CHAPTER ONE

INTRODUCTION

1.1 General Concept :

Disaster response to mass-casualty incidents represents one of the greatest challenges to a community's emergency response system and should provide care to large numbers of casualties in a setting of limited resources, inadequate communication, misinformation, and great personal risk.

In this chaotic environment, new technologies in communications, the Internet, computer miniaturization, and advanced “smart devices” have the potential to vastly improve the emergency medical response to such mass-casualty incident disasters.

Doctors can communicate directly with their patients, record their vital signs accurately, maintain logs about visits and consultations, and achieve greater procedural efficiency.

The demand for wearable devices has grown since their introduction in the past few years, since the release of bluetooth in 2000. People today use their phone to track everything from their steps, physical fitness and heartbeat, to their sleeping patterns. The advacement of these wearable technologies is in conjunction with rising chronic diseases like diabetes and cardiovascular disease, and aim to combat these by helping patients to monitor and improve their fitness.

1.2 Problem statement

In some pathological cases, patients / paralyzed face difficulty communicating with who's their care about. In general, patients and elderly need continuing follow-up and that's difficult to do it by regular way. Problem which face co-patient to understand patient situation.

1.3 Objectives

The main objectives in this project are :

- ❖ Facilitate communication between paralyzed / elderly and who is care about them.
- ❖ Making communication, socializing and life much easier and simpler.
- ❖ Increasing efficiency and productivity of the individual.

1.4 Methodology

- ❖ Study and understand the previous works.
- ❖ Study and understand basics of Medicare.
- ❖ Design Circuit and model simulation.
- ❖ Design a model of smart assistant.

1.5 Layout

This research consists of five chapters. Chapter one gives a general introduction, problem statement, objectives and methodology .Chapter two introduces general control concepts, microcontroller and sensors. Chapter three presents model design and component circuit such as Arduino and GSM module . Chapter four represents simulation and operation of model. Chapter five includes conclusion and recommendations.

CHAPTER TWO

THEORETICAL BACKGROUND

2.1 Introduction

A disability is defined as a condition or function judged to be significantly impaired relative to the usual standard of an individual or group. The term is used to refer to individual functioning, including physical impairment, sensory impairment, cognitive impairment, intellectual impairment, mental illness, and various types of chronic diseases. There may be effects on organs or body parts and there may be effects on a person's participation in different areas of life.

Disabilities can affect vision, hearing, thinking, learning, movement, mental health remembering, communicating and social relationships.

The concept of monitoring individuals in the home and community settings was introduced more than 50 years ago, when Holter monitoring was proposed (in the late 1940s) and later adopted (in the 1960s) as a clinical tool. However, technologies to fully enable such vision were lacking and only sporadic and rather obtrusive monitoring techniques were available for several decades. Over the past decade, we have witnessed a great deal of progress in the field of wearable sensors and systems. Advances in this field have finally provided the tools to implement and deploy technology with the capabilities required by researchers in the field of patients' home monitoring. These technologies provide the tools to achieve early diagnosis of diseases such as congestive heart failure, prevention of chronic conditions such as diabetes, improved clinical management of neurodegenerative conditions such as Parkinson's disease, and the ability to promptly respond to emergency situations such as seizures in patients with epilepsy and cardiac arrest in subjects undergoing cardiovascular monitoring. Current research efforts are focused on the development of systems enabling clinical applications. The current focus on developing and deploying wearable systems targeting specific clinical applications has the potential of leading to clinical adoption within the next five to ten years.

Healthcare systems are a very important part of the economy of any country and for the public health. In this fast pace of life, it is difficult for people to be constantly available for their near ones who might need them while they are suffering from the difficult. Patient monitoring systems measure physiological characteristics either continuously or at regular intervals of time. The recent survey of world health organization estimated approximately 5.6 million people were paralyzed representing 1.9 percent of the population roughly 1among 50. Health surveillance of the paralyzed in the hospitals reveals that, there are many exercises, stimulation and medicines to safeguard the paralyzed people. But there is not a particular monitoring system to monitor the health conditions of the paralyzed. To overcome these problems a monitoring system is introduced, which is used to check the patients' health conditions. In this monitoring system ,bio sensors are used to sense the vital framework of patients such as pulse rate, blood pressure, airflow sensor and these parameters are measured continuously and transmits the message to the caretaker by using GSM. This can be processed in Microcontroller (MSP430).

2.2 The elderly patient and paralysis

Many people of paralyzed and elderly patients have communication problems with their doctors or who is care about.

About a third of stroke survivors have some difficulty with speaking or understanding what others say, and this can be frightening and frustrating.

From a chronological viewpoint, medical treatment of the elderly (geriatrics) starts from the age of years old. This definition per se is nowadays certainly not really an adequate definition of an elderly patient and the reason to be treated by a geriatrician. In addition to chronological age, other factors must be considered in order to define the elderly patient.

Old people often have limited regenerative abilities and are more susceptible to disease, syndromes, injuries and sickness than younger adults. The organic process of ageing is called senescence , the medical study of the aging process is called gerontology, and the study of diseases that afflict the elderly is called geriatrics. The elderly also face other social issues around retirement, lones .

The number of elderly persons worldwide began to surge in the second half of the 20th century. Up to that time (and still true in underdeveloped countries), five or less percent of the population was over 65. Few lived longer than their 70s and people who attained advanced age (i.e. their 80s) were rare enough to be a novelty and were revered as wise sages. The worldwide over-65 population in 1960 was one-third of the under 5 population. By 2013, the over-65 population had grown to equal the under 5 population. The over-65 population is projected to double the under five by 2050.

Paralysis is a loss of muscle function for one or more muscles. Paralysis can be accompanied by a loss of feeling (sensory loss) in the affected area if there is sensory damage as well as motor.

Paralysis is most often caused by damage in the nervous system, especially the spinal cord. Other major causes are stroke, trauma with nerve injury, poliomyelitis, cerebral palsy, peripheral neuropathy, Parkinson's disease, ALS, botulism , spina bifida, multiple sclerosis, and Guillain–Barré syndrome. Temporary paralysis occurs during REM sleep, and dysregulation of this system can lead to episodes of waking paralysis.

Drugs that interfere with nerve function, such as curare, can also cause paralysis.

2.2.1 Human Activity Recognition

HAR during daily life is another fundamental function for elderly care system because HAR can provide assistance services. Continuous monitoring of elderly activities allows the detection of abnormal situations and can help ameliorate the effects of unpredictable events such as sudden tired.

These capabilities are required for this type of wearable system to assist the elderly in their daily lives and increase their safety.

Human activities from the status of utilized objects or from changes in environmental variables Sensor-based recognition systems employ on-body (wearable) sensors such as accelerometers and gyroscopes to detect the movements of body parts.

Not all seniors feel comfortable using technology, either because they don’t trust it or don’t understand how to use it. But the senior population is gradually becoming more tech-savvy and integrating technology into its health journey, as those who came of age in the computer era move into their elder years.

Seniors certainly have the desire to reap the benefits of readily available health data. But they aren’t turning that into action. A study published in Journal of the American Medical Association showed that few seniors were using digital health technology despite high ownership of mobile phones and computers. That finding piqued my interest: Why aren’t seniors, who own and use other kinds of technology, using innovations focused on their health.

The study highlights a critical but often-overlooked step when it comes to developing digital health technology: knowing the needs of the intended user. Most connected health devices, including wearables , are usually designed for young users.

Design is a critical factor for wearables for seniors. The needs of this population differ dramatically from those of millennials or middle-aged folks, especially in terms of hearing, vision, and mobility. Design greatly affects a user's desire to interact with his or her device. A senior with a chronic condition such as arthritis, who may also have limited vision, is unlikely to enjoy and regularly use a small device that has a complicated interface and tiny, hard-to-touch buttons.

The medical alert devices that are currently popular with seniors reflect many of the design factors that are important to older individuals, such as simple interfaces, voice communication capabilities, and automated fall detection technology. As these devices evolve to include voice recognition, video, and predictive analytics, they will become even better suited to the unique needs and uses of seniors .

While better design can make it easier for seniors to use wearable devices , physicians can help promote their adoption, too and benefit from them. Data captured over a long period of time can let a health care provider see changes and shifts in a person's actions. Analysis of these data can potentially help avoid major health issues, such as falls, and help stabilize chronic health conditions .

A physician caring for a senior who recently went through hip or knee surgery, for example, could use a wearable to track the patient's recovery and better understand what he or she needs for rehabilitation .

As seniors become more active participants in their care, wearables open up two-way communication and create opportunities to integrate these devices into health care. Physicians who actively encourage their senior patients to use these devices will have an improved communication channel to understand when a patient's health may be deteriorating, or when intervention is needed .

