

Developing Interfaces in SAP for Punching/Engraving VIN Plates

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Abstract

The proposed system contains deploying VIN (Vehicle Identification Number) plate formats on peer machines that contain information about the vehicle being assembled pertaining to the specifications of a country. E.g., in India, in the format followed, everything is written left-to-right, whereas in Arab countries, details are mentioned right-to-left, owing to use of a different script and writing format. So the user requirements state to construct a system which is compatible to punch the details of the vehicle (engine number, color code, certification number, TAT number etc.) which are obtained from the database that is interfaced with SAP and reflect the same on punched VIN plate. These VIN plates provide a unique identity to a vehicle and thus are used worldwide for official purposes. According to the government norms of a particular country, if the number of attributes or their position on the VIN plate changes, the functionality is expected to be built in such a way that it incorporates the above changes easily modifying or adding any surplus code.

The information regarding the plate format (dimensions and coordinates) of a particular country will be combined in a text file, i.e., for every country there may be more than a single format and for each format, there will be a separate text file. These files will be stored on a central repository server from where these will be fetched as per the requirements.

I. INTRODUCTION

The system being developed includes interfacing among the following:

A. SAP^[1]

SAP AG is a German multinational software corporation that makes enterprise software to manage business operations and customer relations. SAP focuses on six industry sectors:

- process industries
- discrete industries
- consumer industries
- service industries
- financial services
- public services.

B. ABAP^[2]

ABAP 4 is the programming language used to code SAP R/3. The full form of ABAP is

Advanced Business Application Programming. There are three main components of the ABAP 4 language. These are:-

- ABAP 4 Development Workbench
- ABAP 4 Data Dictionary
- ABAP 4 Repository Information

The development workbench gives access to SAP's development tools. Definitions of variables and parameters on the other hand are stored in the data dictionary. Any program developed in ABAP is stored in the R/3 repository.

C. IPMS^[3]

Integrated Project Management creates environment for:

- Effective use of organizational process knowledge
- Contribution to the organizational process knowledge.

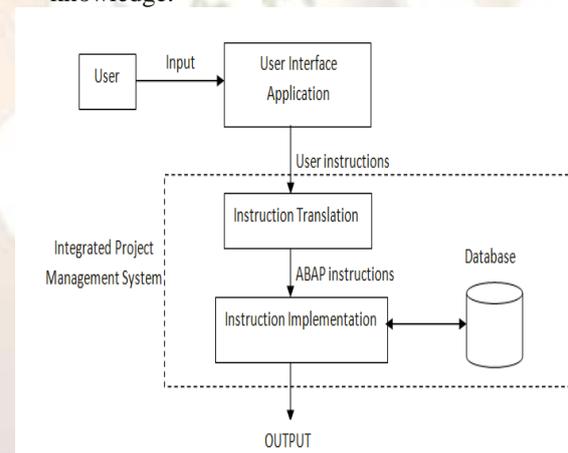


Fig. 1 Interfacing of IPMS & SAP

II. REQUIREMENTS

The chassis number plate contains information pertaining to a vehicle. This information may vary from country-to-country. So the user requirements state to construct a system which is compatible with every proposed requirement.

A. Non-Functional Requirements

1) Performance Requirements

- Easy to understand. Error messages to be displayed whenever necessary.
- While extracting data from the database, care should be taken that the data or the attributes

are retrieved in the correct format and displayed accordingly.

2) Safety Requirements

A back-up server is created to prevent the hampering of the entire punching process in case the primary or the main server fails due to any technical reasons.

3) Security Requirements

This system is basically developed for a particular company's network. Hence, no outside access is permitted. Therefore any provision of communication between the user and the administrator will have to adhere to this constraint. The system should be developed keeping in mind the company's security constraints.

4) Software Quality Attributes

The system developed should be:

- Portable
- Platform independent
- Easy to understand and use
- Flexible enough to incorporate future changes and enhancements
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B. Other Requirements

1) Database Requirements

The system should be able to work accurately with SAP.

