CONTROL POSITIONING AND TRACKING OF WHEELCHAIR USING TONGUE MOTION

Vanita[1], Mudit Kant[2]
[1]HOD ECE, [2]M.TECH SCHOLORS, MRKIET REWARI

ABSTRACT: This is helping to individual with severe disability lead more independent lives. The individual with disabilities such as to operate a computer control a powered wheelchair and interact with their environments simply by moving their tongue. The "tongue operated" system is a tongue –operated assistive technology developed for people with severe disability to control their environment. The tongue is considered an excellent appendage in severely disabled people for operating an assistive device. We have developed a wireless, noncontact, unobtrusive, tongue-operated assistive technology called the Tongue Operated System (TOS). The TOS provides people with minimal or no movement ability in their upper limbs with an efficacious tool for computer access and environmental control. A small permanent magnet secured on the tongue by implantation, piercing, or tissue adhesives is used as a tracer, the movement of which is detected by an array of magnetic field sensors mounted on a headset outside the mouth or on an orthodontic brace inside. The sensor outputs signals are wirelessly transmitted to an ultraportable computer carried on the user's clothing or wheelchair and are processed to extract the user's commands. The user can then use these commands to access a desktop computer, control a power wheelchair, or interact with his or her environment. To conduct human experiments, we developed on a face shield a prototype TOS with six direct commands and tested it on six nondisabled male subjects. Laboratory-based experimental results show that the TOS response time for >90% correctly completed commands is about 1 s, yielding an information transfer rate of ~120 bits/min.

I. INTRODUCTION

Assistive technologies are critical for people with severe disability to lead self supportive independent life. Person severely disable as a causes ranges from traumatic brain and spinal cord injuries to stroke generally find it extremely difficult to carry out everyday tasks without continuous help. Assistive technologies that would help them communicate their intensions and effectively control their environment, especially to operate a computer, would greatly improve the quality of life for this group of people and may even help them to be employed. This device could revolutionize the field of assistive technologies by helping individuals with severe disabilities, such as those with high--level spinal cord injuries, return to rich, active, independent and productive lives. The TOS provides people with minimal or no movement ability in their upper limbs with an efficacious toll for computer aces and environmental control. Tongue consist of A small permanent magnet secured on the tongue by implantation, piercing, or tissue adhesives is used as a tracer, the movement of which is detected by an array of magnetic field sensor mounted on a headset outside the mouth or on an orthodontic brace inside. The sensor outputs signals are wirelessly transmitted to an ultraportable computer carried on the user's clothing or wheelchair and are processed to extract the user's commands. The user can then use these commands to access a desktop computer, control a power wheelchair, or interact with his or her environment.

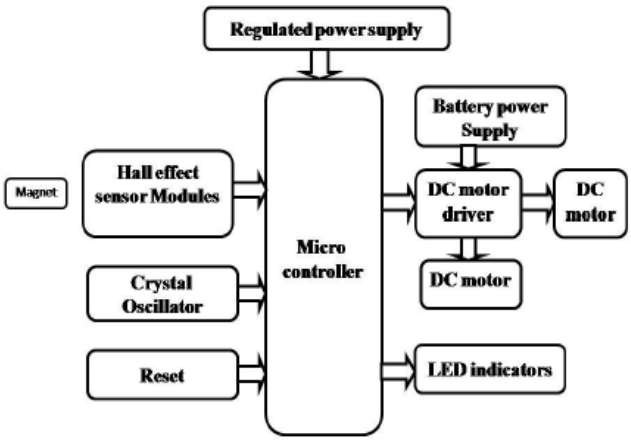


Fig 1: Block diagram of Tongue Operated System

II. INTRODUCTION OF TONGUE SYSTEM EQUIPMENT

Assistive technologies play a critical role in the lives of people with severe disabilities and help them to lead independent self-supportive lives. Persons severely disabled as a result of causes ranging from traumatic brain and spinal cord injuries to stroke and cerebral palsy generally find it extremely difficult to carry out everyday tasks without continuous help. Assistive technologies that help them communicate their intentions and effectively control their environment, especially to operate a computer, can greatly improve the quality of life for this group of people and may even.

