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An Experimental Expert System For Award Implementation

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Abstract

The Western Australian Government Railways Commission (**WestRail**) employs several thousands workers under many different awards. The awards serve to dictate the working and pay conditions of all employees of WestRail. Currently, tens of thousands of recorded time-sheets are processed per year. The present time-sheet processing system is predominantly batch-based and inefficient due to the complexities of many awards and conditions. Consequently, WestRail plans to streamline the entire time-sheet process to a suite of on-line systems. One of the steps towards this goal is to examine the potentials of applying expert system (**ES**) technology to the complex structures of many different awards.

This paper describes an experimental expert system for award implementation at WestRail. The aims in this project are two folds. Firstly, it is to demonstrate to WestRail that the complex award conditions can be captured and applied using the currently available ES technology. The second objective is to show the viability of interfacing the ES with a database. From the results of study, it has been demonstrated that the ES techniques can be used to gather and interpret information from manual time-sheets that are subject to a complex arbitration award. Furthermore, it is believed that the ES technology can and should be integrated into the mainstream programming techniques at WestRail.

1.Introduction

The Western Australian Government Railways Commission (**WestRail**), a large public sector organization, employs several thousands workers under many different awards based on their job categories. The awards serve to dictate the working and pay conditions of all employees of WestRail. There are three major awards, each of which is further segregated into numerous sub-awards. Currently, tens of thousands of recorded time-sheets are processed per year. The present time-sheet processing system is predominantly batch-based and inefficient due to the complexities of many awards and conditions. Consequently, WestRail plans to streamline the entire time-sheet process to a suite of on-line systems. One of the steps towards this goal is to examine the potentials of applying expert system (**ES**) technology (Martin and Oxman, 1988; Pigford and Baur, 1995) to the complex structures of many different awards. The outcome is the development of an experimental expert system for award implementation at WestRail. The primary objective of this project is to demonstrate to WestRail that the complex award conditions can be captured and applied using the currently available ES technology. The second objective is to show the viability of interfacing the ES with a database.

2.Problem Description

In the current time-sheet processing, a worker forwards a time-card containing number of hours on duty to a field time-keeper whose function is to transfer details from the time-card onto an official time-sheet with penalties and allowances for the worker. The completed time-sheet is then forwarded to a supervisor for verification and endorsement. Batches of endorsed time-sheets are forwarded to and processed daily by the time-sheet processing department through manual keying of time-sheet information into the payroll system.

The current system is predominantly batch-based and thus inefficient. The major problems encountered by the current system include high volumes of paper input, high levels of data keying, and complexities due to many awards and conditions. This project is a result of an attempt to overcome the above problems and to provide for more timely and accurate management information.

3.Methodology

Expert systems are one type of software product. As a result, the life-cycle of this project was adapted from the "water fall" life-cycle approach (Guida and Tasso, 1989; Martin and Oxman, 1988; Parsaye and Chignell, 1988). Stages of the methodology cover Feasibility analysis, Conceptual design, Shell selection, Knowledge acquisition, Knowledge representation, and Validation.

According to Coleman (Coleman, 1989), it is very important to select an application for an expert system in a commercial environment. The domain of time-sheet processing is considered to be a suitable application due to the following characteristics. The problem is of sufficient complexity that can be used to demonstrate the suitability and viability of the ES technology to the project. According to Harmon and King (Harmon and King, 1985), the task of time-sheet processing is "subjective, changing or partly judgemental" and thus considered to be appropriate for applying the ES techniques. There is also abundant data available for testing. Finally, the project has the support from the management.

4.Shell Selection

The shell selection criteria are categorized into essential and desirable sections. The essential selection criteria include the following features:-

- Mathematical capability
- Personal computer/MS-DOS based platform
- Interfacing capability with external programs/databases
- Large rule capacity

In addition, it is desirable that the selected shell should satisfy the following criteria:-

- Capacity for further development
- Forward and backward chaining ability
- Programming facilities, preferably based on 'C'
- Good user interface
- Easy to learn and use
- Small memory requirements
- Multiuser access
- Availability of a run-time module

Shells selected for evaluation came from some of the commercial ES building tools in common use (Gevarter, 1990; Freedman, 1990; Bielawski and Lewand, 1988 and Bowerman and Glover, 1988). Based on essential and desirable features of a shell, the 1st-Class HT expert system shell is selected as a development tool. It is an induction-based (Hart, 1989) shell where knowledge can be derived from examples or data in a tabular form.

5.Knowledge Acquisition, Representation And Validation

The knowledge acquisition (Scott, Clayton and Gibson, 1991) phase of this project includes a few semi-structured interview (Hoffman, 1987) sessions with domain experts from WestRail and the extraction of information from many existing award manuals. The semi-structured interviews are conducted to discuss methods in time-sheet processing, time-scale, basic terms and other parameters.

Four sections extracted from the Railway Employees Award (REA) are selected to be implemented as knowledge bases for the ES. They include guaranteed week, hours of duty, overtime allowance, and Saturday time for shift workers. Each section has conditions that relate to another section. All four sections hold sufficient complexity for rule construction.

After the knowledge bases have been created, two demonstration sessions are staged to domain experts, senior consultants, and users of WestRail. The aims are to familiarise domain experts with the representation of knowledge and to verify the validity of the knowledge bases. Initial trials with the system

are encouraging. The consensus is that ESs have the potential for award implementation and are worthy of further investigations in future projects.

6. System Interface

Interfacing with an external system is based on the Inter-system Communication approach (Al-Zobaidie and Grimson, 1987) where the ES and the external system (eg. a DBMS) coexist as independent systems that can communicate with each other. 1st-Class HT provides the interfacing with an external system through ASCII files. In this project, data from the Dataflex DBMS is written into an ASCII file. This is passed to the 1st-Class HT that writes the results into another ASCII file and passes it back to the DBMS. Although this interfacing method results in a slow speed of interaction between the two systems, it demonstrates successfully the viability of interfacing between an ES and an external system.

7. Conclusion

An experimental expert system for award implementation has been described. From the results of study, it has been demonstrated that the ES techniques can be used to gather and interpret information from manual time-sheets that are subject to a complex arbitration award. Furthermore, it is believed that the ES technology can and should be integrated into the mainstream programming techniques at WestRail. The success of the experimental ES in satisfying initial objectives will not be possible without the cooperation between the information technology staff and the domain experts of WestRail, and Edith Cowan University.

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