

# Device Operated Aid for Patients using Head Movement

V. S. Dharun\* and Vyshakh Asokan

Department of Biomedical Engineering, Noorul Islam University, Kumaracoil - 629180, Tamil Nadu, India;  
dharunvs@yahoo.com

## Abstract

**Background:** Patients who are bed-ridden or paralyzed from neck down often rely on human assistance for their daily basic needs. Their life is a struggle even to do simple every day task. Now a days there are many assisted devices in making them do their daily task a simpler one. **Methods:** Famous scientist and physicist Stephen Hawking who suffers from a rare paralysis disease uses a speech generating device to communicate. The main causes of paralysis are myopathy a disease that affects the muscles, neuropathy they are caused by damages in the nerve, spinal cord injury or strokes in the brain the events that follow after this can be severe. In some cases paralysis can be permanent. Patients with paralysis have to often call out for help for switching on the light, fan or any other electronic devices. There must be a standee near to them every time. **Findings:** This paper aims in helping the bed-ridden patients to control the electrical appliances and basic switching on and off of lights, fans etc. without the help of by standee. The patient can totally depend upon him or herself. With the movement of head, patients can control fan, light and basic electronic devices. **Improvements:** This device works on the principle of an accelerometer which helps in detecting the head motion. A buzzer is also present in the device which helps the bedridden patients to call out for a human assistance. The device is tied to the patient's neck. Moving the head towards left or right and up or down can switch on and off light, fan etc.

## Keywords:

## 1. Introduction

Paralysis is a condition in which the patient loses his or her muscle function. Patients who involve in a severe accident or illness can lead to paralysis. It is often caused due the damages in nervous system. Paralyzed patients often lose their voluntary capabilities. Some paralysis patients can lose their movement and sensation in the limbs, some injuries can affect the face and some can affect from neck down region. Patients who are bedridden are often felt lonely or emotional due to their condition. They cannot do activities like other normal people can do. They often have to rely others. Patients who are paralysed from neck down have to totally depend up on others. He cannot feed him, do basic things such as switching on and off lights, fans etc. This device helps in solving the patient's problem. This device operates with the help of an accelerometer. Each head movements are assigned with respective electronic equipment's. The accelerometer

is used in order to convert the physical movements into the electrical signals. The device consist of a transmitter part and also a receiver part. They help in sending and receiving signals. They help in sending and receiving from the accelerometer towards the receiver. The device can also be equipped with a buzzer so that the patient can call out for help in case of an emergency.

An assistive device can be defined as a system or equipment which is altered or customized to improve the life of an individual with disabilities more functional. They help to perform task for the disabled which they were formerly unable to do. There are many assistive devices available now a days.

Some of the assistive devices are hearing aids, cognitive assistance (they include computer or electrical assistive devices), adaptive switches which makes persons with limited motor muscle movement to interact with toys and video games. In an environment such as a class room assistive devices plays a major role such as automatic page

\* Author for correspondence

turners, adapted pencil grips, book holders etc. for the disabled children. People with disabilities can use modern touch screen phones with the help of this technology. In nearby future we can see many developments in the field of assistive devices.

## 2. Literature

Several techniques using the head movement have been approached during the last decade. In<sup>3</sup> the accelerometer gives an idea about its significant in the field of medical science such as its accuracy and correctness. In<sup>5,6</sup> a method using time measurement is used in order to collect the data. The measurement of acceleration using a motion detector can be found out from this experiment. In<sup>4</sup> we see that the quake-catcher network uses a low cost motion sensor which is connected to computer using an internet connection.

Here we note that the studies given below suffers from late time duration and some of the techniques mentioned above needs manual humans assistance at all times therefor they are not self-automated. In this paper we use the latest microprocessor i.e. PIC 16F877A, as a result we get the benefits of speed, accuracy, self-automated and are more reliable than the above mentioned literature reports. There are works related to this field such gadgets with multitask controlled by the movement of eyes.

