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AN ABLEEDGE NODE FOR CUSTOM IN COMPUTER-INTEGRATED MANUFACTURING (CIM)

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ABSTRACT

This paper presents the design and simulation results of an intelligent interface node appropriate for use in a computer-integrated manufacturing (CIM) environment. The interface node is a major step toward resolving two of the primary problems present today in CIM applications; inadequate communications resources for handling real-time data requirements including priority interrupts, and uncertainty of data conceming conditions in the manufacturing cell served by the node. A technique is presented to reorder the order of transmission of data through the intelligent interface nodes connected to the primary data communications channel. A secondary communications channel is used for the transmission of the information necessary to implement the technique. A second technique is presented to diagnose, under conditions of uncertainty, major problems with operations in the manufacturing cell served by the intelligent interface node. This approach is based upon the MYCIN Model methodology for dealing with uncertainty, and is specially modified for a CIM environment. These were simulated for an example case study on an IBM-compatible personal computer. The results of this approach clearly demonstrate that this intelligent interface node will handle real-time data communications, responding to all of the highest priority situations, and will do so in the face of imperfect information.

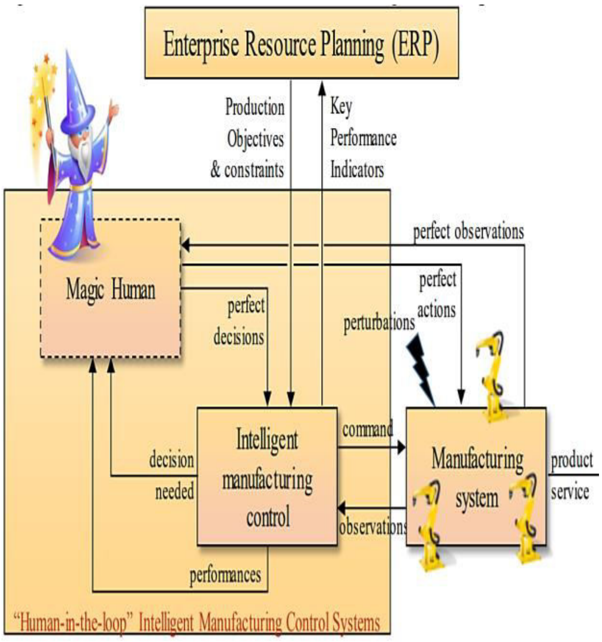
INTRODUCTION

Computer integrated manukacturing (CIM) involves all activities in the product life cycle, including product design, planning, and manufacturing. To accomplish these activities efficiently requires the utilization of diverse heterogeneous data that address the various needs of design, planning, manufacturing, and management control. Design data, generally stored and maintained in a computer-aided design (CAD) database, concentrates on the geometric and physical characteristics of the product. Planning data, usually stored in some type of material requirements planning (MRP) database, deals with resource capacity, dlocation, and scheduling aspects of the manufacturing system. Data required for shop floor level manufacturing and control are composed of programs for numerical control machines, feedback data from programmable logic controllers, and control responses from a wide variety of machines and machine centers, all of which can be found in the computer-aided manufacturing (CAM) database.

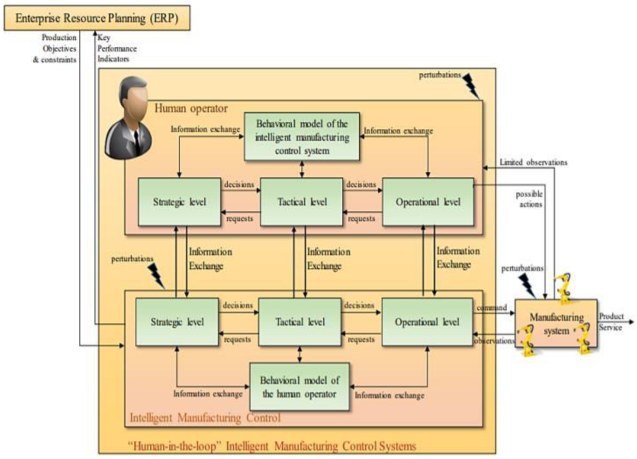
Managerial control data include the financial, accounting, and administrative control aspects of data, that are typically stored in the accounting (ACC) database. In general, CAD and CAM data are complex, local, and dynamic. Accounting data are relatively simple, general, and static. MRP data fall somewhere in between these two extremes. Furthermore, design and manufacturing data are heterogeneous, composed of graphical, textual, procedural, and mathematical data, whereas accounting data are homogeneous being composed of only text and numeric data. Again, manufacturing planning data span the two realms, that is, it is composed of both heterogeneous data and homogeneous data. Ideally, all CIM databases should be concurrently designed, built, and maintained. However, in most cases, these databases predate a firm's CIM effort and they form autonomous information islands.

