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A collaborative framework for social media aware manufacturing

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Abstract

The growing use of internet could make product manufacturing a collaborative and collective process. Social media provide the opportunity to many businesses to optimize the manufacturing process, by taking into consideration the needs, the background and the experiences of a wider external audience. The paper proposes a framework using social media combined with a Live Streaming process, in order to optimize: (a) the design process (CAD) of a product, using the opinions of potential customers and (b) the manufacturing process (CAM) of a product, and more specifically the selection of cutting conditions, using the experience of other external expert technicians.

Keywords: CAD/CAM; Social media; Design; Live streaming

1. Introduction

In their effort to become more competitive, enterprises promote their products with advanced marketing methods. The improvement of their products and services can then be tailored to the clients and markets trends. The more information an enterprise possesses, the better success they can expect for their upcoming products. The volume of this information and the need for analytics in the last decade has shown exponential increase, primarily due to the universal adoption of Internet and the social media booming. Latest improvements in technology provide many useful tools for the productive management of this information [1–4].

Social media depend on mobile and Web-based technologies to offer highly interactive platforms through which individuals and communities share, co-create, discuss, and modify user-generated content [5]. In addition with the social network in working environment, cloud-based design and manufacturing (CBDM) has recently been proposed [6–9].

In contrast to television and radio broadcasting, Internet drastically changes the role of users who can be updated but also interactively communicate and express opinions on various internet platforms which utilize social media [10–13].

Enterprises of today should adapt to this new reality and strengthen their competitiveness by a more dynamic inclusion of consumers to the production processes.

This work sets the principles and identifies the processes which can leverage the collection and use of information and opinions from external audience (consumers and technicians) towards evaluating and influencing the production processes. In this context, two stages of the manufacturing process are prioritized: (a) the *design process* (CAD), at which the opinions and views of the consumers will be requested via a social network, and (b) the *process planning* and more specifically the *selection of cutting conditions* (CAM), at which the opinions and the experiences of external experts will be considered as expressed in a social media live streaming process. Both of these stages are managed by the respective enterprise moderator.

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2. An open and interactive product manufacturing framework

The creation of a product follows several stages from the concept of the idea until the final production. These stages involve between others: (a) the CAD process, where the design of the product is conducted, and (b) the process planning of the product, in which for each machining operation, the proper cutting conditions are selected. This work proposes the inclusion of a new phase to the typical product manufacturing procedure. This new phase exploits the live-streaming practice in the design and manufacturing of a new product.

2.1. The live-streaming process in manufacturing

Live-streaming [14,15] capability has largely impacted the popularity of many Internet based broadcasts, due to its simplicity and usefulness for both the transmitters and the receivers.

In a live-streaming setting, the choice of receivers varies from any Internet user to a specific expert user who might be selected by a transmitter in a closed network (Fig. 1).

In a production process scenario, the content of the transmission will be the product's characteristics, and the goal for the visitors to have the capability to form their opinion and contribute actively in the formation and modification of the product in various ways. For CAD/CAM this last operation is particularly important, since it provides any interested user with the capability of step-by-step observance of the design of a product. This new element gives a new character to the design and manufacturing process, since the interested parties – consumers, technicians and the enterprise – can interactively have a say in the product's decision making process. In our proposal the choice of non-conventional architectures depends on the content and its bandwidth requirements. The paper proposes utilizing a CDN which serve content to its users by meeting high availability and high performance requirements. The broadcasted content transmission will be made available on a chosen CDN. It is up to the company to either contact a CDN or create their own live-streaming server, depending on the broadcasting requirements and the company's servers capacity.

2.2. The collaborative processes in detail

The live-streaming process functions as follows: the transmitter (an enterprise's moderator) selects which part of its screen – thus what data – will transmit on the internet. The use of a dual monitor is practical, because one monitor can be used to run the CAD/CAM software and the other to show through the chat box the ideas and comments in a form of a dialogue (Fig. 2). The chatting process has been chosen since it offers immediate users interaction and users are quite familiar in exchanging messages in a fast manner. With the use of a chat box, there is a plethora of ways for the public to contribute to the formulation of the product. The visitors in this process can be either consumers for the CAD stage or external experts for the CAM stage.