2.2.2 Communication problems

Many people of paralyzed and elderly patients have communication problems with their doctors or their care about.

About a third of stroke survivors have some difficulty with speaking or understanding what others say, and this can be frightening and frustrating

A stroke can cause problems with communicating if there is damage to the parts of the brain responsible for language. These functions are controlled by the left side of the brain in most people. As one side of the brain controls the opposite side of the body, many people who have communication problems after stroke also have weakness or paralysis on the right side of their body.

Stroke can also cause communication problems if muscles in the face tongue or throat are affected .

These people in most cases are not able to convey their needs as they are neither able to speak properly nor do they convey through sign language due to loss in motor control by their brain.

According to research, we found that approximately 2000 people died monthly due to the only carelessness of their health. This is because they don't have time for themselves and forget about their health management due to a heavy workload .

Here we need to talk about Aphasia (sometimes called dysphasia) is the name for the most common language disorder caused by stroke. Aphasia can affect how you speak, your ability to understand what is being said, and your reading or writing skills. It does not affect intelligence, although sometimes people think it does.

2.3 Control System

In our daily lives there are numerous “objectives” that need to be accomplished .For instance, in the domestic domain; we need to regulate the temperature and humidity of homes and buildings for comfortable living. For transportation, we need to control the automobile and airplane to go from one point to another accurately and safely. Industrially, manufacturing process contain numerous objectives for products that will satisfy the precision and cost effectiveness requirements. [1]

Automatic control has played a vital role in the advance of engineering and science. In addition to its extreme importance space-vehicle systems, missile-guidance systems, robotic systems, and the like, automatic control has become an important and integral part of modern manufacturing and industrial processes.

A control system consists of subsystems and processes (or plants) assembled for thepurpose of obtaining a desired output with desired performance, given a specifiedinput. It is used to manages, directs, or regulates the behavior of other devices or systems using control loops. It can range from a single home heating controller using a thermostat controlling a domestic boiler to large industrial control systems which are used for controlling processes or machines.[3]

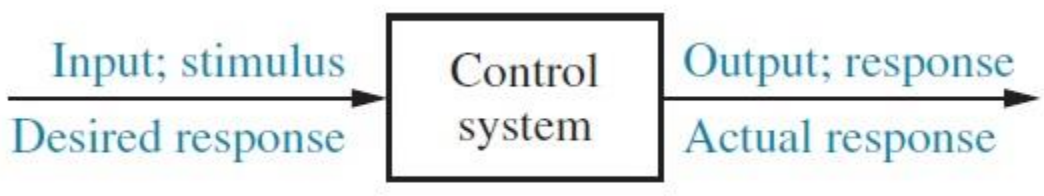


Figure 2.1: Simplified description of a control system

There are two common classes of control systems, open loop control systems and closed loop control systems. In open loop control systems output is generated based on inputs .In closed loop control systems current output is taken into consideration and corrections are made based on feedback . A closed loop control systems is also called a feedback control system.

The first significant work in automatic control was James Watt's centrifugal governor for the speed control of a steam engine in the eighteenth century.

In 1922, Minorsky worked on automatic controllers for steering ships and showed how stability could be determined from the differential equations describing the system. In 1932, Nyquist developed a relatively simple procedure for determining the stability of closed-loop systems on the basis of open-loop response to steady-state sinusoidal inputs. In 1934, Hazen, who introduced the term servomechanisms for position control systems, discussed the design of relay servomechanisms capable of closely following a changing input.

During the decade of the 1940s, frequency-response methods (especially the Bode diagram methods due to Bode) made it possible for engineers to design linear closed loop control systems that satisfied performance requirements. From the end of the 1940s to the early 1950s, the root-locus method due to Evans was fully developed.

Since the late 1950s, the emphasis in control design problems has been shifted from the design of one of many systems that work to the design of one optimal system in some meaningful sense.

Since about 1960, because the availability of digital computers made possible time-domain analysis of complex systems, modern control theory, based on time-domain analysis and synthesis using state variables, has been developed to cope with the increased complexity of modern plants and the stringent requirements on accuracy, weight, and cost in military, space, and industrial applications. During the years from 1960 to 1980, optimal control of both deterministic and stochastic systems,as well as adaptive and learning control of complex systems, were fully investigated. From 1980 to the present, developments in modern control theory centered on robust control, H, control, and associated topics.

Now that digital computers have become cheaper and more compact, they are used as integral parts of control systems. Recent applications of modern control theory include such no engineering systems as biological, biomedical, economic, and socioeconomic systems.

2.3.1 Open-loop control system

The open- loop control system refers to systems in which the output has no effect on the control action. 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 a 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 reference input .Thus, to each reference input there corresponds a fixed operating condition; as a result, the accuracy of the system depends on calibration. In the presence of disturbances, an open-loop control system will not perform the desired task. Open-loop control can be used, in practice, only if the relationship between the input and output is known if there are neither internal nor external disturbances.

Clearly, such systems are not feedback control systems.

The figure 2.2 starts with a sub system called an input transducer, which converts the form of the input to that used by the controller. The controller drives a process or a plant .Other signals ,such as disturbances, are shown added to the controller and process outputs via summing junctions, which yield the algebraic sum of their input signals using associated signs.

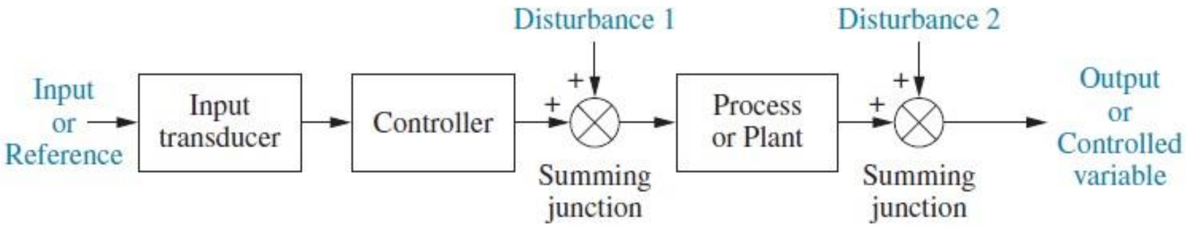


Figure 2.2:Block diagram of an open-loop control system

2.3.2 Closed – loop control systems

A system that maintains a prescribed relationship between the output and the reference input by comparing them and using the difference as a means of control is called a closed-loop control system .An example would be a room temperature control system. By measuring the actual room temperature and comparing it with the reference temperature, the thermostat turns the heating or cooling equipment on or off in such a way as the ensure that the room temperature remains at a comfortable level regardless of outside conditions.

In a closed-loop control system the actuating error signal, which is the difference between the input signal and the feedback signal (which may be the output signal itself or function of the output signal at its derivatives and/or integrals), is feedback to the controller so as to reduce the error and bring the output of the system to a desired value.

The term closed-loop control always implies the use of feedback control action in order to reduce system error .

In figure 2.3 the input transducer converts the form of the input to the form used by the controller. An output transducer, or sensor, measures the output response and converts it into the form used by the controller . The first summing junction algebraically adds the signal from the input to the signal from the output, which arrives via the feedback path, the return path from the output to the summing junction. The output signal is subtracted from the input signal. The result is generally called the actuating signal. The actuating signal's value is equal to the actual difference between the input and the output. Under this condition, the actuating signal is called the error.

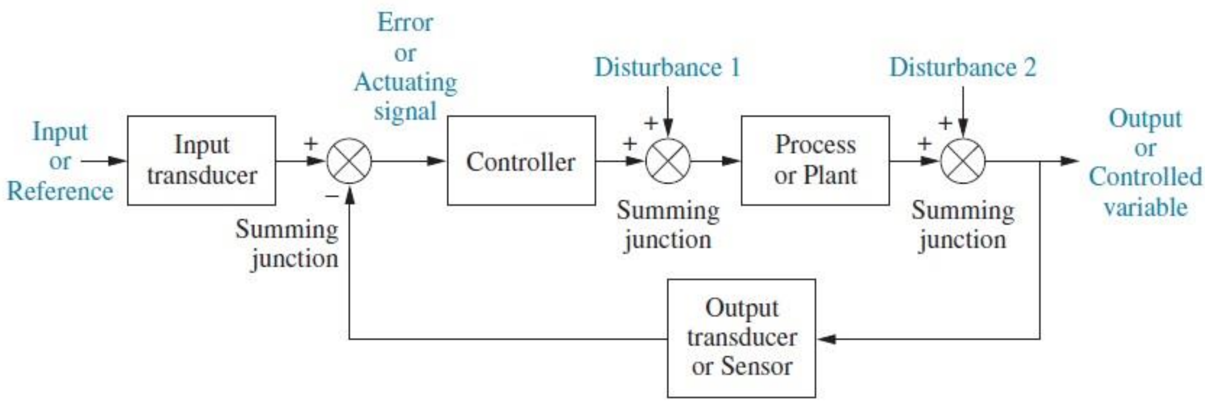


Figure 2.3: Block diagram of a close-loop control system

2.3.3 Advantages of Control System

With control systems we can move large equipment with precision that would otherwise be impossible. We can point huge antennas toward the farthest reaches of the universe to pick up faint radio signal controlling these antennas by hand would be impossible. Because of control systems, elevators carry us quickly to our destination, automatically stopping at the right floor. We alone could not provide the power required for the load and the speed; motors provide the power, and control systems regulate the position and speed. [2]

2.4 Sensors

A sensor is a device which provides a usable output in response to a specified measured. It acquires a physical quantity and converts it into a signal suitable for processing (e.g. optical, electrical, mechanical).

