# Remote Control of Electrical Appliances by Mobile SMS Using STC89C52RC Microcontroller

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**Abstract:** *The aim of this project is to control home electrical appliances utilising the Global System for Mobile Communications (GSM) hand phones we are using every day. This can be achieved by sending Short Message Service (SMS) from the authorized cell phone to the GSM SIM modem which in turn, commands the microcontroller (MCU) to carry out the switching by mean of power relays. This setup is useful for controlling devices where no wired connection to the place is available. To implement the setup, a GSM modem is connected to a programmed microcontroller which would receive SMS from authorized cell phone. The received SMS is then extracted out and processed by the microcontroller-preferred format. Commands are used for controlling the functionality of the GSM hand phone. Utilising low-cost STC89C52RCMCU to read the SMS coding from GSM hand phone and able to translate the coding to switching commands by means of C programming language. A USB to RS232 interface converter connected to computer is used to monitor the transmission between the cell phone and the microcontroller.*

**Keywords**: *GSM modem*, TC35module, STC89C52RC microcontroller, relay PIC18F4520 microcontroller.

## 1. Introduction

The overview of this project is to evaluate remote controlling technologies that are currently available in the market, particularly in the field of smart homes. Remote controlling can be done in wired or wireless modes. In wireless mode, localized means can be by Infrared, Radio Frequency or Bluetooth, just to name a few. One example is the employment of dedicated GSM modem controller for use in remote switching of garage/house door and time-sensitive appliances. Optional feature can also include feedback control, telling the user the status of the appliance currently in. Due to the high cost in purchasing, installation and probably maintenance of the equipment, much can be done by looking into a simple yet multi-functional setup for the average users to be able to utilize remote controlling of household electrical appliances from anywhere in the world!

Generally, this project provides exposure to the following technologies: (I) Microcontroller (ii) Embedded C programming for microcontroller & Microsoft visual basic for PC interface. (iii) GSM modem. (iv) Design of Printed Circuit Board (PCB). (v) Power relay

## 2. Objective

There are some objective need to be archived in order to accomplish this project. These objective will act as a guide and will restrict the system to be implemented for certain situation
1) to design & develop low cost and power consumptionremote switching of appliances using ordinary hand phone.
2) To use GSM as a medium to receive the message from the owner.
3) To develop the system that work automatically.
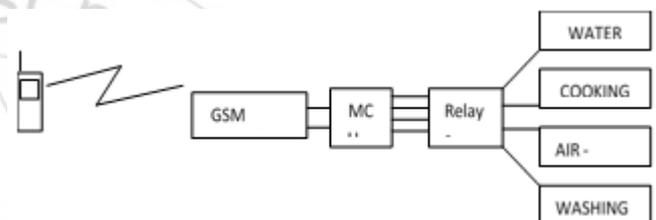4) To use C language for developing program and system optimization



**Figure 1:** Block diagram of the system

1) **Mobile phone:-**is a wireless electronic device used for telephone and multimedia communications.
2) **GSM modem**: -is used to receive SMS message foreperson who is responsible for the appliance.
3) **MCU: -** is the brain of the system where it gets the inputs from the GSM modem and it activates the relay of the appliance and it notifying through SMS.
4) **Relay:** -is used to activate and deactivate the appliance depending on the SMS entered or received.
5) **Appliances:-**is an electrical/mechanical machine which accomplish some household functions such as cooking washing lighting cooling cutting etc.

## 3. Hardware System

Embedded systems for real-time applications are implemented as mixed software-hardware systems. Generally, software is used for features and flexibility, while hardware is used for performance. The hardware design and its implementation for this system & its components will be discussed in the subsequent sections.

### 3.1 Microcontroller Circuit (STC89C52RC)

Microchip STC89C52RC microcontroller was chosen for this project due the high computation capabilities with relative low cost,to work fast, strong anti-jamming ability, stable performance and Other significant advantages, are widely used in industrial, military and other fields, the Product uses a macro crystal STC89C52RCmicroprocessor microcontroller for processing the data8-bits microcontroller comes with high temperature endurances.
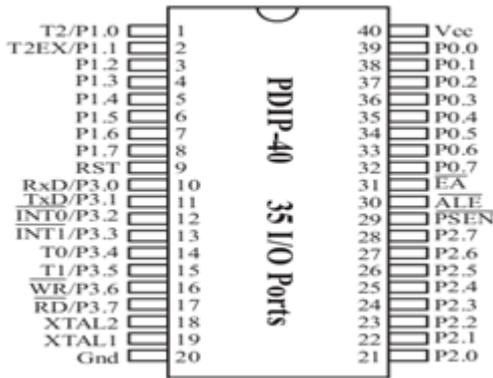
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**Figure 2:** STC89C52RC pins diagram

## 3.2 TC35 GSM Modem

GSM modem has a variety of value added services such as voice mail, call handling facilities, and SMS messages.

