

Developing an Online Library for Faster Retrieval of Mold Base and Standard Parts of Injection Molding

Alan C. Lin, Ricky N. Joevan

Abstract—This paper focuses on developing a system to transfer mold base plates and standard parts faster during the stage of injection mold design. This system not only provides a way to compare the file version, but also it utilizes *Siemens NX 10* to isolate the updated information into a single executable file (.dll), and then, the file can be transferred without the need of transferring the whole file. By this way, the system can help the user to download only necessary mold base plates and standard parts, and those parts downloaded are only the updated portions.

Keywords—CAD, injection molding, mold base, data retrieval.

I. INTRODUCTION

MOLD base is a term to define the parts used to enclose the cavity for plastic injection molds. Mold base also has the role of directly installing the mold to the plastic injection molding machine. Although the components were designed and manufactured as needed, standard mold bases are becoming more and more popular and being used around the world. Standard parts are individual parts or components that are manufactured thousands or millions to the same specification. A mold base used in combination with standard parts like guide pins, guide bushes, return pins, etc. The structure of a mold base and its constituent components can be seen in Fig. 1.

The basic information about a mold base sometimes undergoes an update from the supplier. Fig. 2 shows the shapes of a standard mold base. In the current practice of mold design, there is no way to check whether the mold base files that the designer has in their personal computer are up to date or not. If the designer does the designing step using an old data, an error could occur to the new mold. For right now, the designer found that it is hard to check the mold base files if it is the latest or not every time that they need it because a mold base file consists of many parts. The steps taken today are downloading the entire data, which could be several hundred CAD files, from the server every time that they want to use it.

The main objective of this research is to develop a system that can help the user to download only necessary mold base plates and standard parts, and only the updated portions in .dll form are downloaded.

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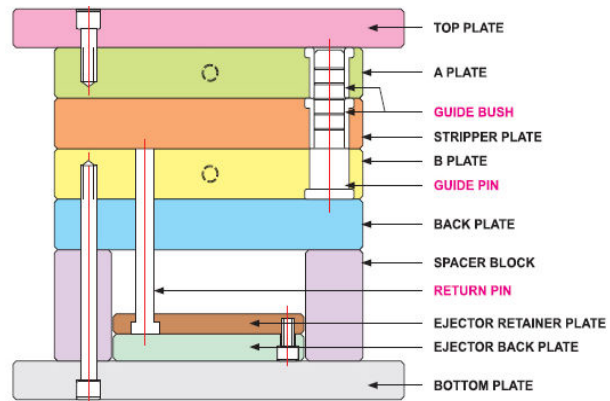


Fig. 1 The structure of a mold base and its constituent components [1]



Fig. 2 Standard mold base [2]

II. LITERATURE REVIEW

Over the past few years, the standard parts library with well-established user interface and working database architecture was successfully developed. Huang et al. [3] develop a three-tiered mold base design model with distributed database. This design is meant to reduce the expense for software building and system database renewal. On the other hand, Li et al. [4] undertake a research based on a web-based parts library system. The technologies include a web-based part data description norm on data dictionary, a feature-based neutral representation of part geometric information, and a hoops-based visualization method of part feature model. Kim et al. [5] develop a system that supports synchronous communication and manipulation of 3D part models on the web. The system has two functions that are to maintain part data in a part library, and to provide a way for users to cooperate. Wu [6] develops a standard parts management system using Pro/Toolkit, and has been successfully sorted eight common types of standard parts based on its

specifications. On the other hand, Shieh [7] develops a system using ASP.NET to build a web page and links it with the SQL database. This allows the resources to be accessed through the web browser, instead of using any Pro/ENGINEER plug-in. The latest development has been done by Hsu [8]. He develops a guiding system focusing on how to generate a preview of 3D model and the easiness of data expanding. The system can help the library administrator to add the mechanical parts data quickly.

According to the above-mentioned literature, it is known that the web-based standard parts library needs CAD software as the core and the specification data are stored in the database, and the construction of the specification data must be standardized. By far, there is no development of web-based standard parts libraries that is focusing on the data transfer method. When developing a standard parts library, the convenience of the user must be considered. The file transfer data can be a burden if not promptly treated. While the mechanical parts data are getting bigger and bigger, there is still no procedure that can be used for faster data retrieval.

III. ONLINE LIBRARY FOR FASTER DATA RETRIEVAL

There are three major things that are proposed in this study. The first one is file updater; the second is mold base and standard parts online library; and the last is data compression using Siemens NX 10 [9].

