

Gait Assistive Exoskeleton Device For Semi Paralyzed Stroke Survivors

Y.Vasantha Rao, Swamy Bhukya, Prasanth Kancharana



ABSTRACT--- *dominant human gait could be a dynamic and time crucial activity and so it needs a true time management surroundings. the most objective is to regain the walking ability for semi-paralyzed stroke affected patients and to assist them walk severally with none support. MEMS measuring device device senses the walking movements of the patient's healthy leg. By victimisation these values as reference, microcontroller is programmed and interfaced to the motor fastened within the body covering device. Microcontroller is employed to manage the motor in line with the input given by the measuring device. Microcontroller is programmed victimisation PIC CCS Compiler software system. Associate in Nursing body covering device for semi paralytic patients is developed to exercise their muscles and to revive the sensation of walking in their legs at a way lower value than that is offered on the market nowadays.*

Key Words—Human Gait, body covering device, MEMS measuring device device.

I. INTRODUCTION

Stroke causes the long serious incapacity and it affects gait in stroke survivors worldwide. within the u. s., about 8,00,000 individuals gets affected by perennial stroke once a year and needs rehabilitation to regain and come through practical independence. Exoskeletons designed area unit wearable robots which is employed to support and augment the physical movement within the unfit leg of the stroke affected patients. About five hundredth of stroke affected patients would like help to perform the daily activities of a standard soul. Gait disorders when stroke is that the wide affected among stroke survivors. The gait of somebody's is the cadenced activity that involves many joints having many degrees of freedom and mechanics. activity of vary of motion is vital, whereas physiological parameters and mechanics area unit wont to monitor accurately in real time. Realizing a natural gait with Associate in Nursing outwardly worn body covering device is a really difficult half, that causes major impact on frame. a number of the cons area unit as follows

Canes aren't used for weight bearing. Umbrella handle canes causes pistol tunnel Syndrome.

Crutches need substantial energy expenditure and strength and it conjointly causes risk of nerve or artery compression.

Walker has to be raised up with every step. Natural gait tends to be slow whereas victimisation the walkers.

These disadvantages area unit overcome by victimisation the gait helpful body covering device. An body covering worn is comfy, light-weight, with a rigid structure, that is appropriate to numerous patients. Patients cannot shift their own weight equally on each lower limbs whereas walking with cane/crutches/walkers. This causes Associate in Nursing uneven gait pattern. The gait helpful body covering device is being trained to correct the pattern of weight shifting between lower limbs and knee flexion. The patients get up and assist their motions manually. the most important drawback is that the proportion of motor perform that's recovered in existing normal rehabilitation techniques is poor. The human leg could be a advanced and unflawed a part of the body. The human leg consists of variety of advanced functions and provides multiple degrees of freedom, therefore it's nearly not possible to imitate by any means that of prostheses. The human walking pattern could be a periodic perform of the movement of the higher and therefore the lower limb. The human stance is split into 5 phases particularly stance heel strike, foot flat, midstance, knee off and toe off. throughout the stance part, the heel of the foot strikes the bottom and therefore the knee flexes and therefore the whole weight of the body is shifted on the leg and therefore the lower limb moves. throughout the swing part, the foot leaves the ground and therefore the knee swings until the heel of the foot is prepared to strike the bottom. the most energy is consumed in walk throughout the swing part.

II. EXISTING WORK

The connected add this paper has been impressed with the thought of helpful body covering device for stroke survivors. In the prevailing work[1], the look and human machine interface of an energetic Leg body covering (ALEX) for the gait rehabilitation of semi paralysed stroke patients. This states that the force-field controller that applies appropriate forces on the leg, helps it to maneuver on a desired flight. The forces that area unit interactive between the topic and therefore the orthosis area unit designed for assistant safe and effective gait coaching. Experiments area unit performed with subjects underneath traditional healthy conditions for walking on a treadmill.

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* Correspondence Author (s)

Y.Vasantha Rao, Professor, Department of ECE, Siddhartha Institute of Technology & Sciences, Narapally, Ghatkesar, Hyderabad, Telangana, India.

Swamy Bhukya, Assist. Prof, Department of ECE, Siddhartha Institute of Technology & Sciences, Narapally, Ghatkesar, Hyderabad, Telangana, India.

Prasanth Kancharana, Assist. Prof, Department of ECE, Siddhartha Institute of Technology & Sciences, Narapally, Ghatkesar, Hyderabad, Telangana, India.

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this steam-powered orthosis are used for gait coaching of semi paralysed patients.

Another existing proposal[2] was a couple of Robotic system changing into a lot of interactive and helpful to mortals day by day. They serve humans within the fields of business, medication and defence. Exoskeletons area unit the devices that reside within the sector of wearable robots. Associate in Nursing body covering is Associate in Nursing external structure of mechanism with joints and links that corresponds to those of the frame. With applications in rehabilitation medication and computer game simulation, exoskeletons provide advantages for each disabled and healthy populations. Exoskeletons will be used as a capability scientific instrument or helping device. This paper presents a planned style for sensible active body covering for lower limbs. This planned body covering style not solely assist an individual however conjointly tries to boost its Gait.

