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Virtual Reality Training in Smart Factory: A Perspective View

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ABSTRACT

The paper presents a model Virtual Reality framework for learning of activity in a clever industrial facility, working as per the idea of Industry 4.0. The Smart Factory lab—illustration of some portion of savvy processing plant—is depicted. The VR model framework and cycle of its structure is additionally introduced, beginning from digitalization of the genuine brilliant plant, through rationale programming also, association of fringe VR gadgets. Elements of the preparation framework are introduced, alongside bearings of future investigations and advancement.

KEYWORDS: *Industry 4.0, Smart factory, Virtual reality training system*

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I. INTRODUCTION

The brilliant city idea is as yet in transition and subject to discuss. Meanings of brilliant urban areas fluctuate across OECD nations and establishments as indicated by the international setting and to the particular issues within reach. In any case, as a rule, keen urban communities rotate around drives that utilization advanced development to make metropolitan help conveyance more productive and in this manner increment the general intensity of a local area. While advanced development stays vital to the savvy city idea, a key inquiry is whether interest in brilliant advances and computerized advancements eventually add to work on the prosperity of residents. A human-driven methodology is viewed as key to make a city more astute. This is the reason the OECD characterizes shrewd urban communities as "drives or approaches that adequately influence digitalization to support resident prosperity and convey more effective, feasible and comprehensive metropolitan administrations and conditions as a feature of a synergistic, multi-partner measure".

II. PREVIOUS WORK

There are a couple of papers which have been considered and insinuated on my work.

The article presents the results of research on the impact of virtual reality on the effectiveness of training employees performing production tasks. The research was carried out in the Smart Factory laboratory, which is a model of a smart factory functioning in accordance with the concept of Industry 4.0. A prototype VR system and its building process were presented, starting with the digitization of the laboratory, through logical programming and connecting peripheral devices. The subject, scope and plan of conducting comparative studies of operator training at both real production stations and in a virtual environment were presented. As a criterion for comparing the results achieved by individual groups subject to the study, the following were adopted: the time to complete the production task and the number of non-compliant products achieved in real conditions. (PrzemysławZawadzki, Krzysztof Żywicki ,PawełBuń And FilipGórsk; 2020)

Increasingly, the smart city space is requiring a reconceptualization of forms and factors of production, including factories and their place in the smart city space. Factories have always been a part of the city and many people spend a significant part of their lives there. Cities and factories share the same physical space and draw from the same resources, such as the energy grid, communication networks, public utilities, social connections, etc. Factories and cities should share the same IoT network in order to maximize their synergy level. In this view, as ICT-enhanced solutions are being implemented and so the concept of the smart city becomes a reality, it is mandatory that the connection between the smart city and the smart factory is examined. This paper represents the first step in this direction. We are presenting a new smart way to lighten the workload for employees (especially those involved in assembly, setup and maintenance) and increase factory efficiency. We have developed a brand-new smart solution for designing and presenting work instructions. The solution can be easily adapted to use in other fields like healthcare or smart-homes. This paper presents a comparison of different types of virtual/augmented and conventional assembly instructions. Today, we face the challenge of a lack of skilled employees and a high rate of employee turnover. Both result in huge time and production losses, because new employees have to be taught simple assembly tasks over and over again. In addition, as companies begin hiring many more foreign workers who do not understand the local language, the challenge of teaching becomes even more acute. Despite this, in modern production systems we can still find ineffective and complicated books and manuals with assembly, service and measurement instructions. We have prepared several variants for non-trivial multistep assembly instructions: traditional ‘‘paper’’ instructions, video instructions, virtual instructions on screen (with/without in-situ projection and with/without a special controller). We have developed our own software system for working with and developing virtual assembly instructions. In this case the in-situ augmentation is a projection on to different parts of the workplace. 60 subjects were tested over two years in order to gather the learning curve for each of 5 types of instructions using virtual and augmented reality. We have proven that using any type other than ‘‘paper’’ will shorten the learning time by approximately half. Practitioner summary: We have prepared and tested variants for non-trivial multi-step assembly instructions. 60 subjects were tested over two years in order to gather the learning curve for all 5 types of instructions – traditional paper, video instructions, virtual instructions and two types of virtual instructions combined with augmented reality in-situ projection. We have proven that using any type other than ‘‘paper’’ will shorten the learning time by approximately half. (Peter Hořejší and Michal Šimon; 2020)

