

## Smart Switch

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**Abstract:** Smart switch is a device which operates (ON/OFF) any electrical appliance with the help of mobile phone only by sending a SMS from any place (wherever GSM network is available). User sends a SMS to the mobile number, installed inside the GSM Module. The device first checks the authorization of the mobile number from which the SMS is received if it is from the user or not. If it is from the user, the device then compares the message body of the SMS which is treated as operating code or instruction with the predefined instruction which is already written in memory of the microcontroller & switches the state of the terminal, specified in the received instruction to ON or OFF. In user interface of the device, there is a LCD Display which shows the present status of the terminals, means which point is ON or which point is OFF, of the device. Password protection logic is used to provide protection. The password is needed to save the authorized mobile number, from where the SMSs will be received. User can also operate the switch manually by pressing keys in the keypad in user interface.

**Keywords:** SMS based Smart Switch, GSM Module, Microcontroller (ATMega32A-PU), User Interface, Drives.

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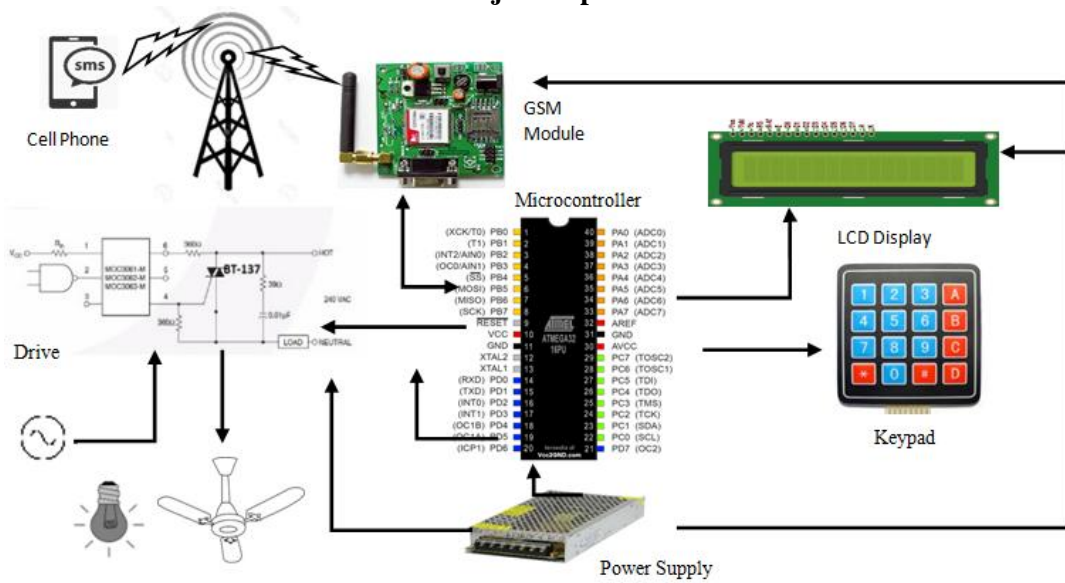
### I. Introduction

In the modern technological life, we want to do every work with minimum effort & time which leads to a smart life. This device may help us to be smart by saving energy & time. That is the reason it is named "SMART SWITCH". I had forgot to switch OFF the lights, fans or some other electrical appliance at home, he just need open his message option in mobile phone & send a single & simple SMS. The lights & fans will be turned off automatically after delivery of the SMS. Thus using this switch we can operate our daily electrical appliances like light, fan, TV, cooler etc. by sending a SMS without going near to the switch board. User can also operate the appliances manually as well as sending SMS. Thus he can operate lights or fans manually when present at home without wasting any SMS cost. This is how we can make our daily life smart by using "SMART SWITCH".

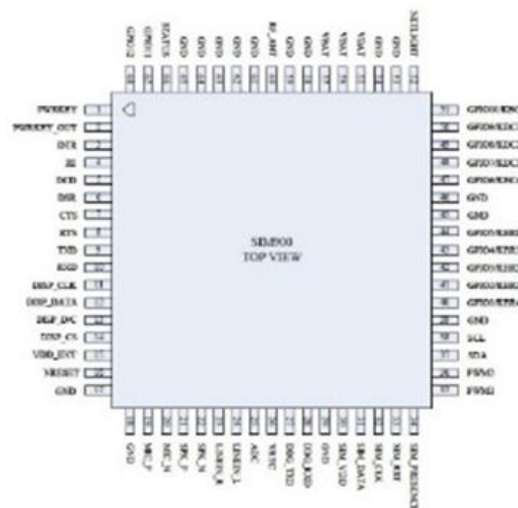
### II. Background

GSM based remote management controlled is a subject of growing interest which has found application in different areas. Tan, Lee & Mok 2007 developed an automatic power meter reading system using GSM network. It utilizes the GSM network to send power usage reading to authorize office to generate the billing cost & send back the cost to the respective consumer through SMS. Lock, 2004 developed a remote & security control system via SMS to control the switch for lamp, door, & alarm system using visual basic 6.0 software. This paper deals with a system which is associated with smart switching system of our daily appliances using Microcontroller (ATMega32A-PU).

