Edge Power International (HK) Ltd.

EPM-1000 GSM Module

Specification

Product Specification

Revision history

Revision	Date	Description
V1.0	28/05/2012	Original

TABLE OF CONTENTS

1. Introduction

Machine-to-Machine (M2M) is called the "Internet of Things". The building block of the M2M application is the smart device, which has the capacity to process data and communicate to each other.

The smart device is a result of integration of following technologies:

1. Electronic
2. Embedded software
3. Data communication
4. Mechanical (i.e. sensor, actuator)

EPM-1000 is a module designed for the success of M2M market. The module integrated strong processing power (32-bit processor), wireless communication capacity (GSM module) and ready to use firmware into a small package. Edge Power also provides reference design to interface with mechanical devices. The module provides a cost effective way to speed up the development cycle and produce a reliable end product.

The next chapter will introduce the possible applications of the module. Chapter three will descript the hardware, the mechanical lay out and the electronic characteristic of the module. Chapter four will descript the application development process. The software structure will be introduced and you may examine the designed pattern to if it is suitable for your application. The last chapter is the summary.

2. Applications

The following are some of the application for the module:

*   Telematics
*   Security
*   Remote control/sensor
*   Remote Medicare
*   Logistic
*   Environmental monitor

3. Hardware

This chapter will descript the hardware of the module. The first section is the hardware block diagram. The description of pin function is follow by the pin assignment. A picture of the modules and the dimension

3.1. The block diagram
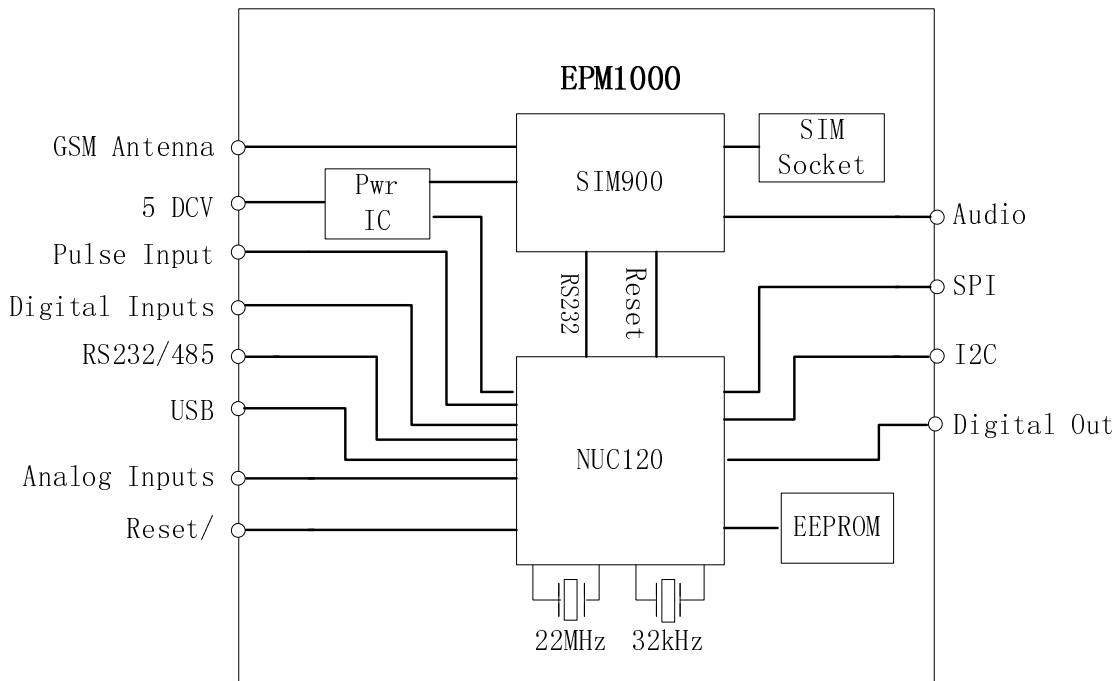
3.2. Pin description

While there are a few pins with fixed function, most of the pins are multi-function, and configurable through software. The following section will have a description of common function for the I/O pins

3.2.1. Pulse count input

The pulse count inputs are design for capture and count pulses. The input may be configured to use as:

1.   Pulses counter

2. Frequency counter

3. Timer

Interface with flow meter will be a good example pulse counter function: The flow meter out put a pulse for a fix amount of flow volume.

