Asian Journal of Applied Science and Technology (AJAST)
(Open Access Quarterly International Journal) Volume 2, Issue 2, Pages 537-542, April-June 2018

Auto Assist Physio Arm

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Article Received: 01 March 2018 *Article Accepted: 09 April 2018* *Article Published: 28 April 2018*

ABSTRACT

Each and every human being in this world have their desire and right to lead a healthy life. But unfortunately accidents, diseases, elder-ship make their desire into disability. Moreover the number of handicaps and paralyzed patients are increasing day by day. They always need someone to help them in moving and undergoing some physical therapies for recuperating their strain back. In this paper the proposed system helps them to undergo the therapy activities of physiotherapist in a cost effective manner. In this project, paralyzed patient have inbuilt arm for their daily exercise. This arm can be activated through another arm by the doctor. The doctor can give command to the patient through arm. This arm helps to fold, straight and rotate the patient arm as per doctor arm. The aim of the research is to design a robotic arm for the paralyzed patient in order to help them undergo treatment at the place they are located, rather than making a regular visit to the hospital.

Keywords: Paralysis, Stroke; Hemiparesis, Rehabilitation, Deep learning technique and Spina bifida.

1. INTRODUCTION

One in every 75 people suffer from Paralysis. Paralysis is a disorder where the loss of muscle function occurs in one or more muscles. It is a complete loss of strength in an affected limb or muscle group [1]. The paralysis most often occur as a result of nervous system damage, trauma cases involving severe nerve injury and most often it is a by-product of stroke. There are cases were paralysis occurs even in new-borns as a result of Spina bifida [2]. Paralysis usually affects various parts of body, it may be a localised one or generalised one. The types of paralysis include Monoplegia (affecting only one arm), Diplegia (affecting the same body region on both the sides), Hemiplegia (affecting one side of the body), Paraplegia (affecting both legs), Quadriplegia (affecting all limbs and trunk) [3]. There is no instant cure for paralysis as of now. The paralysed patients are being approached with some medications and physiotherapy [4]. Physiotherapy seems to be a widely adopted solution for muscle arrest as it enhances blood circulation to a particular organ and relax those muscles. These therapy treatment not only recovers the damaged muscles but also hampers the progress of paralysis to a great extent. In order to undergo this therapeutical treatment, the patient needing physical rehabilitation have to make a regular visit to the hospital, to get the treatment done by the therapist. This regular visit to the hospital causes inconvenience to the patients, as they have got to travel a distance. Moreover the existing shortage of therapists and caregivers assisting physically disabled individuals at home is expected to increase and would become serious problem in the near future. The patient population needing physical rehabilitation of the upper extremity is also constantly increasing. Robotic devices have the potential to address this problem as noted by the results of recent research studies. However, the availability of these devices in clinical settings is limited, leaving plenty of room for improvement. In order to rectify this issue, an Auto Assist Physio model for therapeutical purpose have been proposed. In this system, two arms are being employed. The paralyzed patient will be provided with an arm for therapy purpose and another arm will be with the doctor for assisting the therapy. This model provides therapy only to the upper extremities. The patient arm will be attached to the patient by having a grip at neck and shoulder of the patient. On the other side the doctor will be giving therapy to these patients via commands that is being executed on the doctor arm model. In

response to the doctor arm command, the patient arm executes the therapy. The command operations includes folding, straightening, rotating to particular degree, massaging and so on. The implemented work is actually a combination of two parts i.e. controlling part and therapy part.

2. METHODOLOGY

2.1. Controlling portion

The Doctor arm frames the controlling part of the model. A block diagram representing all the elements used in the controlling portion is shown in Fig 01. Here rotary sensors are being used for measuring the angle between the knee joints and this is provided with a supply voltage of 5V. Rotary sensor of high sensitive passive design is used.PIC microcontroller is used for the controlling operation. PIC16F877 belongs to a class of 8-bit microcontrollers of RISC architecture. It has 8kb flash memory for storing a written program. It is usually used for storing important data that must not be lost if power supply suddenly stops. MPLAB IDE is the software program that runs on a PC to develop applications for Microchip Microcontrollers. The doctor codes the therapy to be done into the controlling portion of the device and the code is being transmitted through the RF transmitter. HT12A with a 38 kHz carrier for infrared transmission medium is being employed.

