



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**

**An Autonomous Institution**

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Approved by AICTE, New Delhi & Affiliated to Anna University,  
Chennai



## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECT213- IoT SYSTEM ARCHITECTURE**

II ECE / IV SEMESTER

UNIT 3 – ACTUATORS AND IOT NETWORKING DEVICES

**TOPIC 4 – IoT Networking devices Programming and  
Interfacing: GSM Module**

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# GSM Interfacing Board



- A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.
- 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.





# GSM Interfacing Board



**GSM Interfacing Board Introduction:** GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL -Modem is **SIM900ADual-band GSM / GPRS device**, works on frequencies 900 MHZ and 1800 MHZ.

It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with **3V3 and 5V DC TTL** interfacing circuitry, which allows User to directly interface with 5V Microcontrollers (PIC, AVR, Arduino, 8051 etc.) as well as 3V3 Microcontrollers (ARM, ARM Cortex XX, etc.).

The baud rate can be configurable from 9600-115200 bps through AT (Attention) commands. This GSM/GPRS TTL Modem has internal TCP/IP stack to enable User to connect with internet through GPRS feature. It is suitable for SMS as well as DATA transfer application in **mobile phone to mobile phone interface**.



# GSM Interfacing Board



## Features:

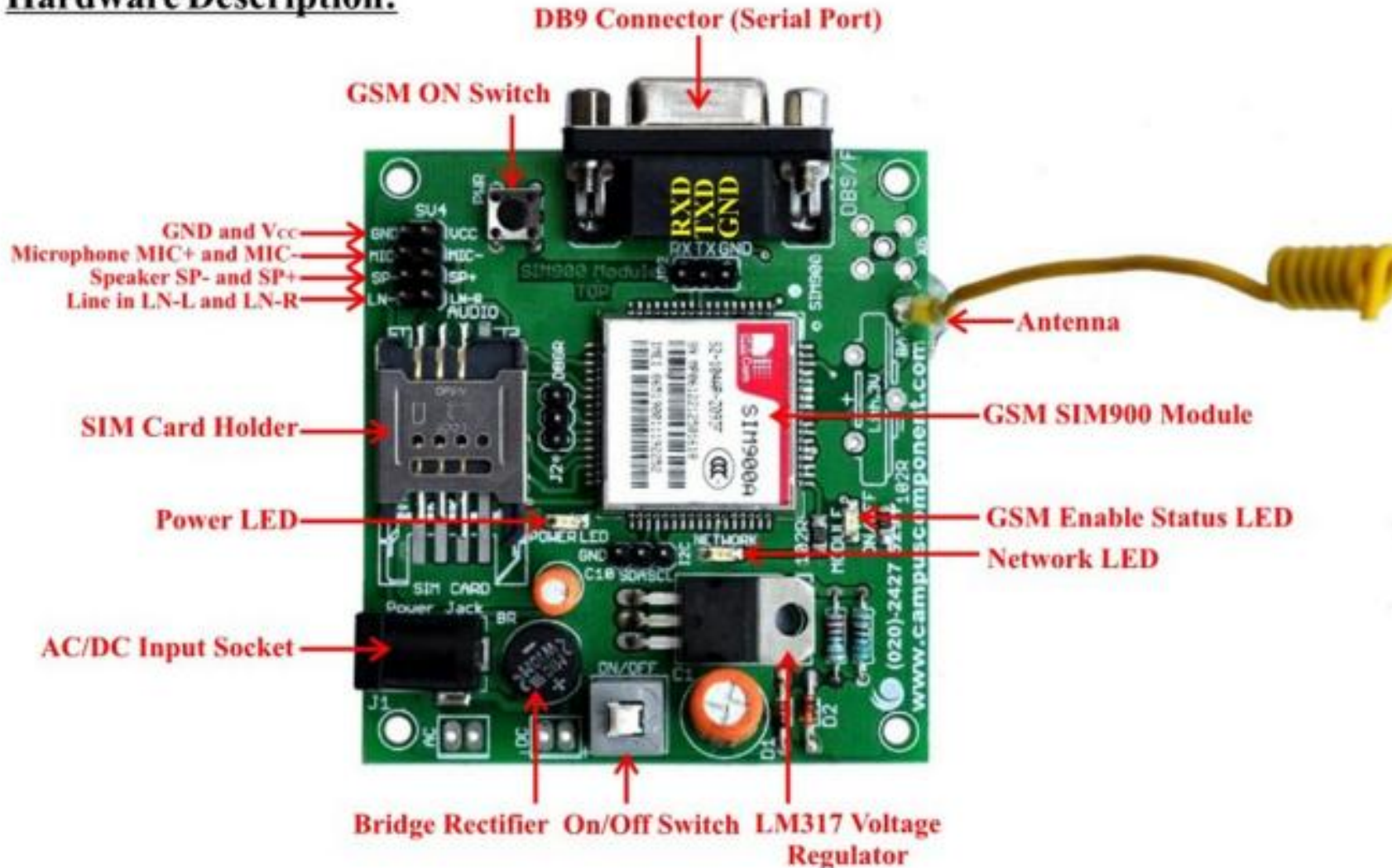
- Dual Band GSM/GPRS : 900 / 1800 MHz
- Built in RS232 to TTL and viceversa Logic Converter (MAX232)
- Configurable Baud Rate
- SMA (SubMiniature version A) connector with GSM L Type Antenna
- Built in SIM (Subscriber Identity Module) Card holder
- Built in Network Status LED
- Inbuilt Powerful TCP / IP (Transfer Control Protocol / Internet Protocol) stack for internet data transfer through GPRS (General Packet Radio Service)
- Audio Interface Connectors (Audio in and Audio out)
- Most Status and Controlling pins are available
- Normal Operation Temperature : -20 °C to +55 °C
- Input Voltage : 5V to 12V DC
- DB9 connector (Serial Port) provided for easy interfacing

