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Application of Biomechanics for Occupational Safety: Accident Protection and Release of Stress Use of SAMMIE CAD System in Occupational Designs

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Abstract:
Biomechanics is crucial in occupational safety, utilizing mechanical principles to study human movement and structure. It aids in accident prevention and stress relief, utilizing Computer-Aided Design technologies like SAMMIE. It helps identify ergonomic hazards, develop preventative measures, and address stressors, enhancing mental health and productivity in work environments.

Introduction:
Biomechanics is important in occupational safety because it applies mechanical principles to the study of the human body's movement and structure. This discipline can be used for accident prevention and stress relief in a variety of work settings. Furthermore, the adoption of Computer-Aided Design (CAD) technologies, such as SAMMIE (System for Assessing and Managing Mechanical Interaction with the Environment), can greatly improve the design process for producing safer and more ergonomic work environments.
In the field of occupational safety, biomechanics is an essential tool for assessing the physical demands placed on workers during their duties. Biomechanics analyses the pressures, movements, and weights involved in diverse occupational duties to identify potential ergonomic hazards and devise interventions to reduce the risk of musculoskeletal illnesses. Understanding the biomechanics of activities like lifting, reaching, and repetitive tasks allows you to establish safer work practices and adopt ergonomic solutions that are tailored to your individual job requirements.
Accident prevention is another critical part of workplace safety, and biomechanics performs an essential role. By studying the mechanics of accidents and accidents, researchers and safety professionals can develop and apply preventative measures that limit the severity of injuries. This proactive strategy entails analysing the pressures and energy involved in accidents, allowing the development of safety equipment and measures that effectively absorb, disperse, or redirect hazardous forces, so protecting workers from potential harm.
In addition to physical safety, biomechanics addresses individuals' psychological well-being at work by researching stressors and devising stress-reduction measures. Understanding the biomechanics of stress-

related physiological reactions enables the design of environments that enhance mental health while lowering the danger of occupational stress-related diseases. This integrated approach takes into account both the physical and mental components of occupational health, resulting in a work environment that boosts overall employee satisfaction and productivity.

Why Study Occupational Safety?

- To appreciate importance of safety.
- To learn how to prevent, minimize, or eliminate waste of human resources caused by industrial accidents and occupational illness
- To know what business, industry and the government are doing to avoid or minimize human sufferings and loss of earnings because of accidents or illness in the industry.
- To know the duties and responsibilities of management, the safety officer, the medical officers, and the personnel manager regarding health and safety.
- To know the duties, responsibilities, and obligations of employees in accident prevention.

Major Health Related Problems in Organizations:

- Skin diseases, which are illnesses involving the worker's skin that are caused by work exposure to chemicals, plants or other substances
- Respiratory Conditions, illnesses associated with breathing hazardous biological agents, chemicals, dust, gases or fumes at work (e.g. tuberculosis and occupational asthma)
- Poisoning includes disorders evidences by abnormal concentration of toxic substance in blood, tissues, bodily fluids or the breath that are caused by ingestion or absorption of toxic substance into the body.

Repetitive Motion Disorders:

- Affects tendons that become inflamed from the strains and stresses repeated, forceful motion
- Primarily affects the neck, back, legs, arms, hands, wrists or elbows
- Carpal tunnel syndrome (pain in the wrist bone) is the most common repetitive motion disorder

Lower Back Disorders:

Frequently caused by engaging in activities such as lifting, carrying, and pulling of objects Occupations at greater risk are nurses, truck drivers and manual laborers

Diseases Linked to Workplace Hazards:

- Cancer
- Liver
- Lung
- Brain
- Kidney

Lung Disease:

White, Brown, and Black Lung, Leukaemia

- Bronchitis, emphysema
- Lymphoma, aplastic anaemia

- Central nervous system damage
- Reproductive Disorders
- Skin Disease

Disease-Causing Hazards:

- Arsenic, asbestos, benzene, chloromethylated
- Coal dust, coke-oven emissions, cotton dust
- Lead, radiation, vinyl chloride

Workers most likely to be exposed:

- Chemical and oil refinery workers, miners, textile workers
- Steelworkers, lead smelters
- Medical technicians, painters, shoemakers, plastics industry workers The Pre-Accident Situation
- In any situation prior to an accident taking place, two important factors must be considered, namely:

A. The objective danger: This is the objective danger associated with a particular machine, system of work, hazardous substance, etc. at a particular point in time.

