DESCRIPTION

The Saleng GSM module adds SMS, GPRS and data call capabilities to your Saleng Uno or Arduino projects. The board greatly simplifies implementation with its integrated supporting circuits. All that is required is an Arduino or any microcontroller with a UART, the Saleng GSM module and a 5-12Vdc/2A source of power. No complicated wiring.

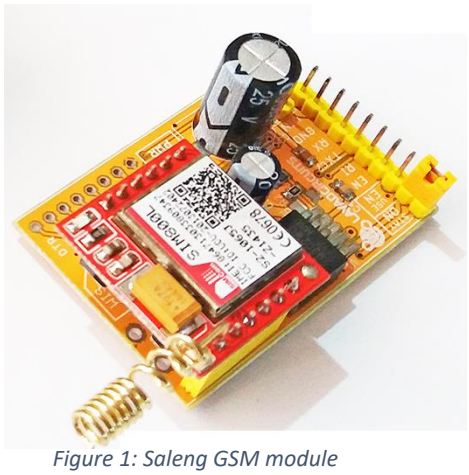

Figure 1: Saleng GSM module

This module is a culmination of several years of experience working with GSM modules, in particular, the SIMxxx series. The shield is powered by the popular SIM800L GSM module and comes with the necessary power circuit, logic level conversion and SIM card slot. It also comes with an integrated helical spring antenna. The most common pins (Power, RX, TX, RI, and power Enable) are routed into the main header with separate and unpopulated header slots for the speaker, microphone, DTR and RST pins of the module.

The module is compatible with any microcontroller or computer with a Serial Port (UART) such as an Arduino board.

FEATURES

- Powered by SIM800L GSM module.
- detachable/ replaceable core SIM800L
- Onboard 3A LDO and Level Shifter circuit
- Wide external input voltage: 5V ~ 12V
- Integrated antenna and micro SIM card slot
- Jumper selection for Power Enable method
- RI and TXD LED indicators
- Recommended Power Supply Current rating >= 2A for heavy communications. May be lower current for simpler applications .

HARDWARE OVERVIEW

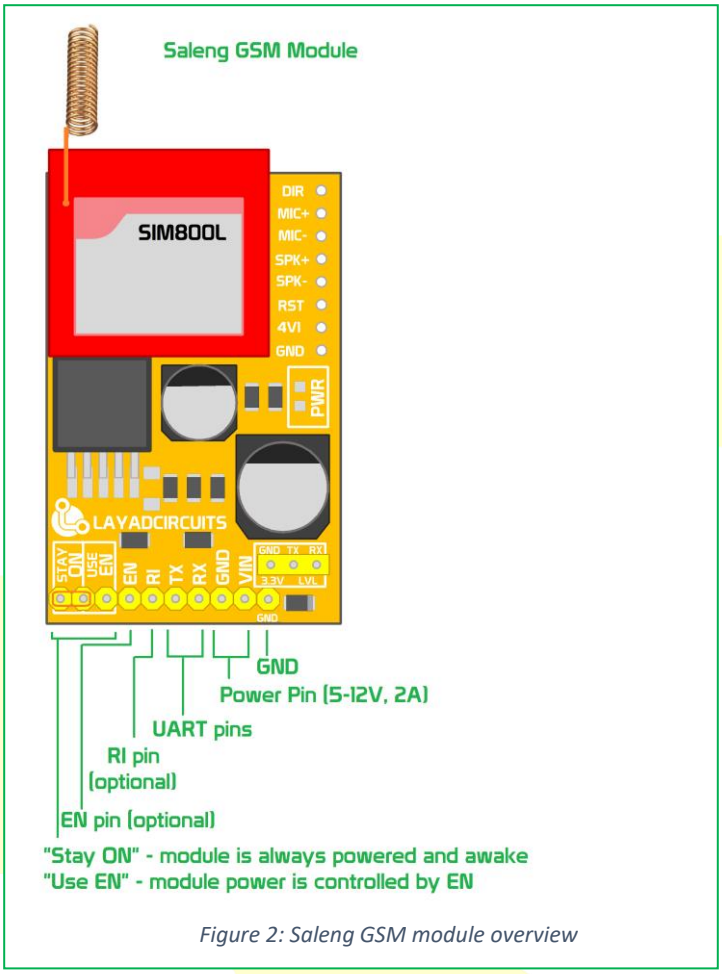

Figure 2: Saleng GSM module overview

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POWER REQUIREMENTS

The SIM800L core module alone has a peak current of 2 Amperes during communications. This may be brief but is significant if communications is continuous. The whole module draws a current <= 200mA when the SIM800L is idle. With these we recommend a power supply of 5-12V with a current rating of 2A or more applied at the VIN pin and GND.