Fig 3.1:-Introduction of Tongue System Equipment

III. TONGUE OPERATED CONTROL SYSTEM

A large group of assistive devices are available that are controlled by switches. The switch integrated hand splint, sip and puff device, chin control system, and electromyography (EMG) switch are all switch based systems and provide the user with limited degrees of freedom

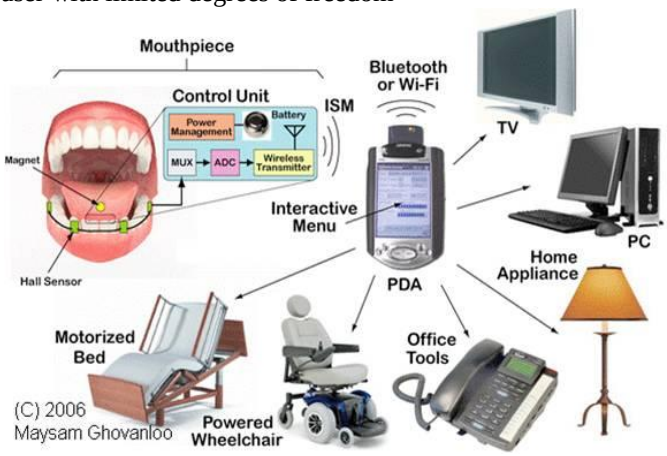
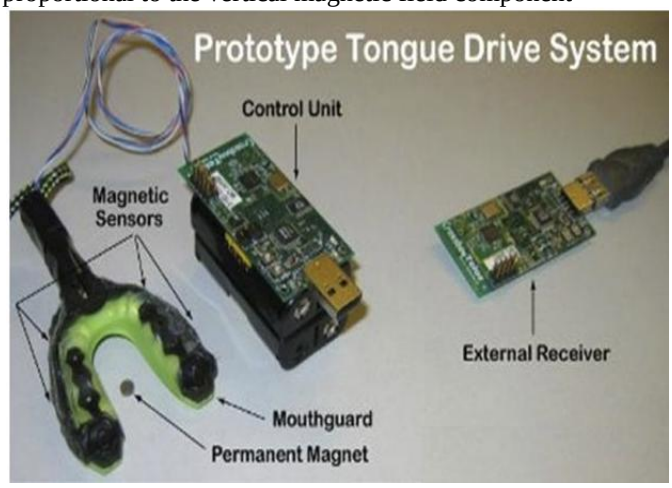


Fig 3.2:-Tongue Operated Control System

IV. PROTOTYPE TONGUE OPERATED SYSTEM

We have developed a prototype Tongue Operated system using off-the-shelf commercially available components to evaluate the feasibility and performance of this approach in developing assistive devices. The main purpose of this prototype device was to substitute mouse in computer access by moving the cursor on the computer screen based on the location of the magnetic tracer relative to the four magnetic sensors. Four ratio metric linear sensors are installed in cavities created in a mouth guard. The sensors readily provide temperature compensated linear voltage output proportional to the vertical magnetic field component



V. COMPONENTS AND DESCRIPTION

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

The Intel 8051 is an 8-bit microcontroller which means that most available operations are limited to 8 bits. There are 3 basic "sizes" of the 8051: Short, Standard, and Extended. The Short and Standard chips are often available in DIP (dual in-line package) form, but the Extended 8051 models often have a different form factor, and are not "drop-in compatible". All these things are called 8051 because they can all be programmed using 8051 assembly language, and they all share certain features (although the different models all have their own special features

Some of the features that have made the 8051 popular are:

- 4 KB on chip program memory.
- 128 bytes on chip data memory (RAM).
- 4 register banks.
- 128 user defined software flags.
- 8-bit data bus
- 16-bit address bus
- 32 general purpose registers each of 8 bits
- 16 bit timers (usually 2, but may have more, or less).
- 3 internal and 2 external interrupts.
- Bit as well as byte addressable RAM area of 16 bytes.
- Four 8-bit ports, (short models have two 8-bit ports).
- 16-bit program counter and data pointer.

