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Management Information System - Human Resource & Payroll System for Sri Lanka Ports Authority

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ABSTRACT

Payroll is the one of most critical process in every large organization; it has many functionalities to fulfill on time for a smooth payroll process. When the number of employees varies on time to time due to retirements and new appointments and calculation method differs based on it, increases the complication of the system. Management operations concerning data can be a complicated scenario when the amount of data involved is large. More importantly, when the data involved requires a high level of accuracy, then the management role becomes hectic. Payroll is a sector of the management in which accuracy is required and a lapse in the data can lead to adverse effect on employee motivation and production. In such system, cost estimation is very vital for top management proceed with future organizational plans.

Keywords-- Cost Estimation, Data Mining, Human Resource & Payroll, Management Information System

I. NTRODUCTION

Sri Lanka Ports Authority (SLPA) is one of the largest and economically important leading semi-government Organization in Sri Lanka. One of their major problems exists with managing Human Resource and making estimates which is very crucial to plan future fund allocation for Payroll and Plan Investment. SLPA work force is nearly 10,000 and pays annually over 14 Billion rupees for their employees as salary, which is nearly 40% of Organization Cost [16]. Payroll cost distributes mainly as mentioned below.

Employee Loans	-	30%
OT	-	25%
Other Allowances	-	20%
Basic Salary	-	12%
EPF/ETF	-	08%
Bonus	-	05%

Currently payroll cost estimation is done using manual calculating methods and it is vastly different from the actual cost in some months. Major parameter for SLPA Payroll cost fluctuation is SLPA Loans. The reason for this is new recruitments taken place by SLPA one year or three years ago. If the SLPA recruits a few hundreds of employees within one year, they are eligible for loans from the date of their appointment. This Results on the un-expected rising amount on the loan cost by several Millions. . If this repetition goes on in the same manner at the time of renewal of their Loans, the cost is unbearable to SLPA in one particular month. Taking into consideration this situation, this research is mainly focused on SLPA loans cost rather than other attributes.

Every permanent employee can apply for either 3 Months or 10 Months loan if employee has completed the specific time period from the date of appointment and date of retirement.

SLPA recruits employees as few personnel sometimes 500 employee for a batch in some months. After 1 year or 3 years period from the recruitment date, they are eligible to apply a New Loan. After one year from the Last Loan provided month, Employee is eligible to renew the loan or apply for a new loan category. SLPA consider Employee's date of Retirement as well prior to granting Loans. Other Payroll cost attributes have slight deviations throughout the year.

Finally, in this research, Finance Division of Sri Lanka Ports Authority gets an opportunity to estimate their Payroll cost, few months ahead which will assist them to analyze and manage their funds. Solution methodology is proposed to tackle date of Appointment and date of Retirement of Employees.

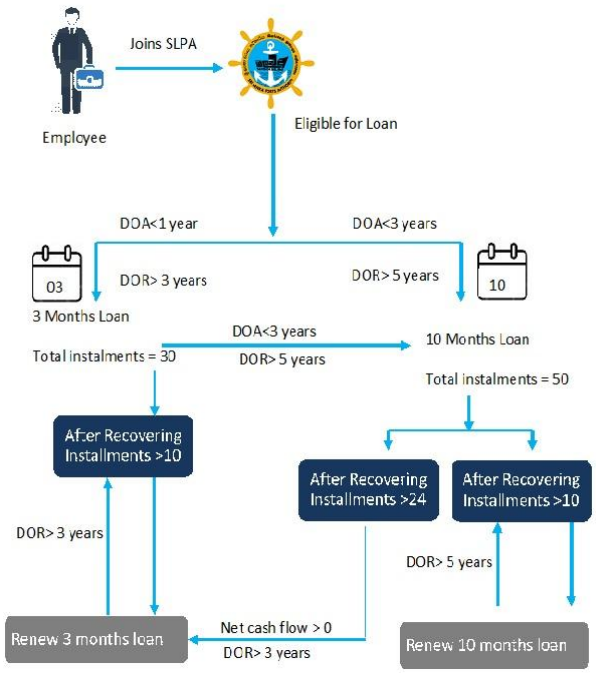

Figure 1: Loan Eligibility Process

Therefore, in order to provide provision in discussing the research models associated with solving Cost estimation problems in Payroll systems, this report surveys the current state of the art in relevant technologies and methods applicable in the industry.

