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Design and Development of an Arm Control System for Paralyzed Patients using Pic Microcontroller

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Abstract – **In today's world, most of the people are suffering by a disease called Paralysis. Paralysis is a disease caused due to loss of ability to move their muscles. It is mainly caused due to the problems in nervous system. Around 1 of every 50 individuals in the**
have been determined to have some type of loss of motion, transient or changeless. In this paper, paralyzed patient have an inbuilt arm for their daily exercise. This arm can be activated through another arm by doctor. The doctor can give command to the patient through his arm. This arm helps to fold, straight and rotate the patient arm as per doctor arm. As the doctor moves his arm, the patient's arm will move accordingly. The control for arm is given through the microcontroller and the signals are transmitted. The transmitted signals are received in the receiver side that is connected to the patient's arm. Thus, this paper proposes a method of arm control for paralyzed patients.

Keywords: Paralysis, PIC Micro controller, Motor drive, RF transmitter and receiver, Robotic arm setup.

I. INTRODUCTION

The current lack of advisors and parental figures helping physically debilitated people at home is relied upon to increment and end up significant issue sooner rather than later. The patient populace requiring physical restoration of the furthest point is additionally always expanding. Mechanical gadgets can possibly address this issue as verified by the consequences of late research thinks about. Be that as it may, the accessibility of these gadgets in clinical settings is restricted, leaving a lot of opportunity to get better. The reason for this paper is to archive an audit of automated gadgets for upper appendage restoration incorporating those in creating stage so as to give an extensive reference about existing arrangements and encourage the advancement of better than ever gadgets. This is a simple operation and worldwide control. The patient who is paralyzed will be given exercise from doctor through another robotic arm. This is done by providing control mechanism using PIC 16F877A microcontroller. The signals are transmitted through Radio frequency Transmitter and Receiver. The main advantage

of this work is that One doctor can give exercise to more patients. And the patients feel less difficulty in doing the regular exercise. He or she can get cured within a short period of time with proper and regular workouts.

II. BLOCK DIAGRAM

There are two block diagram involved in this paper, one is the blocks which are forming the Doctor's arm and the other one forms the Patient's arm.
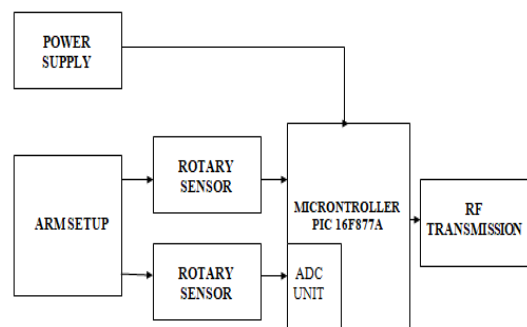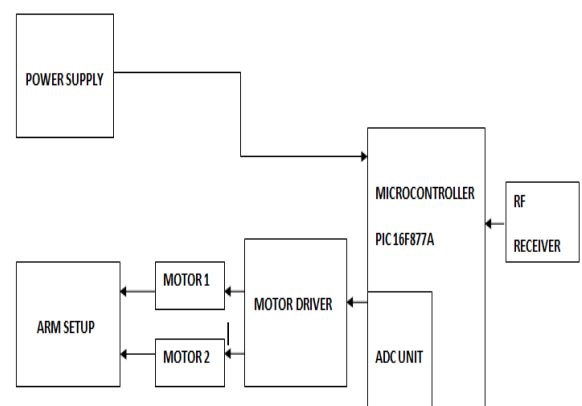

Figure.1 Schematic of Doctor's Arm

Figure.2 Schematic of Patient's Arm

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III. BLOCK DIAGRAM DESCRIPTION

A. Powersupply:

The power supply circuits assembled utilizing channels, rectifiers, and after that voltage controllers. Beginning with an air conditioner voltage, an enduring dc voltage is gotten by correcting the air conditioner voltage, at that point separating to a dc level, lastly, managing to get a coveted settled dc voltage. The direction is generally gotten from an IC voltage controller unit, which takes a dc voltage and gives a fairly bring down dc voltage, which continues as before regardless of whether the info dc voltage shifts, or the yield stack associated with the dc voltage changes.