The system needs a root directory to store all of the mold base and standard parts files in the user's personal computer. Every download made using the system will be stored into the root directory.

In this study, there are two types of data that can be downloaded. The first one is the mold base original CAD data or hereinafter referred as raw data. The second one is the mold base CAD data that have been modified, or hereinafter referred as updated data.

There are two ways to download the mold base and standard parts data. The first one is automatic download using the file updater. The data that can be automatically downloaded are the raw data. For the download using the file updater, the user cannot choose the data that they wanted. The updater will download every updated data that are available in the server.

The second way is the manual download via mold base and standard parts online library. This manual download can handle both types of file, which is the raw data and the updated data. The manual download also serves as the backup plan in the case where some data are missing or corrupted. For the updated file, there is an additional step that has to be done. The file needs to be updated using the NX 10 software.

The results of these methods are the updated mold base and standard parts file in the user's personal computer. These data then can be used to design a new type of mold.

A. File Updater

The purpose of file updater is to help the user to compare the data that they already have in their personal computer with the one in the server. This program also used for downloading the data from the server automatically.

The file updater's interface is made using the windows forms application. The file updater is made as simple as possible, in this case with only two features. The first one is to open the mold base and standard parts online library. The second one is to check and download the data from the server. The mold base and standard parts data type that can be downloaded using the file updater is the raw data. The program interface can be found in Fig. 3.

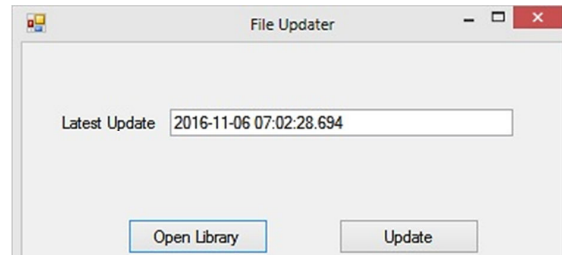


Fig. 3 File updater interface

At first, the file updater will read the latest updated time from file log.txt that exists in the root directory. This information is then relayed to the server for the further use to be compared to the date time of the mold base and standard parts files inside the database. Whenever there are new data, the file updater will automatically open a connection to the SQL database and then grab new data that are available from the database. Then, the data will be written into a file in the root directory. After every step, the date and time inside the log.txt will be replaced with the current date and time when the update is happened. If there is an error, all the process will be rolled back and stopped.

The file updater has single drawbacks. This program can handle the download only once for any data. In case of any missing or corrupted data after the download, the file updater cannot download that particular file again.

B. Mold Base and Standard Parts Online Library

The mold base and standard parts online library is created to provide a way for an injection mold designer to access the files in the database. The library also provides a way for the user to check the newest update for the files. The online library serves as a backup plan in case there is a missing or corrupted data in the user's personal computer.

The mold base and standard parts online library's interface is made using Visual Studio 2012 module ASP.NET. The ASP.NET fabricates the interface using static X(HTML) components, while the background process is handled using C# language.

The online library starts with a login page. The client can input their username and password into the form that is already provided. In the administrator page, there are three parts, i.e. the mold base, standard parts, and a tab to add picture to the web. The administrator page can be seen in Fig. 4.

Fig. 5 illustrates the interface of the mold base tab. There are three tasks that can be done, which are adding mold base vendor, adding mold base type, and adding the mold base file.

Vendor is the supplier of the mold base, while type is the category for mold base that's provided by the supplier.

Fig. 6 shows the "standard parts" tab of the administrator page. The functions are almost the same with those in the mold base tab but in this case are for adding the information for the standard parts, instead of the mold base. In the standard parts tab, there is only one function that is different from the function in mold base tab, which is adding the component.

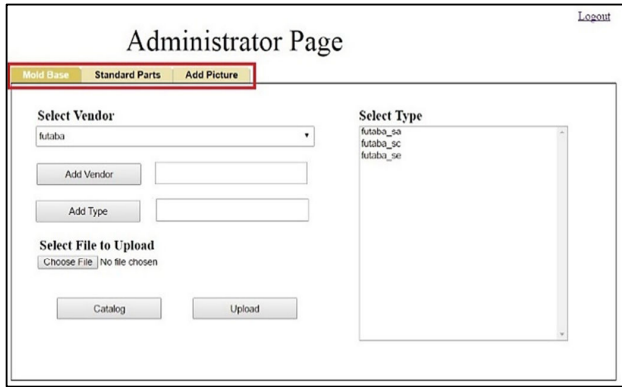


Fig. 4 Administrator page interface

The picture is used to guide the user when they look for some data, e.g. when choosing a type, the picture can help the user to decide which mold base type to select.

