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A REVIEW: HUMAN MODELS IN AN INDUSTRIAL APPLICATIONS

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Abstract
Human models are currently being used in a wide field of industrial and scientific applications. It is very important for especially industrial applications. There are mainly two types of direction, i.e. physical direction modeling and cognitive direction modeling. A short survey about the above-mentioned modeling methods is presented in this paper. And takes a closer look at a special overview approach and an overview is given of the main developments in recent years as per the requirement of an industry as well as for fast growth and development of an industry. These models have been developed consisting of many human aspects.

Keywords:
Human model, modeling behavior, industrial application, and design.

I. Introduction

Human models are developed to evaluate and optimize socio-technical aspects of production systems. Human models specially are used to adapt workplaces or productions to human requirements. This paper provides an overview of human modeling techniques and their applications in the present and in the future [02]. In an industrial application, human model technology is efficiently and transparently implemented regarding human control expertise. Human models are provided with set values based on the process control expertise for controllers put in its methods [26].
This leads to the process of defining (i) The type of the needed model, and (ii) the model characteristics

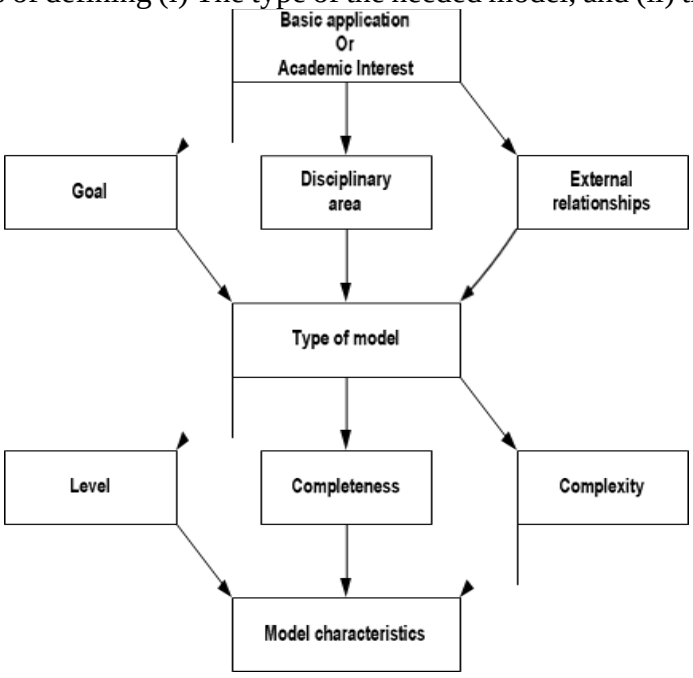

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Figure 1: Initial problem determination model.

II. Literature

2.1 Human Models, Modeling And Development

There are different types of point of view to describe the various types of human models. The main objective of human models is it shows strength and limitations of the human body. Comfortable and facilities provide to human & give good intercommunication with various type tools [03]. Human models like a tool that can be simulated any parameter in industrial applications. Design processes are used to evaluate different alternatives and user requirements. Designers need huge benchmark data for system. Human models are used directly in design for human functions, performance requirements [01].

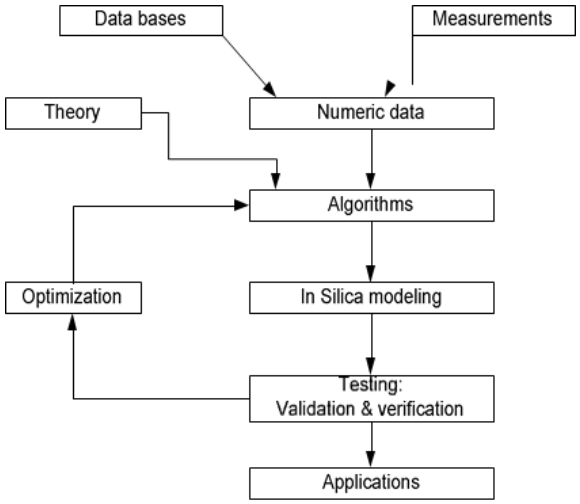

Figure 2: Development of a human model

The practical application or the academic interest for a specific human aspect to be modeled determines the goal of the model, the involved disciplinary areas, and the external relationships between human and environment.

