

# “Design and Implementation of Multimodal Wheelchair for Paraplegia Patients using RF module”

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## Abstract

According to India's population there are many health related problems. But the challenging fact is that when people lose their mobility, they are dependent on others for daily activities due to paralysis, stroke, arthritis or for senior citizens. The main objective of this paper is to provide an automated system for such disabled people in the form of an automatic wheelchair. The proposed system recognizes hand gestures which induce control commands to the controller so that it can control the movement of the wheelchair according to the user. Development of a motion-controlled wheelchair has been executed using wireless communication, a flex sensor, and a microcontroller. Depending on the variation in the sensor, the microcontroller controls the wheelchair orientation with DC motor utilization.

**Index term-** RF module, Microcontroller, wireless, Sensor.

## 1. Introduction

As per the study conducted by Christopher & Dana Reeve Foundation, the rate of people suffering from paralysis due to nervous system damage is near about one person in 50. Given figure approximates to 6 million people worldwide and has raised by 33% from prior estimation. Paralyzed patients are disabled to move from one place to another. The causes for such disability in motion possibilities can be distinct such as stroke, arthritis, degenerative diseases of bones and joints, high blood pressure, and birth defects. In this system, we plan to construct a cost-effective design for a wheelchair for such a type of people who perceive the difficulty to move independently. The other important provision is that the wheelchair must have to give a response quickly and control the user's commands effectively. In this proposed system, a wheelchair is developed for physically disabled people in which a microcontroller enables a standard electric wheelchair which is operated by hand gestures of the user. The framework of the wheelchair is assembled using a PIC microcontroller due to its low cost, features that are easy to erase and program, an RF module for data transceiving, and flex sensors. Micro Electro Mechanical Sensors (MEMS) that convert mechanical signals to electric signals also drive DC motors. The DC motors are fixed to the wheelchair to control the direction of the wheelchair which is interfaced with the PIC via a relay driver circuit.

## 2. Proposed Work

The multimodal wheelchair involves flex sensors which sense the motion of user's hand , microcontroller to control the direction of wheelchair using DC motors , RF module used to communicate the wheelchair with the patient. The speed of motors are controlled by the PWM technique which is very essential for the patient.

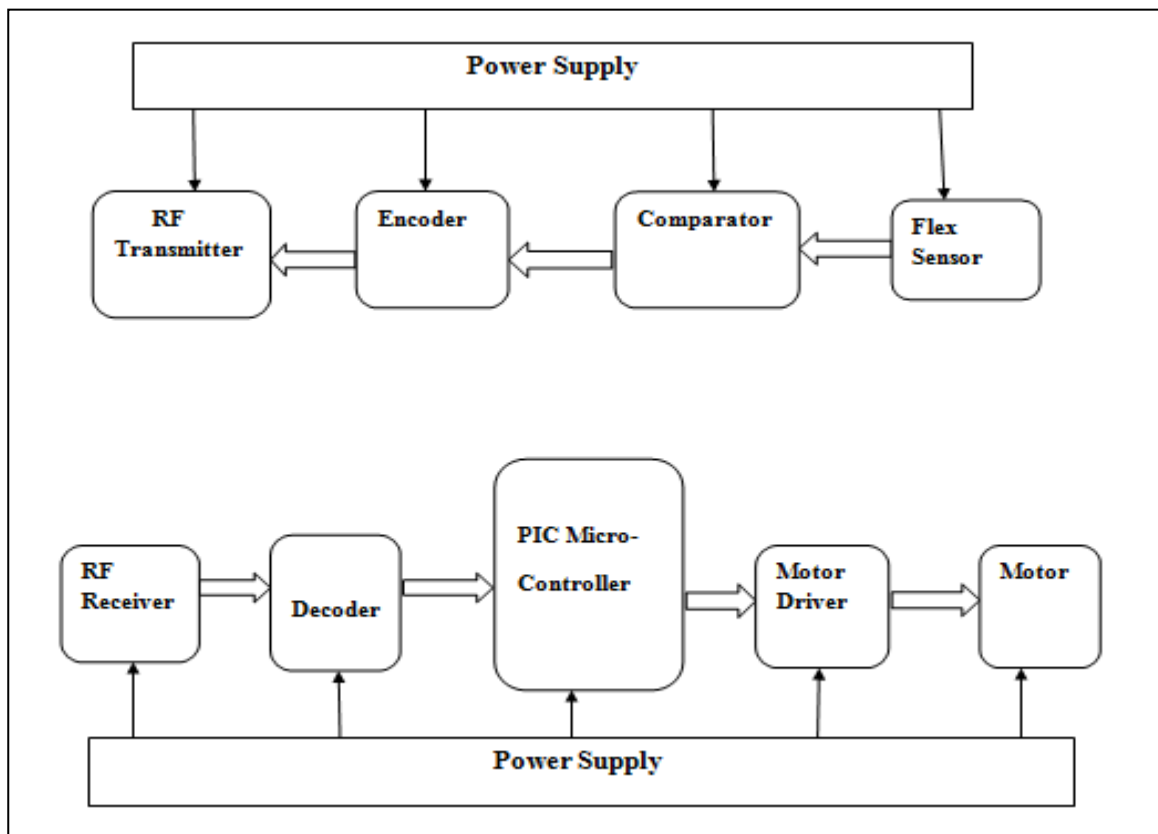


Figure shows the block diagram of the system, the RF module in which transmitter and receiver are present used to transmit and receive the radio frequency signal from flex sensor to controller respectively. The transmitter side is placed at the user side and the receiver side is placed at the wheelchair. The flex sensors are linked to the hand gloves of patient, depending upon the movement of fingers sensor gives the signal to controller which drives the motors and chair will move back and fro, left and right , stop with the help of wireless communication. So by identifying the hand gesture of physically disabled people the automated wheelchair easily move from one place to another. Also there is a provision of buzzer on robot to send the signal for patient's relatives.