The next page is the mold base and standard parts catalog page. The interface of the mold base and standard parts catalog is depicted in Fig. 7. In this page, there is a notification box that contains the information about the files that were recently uploaded or updated. The notification will be posted directly to the notification box whenever the admin made an update.

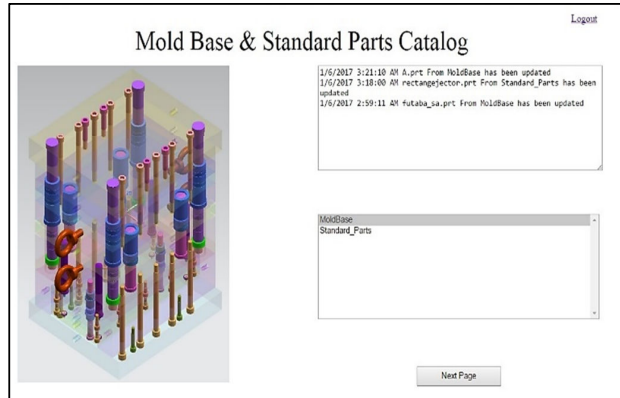


Fig. 7 Mold base and standard parts catalog

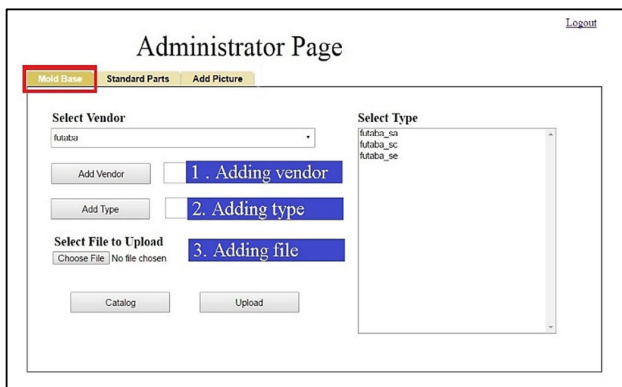


Fig. 5 Administrator page – mold base tab

The example of the notification can be seen in Fig. 8. From the image, it can be seen that there are ten parts of mold base that is updated on 6 January 2017. Using this information, the user can check the file that they have in their personal computer.

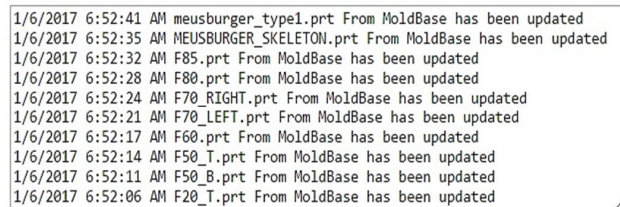


Fig. 8 Notification box

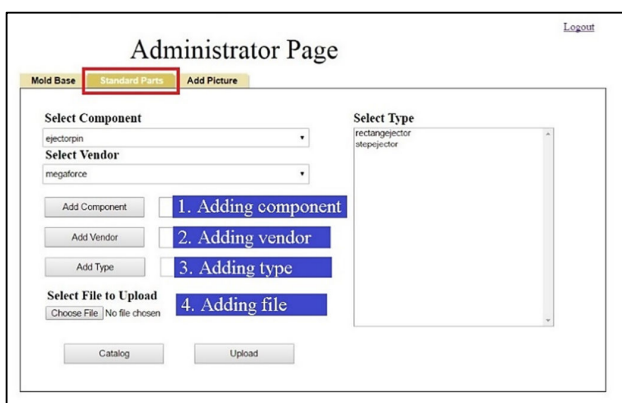


Fig. 6 Administrator page – standard parts tab

The last part of the administrator page is the "add picture" tab. This tab is providing a way to upload a picture into the web.

The user can choose between mold base catalog and standard parts catalog. If the user chooses mold base catalog, they will be directed to the supplier and type catalog directly. But, if the user chooses standard parts catalog, they will be sent into the standard parts component catalog.

The next catalog is the suppliers and types catalog. This catalog serves both mold base and standard parts. This catalog is intended to help the user to choose the supplier of the mold base or standard parts and the type that is available from the selected supplier.

