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College of Engineering

Electrical Engineering

Fabrication of Smart Mouse

تركيب الفأرة الذكية

A Project Submitted In Partial Fulfilment for the Requirements of the Degree of B.Sc. (Honor) In Electrical Engineering

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الآية

بسم الله الرحمن الرحيم

قال تعالى :

اللَّهُ لَا إِلَٰهَ إِلَّا هُوَ الْحَيُّ الْقَيُّومُ لَا تَأْخُذُهُ سِنَةٌ وَلَا نَوْمٌ لَهُ مَا
فِي السَّمَاوَاتِ وَمَا فِي الْأَرْضِ مَنْ ذَا الَّذِي يَشْفَعُ عِنْدَهُ إِلَّا
بِإِذْنِهِ يَعْلَمُ مَا بَيْنَ أَيْدِيهِمْ وَمَا خَلْفَهُمْ وَلَا يُحِيطُونَ بِشَيْءٍ مِنْ
عِلْمِهِ إِلَّا بِمَا شَاءَ وَسِعَ كُرْسِيُّهُ السَّمَاوَاتِ وَالْأَرْضَ وَلَا يَئُودُهُ
حِفْظُهُمَا وَهُوَ الْعَلِيُّ الْعَظِيمُ "

صدق الله العظيم

البقرة (255)

DEDICATION

Every challenging work needs self-efforts as well as guidance of elders especially those who were very close to our hearts. Our humble effort is dedicated to our sweet and loving parents, our brothers, our sisters and our friends whose affection and encouragement make us able to get such success and honor. This project would have never been possible without their support and love.

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Lastly we need to thank our teachers in electrical and nuclear engineering school for their support.

Abstract

The computer has become one of the most important tools and necessities of many uses in our daily life, which has made great advances in technology to provide comfort. And the computer is linked to some accessories that are indispensable to work without them as tools to enter what is known as the mouse, which has evolved in its form and size. It has been noted that the continuous use of this tool leads to health problems for mouse users, this research aims to design and implement a traditional glove placed in the hand and the same functions of the mouse. This was done using tools such as Arduino, acceleramterand Bluetooth .

المستخلص

أصبح الحاسوب واحدا من اهم الأدوات وذلك ما يقتضيه من أستخدامات كثيرة في حياتنا اليوميه الشي الذي جعل هنالك تقدم كبير في مجال التكنولوجيا لتوفير سبل الراحه . والحاسوب ترتبط به بعض الملحقات التي لا غنى له عن العمل بدونهاكادوات الادخال منهاما يعرف بالماوس الذي شهد تتطور في شكله وحجمه . وقد لوحظ ان الاستخدام المتواصل لهذه الاداة يؤدي إلى مشاكل صحية لمستخدمي الماوس،يهدف هذا البحث الي تصميم و تنفيذ قفاز تقليدي يوضع داخل اليد ويعمل نفس مهام الماوس.وتم تنفيذ ذلك باستخدامادوات مثل Arduino وحساس ميلان وبلوتوث.

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LIST OF ABBREVIATIONS

RAM	Random access memory
ROM	Read only memory
OTP ROM	One time programmable read only memory
LED	Integrated Development Environment
CS	Control system
EDR	Enhanced Data Rate
AFH	Adaptive Frequency Hopping Feature
USB	Universal Serial Bus
IDE	integrated developmentenvironment

CHAPTER ONE
INTRODUCTION

1.1Background

As the time passed, the device of more suitable and reliable machine was need which could perform our work more quickly. During this time, in the year 1946, the first successful electronic computer called ENIAC was developed and it was the starting point of the current generation of computer.

ENIAC was the world first successful electronic computer which was develops by the two scientists namely J. P. Eckert and J. W. Mauchy. It was the beginning of first generation computer. The full form of ENIAC is "Electronic Numeric Integrated and Calculator" ENIAC was a very huge and big computer and its weight was 30 tones. It could store only limited or small amount of information. Initially in the first generation computer the concept of vacuum tubes was used. A vacuum tube was such an electronic component which had very less work efficiency and so it could not work properly and it required a large cooling system shown in Figure 1.1

Figure1.1: First generation of computer

As the development moved further, the second generation computers knocked the door. In this generation, transistors were used as the electronic component instead of vacuum tubes .A transistors is much smaller in the size than that of a vacuum tube. As the size of electrons components decreased from vacuum tube of transistor, the size of computer also decreased and it became much smaller than that of earlier computer shown in Figure 1.2

Figure1.2: Second generation of computer

The third generation computers were invented in the year 1964. In this generation of computer, IC (Integrated circuits) was used as the electronic component for computers. The development of IC gave birth to a new field of microelectronics. The main advantage of IC is not only its small size but its superior performance and reliability than the previous circuits. It was first developed by T.S Kilby. This generation of computer has huge storage capacity and higher calculating speed shown in Figure1.3

Figure1.3: Third generation of computer

This is the generation where we are working today. The computers which we see around us belong to the fourth generation computers In that generation, computer will possess artificial intelligence and it would be able to take self decisions like human being.Computer hardware includes the physical parts or components of a computer, such as the central processing unit, monitor, keyboard, computer data storage, graphic card, sound card, speakers and mouse ,mouse is a little device that controls the input data in computers that used with hands .the motion of mouse is typically translated into the motion of pointer on display, which allows a smooth control of the graphical user interface ,Computer mice have one or more buttons to allow operations such as selection of a menu item on a display. Mice often also feature other elements, such as touch surfaces and "wheels", which enable additional control and dimensional in putshown in Figure 1.4.

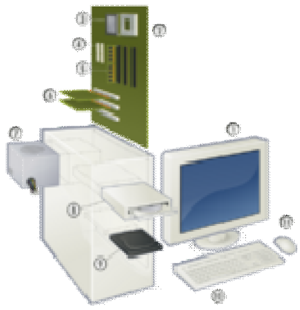

Figure1.4: Fourth generation of computer

1.2 Problem statement

The current use of the classic computer mice is a great obstacle for disabled people who lost their fingers or suffering from neurological problems.

A study conducted by the National Institute of Occupational Health in Denmark revealed the danger of using a computer mouse for a large period. The study conducted on 3.5 thousand workers in 11 Danish companies that the workers who use them for two hours or three hours continuous are experiencing serious problems in the hand and wrist muscle and Swelling, inflation and numbness. [One researcher adds that every time a person clicks on the mouse, he experiences the problems of torsion, inflation, numbness in the hand, wrist muscle, and multiple pains in the neck and shoulder as well. We click on the mouse.

1.3 Objectives

The main objective of this project is to design a model of mouse controlled by glove motion to serve people with physical disabilities, painters and games.