Interface with an ultrasound distance sensor will be ideal to use the timer function: measure of the pulse width in time could be easily converted to distance.

3.2.2. Digital inputs

The input voltage for all the digital inputs are from 0 - 3.3 DCV. The small scale reference design has 6 pin dedicated for digital input, while large scale reference design use I/O extender to expend the number of digital inputs.

3.2.3. UART

The UART port may be configured to run as RS232 or RS485. RS232 is commonly used for wide range of sensor or control device, while RS485 is used in industrial control. The reference design used the UART for host interface. The UART also support hardware flow control.

3.2.4. USB

The USB is USB 2.0 Full-Speed device with up to 12Mbps data rate. The module has onboard connector for the USB.

3.2.5. SPI

The SPI supports master/slave mode in high speed. The SPI interface may be used to the following device:

•   RF transceiver

•   LCD

•   WiFi

The SPI interface was used for LCD display in the reference design.

3.2.6. I2C

The I2C support both mast and slave mode. The device address 0 is reserved for the onboard EEPROM.

3.2.7. Microphone

The differential Microphone input is directly connected to the onboard GSM module.

3.2.8. Digital Out

The out voltage for all the digital out should connect to pull up resistor. The small scale reference design has 6 pin dedicated for digital output, while large scale reference design use I/O extender to expend the number of digital put

3.2.9. Speaker

The differential speaker output is directly connected to the onboard GSM module.

3.3. Pin assignment

Pin No.	Symbol	Type	Pre-defined function
1	GPIO1	I/O	GPIO
2	GPIO2	I	GPIO/Pulse count input
3	GPIO3	I	GPIO/Key 5 input
4	GPIO4	I	GPIO/Rx for UART
5	GPIO5	O	GPIO/Tx for UART
6	GND	I	Ground
7	USB_D+	I/O	USB D+
8	USB_D-	I/O	USB D-
9	VCC	I	VCC
10	GND	I	Ground
11	GPIO6	O	GPIO/LCD data out
12	GPIO7	I	GPIO/LCD data input
13	GPIO8	O	GPIO/LCD clock
14	GPIO9	O	GPIO/LCD CS
15	GND	I	Ground
16	GPIO10	I	GPIO/Pulse count input 2
17	GPIO11	O	GPIO/LED 1
18	GPIO12	O	GPIO/LED 2

19	MIC-	I	Mic+ for GSM
20	MIC+	I	Mic- for GSM
21	GND	I	Ground
22	GPIO13	I	GPIO/ADC0
23	GPIO14	I	GPIO/ADC1
24	GPIO15	I	GPIO/ADC3/Key 5
25	GPIO16	I	GPIO/ADC/Key 6
26	GPIO17	I	GPIO/Key 1 input
27	GPIO18	I	GPIO/Key 2 input
28	GPIO19	I	GPIO/Key 3 input
29	GPIO20	I	GPIO/Key 4 input
30	GND	I	Ground
31	GPIO21	O	GPIO/LED 6
32	GPIO22	O	GPIO/LED 5
33	GPIO23	O	GPIO/LED 4
34	GPIO24	O	GPIO/I2C WP
35	GPIO25	O	GPIO/I2C SCLK
36	GPIO26	O	GPIO/I2C SDO
37	GPIO27	O	GPIO/LED 3
38	GPIO29		NC
39	SPK+		SPK+
40	SPK-		SPK-