There are several problems with this situation. First, due to the separation and heterogeneity of the databases, data cannot be efficiently shared among the CIM systems, hence the overall effectiveness of the manufacturing effort will be hindered. For example, in product design, information about manufacturing capabilities (located in the MRP database) and manufacturing costs (stored in the ACC database) should be made available to the CAD system. Similarly, a Bill of Materials (BOM) must be extracted from a design stored in the CAD database and passed to the MRP system, which uses it to explode the master production schedule. Second, the limited degree of data sharing that normally takes place among the databases is accomplished using manual methods. If one system requires use of data stored in other system's database, the data must be reentered and stored in the requesting system. Third, with such a process, there are data inconsistencies among the data for describing the product, the data for producing the product, the data for controlling the process, and the data for monitoring total system performance. In a word, the limited degree of data sharing, lack of data exchange, and inconsistency of information are serious drawbacks with this situation. As a result, manufacturing management is often plagued by inaccurate, untimely, or unshared data resources.

Thus, central to an integrated manufacturing system is data integration. One method to attack these problems is to develop a single, new, unified homogeneous database system to store and manage the various types of design, planning, manufacturing, and accounting data, based on a uniform data model, by discarding the existing individual functional databases of CIM. This method, of course, will generate a fully integrated system but it requires the complete redesign of both the total database system and all associated application systems. Unfortunately, the nature, scope, and characteristics differences between the administrative data needs and data requirements of engineering make it almost impossible to develop a single, completely unified database based on a single uniform data model. A second method to overcome the data isolation problem is to develop an integrated data administration system to manage heterogeneous distributed databases. This method will result in the creation of new generation of fully integrated manufacturing system, but at the cost of a total redesign of the individual databases and the reprogramming of the application systems. To build such a system will be very time consuming and costly. So far, such a fully integrated system is nonexistent.



In the architecture of the total system, the integrated interface (also called global data manager) coordinates the work of the system. It performs the mapping between the global view of data and \he underlying schema of the four individual databases, resolves the data conflicts and data inconsistencies among the four databases, and controls the transmitting of data among the KBS's. In principle, it acts as a traffic controller in directing communications among four KBS's by message passing, or procedure calling. Furthermore, as an interface, it also accepts a global query from a user in a global manipulation language, decomposes this query over the global schema into a set of subqueries over the individual databases' schema by consulting the global data dictionary to determine the data location, transfers the subqueries to the corresponding KBS for processing, receives the results from the appropriate KBS, assembles any individual results to produce the answer to the original query, and transmits the output to the user or the requesting database. The user is indifferent to the organization or location of the data. Through the integrated interface, either a user or another database can directly inquire about multidatabase data in a consistent way. The system provides the user with a uniform, integrated access to the multiple database which frees the user from the necessity of having precise knowledge of structures of the multitype databases. Thus, from the user's view, the multi databases are organized as an integrated information system.

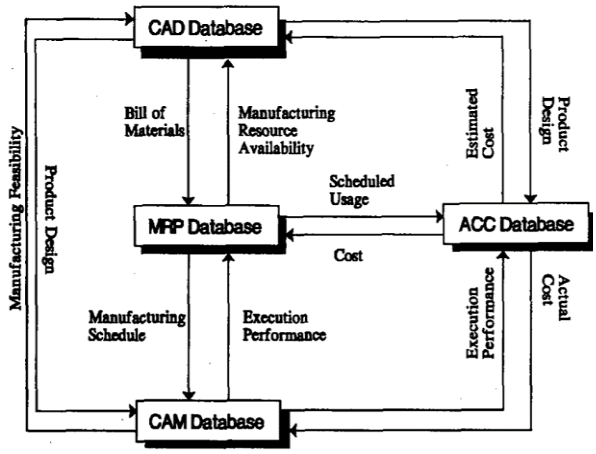


LITERATURE REVIEW

A growing number of researchers, especially in ergonomics and human engineering, are addressing the domain of industrial engineering to ensure more human-centered manufacturing control system designs. As a prerequisite, they have worked on Human-Machine Cooperation, Levels of Automation and Situation Awareness, and Human-Automation Symbiosis (May et al., 2014;