Nowadays common sensors convert measurement of physical phenomena into an electrical signal. Active element of a sensor is called a transducer.

The following are some of the more important sensor characteristics:

- ❖ Transfer function: the transfer function shows the functional relationship between physical input signal and electrical output signal. Usually, this relationship is represented as a graph showing the relationship between the input and output signal, and the details of this relationship may constitute a complete description of the sensor characteristics. For expensive sensors that are individually calibrated, this might take the form of the certified calibration curve.
- ❖ Sensitivity: the sensitivity is defined in terms of the relationship between input physical signal and output electrical signal. It is generally the ratio between a small change in electrical signal to a small change in physical signal. As such, it may be expressed as the derivative of the transfer function with respect to physical signal. A Thermometer would have “high sensitivity” if a small temperature change resulted in a large voltage change.
- ❖ Span or dynamic range: the range of input physical signals that may be converted to electrical signals by the sensor is the dynamic range or span.

  Signals outside of this range are expected to cause unacceptably large inaccuracy. This span or dynamic range is usually specified by the sensor supplier as the range over which other performance characteristics described in the data sheets are expected to apply.

- Accuracy or uncertainty: uncertainty is generally defined as the largest expected error between actual and ideal output signals. Sometimes this is quoted as a fraction of the full-scale output or a fraction of the reading. A thermometer might be guaranteed accurate to within five percent of fullscale output (FSO). Accuracy is generally considered by metrologists to be a qualitative term, while uncertainty is quantitative. One sensor might have better accuracy than another if its uncertainty is one percent compared to the other with an uncertainty of three percent.
- Hysteresis: some sensors do not return to the same output value when the input stimulus is cycled up or down. The width of the expected error in terms of the measured quantity is defined as the hysteresis.
- Linearity: the maximum deviation from a linear transfer function over the specified dynamic range. There are several measures of this error.
- Noise: all sensors produce some output noise in addition to the output signal. In some cases, the noise of the sensor is less than the noise of the next element in the electronics, or less than the fluctuations in the physical signal, in which case it is not important. Many other cases exist in which the noise of the sensor limits the performance of the system based on the sensor. Noise is generally distributed across the frequency spectrum.
- Resolution: the resolution of a sensor is defined as the minimum detectable signal fluctuation. Since fluctuations are temporal phenomena, there is some relationship between the timescale for the fluctuation and the minimum detectable amplitude. Therefore, the definition of resolution must include some information about the nature of the measurement being carried out.. If the shape of the noise distribution is also specified, it is possible to generalize these results to any measurement.

❖ Bandwidth: all sensors have finite response times to an instantaneous change in physical signal. In addition, many sensors have decay times, which would represent the time after a step change in physical signal for the sensor output to decay to its original value. The reciprocal of these times correspond to the upper and lower cutoff frequencies, respectively.

Table 2.1: Sensors classifications

PROPERTY	SENSOR	ACTIVE/PASSIVE	OUTPUT
Temperature	Thermocouple	Passive	Voltage
	Silicon	Active	Voltage/Current
	RTD	Active	Resistance
	Thermistor	Active	Resistance
Force/Pressure	Strain Gage	Active	Resistance
	Piezoelectric	Passive	Voltage
Acceleration	Accelerometer	Active	Capacitance
Position	LVDT	Active	AC Voltage
Light Intensity	Photodiode	Passive	Current

There are many types of sensors with different shapes and sizes as shown in figure (2.4).

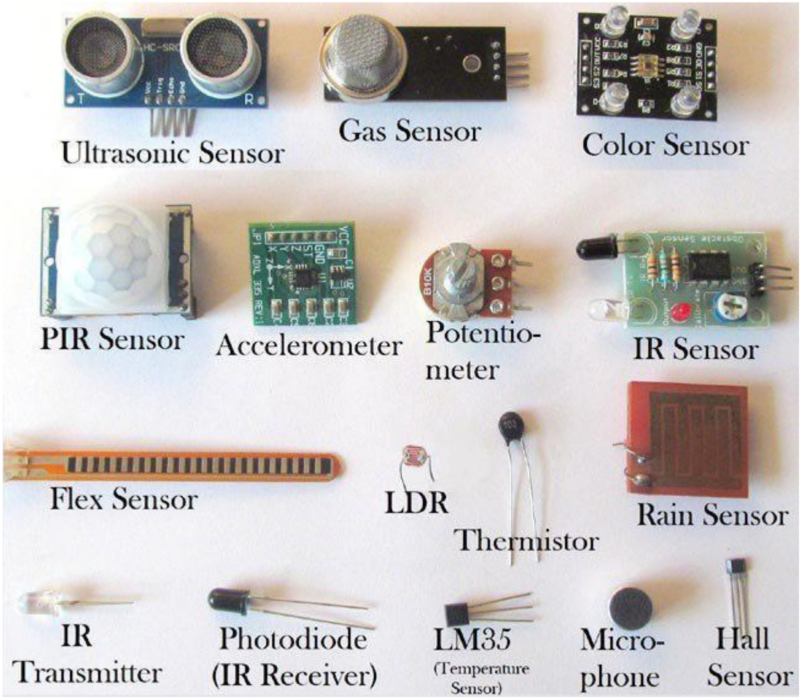


figure (2.4) : Types of Sensors

2.5 Microcontroller

A microcontroller is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip or ‘SoC’; an’ SoC’ may include a microcontroller as one of its components.

A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric” RAM, NOR flash or OTP ROM “is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips.

2.5.1 Microcontroller components

A microcontroller consists of many components such as:

- ❖ Central processing unit

Central Processing Unit is the brain of a microcontroller. CPU is responsible for fetching the instruction, decodes it, and then finally executed. CPU connects every part of a microcontroller into a single system. The primary function of CPU is fetching and decoding instructions. Instruction fetched from program memory must be decoded by the CPU.

- ❖ Memory

Memory in a microcontroller is same as microprocessor. It is used to store data and program. A microcontroller usually has a certain amount of RAM and ROM or flash memories for storing program source codes.

- ❖ Parallel input/output ports

Parallel input/output ports are mainly used to drive/interface various devices such as LCD’S, LED’S, printers, memories, etc. to a microcontroller.

- ❖ Serial interfacing ports

Serial ports provide various serial interfaces between microcontroller and other peripherals like parallel ports.

- ❖ Timers and counters

This is the one of the useful function of a microcontroller. A microcontroller may have more than one timer and counters. The timers and counters provide Program. The interrupt may be external (activated by using interrupt pin) or internal (by using interrupt instruction during programming).

- ❖ Special functioning block

Some microcontrollers used only for some special applications (e.g. space systems and robotics) these controllers containing additional ports to perform such special operations. This considered as special.

MCs are classified by architecture, instruction set, MC ideology and producer.

Classification of MCs by architecture :

there are two MC architectures Von Neumann and Harvard. The MC developed using Von Neumann architecture has common memory for storage of data and programs and , consequently, the common bus for transferring of instructions addresses and data figure (2.7).