B. The subjective perception of risk on the part of the individuals: People perceive risks differently according to a number of behavioural factors, such as attitude, motivation, training, visual perception, personality, level of arousal and memory. People also make mistakes.

- Ergonomic design is significant in preventing human error.
- The principal objectives of any accident prevention programme should be, firstly, that of reducing the objective danger present through, for instance, effective standards of machinery safety and, secondly, bringing about an increase in people's perception of risk, through training, supervision and operation of safe systems of work.

The Pre-Accident Strategies

The principal objective of a 'safe place' strategy is that of bringing about a reduction in the objective danger to people at work. These strategies feature in much of the occupational health and safety legislation that has been enacted over the last century Safe place' strategies may be classified under the following headings:

- Safe premises
- Safe plant, equipment and machinery
- Safe processes
- Safe materials
- Safe systems of work
- Safe access to and egress from the workplace
- Adequate supervision and control
- Competent and trained employees.

Safe Person' Strategies

- Generally, 'safe place' strategies provide better protection than 'safe person' strategies. However, where it may not be possible to operate a "safe place" strategy, then a 'safe person' strategy must be used.

- In certain cases, a combination of 'safe place' and 'safe person' strategies may be appropriate.
- The main aim of a 'safe person' strategy is to increase people's perception of risk.
- One of the principal problems of such strategies is that they depend upon the individual conforming to certain prescribed standards and practices, such as the use of certain items of personal protective equipment.
- Control of the risk is, therefore, placed in the hands of the person whose appreciation of the risk may be lacking or even non-existent.
- Safe person' strategies may be classified as follows:
- Care of the vulnerable, such as pregnant employees and young persons
- Personal hygiene
- Safe behavior
- Personal protective equipment's
- Caution in the face of danger

Post-accident strategies can be classified as follows:

- Disaster/contingency/emergency planning
- Feedback strategies, such as those arising from accident investigation
- Improvement strategies

Post-Accident (Reactive) Strategies

- Whilst principal efforts must go into the implementation of proactive strategies, it is generally accepted that there will always be a need for reactive or 'post-accident' strategies, particularly as a result of failure of the various 'safe person' strategies.
- The problem with people is that they forget, they take short cuts to save time and effort, they sometimes do not pay attention or they may consider themselves too experienced and skilled to bother about taking basic precautions.

Occupational Safety and Health Act (OSHA) of 1970

Missions of OSHA:

- To assure the safety and health of workers by setting and enforcing standards.
- Providing training and education
- Establishing partnerships with businesses
- Encouraging continual improvements in workplace safety and health
- Coverage of employees—all nongovernmental employers and employees; state and local government employees

Provisions of OSHA

OSHA Standards

- Apply to general industry, maritime, construction, and agriculture
- Cover the workplace, machinery and equipment, material, power sources, processing, protective clothing, first aid, and administrative requirements. Enforcement of the Act: The Secretary of labour is authorized by the Act to conduct workplace inspections, to issue citations, and to impose penalties on employers.

- Inspections are conducted by the Occupational Safety and Health Administration of the Department of Labor.

Typical Safety Rules:

- Using proper safety devices
- Using proper work procedures
- Following good housekeeping practices
- Complying with accident- and injury-reporting procedures
- Wearing required safety clothing and equipment
- Avoiding carelessness

Creating a Safe Work Environment:

- Recognizing and Controlling health hazards related to hazardous materials and processes
- Use substitutes for hazardous materials.
- Alter hazardous processes and engineering controls.
- Enclose or isolate hazardous processes.
- Issue clothing to protect against hazards.
- Improve ventilation.

