ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

Automated Load Shedding and Notification to the Consumers using GSM

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Abstract:
The development of the load shedding and notifying the customer about the load shedding using GSM, according to the timings which is set in the Python GUI running on the PC is discussed in this paper. And also for reading electrical energy consumed by the user in units and this data is also provided to the electrical department (Power Grid) using GSM technology for billing purposes. Power Grid can send the monthly bill amount over SMS to the User. Once the user get bill amount on his mobile, he has to pay the bill before due date, if he fails the power to the User is made cut off by sending an SMS to the Unit installed at the User side. The proposed system integrates a Global Service Mobile (GSM) Modem, withstand along PIC Microcontroller. A Python GUI will be running on the PC which is used to set the START Time and END Time for each area, this time is then used by the PIC microcontroller to turning ON/OFF the supply in specified time intervals to each area. The GSM alerts to concern Consumers of that area immediately about when the power supply will be provided again to that area. An Alpha numeric LCD is used to display the Current local time, Status of the System and the Units used. Another feature of this project is that it will give notification to the subscribed farmers about the Three Phase availability.

Keywords: Microcontroller PIC18F46k22, Alphanumeric LCD, Global system mobile, Module, Energy Meter.

I. INTRODUCTION

The movement to reduce power usage and energy consumption among both consumers and businesses has never been stronger. A growing economy, rise in population, and increased investments all put a high demand on electricity consumption which cannot be met from the present capacity. One year of energy consumption can now beat the energy production rate of the previous half-century. Demand response instead relies on specific devices, to reduce power, ON or completely shut down high-energy-usage machines and components during peak demand times, or otherwise balance, usage between high- and low-demand cycles. This strategy is often referred to as load shedding.

Load shedding is designed to distribute the available power to consumers by turning off one area and supplying another, in an attempt to serve all the customers. If it is used effectively, can help both the utility company and the customer to conserve energy and reduce costs. This helps to reduce brownouts, which can occur when energy usage exceeds the amount of energy that is available. Managing the power consumption and more evenly spacing it allows power companies to avoid scaling for additional power production. The energy provider is responsible for signaling that it's time for customers to make the necessary adjustments to power-consuming devices.

This is accomplished by directly notifying customers about load shedding time interval. Till now to generate the electricity bill man power is used and also to cut off the power, if the User fails to pay the bill on or before due date, again man power is required. Once user pays the bill, to get the power connection back he might required waiting a day. The proposed system is designed to address all these problems efficiently and avoids manual intervention in generating electricity bill and to automate the power cut off and power connection to the user.

II. EXISTING SYSTEMS

The common practice for load shedding actions is executed when there is a distribution network disconnection from the main grid either by opening the primary circuit breaker at a transient event occurring in the grid (e.g. significant grid frequency variations).

To design a load shedding scheme, the extent of system overloading has to be identified in the first instance. However as a matter of fact, such identification may be a challenging task that both the loads and generation in the distribution network are varying all the time. Besides, power production from various DGs, especially renewable, is less predictable and controllable compared to the conventional generators with spinning reserves.

This may lead to imprecise load shedding actions. Therefore, a load shedding scheme should be well designed to perform the correct extent of load curtailment and to avoid the mal-operations. The GSM/GPRS radio modem is capable to communicate using all standard frequencies: 850, 900, 1800 and 1900 MHz respectively. Also, the modem allows automatic searching and selection of the desired frequency bands through common AT commands implemented is software routines. The AT commands are sent to the radio module as short text strings and represents a common method of control for modem applications. The transmission power used in our application is imposed by the radio modem which can operate in two modes: Class 4 with 2W in GSM 850 and 900MHz and Class 2 with 2W in DCS 1800 and 1900 MHz bands. It is used as a general packet radio service (GPRS) with multisport connectivity.