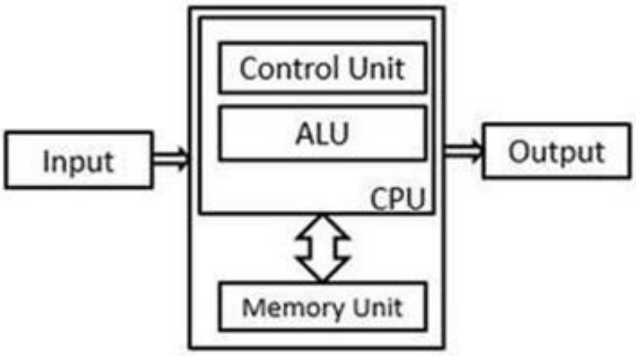


Figure 2.5: Von Neumann Architecture

Harvard architecture differs from Von Neumann architecture. It has separate memory units for program and data storage and separate busses for transferring of instructions addresses and data. Harvard architecture allows to reach higher data transfer speed. The single instruction can be executed during one machine cycle using the MC based on the Harvard architecture. Most MC families are created using Harvard architecture figure (2.5) [3].

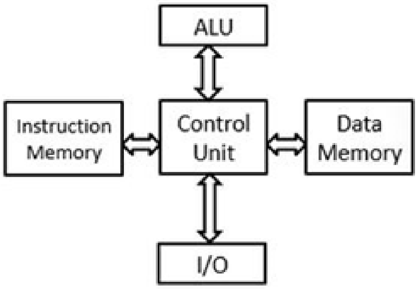


Figure 2.6: Harvard Architecture

Classification of MCs by instruction set: the MCs are divided into two groups by instruction set. There are MCs that belong to the reduced instruction set computer (RISC) group and MCs that belong to the complex instruction set computer (CISC) group. Majority of MCs are based on the RISC ideology. CISC ideology is mostly used in microprocessors [4].

Classification of MCs by ideology: according to ideology MCs are distributed into 8-bit families. The most popular families of 8-bit MCs are:

8051 family (Intel ideology): the MCs of this family are developed using Harvard architecture figure (2.9). They belong to RISC MCs. The 8051 family MCs are manufactured by such firms as: Intel, Atmel, Dallas Semiconductor , Philips , Siemens, Integrated Silicon Solution Inc. (ISSI).

✓ Advantages

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. vice in the future.

✓ Applications

Microcontrollers are used in automatically controlled products and devices, such as:

- ❖ Automobile engine control systems.
- ❖ Implantable medical devices.
- ❖ Remote controls.
- ❖ Office machines.
- ❖ Power tools.
- ❖ Toys and other embedded systems.

CHAPTER THREE

SMART ASSISTANT MODEL DESIGN

3.1 System Description

This proposed project used the technology in telecommunication, where the evolution in telecommunication was applied in this project by using GSM module SIM900A. At the same time, a few circuit and software such as ARDUINO IDE compiler was used to be as a controller for all of the main and sub equipment. A few main component and equipment are used in this project which is gesture sensor (MPU6050) and controlled by ARDUINO UNO board which act as microcontroller by using GSM module SIM900A.

3.2 System Hardware

The circuit components are listed as follows:

- GSM Module.
- Arduino Uno board.
- MPU6050.
- LCD screen.
- Buzzer.
- Push button.
- Breadboard.
- Wires.

3.2.1 GSM Module

A GSM Module is basically a GSM Modem (like SIM 900) connected to a PCB with different types of output taken from the board – say TTL Output (for Arduino, 8051 and other microcontrollers) and RS232 Output to interface directly with a PC (personal computer). The board will also have pins or provisions to attach mic and speaker, to take out +5V or other values of power and ground connections. These type of provisions vary with different modules.Lots of varieties of GSM modem and GSM Modules are available in the market to choose from. For our project of connecting a gsm modem or module to arduino and hence send and receive sms using arduino – its always good to choose an arduino compatible GSM Module – that is a GSM module with TTL Output provisions.

3.2.1.1 Features of GSM Module

Compatibility that we can use the same mobile to make calls in several countries, Flexibility and increased capacity due to equipment is smaller in size, Improved spectrum efficiency, International roaming, Compatibility with integrated services digital network (ISDN), Support for new services, SIM phonebook management, Fixed dialing number (FDN), Real time clock with alarm management, High-quality speech, Uses encryption to make phone calls more secure and Short message service (SMS).

3.2.1.2 Power Requirements of GSM Module

GSM modules are manufactured by different companies. They all have different input power supply specs. You need to double check your GSM modules power requirements. In this tutorial, our gsm module requires a 12 volts input. So we feed it using a 12V,1A DC power supply.

I have seen gsm modules which require 15 volts and some other types which needs only 5 volts input. They differ with manufacturers. If you are having a 5V module, you can power it directly from Arduino’s 5V out.

Note:- GSM Modules are manufactured by connecting a particular GSM modem to a PCB and then giving provisions for RS232 outputs, TTL outputs, Mic and Speaker interfacing provisions etc. The most popular modem under use is SIM 900 gsm modem from manufacturer SIMCom. They also manufacture GSM Modems in bands 850, 300 and other frequency bands .

- Check for TTL Output Pins in the module – You can feed the data from gsm module directly to Arduino only if the module is enabled with TTL output pins. Otherwise you have to convert the RS232 data to TTL using MAX232 IC and feed it to Arduino. Most of the gsm modules in market are equipped with TTL output pins. Just ensure you are buying the right one .

So that's all about the gsm module basics. Now lets power it up

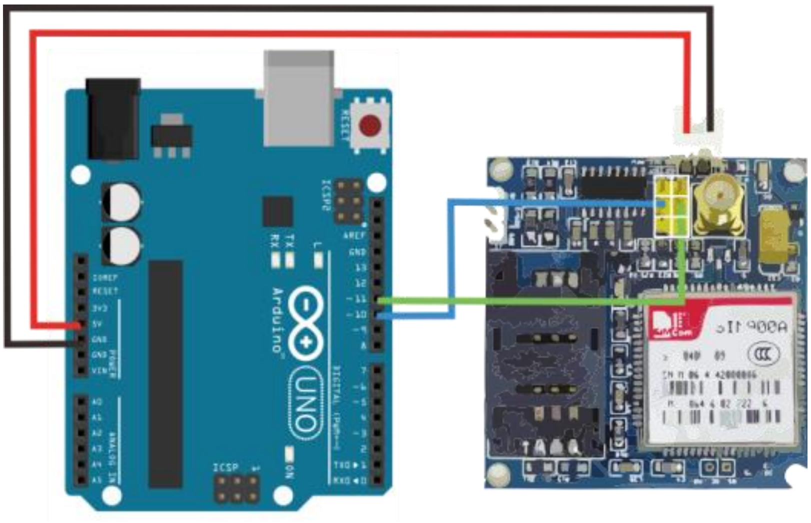


Figure 3.1: GSM Module Connection

3.2.2 Arduino Uno Board

Arduino is a small microcontroller board with a USB plug to connect to computer and a number of connection sockets that can be wired up to external electronics, such as motors, relays, light sensors, laser diodes, loud speakers, microphones, etc. They can either be powered through the USB connection from the computer or from a 9V battery. They can be controlled from the computer or programmed by the computer and then disconnected and allowed to work independently. [5]

Arduino Uno is a member of the Arduino family, and it is based on the ATmega328P microcontroller. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, header and a reset button figure (3.4).

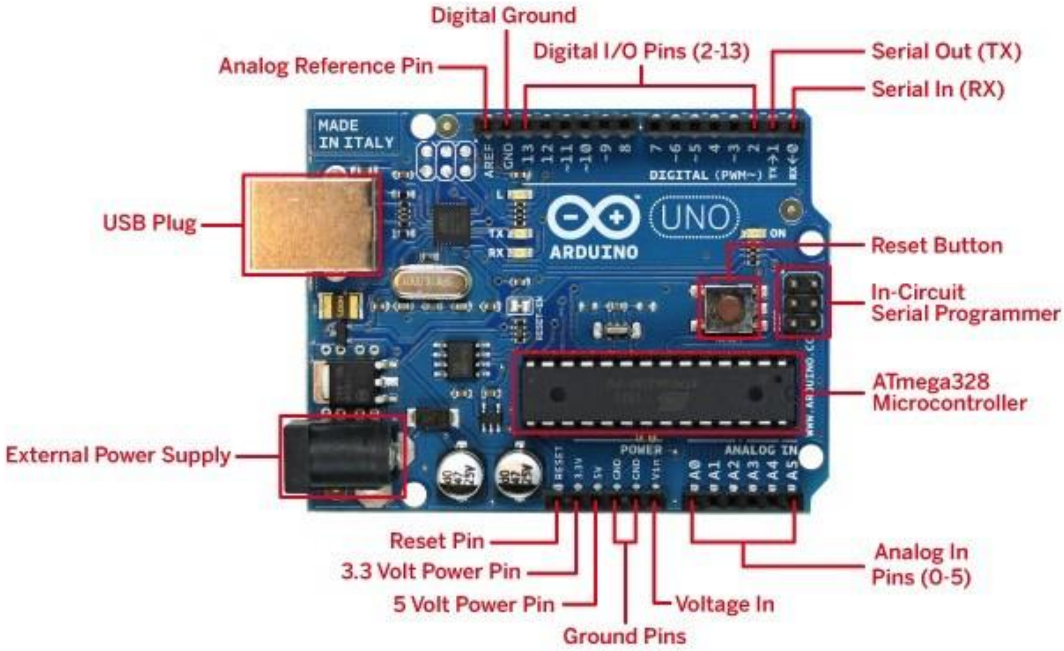


Figure 3.2: Arduino Uno

Each of the 14 digital pins on the Arduino Uno can be used as an input or output, they operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 K ohm. Pins from 2-13 are digital input/out pins. In addition, some pins have specialized functions:

- Serial pins (0 (RX) and 1 (TX)): are used to receive (RX) and transmit (TX) transistor-transistor logic serial data.
- PWM (3, 5, 6, 9, 10, and 11): provide 8-bit PWM.
- Serial peripheral interface SPI (10 slave select (SS), 11 master out slave in (MOSI), 12 master in slave out (MISO), 13 serial clock (SCK)): these pins support SPI communication using the SPI library.