You may also simply split the power source and connect the Arduino's DC plug and the Saleng GSM module's VIN header in parallel so long as the common power supply used meets the power requirements of both boards (6-12V).

For communications with wider time intervals between transmission reception, some customers have got away with power supplies rate at

"Stay On/Use EN" Jumper Option

The 3 left most pins headers are used to select between having the module always turned on as power is applied or have the host microcontroller control the regulator power and hence power to the rest of the circuit. When the microcontroller takes control (micro jumper is set at the side labled"Use En", or between pins 2 and 3 from left), it may turn off the output of the regulator chip and hence no power is applied to the SIM800L. This is done by applying a LOW on digital pin Labeled as "EN". Power may turned back on by applying a HIGH on the EN pin. This scheme provides an actual hardware reset on the SIM800L and is useful in low power applications or where higher reliability is required.

In contrast, when the micro jumper is set at the "STAY ON" (pins 1 and 2 from left) side, the SIM800L chip is **always** powered as long as power is applied to the board via the VIN pin.

Note that the signal attached to this header is not the same as the PWR_KEY of the SIM800L. This header controls the power regulator to the SIM800L chip itself therefore offering a real hardware reset on the GSM chip.

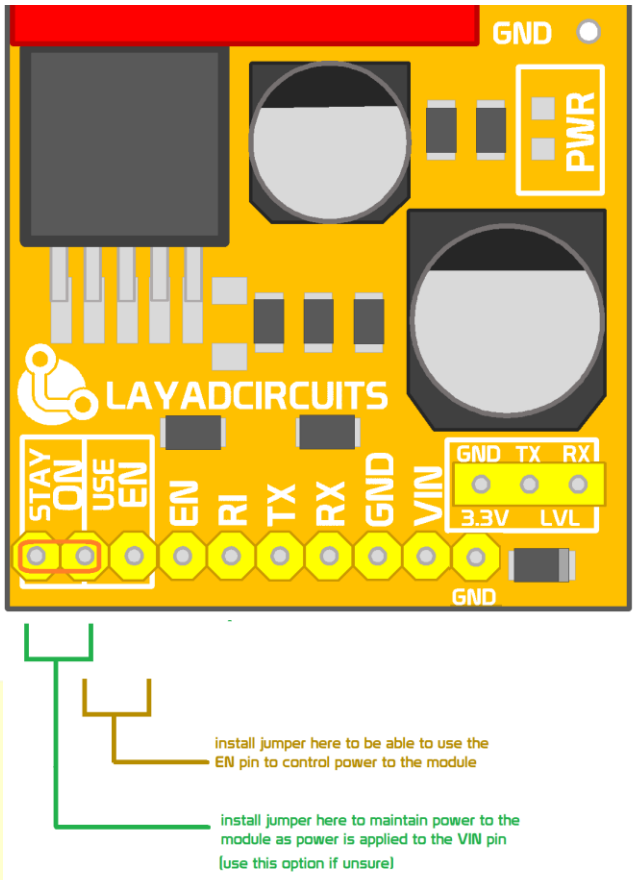

Figure 3: Stay On and Use En jumper option

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PIN FUNCTIONS

9-pin Module Main Header

The 9 pin header is the main header of the module and is identified by the following functions:

Arduino Shield Pins	Function
VIN	VIN is used as power source of the SIM800L. 5-12V, >=2A
GND pins	Power and signal ground. Depending on the version, there may be more than 1 ground pin.
RX	Data Receive line of the SIM800L. This pin accepts 5V logic
TX	Data Transmit line of the SIM800L.
RI	Ring Indicator of the SIM800L. This may be used to detect an incoming call or SMS without using AT commands.
EN	When microjumper is at the USE EN side, this pin is used to turn the power to the module on and off. HIGH – enabled power. LOW – disables power to the GSM module. DO not use this pin when the microjumper is at the STAY ON side
Stay ON/Use EN pins for micro jumper option	See "Stay On/Use EN" Jumper Option section. Most applications would set this jumper at the STAY ON side.

