

Electronic Mouse for Disabled People

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Abstract: - This paper shows the design of computer mouse for disabled people using MEMS accelerometer, MIC and reflection sensor. The movement of cursor on computer is controlled by accelerometer which is mounted on the side of head with the help of rubber band. When head is tilted in some direction, in left/right/forward/backward, accelerometer will sense the tilt. To perform click operation two sensors are used. First is MIC, when air is blown on MIC which is placed in front of mouth it performs clicking operations. If there is a single air blow then it will perform left click operation and if air is blown two times then it will perform right click. Suppose the person is not able to blow air on MIC or is exhausted then second sensor is used. The second sensor is reflection sensor which is mounted in front of cheek. When cheek muscle is moved it is sensed by reflection sensor. If cheek muscle is moved one time then left click operation is performed and if it is moved twice then right click operation is performed. The equipment uses AVR microcontroller ATmega 16A as a control unit. It is used to capture the output of all three sensors and process the data. After processing microcontroller sends commands to computer through MAX232 and DB9 connector. The commands coming from serial port are decoded in the software. Then software will perform the operation of mouse on computer.

Keywords – MIC, ATmega 16A, MAX232, DB9 connector, MEMS accelerometer, reflection sensor

1. INTRODUCTION

Accident is the major cause of disability. According to the report, people are mainly disabled due to accident. 1-5 out of 100000 people suffer from quadriplegia. Disability and paralysis leads to disabled arms. Some of them are paralyzed below shoulder. Due to this they are not able to use the basic facilities. One of the main facilities is computer, which requires mouse to operate it. But mouse cannot be used without hands. This design will make computer mouse useful for disabled people. The accelerometer is used to move the cursor on the screen to perform click operations. There are two available sensors which can be used according to the user requirement. Accelerometer is mounted on the side of head. It will sense the tilt of head. The MIC is placed in front of the mouth. Reflection sensor is placed in front of the cheek. All the data is then processed in ATmega 16 A which will send the command to the computer through serial port.

2. PROPOSED SYSTEM

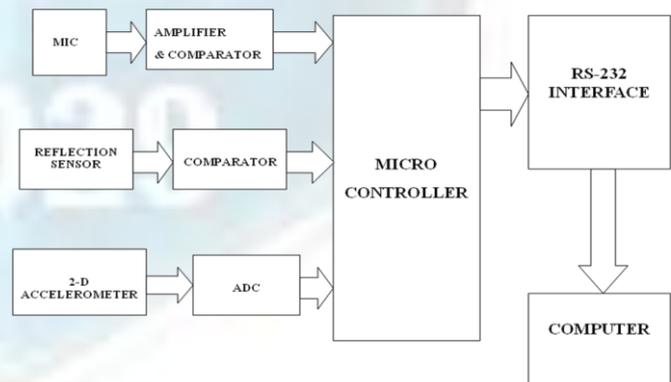


Fig.1. Block Diagram

The above block diagram shows the controlling of mouse by disabled person. In this system 2-D accelerometer is used to detect tilt caused by head. First a reference voltage is given to the microcontroller. In this case we are using internal reference of 2.5V. When head is tilted the output of accelerometer produces some

output in the form of voltage. Accelerometer has 3 outputs, each of x, y and z axis. In this case z pin out is not connected because we are using 2-D accelerometer. The output of the accelerometer is given to the microcontroller. Microcontroller converts it into digital from analog form using internal 10-bit ADC and then processed it by executing some instruction. For click operation MIC is used. It is a Condenser Electret Microphone (CEM). It has a variable capacitor in which one plate is stable (called back plate) another is variable called diaphragm. External power supply is used to charge the plates. When sound strikes the diaphragm, it moves, which changes the capacitance. This causes the change in current flow. JFET is then used to amplify current. The back plate is connected to the gate of the transistor. Source is connected to the ground and electrical signal appears at drain. The output of the MIC is given to the amplifier which amplifies the output and gives to the amplifier which amplifies the output and gives to the comparator. Comparator will then compare the input voltage to the reference and produces the output. The output is given to the microcontroller as an interrupt. If a person is exhausted by blowing air on MIC alternate sensor like reflection sensor (ITR 9909) can be used. It is mounted in front of the cheek. ITR 9909 contains IR transmitter and phototransistor. Both are mounted at 45 degree from normal to the surface. When some object comes in the distance of 7mm, IR rays will reflect and falls on the base of phototransistor. Then transistor switches on and output is given to the microcontroller as an interrupt. The output of both sensors is processed at microcontroller. Microcontroller then generates some commands and sends to the computer through MAX232. Computer receives the commands and all the commands are then decoded on the software made in Microsoft Visual Studio Express 2015 and then it moves the cursor of mouse or performs the click operation.