2.2 ANN Models

Despite the mathematical study of neural networks has been existing for five decades, it has only recently come into broad acceptance, and it continues to develop significantly. Numerous straightforward components working in parallel constitute neural networks. Such characteristics draw their framework from the biological systems of nerves [05]. The connections between parts play a significant role in how well the network functions. In a variety of application areas, such as recognition of patterns, forecasting, recognition, categorization, communication, vision, and control systems, neural networks have been trained to carry out difficult tasks. The best way to describe artificial neural networks is as computational [25].

Models have specific traits such as the capacity to generalize, adapt, learn, cluster, or organize data, and the processes that depend on the use of parallel processing. An artificial network is made up of a collection of basic processing units that connect with one another by sending signals via a significant number of weighted links. Multilayer Perception Network is typically referred to by the terms "Neural Network" (NN) and "Artificial Neural Network" (ANN). Radial Base Function Systems, Cascade Correlation, Functioning Access Systems, Kohonen Systems, Gram-Charlier Systems, Finding out Vector Quantization, Hebb Systems, Adeline Networking, Hetero associative Networking, Recurrent

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Networks, along with Hybrid Networks are just a few examples of numerous other neural network types. [24], [26],[28].

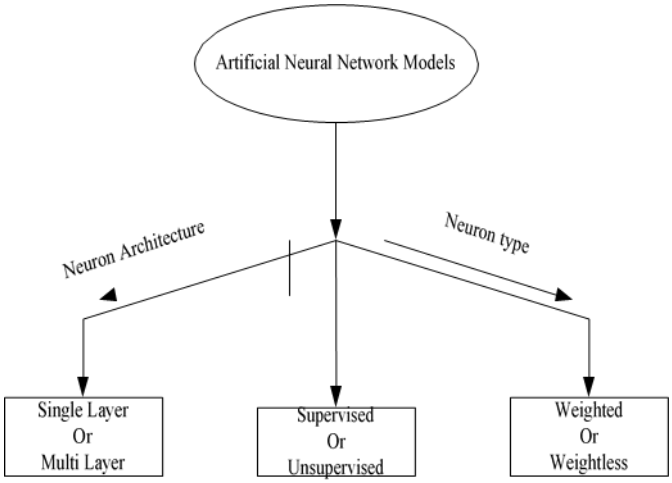

Figure 3 : ANN Human Model

2.3 Fuzzy Logic Models

Zadeh created fuzzy logic for the first time in the middle of the 1960s to describe ambiguous and imperfect knowledge [24]. It offers a rough but useful way to describe the system's behavior that are complex, poorly specified, or difficult to mathematically evaluate [26], [27]. The fuzzy logic controller is a system used to process fuzzy variables. Fuzzification, fuzzy inference, and defuzzification are all involved.

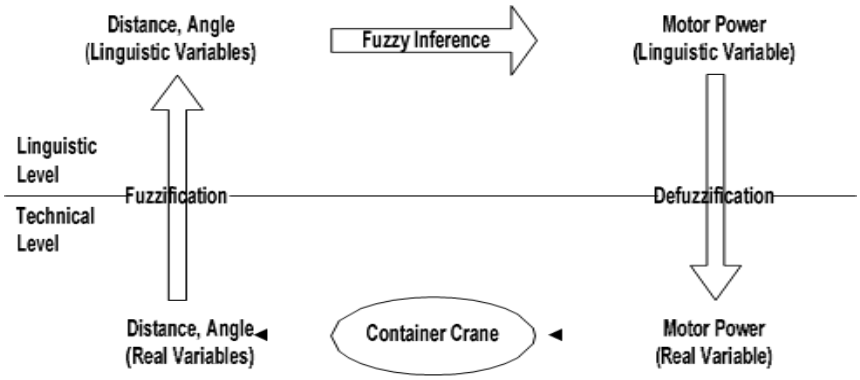

Figure 4 : Structure of Fuzzy Logic System

A crisp input number is transformed into a fuzzy value by the fuzzification process. Drawing findings from the information base is done using fuzzy inference [25]. The fuzzy control activities are changed into crisp control actions through the defuzzification procedure. Fuzzy logic systems are effectively used in a variety of industrial applications, including ANN training, vision of computers, decision-making, and designing systems [29, 30].