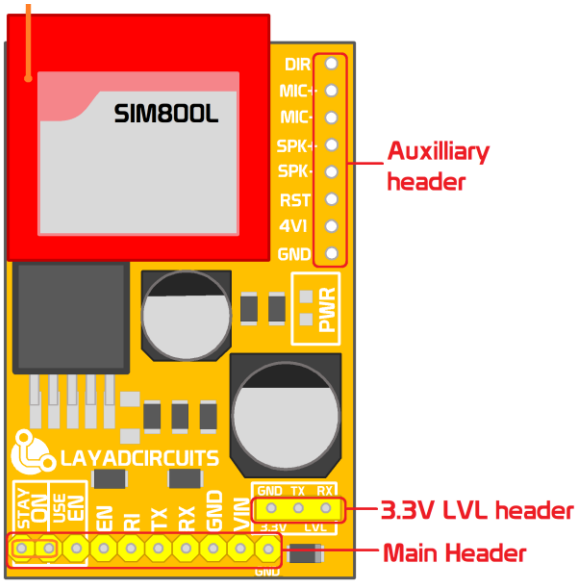

Figure 4: module headers

3.3V LVL Header

The 3 pin header beside the main header are used as connection points for 3.3V logic. The pins labeled as Gnd, Tx and Rx function the same way as in the main header except that they are meant for 3.3V host microcontrollers (e.g. Raspberry Pi, Arduino Due, etc).

Auxiliary Header

Pin Label	Function
-SPK	Negative Terminal, Audio Output
+SPK	Positive Terminal, Audio Output
MIC-	Negative Terminal, Audio Input
MIC+	Positive Terminal, Audio Input
DTR	DTR control signal of the SIM800L UART
RST	Reset line of the SIM800L

4V1	Output of the 4.1V internal regulator. Voltage is approximately between 3.9V and 4.2V
GND	Power/signal ground

PWR LED Indicator

This indicates if the internal regulator is powered up.

NET LED indicator

There is also an LED on board the SIM800L core module as shown the figure below.

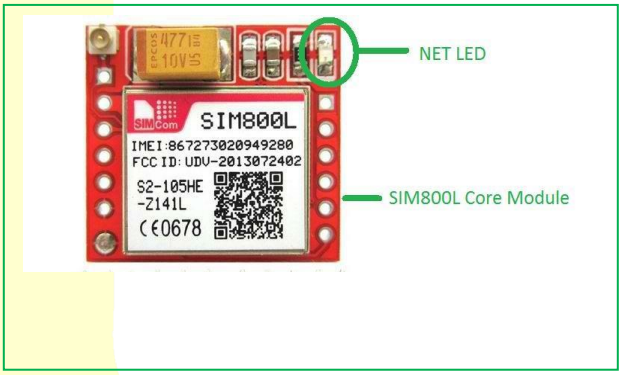

Figure 3 NET LED

This LED shall blink fast at around once every second when it has yet to establish connection to the GSM network either due to the non-availability of GSM signal, if there is no SIM card inserted, or if the module is still busy connecting. This LED will shift to a slow blink of around once every 3 seconds when the module has completed registration to the GSM network. If this LED blinks cycles through fast blink for a few moments followed by a longer pause and repeats in a cycle, this may indicate that the current rating of the power supply is insufficient.

