Scrap Management in Punching Staion of Sheet Metal Industry

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Abstract: *Automotive industry has been experiencing the competitive environment and striving hard to find out the way to reduce the manufacturing cost of the product. Cost reduction could be achieved either by using low cost material or by reusing the scrapped material. Since the customer requires the standard material for their product, low cost material could not be used to achieve the cost reduction. So reusing the scrapped material will help to reduce manufacturing cost. Tracking and retrieving of material is necessary to reuse it. Scrap Tracking and management system is one of the major tool used in the industry to track and retrieve the parts without major effort. This work is carried out in a sheet metal industry with the objective of improving the resource utilization. Aim of this case study is to develop the real time data tracking system to track scrapped sheets. Database is used to store the information about scrapped sheets. This database is linked with scrap tracking application to allow user to add and update the information and also to retrieve the required information. Scrap tag is prepared and attached to the scrapped sheet to retrieve the particular material from the storage without any difficulty.*

Keywords: scrap tracking; Scrap management; scrap tag; database management; scrap storage and retrival.

1. Introduction

Globalization increases the competition for every industry. Manufacturer can sell their product anywhere in the world. Customers are free to buy any product. One of the criteria customer looking is quality. Customer expectation is to buy a good quality product. Every manufacturer can sell good quality product for low cost. Manufacturer has to find a way to sell their product with reduced cost, to increase the customer interest on our product. In the sheet metal industry there is no chance of reducing the material cost as they use the standard material for their product. So cost reduction could be achieved by reusing the scrapped sheets. To reuse the scrapped material we have keep the system to record the necessary information of scraps and those information has to be readily available whenever necessary. Effective utilization of sheet is possible only by implementing suitable scrap tracking and management system.

Microsoft visual studio is an integrated development environment which is used to develop computer programs for windows as well as web applications and other web services. Visual studio has the inbuilt software development platform such as windows API, windows forms, windows presentation foundation and Microsoft Silverlight. It also has built in tool for designing the GUI applications. Visual studio supports different programming language such as C, C++, VB.NET, C# and F#.

A. Organization information

ABC industry is one of the leading manufacturers of sheet metal products which supply the sheet metal parts for many of the leading automotive industries. As the industry growth increase over a time, its competition in the market is increased and they strive hard to improve their competitive strategy. It arises the situation to find out an opportunity to reduce the cost of their product over their competitor.

B. Sheet metal products

Over half of the metal production ends up with sheet metal products. Many of the products such as fuel dispensing pump, Switch gear assembly etc. requires sheet metal parts for their final assembly. Raw material for sheet metal products is from the rolling process. Basically sheets are available in the form of rectangular flat plates. If the sheet is thin and very long they are purchased in the form of roll. One of the major operation require in the sheet metal products are Punching process. Punching is the process of cutting requires shape from the standard sheets. It is the process in which there is a chance for large amount of material wastage. Material wastage may be occurring either by ineffective allocation of parts on sheets or by inadequate customer demand to punch the entire sheet. There is many software packages are available in the market to effectively place the part on the sheet thus to reduce the material wastage. The second kind of material wastage could not be reduced.

2. Problem Statement

Manufacturing product with reduced cost is one of the competitive strategies for every industry. Cost reduction could be achieved by reusing the suitable scrapped sheets. Identifying suitable scrap sheet is possible only by effective storing and retrieving of required information. In the shop floor they have large amount of scrap inventory from which locating the particular sheet is very difficult and time consuming process.

2.1 Objectives

- To develop the real time data tracking system to store and retrieve the information of scrapped parts from the punching operation.
- To store and retrieve the particular sheet in the inventory without any confusion.

- To track the scrapped material from the punching process without extra effort.
- To reduce the requirement of measuring the scrapped inventory each time for reusing the scraps.