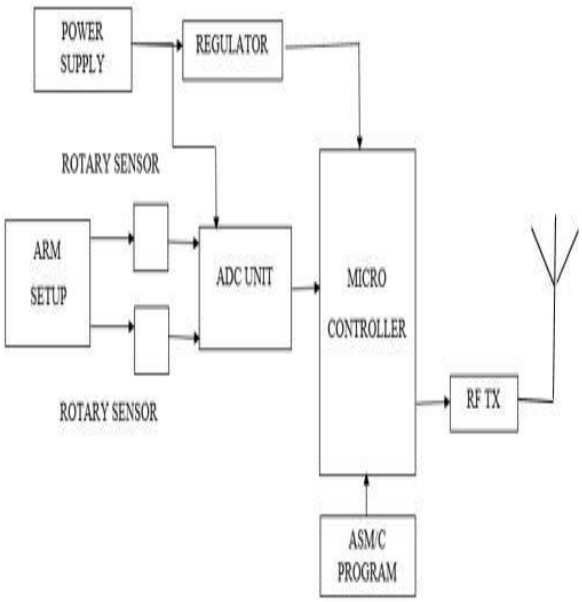

Fig 01: Block Diagram of Doctor arm

2.2. Therapy portion

The Patient arm frames the therapy part of the model. A block diagram representing all the elements used in the therapy portion is shown in Fig 2. Here DC motors are being used for bending and straightening the patient's knee joints and this is provided with a supply voltage of 12v with current rating at about 1amp. The motor has torque ranging about 500 N/m.sq and its RPM is 12. Relay is used to turn on/off the motor. The transmitted signal from the controlling portion is being received via the RF receiver. The antenna is also used at the receiver unit to collect the

data which is send by the transmitting antenna. The antenna receives the desired signal and sends the data to the decoder circuit. The 2^12 decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek's 2^12 series of encoders. Once encoding is completed, the therapy is performed to the patient.

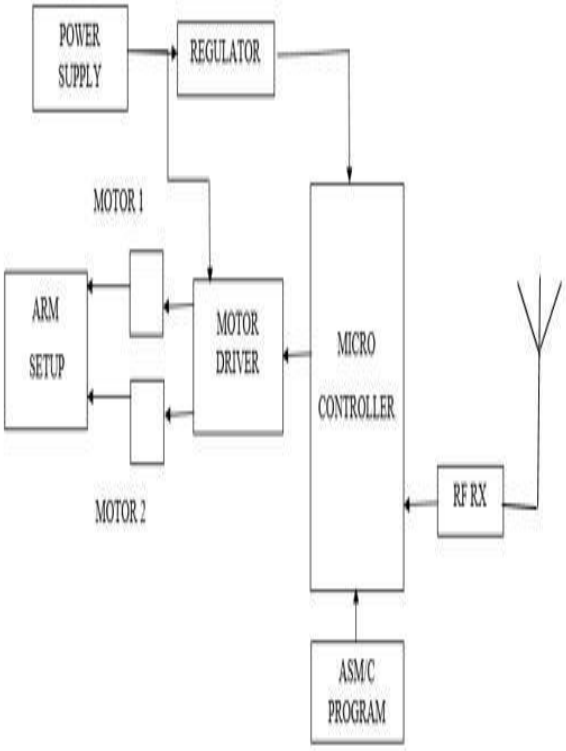

Fig 02: Block Diagram of Patient arm.