3.4. Package
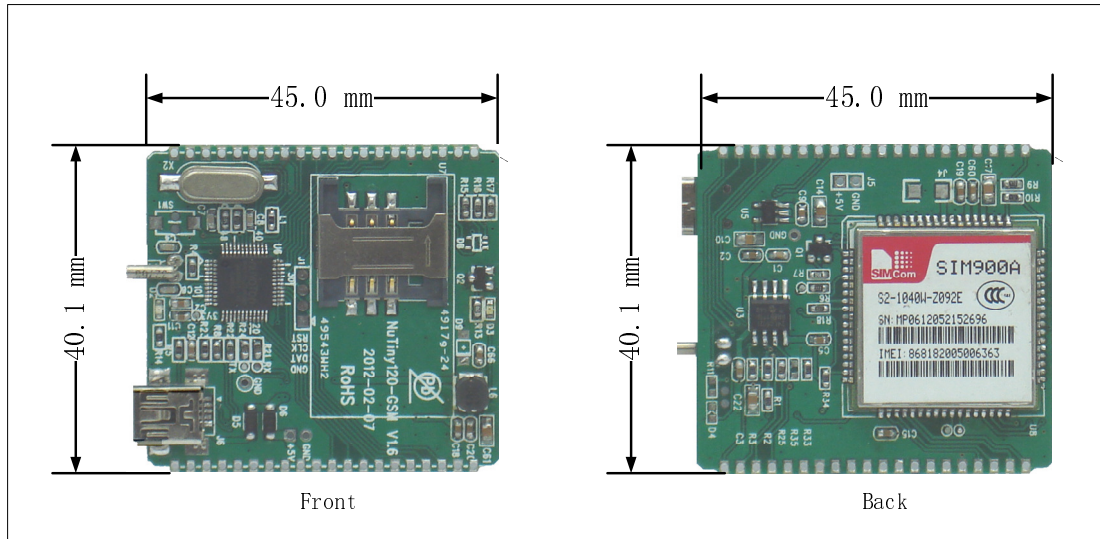
Electrical Characteristics

TBA

4. Application development

M2M application development requires combine knowledge of:

- Control system
- Embedded system
- Communication system

M2M module from Edge Power will reduce the risk of project failed, or long delay. The hardware design optimized for the performance, while the software is a collection of knowledge based on M2M projects we developed. This section is designed to provide options for your M2M application development.
In order to take the full advantage the module offered, we will give an introduction of the software architecture first, follow by a selection process recommendation. The following is a decision making flowchart and option for you M2M project.

4.1. Select development model

The software development is one of the most time consuming task for M2M project.

Edge Power provides a development framework, associated with demo boards to speed up the development process.