HALL EFFECT SENSOR:- The Hall Effect Magnetic and Proximity Sensor Module can be used to detect the presence (or absence!) of nearby objects such as magnets

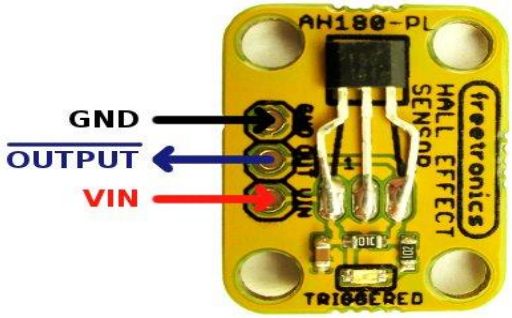


Fig 4.3:- Magnetic and Proximity Sensor Module Quick start Guide

LIGHT EMITTING DIODE A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for general lighting. Appearing as practical electronic components in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness Light-emitting diodes are used in applications as diverse as aviation lighting, automotive lighting, advertising, general lighting, and traffic signals. LEDs have allowed new text, video displays, and sensors to be developed, while their high switching rates are also useful in advanced communications technology. Infrared LEDs are also used in the remote control units of many commercial products including televisions, DVD players and other domestic appliances. LEDs are also used in seven-segment display

Fig 4.9:- Various types of LED's

RESET BUTTON TECHNIQUE The reset button technique (based on the idea of status quo ante) is a plot device that interrupts continuity in works of fiction. Simply put, use of a reset button device returns all characters and situations to the status quo they held before a major change of some sort was introduced. Often used in science fiction television series, animated series, soap operas, and comic books, the device allows elaborate and dramatic changes to characters and the fictional universe that might otherwise invalidate the premise of the show with respect to future continuity. Writers may, for example, use the technique to allow the audience to experience the death of the lead character, which traditionally would not be possible without effectively ending the work

DC MOTOR:- A DC motor is a mechanically commutated electric motor powered from directcurrent (DC). The stator is stationary in space by definition and therefore it's current. The current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

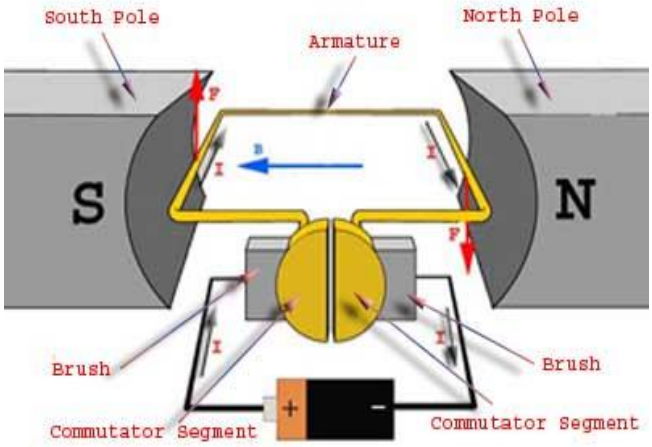


Fig 4.15:-Dc Motor

CRYSTAL OSCILLATOR A crystal is a solid in which the constituent atoms, molecules, or ions are packed in a regularly ordered, repeating pattern extending in all three spatial dimensions. Almost any object made of an elastic material could be used like a crystal, with appropriate transducers, since all objects have natural resonant frequencies of vibration. For example, steel is very elastic and has a high speed of sound. It was often used in mechanical filters before quartz. The resonant frequency depends on size, shape, elasticity, and the speed of sound in the material. High-frequency crystals are typically cut in the shape of a simple, rectangular plate. Low-frequency crystals, such as those used in digital watches, are typically cut in the shape of a tuning fork. For applications not needing very precise timing, a low-cost ceramic resonator is often used in place of a quartz crystal. When a crystal of quartz is properly cut and mounted, it can be made to distort in an electric field by applying a voltage to an electrode near or on the crystal. This property is known as electrostriction or inverse piezoelectricity. When the field is removed, the quartz will generate an electric field as it returns to its previous shape, and this can generate a voltage. The result is that a quartz crystal behaves like a circuit composed of an inductor, capacitor and resistor, with a precise resonant frequency

