication, authorization and confidentiality.

From the Database design, four types of data were categorized according to the frequency of access. Unchanged work norms, annually changeable labour rates, details which are changing seldom and data extracted from expertise (intelligent base) are the four categories of data. These data sets consist thousands of data and they have relations among databases.

The main part of the cost estimation task precedes several calculations. For these calculations each and every step of equations, relationships and methodologies were collected and implemented in the computerized system.

In the manual system they handled several letters, reports and some detailed schedules regarding the maintenance process. All the formats of those documents were collected and used them to construct report generating process.

METHODOLOGY

In this work the manual system was studied by identifying all the processes of each and every officer in the selected branch in the Ceylon Electricity Board. Then working processes are categorized according to their roles. While it was done, each and every drawback of the manual system and some issues on their practices were identified. Then Use Case diagrams were drawn for each scenario as an example

figure 3 represent the high level use case diagram. Activity diagrams were drawn for each and every activity that should be performed in the computerized system. An

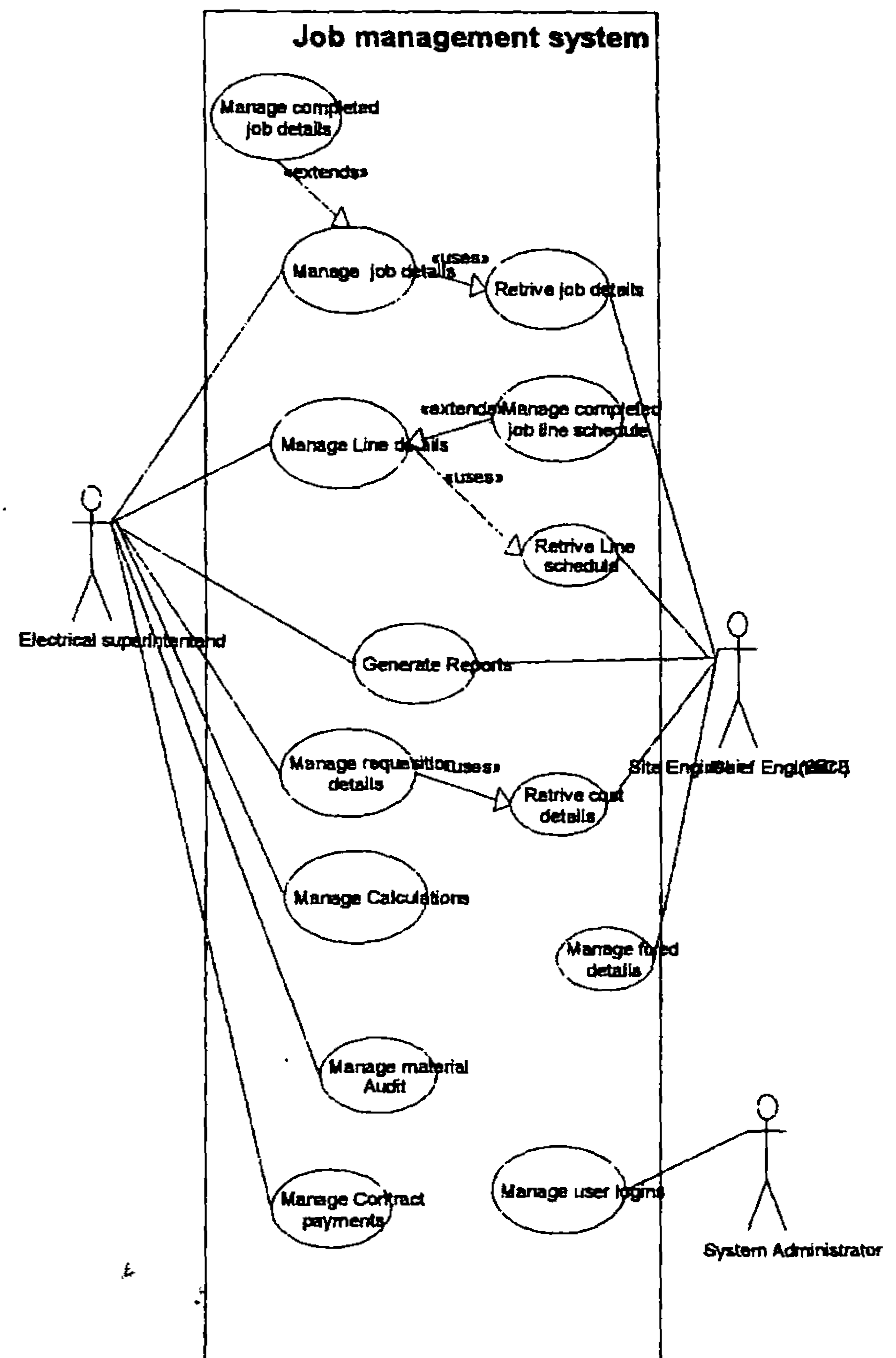


Figure 3. High-level use case diagram

example for activity diagram is shown in figure 4

Relevant data sets, calculation methodologies, reporting structures and letter formats were gathered with the help of technical expertise in each role. These data, methodologies and processes were analyzed to get a clear identification of functional and non-functional requirements. After the study on the data, the database relations were defined and relational diagram was drawn. Simultaneously Class diagram and the sequential diagrams were designed for the computerized system. An example for

sequence diagram is shown in figure 5. Relational diagram and class diagram have included in the project dissertation.

Object oriented methodology is used in designing and implementing the proposed computerized system. Visual Basic .NET 2005 and SQL Server 2005, MS Visio and Crystal Reports are used in the implementation.

Technology used

SQL Server 2005 is an RDBMS that uses Transact-SQL to send requests between a client computer and an SQL Server 2005 computer. SQL Server provides a flexible environment to building the database, tables related to the database and the diagrams representing the relationships among the entities of the database. The database designing of the system was concentrated on the table structured design, on which the underlying data store are maintained and the normalization process is undertaken to maximize database operational activities and to minimize data redundancy (In normalizing this database could achieve third normal form)