Millot, 2014; Romero, Noran, Stahre, Bernus, & Fast-Berglund, 2015). Some EU projects have also been launched to illustrate this nascent field such as SO-PC-PRO (Subject Orientation For People Centred Production) and MAN-MADE (MANufacturing through ergonoMic and safe Anthropocentric aDaptive workplacEs for context-aware factories in Europe). Other research focuses on the interaction between human operators, designers, and machines, and proposes ontological filtering systems to provide a knowledge base that supports exchanges for design and control (Lepratti, 2006; Nishitani, 1996). Interactions between human operators and machines, and between several types of machine are studied in the same way for the purposes of harmonization to achieve more efficient control of a flexible manufacturing cell (Solvang, Sziebig, & Korondi, 2012). Another approach deals with studying a human operator model that could be used to improve human-machine cooperation (Oborski, 2004). (Pires, 2005) highlights semi-autonomous aspects of industrial robotic cells. Concerning the industrial state of the art in this domain, numerous studies are underway to correctly integrate the human operator in manufacturing processes, but they are being conducted mainly at ergonomic level (Methods-time measurement MTM, etc.) and for low-level operational and efficiency-oriented decisions (e.g., lean management). Upper levels, dealing with supervision, scheduling, and control, etc., do not really apply a human-centered approach. This also holds true for IMS, as there are few full-scale real implementations in this field of research.

The interface node configuration to allow implementation of the implementation of the technique for reallocation of real-time data transfer resources and the production system for cell control (the two techniques discussed above) is shown in Figure 2. As shown in the figure, separate central processing units (CPUs) are used to implement each of the techniques. The control channel CPU has its own programmable read-only memory (PROM) for storage of the programs for the control procedures for the real-time reallocation technique, and its own random access memory (RAM) for storage of the data from the nodes on the network, discussed above, that are required for operation of the procedures for storage of the data input to the production system. The control channel CPU is linked to the main CPU of the interface node to obtain information on data transfer requirements. It is also linked to the MAP token bus interface to allow updating of the NS as the token-passing sequence is reordered. In addition, the control channel CPU has its own interface to the control channel through the CSMNCD interface and the control channel modem. A separate CPU is also used to implement the production system required for the technique for handling uncertainty. This CPU also has its own PROM for storage of the programs for the production system, and its own RAM for storage of the programs for the production rules. The cell control CPU is linked to the main CPU of the interface node to obtain the required data for the production system. This parallel architecture allows for speed and efficiency in the implementation of the techniques by providing separate, dedicated processors and peripherals.



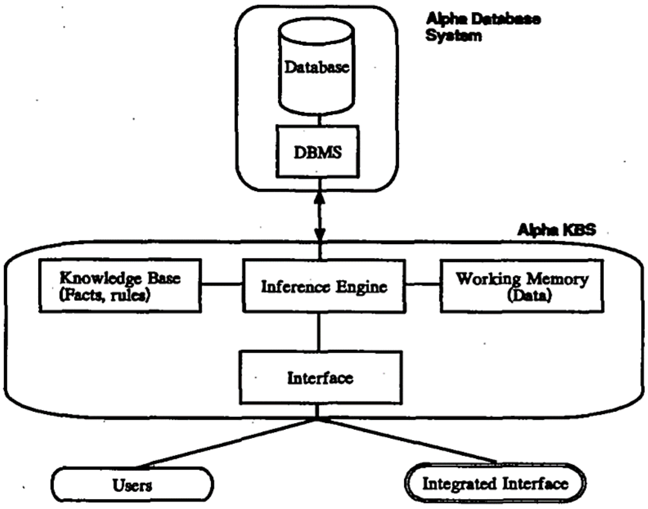
METHODOLOGY

α-KBS

Using the ideas previously presented, each KBS has the same general design. The α -KBS is composed of four major components: knowledge base (KB), working memory, inference engine, and userfriendly interface (see Fig. 3). The knowledge base is the kernel of the a-KBS, which contains facts, rules, and expert information in the specific knowledge of the problem domain. The knowledge base in the proposed a-KBS is primarily composed of following types of knowledge:

1. knowledge about the domain to which data in the a database is related;
2. knowledge about the conceptual data model and logical structure of the cy database;
3. knowledge about accessibility of the data (related to the specific DBMS used for the management of the a database);
4. knowledge about how to adjust the a database to fit the changes of the environment; and
5. Knowledge about understanding queries from users or the other databases.