### III. Project Explanation



#### 3.1 GSM MODULE



The GSM Module (model: Sim900A) is a wireless GSM communication device. It is very much similar with a 2G mobile phone, it can perform all the 2G network operations done by a mobile phone but, it consist only the communication processor. It is a quad band GSM/GPRS cell phone engine in a single 24mm x 24mm x 3mm SMD package made by SIMCOM. It uses four different frequency bands i.e. 850/900/1800/1900MHz to access the Internet, oral and SMSs. The module is managed by an AMR926EJ-S processor. All the functions in this module is operated by AT commands. AT commands can be given externally by any commanding device, such as microcontroller, microprocessor, computer (which have serial communication facility), through a serial communication port, built-in in it. The Modem is designed with RS232 Level converter circuitry, which allow us to directly interface with PC Serial port. The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in auto baud mode. The modem needs only 3 wires (Tx, Rx, and GND) except Power supply to interface with microcontroller/Host PC. In this project, the main stream of the process starts from here by receiving SMS of the operating instructions. After receive any such message, it store the message and send a new message receive indication to the microcontroller through the serial port for further progress. In this project, only the SMS feature of this module is used. Some of the AT commands from its datasheet, related to SMS which are used here to perform functions based on this project, are given below.

Command	Description
AT+CMGD	Delete SMS message
AT+CMGF	Select SMS message format
AT+CMGL	List SMS messages from preferred store

AT+CMGR	Read SMS message
AT+CNMI	New SMS message indication

### 3.2 MAIN CONTROL UNIT

This is the main part of this device. All the comparisons, logical operations & controls of this device are done by it. The main component of this unit is a micro-controller, ATmega32A-PU, made by Atmel®. This micro-controller is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture and consists of 32kB of flash memory, 1024 bytes of EEPROM, 2 kB of SRAM, 32 general purpose I/O lines & 32x8 general purpose working register. It consist some peripheral like USART, ADC, Timer/Counter, ports, etc. It operates in the range of 2.7-5.5V dc & gives up to 16MIPS throughput at 16MHz (Maximum frequency). All the sections of this device are connected to it in different sections of the micro-controller like the GSM module is connected to USART, user interface, LCD & Keypad, & the drive unit is connected to the different I/O ports of the micro-controller. Universal Synchronous & Asynchronous Receiver & Transmitter (USART) is a serial communication peripheral which transfer data between GSM module & micro-controller through the serial communication port. 3 out of 4 digital I/O port connects LCD, Keypad & drives to transfer digital data to them.

### 3.3 USER INTERFACE

This unit of this device interacts with user to display the status & to take input from the user.

**LCD Display:** A 16x2 LCD is used in this device. It consists of one 8bit data port & three control pins. It operates in 5V dc.