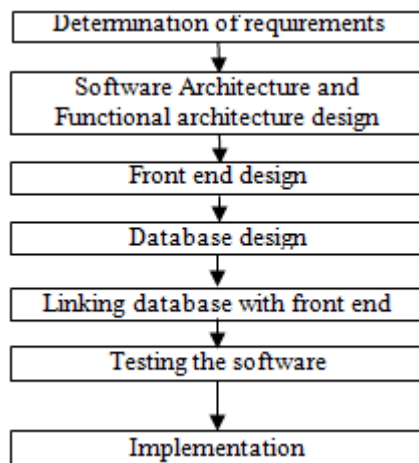## 2.2 Methodology Adapted to Meet the Objectives

Figure 1: Block diagram of methodology

The block diagram of methodology is shown in *fig 1*. Study and anlaysis of current tracking system has been made to identify the requirement of new system and also to identify the improvement required in the current system. Software architecture and the functional architecture of scrap management application has been designed by considering the requirement. GUI has been created by using visual studio 2012. C# program is used to make the application to run according to our requirement. Microsoft access database is created and linked with the front end application to store the data entered by the end user. By using the visual studio integrated development environment the final application has been developed as a distributable application which could be installed and used in any computer system.

3. Building the Application

3.1 Punching Process

Punching is one of the metal forming process in which punching press forces a tool called a punch through work piece to create a part with required features. The material coming out from the hole is called as scrap slug. Before punching process the planning committee has to identify the

number of parts that can be seized from a single standard sheet by using the software. Then software convert the design of punched sheet into program which is feed into the Punching machine to finish the operation. If the customer demand is less than the number of part that can be seized from single punched sheet, it generates the scrapped sheet. In the industry they have used the standard sheet of length, width and thickness. For the Carrier assembly product which is used in fuel dispensing pump, in a single sheet they have punched the parts required to assemble the 6 products. For that particular product customer demand is 500 products.
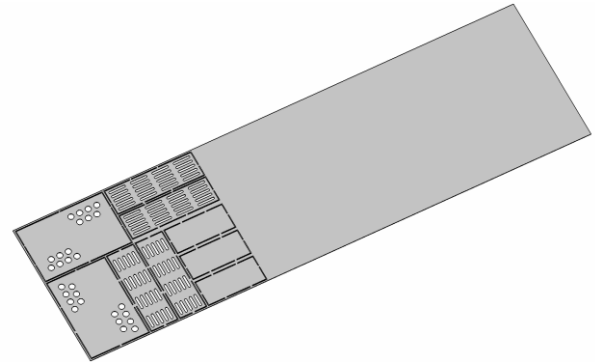

Figure 2: Catia diagram of Punched sheet

So to accomplish the demand they require 83 standard sheet to complete 498 products. For the remaining 2 products if they use single standard sheet it leads to 2/3 of sheet to become a scrap. Catia diagram of punched sheet for CE Carrier assembly product is shown in *fig 2*.