The development process will start when requirement is defined. Instead of jump start to the hardware design, you should check and see if any one of the demo board has the hardware resource close to what you are looking for. The following flowchart outlines the procedure for your application development.
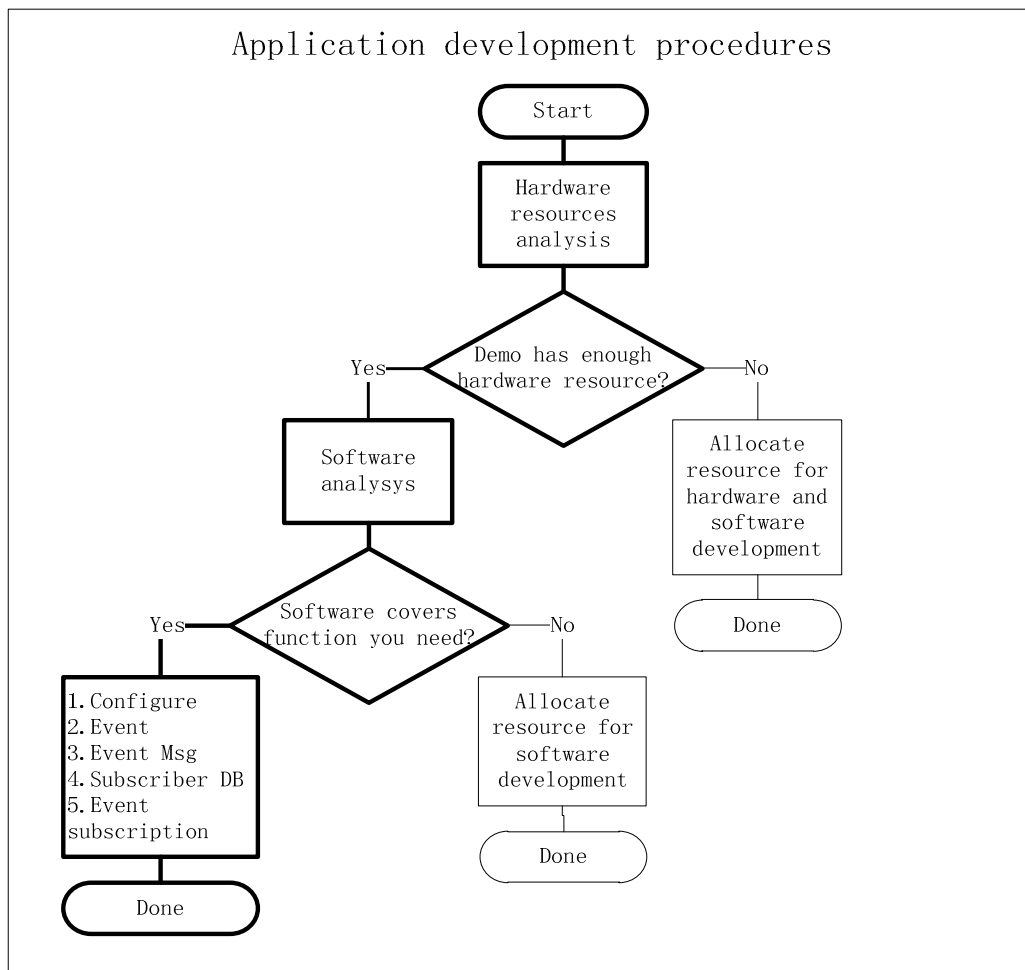
4.2. Hardware resources