APPLICATION NOTES

First Test

Before proceeding, ensure a microSIM card is inserted in the SIM card slot of the SIM800L module. The gold contacts should face up and the corner cut of the card should NOT be inserted first, rather the flat side should be inserted first. A proper power source should also be prepared. Move to where there is a strong GSM signal. To communicate with the GSM module, AT Hayes Commands are used. In a nutshell, these are simple text commands sent from the host microcontroller to the SIM800L. The SIM800L will analyze and then execute the command if it is executable. It shall then give back a response, if enabled, to the host as to the result of the command. By default, the host UART (“serial” port) must be set to the following parameters:

Baud rate: 9600
Number of Data Bits: 8
Parity: None
Number of Stop Bits: 1

This is easily done in the Arduino side with the begin(9600) of the Serial class declared in the setup() function.

The very basic command is the AT. From the Arduino side, send the chars ‘A’ then ‘T’ followed by Carriage Return ‘\r’ and Line Feed ‘\n’. Or simply use the println() function. When this is received by the SIM800L, it replies with ‘O’, ‘K’,’\r’,’\n’. This is a simple test command to check if the host microcontroller is

able to communicate correctly with the SIM800L. See the example code below.

For this example, we will not be communicating with the GSM network, therefore a 1A power supply for the shield may work

Procedures for the First Test

Go through this first test to check if the module is at least able to communicate and execute AT commands. However, since this test has been previously done by Layad Circuits, you may opt to skip it and proceed to your application. This test uses an Arduino Uno or Nano. An Arduino mega may also be used but you should use the hardware serial or at least softwareserial compatible pins

1. Set the microjumper to ALWAYS ON side
2. Connect a 5-12V power supply to the VIN pin of the module. Make sure that the GND of the module is connected to the ground of the host microcontroller.
3. Next, Upload the code that follows:

```
#include <SoftwareSerial.h>
SoftwareSerial salengGsm(2,3);
 void setup() {
Serial.begin(9600);
salengGsm.begin(9600);
}
  void loop() {
if(Serial.available())
salengGsm.write(Serial.read());
if(salengGsm.available())
Serial.write(salengGsm.read());
}
```

4. Once uploaded, go to Tools>Serial Monitor.
5. Set the Serial Monitor window as in the image below.

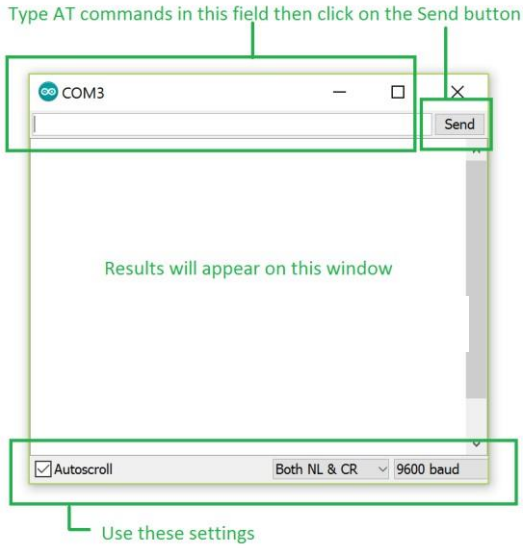

Figure 6: Serial Monitor settings

6. On the send field at the top of the serial monitor, type AT. CR and NL are automatically appended to whatever you type in the send field. You should get an “OK” reply on screen as show below.

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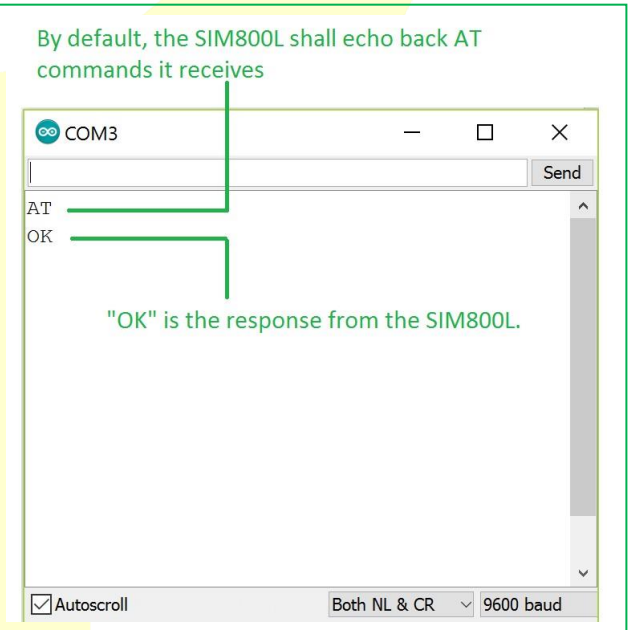