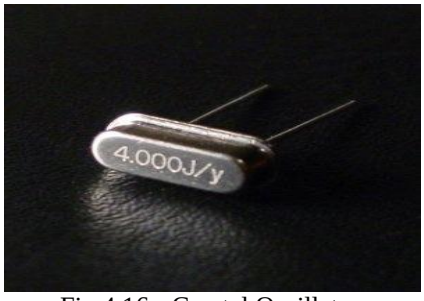


Fig 4.16:- Crystal Oscillator

REGULATED POWER SUPPLY:- Regulated power supply is an electronic circuit that is designed to provide a constant dc voltage of predetermined value across load terminals irrespective of ac mains fluctuations or load variation.

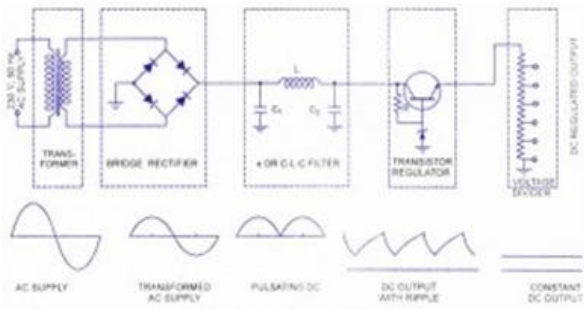


Fig 4.18:- Regulated Power Supply Circuit

Resistors:-

A circuit is always made up of some wire, so there will be some resistance there. If voltage is constant, then we can change the resistor to change the current.

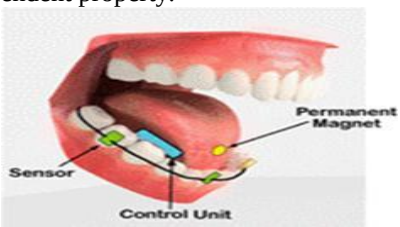
I=V/R

R If "V" is constant and we change "R", "I" will be different.

Capacitors: capacitors have been used to perform the following functions
Turn-off snubbering
• dv/dt snubbering
• RFI filtering
• Transient voltage sharing of series connected devices
• Switched-mode power supply output filtering and dc blocking
• Dc rail splitting for multilevel converters
• Power L-C filters
As well as
• Ac power factor correction and compensation
• Dc rail decoupling
• Voltage multipliers
• motors for single phase supplies
• cascaded multilevel inverters for VAr compensation

VI. WORKPLAN

We use magnetic sensor and Hall Effect sensor. In the magnetic sensor there is a control unit, analog to digital converter and the sensor switches. The module includes a "TRIGGERED" LED which illuminates when the output is active. To verify operation of the module all you need to connect is GND and 5V, and observe the LED when a magnet is brought near the module. To detect the state of the output connect the module. In the Tongue Operated system (TOS), the motion of the tongue is traced by an array of magnetic sensors, which measure the magnetic field generated by a small permanent magnet, the size of a grain of rice, that is embedded in a biocompatible material such as titanium, and attached to the tongue through piercing, implantation, or adhesion. The magnetic sensors can be either mounted on a dental retainer and clipped on the outside of the teeth (internal TOS or iTOS) or on a headset (external TOS or eTOS) positioned near the cheeks. Sensor outputs are amplified, multiplexed, digitized, and transmitted wirelessly to an external controller unit. Signals received by the external controller, which can be a portable computer or a smart phone are processed to indicate the motion of the permanent magnet and consequently the tongue position within the oral cavity. We can assign a certain control function to each particular tongue movement in software and customize the system for each individual user. These user-defined control functions may then be used to operate a variety of devices and equipments including computers, phones, and powered wheelchairs. The signals from the magnetic sensors are linear functions of the magnetic field, which is a continuous position-dependent property.