3. IMPLEMENTATION

3.1. HARDWARE

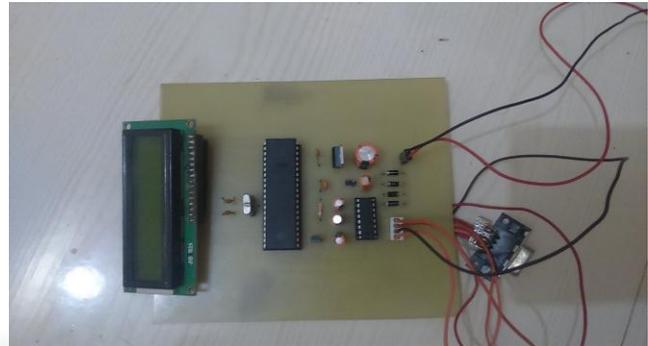


Fig.2. Microcontroller Unit

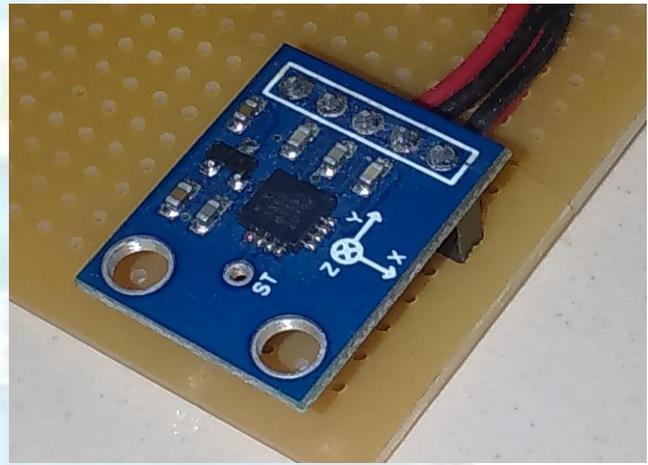


Fig.3. ADXL 335

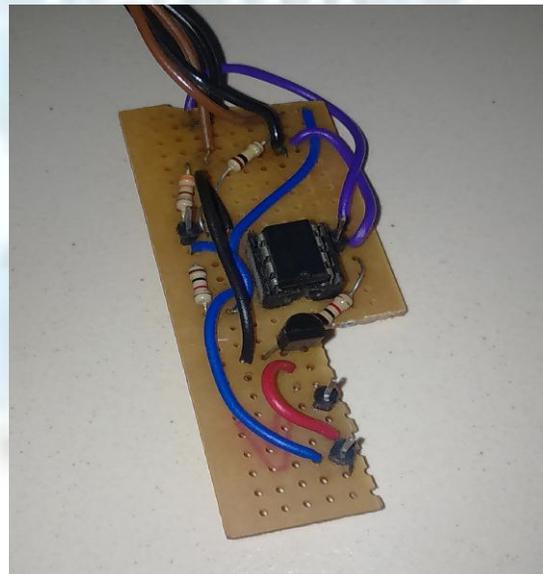


Fig.4. Comparator for Reflection Sensor

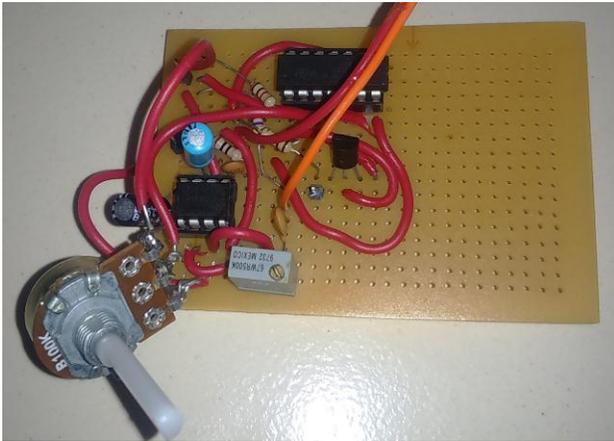


Fig.5. Amplifier and Comparator for MIC



Fig.6. MIC and Reflection Sensor on Goggles

3.1.1. MEMS accelerometer

Accelerometer is used for the determination of the degree of user's head tilt. Accelerometer uses the force of gravity as input vector to determine orientation of object in space. When oriented parallel to earth's surface it can be used to detect the relative tilt of head. One of the most popular applications of accelerometer is tilt measurement.

3.1.2. Reflection Sensor

Reflective IR sensor ITR 9909 contains an IR LED and a photo-transistor. It is placed directly in front of the cheek muscle so as to detect the movement. When the user will move his cheek muscle it will come bit closer to the IR sensor as a result more current will flow through the IR sensor and the voltage across it will decrease and this is taken as an input signal to the comparator. The required distance for detection is 0.7cm. The principle of ITR 9909 is dependent on the change in light intensity due to reduction in distance between cheek and sensor.

It consists of IR LED and photodiode mounted facing each other enclosed in plastic body.

3.1.3. ATmega 16A

ATmega 16A is high performance, low power AVR 8-bit microcontroller. It has advance RISC architecture. It supports 131 powerful instructions and has 32x8 general purpose registers. It has 32K bytes of flash programmable memory, 1K bytes of programmable EEPROM. It has for ports used for interfacing various circuits. It has 10-bit ADC with internal reference voltage.