1) Support 900/1800/1900 MHz GSM Tri band.
2) Uses AT command set
3) SIM card holder/socket ready
4) Ready with SMA antenna for better signal reception and transmission
5) SMS(text) and voice communication is ready
6) Single board solution
7) Power with7-5VDC
8) Ready with UART(2.6V TTL) and RS232 (COM port) serial interface.
9) Serial interface ,baud rate:9600bps,8-1-N
10) 5LEDact as indictor with different mode.



**Figure 3:** Siemens' TC35 GSM modem

## 3.3 Power Supply Circuit

PIC18F4520 microcontroller operates by a regulated voltage 4.2V. With the use of 12V DC battery, we require a 4.2V voltage regulator, LM2576. In order for the microcontroller to operate, the LM2576 step-downthe voltage from 12V to 4.2V. LM2576 is capable of handling input voltage 12V and output voltage 4.2V. A diode here is used to protect the power supply circuit if the battery or power source polarity is connectedreversely. The diode does not allow current to flow as it only allows electric current to flow in one direction only and blocks the flow in the opposite direction.
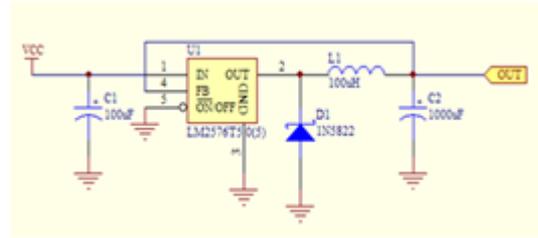


**Figure 4:** Circuit diagram

## 3.4 Relays

A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Current flow through the coil of the relay creates a magnetic field which attracts a lever & changes the switch contacts. In this project relays use to activate and deactivate the appliance. This relay has 5 pins, 2 pins are for the 2 ends of the coil, 1 isCOM,1 isNOand1 isNC. One end of the coil is connected to Vcc and another end is connected to an NPN transistor to amplify the small IC currenttolargervaluerequiredfortherelaycoil.COM pinsconnectedto12VandNOisconnectedtotheappliance
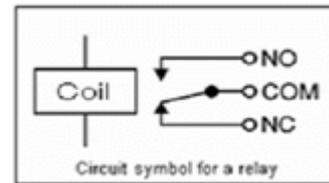


**Figure 5:** relay circuit connection

## 3.5 RS232 Serial Communication Interface

A Max232 serial interface driver IC from Maxim is used to enable RS232 Serial Communication Interface between the microcontroller and the GSM modem. Through this serial communication interface, microcontroller is able to receive a SMS (text) message from the owner. AMax232serialinterface driver IC is used to enable RS232SerialCommunication Interface between the microcontroller and the GSM modem. Through this serial communication interface, the microcontroller is able to receive SMS (text)message from the one who is responsible for the appliance
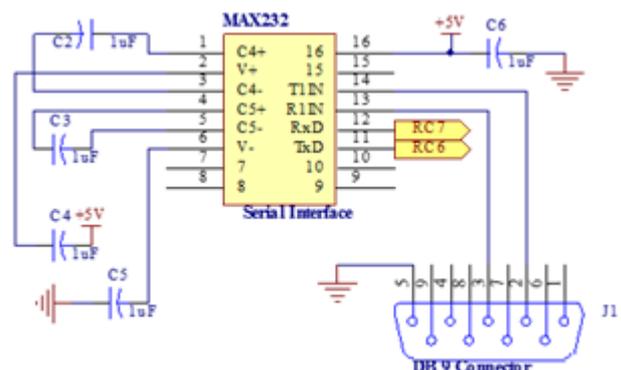


**Figure 6:** Schematic of RS232

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## 3.6 TLC591x8-Channel Constant-Current LED Sink Drivers

The TLC591x is designed for LED displays and LED lighting applications with constant-current control and open-load, shorted-load, and over temperature detection. The TLC591x contains an 8-bit shift register and data latches, which convert serial input data into parallel output format. At the output stage, eight regulated current ports are designed to provide uniform and constant current for driving LEDs within a wide range of LED Forward Voltage (VF) variations. Used in system design for LED display applications,
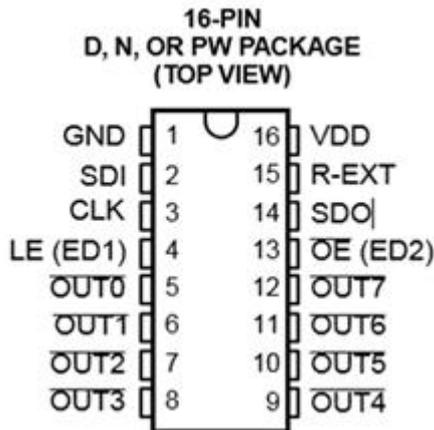


**Figure7:** Pin Configuration and Functions

# 4. Software Development

The software programming for the STC89C52RC Microcontroller is C-program and will be compiled using C18 compiler of the MPLAB Integrated Development Environment. This software provides a single integrated environment to develop codes for embedded microcontrollers.