2.4 Behavioral Operation Management Research

Mathematical models have been used to structure and analyze operation management research, such as supply chain contracting as well as coordination [06]. In addition to testable hypotheses, ORM models also offer a streamlined system structure that is simple enough to be easily replicated in the related experiment designs [24]. Study of part OR two. First, there is growing evidence that formal

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procedures and explicit goal optimization are beneficial. Second, analyze the outcomes. They are used mostly to design the layout of installations and instruments to reduce the operator effort and time of human tasks. Operation research arrives at optimal decision- making problems. Operation research is often concerned with determining the maximum or minimum of some real-world objectives [32], [36], [37].

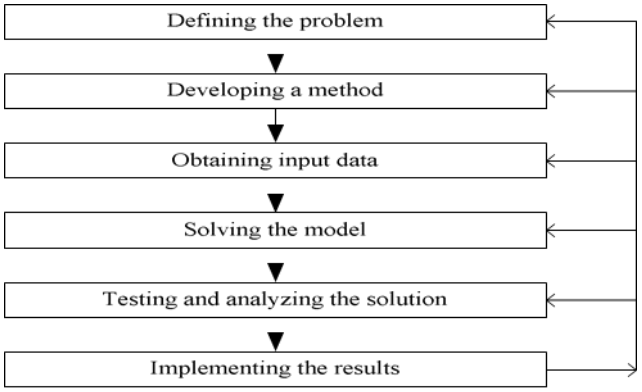

Figure 5: Operation research methodology

Operation research is Mathematical model which consist of Three basic components; Decision variable, Uncontrollable variables and result variables [38].

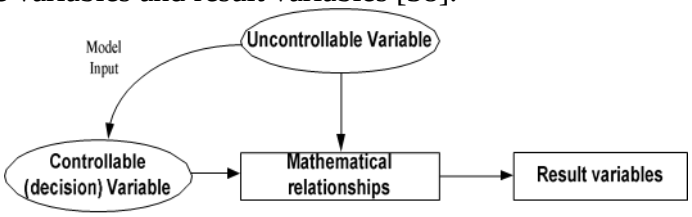

Figure 6 : OR Mathematical model

2.5 Genetic Algorithm

With regard to the needs of the packing industry, genetic algorithms are an emerging method (Hopper and Turton, 1998), but such algorithms were already successfully applied in a wide range of industrial applications, including structural design - planning of telecommunications systems, electronic circuit design – pattern recognition [09], [12]. They employ techniques for search and optimization that function similarly to the evolutionary processes seen in nature. The "survival of the fittest principle" directs the quest in the right path of progress. To do this, the best features from one generation of solutions are taken and combined to create the next generation [22], [21]. The "fitter" persons are chosen for the reproduction process once each solution's quality has been assessed [35].

A popular heuristic from literature is used in two ways; for the second, a better version of this heuristic had created (BLF). The genetic algorithm outperforms both the BL method and the heuristic methods alone, when paired with the improved BLF heuristic. The revised heuristic works well to provide high-quality layouts for industrial applications.

The decoder has a greater impact on the results of the hybrid approach than the GA because the difference in performance comparing the two hybrid GAs is solely attributable to the enhanced heuristic [23]. More layout-specific encoding strategies need to be investigated to improve the GA.

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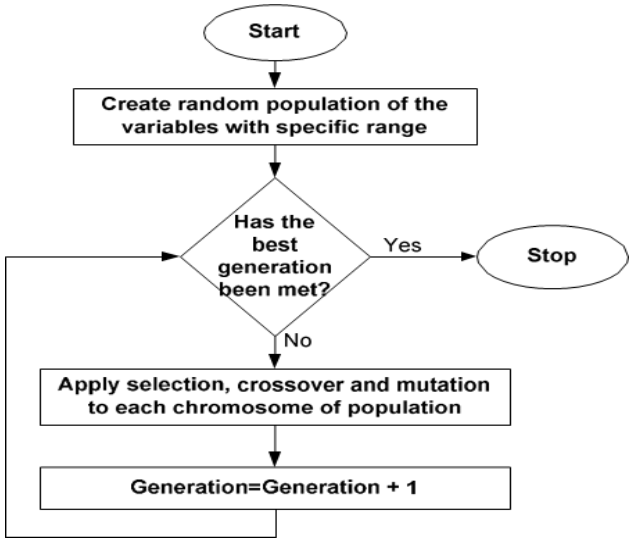