The last page of the online library is the item catalog page. The item catalog is the catalog that shows the item of the selected type from the specific supplier. The page interface is shown in Fig. 9.

There will be two types of data that can be downloaded from the item catalog, which is raw data and updated data. The user

can choose between raw data and updated data according to their needs. The selected data then can be downloaded directly.

C. Data Compression Method Using NX 10

Data compression method using NX 10 is a process utilizing the NX journal tool to record every update that is made. In this case, the data are a mold base and standard parts CAD file. The purpose of the data compression here is to reduce the mold base and standard parts file size. The idea is to convert the .prt files into .dll files.

Dynamic-Link Library (.dll) is Microsoft's implementation of the shared library concept. The .dll file is the same as windows .exe file, which is portable and executable. The .dll file can contain code, data, and resources in any combination.

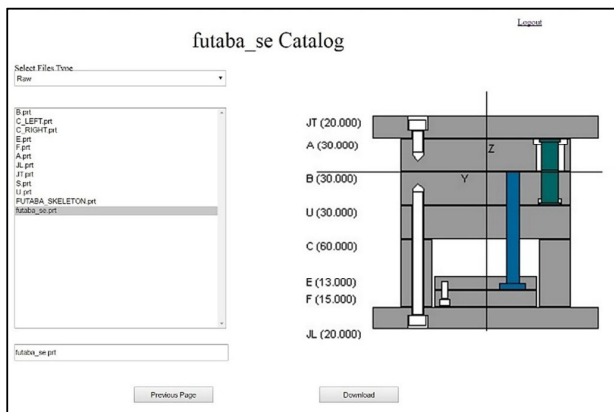


Fig. 9 Item catalog

By using a .dll, a program can be modularized into separate components. Each component can be loaded into the main component. A component is only loaded when that functionality is requested. When there is an update, the updated data are isolated to a .dll. One can just apply the update to the main component without needing to build the whole component again.

The same concept is carried for data compression. The updated information is isolated into a .dll file, that later can be applied into the main file. By this way, we can transfer only the updated information, instead of transferring the whole file.

First, open a mold base or standard parts CAD file in NX 10. After that, record the updating process by using the journal tool. The recording result is a .cs file. This file contains every step that has been done to the original CAD file. The .cs file then converted into an executable .dll file using the help of Microsoft visual studio. After being converted, the data are transferred to the user. In the user side, the only thing to do is opening the original .prt file and then executes the .dll file using NX 10.

IV. SYSTEM IMPLEMENTATION

A. File Updater Implementation

The implementation of the program is used to check whether the program can correctly choose and download the only the

data newer than the latest update. The implementation result is shown in Fig. 10. Even after the execution of the file updater for case number two, not every data is modified. This indicates that only the data newer than the latest update are being downloaded.

B. Online Library Implementation

Figs. 11 and 12 show the implementation result for online library. The notification box is automatically updated whenever the administrator uploads or updates the data in the database and the download function that is existed in the online library can be implemented successfully.