1.4 Methodology

- ✓ The signal is acquired from hand gloves.
- ✓ Posture is detected by receiving Accelometer data.
- ✓ Bluetooth communication path is construct between gloves and the PC or Laptop.
- ✓ All the previous points are utilized to make a Smart Mouse to help any disable people, painters and gamers to be more users comfortable.

1.5 Layout

This thesis consists of five chapters. Chapter one deals with introduction, problem statement, methodology and objectives of the study. Chapter two discusses the literature review history of mouse, control systems, microcontroller System, sensors and Bluetooth.Chapter three describes the model circuit component, details of each component and block diagram of circuit. Chapter four shows the software, simulation and operation. Finallychapter five provides the conclusion and recommendations.

CHAPTER TWO

LITRTURE REVIEW

2.1 Introduction

The mouse is an essential input device for all modern computers but it wasn't so long ago that computers had no mouse and no graphical user interface. Data was entered by typing commands on a keyboard. The mouse was invented by Douglas Engelbart in 1964 and consisted of a wooden shell, circuit board and two metal wheels that came into contact with the surface it was being used on as shown in Figure 2.1

Figure 2.1: First type of mouse

It was 8 years later in 1972 that Bill English developed the design further by inventing what is known as the "Ball Mouse" that we know today. The ball replaced the wheels and was capable of monitoring movement in any direction. The ball came into contact with two rollers that in turn spun wheels with graduations on them that could be turned into electrical pulses representing direction and speed as shown in Figure 2.2

Figure2.2: Ball mouse

At the time Bill English was working for Xerox Parc (Palo Alto Research Centre) the research and development centre set-up by Xerox to 'design the future of computing'. The mouse became part of the ground breaking Xerox Alto computer system which was the first minicomputer system to offer a graphical user interface.

It would be another 8 years before the mouse would be developed any further. An optical mouse was developed in around 1980, eliminating the ball which often became dirty from rolling round the desktop, negatively affecting its operation. In 1988, US patent no. 4751505 was issued for an optical mouse invented by Lisa M. Williams and Robert S. Cherry. As shown in Figure 2.3

Figure 2.3: Optical mouse

2.2 Control System

Control System (CS) is used to control position, velocity, and acceleration is very common in industrial and military applications. They have been given the special name of servomechanisms. With all their many advantages, CS in advertently act as an oscillator. Through proper design. Several characteristics of CS can be linked to human behavior. CS can "think" in the sense that they can replace to some extent, human operation[1]. CS can distinguish between open-loop and closed-loop CS and it is a concept or principle that seems to fundamental in nature and not necessarily peculiar to engineering.The relation between the behavior of living creatures and the functioning of CS has recently gained wide attention .

2.2.1 Control System Theory

Control systemtheory is needed for obtaining the desired motion or force needed; sensors for vision and computers for programming these devices to accomplish their desired tasks.**CS** theory sometimes called automation, cybernetics or systems theory is a branch of applied mathematics that deals with the design of machinery and other engineering systems so that these systems work, and work better than before [2]

2.2.2 Types of control system

- Open-loop control system those systems in which the output has no effect on the control action are called open-loop control systems. In other words, in an open-loop control system the output is neither measured nor fed back for comparison with the input. One practical example is washing machine. Soaking, washing, and rinsing in the washer operate on a time basis. The machine does not measure the output signal, that is, the cleanliness of the clothes. In any open-loop control system the output is not compared with the reference input. Thus, to each reference inputcorresponds a fixed operating condition; as a result, the accuracy of thesystem depends on calibration. In the presence of disturbances, an openloop control system will not perform the desired task. Open-loop controlcan be used, in practice, only if the relationship between the input andoutput is known and if there are neither internal nor external disturbances. Clearly, such systems are not feedback control systems. Note that anycontrol system that operates on a time basis is open loop.

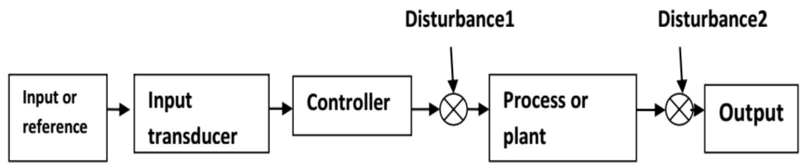

Figure 2.4: open loop control system

- Closed-loop control system**.** Feedback control systems are often referredto as closed-loop control systems. In practice, the terms feedback controland closed-loop control are used interchangeably. In a closed-loop controlsystem the actuating error signal, which is the difference between the inputsignal and the feedback signal (which may be the output signal itself or afunction of the output signal and its derivatives and/or integrals), is fed tothe controller so as to reduce the error and bring the output of the systemto a desired value. The term closed-loop control always implies the use offeedback control action in order to reduce system error.

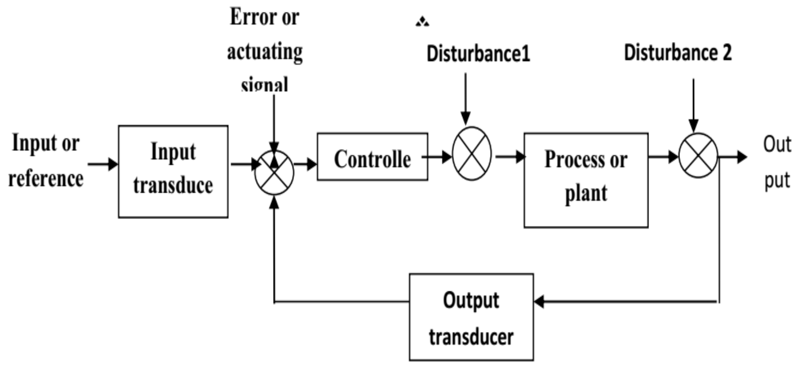

Figure 2.5: closed loop control system

2.2.3 Application of control system

there are many application of control system, these are examples of it:

- ❖ Flight control system.
- ❖ Robotics.
- ❖ Chemical process control.
- ❖ Communications and networks.
- ❖ Automotive.

This theory discussed some of the important aspects of it:

- ❖ As a part of engineering, with industrial applications and as a force in the world related to social problems of the present and the future
- ❖ As an intellectual discipline within science and the philosophy of science

This theory has addressed many problems and has allowed some applications to expand their work and implement the most difficult tasks in simple and innovative ways, including control of multiple works and in different places, all this helped the man to provide his comfort[3]

2.3 Microcontroller

A microcontroller (sometimes abbreviated uC or MCU) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of ferroelectric Random Access Memory (RAM), NOR flash or One Time Programmable Read Only Memory (OTP ROM) is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems[4].

A microcontroller can be considered a self-contained system with a processor, memory and peripherals and can be used as an embedded system. The majority of microcontrollers in use today are embedded in other machinery, such as automobiles, telephones, appliances, and peripherals for computer systems.While some embedded systems are very sophisticated, many have minimal requirements for memory and program length, with no operating system, and low softwarecomplexity.