A basic procedure of operation would be the following: (a) during the *design stage*, the company's designer is managing the conversation by asking opinions and reading the

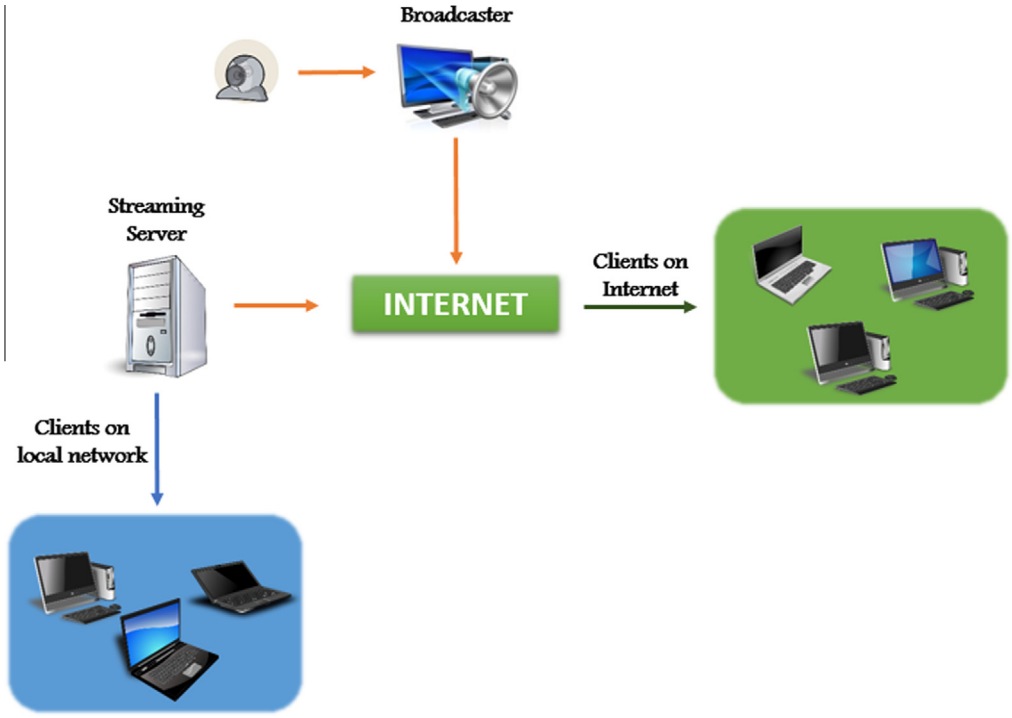

Fig. 1. A typical live-streaming process flow.

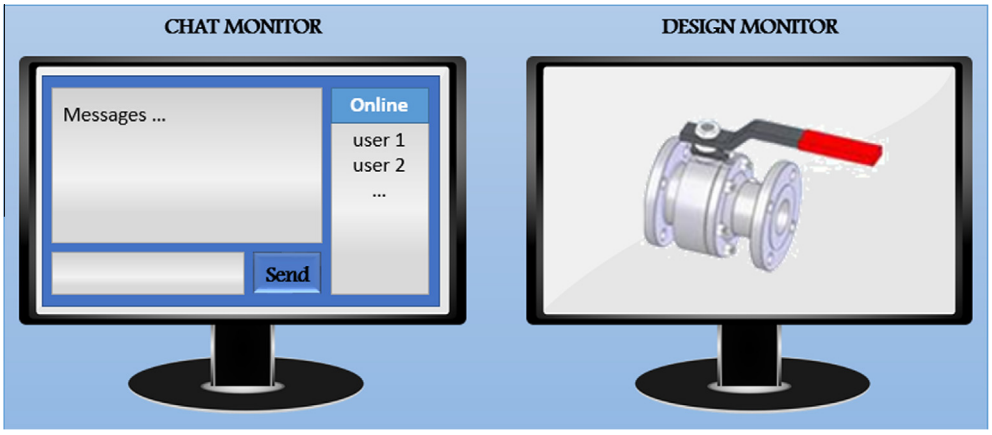

Fig. 2. Dual monitor technique as described in the text.

innovative views. Equally important is the fact that there is a possibility of immediate answer to the comments of the consumers and in this way the whole procedure acquires an interactive character, an element particularly important for the attraction of public interest, (b) during the *process planning* of a workpiece, the company's user managing the conversation with other machinists. He must select the proper set of cutting conditions (feed, cutting speed and depth of cut), for each machining operation. He will use his experience, having in mind that it is important to minimize the manufacturing cost, while increasing productivity. The goal is to produce quality products that are produced with the minimum cost at a high production rate. The difficulty to this is that selecting high cutting speed increases productivity, but reduces tool life, therefore increases also the production cost. Hence it is essential to optimize the selection of cutting conditions. It is crucial therefore to use the experiences of other machinists.

3. Exploitation of collaborative manufacturing

There are two possibilities relating to the content which can be either private or it can be available to anyone interested. In the private mode a member subscription will be needed. Another addition that enterprises can include is the creation of a chat room per user level.