B. Transformer:

A transformer is a gadget which changes high voltage AC into low voltage AC or the other way around. We will likely change over high voltage AC into low voltage DC. So there is definitely no motivation to utilize advance up transformer. The transformer that is utilized as a part of energy supply is venture down transformer, which ventures down the info AC voltage. The extent by which transformer ventures down the voltage relies upon the turn's proportion of essential and auxiliary winding. Watch the greatness of sinusoidal flag before the transformer piece. Its size is very high when contrasted with that of the flag after the transformer piece chart. This shows the flag was ventured around the transformer. There emerges a conspicuous inquiry with reference to why transformer is utilized as a part of this framework. The primary motivation behind why we utilize transformer in the framework are as per the following. We need to diminish the voltage level which we get from the AC mains. Transformer can carry out the activity of decreasing the voltage level in a basic and effective way. The diodes utilized as a part of the rectifier square can't deal with such an abnormal state of voltage from the AC mains. So the voltage is first ventured around the transformer and the lessened voltage is connected to the rectifier area. The specifications of the transformer used is given in Table.1.

S.NO	PARAMETER	RANGE
1	Input voltage	230V
2	Frequency	50Hz
3	Output voltage	12 V
4	Rated power	24VA

Table.1. Specifications of Step down Transformer

C. Rectifier :

A rectifier is an electrical device that believers alternating current (AC), Which regularly reverse direction, to coordinate current (DC), Which streams in only one direction. The procedure is known as modification.

D. Filter:

The yield subsequent to being handled by full wave rectifier isn't an unadulterated DC. The yield is a throbbing DC. The yield contains substantial changes in voltages. This is very clear from the square of full wave rectifier appeared previously. The power supply that we plan to configuration must not have any variety in yield voltage. The voltage that we get from full wave rectifier varies between 0 V and Vpeak, and thus it contains AC segments. These AC segments should be sifted through in order to get DC voltage. This is the place channels come into picture. Channels, as the name proposes, sift through any AC segment introduce and gives DC as the yield. Be that as it may, the yield from the channel is as yet not an unadulterated DC but rather channels evacuates the AC segment in the voltage to an impressive degree. This expands the normal DC estimation of the yield voltage. Presently an inquiry must emerge in the matter of how we can make a channel and which parts are required to make a channel. In spite of the fact that it not the objective of this segment to consider channels in detail, it must get the job done to realize that channels utilized as a part of energy supplies can be made essentially by utilizing capacitors. We leave the outline of capacitive channel to some other segment.

E. IC Voltage Regulators:

Voltage controllers involve a class of generally utilized ICs. Controller IC units contain the hardware for reference source, comparator intensifier, control gadget, and over- burden insurance all in a solitary IC. In spite of the fact that the inner development of the IC is to some degree not the same as that portrayed for discrete voltage controller circuits, the outside activity is much the same. IC units give direction of either a settled positive voltage, a settled negative voltage, or a customizably set voltage.

F. Wiper Motor:

Wiper Motor, the power wellspring of the wiper edge, is the center of the entire wiper framework. Thusly, the nature of the wiper motor must be guaranteed to ensure its execution. The wiper motor is an unchanging magnet facilitate current (DC) one. It is set up on the front windscreen glass with the mechanical parts of the worm

prepare. The worm equip abilities to back off and augment torque. Its yield shafts spur four-bar linkage, by which the improvement is changed from turning to swinging. Three-brush structure is grasped to take off speed change more favourable. The irregular hand-off, by which the between time is controlled, utilizing the entry of switch contacts and the charge-discharge limit of the resistor-capacitor in the exchange, drives the wiper to wipe in a particular cycle. The wiper front line tape, the instrument to clean the water and the rottenness on the glass, presses the surface of the glass with springs. Exactly when the tip of the forefront is in a particular point with the glass, can the required limit be made sense of it. The specifications of wiper motor is given in the table 2.

Rated voltage	12 v
No load speed	90±10
Rated speed	65±15

Table.2. Specifications of Wiper motor.