Typical input and output devices include switches, relays, solenoids, Light Electronic Display (LEDs), radio frequency devices etc. [5].There are a well spread product based on microcontroller chipset known as Arduino which is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE .The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.

Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package. The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 microcontrollers. The plans for the modules are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and savemoney. The Arduino hardware is very affordable and requires a basic knowledge of how to put it together from examples that are provided for free online; however, creating a network that performs a particular task can be very time consuming due to the several components involved in finishing a project [11].

Figure 2.6 Microcontroller

A microcontroller basically contains one or more following components:

❖Central processing unit (CPU).

❖Random Access Memory (RAM).

❖Read Only Memory (ROM).

❖Input/output ports.

❖Timers and Counters.

❖Interrupt Controls.

❖Analog to digital converters.

❖Digital Analog converters.

❖Serial interfacing ports.

❖Oscillatory circuits.

The microcontrollers have the following advantages

- ❖ Microcontrollers act as a microcomputer without any digital parts.
- ❖ As the higher integration inside microcontroller reduce cost and size of thesystem.
- ❖ Usage of microcontroller is simple
- ❖ Most of the pins are programmable by the user for performing differentfunctions.
- ❖ Easily interface additional RAM, ROM, I /O ports.
- ❖ Low time required for performing operations.

The Disadvantages of Microcontrollers are:

- ❖ Microcontrollers have got more complex architecture than microprocessors.
- ❖ Only perform limited number of executions simultaneously.
- ❖ Mostly used in micro-equipment.
- ❖ Cannot interface high power devices directly.

2.3.1 Applications of microcontrollers

- Light sensing and controlling devices.
- Fire detection and safety device.
- Industrial instrumentation devices.
- Process control devices.
- Volt meter.
- Current meter.
- Hand-held metering systems.

2.4 Sensor

We live in a world of sensors. You can find different kinds of sensors in our homes, our offices, our cars ect. Working to make our lives easier by turning on lights by detecting our presence, adjusting room temperature, detecting smoke or fire making delicious coffee, open garage doors once our car is near the door and many other tasks. All these and many automation tasks Other possible due to sensors**.**

A sensor is often defined as a device that receives and responds to a signal or stimulus. This definition is broad. In fact, it is so broad that it covers almost everything from a human eye to a trigger in a pistol. Consider the level-control system shown in Figure (2.4) [6]. The operator adjusts the level of fluid in the tank by manipulating its valve.

Variations in the inlet flow rate, temperature changes (these would alter the fluid's viscosity and, consequently, the flow rate through the valve), and similar disturbances must be compensated for by the operator. Without control, the tank is likely to flood, or run dry. To act appropriately, the operator must obtain information about the level of fluid in the tank on a timely basis. In this example, the information is perceived by the sensor, which consists of two main parts: the sight tube on the tank and the operator's eye, which generates an electric response in the optic nerve. The sight tube by itself is not a sensor, and in this particular control system, the eye is not a sensor either. Only the combination of these two components makes a narrow-purpose sensor (detector), which is selectively sensitive to the fluid level. If a sight tube is designed properly, it will very quickly reflect variations in the level, and it is said that the sensor has a fast speed response. If the internal diameter of the tube is too small for a given fluid viscosity, the level in the tube may lag behind the level in the tank. Then, we have to consider a phase characteristic of such a sensor. In some cases, the lag may be quite acceptable, whereas in other cases, a better sight tube design would be required. Hence, the sensor's performance must be assessed only as a part of a data acquisition system. This world is divided into natural and man-made objects. The natural sensors, like those found in living organisms, usually respond with signals, having an electrochemical character; that is, their physical nature is based on ion transport, like in the nerve fibers (such as an optic nerve in the fluid tank operator). In man-made devices

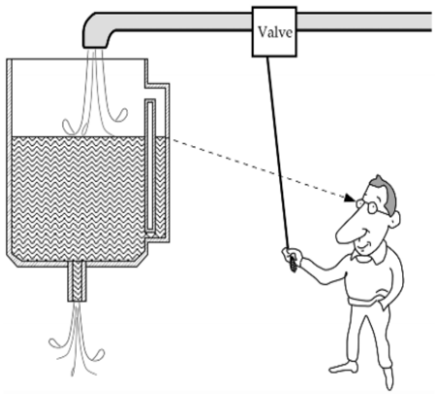

Figure2.7: The operator adjusts the level of fluid in the tank by manipulating its valve

Information is also transmitted and processed in electrical form however, through the transport of electrons. Sensors that are used in artificial systems must speak the same language as the devices with which they are interfaced. This language is electrical in its nature and a man-made sensor should be capable of responding with signals where information is carried by displacement of electrons, rather than ions.1 thus, it should be possible to connect a sensor to an electronic system through electrical wires, rather than through an electrochemical solution or a nerve fiber. Hence, in this book, we use a somewhat narrower definition of sensors, which may be phrased as.A sensor is a device that receives a stimulus and re spends with anelectrical signal. .

The term stimulusis used throughout this book and needs to be clearly under stood. The stimulus is the quantity, property, or condition that is sensed and converted into electrical signal. Some texts (for instance, Ref. [7]) use a different term,measured, which has the same meaning, however with the stress on quantitative characteristic of sensing. The purpose of a sensor is to respond to some kind of an input physical property (stimulus) and to convert it into an electrical signal which is compatible with electronic circuits. We may say that a sensor is a translator of a generally nonelectrical value into an electrical value. When we say "electrical," we mean a signal which can be channeled, amplified, and modified by electronic devices. The sensor's output signal may be in the form of voltage, current, or charge. These may be further described in terms of amplitude, frequency, phase, or digital code. This set of characteristics is called the output signal format. Therefore, a sensor has input properties (of any kind) and electrical output properties.

Sensors detect the presence of energy, changes in or the transfer of energy. Sensors detect by receiving a signal from a device such as a transducer, then responding to that signal by converting it into an output that can easily be read and understood. Typically sensors convert a recognized signal into an electrical – analog or digital – output that is readable. In other words, a transducer converts one form of energy into another while the sensor that the transducer is part of converts the output of the transducer to a readable formatConsider the previous examples of transducers [8]. They convert one form of energy to another, but they do not quantify the conversions. The light bulb converts electrical energy into light and heat however; it does not quantify how much light or heat. A battery converts chemical energy into electrical energy but it does not quantify exactly how much electrical energy is being converted. If the purpose of a device is to quantify an energy level, it is a sensor [8].

So let’s take a look at a sensor that should be familiar to everyone – a temperature sensor.