Key Elements for a Successful Ergonomics Program:

- Provide notice and training for employees.
- Conduct pre-injury hazard assessment.
- Involve employees.
- File injury reports.
- Plan and execute.
- Evaluate and assess the ergonomics program.

Prevention & Control Strategies in Accident Prevention

- **Prohibition:** This is the most extreme control strategy that can be applied, in particular where there is no known form of operator protection available e.g. in the case of potential exposure to carcinogenic substances, or where there is an unacceptable level of risk in certain activities.
- **Substitution:** This implies the substitution, for instance, of a less dangerous substance for a more dangerous one, or of a less dangerous system of work for a more dangerous one.
- **Change of Process Design or Process engineering:** can usually change a process to afford better operator protection. Controlled operation This can be achieved through isolation of a particularly hazardous operation, the use of Permit to Work systems, method statements, mechanic or remote-control handling systems, machinery guarding, restriction of certain operations to highly trained operators, i.e. competent and/or authorized persons, and in the case of hazardous airborne contaminants, the use of various forms of arrestment equipment's.
- **Limitation:** The limitation of exposure of personnel to specific environmental and chemical risks, e.g. noise, gases, fumes, on a time-related basis, may be appropriate in certain cases.
- **Ventilation:** The operation of mechanical ventilation systems e.g. receptor systems and captor systems, which remove airborne contaminants at the point of generation, or which dilute the

concentration of potentially hazardous atmospheres with ample supplies of fresh air (dilution ventilation) is generally required where substances are known to be hazardous to health.

- **Housekeeping:** Personal hygiene and welfare amenity provisions.
- Poor levels of housekeeping are a contributory factor in many accidents.
- The maintenance of high standards of housekeeping is vital, particularly where flammable wastes may be produced and stored. Staff must be trained in maintaining good standards of personal hygiene, particularly where they may be handling hazardous substances.
- The provision of suitable and sufficient sanitary accommodation, washing and showering arrangements, facilities for clothing storage and the taking of meals must be considered.

Costs of Occupational injury/disease

- Work-related accidents or diseases are very costly and can have many serious direct and indirect effects on the lives of workers and their families for workers some of the direct cost of an injury or illness are:
- The pain and suffering of the injury
- The lose of income
- The possible loss of jobs
- Healthcare costs
- It has been estimated that the indirect cost of an accident or illness can be four to ten times greater than the direct cost and even more.
- Payment for Work not performed
- Medical and compensation payments
- Repair or replacement of damaged machinery and equipments
- Reduction or a temporary half in production
- Increased training expenses and administration costs
- Possible reduction in the quality of work
- Negative effect on morale in other works

Occupational Stress

Occupational stress is stress related to one & job. Occupational stress often stems from unexpected responsibilities and pressures that do not align with a person and knowledge, skills, or expectations, inhibiting one's ability to cope. It can increase when workers do not feel supported by supervisors or colleagues, or feel as if they have little control over work processes.

Occupational stress is a growing problem around the world that affects not only the health and well-being of employees, but also the productivity of organizations. It arises where work demands of various types and combinations exceed the person's capacity and capability to cope. Occupational stress can be defined as the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities resources or the worker. Occupational stress is also important because of its impact on society as a whole. It is unlikely that a person experiencing constant stress on the job will function effectively in his or her others roles such as husband, wife, parents, neighbours and community member.

Causes of Occupational Stress

- Work-related stress can be caused by various events.

- For example, a person might feel under pressure if the demands of their job (such as hours or responsibilities) are greater than they can comfortably manage.
- Other sources of work-related stress include conflict with co-workers or bosses, constant change, and threats to job security, such as potential redundancy.
- Stress On the Job:
- It can have various origins or come from just one aspect of a worker's responsibilities and its effects are far-reaching: Workplace stress can affect both employers and their employees.
- The economy is currently on the upswing, but job security was uncertain in not-so- distant years. Downsizing, layoffs, mergers and bankruptcies occur in industries and companies of all types; this means big changes for workers.
- Even when job loss does not occur, employees may face increased responsibility, higher production demands, fewer benefits, pay cuts and more.
- In general, this creates an environment of stress around the office.