Figure 7 : Flowchart of Genetic Algorithm

2.6 Engineering Human Models

Analytical and experimental procedures are under the category of modelling techniques within geo mechanics. Their use in the planning and building of transportation facilities. ANN, biomechanical, microscopic, reliability, and centrifugal models should also be included. In industrial applications, biomechanical models are employed to describe how the human body is influenced by both internal and external factors through dynamic and immobile human activities. Biomechanics use of mechanics method is search the structure and function of the human body. It is the investigation of mechanical laws governing the motion or composition of living things, such as the human body. Kinematics is a subfield of biomechanics that studies movement and how long it takes to complete an activity [33, 34].

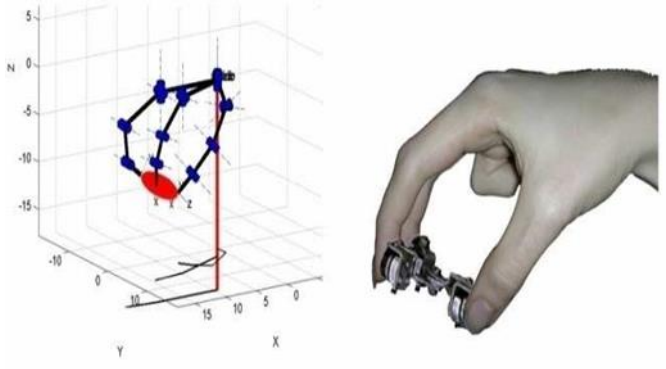

Figure 8 : Biomechanics model

2.7 Digital Human Models

DHM have long presented difficult issues to researchers and practitioners. The study's parameters, analytical and assessment methods, modelling strategies, and outcomes have all been updated. In reality, a review of the literature reveals that numerous alternatives have been put out in various business sectors [10], [31].

Static models - 3D scans
Dynamic models
For visualization (JACK)
Biomechanics - crash dummy (MADYMO)
Interface with CAD for workplace assessment (Safe works)
For comfort assessment (RAMSIS)
Human performance models (IUSS)

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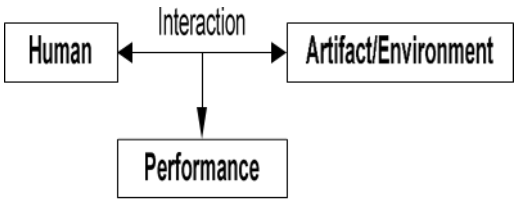

Figure 9 : Interaction between human and artifact

DHM started in the 60s, main purpose to improve ergonomic design. DHMs are effective techniques to visualize, evaluate, and analyze human characteristics, behavior, and interaction with the digital environment in an industrial. DHMS request varying degrees of detail depending on who is doing the study (Berlin et al., 2009). The study's organizational and communication design is the main factor holding up the transition from labs to actual production lines or towards commercially available solutions. Therefore, the study's industrial focus areas, research institutions, and their objectives and findings will be highlighted.

To create a productive workplace design, a variety of tools from many industries—including jack, ramsis, sammie, safework, etc.—are combined with the digital human model. a group of tools for analysis which can be split into semi-quantitative and quantitative tools for evaluation. Workplace postures and physical burdens are assessed quantitatively. Area of vision, reach envelopes, accessibility and clearance assessments, and other semi-quantitative methods. Implementing simulations and knowledge-based decision-making processes are the two methodologies used.

Anthropometric models describe linear dimensions such as distances between physical body landmarks, reach envelops and lines of sight. Shape models describe the shape of the human body. Biomechanical models describe the human kinematics (movements) and the human kinetics where internal and external forces and pressures are considered in relation with movement, tissue deformation or relocation and forces in joints [12], [14], [19].

Anthropometrics Based on Ergonomics Industrial design can benefit from using human motion analysis. The goal of ergonomic research is to evaluate how comfortable and user-friendly new items are. For industrial use, offering high precision motion data that takes into account anthropometric and ergonomic considerations produces useful data.

