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REMOTE MONITORING SOLUTION : REVIEW OF OPEN CPU TECHNOLOGY

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ABSTRACT

In this paper approach to develop cost effective reliable remote monitoring system using M66 module pooled with open CPU technology. Designed remote monitoring system allows efficient, reliable and more precise monitoring and measurement of parameters of equipment's present at remote places. The system is designed using C programing language and SDK's provided by the Quectel. RMS takes the information through a sensor via ADC such as Voltage, RPM, temperature and pressure of equipment's and sends to the server. GSM/GPRS technology is used to transmit these parameters over server.

***Keywords**: Open CPU, M66 GSM/GPRS module, RPM, Quectel, ADC*

I. INTRODUCTION

Monitoring systems of remote locations has excessive opportunity today. At present, numerous remote monitoring systems are designed and developed as per necessities or chucks and application areas. Currently, constrains of remote monitoring systems growing promptly. Open CPU is a prodigious embedded solution for machine to machine (M2M) technology. Intention of developing remote monitoring system is mainly focused on the machineries present at construction fields. Remote monitoring system is developed to measure the parameters and monitor the machineries present at construction field. Construction works is dangerous work because field may have heavy equipment's and machineries. Construction work has much hazardous tasks such as working with heavy equipment's and machineries, power tools, dusty environment. These machineries require with high power or electricity to work. Remote monitoring system avoids coincidence which may happen at construction side. Remote monitoring system is installed once at machineries and required information of machine is monitored over server using GSM technology. It may avoid the unexpected accidents or damages happen in future.

II. HARDWARE DESIGN OF RMS

As reference to the figure 2.1, following peripherals are taken in accounts during development of whole remote monitoring system

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- *Power Supply*
- *M66*
- *ADC*
- *SIM card*

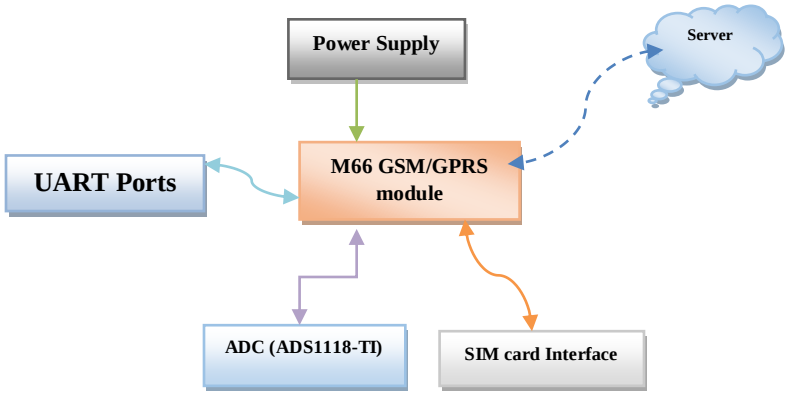

Fig. 1Hardware architecture of Remote monitoring System

2.1 Power Supply

The remote monitoring System is powered from DC power supply of 12V. The power module of the remote monitoring system lowers the power supply to desired DC power.

2.2 M66 GSM/GPRS module

M66 GSM/GPRS module is great open CPU platform comes with the dominant Quad-band GSM/GPRS module with LCC (Leadless Ceramic Carrier) castellation packaging. For open CPU embedded solutions, M66 GSM/GPRS module itself work as a central processor unit. While designing a system following parameters are taken in account namely cost, reliability, power consumption, and more important is time to market.

M66 module with Open CPU creates a ultimate embedded development environment for M2M embedded applications. In open CPU technology, M66 GSM/GPRS module itself acts as dedicated processor. In the RMS M66 module is acts as master device. M66 module itself process and manipulate the information and transfer to the server over GSM network.

M66 open CPU module comes with following major features:

- CPU: 32 – bit ARM7EJ – S RISC 260 MHz
- Memory: 360 KB space for binary image.bin file

Static memory: 100KB Dynamic Memory: 500KB, UFS Memory: 300KB

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2.3 Analog to Digital convertor (ADC) Interface

The analog to digital convertor is interfaced with M66 module using SPI protocol. As reference to Fig 2.2, M66 module is master device whereas ADC acts as slave device.