This document presents the development of the proposal for the virtual headquarters of the Universidad de lasFuerzas Armadas ESPE – SedeLatacunga, highlighting the reconstruction of the university's 3D model using photometry techniques, CAD modeling and rendering optimization to achieve a photorealistic graphic level represented by reality virtual and interacting with the objects that make up the laboratories recreated virtually for the teaching of PID controllers and the formation of industrial control concepts. (Jessica S. Ortiz, Bryan S. Guevara, Edison G. Espinosa and Víctor H. Andaluz; 2020)

Small series production with a high level of variability is not suitable for full automation. So, a manual assembly process must be used, which can be improved by cooperative robots and assisted by augmented reality devices. The assisted assembly process needs reliable object recognition implementation. Currently used technologies with markers do not work reliably with objects without distinctive texture, for example, screws, nuts, and washers (single colored parts). The methodology presented in the paper introduces a new approach to object detection using deep learning networks trained remotely by 3D virtual models. Remote web application generates training input datasets from virtual 3D models. This new approach was evaluated by two different neural network models (Faster RCNN Inception v2 with SSD, MobileNet V2 with SSD). The main advantage of this approach is the very fast preparation of the 2D sample training dataset from virtual 3D models. The whole process can run in Cloud. The experiments were conducted with standard parts (nuts, screws, washers) and the recognition precision achieved was comparable with training by real samples. The learned models were tested by two different embedded devices with an Android operating system: Virtual Reality (VR) glasses, Cardboard (Samsung S7), and Augmented Reality (AR) smart glasses (Epson Moverio M350). The recognition processing delays of the learned models running in embedded devices based on an ARM processor and standard x86 processing unit were also tested for performance comparison. (KamilŽidek; 2019)

III. SMART FACTORY SETUP

The creation framework, which is a gear of a Smart Factory lab at Poznan College of Technology, comprises in a robotized creation line. It comprises of four moving circles, by which there are creation stands. Transport of items is realized by little beds, which can be coordinated to any creation stand. Their computerized ID in the framework is acknowledged with utilization of the RFID innovation. The entirety creation framework is constrained by a creator made PC program, named Factory. Construction of the framework is introduced in Fig. 1.

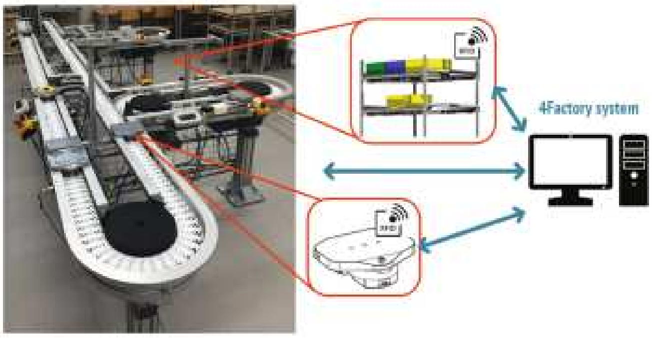

Fig 1 Structure of the Smart Factory system

The 4Factory system is built out of modules dedicated for supervision of material flow and control of work of a production line. The system contains the following modules:

1. Resources—information about resources of a production system.
2. Indexes—characteristics of products and their components,
3. Orders—data of orders for ready products,
4. Technology—definition of processes,
5. Production planning—tasks related to setting course of production orders in a production schedule,
6. Production control—controlling and analyzing realization of the production flow,
7. Magazine—tasks related to material traffic in magazines of resources and ready products.

IV. CONCLUSION

The constructed model VR framework was ready to acknowledge fundamental preparing of representatives/administrators of a creation framework working as indicated by the Industry 4.0 idea. Elements of creation changes in a shrewd industrial facility, because of status of manufacturing modified items, is presently extremely high. An individual is still vital in the creation cycle that is the reason so much relies upon his arrangement and preparing. The proposed arrangement, utilizing the VR innovations, appears to be a decent method of preparing the representatives, as there is a capability of its full combination with a genuine creation framework what's more, the expenses are for the most part low. The fundamental commitment of the introduced paper is loyal portrayal of a genuine sequential construction system understanding the shrewd processing plant idea, agreeing to the Industry 4.0 thought.

Further work on the framework will contain further developing cooperation systems, in request to acquire higher authenticity by empowering clients to perform explicit developments during the gathering system, preparing their perception capacities, yet in addition manual abilities. The idea will be approved with interest of people, who work the Smart Factory creation line consistently (the framework has been at present tried as it were in an extremely essential manner by the creators). It will be important to play out a similar examination of customary instruction strategies with the new framework, to assess adequacy of the proposed arrangement.

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