Some of the Causes of Job Stress are:

- Low morale: When morale is low, workers often feel powerless. This in turn makes them complacent, and productivity suffers. Some of the most stressful jobs include secretary, waiter, middle manager, police officer and editor.
- These occupations are all marked by the service aspect of responsibilities:
- These professionals must respond to the demands and timelines of others with little control over events.
- Common to these types of careers are feelings of too little authority, unfair labor practices and inadequate job descriptions.

Management style:

- Another factor in stressful work situations is management style. When a workplace has poor communication and employees are not included in decision-making processes, workers don't feel supported by their coworkers and employers.
- In addition, a lack of family-friendly policies can lead to increased stress due to effects on work-life balance.
- Job responsibilities: How tasks are assigned and carried out is a big contributor to workplace stress.
- This includes heavy workload, infrequent breaks, long hours and shifts, unnecessary routine tasks, ignoring workers' skills and more.
- When job expectations are uncertain or conflicting, employees feel they have too much responsibility and too many "hats to wear."
- Career concerns: Another factor in workplace stress is career concerns such as job insecurity or lack of advancement opportunities.
- Traumatic events: While not ideal, it is true that some jobs are more dangerous than others.
- Many criminal justice professionals, firefighters, first responders and military personnel experience stressful situations and personal risk every day.
- Occasionally, this can cause ordinary responsibilities to become difficult.
- For that reason, positions such as those listed above are particularly stressful.

- Work environment: Most of the previous causes of workplace stress are emotional; however, a subpar work environment can create physical stress as well.
- Whether this is related to noise, lack of privacy, poor temperature control or inadequate facilities, work setting is critical in lowering workplace stress. Experts from NIOSH recommended a number of practical ways to reduce occupational stress.

These include the following:

- Ensure that the workload is in line with workers' capabilities and resources.
- Design jobs to provide meaning, stimulation, and opportunities for workers to use their skills.
- Clearly define workers' roles and responsibilities.
- Also, while they are being trained, they should let employees understand and be notified of stress awareness.
- Give workers opportunities to participate in decisions and actions affecting their jobs.
- Improve communications-reduce uncertainty about career development and future employment prospects.
- Provide opportunities for social interaction among workers.
- Establish work schedules that are compatible with demands and responsibilities outside the job.
- Combat workplace discrimination (based on race, gender, national origin, religion or language).
- Bringing in an objective outsider such as a consultant to suggest a fresh approach to persistent problems.
- Introducing a participative leadership style to involve as many people as possible to resolve stress-producing problems.
- Encourage work–life balance through family-friendly benefits and policies

SAMMIE

SAMMIE System is a computer based Human Modelling tool.Its capabilities make it an invaluable tool to designers and design teams working on products that are used by people .

Advantages:

- 3D analysis of fit, reach, vision and posture
- reduced timescale
- early input of ergonomics expertise
- rapid interactive design
- improved communication • cost effective ergonomics

Objectives

The main objectives of SAMMIE system is to provide computer based facilities to simulate these activities by the provision of:

- Three-dimensional modelling scheme for building full size models and viewing them on a computer graphics screen (or three-dimensional modelling of equipment and workplaces)
- A man model which can be associated with the workplace model and used for ergonomic evaluations
- A set of human capability evaluative techniques based on the man model and including reach and vision etc.
- An easy-to-learn method of communicating with the model so that it can be amended or evaluated.

Application Areas

SAMMIE has been used for a wide range of design studies in a number of fields:

- Transportation: Car, Bus, Truck and Aircraft
- Materials Handling: Crane, Fork-Lift, Straddle Carrier
- Plant Design: Robot Work Stations and Aircraft Assembly Jig
- Interior Design: Office, Control Room, Bank Service Counter, Kitchen.

