



# Embedded Wireless Data Transfer to Cloud for Agriculture Application based on GPRS

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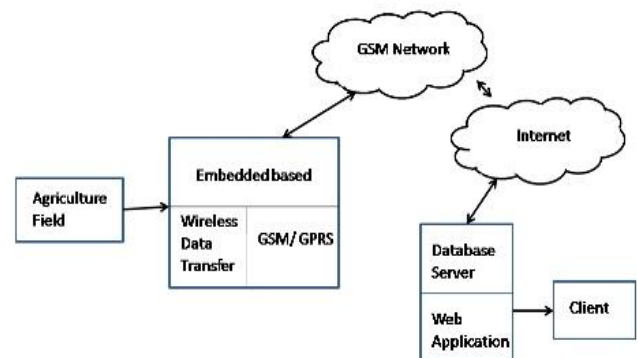
## Abstract

This application introduces the design of Wireless Data Transfer (WDT) based on ARM Cortex – A8 Processor and SIM300 GPRS Modem through which we could acquire the different real-time information. In other words, this application collects the data and send it through GPRS service provided by the GSM network. WDT plays an important role in real time Data Transfer and online data Supervisions and that is the reason why in Web Applications based on client/server architecture, it is always better to use GPRS services other than Internet services for decreasing volume, cost, Dust proof, easy carry and power consumption. And also, monitoring agricultural parameter remotely is most important criteria for maximizing production and hence we have exclusively used the embedded Sim 300 modem with 1 GHz Samsung S5PV210 32 bit ARM processor for data Transfer to Cloud.

**Keywords-** ARM processor, GPRS, GSM Modem

## 1. Introduction

The Wireless Data Transfer system with live data monitoring feature is more useful in Industrial applications. Such Applications yield best results in quick time as the work is done by unmanned devices. With the ability to access the application remotely, corporation can eliminate the need to send a service person to the application and so save the labour time and money. The implementation is done in rugged system i.e. Embedded based system. The Main Application takes required information and transmits it to the server using GPRS service provided by the GSM Network. We have used SIM 300 GSM/ GPRS modem to transfer the collected data to the server. ARM Processor is chosen because ARM has high data processing capability. It also has multi tasking capability.



**Figure. 1 System overview / Block diagram**

In this application we used 1 GHz Samsung S5PV210 32 bit ARM processor with real time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory. This is interfaced with the GPRS modems through the MAX232. The Agriculture related sensors are also connected through the MAX232. Sensor values are sent to the ARM Processor unit through serial communication. It sends the same acquired values to the GPRS modem through another com port, to save the data on Data base Server.

We have mainly used AT command Instruction set for controlling the GSM based GPRS Modem. T is the shortening (of a word) of ATtention. Every command line starts with "AT" or "at". Every command can starts with "AT" or "at". That's why modem commands are called AT commands. The AT commands with respect to GSM based GPRS Modem can be used to transmit the data to the remote server for below information and services:

- I. Set the modem configuration suits to our device.
- II. SMS (Message) services.
- III. GPRS (Data) services

The Touch Screen used tends to display the output for AT commands, enter the farmer information and display

the sensor values. And to acquire the desired output we have used power supply of 5v 2amp for ARM Board and 7 -12V 2amp for Sim 300 Modem.

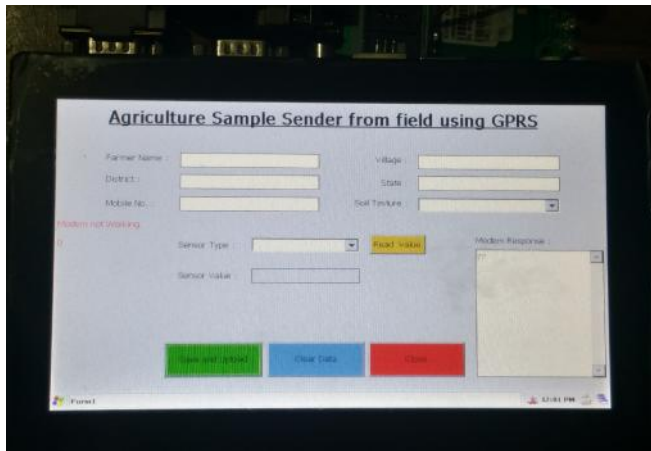


Fig2: Embedded Application View

In the ARM Cortex – A8 Board, Windows CE6.0 image has been installed to run the .net application which further is needed to retrieve the data from sensor and gives the user to better graphical user interface. The data is received from sensor and user simultaneously and after which the received data is saved and sent to the server using GSM based GPRS Modem.

The wireless network is required to transmit agriculture data to live server. Here, the best signal will be selected for the coverage of GSM network in order to transmit required data to remote server. It is a best way and cost effective to send the data to remote sever without using internet based network computers. To transmit data over GSM network, a GSM modem is required.

A GSM modem can send and receive data, SMS text messages and GPRS data over GSM network. AT commands can be sent to GSM modem using serial interface. It has a 'Built In' UART that accepts the AT commands. The modem functioning depends on AT command received. Once the data is ready in GPRS networks, it transmits data to live server. The server is hosted live to receive the information and insert the data into SQL server database. For user convenience we format and display the information in searchable report style.

Here, we have provided a download option in different formats to download the information. In this online web application we provide an authentication to login and check the received details and also provides latest received values and date wise, sensor wise reports after which the end user can download excel/pdf/word formatted documents to local pc for further modifications.



Fig3: Web Application View

## 2. General Packet Radio Service (GPRS)

GPRS is a mobile data transfer service for mobile phones and other devices that use GSM (Global System for Mobile) networks. Since it is packet oriented, it is charged by the number of packets of data transmitted and not by the amount of time used.