- LED (13): there is a built-in LED connected to digital pin 13.

The Arduino Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure 28 from ground to 5 volts, though is it possible to change the upper end of their range using the analog reference (AREF) pin.

- Two wire interface TWI (A4 or data line (SDA) pin and A5 or clock line (SCL) pin): support TWI communication using the Wire library.
- AREF: reference voltage for the analog inputs.
- Reset: used to reset the microcontroller.

Arduino Uno microcontroller can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). It is the main processor and all parts of the circuit are connected to it.

3.2.3 MPU 6050

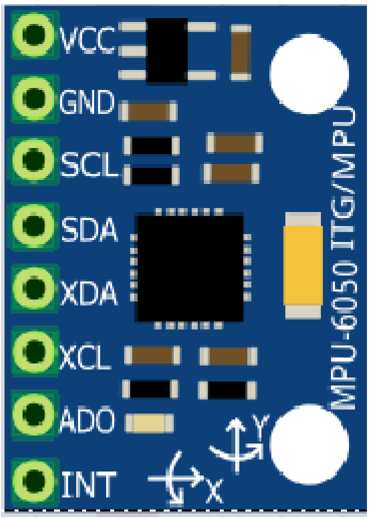


Figure 3.3: MPU-6050

The MPU-6050 is a micro electro-mechanical system (MEMS) which consists of a three-axis accelerometer and three-axis gyroscope inside it figure (3.4). This helps in measuring acceleration, velocity, orientation, displacement and many other motion related parameters of a system or object. This module also has a digital motion processor (DMP) inside it, which is powerful enough to perform complex calculation and thus free up the work for microcontroller.

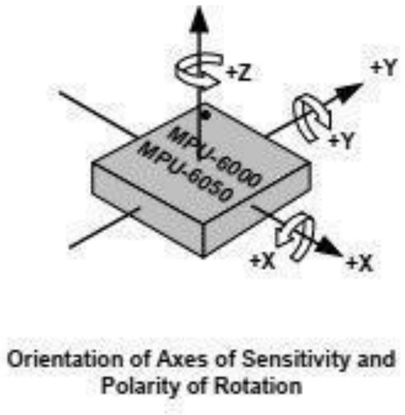


Figure 3.4: MPU-6050 Axes

Conceptually, an accelerometer behaves as a damped mass on a spring. When the accelerometer experiences an acceleration, the mass is displaced to the point that the spring is able to accelerate the mass at the same rate as the casing. The displacement is then measured to give the acceleration. The voltage common collector (VCC) pin and ground (GND) are connected to the 5v pin and ground pin on the Arduino respectively.

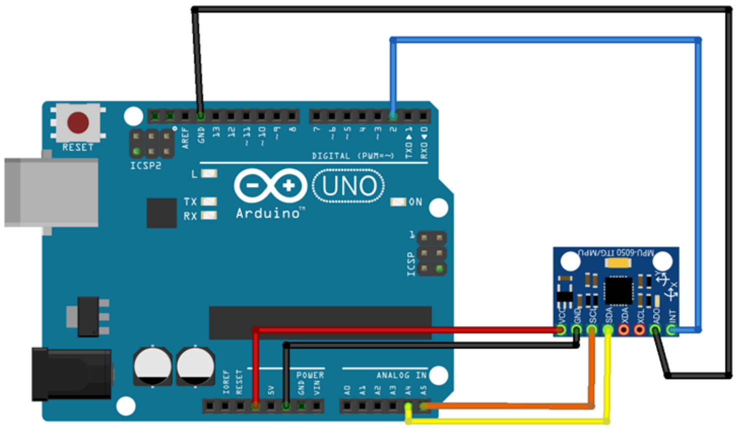


Figure 3.5: MPU-6050 Connection

The SCL and SDA pins are connected to A5 and A4 pins on the Arduino respectively. The address (AD0) pin is connected to ground and the interrupt digital output (INT) pin is connected to pin 2 on the Arduino figure (3.5).
It is used to acquire the hand's relative position and to form alongside the flex sensors data the hand gesture.

3.2.4 LCD Screen

It is an output device for presentation of information in visual or tactile form figure (3.6). A liquid crystal cell consists of a thin layer of a liquid crystal sandwiched between two glass sheets with transparent electrodes deposited on their inside faces. When the input information is supplied as an electrical signal, the display is called an electronic display. An LCD uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome [6].

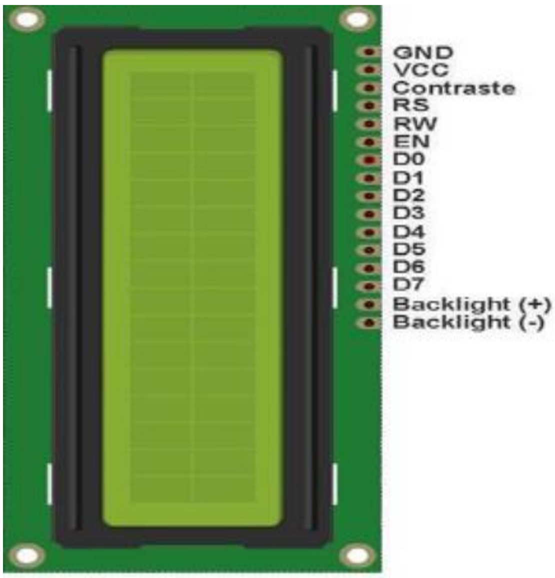


Figure 3.6: LCD

The backlight of the LCD screen is controlled using a variable resistance (potentiometer) .The LCD screen pins are connected as follows figure (3.7):

- GND and read/write (RW) pins to the Arduino GND.
- VCC: to the Arduino 5v pin.
- V0: to the output of the potentiometer.

- Register selector (RS): to the Arduino pin 12.
- Enable (E): to Arduino pin 11.
- Data pins (D4, D5, D6 and D7): to Arduino pins 5, 4, 3 and 2 respectively.

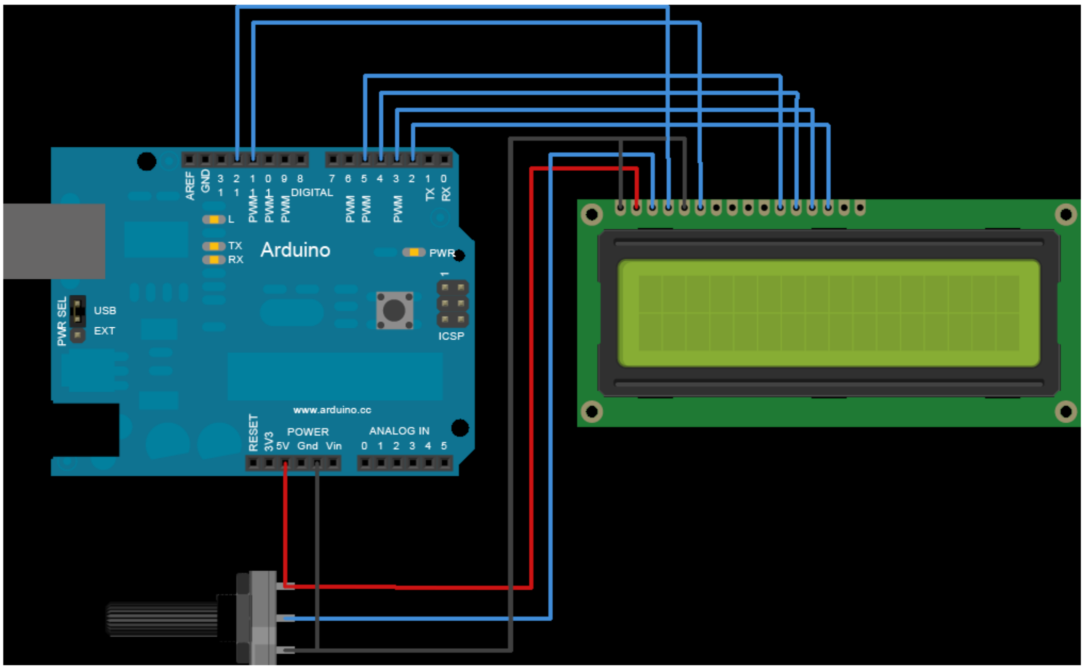


Figure 3.7: LCD Connection

3.2.5 Medical Gloves

It's made from Spandex+nylon . This glove can help ease pain and tension when your hand is hurt.