Figure 10: AT with an OK response

7. If you receive the "OK" then everything should be in order. You are now ready for your application.

First test with Arduino Mega 2560

The difference with the Mega 2560 board is that it has 4 UART / "hardware serial" ports available for use. Unless you have a compelling reason to use the Software serial on the mega, then it is best to use hardware serial. Do note that pin 2 on the Arduino Mega 2560 or Arduino Leonardo cannot be used as software serial.Use D10 instead if you must use software serial. To connect Serial1 of the Arduino UNO, to the Saleng GSM module, simply connect TX1 to RX of the module and RX1 to TX of the module.

The test code will slightly change since a hardware serial port will now be used. Upload the following code and then refer to the previous section for the procedures in performing the first test on the Arduino Mega. The code should looks like this:

```
void setup() {
Serial.begin(9600);
Serial1.begin(9600);
}
void loop() {
if(Serial.available())
Serial1.write(Serial.read());
if(Serial1.available())
Serial.write(Serial1.read());
}
```

The Saleng GSM Library

SMS applications may be better off using the Saleng GSM Library. It works specifically for the Saleng GSM Module and Saleng GSM Shield and was created to simplify SMS transmission and reception.

Download the library from the Layad Circuits Github page: https://github.com/layadcircuits/Saleng-GSM

Test Code using the Saleng GSM library : https://github.com/layadcircuits/Saleng-GSM

```
#include <LayadCircuits_SalengGSM.h>
#include <SoftwareSerial.h>

SoftwareSerial gsmSerial(2,3);
// if you are using Arduino Mega or if you plan to use Serial 0 (pins D0 and D1), use the next line instead
// #define mySerial Serial1 // define as Serial, Serial1, Serial2 or Serial3
LayadCircuits_SalengGSM salengGSM = LayadCircuits_SalengGSM(&gsmSerial);

void setup()
{
  salengGSM.begin(9600); // this is the default baud rate
  Serial.begin(9600);
  Serial.print(F("Preparing Saleng GSM Shield.Pls wait for 10 seconds..."));
delay(10000); // allow 10 seconds for modem to boot up and register
salengGSM.initSalengGSM();   Serial.println(F("Done"));
  salengGSM.sendSMS("09164428565","Hi, this is a test SMS from the Layad Circuits' Saleng GSM Shield. Have a
nice day!");
  Serial.println(F("An SMS has been sent out."));
  Serial.println(F("Send an SMS to the phone number of the SIM card and see the message on screen."));
}

void loop()
{
  salengGSM.smsMachine(); // we need to pass here as fast as we can. this allows for non-blocking SMS
transmission
  if(salengGSM.isSMSavailable()) // we also need to pass here as frequent as possible to check for incoming
messages
  {
     salengGSM.readSMS(); // updates the read flag
     Serial.print("Sender=");
     Serial.println(salengGSM.smsSender);
Serial.print("Whole Message=");
     Serial.println(salengGSM.smsRxMsg); // if we receive an SMS, print the contents of the receive buffer
  }
}
```

The code above sends an SMS to the number specified in the first parameter of `salengGSM.sendSMS()`. This SMS is sent around 10 seconds from powerup. This 10 second delay is needed to allow the SIM800 module to fully bootup and register into the GSM network defined by the SIM card. After it sends the test SMS, it will display any message it receives on the Serial Monitor (set to 9600 baud). All the data fields received will be buffered into the `.smsRxMsg` array

and is unprocessed by the library. The user may then extract the information needed from the array. A comma separated message should be seen on screen.

The phone number of sender has been extracted within the library. The last sender's phone number is stored in the variable `smsRxMsg` .