### 3. Hardware Description

#### 3.1 Microcontroller



**Fig .1. Microcontroller**

PIC microcontroller is easy to program with MPLAB and also erase, having features like 20 MHz Crystal Oscillator with Boot loader Software, 32KB flash memory , 2KB SRAM, 256 bytes EEPROM , 35 I/O lines to interface with many peripherals, four PWM channels, in built ADC, supports USB V2.0 for communication having speed from 1.5Mbps to 12Mbps, with Watchdog timer to reset under error it can be used on systems with no human interference.

#### 3.2 Flex sensor

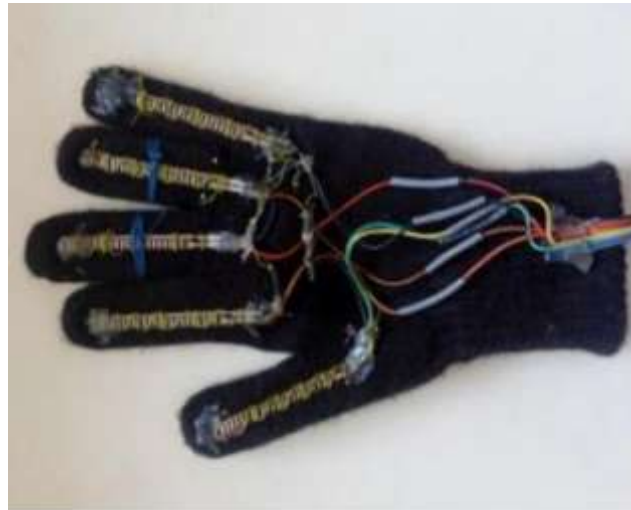


**Fig.2. Flex sensor**

Flex sensor is type of sensor used to measure bending similar to variable resistor sensor, change in resistance is depend on the amount of bending angle or deflection of sensor which is in directly proportion. This sensor is two terminal device having no polarity such as diode, pin 1 is generally connect to power supply and other is grounded . To activate the sensor , usually 3 to 5 Volt DC is required, flat resistance is 25K  $\Omega$  with tolerance  $\pm 30\%$ . We have to convert this changing resistance into voltage for practical purpose by utilizing the voltage divider circuit. This type of sensor is used whenever bending or deflection angle is change like robotics, medical devices , musical instruments etc.

### 3.3 Data Glove

Data glove is the normal hand glove on which the flex sensors are attached along with the fingers by threading or glue such that sensors squat properly and gives proper voltage drop so that transmitter transfers the data very effectively to receiver for controlling the wheelchair.



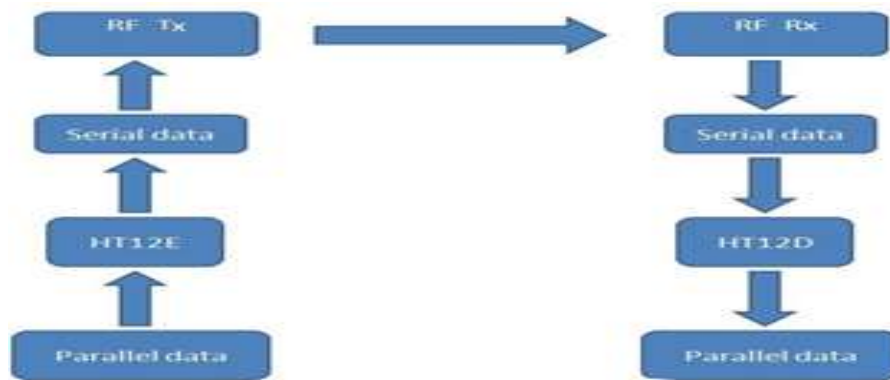
**Fig.3. Data Glove**

### 3.4 RF Module

The module utilizes wireless simplex Tx and Rx operates on 5V, 9 mA to 40 mA, 433MHz operating frequency. It works on Amplitude shift keying modulating technique with 10Kbps data transmission speed having transmission distance three meter to 100 meter. Before transmitting any data via transmitter module required some sort of encoding and decoding after data is received by receiver, for being it module required encoder and decoder IC specifically HT12E and HT12D respectively.



**Fig.4. RF module**



HT12D is 12 bit RF decoder IC, convert the parallel data into serial data, transmit 12 bits data out of which 8 bits for set address and 4 bits for data which is to be decoded. The 8 bit address is common for pair of RF encoder and decoder ICs. HT12E is capable of encoding 12 bit data having 8 bit address and 4 bit data. Both encoder and decoder ICs are CMOS LSIs always used in pair because of RF frequency matching, useful in RF and IR applications and remote control systems.

#### 4. Conclusion

The suggested multimodal wheelchair system possess the human-machine interaction and MEMS sensors is well organized, low cost, low power consumption and beneficial to paralyse patients and senior citizens or those individuals who are not capable to mobile independently. This prototype uses hand glove along with flex sensors instead of joystick as comparing economically. The future system is of developing or adjoining some extra features like voice recognition and perceiving the self-demands.

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