

Revolutionizing Mobile Phone for Tilt Operations Using AT Commands, GSM Modem, Microcontroller from 8051 Family and MEMS Accelerometer



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Abstract:

This project focuses at designing a prototype for GSM mobile with the help of a MEMS ACCELEROMETER SENSOR to help for a friendly hardware interaction for the user. The device is designed by interfacing a Micro Electro Mechanical System (MEMS ACCELEROMETER SENSOR) and a GSM modem. An onboard computer (Microcontroller from 8051 family) controls these two hardware modules. These three combined to form the project that can achieve the following innovative features.

_ Horizontal Right Tilt based Phone Book (forward) reading system.

_ Horizontal Left Tilt based Phone Book (backward) reading system.

_ Vertical Upward Tilt for calling the phone number.

_ Vertical Downward Tilt for disconnecting the call.

This kind of hardware interactions are made possible with the help of the MEMS ACCELEROMETER SENSOR technology.

Key Words:

Revolutionize mobile, mobile designs, fast and less complex operations, illiterates, User friendly operation, Dynamic phone book display, Dynamic calling option, Dynamic calling halting option, Very easy to operate, audible alerts Power saving mode of operation

1. INTRODUCTION:

The objectives of the project are achieved by making use of an onboard computer. Onboard computer can also be termed as a control unit or microcontrollers.

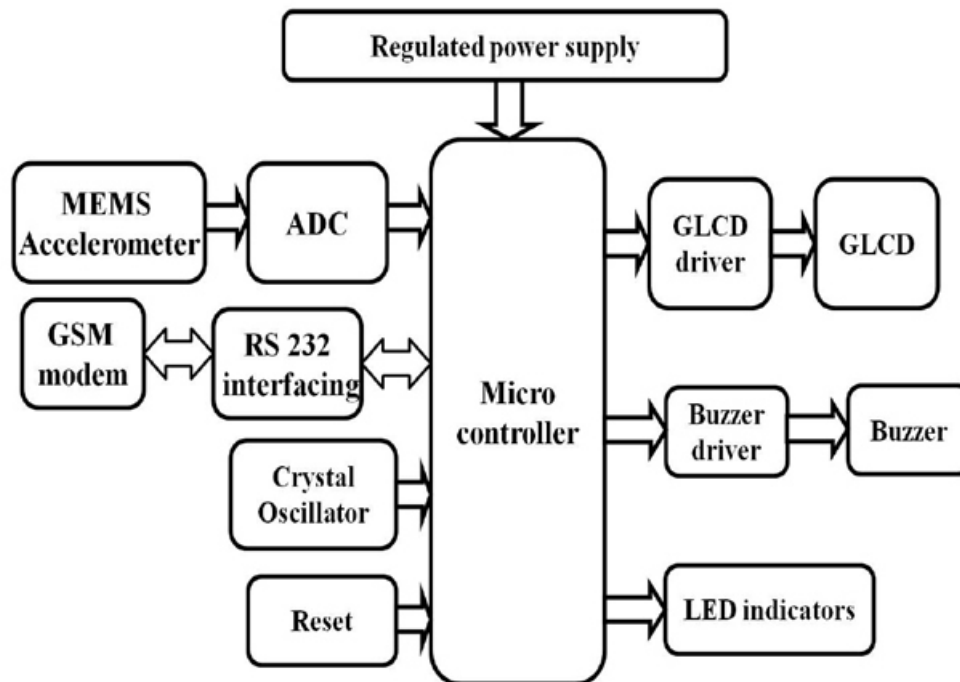
Microcontroller interfaces with MEMS ACCELEROMETER SENSOR based tilt sensor and also with GSM Modem. GSM modem interfacing is done using Serial Communication and AT commands {The reference of which is shown in the later sections with a detailed explanation}. This system also consists of a graphical LCD for better visibility. This displays the control options for tilt based commands, Address book, Mobile operator name and Number dialing/disconnection information. This system is also enabled with the power saving features like disconnecting the power supply to GLCD in case of non-usage of mobile phone for few seconds. The MEMS ACCELEROMETER SENSOR is the input module of the project and provides the information about the tilt in different directions. While the GSM modem issued for remote communication and it catch holds of a SIM card. It is operated without the need of any control button interface and for this the control makes use of AT commands as per the interest of the user (as per the tilt).

2. MAJOR FEATURES OF THE SYSTEMS:

1. User friendly operation.
2. Dynamic phone book display with respect to the horizontal (left/right) tilt angle.
3. Dynamic calling option with respect to the forward vertical tilt angle.
4. Dynamic calling halting option with respect to the backward vertical tilt angle.
5. Very easy to operate.
6. GLCD with backlight control.
7. Power saving mode of operation.
8. Activities display on GLCD.
9. Buzzer for audible alerts.
10. A simple microcontroller from the base is used which is microcontroller from the 8051 family.