View of Magnetic Sensor in Mouth

VII. SOFTWARE DESCRIPTION

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks and I/O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing. Embedded C use most of the syntax and semantics of standard C, e.g. main () function, variable definition, data type declaration, conditional statements (if, switch, case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, unions, etc. In short, Embedded C deals with Microcontrollers, I/O Ports (RAM, ROM).whereas C deals with only memory, operating systems. C is a desktop programming language used for embedding a piece of software code into the hardware for its functioning.

VIII. COMPONENTS OF AN EMBEDDED C PROGRAM

Low Level Codes
In-line Assembly Code
Features like Heap, recursion
I/O Registers
Memory Pointers
Bit Access

IX. WILLAR PROGRAMMER

We are using WILLAR Programmer to burn the hex files generated by Keil µVision to the ATMEL AT89S52 microcontroller. The steps to do the same are shown below,
1. Open WILLAR Programmer
2. Select the target device as AT89S52

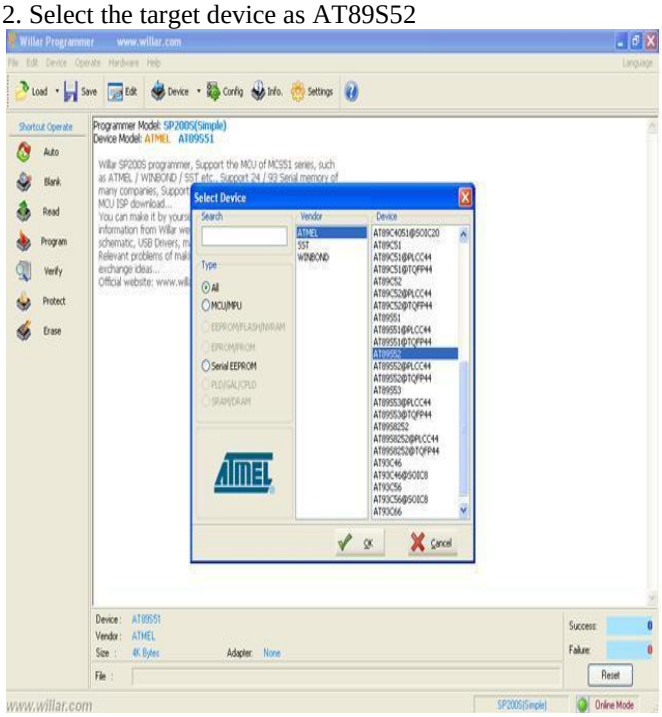


Fig Step 2 Willar Programmer Configuration

3. Load the hex file generated by Keil µVision.

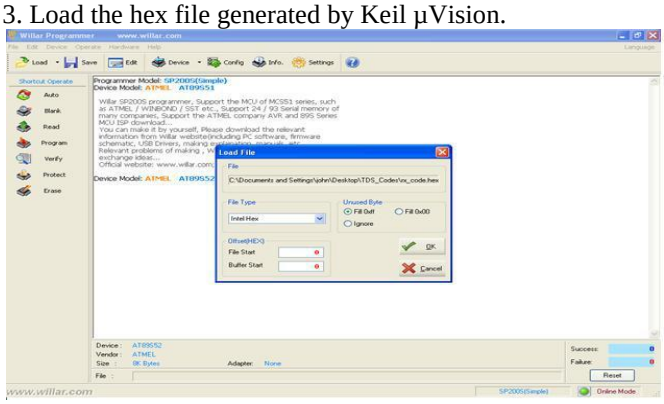


Fig Step 3 of Willar Programmer Configuration

4. Click Auto to blank check, program, verify and protect the hex code into AT89S52.

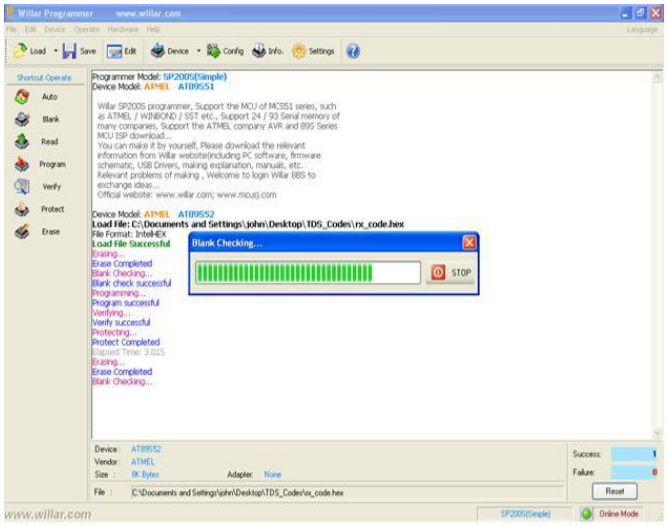


Fig Step 4 of Willar Programmer Configuration

X. RESULT AND CONCLUSION

We have developed a multimodal Tongue Operated system (mTOS) with speech recognition capability by adding a small microphone, a low power audio codec, and a wireless audio link to the original TOS to enhance its functionality in computer access. mTOS allows users to operate the mouse cursor using their tongue motion and type or edit text using speech. Preliminary results supported the idea that a multi-modal AT can significantly improve the speed of completing complex computer access tasks, such as web surfing, where both text entry and cursor navigation are necessary. It was also demonstrated that using TOS with speech recognition does not affect the user's performance with either one of these technologies. We are working to add more input channels, such as head control, to the current mTOS platform to further improve its speed, usability, and end user coverage. We also intend to evaluate the mTOS performance by those with severe disabilities in home/office/outdoors environments. Tongue