## 3. Hardware Description

### 3.1 Transmitter Part

The components seen inside the transmitter part are accelerometer, ADC, 16 x 2 alphanumeric LCD and a RF transmitter.

#### 3.1.1 Accelerometer

The accelerometer used inside this device helps in measuring the acceleration of the head movement. Accelerometer helps in finding the angle at which the head is moved. It detects the acceleration at which the head is moved and also the tilt movement of the head. The accelerometer is tied at the patients neck so that as the patients moves his head it can be detected by the meter. This device uses four types of physical head movements. The movements are up, down, left and right shown in the Figure 2.

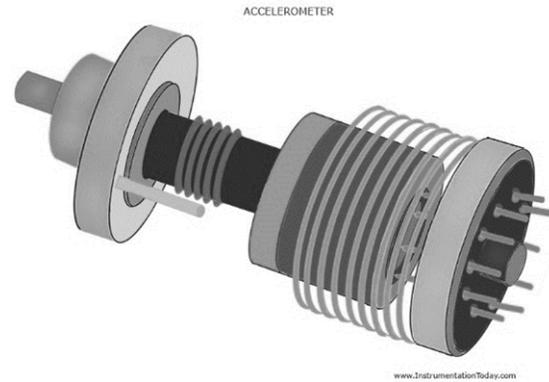


Figure 1. Accelerometer.

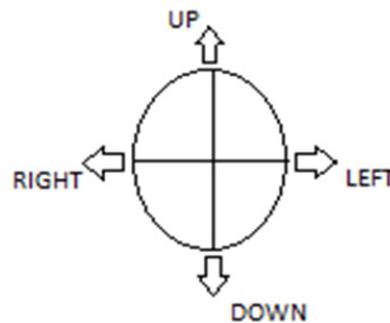


Figure 2. Head Movement Positions.

- Head movements towards up-switches on light.
- Head movements towards down-switches off light.
- Head movement towards left-switches on fan.
- Head movements towards right-switches off fan.

#### 3.1.2 ADC (Analogue to Digital Converter)

The electrical signals from the accelerometer are transmitted on to a microprocessor which have an inbuilt ADC. The microprocessor used here is PIC 16F877A. It is an 8 bit microcontroller. The signals from the accelerometer are in the form of physical quantity i.e. in analogue signal. This ADC converts analogue signal from accelerometer to digital signal which is received at the receiver end. In order to recognize the signal and determine which device is to be operated the PIC is programmed.

#### 3.1.3 Alphanumeric LCD

The signal coming out from the PIC 16F877A is given to a display. The display used here is 162 alphanumeric LCD, which display the respective device i.e. fan, light etc.



**Figure 3.** Alphanumeric LCD.

### 3.1.4 RF Transmitter

The signal coming out from the PIC 16F887A also transmits signals to the RF transmitter, they pass the signal to the transmitter part, the frequency used here is of 433MHz, which do not interfere with any other radio frequency signal in the nearby premises.

## 3.2 Receiver Part

The components used in the receiver part is RF receiver of 433 MHz, PIC 16F877A, 162 Alphanumeric LCD and a driver circuit.

### 3.2.1 RF Transmitter

The signal from the radio frequency transmitter is received by radio frequency receiver at the receiver part. These signal do not interfere with other signal from outside, they both share the frequency of 433MHz.

### 3.2.2 PIC 16F877A

The signal from the RF transmitter are transmitted on to the microprocessor PIC 16F877A, they have a inbuilt ADC. The analogue digital converter converts analogue signal from the receiver to digital signal. The PIC is programmed to recognize the signal and it determines which devices should be operated.

### 3.2.3 Alphanumeric LCD

As seen in the transmitter part the receiver part also uses a 16 x 2 alphanumeric LCD display, they displays the respective device.