Figure 2.8:Digital Readout and Mercury Thermometers

An environmental energy condition that is commonly sensed is temperature. A thermometer senses and converts temperature into a readable output, thus it is a sensor. This output can be direct or indirect. A mercury thermometer which uses a level of mercury against a fixed scale is a direct output. A digital readout thermometer is an indirect output. (see images above) For a digital readout thermometer, a converter is used to convert the output of the temperature transducer to an input for the digital display. The measured temperature is displayed on a monitor. The thermometer is both a transducer (usually a thermocouple that transfers heat energy to voltage) and a sensor (quantifies the transducer output with a readable format).

The mercury thermometer utilizes mercury’s property of expanding or contracting when heated or cooled, respectively. In a mercury thermometer a temperature increase is sensed by the mercury contained in a small glass tube. The thermal energy from the temperature increase is transferred into the mercury (the transducer) causing the mercury to expand. The expansion of mercury is scaled to numbers on the tube indicating the temperature [9]

Following are different types of sensors which are classified by the type of energy they detect.

2.4.2 Thermal Sensors

- ✓ Thermometer – measures absolute temperature (discussed in the previous section.
- ✓ Thermocouple gauge– measures temperature by its affect on two dissimilar metals.
- ✓ Calorimeter – measures the heat of chemical reactions or physical changes and heat capacity

A thermocouple is a device that directly converts thermal energy into electrical energy. When two dissimilar metal wires are connected at one end forming a junction, and that junction is heated, a voltage is generated across the junction see the figure (2.6) If the opposite ends of the wires are connected to a meter, the amount of generated voltage can be measured. This effect was discovered by Thomas See beck, and thus named the Seebeck Effect or Seebeck coefficient. The voltage created in this situation is proportional to the temperature of the junction.

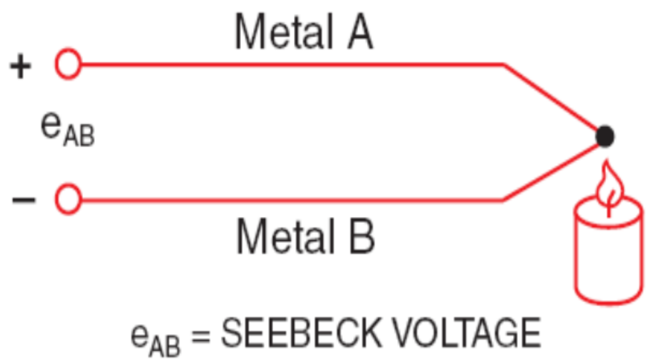

Figure2.9:Thermocouples operate due to the Seebeck Effect

2.4 .3 Mechanical Sensors

Mechanical Sensor Class ofʋ sensors to measure mechanical Includes Pressureʋphenomena and this some types:

- ❖ Barometer – measures atmospheric pressure
- ❖ Altimeter – measures the altitude of an object above a fixed level
- ❖ Liquid flow sensor – measures liquid flow rate
- ❖ Gas flow sensor – measures velocity, direction, and/or flow rate of a gas.
- ❖ Accelerometer – measures acceleration

Barometers determine the level of atmospheric pressure.The figure to the right illustrates a simple mercury barometer.A tube is initially filled with mercury and then inverted into a dish. Some of the mercury from the tube flows into the dish (reservoir) creating a vacuum in the upper portion of the tube. The flow stops when equilibrium is reached between the pressures on the surfaces of the mercury inside the tube and in the reservoir. When the atmospheric pressure increases, the level of the mercury in the tube rises. This is due to an increase in pressure on the mercury's surface in the reservoir. A decrease in the level of mercury in the tube is seen when the atmospheric pressure drops. Markings on the tube (in orange*)* indicate the barometric pressure by measuring the level of mercury.Therefore, a barometer converts the energy from the pressurized gases of the atmosphere into a change in the mercury's height (potential energy) in the column, as read by the markings.

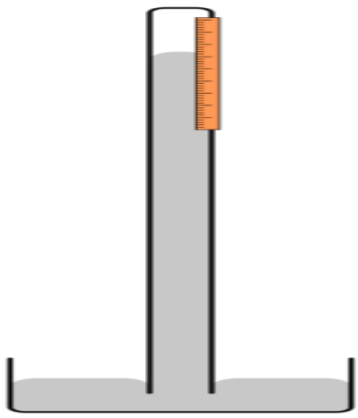

Figure2.10: *Schematic of a mercury barometer*

2.4.4Electrical Sensors

a device which gives an output by detecting the changes in quantities or events can be defined as a sensor. Generally, sensors produce an electrical signal or optical output signal corresponding to the changes in the inputs. And this some types:

- Ohmmeter – measures resistance
- Voltmeter – measures voltage
- Galvanometer – measures current
- Watt-hour meter – measures the amount of electrical energy supplied to and used by a residence or business.

2.4.5 Applications of sensors

- Home automation and consumer devices: consumer weather stations, wireless sensor node.
- Remote monitoring: asset tracking, cellular base stations.

- ❖ Automotive and industrial equipment: automobile climate control,compressed air systems, windshield defogging.
- ❖ Healthcare: respiratory therapy, CPAP machines, ventilators

2.5 Bluetooth

Is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz[10]) from fixed and mobile devices, and building personal area networks (PANs). Invented by Dutch electrical engineer JaapHearten, working for telecom vendor Ericsson in 1994,[11] it was originally conceived as a wireless alternative to RS-232 data cables

The development of the "short-link" radio technology, later named Bluetooth, was initiated in 1989 by Nils Rydbeck, CTO at Ericsson Mobile in Lund, Sweden and by Johan Ullman. The purpose was to develop wireless headsets, according to two inventions by Johan Ullman, SE 8902098-6, issued 1989-06-12 and SE 9202239, issued 1992-07-24. Nils Rydbeck tasked TordWingren with specifying and JaapHaartsen and Sven Mattisson with developing. Both were working for Ericsson in Lund.[12] The specification is based on frequency-hopping spread spectrum technologyBluetooth is a standard wire-replacement communications protocol primarily designed for low power consumption, with a short range based on low-cost transceiver microchips in each device [13] Because the devices use a radio (broadcast) communications system, they do not have to be in visual line of sight of each other; however, a quasi opticalwireless path must be viable [14] Range is power-class-dependent, but effective ranges vary in practice. See the table.

Table 2.1: Ranges of Bluetoothdevices

Class	Max. permitted power (mW)	Max. permitted power (dBm)	Typ. range[2] (m)
1	100	20	~100
2	2.5	4	~10
3	1	0	~1
4	0.5	−3	~0.5

CHAPTER THREE
MODELDESIGN

3.1INTRODUCTION

In the beginning we identify the components used in this project and to find out how to implement the design. In the process of design, a device called the Digital Accelerometer reads hand movement and the Ardino Nano processes these Data and the Bluetooth device send this Data and another Bluetooth receives it then Arduino micro processes this data and then the mouse moves according to that.