Knowledge type 1) is concerned with a specific domain and is used to interpret the meanings of the data in the database. This type of knowledge can be extracted from the data dictionary of the database or it can be acquired from the domain experts and users. Knowledge type 2) can be stored in the knowledge base after the conceptual model and data structure of database are analyzed. This type of knowledge is mainly used to express relationships among the entities and relations among the data elements. Knowledge type 3) involves the specific DBMS used for managing the database. It contains rules for generating target database query language. Knowledge type 4) is associated with the changes of the environment and it is a set of rules used to adjust the database to fit such changes, i.e., to modify the conceptual model and/or the data structure. Knowledge type 5) expresses the syntax and semantic meanings of various queries.



CONCLUSION

The intelligent interface node presented in this paper consists of a knowledge-based expert system integrated with an interface node designed for use in CIM applications. The design effectively addresses the two major problem areas critical to interfacing subsystems in a CIM distributed information system, and which present interface nodes do not address. The node performs reallocation of communications resources to satisfy real-time data transfer requirements enhancing MAP network performance to handle time-critical functions. It also effectively handles uncertainty in the area of diagnostics in CIM implementations. Areas of possible future research lie in the development of procedures to develop values for perishability and priority of data for use by the node in the reallocation algorithm, simulation of sensors and the development of a preprocessor for the generation of evidence instances from those sensors' readings, the development of procedures for estimating certainty factors of evidence instances, and the development of standard modules to allow piecing together typical manufacturing cells.

REFERENCES

[1] Barghi, Hamid, Bredeson, Jon G., and Cronenwett, William. "Throughput and Delay Analysis for a New Efficient CSMA/CD Based Protocol," Proceedings from the Twenty-Second Southeastern Symposium on System Theory, March 11-13,1990, pg 209.

[2] Chien, Jade Y. "Detailed Tests Show How Well Industrial Local Network Performs," Data Communications, vol 14, no 9, August 1985, pg 119.

[3] Satyanarayana, P. and Subramanyam Pavuluri, D.A., 2013. PARAMETRIC MODELING AND DYNAMIC CHARACTERIZATION FOR STATIC STRENGTH OF STEAM TURBINE MOVING BLADES. International Journal of Innovative Research in Science, Engineering and Technology, 2(7).

[4] PAVULURI, S. and KUMAR, D.A.S., 2013. „‟ Experimental Investigation On Design Of High Pressure Steam Turbine Blade““. International Journal of Innovative Research in Science, Engineering and Technology, 2(5), pp.1469-1476.

[5] Sreenivas, P., Kumar, A.S. and Subramanyam Pavuluri, D.A., 2013. Investigations on transient dynamic response of functionally graded materials. a a, 1, p.2.

[6] Pavuluri, S., Rajashekar, B. and Damodhar, B., Process of Press Tool Design and its Manufacturing for Blanking Operation.

[7] KUMAR, S.S. and SUBRAMANYAM, P., DESIGN AND WEIGHT OPTIMIZATION OF OIL PAN BY FE ANALYSIS.

[8] PAVULURI, S. and KUMAR, D.A.S., 2013. „‟ Experimental Investigation On Design Of High Pressure Steam Turbine Blade““. International Journal of Innovative Research in Science, Engineering and Technology, 2(5), pp.1469-1476.

[9] V. Kirshnamurthy, Y.W. Su, and H. Lam, “IMDAS-An integrated manufacturing data administration system,” Data Knowledge Eng., vol. 3, no. 4, pp. 109-131, 1988.

[10] J. F. Korsh and L. L. Garrett, Data Structures, Algorithms, and Program Style Using C. Boston, MA: PWS-KENT, 1988.

[11] F. Manola and M.L. Brodie, “On knowledge-based systems architectures,” in OnKnowledgeBase

ManagementSystems, M. L. Brodie and J. Mylopoulos, Eds. Berlin, Germany: Springer-Verlag, 1986, pp. 35-54.

[12] D. A. Marchand, "Strategic information management: Challenges and issues in the CIM environment," in Expert Systems and Intelligent Manufacturing, M. Oliff, Ed.

[13] A. D. Meyer, "The integration of manufacturing information systems," in Proc. 1988 Int. Conf Comput. Integrated Manufacturing, Troy, NY, May 27-29, 1988, IEEE Computer Society, 1988, pp. 247-259.

[14] T. Sellis, N. Roussopoulos, L. Mark, and C. Faloutsos, "Expert database systems: Efficient support for engineering environments," Data Knowledge Ena., vol. 3, no. 4. DO. 71-85, 1988.