II. RELATED WORK

During last decades, number of integrated approaches have been presented by many Researchers to give the accurate figuring in MIS (Management Information System). None of previous researches could address clearly similar to SLPA use. SLPA have very unique origination structure and salary calculating methods that lead to adverse effect on employee motivation and production. But findings in below articles give areas that must be concerned when the system is designed and developed. Best solution for Sri Lanka Ports Authority (SLPA) is to develop an in-house system which suits to their major problem.

- Key areas and Algorithms for accurate Payroll Estimation: Reviewing papers listed as [1] and [3], this type of models can be considered as productive models for accurate forecasting methods of Payroll System to cope up with minimizing over estimating and under estimating. Therefore, this type of Researchers must be motivated since accurate cost estimation of large organization is a key factor in decision making. Finally, this nature of papers can be chosen as inventions providers for developing of new scenario for Payroll Estimation problems.
- Integrated HR information with Payroll System: Considering the papers reviewed on this study of research, it has been observed that many Researchers are presented their solutions as integrated optimization for multiple resources. With these integrated solutions, comparing with the papers discussed above [3 ~ 6], the approach presented by E. Saez, M. Matsaganis, and P. Tsakloglouet al. [3] is more or less equal compared with the paper [2] reviwed in this report and these models could be efficiently used for a proposed MIS module.
- Create formula for estimation and processing techniques: Yang Agita Rindri, Ridi Ferdiana, Rudy Hartanto [8] has illustrated some formulas that can get payroll estimates for future months. Also he nominated important key areas that must be considered. Jela Abasova ; Jan Janosik ; Veronika Simoncicova ; Pavol Tanuska [9] mentioned about effective processing techniques they have discovered with Payroll data. Those techniques were very useful to create a batch process for monthly data summarizing. Kurt Newman, Debashis Ghosh, Robert Wohlers [10] have innovated prediction and indexing mechanism which they have used in their Payroll cost estimation.
- Use of Rapid Miner: A. Jovic ; K. Brkic ; N. Bogunovic [13] described use and characteristics of Data mining tools. It shows pros and cons of each tool and helped to select most suitable data mining tool. Anna Lisa Gentile, Sabrina Kirstein, Heiko Paulheim, Christian Bizer [14] showed data search and integration capability of Rapid Miner. They also discussed about other data mining tools and user friendliness of Rapid miner. Marcin Blachnik, Mirosław Kordos [15] showed data selection and data compression ethods that can be used in Rapid miner. The method used to solve various problems and give realistic estimates regarding payroll cost is an interesting one, authors are able to reduce the gap between estimated and actual figures. The method they proposed is more understandable for the readers hence the accuracy of the results is acceptable. Therefore, this paper can be rated as highly acceptable to solve cost estimation problem in a Sri Lanka Ports Authority Payroll system which they haven't mentioned about constrains and the assumptions in their paper. Shraddha Dwivedi Paridhi Kasliwal ; Suryakant Soni [11] explained comprehensive study of data analytical tools which can be used to analyse large data. Lei Zhuang; Jiantian Zheng [12] talked about design and implementation of accurate payroll estimation module and risk factors have to be considered in implementation.

Although there are many achievements obtained by introducing interactive tools for MIS and Payroll Estimation in recent past, most of the important rules and constraints are not incorporated equal to SLPA Case study. Therefore, it still exists the gap between implemented models and the practical usage of Payroll Estimation. Since the SLPA practice is very unique for its own, these approaches are not applicable. As a government organization, SLPA change its policies and rules from time to time.