3.2 List of Components

These are the components used in the project design:

- ❖ DC battery
- ❖ Arduino Micro
- ❖ Arduino Nano
- ❖ Digital Accelerometer
- ❖ Bluetooth HC-05
- ❖ Flex sensor
- ❖ Pushbuttons
- ❖ Electrical wires

3.2.1 DC battery

Lithium batteries are primarybatteries that have lithium as an anode. These types of batteries are also referred to as lithium-metal batteries. They stand apart from other batteries in their high charge density (long life) and high cost per unit. Depending on the design and chemical compounds used, lithium cells can produce voltages from 1.5 V (comparable to a zinc–carbon or alkaline battery) to about 3.7 V.

To achieve this project a lithium DC battery with 3.7 volt and maximum capacity of 1500 mAh is connected to supply the other components located in the glove with the power shown in Figure 3.2

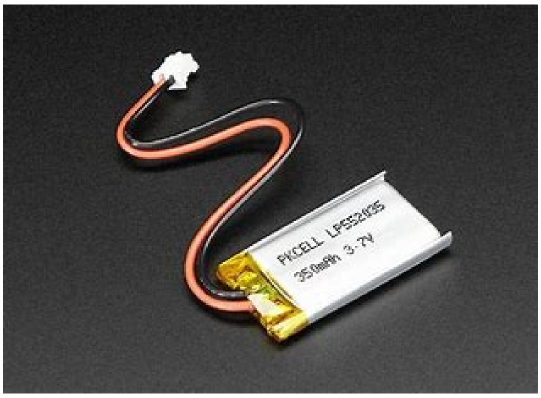

Figure3.1: Dc battery

3.2.2 Pushbuttons

The pushbutton is a component that connects two points in a circuit when you press it. Three wires were connected to the Arduino board. The first goes from one leg of the pushbutton through a pull-up resistor to the 5 volt supply. The second goes from the corresponding leg of the pushbutton to ground. The third connects to a digital I/O pin which reads the button's state. When the pushbutton is open (impressed) there is no connection between the two legs of the pushbutton. When the button is closed (pressed), it makes a connection between its two legs, connecting the pin to ground, The main function of the pushbuttons in this project is to implement the two mouse clicks (right and left).

Figure 3.2:Pushbutton

3.2.3 Flex sensor

Flex sensor is basically a variable resistor whose terminal resistance increases when the sensor is bent. So this sensor resistance increases depends on surface linearity. So it is usually used to sense the changes in linearity. It'susually available in two sizes. One is 2.2 inch and another is 4.5 inch. Although the sizes are different the basic function remains the same. They are also divided based on resistance. There are LOW resistance, MEDIUM resistance and HIGH resistance types. Choose the appropriate type depending on requirement as shown in Figure 3.3

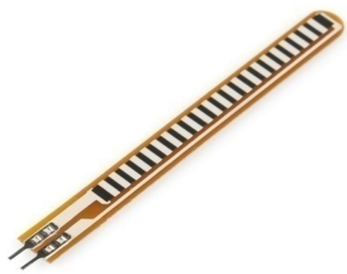

Figure 3.3: Flex sensor

Flex sensor is a two terminal device. The Flex sensor does not have polarized terminals like diode. So there is no positive and negative, and the main function of the flex sensor in this project is to implement the roller of the PC mouse to achieve that it's connected as below:

Pin Number	Description
P1	Connected to positive of power source.
P2	Connected to the Arduino Nano

Table 3.1 Features and Specifications of Flex sensor:

Operating voltage of	0-5V
Can operate on	LOW voltages
Power rating	0.5Watt (continuous), 1 Watt (peak)
Life	1 million
Operating temperature	-45ºC to +80ºC
Flat Resistance	25K Ω
Resistance Tolerance	±30%
Bend Resistance Range	45K to 125K Ohms(depending on bend)

3.2.4 Digital Accelerometer

The ADXL345 is a low-power, 3-axis MEMS accelerometer modules with both I2C and SPI interfaces. The Ad fruit Breakout boards for these modules feature on-board 3.3v voltage regulation and level shifting which makes them simple to interface with 5v microcontrollers such as the Arduino. The ADXL345 features 4 sensitivity ranges from +/- 2G to +/- 16G. And it supports output data rates ranging from 10Hz to 3200Hz.

The sensor consists of a micro-machined structure on a silicon wafer. The structure is suspended by poly-silicon springs which allow it to deflect smoothly in any direction when subject to acceleration in the X, Y and/or Z axis deflection causes a change in capacitance between fixed plates and plates attached to the suspended structure. This change in capacitance on each axis is converted to an output voltage proportional to the acceleration on that axis as shown in Figure 3.4

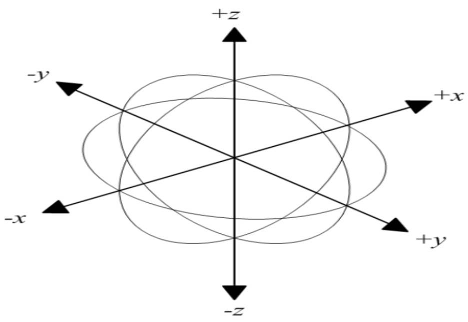

Figure3.4: Rotation oftheAccelerometer

The ADXL345 Breakout has an I2C address of 0x53. It can share the I2C bus with other I2C devices as long as eachdevice has a unique address. Only 4 connections are required for I2C.

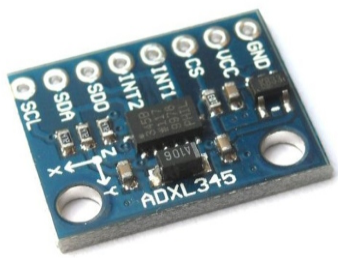

Figure 3.5:Accelerometer

3.2.5 Arduino Nano

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a smallest, complete, and breadboard friendly. It has everything that Diecimila/Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano is automatically sense and switch to the higher potential source of power, there is no need for the power select jumper.