03: Pin Diagram of PIC

In this system, the Deep learning technique is used for getting better data transmission and reception. In Deep learning, a computer model learns to perform classification tasks directly from image, text, or sound [5]. Deep learning models can achieve state of the art accuracy, sometimes exceeding human-level performance. Most deep learning methods use Neural network architecture, which has about 150 hidden layers, while the typical design have only about 2-3 hidden layers.

3. SYSTEM FLOWCHART

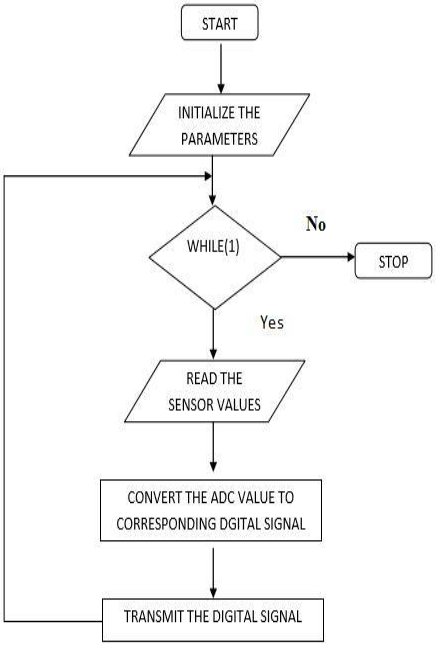

Fig 04: Flow Chart of Doctor Arm Software

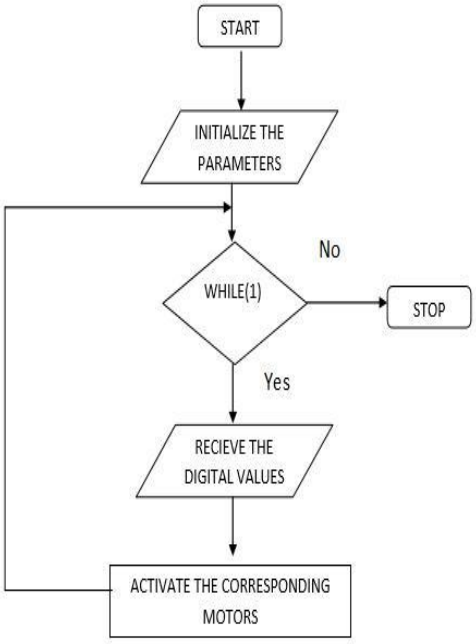

Fig 05: Flow Chart of Patient arm Software

In Fig.04 flowchart of the doctor arm software and in Fig.05 flowchart of the patient arm software are shown which gives the perception of system software.

4. RESULTS AND DISCUSSION

4.1. Outcomes

In the test run, it is found that the patient arm is bended to about 45° in response to the movement of the doctor arm, which is bended to an angle of 45°. In a similar manner, therapy movements such as rotation, streching and massaging can be performed with further advancements.

4.2. System application

1. A paralyzed person needs some important therapies regularly and for long period of time. To avail these therapies a therapist or a doctor or a specialist is essential. But with this system the disable person can accomplish some basic therapies without help of another person or only with the help of family members.
2. Moreover, a therapist or a specialist demands a large amount of fee which is a burden for a person of middle or lower class family. In that case this system can save their money, by fulfilling their demand.

4.3. System advantages

This system has the following advantages

1. Simple operation
2. Wide control
3. One doctor can give exercise to more patients

4.4. System limitation

This system has some limitations also. These includes

1. The proposed system can provide therapy treatment one for upper extremity issues.

4.5. Future development

The improvement of the system can be done as given below:

1. Redesigning and rebuilding as per patient's requirements.
2. Development could made for providing treatment for lower extremity issues.

5. CONCLUSION

In this project, Microcontroller based arm was developed in order to provide therapy for paralysis case with upper extremity. This method of therapeutical approach is more efficient and cost effective compared to the making regular visit to the therapist. However with the advancement in the proposed system, therapy can be provided to all types of paralysis patients in same manner and thereby ensuring the rehabilitation of the defective parts. With the help of Government, this system could be improved and made easily available to the people under poverty line.

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