It outlines our method for capturing human motion without markers. Three cameras are used in our multi-camera system to capture the human subject from various angles. For tracking, the RAMSIS digital human model, which is ergonomics-based, is used. It has the ability to record various anthropometries. The usage of the model is further encouraged by the variety of applications that already exist and the accessible domain knowledge, e.g. force, comfort metrics. Particularly in the automotive industry, RAMSIS is used. It was primarily developed to access CAD-based design of car for improving interior and human workspaces for use in ergonomic studies. The advantages for motion analysis are enlisted with this model performance.

It was first created to facilitate CAD-based human workspace and automotive interior design, in addition to for use in ergonomic research. The usage of this model has the following benefits for motion analysis jobs.

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workstations and automotive interiors, as well as for use in ergonomic studies [20]. Use of this model has the following benefits for motion analysis jobs.
1. Based on anthropometric considerations, the model may capture various body types.
2. The inner joints' placements exactly match those of the joints in the human body. This makes the model perfect for examining the motions that are noticed.
3. It can replicate the majority of human movements while maintaining a realistic exterior.
Due to these benefits, a number of model extensions have been created that offer room for prospective future advancements of our motion detection system. It consists of an interior model that is very closely modelled after an actual person's skeleton, such as having a spine that is approximately realistic for the skin's surface. Different anthropometries (such as height, figure, body mass, etc.) can be accommodated by both the inner and outer models [17]. The initialization process typically involves doing this by hand. In order to make the initialization process simpler, we are now attempting to reduce the parameters required for the anthropometric correction using Principal Component Analysis [12], [14]. We have successfully and correctly tracked full-body (51 DOF) and upper-body (35 DOF) sequences using marker less techniques.

2.8 Cognitive Models

A variety of disciplines, including as psychology, purpose and task, hierarchies, linguistics, physical and device, and architecture, have introduced cognitive models. They simulate the comprehension, knowledge, intention, and processing qualities of the user [08].In the high-risk (such as nuclear and military) industries, a family of modeling techniques known as "cognitive architectures" is employed to imitate actual human perceptual and/or cognitive processes. An intelligent agent's cognitive architecture serves as their design manual. It suggests computational (artificial) processes that behave like specific cognitive systems, most frequently, a human, or behave intelligently according to some criterion. A subset of general agent architectures are cognitive architectures. The term "architecture" denotes a method that aims to simulate both the structural and behavioral aspects of the system being studied. [11], [15].

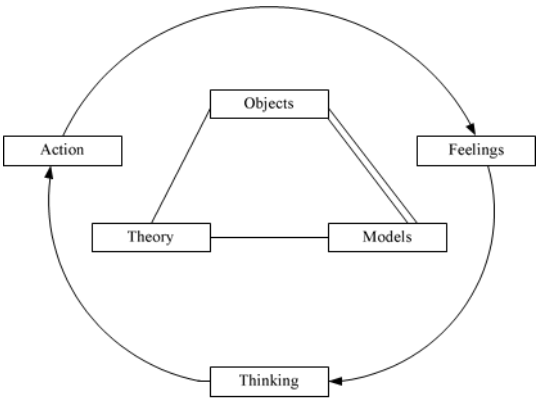

Figure 10 : Cognitive architecture model

Hybrid cognitive architecture some cognitive architectures or models, like the Information Dealing with Language (e.g., Soar based on a single theory of cognition or similarly ACT), are built on a set of generic principles. Many of these systems are founded on the idea that the human mind is similar to a computer. Sub symbolic processing, in contrast, focuses on emergent features of processing units rather than defining such rules in advance. Both methods of processing are combined in hybrid architectures (like CLARION).