Block diagram:

Design and construction of MEMS accelerometer based Touch Free Mobile Phone



3. MATERIALS /EQUIPMENTS USED:

The major building blocks of this project are:

1. Regulated power supply.
2. Crystal Oscillator.
3. GSM modem.
4. MEMS ACCELEROMETER SENSOR.
5. GLCD Display to display address book and calling pages.
6. LED Indicators.
7. Buzzer for audible alerts.
8. Microcontroller from 8051 family

Software's used:

1. PIC-C compiler for Embedded C programming.
2. PIC kit 2 programmer for dumping code into Micro controller.
3. Express SCH for Circuit design.
4. Proteus for hardware simulation.
5. Labview
6. Multisim
7. TINA

3.1.GRAPHICAL LCD:

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

- 1.The declining prices of LCDs.
- 2.The ability to display numbers, characters and graph-ic 's. This is in contrast to LEDs, which are limited to numbers and a few characters.
- 3.Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
- 4.These components are "specialized" for being used with the microcontrollers, which means that they can-not be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

The graphics display resolution is the width and height dimensions of an electronic visual display device, such as a computer monitor, in pixels. Certain combinations of width and height are standardized and typically given a name and an initialism that is descriptive of its dimensions. A higher display resolution in a display of the same size means that displayed content appears sharper.



Fig -1: Graphical LCD

3.2 GSM MODEM:

- A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.
- For the purpose of this document, the term GSM modem is used as a generic term to refer to any modem that supports one or more of the protocols in the GSM evolutionary family, including the 2.5G technologies GPRS and EDGE, as well as the 3G technologies WCDMA, UMTS, HSDPA and HSUPA.
- A GSM modem exposes an interface that allows applications such as Now SMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an “extended AT command set” for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications.
- GSM modems can be a quick and efficient way to get started with SMS, because a special subscription to an SMS service provider is not required. In most parts of the world, GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery.
- A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, such as the Falcom Samba 75. (Other manufacturers of dedicated GSM modem devices include Wavecom, Multitech and iTegno. We’ve also reviewed a number of modems on our

technical support blog.) To begin, insert a GSM SIM card into the modem and connect it to an available USB port on your computer.

- A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer. Any phone that supports the “extended AT command set” for sending/receiving SMS messages, as defined in ETSI GSM 07.05 and/or 3GPP TS 27.005, can be supported by the Now SMS & MMS Gateway. Note that not all mobile phones support this modem interface.
- Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. This is more of an issue with MMS messaging, where if you wish to be able to receive inbound MMS messages with the gateway, the modem interface on most GSM phones will only allow you to send MMS messages. This is because the mobile phone automatically processes received MMS message notifications without forwarding them via the modem interface.
- It should also be noted that not all phones support the modem interface for sending and receiving SMS messages. In particular, most smart phones, including Blackberries, iPhone, and Windows Mobile devices, do not support this GSM modem interface for sending and receiving SMS messages at all at all. Additionally, Nokia phones that use the S60 (Series 60) interface, which is Symbian based, only support sending SMS messages via the modem interface, and do not support receiving SMS via the modem interface.

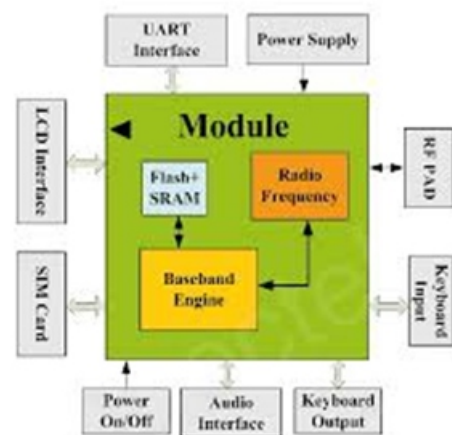


Fig -2: Block Diagram Of a GSM Modem



Fig -3: A GSM Modem

4. WHAT ARE “AT “ COMMANDS ?

AT commands are instructions used to control a modem. AT is the abbreviation of ATtention. Every command line starts with “AT” or “at”. That’s why modem commands are called AT commands. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones. Besides this common AT command set, GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

Note that the starting “AT” is the prefix that informs the modem about the start of a command line. It is not part of the AT command name. For example, D is the actual AT command name in ATD and +CMGS is the actual AT command name in AT+CMGS. However, some books and web sites use them interchangeably as the name of an AT command. Here are some of the tasks that can be done using AT commands with a GSM/GPRS modem or mobile phone:

Get basic information about the mobile phone or GSM/GPRS modem. For example, name of manufacturer (AT+CGMI), model number (AT+CGMM), IMEI number (International Mobile Equipment Identity) (AT+CGSN) and software version (AT+CGMR). Get basic information about the subscriber. For example, MSISDN (AT+CNUM) and IMSI number (International Mobile Subscriber Identity) (AT+CIMI). Get the current status of the mobile phone or GSM/GPRS modem. For example, mobile phone activity status (AT+CPAS), mobile network registration status (AT+CREG), radio signal strength (AT+CSQ), battery charge level and battery charging status (AT+CBC).