III. PLANNED SYSTEM

Fig.1 shows the diagram of the planned system. we tend to use MEMS measuring device device to sense the movementsof patient’s traditional healthy leg post-stroke and sends the detected signal to the microcontroller. Microcontroller already has the reference worth for the leg underneath traditional healthy conditions. Microcontroller is programmed in such the simplest way that it calculates the specified angle to maneuver the leg by doing arithmetic operations. Then the microcontroller sends the management signal to the control board, wherever it optimizes the worth and provides signal to the motor to rotate. The leg then turns to the conventional position by connecting it to the motor shaft. The feedback signal from the control board is send to

the microcontroller. The microcontroller checks for the par value for the leg position and pulse rate and do the operation if necessary alternatively the loop ends. The noninheritable worth is shown on the laptop monitor through ZIGBEE protocol conjointly within the LCD module hooked up to the kit.

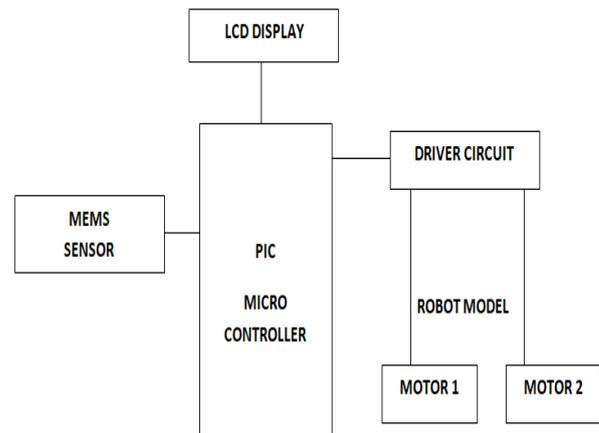


Fig.1 diagram of the planned system

A wearable body covering device for lower limbs designed for return the walking ability of adults also can be used for gait compensation in semi unfit stroke affected patients of the lower limbs. the look of the body covering designed ought to be engineering science, comfy, light-weight, with a rigid structure, appropriate to many users and keeping safety in mind. The body covering frame has bilateral uprights for the thigh and therefore the shank, hinged hip, knee and ankles and articulated footplates (distally) and a waist support (proximally).

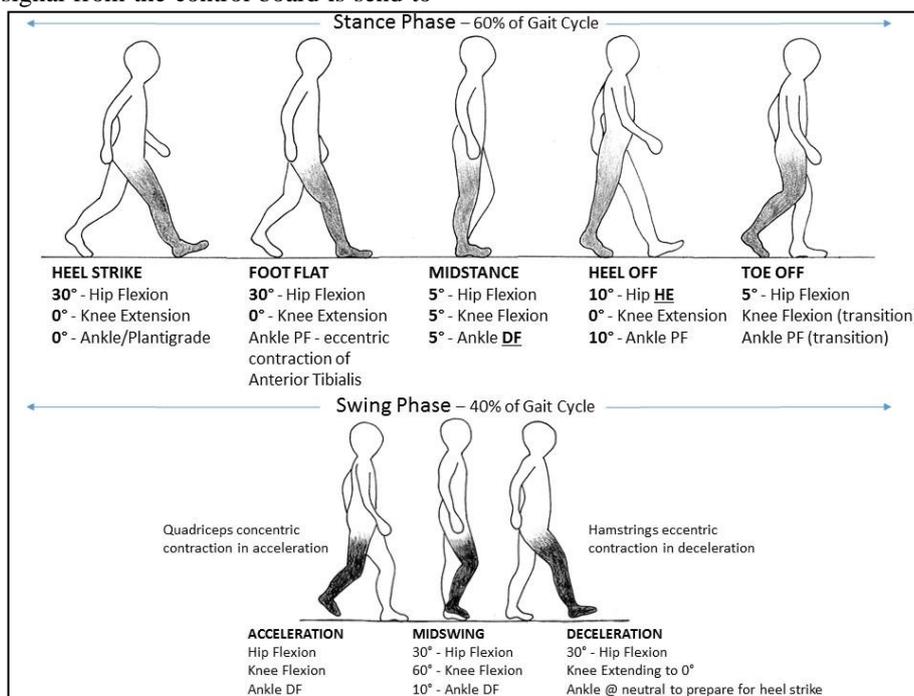


Fig.2 Phases of gait cycle and their angle movements underneath traditional conditions

The vary of motion (ROM) in actual joints automatically restricted for safety reasons. For the gliding joint, plantarflexion is shown as extension and flexure as flexion. The vary of values chosen supported traditional gait on healthy subjects is shown in fig.3

JOINT	MOTION
HIP	Flexion : 10-20 degree of flexion to 40-60 degree of flexion Extension: 40-60 degree of flexion to 50 degree of flexion
KNEE	Flexion : 10 degree of flexion to 80-90 degree of flexion Extension: 80-90 degree of flexion to 0-5 degree of flexion
ANKLE	10 degree of plantarflexion to 20 degree of dorsiflexion

Fig.3 vary of values used for reference

An measuring device is Associate in Nursing mechanical device that's used to measure acceleration and the force producing it. many varieties of accelerometers area unit accessible within the market nowadays. they will be divided in line with the force (static or dynamic) that's to be measured. Static forces embody gravity, whereas dynamic forces will embody vibrations and movement. From the changes in capacitance, the acceleration will be determined. But, since they're large and can't be used for all operations, a smaller and extremely practical device just like the MEMS measuring device was developed. thanks to its tiny size and sturdy sensing feature, they're additional developed to get multi-axis sensing. Here, we tend to use triple axis MEMS measuring device device. The device doesn't modification worths reckoning on the bottom materials used and dependsonly on the electrical phenomenon value that happens thanks to the modification in distance between the plates.