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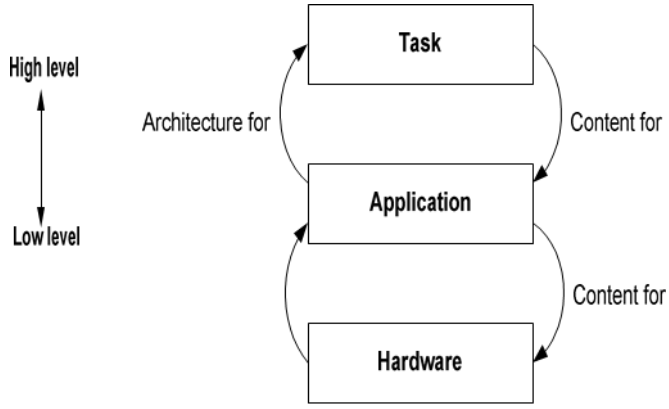

Figure 11 : Cognitive human model behavior

Another difference is if the architecture is decentralized (distributed) or centralized (with the brain's correspond of a processor at its heart). In the middle of the 1980s, the decentralized flavor gained popularity under the names parallel distributed processing and connectionism, with neural networks serving as a prominent example. [16], [17], [18].

2.9 Industrial And Organizational Psychology

The study of workers, workplaces, and organizations is done scientifically. Industrial and organizational psychologists assist in the success of an organization by raising employee productivity and wellbeing. [07]. I/O psychology is referred to as "the scientific study of the relationship between man & the world of work in the way of making a living" by Guion (1965). It is described as "simply the use or expansion of behavioural facts and principles to challenges facing individuals operating inside the framework of business and industry" [04] by Blum and Naylor in their 1968 paper.

Industrial/organizational psychology topics

1. Workplace performance
2. Personnel choice
3. Job evaluation
4. Education 5. Occupational psychology
6. Job augmentation

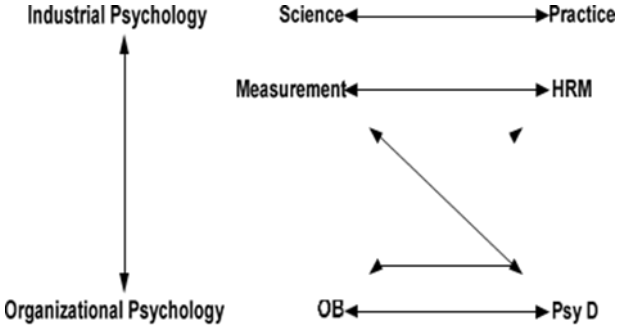

Figure 12: Organizational Psychology

Table No. 1 Overview of Physical Models

	ADAPS	APOLINX	JACK	RAMSIS	ANTHROPOS	SAFE WORK	SAMMIE	HUMOS
Techniques	wire frame	wire frame		wire frame			wire frame	external shapeand internal organs:FEM

Anthropom. data bases	DINED	very limited			world wide		six basic man-nequins	Very limited,avg andlinear scaling
Implementa-tion in CAD			data gloves and body trackers	contumis for individual anthropom	simple environ - ment	CATIA		
Typical application	anthropom evaluation of work place		product design	automation, clothing, sport, medicine	anthropom assessment	ergon analysis	ergonom	car design crash analysis

Specific issues include finding better candidates for positions, lowering absenteeism, enhancing communication, and boosting job satisfaction. I/O psychologists can play a range of roles; frequently, one I/O psychologist would self-identify as a researcher, practitioner, or teacher.

2.10 Industrial Physiological Human Model

Industrial physiology models include modelling interaction between the human body and workplace system. It is developed mathematical and computational models of structure with compare to other structure and function. The application of other industries like aerospace sectors, aeronautical industries etc, to study of fatigue evaluation and human-machine interaction. And also study of human physiology attribution in different condition. Industrial physiological models (such as oxygen and energy consumption) are influenced by the workplace system. [39].

III. Conclusion

In this paper, we have described human models which are used in various applications. Models serve as the foundation for the modelling approaches used in virtual design systems and for design goals. Additionally, the simulation was utilized to model actual world processes, such as those in the aerospace and automotive industries. Its classification has helped us to develop an integrated 'whole human modelling system'. Its main application features include (i) posture predication, (ii) muscle fatigue, (iii) clothing modelling, (iv)Electromyogram, (v)physiological Systems, (vi) real-time visualization, (vii)motion capture, (viii) interacting and communicating, (ix) artificial intelligence, (x) dynamic motion prediction, (xi) anthropometric hand model and (xii) cognitive abilities. At a basic level such features have been programmed and implemented, which proved the feasibility within the assumed boundary conditions.

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