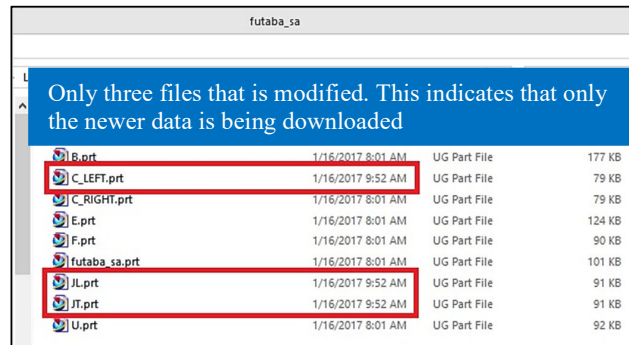


Fig. 10 Results of file updater implementation

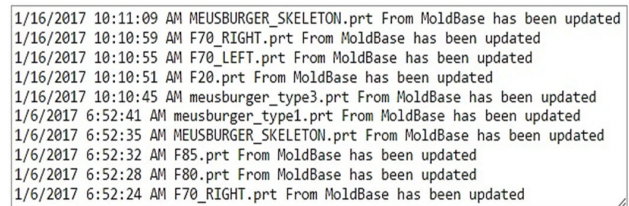


Fig. 11 Notification box of the online library

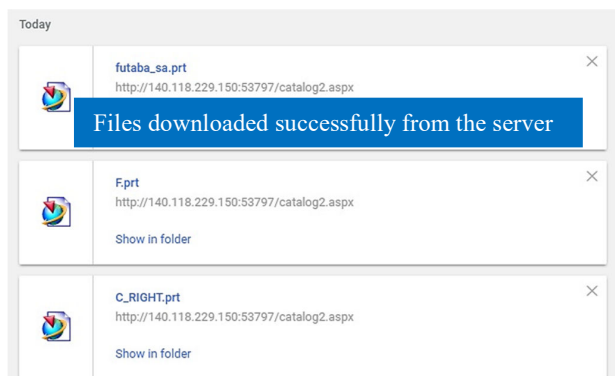


Fig. 12 Files downloaded from the online library

C. Implementation of Data Compression Method Using NX 10

For data compression using NX 10, the initial condition of the data can be seen in Fig. 13. The plate being used is the JT plate from mold base Futaba SC. Fig. 14 shows some new features that have been added to the JT plate, which are two

holes in the middle of the plate. The updated information is isolated from the main file using the journal module from NX 10. The recording result then converted into the .dll file for further being transferred into the user.

The execution got the same result when the updated information applied to the JT plate from another computer. The update still runs successfully even when the updated file has been transferred.

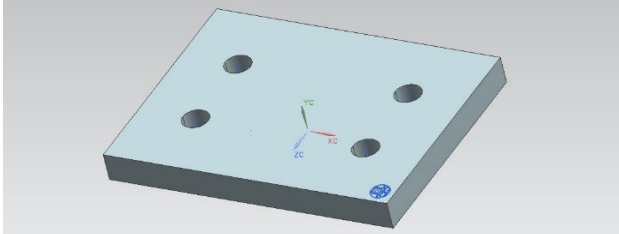


Fig. 13 Initial condition of JT plate from Futaba SC type

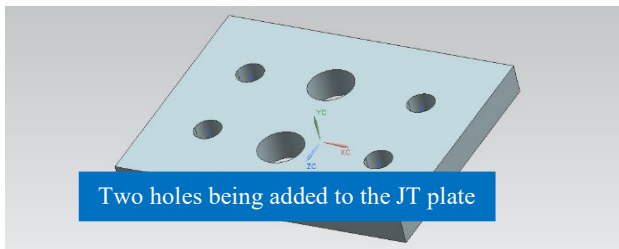


Fig. 14 Updated JT plate

V.CONCLUSION

This paper proposes three modules; namely, file updater, online library, and file compression that can be used to download only necessary mold base plates and standard parts. By using the file updater, the user can check whether a file is up to date or not and automatically download the files. The utilization of the file updater can prevent data that are already up to date to be downloaded again. By using the online library, the user can check which file is recently updated through the notification box and then select the desired files and download it. By using the file compression module, the updated information can be isolated into a single executable file and then can be transferred without the need of transferring the whole file.

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REFERENCES

- [1] <http://www.ashnaent.com/standard-mould-base.html>, Accessed on Jan. 30, 2017.
- [2] http://www.taikin.com/en/?page_id=193, Accessed on Jan. 30, 2017.
- [3] J.M. Huang, Y.T. Jou, L.C. Zhang, S.T. Wang, and C.X. Huang, "A web-based model for developing: A mold base design system", *Expert Systems with Applications*, vol. 36, no. 4, pp. 8356-8367, 2009.
- [4] Y. Li, Y. Lu, W. Liao, and Z. Lin, "Representation and share of part

feature information in web-based parts library", *Expert Systems with Applications*, vol. 31, no. 4, pp. 697-704, 2006.

- [5] Y. Kim, Y. Choi, and S.B. Yoo, "Brokering and 3D collaborative viewing of mechanical part models on the web", *International Journal of Computer Integrated Manufacturing*, vol. 14, no. 1, pp. 28-40, 2001.
- [6] M.S. Wu, *Programming and Application of Pro/Engineer Component Manager*, Master thesis, Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan, 2012.
- [7] S.Y. Shieh, *Programming and Application of Internet-based Platform of Pro/Engineer Part Library*, Master thesis, Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan, 2012.
- [8] T.W. Hsu, *Guiding System for Data Accumulation of Pro/Engineer Standard Parts Library*, Master thesis, Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan, 2016.
- [9] https://www.plm.automation.siemens.com/en_us/products/nx/about-nx-software.shtml, Accessed on Jan. 30, 2017.