GPRS is an extension to the GSM standard so it allows higher transmission rates of data in GSM networks. Its speedy data transfer enables files, pictures and music to be transferred conveniently. WDT uses GPRS functionality to synchronize the mobile device with the main asset database using mobile data known as the SIM card.

This plays an important role when a standard wired or a wireless network connection is not available. Nowadays mobile phones are very common for people so the network also spreads to every location in that most coverage area capable of GSM network and 24/7 available. GPRS can transfer information from 56kbps up to 114 Kbps (with the eight available slots of each frame). Thus is most suitable for our Wireless Data Transfer System.

Here we are using SIM 300 as a GSM Modem. This SIM 300 GSM Modem has a plug and play feature with a simple to interface serial interface. It is used to send SMS, make and receive calls, and does other GSM operations by controlling it through the command line using AT commands from embedded devices. A standard RS232 connecting point comes with it which can be used to communicate the modem to the devices easily.

The modem consists of all the demanded external circuits needed to start experiments with the SIM300 module like the external external antenna, power regulator, SIM Holder, etc. It provides easy connection of the industry standard RS232 connecting point to the embedded devices. Also, it provides easy and direct connecting point to

microcontrollers through TTL. For better reception, it comes with an onboard wire to receive signals and Power, RING and Network LEDs are also present for easy finding and correcting mistakes in.

The SIM300 allows baud rate from 1200 to 115200 bps (9600 default) which is able to be changed too. This modem has a low power use of 0.25 A during general operations and around 1 A during transmission and its usual operating voltage is 7 - 15V DC.

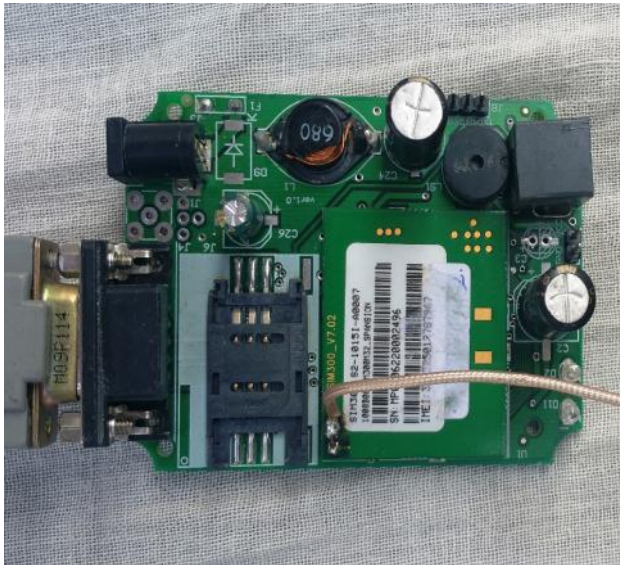


Fig4: SIM300 GSM based GPRS modem

### 3. AT commands

Sent :: AT : Check the Modem Status. Return Ok : Modem connected  
OK

Sent :: AT+CSQ? -- AT command returns the signal strength of the device.

Received :: +CSQ:18,99

Possible values are,

Value : 2 to 9 - Marginal

Value: 10 to 14 - ok

Value: 15 to 19 - Good

Value: 20 to 30 - Excellent

Sent :: AT+CMGF=1 -- command select the text message format  
Received :: OK

Here is the sequence of AT commands for data transmit to remote server. All commands should be followed by Carriage return(\r) and Line feed(\n) at the end. If the commands are correct, the modem will return OK otherwise ERROR.

AT+CGATT=1 - Attach to GPRS Service

OK

AT+CGDCONT=1,"IP", "<apn>" - Define PDP Context (cid, PDP type, APN)  
Received :: OK

Sent :: AT+CSTT="<apn>","","" - Start Task & set APN, User ID, and password  
Received :: OK

Sent :: AT+CIICR - Bring up wireless connection with GSM or CDS  
Received :: OK

Sent :: AT+CIFSR - Get Local IP address  
Received :: 10.190.245.172  
Received :: OK

Sent :: AT+CIPSTATUS - Query current connection status  
Received :: OK  
Received :: STATE: IP STATUS

Sent :: AT+CIPHEAD=1 - to add an 'IP Header' to receive data  
Received :: OK

Sent :: AT+CDNSORIP=1 - query the IP address of the given domain name  
Received :: OK

Sent :: AT+CIPSTART="TCP", "www.satish.com", "80" - Start up TCP connection  
Received :: OK  
Received :: CONNECT OK - Indicates you've connected to the server

Sent :: AT+CIPSEND - Issue Send Command  
Received :: >

Sent :: GET /http://satish.aspx?ID=<farmanername>|<village>|<district>|<State>|<Mobilen0>| <Soil Testure>|<Sensor Name>|<sensor Value>| HTTP/1.1 (ctrl+m)(ctrl+j)

Sent :: HOST: www.satish.com (ctrl+m)(ctrl+j)(ctrl+j)(ctrl+z)

Received :: SEND OK

\$\$Inserted...

Then we recognised as data inserted into Database. Close the established GPRS connection

"AT+CIPCLOSE" followed by "\r\n"

Close the Connection from Server

"AT+CIPSHUT" followed by "\r\n"

All these commands are useful while transmitting information to server through GPRS.

## CONCLUSION

The basic aim of the project is to highlight the mode of sending the data from field to the server that enables agricultural field monitoring through an embedded application and equipment which occupies less space. Hence, there would not need a fully-fledged computer but just a microprocessor that contains MAX232 port and operating system software required for handling GSM/GPRS Modem. The sensors report status information to our server, which can be useful for information processing. Our system can be extended to serve any industrial purpose of transmitting and receiving of data from remote locations.

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