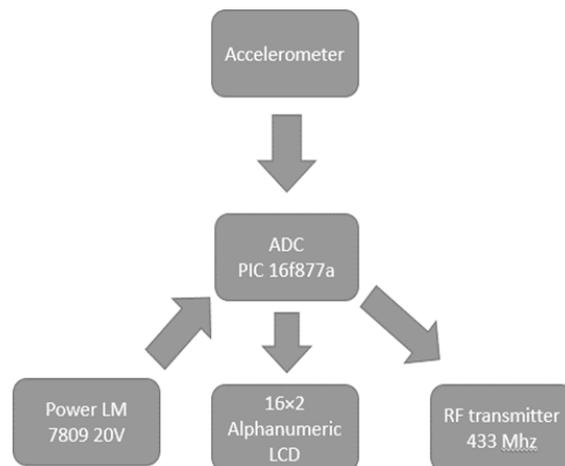
### 3.2.4 Driver Circuit

A driver circuit is used to regulate or control other circuit which passes the signal to the respective electronic device. They also control the flow of current through the circuit.

We have two devices fan and light which have their own functions. A buzzer can also be connected which helps the patients to call out for a human assistance.

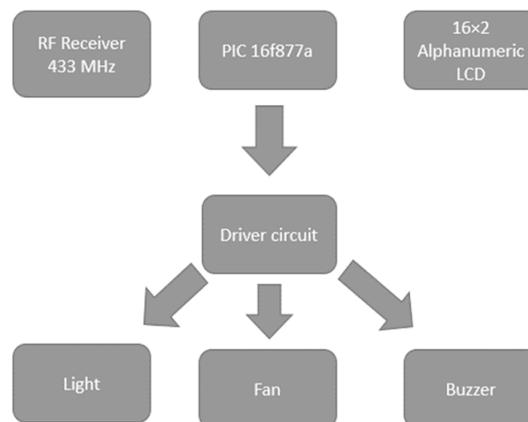
## 4. Block Diagram

### 4.1 Transmitter



**Figure 4.** Architecture of Transmitter.

### 4.2 Receiver



**Figure 5.** Architecture of Receiver.

## 5. Block Diagram Description

At the transmitter part an accelerometer is used to sense the physical movements of our head. Our head have four types of physical head movements such as up, down, right and left. Each of these head movements are assigned with respective electronic equipment's. So in order to convert the physical movement into electrical signals an accelerometer is used. These electrical signals are then passed on to microprocessor PIC 16F77A which have an inbuilt ADC in it. This ADC converts analogue signal from accelerometer to digital signal. The pic is programmed to recognize the signal and determines which device to be operated.

At the receiver part the radio frequency transmitter from the transmitter is received by the radio frequency receiver in the receiver part which used a frequency of 433 MHz. These electrical signals are then passed on to the microprocessor PIC 16f877a which have a inbuilt ADC in it. This ADC converts analogue signal from the receiver to digital signal. The pic is programmed to recognize the signal and decides which device is to be operated. The signal from the PIC16F877A is given to  $16 \times 2$  alphanumeric LCD, which displays the respective device. The signal from the PIC 16F877A is also passed to driver circuit, the driver circuit is the device which decides to pass the signal to the respective electronic device. We have three electronic, such as fan, light, buzzer. Each of them have their own functions. Buzzer helps to call out for human assistance for the patients.

## 6. Results

As a result the proposed electronic devices such as Fan, Light, and buzzer were operated using the patients head motion. The main component of this device the accelerometer helped in detecting the head motion of the patient. Thus the electronic device such as fan, light and buzzer could be switched on and off with an ease without the help a bystander for the bedridden patients. The device could be tied to the patient's neck and requires no setup.

Thus everyone can operate this device with ease. With the help of the latest components the device performs well without any lag in time and is very accurate. This device can play a vital role in patients who are bedridden or to patients who are paralysed from neck down.

## 7. Conclusion

In this paper a development of an assistive aid for the bedridden patient is presented. The motivation behind this paper is to help the patients who are paralyzed or bedridden, as they cannot do the basic stuff by them self. This device helps them feel less burden to others as they have to call out for help always. This device helps them to do the stuff by their own. By using the latest components the device is more reliable, faster speed and more durable.

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