Previous Researchers have developed wide range of Payroll systems but most of them were not reaching up to MIS stage. Best solution for Sri Lanka Ports Authority (SLPA) is to develop an in-house system which can suit for their major problem. Currently SLPA has a big issue with making estimates before Payroll payment. But unfortunately none of the previous Researches could address clearly for SLPA case. Therefore, a new approach and a method required to solve the SLPA Payroll Cost Estimation problem.

III. PROPOSED METHOD

This following sub sections illustrates the methodologies and techniques which have been used to develop the system. Considering the complexity and volume of Payroll system, Employee Loan Cost and other Payroll cost Estimation in future months, series of activities were used to find realistic output. Therefore, to implement this system more attractive and efficient, few tools, technologies were used. The details of the implementation environment, hardware infrastructure, development strategies, tools used, database and the Application development architecture are described in this chapter.

Web based application is developed as a solution for the Cost Estimation problem and to provide interfaces for both Finance Division and Top Management users of SLPA. Hardware infrastructure basically divided into two categories as Server and Client environment.

Technologies and Tools Used

C# Language:

C# version 5 is used to develop the applications, since C# is multi paradigm Programing Language and run on .Net frame work. C# is a server-side scripting language designed for Web development.

Joomla Framework:

The system is based on Joomla Core framework. Joomla component development architecture compile with Model View Controller (MVC). This gives more dynamic architecture to development the system. Based on Joomla core the system has been used the legacy Object Relational Mapping (ORM) on Joomla when doing the DB queries. Also Joomla framework has been utilized to session handling and log file maintenance.

Rapid Miner:

Rapid Miner is a data mining tool that can be used to analyse data more scientifically. It is a machine learning software and system can forecast with realistic values for future period. Furthermore, Rapid Miner supports for most of data formats and data bases and able to give outputs as graphically or figures.

Sublime:

Sublime text 3 was used as the Integrated Development Environment (IDE) for this project. Sublime text is one of the most popular code editors available today and it is adored by many Programmers for it's speed, simplicity and rich plug in ecosystem. Sublime has been installed with all syntax checker features and this gives developer friendly environment.

Apache:

Apache is the most widely used web server software and Apache 2 was used as the web server of this project. Apache is an open source freely available software which is fast, reliable and secure. It can be highly customized to meet the needs of many different environments by using extensions and modules.

My SQL:

My SQL is an Oracle-backed open source Relational Database Management System (RDBMS) based on Structured Query Language (SQL). My SQL runs on virtually all platforms, including Linux, UNIX and Windows. My SQL is based on a client-server model. The core of MySQL is MySQL server, which handles all of the database instructions (or commands). MySQL server is available as a separate program to use in a client-server networked environment and as a library that can be embedded (or linked) into separate applications.

Php My admin:

This is an open source tool to query the database values and execute SQL statements.

Web browsers debug tools:

Firefox and Chrome developer tools are used in the implementation process. These tools provide many debugging features of error handling when the issues arrives at the system.

The solution is Analyzed and designed in two separate phases and integrates the implementation as follows.

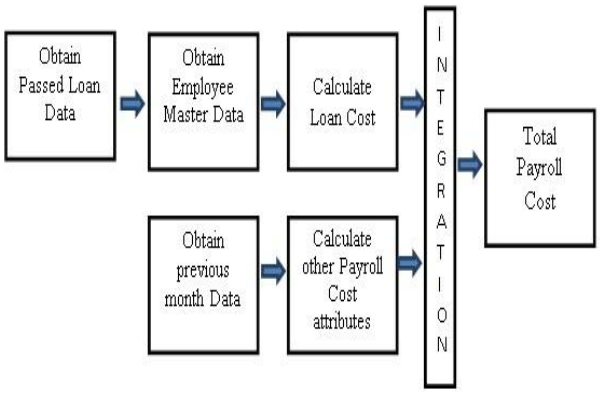

Figure 2: Proposed Solution

After monthly payroll process, batch process is scheduled to run and transfer Processed payroll data to MIS module which consists with Rapid Miner module. Result of Rapid Miner module can use to calculate required estimates.