3.2 Proposed Method

In the proposed method data tracking system will be used to record the information about scrapped sheets. While designing the punching sheet the planning committee has the knowledge of length, width and thickness of the scrapped material coming out of the punching process. They start to enter that detail in the data tracking system and they also instruct the punching labor through route sheet to fix the appropriate scrap tag on the scrapped material. Then the scrapped material with scrapped tag is stored in the scrap inventory. If the planning committee required sheet with reduced dimensions they search the database whether they have a particular sheet in the inventory.
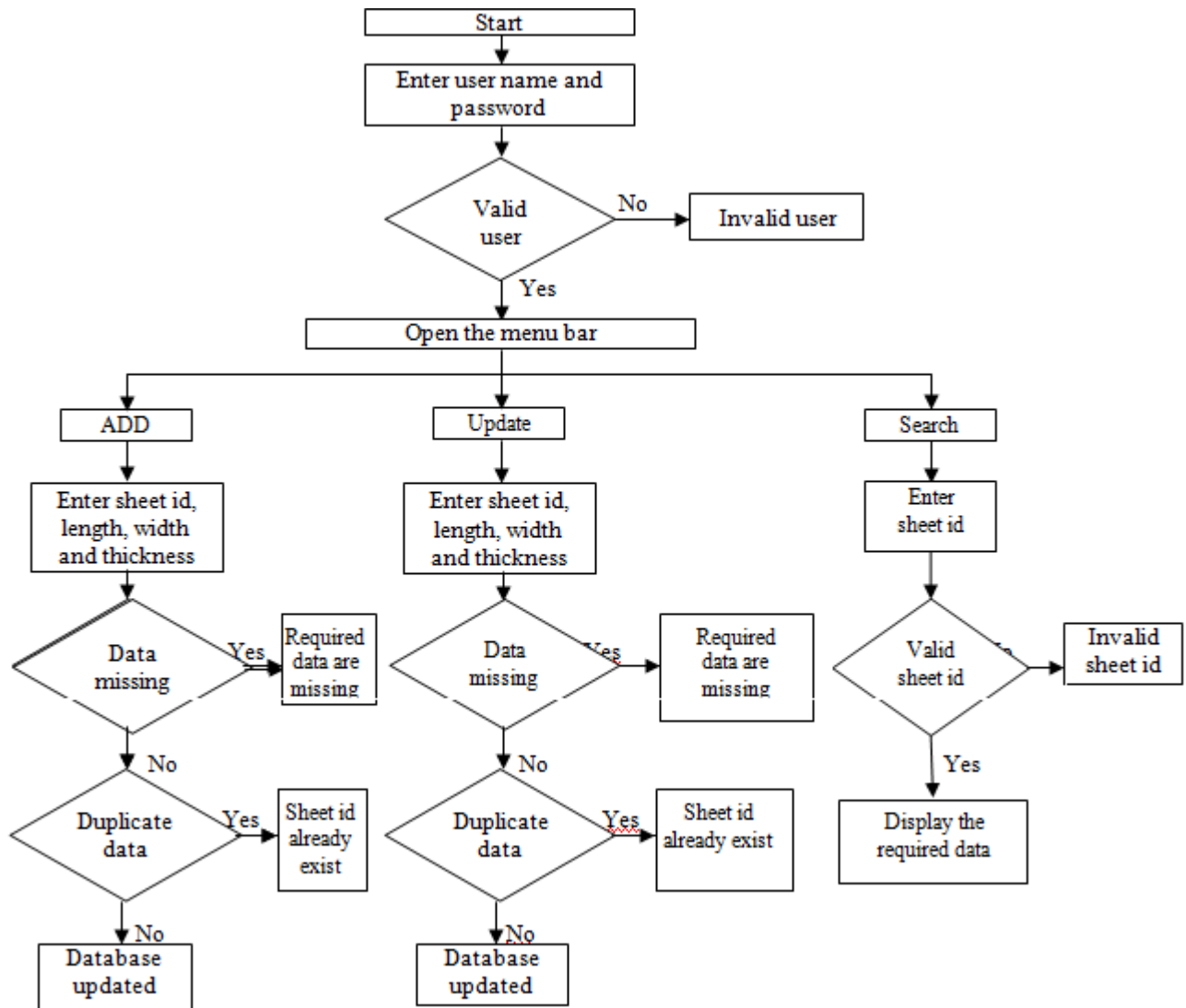
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Figure 3: Functional Architecture of application

If the sheet is available the planning committee instruct the labour to pick the by entering the sheet id in route sheet.

3.3 Need of the Scrap Management System

- To reduce the time required to track the information of particular material in the inventory.
- To locate the required material in the storage without any confusion.
- To eliminate the measurement activity to identify the dimensional information of the material.

3.4 Determination of Requirement

Scrap management application have to accomplish the following requirements

- The application should allow only authorized user to use the application.
- It should have the database in the back end to store the information about scrapped sheets.
- There should be an option in front end to add and update the database by entering the required information in the front end.