Comfortable, breathable and easy to clean . Open fingertip design allows you to play mobile phone anytime and anywhere.

Don't worry about slippery hands when you pick up glass.

Improve blood circulation, relax muscles and activate collaterals, and can be used for corporate or outdoor activities.

Figure 3.8 : Medical Gloves

3.2.6 Miscellaneous

Some extra components were used to complete the circuit such as :

- Breadboard: A breadboard is a solderless device for temporary prototypes with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connect the holes on the top of the board .The vertical red and blue lines figure(3.9) are connected to the power supply, where the red line is the 5v source and the blue line is the ground. The other yellow rows are 36 connected horizontally with five columns each and without any links to the rows across the center.

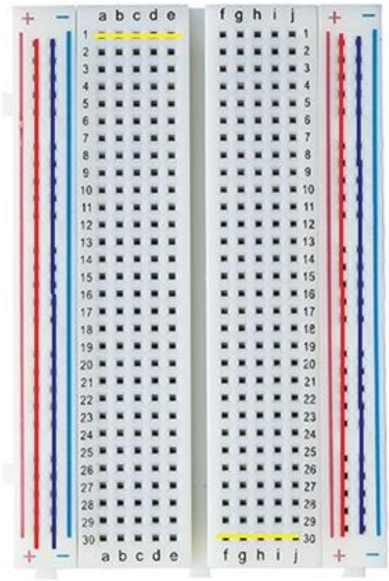


Figure 3.9: Breadboard

- Wires: Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards, Arduinos and other prototyping tools in order to make it easy to change a circuit as needed. Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire figure (3.10).

Figure 3.10: Wires

- potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

Figure 3.11: Potentiometer

3.3 Circuit Diagram

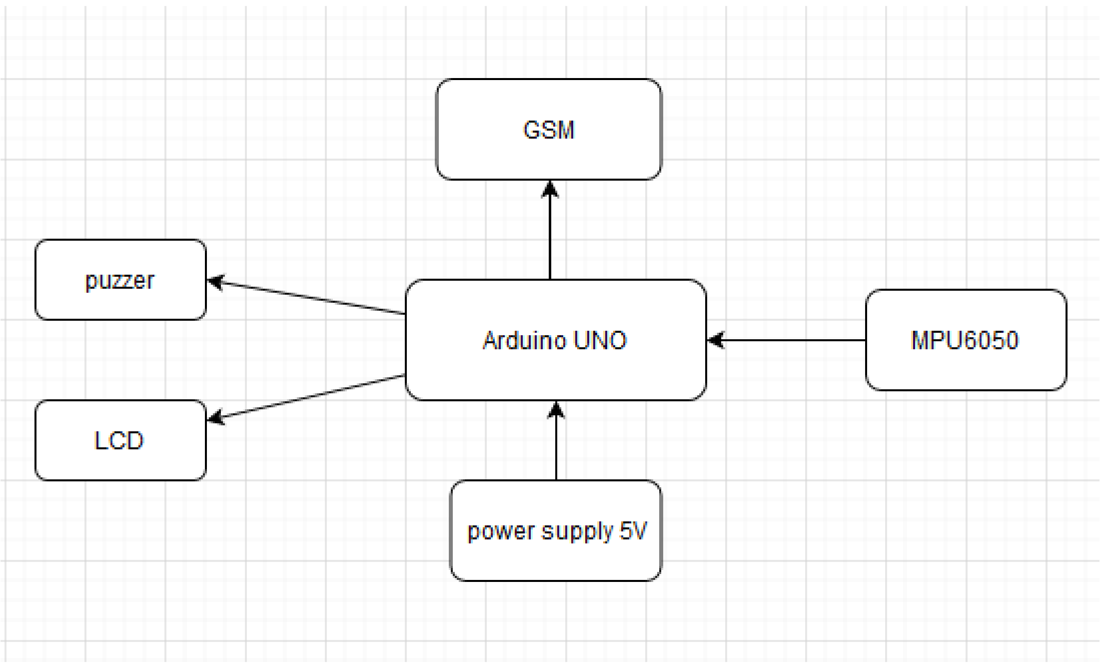


Figure 3.12 : Circuit Block Diagram

CHAPTER FOUR
SYSTEM SIMULATION AND IMPLEMENTATION

4.1 Introduction

Simulation is a very powerful technique to understand how the system will work after implementing in real as a hardware unit. Therefore, the simulation can be defined as an emulation of the operation of a true procedures or system over time. The demonstration of mimicking something initially requires that a model be created; this model depict to the key characteristics, behaviors and functions of the selected physical or abstract system or process. The model speaks about the system itself, but the simulation depicts the performance of the system over time [8].

Simulation software is based on the process of modeling a real phenomenon with a set of mathematical formulas. Essentially, a program allows the user to observe an operation through simulation without actually performing that operation. In addition to imitating processes to see how they behave under different conditions, simulations are also used to test new theories. After creating a theory of causal relationships, the theorist can codify the relationships in the form of a computer program. If the program then behaves in the same way as the real process, there is a good chance that the proposed relationships are correct [8].

There are a lot of simulating tools that can be used as an imitation software unit, but for this project, Proteus has been used as the simulation software.

4.2 Hardware Implementation

In the circuit implementation will be explain briefly the whole circuit in the project system and also explain about the block diagram and component to be used in the circuit. Regarding to the project design, the operation of this project is automatic paralysis/elderly healthcare system is aid and facilitate the paralysis/elderly patient either patient in home or get treatment at Hospital.

Besides, the system of this project also aids the family patient or medical staff to take care of them easier and not 24 hours to treat them. Figure 2 shows the flow chart where the sensor is activated by program code; the sensors will be detected by swiping the hand toward the gesture sensor in particular range. The operation of gesture sensor is detecting any movement with any part of the body mostly by hand which used to convey instruction to help them for example medical staff or nurse at hospital which responsible to treat and care of the patient almost 24 hours every day. There are several hand movement direction set up and each movement direction will indicate different type of instructions for example to help for meals, assist to toilet and etc. So, this system will use to facilitate those care taken of the paralysis patient.

The Arduino is one of the electronic components that use the microcontroller ATmega328 interface where the hardware this board used consist of simple open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The GSM Module used in this project is GSM Module SIM 900A due to 2G capabilities in Malaysia was used GSM900 and GSM1800. In this project, GSM Module SIM900A used for sending simple message (SMS) to the consumer after receiving signal from ARDUINO UNO.

The MPU6050 is a sensor that combine human and machine interface. This sensor is only requiring the gesture by moving hand.

4.3 Proteus Simulation Software

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing. It was developed in Yorkshire, England by Labcenter Electronics Ltd. Proteus is a widely used software and it’s well known in the field of electrical and electronic engineers due to its high reliability and accuracy. Proteus can ensure the user that the final product will be very close to the simulated system in performance aspects [9].

The Proteus Design Suite comprises a fully integrated electronic design automation (EDA) package with modules for schematic capture intelligent sensing for innovative structures (ISIS), circuit simulation (PROSPICE), printed circuit board (PCB) layout advanced routing and editing software (ARES) and embedded co-simulation virtual system modelling (VSM). The simulation functions take place entirely within the schematic editor whilst ISIS and ARES share a common, easy to use, windows user interface. All of which reduces the time to master the software. Naturally, ISIS and ARES are themselves tightly integrated, offering both forward and backward annotation and a unique design explorer which allows to navigate and cross probe between the schematic, net list and PCB databases [10]. ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation. ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components. The designer can also develop 2D drawings for the product.

4.4 Simulation Procedures

The Proteus designing platform is accessed by clicking the schematic capture icon as shown in figure (4.1).