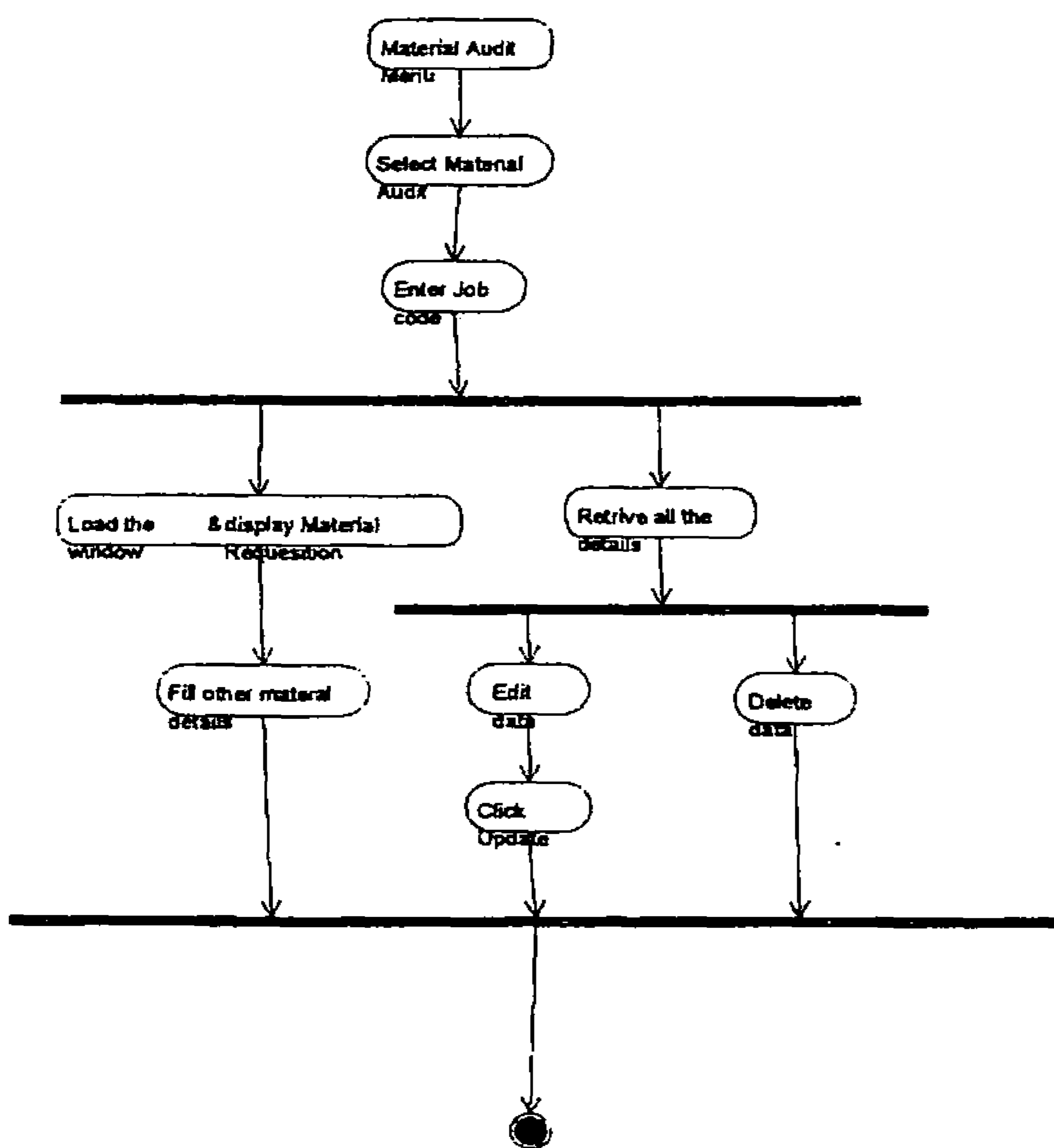


Figure 4. Activity diagram (for material audit)

In the manual system their line schedule was a blank sheet with 60 columns for tasks and 30 rows for pole numbers. Number of tasks and the number of poles are varying according to the job. Designing line schedule table similar to the manual sheet may have to allocate more unnecessary table space. (In some cases, one task may be used by only one pole. in such cases reserving a column for the task is inefficient).

There was not a unique identification of tasks in their manual system. Therefore, task code was introduced with the CEB concurrence and assistant. As a solution for the above problem another table was designed for temporary data as follows preserving database quality.

Jobcode	Task _cod e	Pole _no	A_ amou nt	B_ amou nt	C_ amo unt	D_ amount
			↑	↑	↑	↑

Figure 6. Table structure of line schedule

VB.NET is a part of Visual Studio.NET which finally consolidates all the development languages in to one place: VB.NET, C++.NET and C#. We can even create a single solution containing multiple projects in which the individual projects are written in separate languages. Visual Studio.NET provides a single, unified development environment build on the .NET framework

Visual Basic .NET provides the features that are most important to programmers, such as object-oriented programming, string, graphic, graphical user interface (GUI) component, exception handling, multithreading, multimedia (audio, images, animation and video). These features were used in developing the system to reduce the codes, handle exceptions and to design GUI .Some GUIs and some set of codes are included in the dissertation as a justification.