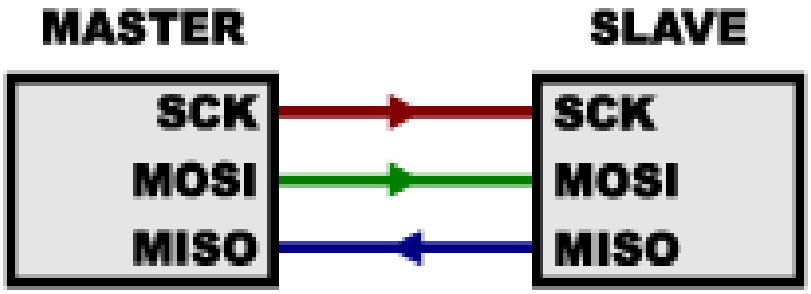

Fig. 2 Hardware architecture of Remote monitoring System

ADC gets the analog signal form sensors connected to the remote machines at field. These analog signals are processed and digital signals are fetches to the M66 module over SPI communication protocol. The required process and calculations to convert the digital information to standard unit is done by decoding algorithm. The M66 module process and manipulates the digital information from ADC and send over server. Server gives response after receiving information.

2.4 SIM card Interface

M66 provide separate pin outs for SIM card interface, so as to easily interface SIM card tray with module.

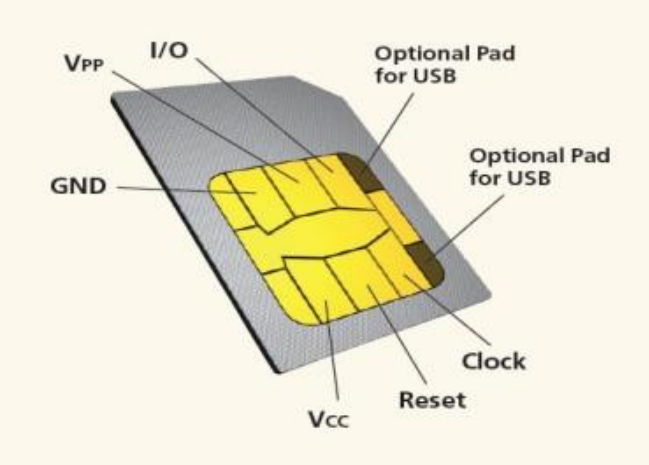

Fig. 3 SIM card pin outs

The SIM card interface supports the functionality of the GSM phase specification and also supports the functionality of the new GSM phase 2+ specifications for fast 64kbps SIM card. The SIM interface is powered by an internal regulator in the module. M66 supports both 1.8 volt and 3.0 volt SIM cards.

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III. SOFTWARE DESIGN

Open CPU is totally different technology. Quectel provides manual to use Open CPU platform. Firmware development of Open CPU is done using C programing language. Set of API's is available in SDK provided by quectel. This function provides the access to deal with the hardware interfaced with the M66 open CPU module.

3.1 Compiling

Software developed kit (SDK) provided by quectel comes with preconfigured command line version such as makefile and windows batch file. Quectel also provide integrated development environment (IDE) for open CPU with GCC and and eclipse. The command-line version (Makefile) is used for developing application since it allows full control and it is independent on the editor used while editing programs. The new binary file is generated at specified directory by calling the "make clean" and "make new" commands.

3.2 Editor

Notepad++ (N++) editor is used to edit the code. Notepad++ is open source code editor built in C++ programing language running in windows environment. It supports multiple languages. Editor provides syntax highlighting and code navigation.

3.3 QFlash

After the compilation of source codes, binary file is created in specified directory. This binary file is needed to download to the M66 open CPU module. QFlash is tool provided by Quectel for downloading the binary file to the module. After the binary file is downloaded into module testing is done by observing the output on serial com port.

Fig. 3.1 shows the tested output of RMS application. Tera term software tool is used to display the generated output message of serial ports.