G. Relay:

Transfers are essential switches which are worked both electrically and mechanically. Transfers include an electromagnet and moreover a game plan of contacts. The exchanging system is finished with the help of the electromagnet. There are in like manner other working guidelines for its working. Nevertheless, they differentiate according to their applications. Most by far of the devices have the use transfers. The essential assignment of a hand-off comes in places where only a low-control banner can be used to control a circuit. It is in like manner used as a piece of spots where only a solitary banner can be used to control an extensive measure of circuits. The utilization of exchanges started in the midst of the advancement of telephones. They accepted a key part in trading acquires telephone exchanges. They were moreover used as a piece of long partition media transmission. They were used to switch the banner beginning with one source then onto the following objective. After the advancement of PCs they were also used to perform Boolean and other reliable errands. The higher end employments of transfers require high vitality to be driven by electric motors, and so forth. The specifications of the transformer used is given in Table 3.

S.NO	PARAMETER	RANGE
1	Nominal voltage	12 v
2	Coil resistance	400 Ω
3	Power consumption	0.36 W
4	Nominal current	30 mA
5	Drop out voltage	10% min.

Table.3. Specifications of Relay.

H. LCD:

LCD (Liquid Crystal Display) screen is an electronic display module and locate an extensive variety of uses. A 16x2 LCD is extremely essential module and is exceptionally commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs

I. PIC16F877 Microcontroller:

PIC16F877 belongs to a class of 8-bit microcontrollers of RISC architecture. It has 8kb flash memory for storing a composed program. Since memory made in FLASH technology can be customized and cleared more than once, it makes this microcontroller reasonable for gadget advancement. IT has information memory that should be spared when there is no supply. It is generally utilized for savingy critical information that must not be lost if control supply stops all of a sudden. For example, one such information is a predetermined temperature in temperature controllers. On the off chance that amid lost power supply this information was lost, we would need to make the alteration upon regaining supply.
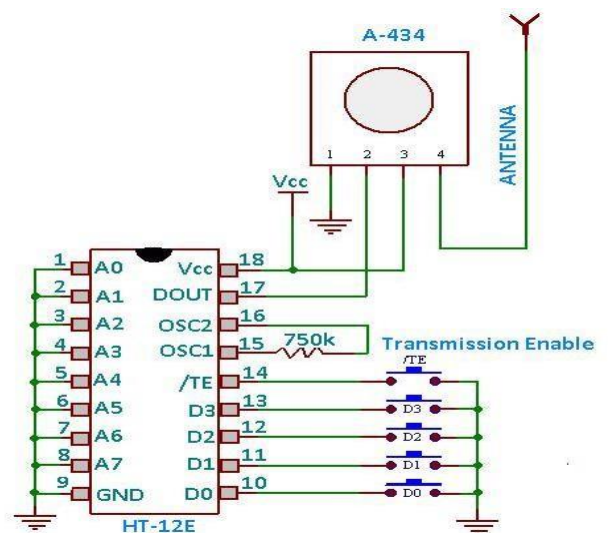
J. RF TRANSMITTER:

Figure 3.RF Transmitter

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RF transmitters are electronic gadgets that make persistently fluctuating electric current, encode sine waves, moreover, impart radio waves. RF transmitters use oscillators to make sine waves, the base troublesome and smoothest sort of continually moving waves, which contain information for example, sound and video. Modulators encode these sign waves and recieving wires pass on them as radio signs. There are a few approaches to manage encode or deal with this data, including Amplitude Modulation (AM) and Frequency Modulation (FM). Radio systems constrain bound impedance and disturbance. With facilitate plan spread range, signals are spread over a gigantic band by multiplexing the banner with a code or check that modifies each piece. With repeat hopping spread range, signals go through a limited plan of coordinates in a continuous, rehashing, and predestined case.The specifications of the transmitter used is given in Table 4.