SAMMIE System Components

The two essential features of SAMMIE are:

- Its facilities for building three-dimensional models of workplaces. (workplace model provide an valuable design information).
- Its anthropometric and biomechanical man model. (Man model produces an Ergonomics or Human Factors evaluation system).
- SAMMIE system is a hierarchical structure which allows a completely three-dimensional full-scale representation of the equipment which can be created, stored, retrieved and displayed. This data structure may be manipulated to:
- build a three-dimensional model of the workplace;
- place a man model within the workplace;
- display and view the model in a variety of useful ways;
- interact with the model to amend it or to carry out evaluations involving man or machines in the workplace.

1. Workplace modelling system

The workplace modelling system is used to generate full-size geometric representations of the human operator's working environment and specific items of equipment. The workplace model is normally specified by data input prepared off-line from working drawings.

Objectives

- To produce a highly interactive system, whilst at the same time maintaining a sufficiently accurate three dimensional model, a relatively simple boundary representation form of solid modelling (Specification of the location of the vertices, together with the relationships between vertices to generate edges, and between edges to form plane polygon faces) is used.
- In addition to defining the geometry, tasks are eased by the use of a set of simple parametrically defined shapes such as cuboids and prisms. For example, a cuboid can be geometrically defined by a statement of its three principal dimensions (length, width, and height). Complex shapes can be generated by the specification of the Cartesian coordinates of the vertices and the topological relationships between them (i.e. pairs of vertices are formed into edges which in turn are chained together to form faces).

Dual Workstation Design for Computer Aided Engineering can be built to an accuracy well within the needs of ergonomic evaluation, and most importantly the models created can be swiftly manipulated to change the geometry or to change the view as seen on the screen. Use of SAMMIE system in Driver view point

Automotive Seat design for Sitting comfort

Criteria for a driver's seat:

- The seat should position the driver with unobstructed vision and within reach of all vehicle control
- The seat must accommodate the driver's size and shape

- The seat should be comfortable for extended period
- The seat should provide a safe zone for the driver in a crash.

Control and Displays

Design of symbols for automobile

- Digital meters (Discreet digital meters maximize forward visibility and help create a sense of uncluttered spaciouness).
- Triangle –motif steering wheel (The triangle –motif steering wheel helps harmonize exterior and interior design for a feeling of unity throughout).
- Centrally positioned audio panel (A 2 Din opening for audio components is centrally positioned at the top of the instrument panel for easy access and visibility.
- Textured dashboard and console (The dashboard centre, floor console and front pillars are trimmed with a new textured material with a refined look and feel).
- Sporty two- tone fascia(The sporty two- tone fascia adds a touch of pizzazz to the Liana's interior).

2. Man Model

The Man Model provides much of the evaluative power of SAMMIE through its anthropometric and biomechanical modelling capabilities. It consists of a set of pin joints and straight rigid links structured hierarchically to represent the major points of articulation and the body segment dimensions.A three-dimensional flesh shape based on a somatotype classification (Sheldon, 1940) is arranged about this link structure using the modelling methods described as figure. (The Anthropometry of Man Model is infinitely variable)

The Man Model represents the human body as a mechanical system of 19 links connected at points corresponding with bone joints such as the hips, elbows, ankles etc.

Parameters for each of the nineteen body segments are extracted from a database which contains definitions of a user population in terms of :-

- the linear dimensions between adjacent joints (e.g. from knee to ankle).
- the body segment parameters of weight and centre of gravity.
- the absolute and 'normal' limits of extension of each joint in each of the available three degrees of freedom.

The database is accessible to the user both to extract information to define a man model and to add to the contents of the database. The selection of an adequate database and the subsequent manipulation of the information requires a thorough understanding of the anthropometric implications, but SAMMIE provides a useful framework and user interface. The man- model is constructed in a manner completely analogous with workplace models in that it consists of a set of geometric, spatial and logical relationships maintained in a hierarchical data structure.