Edge Power developed demo boards as reference design for different M2M application. Please check with technical support to search for a reference design. The following is a basic demo boards with features as follow:
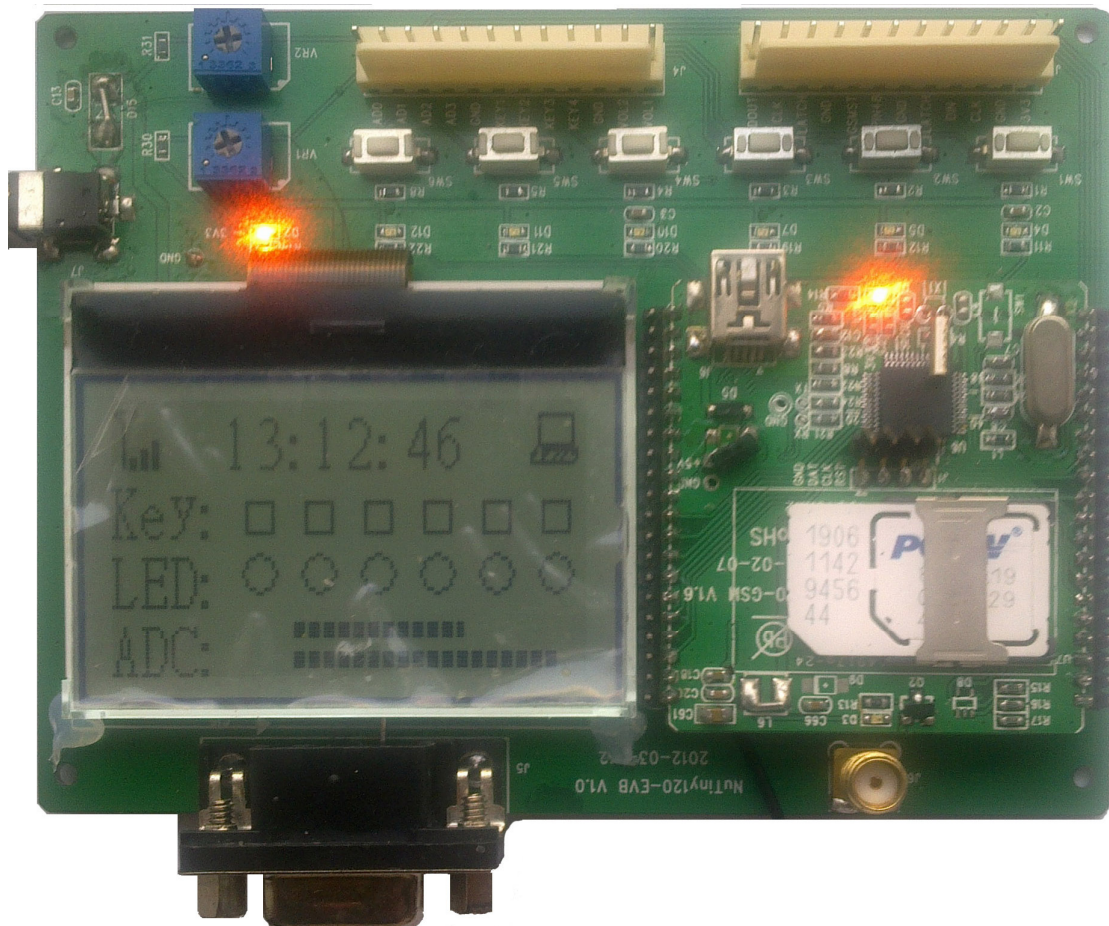
- Six digital inputs
- Six digital outputs
- Two analog inputs

- LCD display
- One UART

Edge Power also offers reference design for application requires large number of digital inputs and outputs.

If the reference design covers matches your hardware requirement, you should continue to the next section to check the software.

The following is a picture of the demo board.


4.3. Software Architecture

The GSM module is designed to speed up the development time. A software framework is developed to minimize the software development effort. A full set of AT-command enable user to setup the module with minimum software programming.

While the software design and architecture will be covered in another document, this section cove the following