2) Legal Requirements

All the inputs should be as updated by the TML's Administrator. All such data should be kept confidential.

III. IPMS PLATE PUNCHING PROCESS

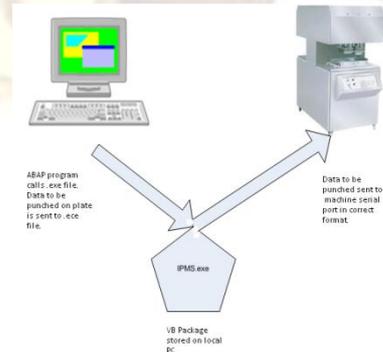


Fig. 2 Plate punching process

- Plate Punching and Engraving is triggered by program which extracts the data to be punched on the plate from IPMS system.
- The same program creates a text file on local drive which contains data to be punched on the export vehicle plate.
- At the next event, this ABAP program calls an executable file which is built and is stored on the local punching machine.
- Function of this file is to relay the data in text file created by IPMS program to the punching

machine and to select the serial port of the machine on which the plate is to be punched.

- The layout of data to be punched on the plate is selected manually on the punching machine by giving 'X' & 'Y' co-ordinates of the data to be punched on the plate.

IV. PROPOSED SOLUTION

A. Client-server architecture

A network architecture in which each computer or process on the network is either a client or a server. Servers are powerful computers or processes dedicated to managing disk drives (file servers), printers (print servers), or network traffic (network servers). Clients are PCs or workstations on which users run applications. Clients rely on servers for resources, such as files, devices, and even processing power.^[4]

The client server architecture in the proposed solution includes a centralized server which will have file formats of different countries and the database. This database has all the details that will be required for the entire plate punching process (login details, vehicle details etc.) and any changes in the database can be made solely by the SAP consultants. The file formats which are editable can be tampered /manipulated only by the admin. The clients are bestowed with the rights of only using details of these file formats to send them to the punching machine.

In the proposed system, the server program is to be executed all the time. Whenever the admin (situated on the client side) creates a new country format, a call to the package containing file creation program is made and using the file handling commands, details in this newly created file are entered. The format which is created is stored on the server machine and is fetched as and when required.

In the case wherein the admin wishes to make changes to the existing country format, the file from the server machine is fetched, changes will be made to it and the same will be stored back on the server.

B. Port Communication

The plate punching machine being used is connected to the client machine through the communication ports. The data to be punched is sent to the machine via these ports.

Generally, two types of ports are used in such communication activities:

- Communication port (COM Port) which uses RS232 as the port for communication.
- USB port

1) RS232

RS-232 is the traditional name for a series of standards for serial binary single-ended data and control signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. The standard defines the

electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors.^[5]

2) USB port

Compared with RS-232, USB is faster, uses lower voltages, and has connectors that are simpler to connect and use. However, USB is limited by standard to no more than 5 meters of cable, thus favoring RS-232 when longer distances are needed. The proposed system however, uses the former communication type owing to the limitations of the latter type.

C. File Handling

In the proposed system solution, file handling refers to the files stored on the server or hard disk. Each time the admin needs to create a new format or edit the existing one, he needs to use the file handling commands to create/open a file, write/modify the details and store the file back onto the server.

D. Barcode Scanner

The Barcode scanner is basically used to scan the incoming chassis number (barcode format) and converts it into its equivalent number sequence. The VC number corresponding to this number sequence is retrieved from the database tables and the process of selecting the required country format, punching and so on continues.

The Barcode Scanner used in the system is a sequential scanner, i.e., it scans the barcode, converts it into an equivalent code and sends the output to the machine as a stream of numbers, followed by a termination character (generally a 'r'). The input generates an effect of key-press in quick succession. Thus it is easy to operate it in parallel with the standard keyboard of the system.

V. MATHEMATICAL ANALYSIS

The VIN plate formats are stored as .txt files on the central repository server. These files as per requirement are then fetched by the program. The program follows SEQUENTIAL SEARCH technique to locate the file on the server and then download it on the peer machine.