Nano's got the breadboard-ability of the Boarduino and the Mini+USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable as shown in Figure 3.6

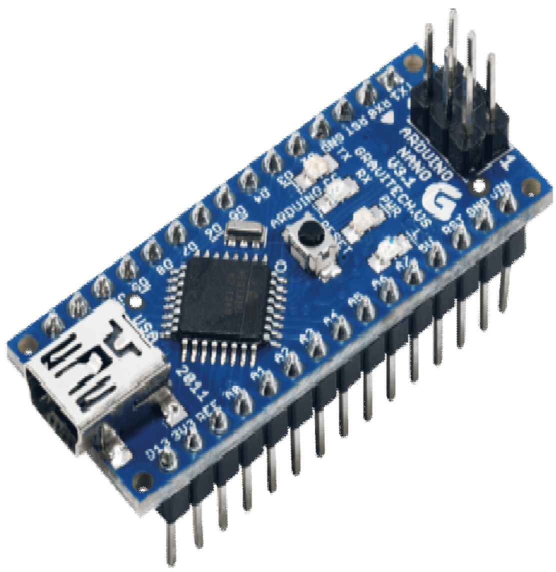

Figure3.6: Arduino Nano

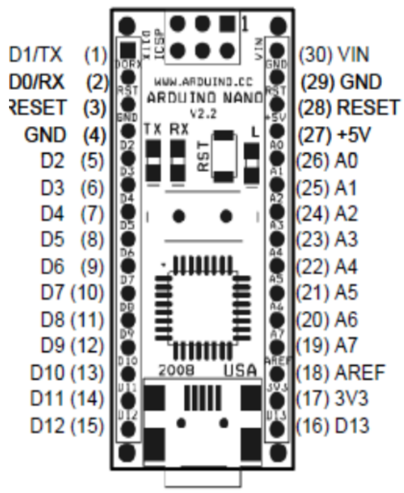

Figure 3.7: Arduino Nano Pin Layout

Table 3.2: Arduino Nano data sheet.

Pin No.	Name	Type	Description
1-2, 5-16	D0-D13	I/O	Digital input/output port 0 to 13
3, 28	RESET	Input	Reset (active low)
4, 29	GND	PWR	Supply ground
17	3V3	Output	+3.3V output (from FTDI)
18	AREF	Input	ADC reference
19-26	A7-A0	Input	Analog input channel 0 to 7
27	+5V	Output or Input	+5V output (from on-board regulator) or +5V (input from external power supply)
30	VIN	PWR	Supply voltage

Arduino was connected to transmitter circuit to take information from IMU and send it by RF transmitter.Arduino was connected to receiver circuit to receive information from RF receiver and give command to the driver [14].

The main function of this device in this project is to receive the signals from the previous devices (Accelerometer, Pushbutton and flex sensors) and pass it to the Bluetooth sending end module.

Table 3.3: Specifications of Arduino Nano:

Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 Ma
Flash Memory	32 KB (of which 2KB used by bootloader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Dimensions	0.70” x 1.70”

3.2.6 Bluetooth HC-05 module

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH. It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

There are two HC-05 modules used in this project, one for sending signals from the sensors located in the glove and the other for receiving the data at the receiving end.

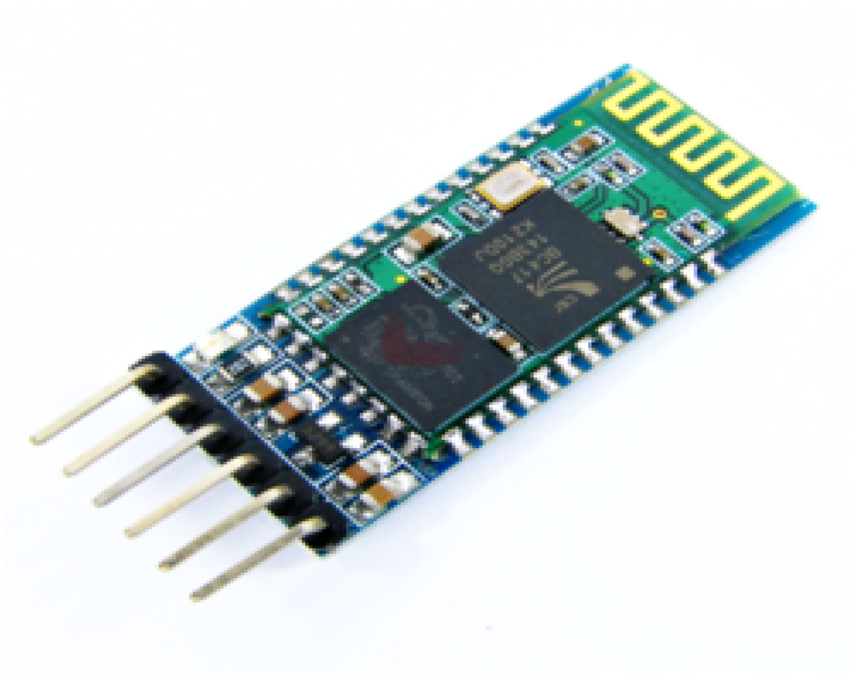

Figure 3.8: Bluetooth HC-05

Table 3.4 Specifications of Bluetooth:

Typical -80dBm sensitivity
Up to +4dBm RF transmit power
Low Power 1.8V Operation ,1.8 to 3.6V I/O
PIO control
UART interface with programmable baud rate
With integrated antenna
With edge connector

3.2.7 Arduino Micro

The Arduino Micro is a microcontroller board based on the ATmega32u4. It has 20 digital input/output pins (of which 7 can be used as PWM outputs and 12 as analog inputs), a 16 MHz crystal oscillator, a micro USB connection, an ICSP header, and a reset button as shown in figure(3.9) .

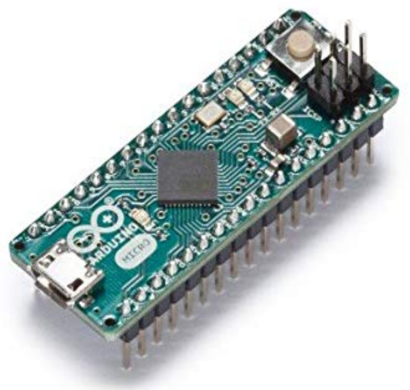

Figure3.9: Arduino micro

The Arduino Micro features a user-programmable ATmega32U4 AVR microcontroller that has built-in USB functionality, eliminating the need for a secondary processor or serial adapter. This makes the Arduino Micro more versatile: in addition to supporting a virtual (CDC) serial/COM port interface, it can appear to a connected computer as a mouse and keyboard.

The signal received from the receiving end Bluetooth is decoded by the Arduino Micro and delivered to the PC via USB as a digital signal implementing the motion of the mouse. Of the flex sensor, pushbuttons and the accelometer micro appears to a connected computer as a mouse or keyboard

Table 3.3:Technical specification

Microcontroller	ATmega32u4
Operating Voltage	5V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20V
Digital I/O Pins	20
PWM Channels	7
Analog Input Channels	12
DC Current per I/O Pin	40Ma
DC Current	3.3V Pin 50 m A
FlashMemory	32 KB (ATmega32u4) of which 4 KB used by bootloader
SRAM	2.5 KB (ATmega32u4)
EEPROM 1 KB (ATmega32u4)	1 KB (ATmega32u4)
Clock Speed	16 MHz

3.2.8 Wires

These Male/Male Jumper Wires are handy for making wire harnesses or jumpering between headers on PCB's. These premium jumper wires are long (150mm) and come in a 'strip' of 20 (2 pieces of each of ten rainbow colors). The best part is they come in a 20-pin ribbon cable. You can always spull the ribbon wires off to make individual jumpers, or keep them together to make neatly organized wire harnesses.