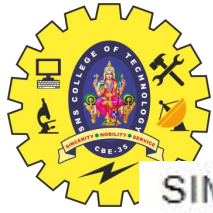


# GSM Interfacing Board



## Hardware Description:





# Interface GSM Module with Arduino



SIM900A will typically be available in modules with breakout pins for easy interfacing along with connectors for SIM cards, antennas and a few more extra features. For this guide, we will be using the AE GSM SIM900A module.

It has features such as direct

1. UART pinout
2. SPI pinout
3. RS232 connector, for connecting the module to PC
4. Support for external antenna (comes with one antenna)
5. SIM slot to add in SIM card
6. 12V external DC power jack

## Components Required to Interface GSM Module with Arduino

1. Arduino Uno
2. SIM900A GSM module
3. 12V power adaptor
4. 3x male to female jumper cables
5. Working SIM card with active 2G network



# Interface GSM Module with Arduino



## Connection Setup of GSM Module with Arduino

1. First, we will need to insert the SIM card onto the SIM card tray on the GSM module and lock it
2. Connect the external antenna to the module, if not done already
3. Make the following connections between your Arduino and the GSM module
4. Once the connections are done, you can power on the GSM module by plugging in your external 12V DC Jack
5. The onboard Network LED will initially blink rapidly. After a few minutes, the blinking should slow down to a steady pace. This means the GSM module has successfully been registered on the mobile network and is ready to be used

Arduino Uno	GSM Module
D9	Tx
D10	Rx
GND	GND



# Interface GSM Module with Arduino



```
#include <SoftwareSerial.h>
SoftwareSerial Sim(9, 10);

void setup()
{
  Sim.begin(9600);           // Setting the baud rate of Sim Module
  Serial.begin(9600);       // Setting the baud rate of Serial
  Monitor (Arduino)
  delay(100);
}

void loop()
{
  if (Serial.available()>0)
    switch(Serial.read())   // Read data given in Serial Monitor
    {
      case 's':             // If data is 's', goto SendMessage()
function
      SendMessage();
      break;
      case 'r':             // If data is 'r', goto ReceiveMessage()
function
      ReceiveMessage();
      break;
    }
}
```