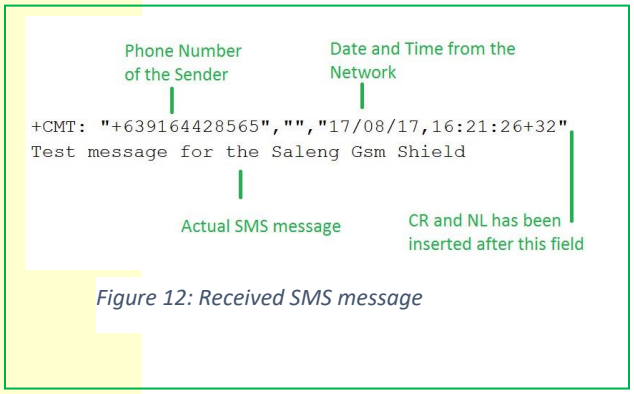


Figure 12: Received SMS message

Mini Project: An SMS remote control

Objectives:
This tiny project aims to demonstrate how a user can utilize the Saleng GSM module to control an AC load such as a light bulb.
Hardware:

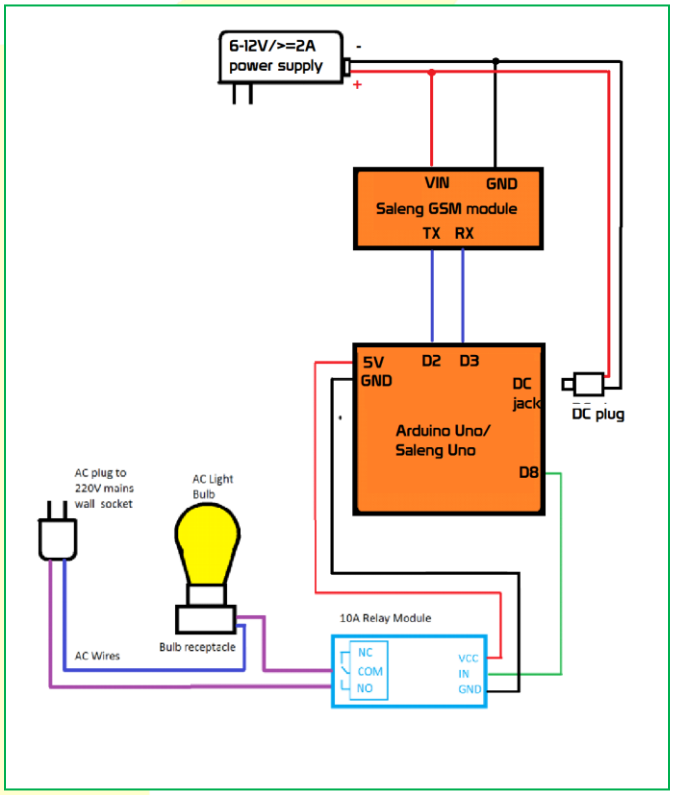
- Saleng UNO or Arduino UNO
- Saleng GSM Shield
- 7-12V / 2A power supply adaptor with 2.1mm DC plug
- A single channel relay module
- A 220V light bulb 100W or less
- A bulb receptacle
- An AC plug
- 1-2m of AC wire
- 3 pieces Male-Female connecting wires

Wiring:

Saleng GSM Pin	Host/Power
VIN	Connect to appropriate power supply 5-12V/>=2A. You may share this with the Arduino if using at least 6V
GND	Connect to power Gnd / Arduino Gnd
TX	D2
RX	D3
Set micro jumper at the ALWAYS ON side	

The lightbulb should be wired up as follows using the relay module's NO (Normally Open) and COM (Common) terminals. The control pin of the relay (IN) shall be controlled by the Arduino's pin D8.
Refer to the following wiring diagram.

For safety, use appropriate wiring for the AC part of the circuit. A standard flat AC cable or single solid/stranded cables of gauge 18 or close to this may be used. The input side of the relay may use smaller wires such as gauge 22-24 connecting wires. Care should be exercised in handling the relay and AC section, the exposed pins of the relay on its terminal block and at the bottom side of the PCB are live and should be insulated properly.



Operation:

Once the hardware has been properly wired and the code uploaded, power up the device and wait for 10 seconds. Then send the words LIGHT ON to the SIM card on the Saleng GSM module via SMS. When the message is received, the Arduino checks for the keywords and then energizes the relay and therefore turns on the relay. Send the words LIGHT OFF to turn the light bulb off.