## 4.1 MPLAB Integrated Development Environment (IDE)

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC microcontrollers. It is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB support both Assembly Language and C programming languages, others language may be supported through the use of third party programs.

## 4.2 Process flow chart

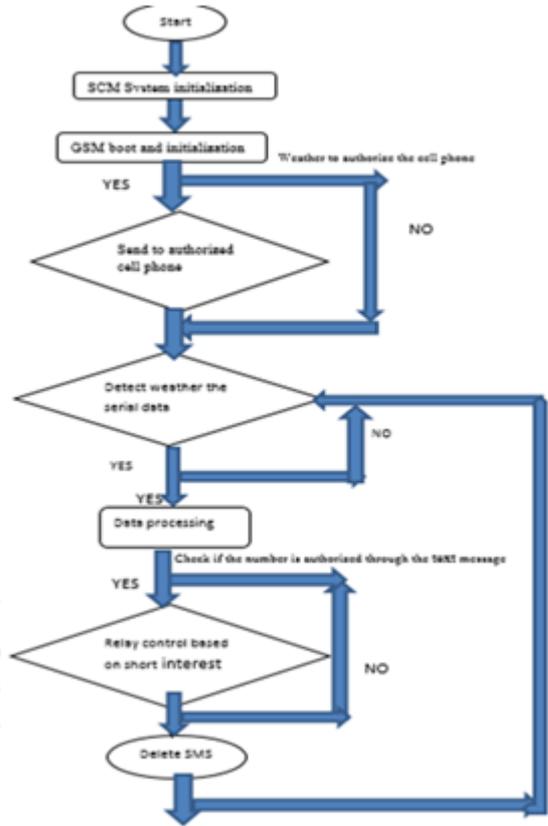The picture below shows the process flow diagram of the whole system.



**Figure 14:** Process flow of the program

## 4.3 Software Algorithm

TC35 / TC35i and MCU51 SMS experiment control relays C program *
* Function: SMS / fetion control 8 relay on and off *
* SMS / fly letter reads 8 relay current switching state *
* SMS / fetion setting authorized phone number *
* SMS / fetion delete authorized phone number *
* SCM: STC89C52RC *
* Crystal: 11.0592MHZ
*************************************************
*********************

```
#include <reg52.h>
#include <intrins.h>
#define uchar unsigned char
#define uint unsigned int
#define RxIn 90 // array length is defined as the 90 received
uchar code AT [] = "AT"; // handshake
uchar code ATE [] = "ATE"; // echo off
uchar code AT_CNMI [] = "AT + CNMI = 2, 1"; // Set This
```
set of parameters to the new display information directly to the serial port, not for storage
```
uchar code AT_CSCA [] = "AT + CSCA ="; // set the
```
service center number
```
uchar code AT_CMGF [] = "AT + CMGF = 1"; // set the
```
SMS format text format
```
uchar code AT_CMGR [] = "AT + CMGR ="; // read SMS
uchar code AT_CMGS [] = "AT + CMGS ="; // Send SMS
uchar code AT_CMGD [] = "AT + CMGD ="; // delete
```
SMS
```
uchar code AT_CSCAE [] = "AT + CSCA?"; // read the
```
message center
```
uchar code AT_CPBR [] = "AT + CPBR ="; // read the
```
phone book

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uchar code AT_CPBW [] = "AT + CPBW ="; // write the phone book
ucharidata AT_CSCAR [23]; // set read SMS center
uchar code successfully [] = "operation successfully!"; // send a message to the target number of successful operation
uchar code fail [] = "operation failed, please try again!"; // operation failed message sent to the target number
uchar code KJ [] = "You are welcome to use YCGD - TC35!"; // Send the product you are welcome to use YCGD - TC35 information to the target number!

## 5. Conclusion

The whole setup is able to receive an incoming SMS from other sources which in turn, the Microcontroller triggers the GSM modem for the incoming message by using the AT Commands. The message received from the MCU is then translated to output commands turn ON or OFF the power relays capable of handling 230 V ac. Therefore, the setup can be modelled to run on 12 V batteries and wire up in junction box to control the home appliances. The system provides with several benefits and can operate automatically. The system runs smoothly by implementing C programming in the system. It will also trigger the GSM modem to receive SMS message from the owner and it has the ability activating or deactivating the relay to operate the appliance. Besides these, it has helped me to improve my hardware design, software design, programming and planning skill

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