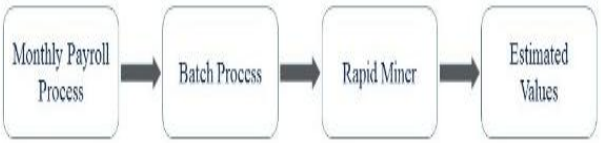

Figure 3: Proposed Processing Steps

PORTID	SCALENO	PAYCODE	AMOUNT	UNITS	NOOFREC	YEAR	MONTH
C	011	005	497500	0	10	2018	02
C	011	005	497500	0	10	2018	01
C	011	005	497500	0	10	2018	03
C	011	008	15432.69	0	1	2018	01
C	011	015	24516.35	0	1	2018	01
C	011	055	11076.92	0	1	2018	02
C	011	055	2692.31	0	1	2018	01
C	011	090	9000	0	2	2018	03
C	011	090	5000	0	1	2018	01
C	011	101	112500	0	3	2018	03
C	011	101	112500	0	3	2018	01
C	011	101	112500	0	3	2018	02
T	112	088	68958.4	884.05	5	2018	01
C	061	088	17950665	103532.3	346	2018	02
C	062	088	8724681	52086.6	138	2018	02
C	063	088	12860854	86073.95	321	2018	02

Figure 4: Output of Data File

Batch Process Output

Following Rapid miner modules work on above output and gives the estimated results.

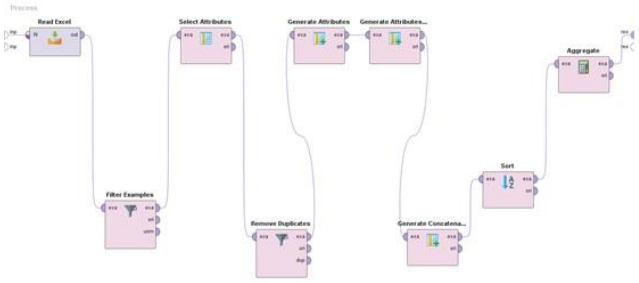

Figure 5: Rapid Miner Modules

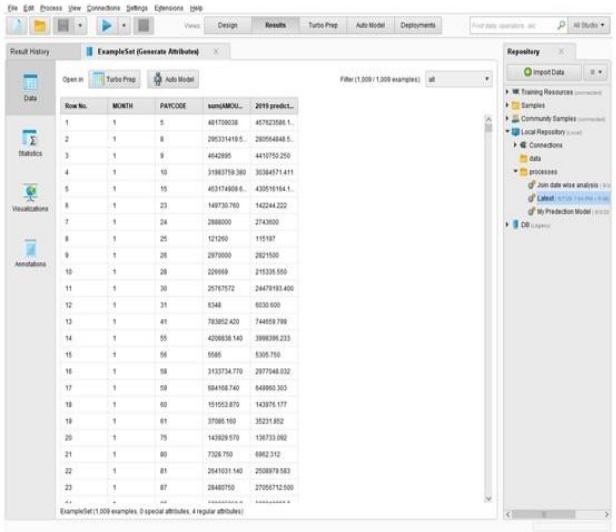

Figure 6: Rapid Miner Output

The monthly fluctuations of payroll data graph illustrates how mean values of actual and predicted data alteration according to month.

IV. EVALUATION

Statistics and the evaluation of the system is done. The ultimate goal is ascertaining accuracy of the predicted data. To perceive the research results, a study model was developed using independent and depend variables. An independent variable is a factor that functioning or stand-up on its own. It is not exaggerated by other factors. Depend variable is a factor that is affected by other factors, mostly on independent variables. In this particular study two variables were identified. Following diagram illustrates the study model and relationship between identified variables.