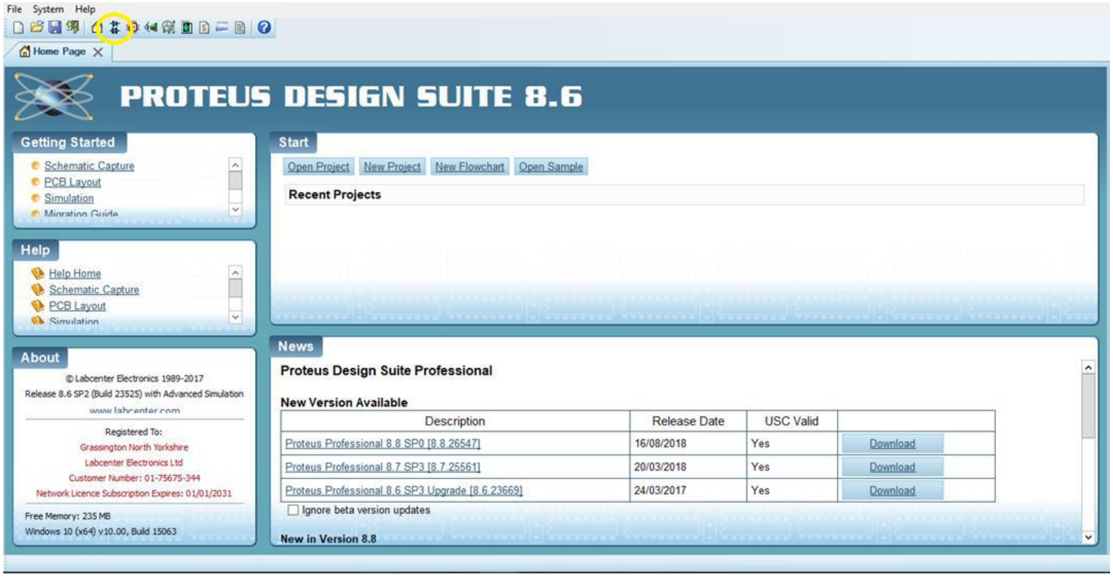


Figure 4.1: Proteus Software Start Page

Arduino integrated development environment (IDE) is used to prepare the required code to implement the circuit in Proteus software.

The Arduino Uno simulation block is added to the design platform after choosing it from the pick devices window and uploading the code to it figure(4.2).

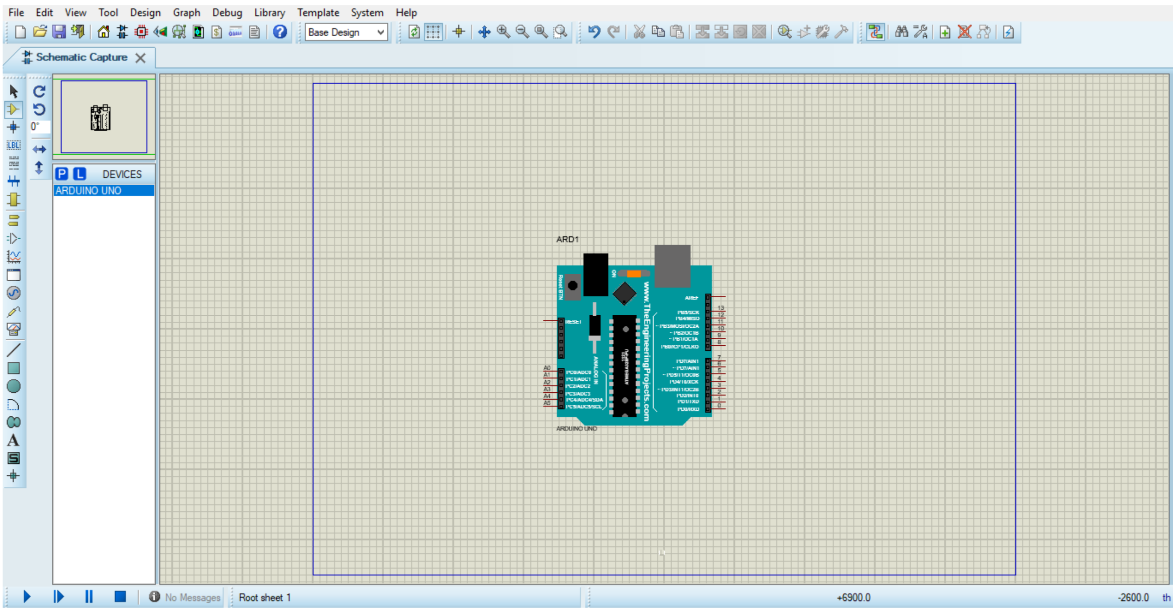


Figure 4.2: Arduino Addition in Proteus Software

The following figure show the connecting of componenets :

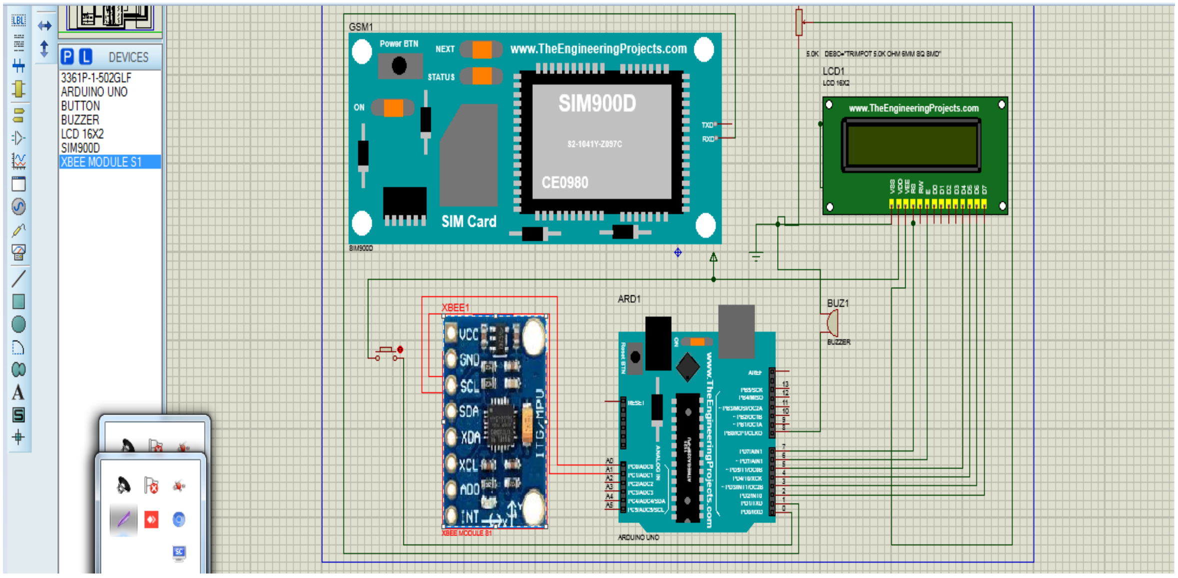


Figure 4.3 : Entire Circuit Simulation Run in Proteus Software

The hex files are uploaded into the simulation platform after verifying the code in Arduino IDE. The simulation is run by clicking the triangle run icon at the left corner of the screen as shown figure (4.3).

After writing the Arduino code using Arduino IDE as shown in Appendix [] and running the simulation and obtaining results, the construction of the practical circuit began. Firstly, the accelerometer (MPU6050) was connected to the breadboard and tested to acquire the operational range. and the wires were connected to the breadboard and tested to acquire the operational range. Then Then LCD screen was connected to the breadboard using a potentiometer to adjust the brightness. the GSM module were connected to the breadboard as shown in. Then we used a power supply and connected to the power supply DC jack.

A list of the most important phrases that they use daily was designed then implemented them into the Arduino code. The Arduino code was uploaded to the Arduino Uno and the circuit was operational figure (4.4).