# Interface GSM Module with Arduino



```
if (Sim.available()>0)
  Serial.write(Sim.read());           // If SIM module sends messages, print
it to Serial monitor
}

void SendMessage()
{
  Sim.println("AT+CMGF=1");           // Sets the Sim Module in send SMS mode
  delay(1000);                         // Delay of 1 second
  Sim.println("AT+CMGS=\"+91xxxxxxxxxx\""); // Replace x with mobile number
  delay(1000);                         // Delay of 1 second
  Sim.println("I am SMS from Sim Module"); // Type in the SMS text you want to
send
  delay(100);                          // Delay of 0.1 second
  Sim.println((char)26);                // ASCII code of CTRL+Z (to exit out)
  delay(1000);                         // Delay of 1 second
}

void ReceiveMessage()
{
  Sim.println("AT+CNMI=2,2,0,0,0");    // AT Command to receive a live SMS
  delay(1000);                         // Delay of 1 second
}
```



# Interface GSM Module with Arduino



To upload the code to your Arduino, follow the steps below

**Step 1:** Open Arduino IDE

**Step 2:** Copy paste the same code into your IDE

**Step 3:** Change the phone number and the message you would like to send to the required values

**Step 4:** Connect your Arduino to your PC

**Step 5:** Select the Board as "Arduino Uno" under Tools

**Step 6:** Select the correct COM port under Tools

**Step 7:** Click on upload

After uploading is done, open the Serial Monitor and set baud rate to 9600

After uploading is done, open the Serial Monitor and set baud rate to 9600

The above sketch we have uploaded has a feature to both send and receive SMS. To send SMS, send the character 's' in the Serial Monitor. The Arduino will programmatically send a text SMS with the message and the phone number you have provided. Note, this may take a few seconds depending on the range and network connectivity

To receive SMSs, you can set the GSM module to listen for SMS by sending the character 'r'. The GSM module will be set to listen mode and check for any SMSs every 1 second. If the SMS arrives, the GSM module will print the contents of the message to the Serial Monitor



# GSM Interfacing Board



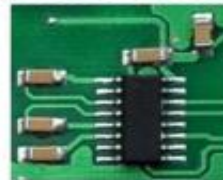
## SIMCom SIM900A GSM Module:

This is actual SIM900 GSM module which is manufactured by SIMCom. Designed for global market, SIM900 is a quad-band GSM/GPRS engine that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM900 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 24mm x 24mm x 3mm, SIM900 can meet almost all the space requirements in User's applications, such as M2M, smart phone, PDA and other mobile devices.



## MAX232 IC:

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits, so that devices works on TTL logic can share the data with devices connected through Serial port (DB9 Connector).



## Serial port / DB9 connector:

User just needs to attach RS232 cable here so that it can be connected to devices which has Serial port / DB9 Connector.



- Pin 1 : DCD (Data Carrier Detect)
- Pin 2 : RxD (Receive Data)
- Pin 3 : TxD (Transmit Data)
- Pin 4 : DTR (Data Terminal Ready)
- Pin 5 : Signal Ground (SG)
- Pin 6 : Data Set Ready (DSR)
- Pin 7 : Request To Send (RTS)
- Pin 8 : Clear To Send (CTS)
- Pin 9 : Ring Indicator (RI)



# GSM Interfacing Board



## Power Supply Socket:

This power supply socket which actually named as *AC/DC Socket* provides the functionality to user to connect external power supply from *Transformer, Battery* or *Adapter* through *DC jack*. User can provide maximum of 12V AC/DC power supply through *AC/DC socket*. This is power supply designed into maximum protection consideration so that it can even prevent reverse polarity DC power supply as well as DC conversion from AC power Supply. It also includes *LM317 Voltage Regulator* which provides an output voltage adjustable over a 1.2V to 37V.



## Power On/Off and GSM On Switch:

Power On/Off switch is type of *push-on push-off DPDT* switch which is used for only make power supply on/off provided through *AC/DC Socket* indicated by '*Power LED*'. GSM On Switch is type of *Push on DPST tactile* switch which is used for only to make GSM module '*On*' indicated by '*Module On/Off LED*' while initiating with Network indicated by '*Network Indication LED*'.