Based on the study model a hypothesis is established. Simply a hypothesis is analyzing evidences to suppose or oppose particular idea that has not yet been proved. In this research the expected outcome is an accurate solution to forecast loan amount for SLPA Payroll. The hypothesis is developed by exploring the nature of relationship between accuracy (depend variable) and system outcome (independent variable).

H0: The system is accurate to forecasted payroll cost.

H1: The system is not accurate to forecasted payroll coast.

Hence the hypothesis develops the latter part of the paragraph focused on data analyze for testing hypothesis, from 2010-2019 (10 years) the Payroll data collects and mean values calculates year wise and month wise. Mean represents average value for a group of data. It eases the complexity of analyzing large amount of data. Below tables exemplifies the mean values of loan data from past ten years while line graphs displaying inter relationships between predicted and actual Payroll cost.

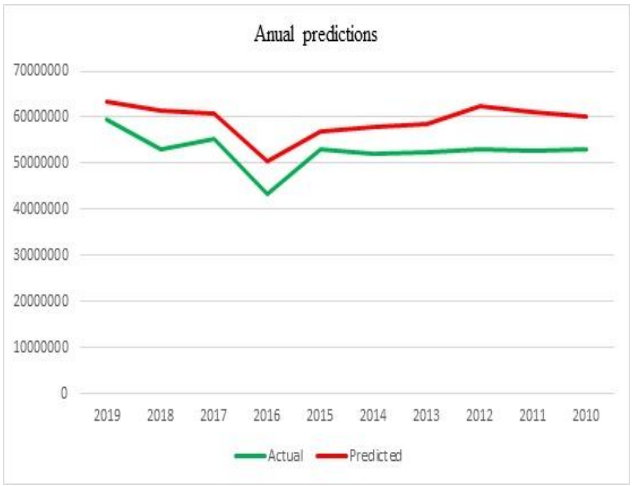

Figure 7: Comparison with Passed Actual Data

The monthly fluctuations of payroll data graph illustrates how mean values of actual and predicted data alteration according to month.

Figure 8: Comparison with Passed Actual Data

V. DISCUSSION

Forecasted results generated by the system were compared and it is realized that the results are more than 80% accurate with actual data. Further, according to the results obtained from the test cases, most of the functions expected through the system are achieved successfully.

VI. CONCLUSION

SLPA have very complicated, procedural and unique way for payroll calculations, estimations and HR functions. It is the key challenge for customizing tailor made software package according to SLPA requirements. Not only software packages, past research papers also not suit for fulfil SLPA requirements. Because of that most efficient way of giving solution for this case is do a thorough analysis of current procedures and make a flexible, user friendly and accurate in house development with high user involvement.

In an increasingly competitive international shipping industry environment, the imperative need and search for efficient, cost effective techniques, particularly through an application of computer and communication technology has dramatically intensified. Hence, the need for a computerized system that dynamically adapt to changing environment is apparent as there is a limited number human involvement and need to ensure about high accurate output.

To achieve the required accuracy, the system was developed to overcome the realistic cost estimation problem in SLPA Payroll. Since 2006 SLPA survived with in-house build Payroll system with smooth functioning without any issue. SLPA top management and Finance division officials are fully satisfied with on-going system and they need only minor modifications for current system.

According to the evaluation of the system, all the modules of the system are successfully implemented. At this phase of development, the functionality of generating graphical and figured outputs are fully tested with passed data. In the current manual process practiced by the finance division decision makers, they analyse past month cost and last year particular month cost and get a rough estimate fund reservation for next payroll. Some months this estimation is way beyond with the actual cost of the particular moth. If the actual cost is very high, management has to withdraw some deposits or delay other payments. Accordingly, it is obvious that system is a fine solution to the accurate cost estimation problem for Sri Lanka Ports Authority faced for several years.

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