Response to Reviewers

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Title: A smart algorithm for personalizing the workstation in the assembly process
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Dear Reviewer,

Thanks very much for taking your time to review this article. I really appreciate all your comments and suggestions! Please find my itemized responses in below and my revisions/corrections in the re-submitted files (using “Track Changes” function).

Thanks again!

Comments and a summary of the revision

The authors refer to the 4M approach. It would be logical to more clearly structure the problems for these traditional jobs’ classification "Machine, tools and labor ". And, accordingly, for the tasks that the described intelligent system solves.
As suggested, we describe our motivation for paper, initial problem and causes for the problem in form of Ishikawa diagram or as 4M method (figure below). So the problem is inappropriate assembly workstation (traditional one), which can`t handle the rapid changes on the market, customization of the product and constant (re)configurability of workplace. In the brainstorming process with the constant question asked “Why does this happen?” we came to influential parameters and its dependences as shown on fig. 2 in the article. As the result of the problem of not appropriate workstation, we propose our newly developed smart assembly system described in article.

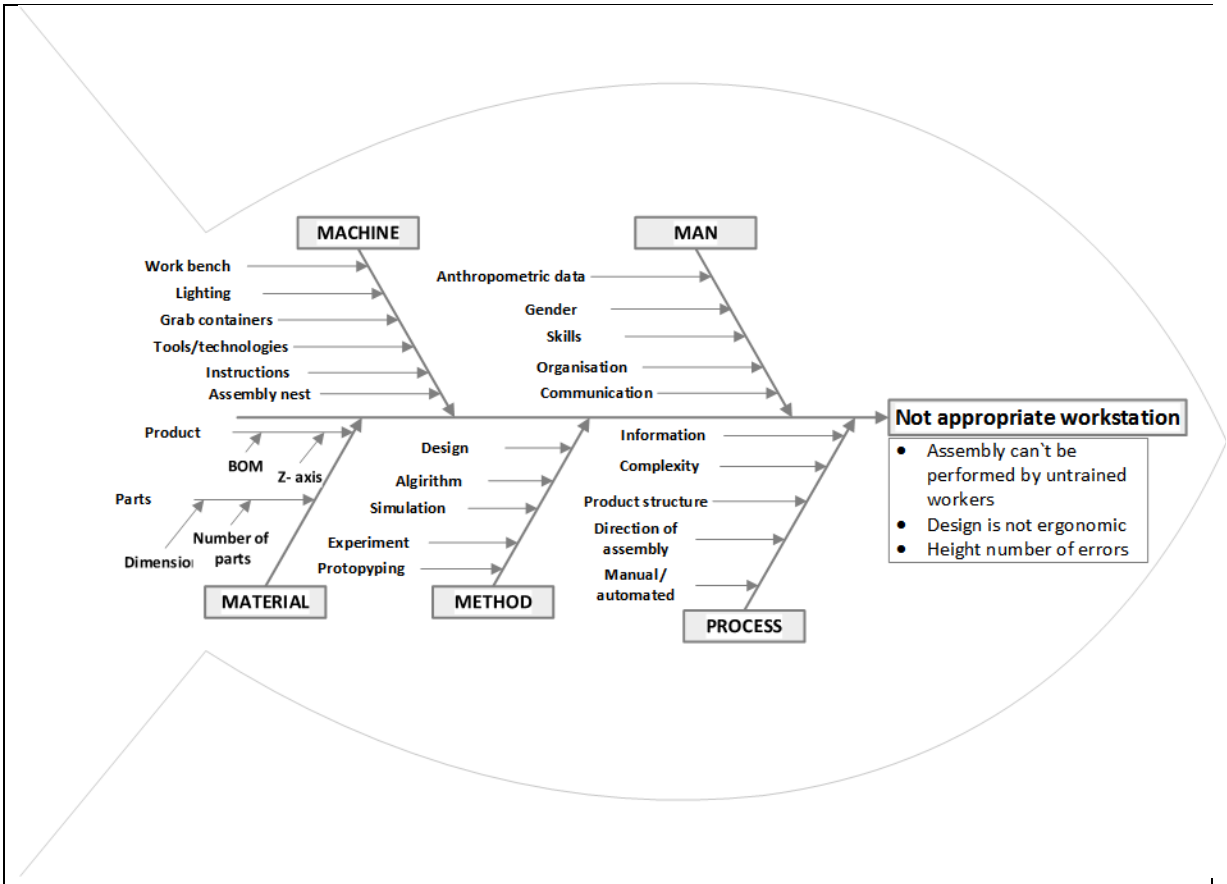


Fig.: Ishikawa diagram of causes for the problem described as not appropriate workstation.

The Authors write that 40 people of different categories took part in the experiment (by age, gender, and anthropological data), but it is not clear what errors are typical for each of these categories in the traditional workplace?
Here, we did not specifically perform an error analysis dividing workers by gender, age, and anthropometric data. With the experiment we tried to get as close as possible to the situation in the industry, where time standards/norms, permissible number of errors and the procedure of performing assembly are known in advance, without taking into account the characteristics of workers. In our case, when performing the experiment, we tried to select a sample of people that can be compared to the real industrial environment. Our focus was also to determine whether it is possible to performed assembly sequence by untrained workers, regardless of gender, age or anthropometric characteristics, which we also showed through analyzes (shortening of assembly time, minimizing errors). This explanation was also added to the article (row 364).
The approaches of the authors is certainly interesting and relevant. The authors cite to the researchers who have contributed to the development of intelligent systems. But it is not clear from the article whether there are practical analogues of this intelligent algorithm?
Thank you, this is a very interesting question. To the best of our knowledge, no previous studies has reporter practical analogues of that kind of intelligent algorithm. As for our system (manual assembly workstation controlled by smart algorithm) the practical examination and implementation have not yet been made. But, of course those studies are important for improvement of society, work ethic, workers` health and safety, and nevertheless for economic benefits for the company. These are the reasons that indicate the need to implement a smart system as we proposed in the industrial environment, which is also our intention in the future

What do the cost of installing jobs of the intelligent systems? How much do the costs of implementing smart systems exceed the costs caused by a build failure?
The cost can be divided on hardware and software. The cost of hardware is approximately 8.000 €, AR glasses included. The cost of software is hard to evaluate. It includes LPM software for digital instructions and smart algorithm. And each software need updates for better performance and for adding new workers and products. So we can conclude that hole smart system with support costs about 50.000€. Maybe it sounds a lot, but this system not only compensates for losses due to products wastes, but also prevents work-related illnesses and injuries, leading to large savings in the long run. After all, people are healthier, they work more efficiently and have fewer absences from work and fewer sick pays. On the other hand, the smart manual workstations is suitable for all type of workers (age, gender, qualifications) – the company has easier job to find proper worker. Based on the results of time analysis and number of errors we can estimate payback period at several years.