1. Software block diagram

2. Description of the functional blocks

3. AT-command for system configure

4. Configure a system

4.3.1. Software block diagram
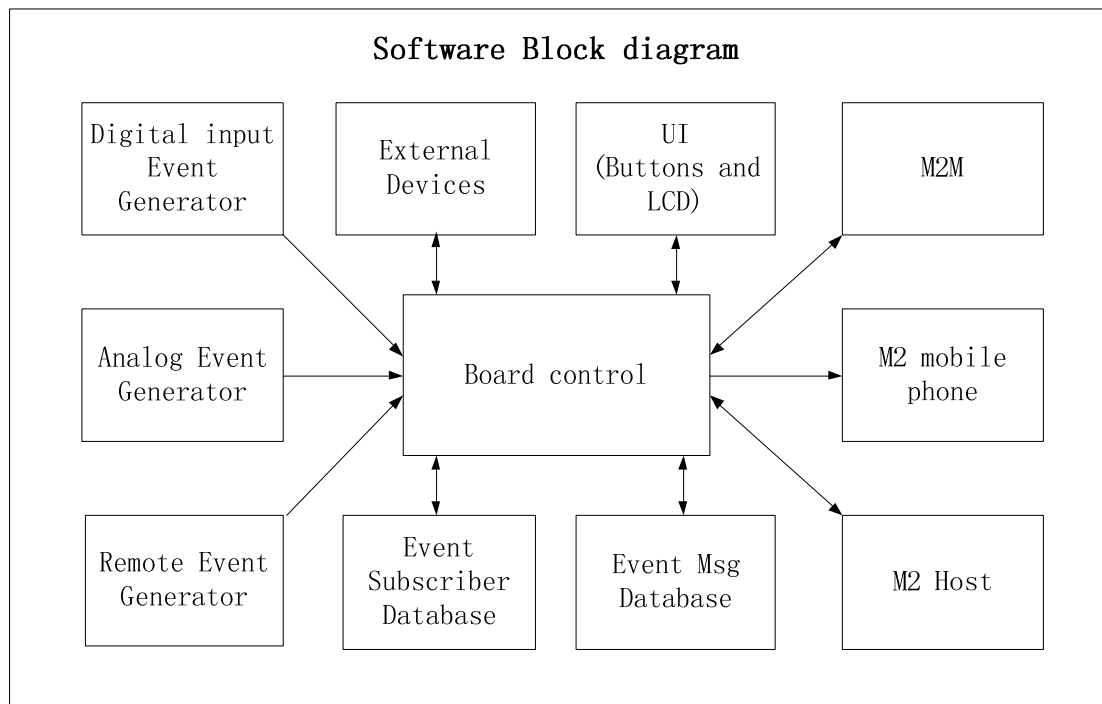
4.3.2. The board control

The board control is responsible for

- Task schedule,

- System information management

- Message distribution

- Manage events and event message

The system runs in an event driven loop and the board control task is the coordinator of all the software components.

The board control also responsible for manage the configuration and the communication link between the devices on the system.

4.3.3. M to M

M2M is responsible for sending message to other machine/device. The following are

channels M2M use to send message:

- Traditional SMS
- SMS through GPRS
- TCP/IP (through GPRS)

The content of the messages are packed and unpacked according to same protocol for the sender and receiver.

Additional security features, i.e. validation of the incoming call phone number may use to address the security of the system.

4.3.4. M to mobile phone

The M2 mobile phone is responsible for sending SMS to mobile. Sending a SMS is triggered by the following condition

- Device are connected
- There is an event
- The user subscribed to the event

The content of the SMS is either predefined event message from the data base, or a combination of predefined message with real time data.

A SMS subscriber database will store the information of the following information:

- Subscriber name
- Phone number
- Event subscribed

4.3.5. M to Host

A host computer may be connected to the device for:

- Initialization
- Change configuration
- Diagnostic
- Collecting data

4.3.6. Analog input

The analog inputs are connected to onboard 12-bit ADC. The software is responsible for:

- Schedule the conversion
- Normalize the result
- Map result with the desire output

- Fine tune results
- In additional, thresholds may be set to define an event.

4.3.7. The digital input

There are two sources of the digital inputs:

- Digital input
- Digital signal collected through serial interface

The states of digital input may be read by software directly. The software will apply de-bounce and filter algorithm to stabilize the input signal. Another source of the digital input is from serial interface. A software driver is required to run the interface protocol and interpret the result.

The digital events may be triggered by:

- Timer
- Change of logical level

A typical timer trigger event is a periodical status update. As for change of logical level event, there will be two states the input: one for the raise from high to low, anther for falling.

4.3.8. External devices

The external devices are driven by software drivers. The following are some of the examples:

- Relays
- Actuator
- Motors
- Signal board and LED

4.4.   Extended AT-command

A set of AT-command enable user to configure the system according to the application. The AT-command may be used to:

- System configuration
- Initialize value
- Setup onboard database
- Collect data and status
- Calibration and fine tune

The syntax, parameter and return value of the AT-command will be covered in a separate document.

5. Summary

The M2M is an integration of hardware, software and wireless data communication technologies. Edge Power provides demo board, reference design with pre-loaded software. The extended command will enable user tailor the device for the system no software development.

The M2M module is designed for the success of your project.