PARAMETERS	RANGE
Operating voltage	2.4 v-12 v
Low standby current(V_{DD})	5 v
Carrier frequency	38Khz

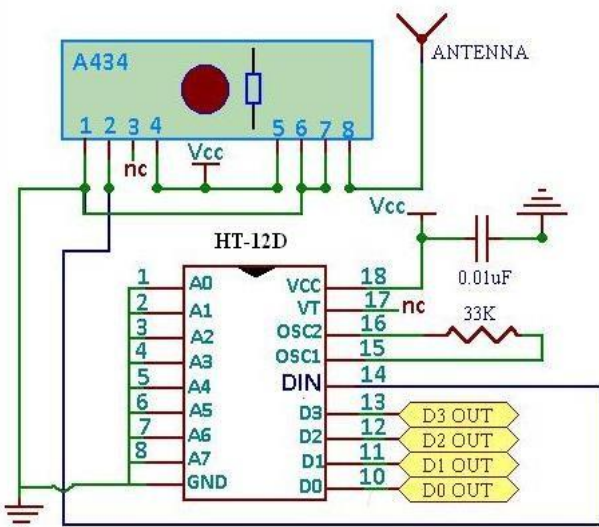Table 4 . Specifications of the transmitter

K. RF RECEIVER:

Figure 4.RF Receiver

The receiver module has IC RX3400/RX3400 crystal oscillator, capacitor, inductor and numerous segments. The RX3400/RX3400-LF is low powers ASK collector IC which is completely perfect with the Mitel KESRX01 IC

and is appropriate for use in an assortment of low power radio applications including remote keyless section. The RX3400/RX3400-LF depends on a solitary change, super-heterodyne receiver design and consolidates a whole Phase Locked Loop (PLL). The specifications of the receiver used is given in Table 5.

Frequency range	433.92 MHz
Modulate mode	ASK
Supply voltage	5 v

Table 5.Specifications of receiver.

IV. METHODOLOGY

The methods for design and development of arm control for paralysed patients is given by the following steps. Flowcharts for design of doctor and patient arm are given in Fig. a and Fig. b. The signals transmit from the doctor's arm to patient's arm. The doctor can give exercise to the patient according to his wish.
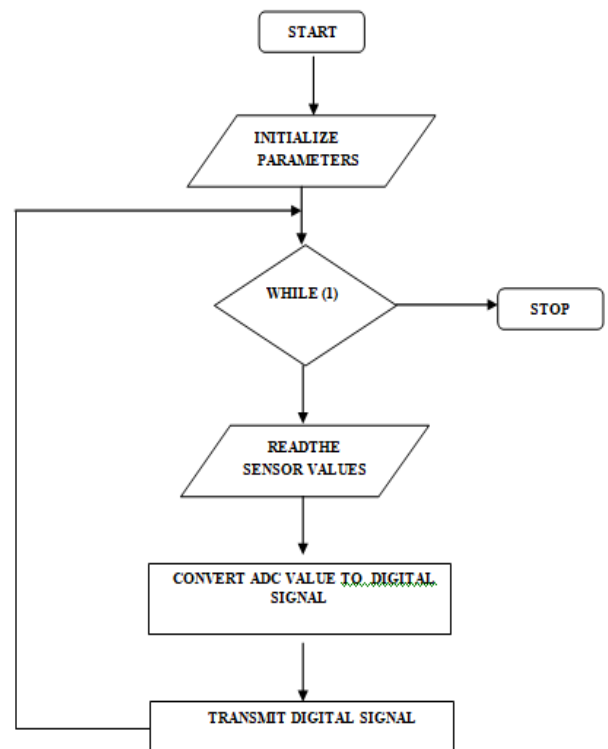

Figure.5.Flowchart of Doctor's arm

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Initially the doctor can rotate his arm according to the exercise he wish to give to the patient. This rotation will be sensed by rotary sensors and analog voltage is obtained as a sensor output. The analog output is given to the microcontroller for analog to digital conversion. The converted digital output is fed into the coding of the microcontroller. The coding will be compiled and data is obtained depending upon the position of arm. This data will be encoded using HT-12E encoder and gets transmitted with the help of A-434 transmitter. The signals will be transmitted through RF antenna.