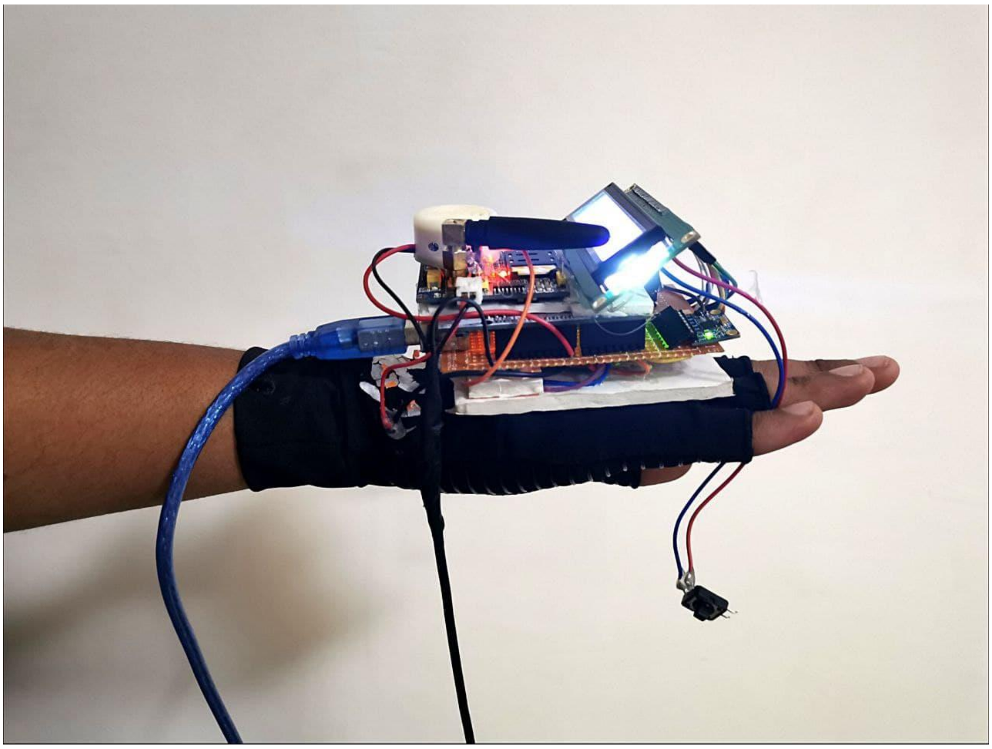
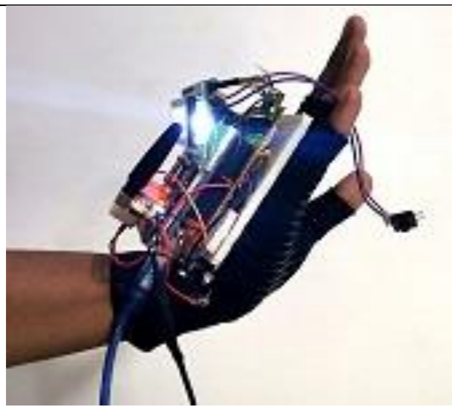


Figure 4.4: Practical Circuit

When a 9V power source is connected to the Arduino board via the AC jack, the Arduino is turned on, and then the instructions are shown on the LCD. The person concerned presses the push botton, after that MPU6050 sensor is activated on the current position of the hand and message displayed on the LCD then waiting for the gesture movement. After the user did the gesture, a ringing sound is issued to indicate the completion of the command and MPU6050 sensor determines the gesture as in the attached table (4.1) and then send the message or make a call. After that, the device returns to the first position, waiting to press the push button again and repeat the same previous steps .

The following table describe the gestures of model :

Table 4.1 : Type of Gesture with Description

Gesture	Description	Gesture
UP	A swipe from the bottom of the board to the top and out of range of the sensor. Make sure that our wrist/arm is not in the sensor's range at the end of the swipe!	
DOWN	A swipe from the top of the board to the bottom and out of range of the sensor.	
LEFT	A swipe from the right side of the board to the left and out of range of the sensor.	
RIGHT	A swipe from the left side of the board to the right and out of range of the sensor.	

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

A model was built to help the elderly patient and the paralyzed to communicate with their loved ones or those who care about them through hand gesture and translate it in the form of text messages or a call in emergency cases .

The project presents development of automatic healthcare system using GSM for paralysis and elderly patient.

Firstly, general information about paralyzed and elderly patient and the previous efforts in this field was collected and studied and then the selection of components for the circuit and device specifications was done . After that Arduino coding was learnt and the specific code for the project was written. Next, Proteus software was used to conduct the simulation until satisfactory results were obtained. Then the components were acquired and connected together to form the circuit as designed. The device was tested and found to be fully operational and the desired results were obtained successfully.

5.2 Recommendations

We recommend, for further improvement of the project that :

- ✓ Add some sensors to the system to measure vital processes such as temperature and pressure sensor and link them with a smart phone to facilitate monitoring and preserve their lives .
- ✓ Add smart home features to the system to facilitate dealing with their needs .

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APPENDX

Arduino Code

The following is the Arduino Uno IDE code :

```
#include <LiquidCrystal.h>

// initialize the library by associating any needed LCD interface pin
// with the arduino pin number it is connected to
const int rs = 7, en = 6, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

#include <MPU6050_tockn.h>
#include <Wire.h>
int S=A0;
MPU6050 mpu6050(Wire);
int sys=0;
int maxvalue=45;
int minivalue=-45;
float   gyroYoffset;
float   gyroXoffset;
const int buz =  8;
void setup() {
 pinMode(S,INPUT);
 Serial.begin(9600);
   pinMode(buz, OUTPUT);
 Wire.begin();
 lcd.begin(16,2);
```

```
}

void loop() {

 if (sys==0)
 {
   if (digitalRead(S)==0)
{
 sys=1;
}
   lcd.clear();
   lcd.setCursor(0,0);
   lcd.print("EMERGENCIY CALLI");
    lcd.setCursor(0,1);
   lcd.print("TILT YOUR HAND ");
   delay(200);

 }
 if (sys==1)
 {
   lcd.clear();
   lcd.setCursor(0,0);
   lcd.print("PLEASE WAIT...");
     mpu6050.begin();
     mpu6050.calcGyroOffsets(true);
     sys=2;
 }

  if (sys==2)
 {
```

```
    lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("READY!");
   mpu6050.update();
Serial.print("angleX : ");
Serial.print(mpu6050.getAngleX());
Serial.print("\tangleY : ");
Serial.println(mpu6050.getAngleY());

  if (mpu6050.getAngleX()>=maxvalue)
  {
    digitalWrite(buz, HIGH);
    delay(500);
     digitalWrite(buz, LOW);
    delay(500);
    Serial.println("M1");
    Serial.print("ATD +249115820797;\r"); //Phone number you want to call
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("CALLING");
    sys=0;
    delay(2000);
  }

  else  if (mpu6050.getAngleX()<=minivalue)
  {
     digitalWrite(buz, HIGH);
    delay(500);
     digitalWrite(buz, LOW);
    delay(500);
```

```
  Serial.println("M2");
  sms1();
   sys=0;
  delay(2000);
}

if (mpu6050.getAngleY()>=maxvalue)
{
   digitalWrite(buz, HIGH);
  delay(500);
   digitalWrite(buz, LOW);
  delay(500);
  Serial.println("M3");
  sms2();
   sys=0;
  delay(2000);
}

else  if (mpu6050.getAngleY()<=minivalue)
{
   digitalWrite(buz, HIGH);
  delay(500);
   digitalWrite(buz, LOW);
  delay(500);
  Serial.println("M4");
  sms3();
   sys=0;
  delay(2000);
}
```

```
 }


}

void sms1() {
 lcd.clear();
  lcd.setCursor(0,0);
 lcd.print("I need Food");
 lcd.setCursor(0,1);
 lcd.print("Sending Message..");
Serial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
delay(1000);  // Delay of 1000 milli seconds or 1 second
Serial.println("AT+CMGS=\"+249115820797\"\r"); // Replace x with mobile
number
delay(1000);
Serial.println("I need Food");
delay(1000);
Serial.println((char)26);// ASCII code of CTRL+Z
delay(1000);
}

void sms2() {
 lcd.clear();
    lcd.setCursor(0,0);
 lcd.print("I need water");
 lcd.setCursor(0,1);
 lcd.print("Sending Message..");
```

```
Serial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
delay(1000);  // Delay of 1000 milli seconds or 1 second
Serial.println("AT+CMGS=\"+249115820797\"\r"); // Replace x with mobile
number
delay(1000);
Serial.println("Ineed Water");
delay(1000);
Serial.println((char)26);// ASCII code of CTRL+Z
delay(1000);
}

void sms3() {
 lcd.clear();
   lcd.setCursor(0,0);
 lcd.print("I need Toilet");
 lcd.setCursor(0,1);
 lcd.print("Sending Message..");
Serial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
delay(1000);  // Delay of 1000 milli seconds or 1 second
Serial.println("AT+CMGS=\"+249115820797\"\r"); // Replace x with mobile
number//912159932
delay(1000);
Serial.println("I need Toilet");
delay(1000);
Serial.println((char)26);// ASCII code of CTRL+Z
delay(1000);
}
```