Application Hints:

The Saleng GSM Shield exposes the RI signal on the main header. One may use this pin to detect if an incoming call is received which will in turn toggle the bulb on and off. This will avoid additional costs of sending SMS. Instead, a call is initiated by the phone.

Arduino Sketch:

The code for this project is rather simple. Our concept is to turn ON the bulb via the relay when the words LIGHT ON are received via SMS. We turn the bulb OFF with the words LIGHT OFF. We shall utilize the library and modify its example code as in the following code.

```
#include <LayadCircuits_SalengGSM.h>
#include <SoftwareSerial.h>
SoftwareSerial gsmSerial(2,3);
LayadCircuits_SalengGSM salengGSM = LayadCircuits_SalengGSM(&gsmSerial);

byte relayPin = 8;

void setup()
{
  pinMode(relayPin,OUTPUT);
  digitalWrite(relayPin,HIGH); //initially Off
  salengGSM.begin(9600); // this is the default baud rate
  Serial.begin(9600);
  Serial.print(F("Preparing Saleng GSM Shield.Pls wait 10s..."));
delay(10000); // allow 10 seconds for modem to boot up and register
salengGSM.initSalengGSM();   Serial.println(F("Done"));
  Serial.println(F("Send LIGHT ON to turn on the bulb"));
  Serial.println(F("Send LIGHT OFF to turn off the bulb"));
}

void loop()
{
  salengGSM.smsMachine();
  if(salengGSM.receiveSMS())
  {
     if(strstr(salengGSM.smsRxMsg,"LIGHT ON")) digitalWrite(relayPin,LOW);
     else if(strstr(salengGSM.smsRxMsg,"LIGHT OFF")) digitalWrite(relayPin,HIGH);
  }
}
```

WHY SALENG GSM MODULE?

This product was designed as a very easy to use GSM module with a set of features that cater to both novice and advanced users alike. Here are some of the unique features of the Saleng GSM shield that makes it one of the best GSM module available to date.

- **Uses the latest SIM800L module** – the SIM300 and SIM900 are older products and have been replaced by the SIM800. The shield uses the current SIM800L chip
- **Large buffer capacitors** – these capacitors have been selected to help sustain power during sudden current surges. Some other shields and modules use smaller values ,or none at all, that may cause unwanted resets of the module during heavy communications when high current drains are expected.
- **Complete circuit** – while the SIM800L core module, and other similar modules, is a nice little board that may be used directly, it requires a non-standard power source of between 3.3V and 4.3V / 2A , logic level shifters for the module's UART and protection for the circuit.
- **True Hardware Reset** – The SIM800L may be awaken with the PWR_KEY pin internal to the chip. However, this requires a specifically timed pulse. Sending the same pulse again puts the module back to sleep mode. This may cause confusion when the host starts generating the pulse upon reset/power up which happens often during development (e.g. when uploading an Arduino code, the pulse generated in setup() may put the module in sleep mode when the GSM module is initially awake). The Saleng GSM module provides a hardware reset, that is, an actual removal of power, by simply toggling the EN pin. This is also useful in completely resetting the GSM chip when an unwanted condition occurs (e.g. the SIM800L locks up)

Option to boot up immediately upon power – Most SIMxxx shields have a power button routed to the PWR KEY pin of the GSM module. To wake the module up, apply power and then manually press and hold the button for a period of time before it turns on. This may be a problem when the device is deployed on the field without the benefit of human intervention. Simply set the jumper to the STAY ON position

- **SIM800L is completely replaceable** – In the unlikely event of damage to the SIM800L or if it is wanted for testing, the SIM800L core module may be replaceable.
- **Exposed Audio signals** – both microphone and speaker outputs are available in this Shield via the auxiliary header.
- **Ring Indicator Signal** – the RI signal is available from the main header. This makes it easy for the user to access this and use it.
- **Designed and Made in the Philippines**

  Specifically, in Baguio City. The Saleng GSM module is Filipino designed and made. By purchasing this module, you help promote embedded systems technology awareness in the Philippines and provide much needed support to your local innovators.

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