The number of comparisons required for a successful search is not fixed. It depends on the location of the element to be searched. An element at i^{th} location will be searched after i -comparisons. Number of comparisons required is probabilistic in nature. We could best calculate the average number of comparisons required for searching an element.

Let P_i is the probability that the element to be searched will be found at i^{th} position. i number of comparisons will be required to search the i^{th} element.

Therefore, the expected number of comparisons for a successful search,

$$C = 1.P_1 + 2.P_2 + \dots + n.P_n$$

Since the element could be found at any location with equal probability,

$$P_1 = P_2 = \dots = P_n = 1/n$$

Therefore,

$$\begin{aligned} C &= 1/n + 2/n + \dots + n/n \\ &= 1/n (1 + 2 + \dots + n) \\ &= n(n+1) / 2n \\ &= n+1/2 \end{aligned}$$

Time complexity of sequential search = $O(n)$.

The values of the attributes are passed to the plate punching machine along with their left and top co-ordinates (the co-ordinates are referred in order to punch the data at its pre-decided position in the VIN plate format of a particular country). Depending upon these co-ordinates, the head of the plate-punching machine moves on the VIN plate and punches the data accordingly. The movement of the head can be explained using the TRAVELLING SALESMAN PROBLEM as follows:

In Travelling Salesman Problem, we have a complete undirected graph, having non-negative integer cost associated with every edge. We need to find a path for the given graph in such a way that the cost of the path is least. Similarly, in a plate punching machine, the head punches the attribute which is in the least proximity compared to the earlier one.

The complexity can be analyzed as follows:

Let there be n attributes to be punched on the plate. The cost required to punch one attribute will be

$$\sum_{k=1}^{n-2} (n-1) k \cdot n^{-2} C_k$$

For the entire n attributes to be punched, the head will move $n-1$ times.

Thus the total complexity of the process is equal to

$$\begin{aligned} &= O \left[(n-1) + \sum_{k=1}^{n-2} (n-1) k \cdot n^{-2} C_k + (n-1) \right] \\ &= O \left[2n - 2 + (n-1) (n-2) 2^{(n-3)} \right] \\ &= O \left[(2n - 2 + n^2 - 3n + 2) \cdot 2^{(n-3)} \right] \\ &= O \left[n^2 \cdot 2^n \right] \end{aligned}$$

Thus the space complexity is $O(n^2)$.

VI. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

A. Advantages

- JAVA has been used for interface designing and process implementation, thus making the application platform independent.
- Less human efforts.
- Remote access.
- Easier up-gradation and maintenance of the system.

B. Disadvantages

- In case of a server failure (physical/technical) or any damage to the connectivity (links), the entire system stops working.

- As the system involves network, there is always a threat of information leak, security breach or unauthorized access.

C. Applications

The above system can be used to punch the various details (engine number, TAT number, front axle weight, rear axle weight, net weight, etc.) of a vehicle (cars, trucks, buses, etc.) on the punching plate regardless its format, number of attributes or their position on the plate.

VII. FUTURE ENHANCEMENTS

The future enhancement for this application includes developing a mobile Android application. This application will allow remote access to the system. In this application, the user can scan the chassis number which is inputted in the form of a barcode. This application will decode the barcode and send it across the communication ports to the VIN plate punching application, using Bluetooth or internet, whichever applicable. Thus it will provide a higher and advanced level of interaction between the user and the Plate Punching application.

Currently the system includes manual design of the new plate format, i.e., coordinates of the details to be punched has to be entered by the user. In future enhancement, it is planned to enable system to design the format by scanning a sample plate. The system will itself determine the coordinates. This will further enhance the accuracy & applicability of the VIN plate format.

VIII. CONCLUSION

A whole new code should not be developed whenever the format of the punching plate pertaining to a particular country changes. Also whenever a particular format is added or edited, the changes should not be deployed on peer machines individually. These shortcomings can be overcome using the above approach of interfacing in SAP for the VIN plate punching.

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