- There should be an option in the front end window to check whether the particular record is available in the database or not.
- There should be an option in front end to check current stock status of scrapped inventory.
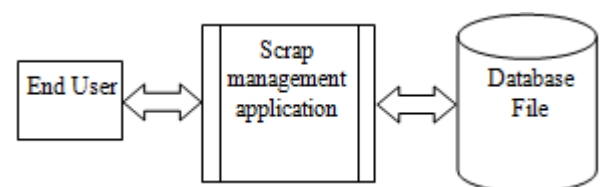
3.5 Software Architecture

Figure 4: Functional Architecture of application

The software architecture of application is shown in *fig 3*. In which application is placed in front end and database is developed and stored in back end to allocate the space to store the information entered by the end user. The flow chart of software architecture is shown in *fig 4*. Here scrap management application is front end which allow user to read and write the information. Database is lies in the back end which stores the information in appropriate place and

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helps to display the information whenever it required by the user.

3..6 Database creation

In the database one table has to be created. In the part table five fields have to be added to store the id, length, width, thickness and quantity of the sheets. Data type for all the field is set as "Short number" sheet id should not be more than six digit. So field size for Sheet id field is set as 6. For the remaining field maximum field size is set as 3. After creating the database the major step is to link the database with application. To link the database, name the database file as ivendb and store it in Local disk(D).

3.7 Model building

Microsoft visual studio 2012 is used to build the application. In that to create the GUI window Windows Form application has been used. C# program is written to make the application to function according to the requirement. The application contain 4 Windows Form module and one MDI module. MDI module is used to integrate the Add, Update and Search dialog box into the single menu bar. Whenever we try to open scrap management system initial dialog box (*fig 5*) ask the user name and password to allow only authorized user. If the user name and password is correct it will open the MDI window as shown in *fig 6*. Otherwise it will show message as "the invalid user" The non-value added activities can be either reduced or eliminated in order to reduce the overall lead time.

In the menu bar there is 6 options such as Add, Update, Search, Report, About and Logout. Each option has its own function. The program is written for each option depending upon their functional requirement. While clicking the Add button it will open the Add dialog box as shown in *fig 7*.
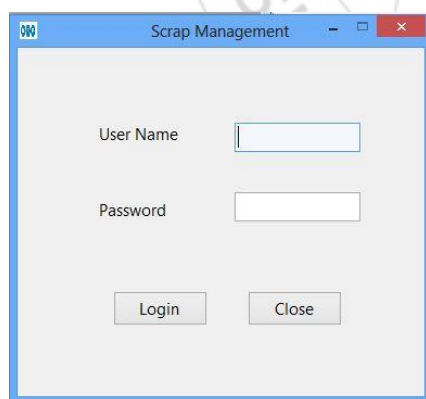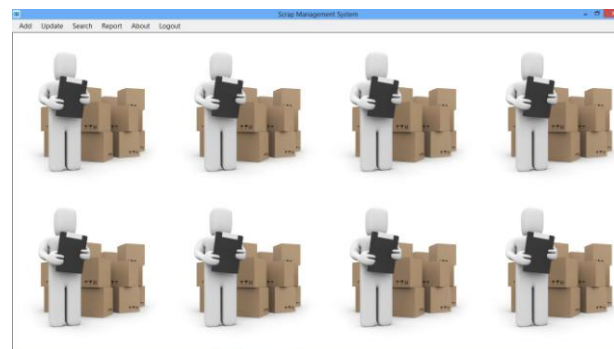

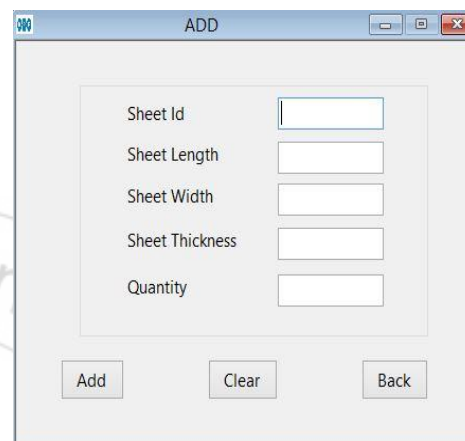**Figure 5:** Sign in dialog box

Figure 6: MDI window

Figure 7: Add dialog box

After entering the required information to store it in a database Add option have to be selected. While clicking add button initially it will check whether every text box contains appropriate information or not. If any one of the text box is not filled it will shows the error message as "Required Data are missing" Otherwise it will check whether sheet id is duplicate or not. If the sheet id is already exist in the database it will show the message as "Sheet id already exist" otherwise it will store the information entered by user as separate record in the database.