Figure 3.10: Wires

3.3 Circuit Description

The following block diagram gives a basic idea about the implementation method for this project which can be viewed as a hardware & software approach

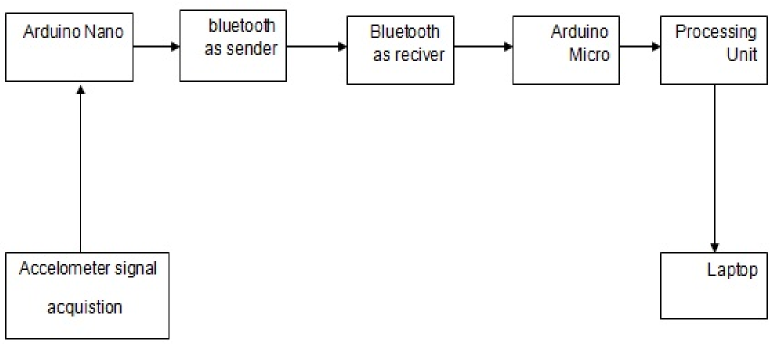

Figure 3.11: Project circuit description

CHAPTER FOUR
OPERATION SYSTEM

4.1 Introduction

To run the circuit that has been designed in chapter three we used microcontroller requires code to do the work.Arduino Nano was used on the transmitter side as well as Ardino Micro on the receiving side.They were connected via Bluetooth on both sidesand was also programmed for theC++ language.

4.2 Software

Arduino programs may be written in any programming language with acompiler that produces binary machine code. Atmel provides a developmentenvironment for their microcontrollers, AVR Studio and the newer Atmel Studio.The Arduino project provides the Arduino integrated developmentenvironment (IDE), which is a cross-platform application written in Java. Itoriginated from the IDE for the Processing programming language project and theWiring project. It is designed to introduce programming to artists and othernew comers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation , and provides simple one-click mechanism for compiling and loading programs toan Arduino board. A program written with the IDE for Arduino is called a"sketch "The Arduino IDE supports the C and C++ programming languages usingspecial rules of code organization. The Arduino IDE supplies a software librarycalled "Wiring" from the Wiring project, which provides many common input andoutput procedures. A typical Arduino C/C++ sketch consist of two functions thatare compiled and linked with a program stub main() into an executable cyclic executive program:

- ✓ setup(): a function that runs once at the start of a program and that can initialize settings.
- ✓ loop(): a function called repeatedly until the board powers off.

4.3 Installation

Initially, a classic glove shown in figure (4.1) has been acquired then a welding board was glued to the glove to contain the other components.

Figure 4.1: A classic glove

The points (5v),(GND) of the Arduino Nano was connected to the points (Vcc),(GND) of the accelerometer respectively and the points (A4), (A5) of the Arduinonano were connected to (SDA),(SCL) of the accelerometer respectively as shown in Figure 4.2

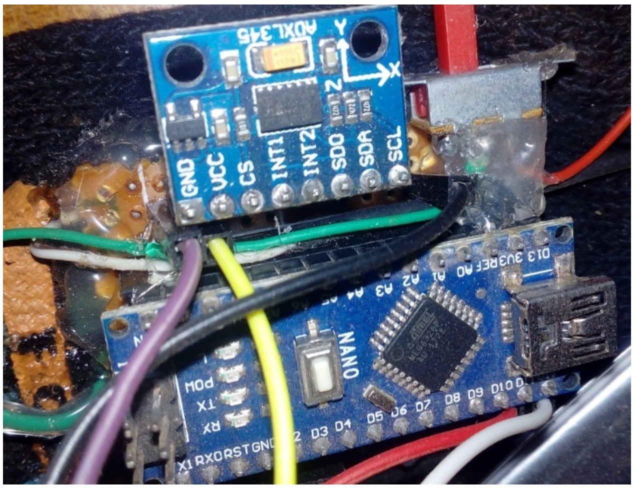

Figure 4.2: InstalltionArduino Nano and accelerometer (ADXL345)

The first leg of the flex sensor was connected to the point (5v) of the Arduinonano and the other leg (Ao) to the point (Ao) of the Arduinonano, and a small resistance was connected to the (GND) of the Arduinonano to divide the voltage.

Figure 4.3: Installation Arduino Nano and Flex sensor

A Bluetooth (HC05) module has been connected the Arduinonano according to this sequence (5v) (GND)(2,3) of the Arduinonano to (Vcc) , (GND) , (Rx,Tx) of the Bluetooth module respectively as sender.

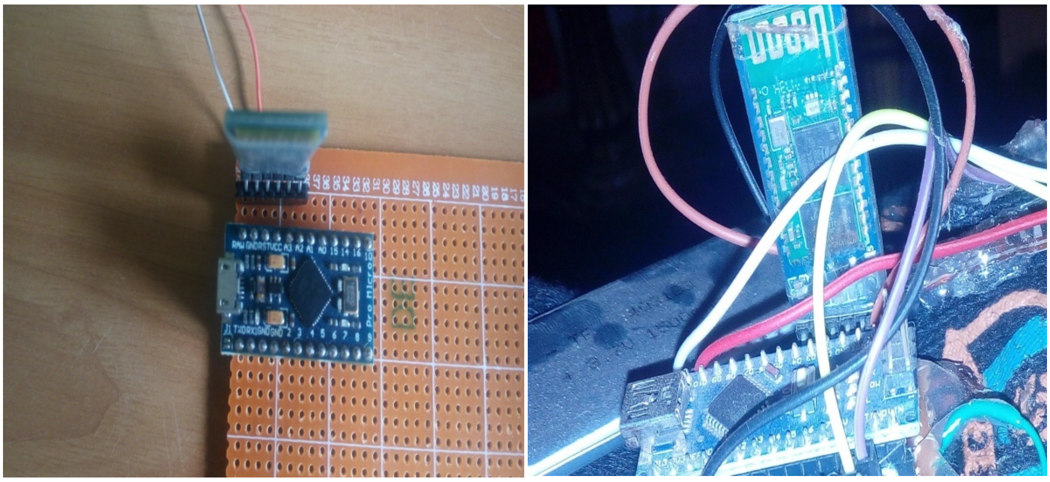

Figure 4.4: Installation Arduino Nano and Bluetooth HC05

Two pushbuttons was connected to operate as right click andleft click, point of the right click was connected to (Vcc) and (A_{12}) of the Arduinonano where the points of the left click were connected to (GND) and (A_{11}) of the same Arduino.

Figure 4.5: Installation Arduino Nano and Two pushbuttons

DC battery has been connected to the point (V_{in}) And (GND) of the Arduinonano.

Figure 4.6: Installation Arduino Nano and Dc battery

A Bluetooth (HC05) module has been connected the Arduinomicro according to this sequence (5v) (GND)(9,8) of the Arduino micro to (Vcc)(GND) , (Rx ,Tx) of the Bluetooth module respectively as a receiver.