3.4 Application Work Flow

In order to start the RMS device, switch on the power supply. In primary state initialization of UART, SPI configuration, ADC initialization, GPIO and memory initialization is done. In next state RIL (radio interface layer) initialization is done. Open CPU RIL is the API function module used to open source layer and start AT processing. With the Open CPU RIL, developer can simply call API to send AT commands and get the response when API returns. Based on this, programmer can easily develop the mid layer API functions that serve the Upper application.

In Open CPU module, all URC (Unsolicited Result Code) messages are reported to App by a system message "MSG_ID_URC_INDICATION". It will check the SIM card status, GSM network strength, register module to GPRS. M66 supports two kinds of timers namely "common timer and fast timer". Timer is started with callback timer function. ADC write configuration and read configuration functions are called in callback timer function, so as to continue read/write process still power is supplied. When the module is registered to GPRS network, data gathered in buffer is send over server.

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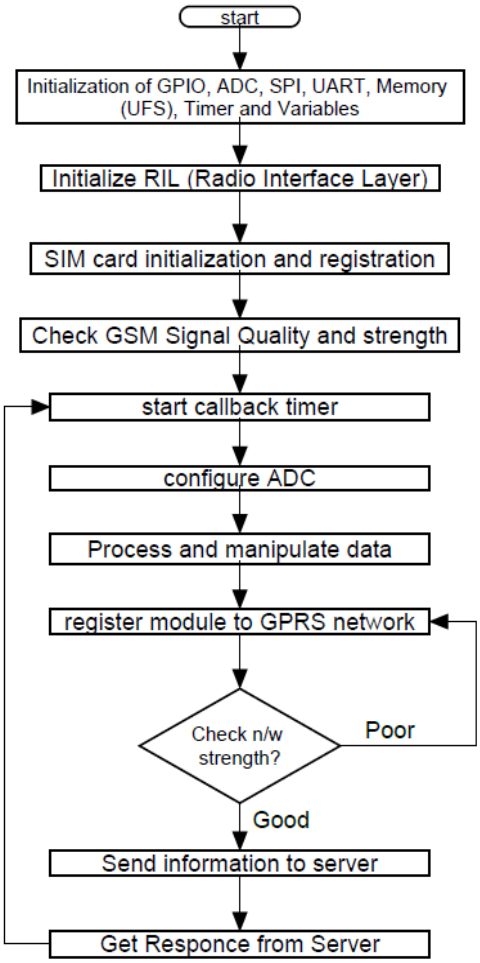

Fig. 4 Application flow diagram

IV. RESULTS

Following figure 4 shows thehardware of RMS under testing. Resultsare observed on Tera Term tool by tracing the debug message inserted during development. All the results are observed on serial port.

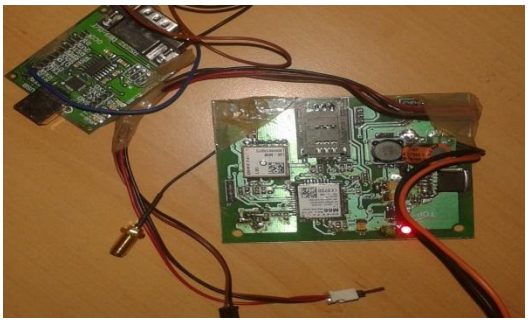

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Fig. 5Remote Monitoring System

Observed message on the tera term serial monitoring tool is shown in figure 6. Figure 7 shows the data send on the server by the remote monitoring system.

Fig. 6 Message tracing on Tera term

ID	Server Date Time	String
61600	2017-06-04 15:13:06	$;YY:0;MM:0;DD:0;hh:0;mm:0;ss:0;Lat:0;Long:0;;#
61599	2017-06-04 15:12:56	$;YY:0;MM:0;DD:0;hh:0;mm:0;ss:0;Lat:0;Long:0;;#
61598	2017-06-04 15:12:46	$;YY:0;MM:0;DD:0;hh:0;mm:0;ss:0;Lat:0;Long:0;;#
61597	2017-06-04 15:12:36	$;YY:0;MM:0;DD:0;hh:0;mm:0;ss:0;Lat:0;Long:0;;#
61596	2017-06-04 15:12:26	$;YY:0;MM:0;DD:0;hh:0;mm:0;ss:0;Lat:0;Long:0;;#
	2017-06-	

Fig. 7Data on server

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