Cognitive and Cybernetics based Human Adaptive Mechatronics System in Gait Rehabilitation Therapy

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Abstract – **Human adaptive mechatronics [HAM] is an intelligent form of man machine interface system. HAM system adapts itself to user ability to carry out their routine task under constrained environments and also improves the functional motor skill. It assists the elderly person suffering from gait disorder to achieve enhanced ability in doing daily task by their own. The HAM system assisting the elderly or disabled person will adapt to the user gait phase and consume low metabolic energy. With the short fall of availability of nursing assistant in near future the HAM systems becomes ineluctable. Objective of this research is to synthesize the current knowledge about HAM and various human factors in the application of adaptive mechatronics system used for restoring muscle function with supporting device in rehabilitation therapy. In depth analysis on related articles orthotic assisting system and technologies like medical electronics, cybernetics, robotic knee assistive devices used in rehabilitation therapy are reviewed along with its merits and limitations. This article presents an overview of fundamental technologies used for adaptive rehabilitation therapy, suggesting the need to examine this information in a comprehensive review for designing human adaptive mechatronics system.**

Keywords – **Human Adaptive Mechatronics, Occupational Therapy, Cybernetics, Gait rehabilitation, Sensors and Human-Robot interface**

I. INTRODUCTION

Human Adaptive Mechatronics system has the ability to adapt itself to improve the human skills like machine operation in production sector, driver assist and in gait rehabilitation in bio medical field. HAM research is getting attention from the biomedical engineers in designing of assistance device for the elderly and disabled persons in carry out their daily routine independently. It makes the individual self-reliant as they don't have to depend much on care takers. This will address the shortfall of nursing assistance in near future [3].

Nowadays mechatronics devices are performing surgery under supervision of medical practitioner. Robots assisting and monitoring the condition of the patient is also available. Even though many research models are proposed in gait rehabilitation and occupational therapy with autonomous mechatronics adaptive system, some limitations like mass of the wearable device[1], power consumption, size of the control unit, delay in response, repeatability of sensor output data, transient error and cope with exact need of the individual. In HAM selection of proper sensor and control circuit algorithm to optimize various human factors like speed of limb joint movement, angle of extension and flexion of limb[2] are determined by the methods that adapt with every individual user. Self-care occupational therapy goal is to merely facilitate self-independence, with the least amount of assistance from human care taker. HAM system used in biomedical engineering field promotes the user independence [4] by helping to restore or improvise muscle function of elderly or disabled person.

Major chapter's covered in HAM research are:

- Haptic interface modeling of system works in constraint environment
- Human-machine, Assistive robotics and mechatronics interface
- Medical applications of HAM in assistive rehabilitation therapy and occupational therapy
- Sensors and actuators with high repeatability, stability and precision ratio