# GSM Interfacing Board



## SIM (Subscriber Identity Module) Card Slot:

This onboard SIM card slot provide User functionality of insert a SIM (GSM only) card of any service provider. Process of inserting and locking SIM card into SIM card slot is given in this manual. While inserting in and removing out SIM card from SIM card slot, User needs to take precaution that power supply should be OFF so that after making Power supply ON it will be easy to reinitialize with SIM for this module.



## Indicator LEDs:

Indicator LEDs just used to indicate status accordingly. These are three LEDs represents Power On/Off Status, Network Status and Module On/Off Status respectively. Power LED will keep on until the power supply is enable to this board by using *push-on push-off* switch. Network Status LED will show whether inserted SIM card successfully connected to service provider's Network or not, in short signal strength. Module On/Off indicator LED will show status of GSM module's power on/off.





# GSM Interfacing Board



## RXD, TXD and GND pins (JP2):

These pins are used to connect devices which needs to be connected to GSM module through USART (Universal Synchronous Asynchronous Receiver and Transmitter) communication. Devices may be like Desktop or Laptop Computer System, Microcontrollers, etc. RXD (Receive Data) should be connected to TXD (Transmit Data) of other device and viceversa, whereas GND (Ground) should be connected to other device's GND pin to make ground common for both systems.



## Audio Connectors:

Audio Connectors deals with Audio related operations. These pins already shown in hardware description diagram. These are eight pins in a group of two each denoted by SV4. GND (0V Supply) and VCC (+5V Supply) are used to have source for external device. MIC+ and MIC- used to connect Microphone (abbr. as Mic) through which user can give audio input while calling. SP- and SP+ used to connect Speaker (can be connected to amplifier circuit if necessary) through which User can hear audio output. LN-L and LN-R used to connect Line in to GSM module.





# GSM Interfacing Board



## Inserting SIM card into SIM card Slot/Holder:

Here is the process how to insert SIM card into SIM card slot. User just need to unlock SIM card cover by sliding back. Then user need to open this cover and insert SIM card according to slot. Put down cover on SIM card and then lock by sliding forward.



**Warning:** Be careful about SIM card slot as it is too delicate one while inserting in and removing out SIM card.

## Power On/Off and Module On/Off process:

Here is the process how User should make power supply on/off and module on/off. First of all User need to connect external power supply by using Battery / Adapter / Transformer. Now User needs to press Power On/Off switch (It is push-on push-off switch, thus User need to push it to make power on and push it again to make power supply off). Two LEDs will glow, one is Power On/Off indicator LED and another one is Network Status LED (which glows continuous to indicate no network or searching for network). After this User needs to press Module on switch (denoted as PWR) for at least 2 seconds. As soon as Module On/Off LED will glow User can release this switch, Network LED will blink to indicate signal strength.



**Note:** If message sending, receiving, calling functions are failed due to weak signal strength then User needs to check SIM card's service provider's availability in coverage area, its not mean that GSM Module is not working properly.



# GSM Interfacing Board



## Connecting GSM module with RS232 (SB9-DB9) Serial Cable:

User can connect GSM interfacing board either through Serial port or through Serial to USB converter. Here is process to connect RS232 cable to GSM interfacing board.







# GSM Interfacing Board



## Connecting GSM Module with Serial to USB converter through RXD, TXD and GND:

This module is designed in a way so that User can connect this module without Serial cable, this module can be connected to any of Serial to USB converter module or cable. Here we have shown demo how to connect this interfacing board with CP2102 Serial to USB converter Module through RXD, TXD and GND.

Connect CP2102 Serial to USB converter module to PC through USB cable, connect one end of USB cable to PC's USB connector and connect another end of USB to CP2102 module's USB connector.



Connect three Single Berg Wires to CP2102 modules's RXD, TXD and GND pin. Then connect RXD wire to TXD of GSM module and TXD wire to RXD of GSM module. Make GND common by connecting GND wire to GND pin of GSM module.