Visitors through a chat box have the possibility to contribute to the formulation of a product. There is a filter possibility of the chat box from the moderators, who are people designated by the enterprise and have as a role the correct operation and flow of the discussion.

In case of mass transmission and large number of users, the moderators can use proper filtering algorithms. The content of the discussion constitutes a source of information and further analysis will be feasible from the corresponding analytics department of the enterprise, for future products and advertisement campaigns.

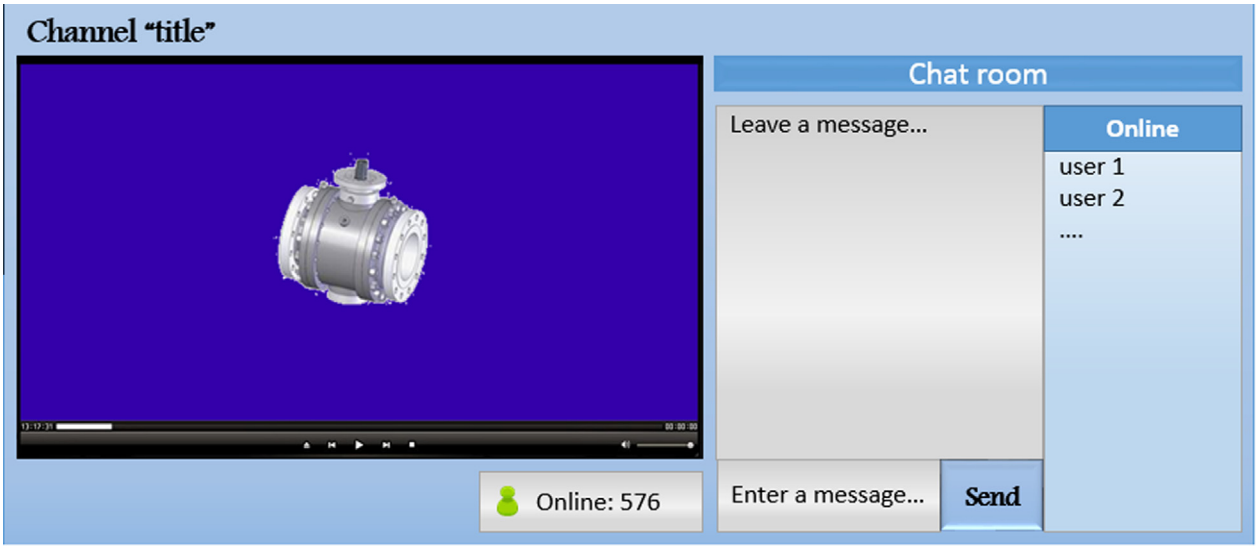

Fig. 3. Interface of the website.

It is very easy to determine the number of viewers, their age, their sex, even their social class or hobbies. All the above information is included in social media and can be exploited. Such information is very important and part of marketing, as each product aims to specific population groups and the information received by the corresponding group each time plays a decisive role in the formation of the prototype product.

The constitution of a network is feasible, which will exclusively refer to the design of products and will be accessible and useful to any internet user, without the need of design knowledge or some scientific background. In the case that this will be materialized with a website, the classification of each product category can be done with the following way as shown on Fig. 3.

4. Conclusion

Online chatting can improve manufacturing, by giving the opportunity to exchange ideas, opinions and experiences between a practically unlimited number of people related with a specific product. Other social media (such as Facebook, twitter) have not been initially chosen since their orientation is on either distributing content and networking or on exposing posts, so they're not prioritized for the collaborative manufacturing but in the future such a potential will be considered.

This work has focused on opening and enhancing the design and manufacturing process. This will be realized by involving consumers and external experts in collaboration with the enterprise moderators. Thus, the manufacturing procedure becomes an active and dynamic process. By using the proposed framework at (a) the design process, the company is in position to receive some of the first reactions from the consumers before initiating the production process, (b) the manufacturing process, the company may take advantage of the experience of a practically unlimited number of experts machinists.

The novelty of the proposed framework is in its openness, its freely distributed availability and its community inclusion at the different stages from designing to manufacturing. The advantages are the involvement of live-streaming in a free, user-friendly and simple process. There are two main issues regarding copyrights. The first one has to do with the live streaming process itself which can be secured by acquiring a Creative Commons license. The second copyright issue has to do with the content of the broadcast. No company wishes to have their design copied before it is law ensured and have their idea stolen, thus enterprises need to invest some research in which features of the upcoming product will be shown.

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