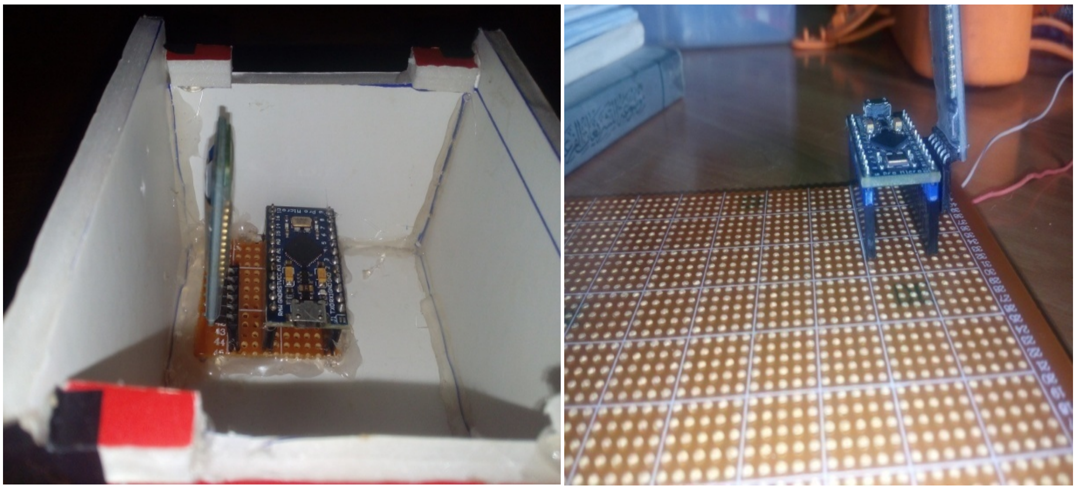

Figure 4.7: Installation Arduino micro and Bluetooth HC05

By combining that arduinoNano ,Bluetooth module HC05, accelerometer ADXL345 and Flex sensor to build in glove. And this final a shape

Figure 4.8: Final shape of the smart mouse

4.4 The Operation

At first the accelerometer ADXL345 tracks the movement of the hand ,which is based on three axis(x.y.z).if the hand moves to the right .it sends the data of the movement according to the library located in the arduino, then the arduinonano translate the orders that came from accelerometer after that this orders resend by Bluetooth sender to the receiver part which contain Bluetooth receiver, orders which has been sent translated by arduino micro to be executed by the computer. According to that the pointer move toward all directions .

CHPATER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In this study the objectives have been accomplished successfully, the following points were noticed In this study the objectives were successfully completed and the operating orders were formulated by means of Arduino devices and data manipulation and manipulation using Arduino. All the components of the program were successfully programmed. The transmission range was properly configured via Bluetooth on a 10 meter scale so that orders could be sent to and from Arduino and connect them to the computer. A classic glove has been implemented into a smart mouse by applying the appropriate steps.Performancewassatisfactory.

5.2 Recommendation

There are points of recommendationsContinued:

1- recommended to add wireless replace of Bluetooth .

2- recommended to use another sensor attached to the glove to assist in obtaining a full drive

3- The final shape of the design can be as minimal as all the tools inside the glove, if the necessary technology is available, the design can be reduced to a ring in hand only.

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APPENDIX A

PROGRAMMING CODES

The first Arduino code (sender):

```
#include <Wire.h>
#include <FaBo3Axis_ADXL345.h>
#include <SoftwareSerial.h>

SoftwareSerial S(2, 3); // RX, TX
int x, y, z, n, F;
FaBo3Axis Acc;

void setup()
{
Serial.begin(9600);
S.begin(9600);
pinMode(12, INPUT_PULLUP);
pinMode(11, INPUT_PULLUP);
Serial.println("Checking I2C device...");

  if (Acc.searchDevice()) {
Serial.println("ADXL345");
  }
Serial.println("Init...");
Acc.configuration();
Acc.powerOn();
}
void loop() {
  F = analogRead(A0);
Serial.println(F);
Acc.readXYZ(&x, &y, &z);
//    Serial.print("x=");
//       Serial.print(x);
//    Serial.print("y=");
//    Serial.print(y);
//    Serial.print("z=");
//    Serial.println(z);
  if (F < 180 && F > 100) {
S.print("S");
    delay(100);
  }
  if (F < 280 && F > 220) {
```

```
S.print("A");
    delay(100);
  }
  if (digitalRead(12) == 0) {
S.print("C");
    delay(200);
  }
  if (digitalRead(11) == 0) {
S.print("O");
    delay(200);
  }
  if (x < 15 && x > 7) {
S.print("R");
    n = 15 - x ;
  }
  else  if (x < 30 && x > 15) {
S.print("r");
    n = 30 + x ;
  }
  else if (x > -15 && x < -7) {
S.print("L");
    n = 15 + x;
  }
  else if (x > -30 && x < -15) {
S.print("l");
    n = 30 - x;
  }
  if (y < 15 && y > 7) {
S.print("U");
    n = 15 - y ;
  }
  else  if (y < 30 && y > 15) {
S.print("u");
    n = 30 + y ;
  }
  else if (y > -15 && y < -7) {
S.print("D");
    n = 15 + y ;
  }
  else if (y > -30 && y < -15) {
S.print("d");
    n = 30 - y ;
  }
  delay(n);
}
```

APPENDIX B

• The second Arduino code (Receiver):

```
#include <SoftwareSerial.h>
#include <Mouse.h>
SoftwareSerial R(8, 9); // RX, TX
char Data;
void setup() {
R.begin(9600);
Serial.begin(9600);
Mouse.begin();
}
void loop() {
  if (R.available()) {
    Data = R.read();
Serial.println(Data);
    if (Data == 'U') {
Mouse.move(-1, 0, 0);
    }
     else if (Data == 'u') {
Mouse.move(-20, 0, 0);
    }
    else if (Data == 'D') {
Mouse.move(1, 0, 0);
    }
     else if (Data == 'd') {
Mouse.move(20, 0, 0);
    }
    if (Data == 'L') {
Mouse.move(0, -1, 0);
    }
    else if (Data == 'l') {
Mouse.move(0, -20, 0);
    }
    else if (Data == 'R') {
Mouse.move(0, 1, 0);
    }
    else if (Data == 'r') {
Mouse.move(0, 20, 0);
    }
```

```
   if (Data == 'C') {
Mouse.click(MOUSE_LEFT);
   }
   if (Data == 'O') {
Mouse.click(MOUSE_RIGHT);
   }
   if (Data == 'S') {
Mouse.move(0, 0, 1);
   }
   if (Data == 'A') {
Mouse.move(0, 0, -1);
}  }
}
```