ASPECTS OF INTEGRATING KNOWLEDGE DISCOVERY IN A COMPUTERIZED INFORMATION SYSTEM

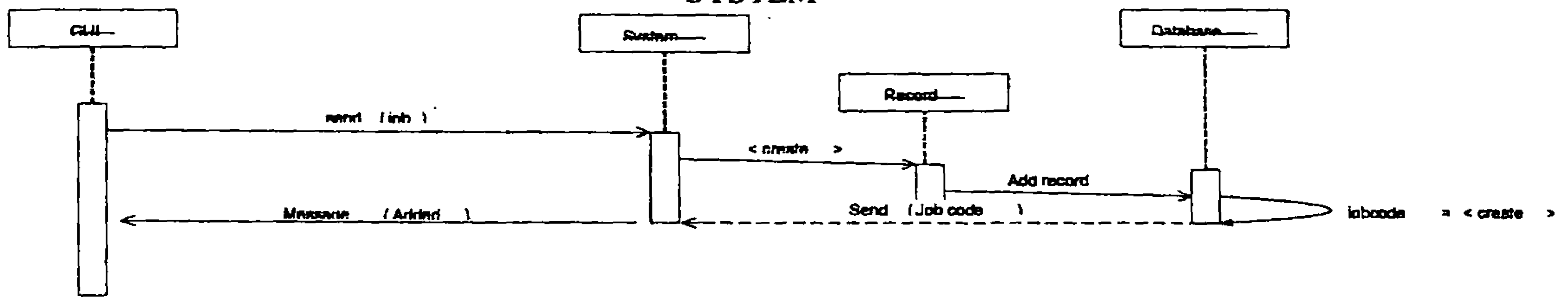


Figure 5. Sequence Diagram

The system was tested by a user, a software developer and a professional via module testing, functional testing, program testing, system testing, usability and acceptance testing. A user training session was conducted (user manual was provided) and let them to use the computerized system parallel to the manual system. On the other hand the system was evaluated by delivering questionnaires among the users. From the analysis of these evaluations it is clearly noted that the system has achieved the expected goals.

RESULTS AND DISCUSSION

It was able to organize the knowledge extracted from expertise in estimating process of Distribution Maintenance in CEB in a useful manner. This knowledge was implemented in the selected branch of CEB and working it properly. It is a well organized computerized system with role base login system ensuring security and also it performs each and every calculation, documentary works and generates reports. Further it consists of help desk and a user manual that gives guidance to users.

A user training session was conducted for all the levels of users while the testing is running. Evaluation sheet was distributed among users and collected them after few months. From their responses, it can be concluded that the system is user friendly and efficient system. But, because of there are no sufficient hardware, system can't be installed to some computers. After installing network to connect each machine in the branch, this problem can be overcome.

From the analysis of the user feedbacks, performance of the system is compared with the manual system in the table 1.

Table 1. Comparison of performances

Task	Performance	
	Manual system	Computerized new system
Time take for cost estimation	Five working days	1 hour
Accuracy of calculations	75%	98%
Clarity of line schedule	65%	99%
Time take to draft letters (need 5 letters for one task)	2 hours	No extra time (2 minutes to generate letters)
Time is taken to prepare reports	3 hours	5 minutes
Correctness of letters and reports	50%	100%
Accessibility of previous maintenance works	25%	100%
Accessibility of rates and work norms	40%	95%
Accessibility of unauthorized users	50%	0%

Advantages

- Can access at anytime and anywhere.
- Minimize mistakes that can occur during data entry and ensure data integrity.
- Contain efficient and productive interfaces.
- Help the users to store data correctly

- guide user to eliminate their technical mistakes in calculating estimate cost
- Quick response for all functions.
- Provide more accurate Estimates for the jobs
- Provide well arranged letters ,forms and line schedules
- Contain each and every records of previous jobs
- Contain all the fixed rates and standards
- Provide necessary reports when requested.

Disadvantages

- If the computers or the networks have technical failures workers have to wait until they are fixed
- All the employees who have enrolled in the estimating and documenting tasks should have computer knowledge.

Construction Branch and Low Voltage Line Improvement Branch are also using similar manual process. Hence this computerized system can be implemented after making minor changes. Now the Distribution Maintenance Branch supposes to use a Geographical Information System (GIS) to collect line details. System can be improved to integrate with the GIS.

CONCLUSION

A computerized system for distribution maintenance branch of CEB in NWP is successfully developed and presented. Performances of developed system is evaluated and compared with previous system. Advantages and disadvantages of the system are identified and discussed.

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