3.1.4. MAX 232

The MAX 232 is dual driver and typically converts the RX, TX CTS and RTS signals. It converts TTL levels to RS-232 logic level which is compatible to the computer. It is used to connect microcontroller to the computer to send some commands.

3.1.5. Comparator

Comparator is used to compare the output of sensor with the reference voltage. It turns its output to high if the input voltage is higher than reference voltage. If input voltage is less than the reference voltage, output goes low.

3.2. SOFTWARE

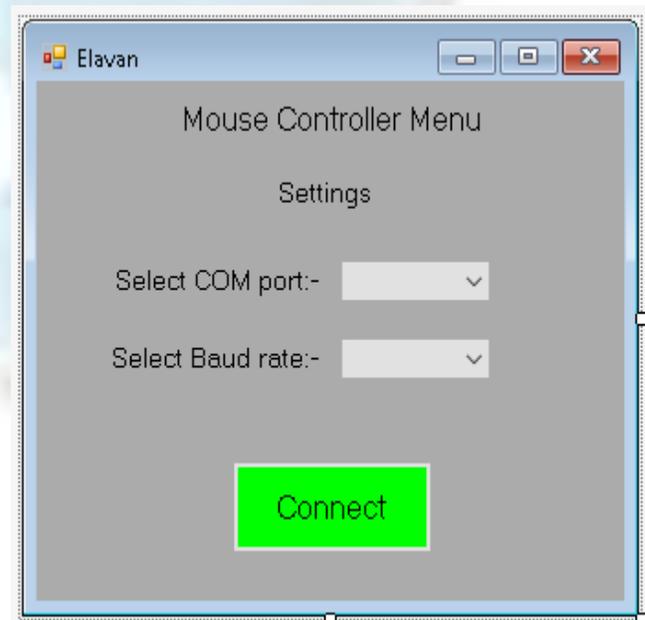


Fig.7. Software in Computer

3.2.1. Visual Studio Express 2015

Visual studio is an IDE developed by Microsoft. It is used to develop software, websites, web applications and web services for computer. In this system it is used to develop software which decodes the commands sent from the microcontroller and use these commands to perform mouse operations.

3.2.2. Atmel Studio 7

Atmel Studio 7.0 is a software environment which provides code editor to write program for AVR microcontrollers. IT supports all AVR controllers and programmers. It is used to build the program and transfer the program to the microcontroller.

4. CONCLUSION

This system is more suitable for disabled or paralyzed people to use computer mouse. It can be interface with any computer having Microsoft Windows OS with serial port. The movement of cursor is controlled by tilting head. Click operations are performed by blowing air on MIC or moving cheek muscle in front of reflection sensor.

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