Update option (*fig 8*) is used to update the existing record with new data. Update function is same as Add function instead of storing the information as new record it will replace the data in the existing sheet id.
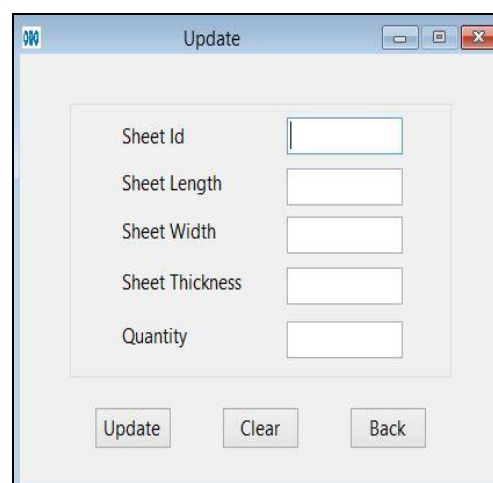

Figure 8: Update dialog box

Search option is used to ensure that whether the particular sheet id is available in the inventory or not. To search a particular information click the Search option in the menu bar and enter the appropriate sheet id in the search dialog box (*fig 9*). If the sheet id is available it will show the information of the sheet in the dialog box. Otherwise it will show the message as "Sheet id doesn't Exist"

Figure 9: Search dialog box

Report option is used to display the current stock status of scrapped sheets. While clicking the Report option from menu bar it will show the list of entire record in the database in a Stock status dialog box as shown in *fig 10*.

Figure 10: Stock staus report

About option in the menu bar is used to identify name and cureent version of the application. Logout option is used to close the MDI window and close the current user. It will not close the application instead it redirect the user to initial sign in window. In any time to close the entire application click the close button placed in the top right corner of the window.

3.8 Testing the Application

The application can be built as a distributable component by using the publish option in the Microsoft visual studio 2012. This option is used to generate the exe file of the application which could be installed in any computer for further use. After installing the application ivendb database file is placed in the Local disk(D) and the application has been tested by clicking the shortcut icon from the desktop.

4. Implementation

4.1 System Requirement

Following software should be installed before installing the scrap tracking and management system
1. Microsoft access database
2. Microsoft .NET Framework 4 client profile(x86 and x64)
3. SQL server compact 3.5 SP2
4. Windows installer 3.1
The above software package could be downloaded either from internet. The web address to download those software is given in the installation guide.

4.2 Creation of Scrap Tag

In Database sheet id is set as a primary key, so it will not allow us to enter the same id more than one time. Sheet id should be in such a way that it relate all dimensions (length, width and thickness) of the sheet. So sheet id must be in 6 digit. The first two digit represents the length of sheet. In this two digit we can represent the one decimal place. The digit 3, 4 represents the width of the sheet. Here we can represent the one decimal place. The digit 5, 6 represent the thickness of the sheet. Here we can represent the one decimal place. For example sheet id 803015 represents the sheet having length 8ft, width 3ft and thickness of 1.5mm.

5. Result and discussion

Scrap management and tracking system is development and implemented for trial run.
- Traditional manual tracking and retrieving of information is replaced with the Real time data tracking system.
- Requirement of measuring the sheet each time to identify the dimensional information is eliminated by introducing the scrap tag.
- Manual searching by labor to check the availability of particular sheet is eliminated.
- The database file containing the information of scrapped material is saved in the local disk(D) as shown in figure.

Figure 11: Database file

6. Conclusion

Scrap management application provide GUI for the user to store and retrieve the information in the database. The dimensional information of material is directly obtained

from the design drawing which eliminate the measuring activity. The sheet id is formed and labelled in each scrapped material. By reading the label operator can identify the dimensional information of any material in the inventory without taking any measurement. It also reduce the tracking time to locate the particular sheet in the inventory.

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