Operated system is a gift for the physically challenged and disable person to lead their life equal to the normal person in the society. A Tongue operated magnetic sensor based wireless assistive technology has been developed for people with severe disabilities to lead a self-supportive independent life enable them to control their environment using their tongue. This technology works by tracking movement of permanent magnet, secured on the tongue, utilizing an array of linear Hall-Effect sensor. The sensor outputs are a function of the position-dependent magnetic field generated by the permanent magnet. This allows a small array of sensor to capture a large no of tongue movement. Thus providing quicker, smoother, and more convenient proportional control compared too many existing assistive technology. Other advantages of the Tongue Operated system are being unobtrusive, low cost, minimally, invasive. Flexible and easy to operate, a more advanced version with custom designed low-power electronics that entirely fit within the mouthpiece is currently under development.

REFERENCES

[1] X. Huo and M. Ghovanloo, "Using unconstrained tongue motion as an alternative control surface for wheeled mobility,"

[2] X. Huo, J. Wang, and M. Ghovanloo, "Introduction and preliminary evaluation of tongue Operated system: a wireless tongue-operated assistive technology for people with little or no upper extremity function,"

[3] X. Huo, J. Wang, and M. Ghovanloo, "A magneto-inductive sensor based wireless tongue-computer interface,"

[4] X. Huo, J. Wang, and M. Ghovanloo, "Wireless control of powered wheelchairs with tongue motion using tongue Operated assistive technology,"

[5] J. Wang, X. Huo, and M. Ghovanloo, "A quadratic particle swarm optimization method for magnetic tracking of tongue motion in speech disorders,"

[6] X. Huo, J. Wang, and M. Ghovanloo, "Using Tongue Operated system as a new interface to control powered wheelchairs,"

[7] Robert L. Boylestad and Louis Nashelsky, "Hall Effect and Diodes" Pearson Publication. Electronics Device and Circuit Theory Edition Year 2002.

[8] J.B. Gupta, "Oscillator and its operation" S.k. Kataria and Sons. Edition Dec. 2000

[9] Mohammad Ali Mazidi, Janice Gillespie Mazidi and Rolin D. McKinlay," Microcontroller 8051 ". The 8051 Microcontroller and Embedded System. Pearson Education Edition 2009.

[10] Ramakant A. Gayakwad, "Introduction and Working of IC's. OP-AMPs and Linear Integrated Circuits. Edition 2001.