Reach Test

When testing the ability of the man model to reach the objects in the workplace model a posture for the appropriate arm or leg is predicted by the system and tested for feasibility against the joint angle constraints. The user can specify a point to reach by a number of means:

- the reach point may be specified in terms of three-dimensional coordinates of the workplace model i.e. the global coordinates;

- an object in the workplace model may be named and the 'anchor point' of the object becomes the reach point;
- the current position of the man model's hand or foot may be incremented away from its current position towards the object to be reached.

The reach algorithm predicts a single feasible posture which is "good' with respect to extension of limbs about joints and by permitting extension of distal limbs in preference to those that are more proximal.

Fit Test

The ability of a range of operators to fit into available workspace can be assessed visually using the facilities for specifying men of varying size and shape and the facilities for viewing the model in a variety of ways. These tests are particularly useful for the assessment of access to workplaces through restricted spaces and in the assessment of necessarily confined workspaces. Model manipulation can be made to make best use of the available space and the revised layouts can be assessed in terms of the feasible maximum stature and somatotype (fatness/thinness) limits for the users of the equipment being designed.

Ergonomic Evaluation Facilities

Ergonomic evaluations that can be carried out using the man model in SAMMIE include: • tests on the model's ability to reach items defined in the workplace, or teats to display complete envelopes of reach;

- tests of the ability of the operator to fit into the available space within the equipment. The working postures adopted can be evaluated for feasibility and comfort by reference to the degree of joint extension;
- display of the view as seen by the man model in his working environment and evaluation using visibility plots to enable 'blind spots' to be quantified;
- demonstration of sequences of movement simulating work tasks.

Definition of CAD

1. CAD/CAM is a term which means computer-aided design and computer-aided manufacturing. It is the technology concerned with the use of digital computers to perform certain functions in design and production.
2. Computer-aided design (CAD) can be defined as the use of computer systems to assist in the creation, modification, analysis, or optimization of a design.
3. Computer-aided manufacturing (CAM) can be defined as the use of computer systems to plan, manage, and control the operations of a manufacturing plant through either direct or indirect computer interface with the plant's production resources.

Objectives of CAD

1. CAD enables the development, modification, and optimization of the design process. CAD helps in engineers can make more accurate representations and modify them easily to improve design quality. The software also takes into account how various materials interact.
2. CAD allows designs to be made according to specified engineering data, it is often used to model the function of machines, components, and work environments for safety assurance purposes. These

models provide efficient, low-cost simulations for testing whether a product or environment will meet a desired occupational safety standard or full fill a desired safety function.

3. Used by engineers, architects, and construction managers in workplace designing, industrial designing, graphic designing and in in architecture industry. CAD has replaced manual drafting. It helps users creating designs in either 2D or 3D so that they can visualize the construction.

Categories of CAD used in Workplace

As indicated by the definition, the applications of computer-aided manufacturing fall into two broad categories:

1. Computer monitoring and control: These are the direct applications in which the computer is connected directly to the manufacturing process for the purpose of monitoring or controlling the process.
2. Manufacturing support applications: These are the indirect applications in which the computer is used in support of the production operations in the plant, but there is no direct interface between the computer and the manufacturing process.

CAD Process in Workplace Designing

1. 1.Geometric Model θ Computer geometric modeling is the mathematical representation of an object's geometry using software. θ The workplace designs using CAD software provides a geometric model which contains description of the modeled object's shape. Computer geometric modeling uses curves to control the object's surface.
2. Design and Analysis θ Design analysis is essentially a decision-making process in which analytical tools derived from basic sciences, mathematics, statistics and engineering fundamentals are utilized to develop a product model that can be converted into an actual product. θ This is a very important step while performing workplace designing.
3. Design Optimization θ For performing the best suitable option, Design optimization is one of the major procedures for effective software credibility in performing tasks. θ Design optimization is an engineering design methodology using a mathematical formulation of a design problem to support selection of the optimal design among many alternatives. Drafting & Documentation Drafting is the act or process of producing a technical drawing, or draft while documentation is something transposed from a thought to a document; the written account of an idea. This is the final phase of the workplace design using CAD software which instruments the final designing.

How CAD helps in Occupational Designing?