- » Establish a data connection or voice connection to a remote modem (ATD, ATA, etc).
- » Send and receive fax (ATD, ATA, AT+F*).
- » Send (AT+CMGS, AT+CMSS), read (AT+CMGR, AT+CMGL), write (AT+CMGW) or delete (AT+CMGD) SMS messages and obtain notifications of newly received SMS messages (AT+CNMI).
- » Read (AT+CPBR), write (AT+CPBW) or search (AT+CPBF) phonebook entries.
- » Perform security-related tasks, such as opening or closing facility locks (AT+CLCK), checking whether a facility is locked (AT+CLCK) and changing passwords (AT+CPWD). (Facility lock examples: SIM lock [a password must be given to the SIM card every time the mobile phone is switched on] and PH-SIM lock [a certain SIM card is associated with the mobile phone. To use other SIM cards with the mobile phone, a password must be entered.]
- » Control the presentation of result codes / error messages of AT commands. For example, you can control whether to enable certain error messages (AT+CMEE) and whether error messages should be displayed in numeric format or verbose format (AT+CMEE=1 or AT+CMEE=2).
- » Get or change the configurations of the mobile phone or GSM/GPRS modem. For example, change the GSM network (AT+COPS), bearer service type (AT+CBST), radio link protocol parameters (AT+CRLP), SMS center address (AT+CSCA) and storage of SMS messages (AT+CPMS).
- » Save and restore configurations of the mobile phone or GSM/GPRS modem. For example, save (AT+CSAS) and restore (AT+CRES) settings related to SMS messaging such as the SMS center address.
- » Note that mobile phone manufacturers usually do not implement all AT commands, command parameters and parameter values in their mobile phones. Also, the behavior of the implemented AT commands may be different from that defined in the standard. In general, GSM/GPRS modems designed for wireless applications have better support of AT commands than ordinary mobile phones.
- » In addition, some AT commands require the support of mobile network operators. For example, SMS over GPRS can be enabled on some GPRS mobile phones and GPRS modems with the +CGSMS command (command name in text: Select Service for MO SMS Messages). But if the mobile network operator does not support the transmission of SMS over GPRS, you cannot use this feature.

4.1. TYPES- BASIC COMMANDS AND EXTENDED COMMANDS:

There are two types of AT commands: basic commands and extended commands. Basic commands are AT commands that do not start with “+”. For example, D (Dial), A (Answer), H (Hook control) and O (Return to online data state) are basic commands.

Extended commands are AT commands that start with “+”. All GSM AT commands are extended commands. For example, +CMGS (Send SMS message), +CMSS (Send SMS message from storage), +CMGL (List SMS messages) and +CMGR (Read SMS messages) are extended commands.

5. CONCLUSION AND RESULT:

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC’s with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

6. FUTURE SCOPE:

Our project “Design and construction of MEMS accelerometer sensor based Touch Free Mobile Phone” is mainly intended to provide an interaction with mobile phone using GSM and MEMS accelerometer sensor are helpful for user who is interested for fast and less complex operations and also for the illiterates who least prefers for button operation. Microcontroller interfaces with MEMS ACCELEROMETER SENSOR based tilt sensor and also with GSM Modem. GSM modem interfacing is done using Serial Communication and AT commands. This system also consists of a 16x2 LCD for better visibility. This displays the control options for tilt based commands, Address book, Mobile operator name and Number dialing/disconnection information.

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BIOGRAPHIES:

B. Harikishor Rao Completed B.E in “Mechatronic” from CSIT in 2013. Right now he is working as a mentor and teacher in ESIAC, Ideology for Career Enhancement and Seans Infosystem. He is also the founder of The Innovation 4 U group.

Rupal Jain has remained consistently good in academics as well as co-curricular activities. She has won prizes for drawing and painting at the National and International level. Some of these include- “Picasso International Golden Artist Award, M.F. Hussain Award, Shipra Shreshtha Kalankan Award, Highly Commended Jury Award and many more. She is a person with self-reliance and good levels of self-confidence.