The signals that is transmitted from the transmitter is received by the RX 3400 receiver the data received from the receiver is decoded using HT-12D decoder. The data output that is decoded is used to drive the motor drivers, which in turn, used to drive the motor. The patient's arm will change its position with respect to the motor rotation.
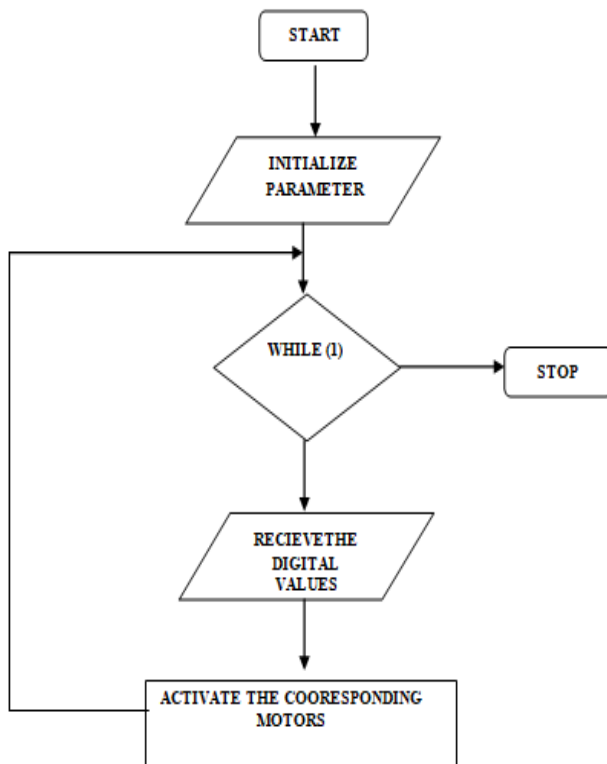

Figure 6.Flowchart of Patient's arm

The program coding is shown in figure

PROGRAM DESCRIPTION:

In this paper, the program coding is compiled in the PIC microcontroller with the help of MATLAB IDE software.

MPLAB IDE is an item program that continues running on a PC to make applications for Microchip Microcontrollers.

It is called an Integrated Development Environment, or IDE, in light of the way that it gives a particular joined "condition" to make code for inserted Microcontrollers.

An installed framework is ordinarily an outline making utilization of the energy of a little microcontroller. These microcontrollers join a microchip unit (like the CPU in a work area PC) with some extra circuits called "peripherals", in addition to some extra circuits on a similar chip to make a little control module requiring couple of other outside gadgets. This single gadget would then be able to be inserted into other electronic and mechanical gadgets for ease computerized control.
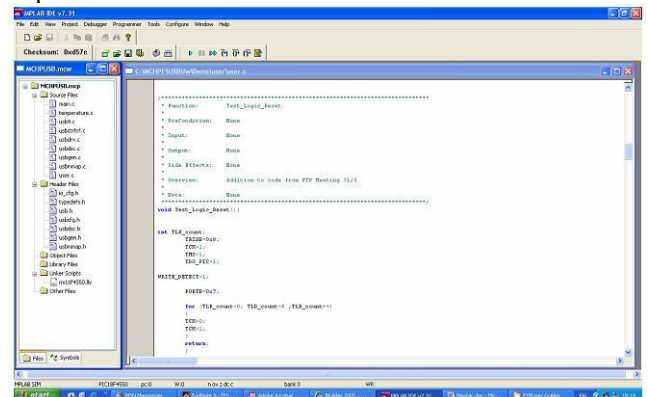

Figure 7. MPLAB IDE

The program is divided into four stages: Arm in rest, Fore arm bend, Arm total bend, Arm stretch. For every stage, each pin is assigned as High, where the remaining pins is assigned Low. Depending on the data output of microcontroller, the arm will either stretch, bend or remain at rest. This data generated through the coding is encoded and passed to the transmitter.

V. CONCLUSION:

Thus, arm control system for paralysed patients is designed using PIC 16F877A microcontroller. The system is implemented and tested for various arm movements. The model of this paper is useful to teach the basic exercise which useful to recover the handicap's usual working habits. An arm to arm controller will reduce the effort of the doctors to give the treatment to more patients. All the process will be done simultaneously. This controller is an electronic device so it will be user friendly. Once you programmed for a specific act or exercise, it will do the repetition for more time. All we need to do this an electricity. In future, it will make a huge impact in medical field as well as physiotherapy field.

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