**Keypad:** A 4x4 matrix keypad is used to put inputs from the user.

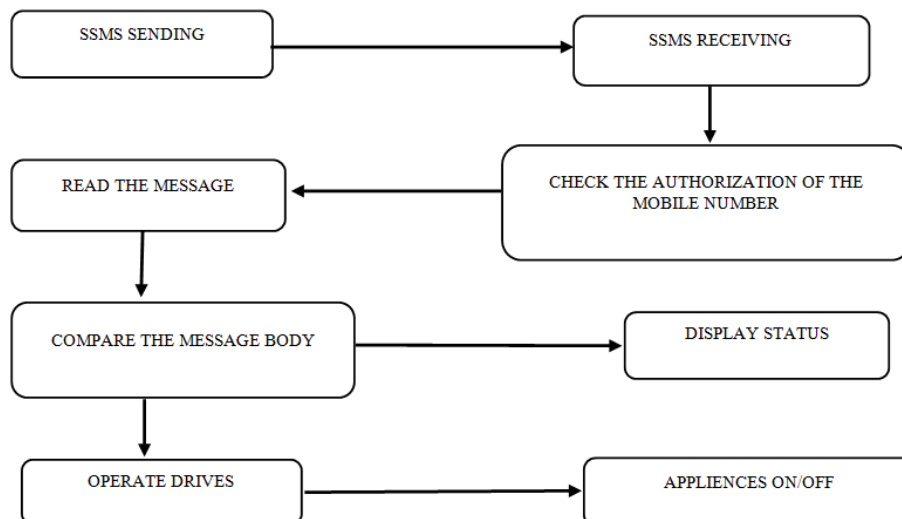
### 3.4 DRIVES

This unit is used to operate main switching operation in the smart switch at high voltage level by the low voltage signal coming from the main control unit. The electrical appliances which have to switch through this smart switch are directly connected to this unit. The main component of this unit is Triac BT136 & Opto-coupler MOC3063 & D-type flip-flop SN74LS374. This drive has 8 terminals to connect load and each terminal can carry up to 4A load current.

### 3.5 POWER SUPPLY

This unit supply dc power to the other unit of this device. It consists of a 200\12V, 2A transformer, diode (1N5408), 4700µF/25V capacitor, 470µF/25V capacitor, voltage regulator IC 7805, & dc sockets.

## IV. Operation



**Fig. 1:** Block Diagram

A SMS with the operating instruction code is sent to the number, inside the GSM module of the Smart Switch. After receiving the SMS, GSM module sends a notification in form of AT command (“+CNMI”) to the micro-controller through the serial port to inform that a new SMS is received. Then the micro-controller sends AT Command “AT+CMGR” to the GSM module to read the SMS. After getting the AT Command, GSM module transfer the SMS to the micro-controller. Then the micro-controller first check the authorization of the mobile number from the SMS was received. If the number is unauthorized, the micro-controller send the command (AT+CMGD) to the GSM module to deletes the SMS from its memory to free the memory for new

SMS. If microcontroller found that the number is matched with the registered number and the number is authorized, then the micro-controller compares the SMS body with the instruction code which are saved previously in its memory. If the SMS body matches with one or more instruction code of the memory, then the microcontroller send signal to the drive to operate the drives as per instruction code to operate (ON/OFF) the electrical appliance which is connected to the drives. Otherwise the SMS will be deleted by the micro-controller to free memory for new SMS. After operates drive, micro-controller operates LCD to display present status of the drive. Along with the SMS controlling, the smart switch can also be operated manually through its keypad by pressing 1 to 8 keys of the keypad. The keypad is also used to put and store the users' mobile number from where the SMSs will be received.

## V. Observation

After turning on the Smart Switch, it shows all the information related to the GSM module (e.g. – IMEI number, network operator name, signal strength of the network in that area, where the device is installed, etc.) and checking status of all the peripheral. After that, it jump into the home screen and the switch is now ready to operate. Home screen shows the output status of the drive and menu options for manual operation and number registration. At this moment, user can send SMS to operate those appliances connected to it. If user send “ON S1” from the registered number through SMS, the appliance connected to terminal 1 in the drive will be turned on after delivery of the SMS to the GSM module. Similarly, if user need to turn off no.1 appliance, just need to send “OFF S1”. The appliance will be turned off. Same thing will happen for all the terminals, user just need to mention the terminal number after “S”. If user needs to turn on or off all the appliances at a time, just need to replace “Sx” with “ALL” (x – Terminal number). User can turn on or off the appliances manually. For manual operation, press “Enter” button in keypad when display shows the menu option to enter menu. After entering menu, press “1” to choose manual operation and “2” for new number registration. If press “1”, the device will ask for the terminal number for switching. If “2” pressed, device will ask for the password to save a new mobile number for registration.

## VI. Evaluation

This device is designed for maximum 4A load for each drive terminals. Total we connected 8 electrical appliances in the 8 terminals of the drive.

Electrical appliances like light, fan can be switched off from anywhere when forget to off lights & fans. Thus it is an energy saving & smart device.

User can set the authorization number, so no other can operate this device without the authorization number. User can change the authorization number if they want.

It is a GSM network controlled device. So GSM network is very essential for its operation. So, users have to choose a network which gives good signal strength where the device is used.

## VII. Conclusion & Future Aspects

Day to day technologies are getting smart to smarter & human demands are going even higher; the idea like smart house, smart city are thus turning out to be inevitable. This smart device is just a part of the smart ideas like smart house and smart city. The device is primarily designed to switch On/Off the electrical appliances through SMS, but some modification like feedback for each operation through SMS, status checking through SMS, using more than one authorization number, may be done in future. Thus this smart device will become smarter and more energy saving.

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