Fig.4 MEMS device interfaced with programmed PIC Microcontroller

IV. SYSTEM OPERATION

In pre-programmed mode, the electro-mechanical system will be done victimisation these 3 totally different modes. Exercise is provided to a explicit limb by continuation movement sequence of a selected limb, that is then calculated based mostly upon the degree of freedom of the patient.



Fig.5 body covering leg base for the unfit limb of patients

First mode is employed for physical exertion feet.

Second mode is employed for physical exertion knee.

Third mode associated with the movement of the mechanical device system.

in such the simplest way that it exercises the particular walking pattern of the human leg. initial the knee section limb is affected backwards, followed by raising of the thigh section limb, followed by the movement of the foot section motors, then the calves section motor is revolved backwards in order that the mechanical limb is straight. The patient then must take support of the walker provided and move their different leg forward. Then the calves section motors area unit revolved in reverse direction in order that the total system is upright like however the leg is upright whereas standing. This sequence is recurrent till it's interrupted once the MEMS device is placed traditional, afterwhich all the motors stop to rotate.

In the context of rehabilitation of gait in post stroke, the development and therefore the proof for safety and therefore the usability of wearable body covering is conferred. the most objective is that the developed device provides a secure and intensive gait in stroke affected patients. The mechanism developed is simple to use and is accepted by the patients as a possible device for rehabilitation. To fully use the practicality of the body covering device, future developments also can involve some practical tasks like sit-to-stand, stand-to-sit and step rise. Associate in Nursing body covering for a semi unfit leg is meant to regain the conventional gait of somebody's leg. This device is meant in such the simplest way that it's accessible at lower value and affords a tolerant average financial standing. PIC Microcontroller is programmed to manage the direction of rotation of motors. The DC double-gear motors area unit used in order that they need higher driving capabilities as compared to different motors.



Fig.6 Stroke affected patient victimisation body covering at the start

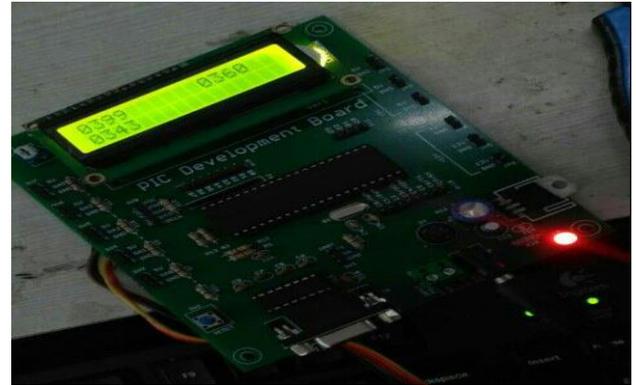


Fig.7c To make the semi paralyzed patients regain walking

Fig 7a,7b,7c shows x,y,z reference values obtained victimisation MEMS measuring device device. Fig.7a represents the reference worth wont to move the motor fastened in body covering to form the semi unfit patients exercise their feet. Fig.7b shows the reference worth wont to move the motor close to the knee of the body covering to exercise the calves section of the semi unfit patients. Fig.7c shows the reference worth that is employed to form the semi unfit patients regain walking with this wearable body covering device.



Fig. 7a To make the semi paralyzed patients exercise their feet



Fig.7b To move the motor near the knee of the exoskeleton to exercise the calves section of the semi paralyzed patients

V. SIMULATION RESULTS

Simulation of gait movements is recorded and analysed with regard to time delay. The abnormal gait is initial recorded supported the values detected by the MEMS measuring device device of the unfit leg. when the body covering is worn on the unfit leg of patients, the abnormal gait is corrected and is recorded as traditional. The abnormal and traditional waveforms of gait movements is shown within the Fig.8 and Fig.9.

VI. CONCLUSION

The body covering device summarizes the development and therefore the analysis of Associate in Nursing body covering device for rehabilitation semi unfit lower limb of stroke affected patients. The device is light-weight and cozy, herewith allowing gait coaching in practical tasks that involves overground walking compared with ancient rehabilitation robotic body covering devices. so the field of force management will facilitate to regain a parallel gait pattern in stroke affected patients, assists the segments that require it and prevents unwanted counteractive gait patterns, like hip hiking.

VII. ACKNOWLEDGMENT

Always grateful and grateful to Almighty God UN agency wrote in his book "My Mercy prevails over my wrath". we tend to area unit indebted to our oldsters for his or her blessings and support.

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