1. A Streamlined Design Process θ Designers working with CAD can take advantage of the way the software smoothest out bumps in the design process. They can more easily visualize the final product that's being created and all of the little constituent parts that are involved which helps in improving better visualized picture of the work place and future improvements for designing. θ With most CAD software, animation can be added so that designers and construction managers can get an idea of how the model will work in the real world. It can be seen moving and interacting with the rest of the elements it's meant to be paired with.
2. Improves Communication θ Today, drawings/plans can be stored in the cloud, Thus, contractors have gained access to CAD-based drawings/plans at the worksite. Entire teams can check out plan

modifications easily, including the contractor and subcontractors. This way, it is possible for relevant parties to recognize the possible impact the changes might have on construction and adapt as needed.

3. Better Quality Design θ Design quality suffers when the project is a uphill and when it's difficult to see the finalized product. With the tools that are available when designers are working with CAD, can analyze the engineering process. θ Design teams and project planning staff communicate the results of CAD design that yields prototype with fewer issues. CAD systems are deadly accurate and allow error figures to drop drastically. θ CAD systems can run all kinds of scans and tests to ensure that the modeled workplace station can bear the weight it purports to and withstand the pressure needed.
4. Increases Productivity θCAD helps in effective utilization of all information. CAD enables designers to consider electricity, plumbing, and other elements, helping to create a more comprehensive design. Ultimately, this translates to fewer work changes and fewer surprises during construction.
5. A Manufacturing Database θ CAD design process system helps to outline the manufacturing process. List of materials required and recommendations for workplace facilitation can be figured out with the database available in the software system. θ The CAD design smoothen the roles for manufacturers. It explains effortless drawing of complex manufacturing designs and recommends better design ideas for smoother facilities and designing for the workplace.
6. Technological benefit θ CAD and its spinoffs, with their many features, have become a staple throughout the workstation construction industry and through all phases of the process. Its technological impact has been a game-changer in the industry—I θ It has transformed construction into a technology job.
7. Documenting the Design θCAD software is excellent at documenting all aspects of a design. The measurements, angles, and dimensions of a product are all conveniently recorded and saved for future use. Components and subassemblies are also saved and can be used for future designs if need be.

The Limitations of CAD in Workplace Designing?

1. User decides the design θ CAD/CAM is tools which are used by a designer to create a design. These tools are only as useful as the one handling them. While a computer can inform what a design will look like while using either steel or wood, the user is the one who makes the decision, which inevitably affects function. θ CAD software can not inform which design is more aesthetically pleasing, and in some industries, that overrides function.
2. Designing Physical Objects in a Virtual Workspaceθ There is a degree of separation from the physical object that is implied. Designing the model with the help of the technology virtually allows the user to create perfection without concerning themselves with real-world constraints. θ I.e. A woodworker, who designs a table in the real world, using manual measurements and drafts, has a better understanding of the process and the product.

Conclusion

The addition of biomechanics into occupational safety is a significant step forward in safeguarding workers' well-being. By applying mechanical concepts to the study of human movement and structure, biomechanics provides a thorough understanding of the physical demands of various occupational jobs. This information is critical for designing effective ergonomic interventions and accident prevention techniques.

The application of computer-aided design (CAD) technology, such as the SAMMIE system, improves the design process and allows for the creation of safer and more ergonomic work spaces. SAMMIE's 3D analysis of fit, reach, vision, and posture, combined with its ability to provide early ergonomics expertise, enables rapid and interactive design while shortening deadlines and costs. This not only streamlines the design process, but also makes a substantial contribution to the overall goal of building workspaces that focus human health and safety.

Biomechanics is essential for assessing the physical demands placed on workers, understanding potential ergonomic dangers, and applying personalised solutions for individual job requirements. Beyond physical safety, biomechanics addresses employees' psychological well-being by analysing stresses and devising stress-reduction strategies. This comprehensive approach takes into account both the physical and mental aspects of occupational health, resulting in work settings that increase overall employee satisfaction and productivity.

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