III. PROPOSED SYSTEM

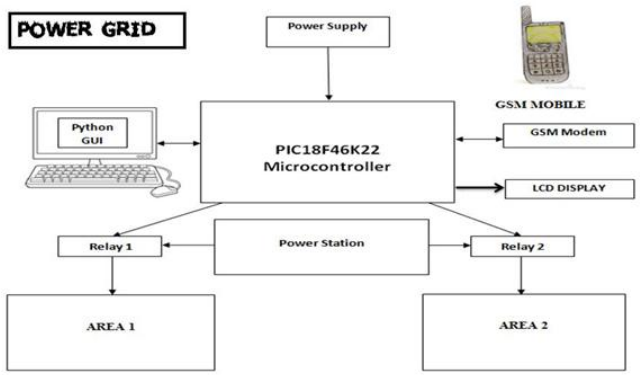


Figure 1

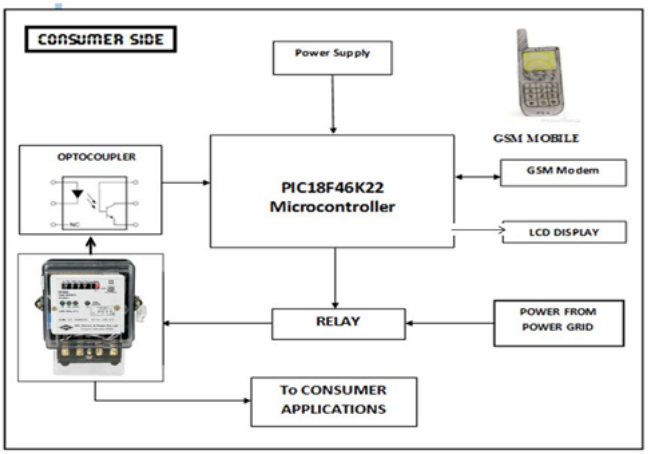


Figure 1

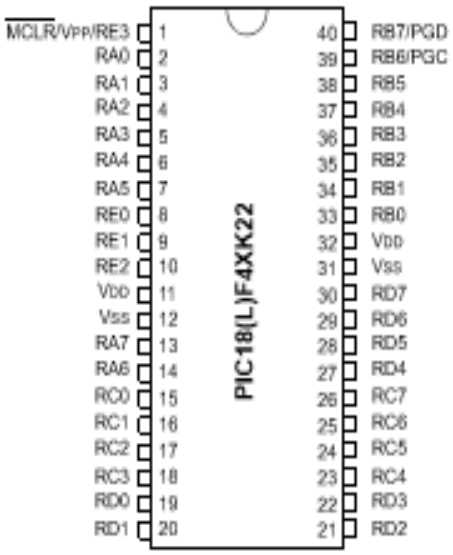
Smart power Grid consists of Microcontroller PIC18F46k22, is the main part of the project which controls and drives all peripherals. A Python GUI running on the PC is used to set the time intervals for each individual area. Once the time is set the UI will start sending the data on to the UART of the PIC microcontroller through PC serial port. The data from the UI contains, Current local time, Customer Contact Numbers, information on whether to turn ON/OFF the supply to each individual areas. The microcontroller receives this data and uses this to control each electro mechanical relays, to display the current local time and status of the System on the LCD (Liquid Crystal Display), and to send the notification message to the customers about the load shedding. If the energy provider provides the 3 Phase Power to Farming lands, the system will notifies the farmer about it though SMS using GSM.

If the farmer has installed GSM based automated irrigation system, he can turn ON the Water Pump once he receives the notification from the power station, else he can go to the farming land to turn ON the Motor, which in turn saves the farmer from missing out the 3Phase power availability and he can concentrate on other works outside of his farming land. In the proposed system generation of electricity usage bill is made automated by reading the Watt Hour pulses using Op-to-coupler and microcontroller, the Op-to-coupler Senses the pulse count, when each time the LED on energy meter flashes. The overall count is then send to the power grid through SMS using GSM. When the GSM at the Power Grid receives the SMS it calculates the bill amount for used Units by the User and send the billed amount and due date info to the User to his mobile. If the User fails to pay the bill in time, the power grid sends an SMS to the System installed at the User side. Once the SMS is received by the GSM at the User side (Customer side), the PIC Microcontroller cut-off the power by triggering a relay which acts as a switch between power supply from the Grid and energy meter power input, when the customer pays the bill, automatically user gets the power supply back as the grid send SMS to trigger Relay. Thereby removes the manual intervention to cut off the power and to provide power supply back.

IV. TARGET DEVICE:

Microcontroller PIC18F46k22.

This section is the control unit of the whole project. It basically consists of a Micro controller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Micro controller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written. A Micro controller consists of a powerful CPU tightly coupled with memory RAM, ROM or EPROM), various I / O features such as Serial ports, Parallel Ports, Timer/Counters, Interrupt Controller, Data Acquisition interfaces. Analog to Digital Converter (ADC), Digital to Analog Converter (ADC), everything integrated onto a single Silicon Chip. Micro controller has memory such as RAM, ROM or EPROM and peripherals on a single chip so development of a similar system with a micro controller reduces PCB size and cost of the design. The proposed microcontroller which is specifically used in our project is PIC18F46K22 microcontroller where PIC (Peripheral interface controller) which is 40 pin package with many multiplexed pins. It has 8 bit core architecture (Harvard) with RISC instruction set, along with 256 bytes of addressable data space. It has 64k byte of memory with RAM, ROM and special function registers. Operating speed is up to 16MIPS and 36 input output points with easy to connect standard headers and the speed is about 64 MHz crystal. Harvard architecture is used and high performance RISC CPU is performed. The PIC18F46K22 microcontroller has 4KB of ROM and 1KB of RAM. The PIC18F44K22 microcontroller has 3KB of ROM and 512KB of RAM. The operating speed to execute is about 16 million instructions per second. This microcontroller PIC18F46k22.a is a main component in the system.



V. FLOW CHART OF THE PROPSED MODEL

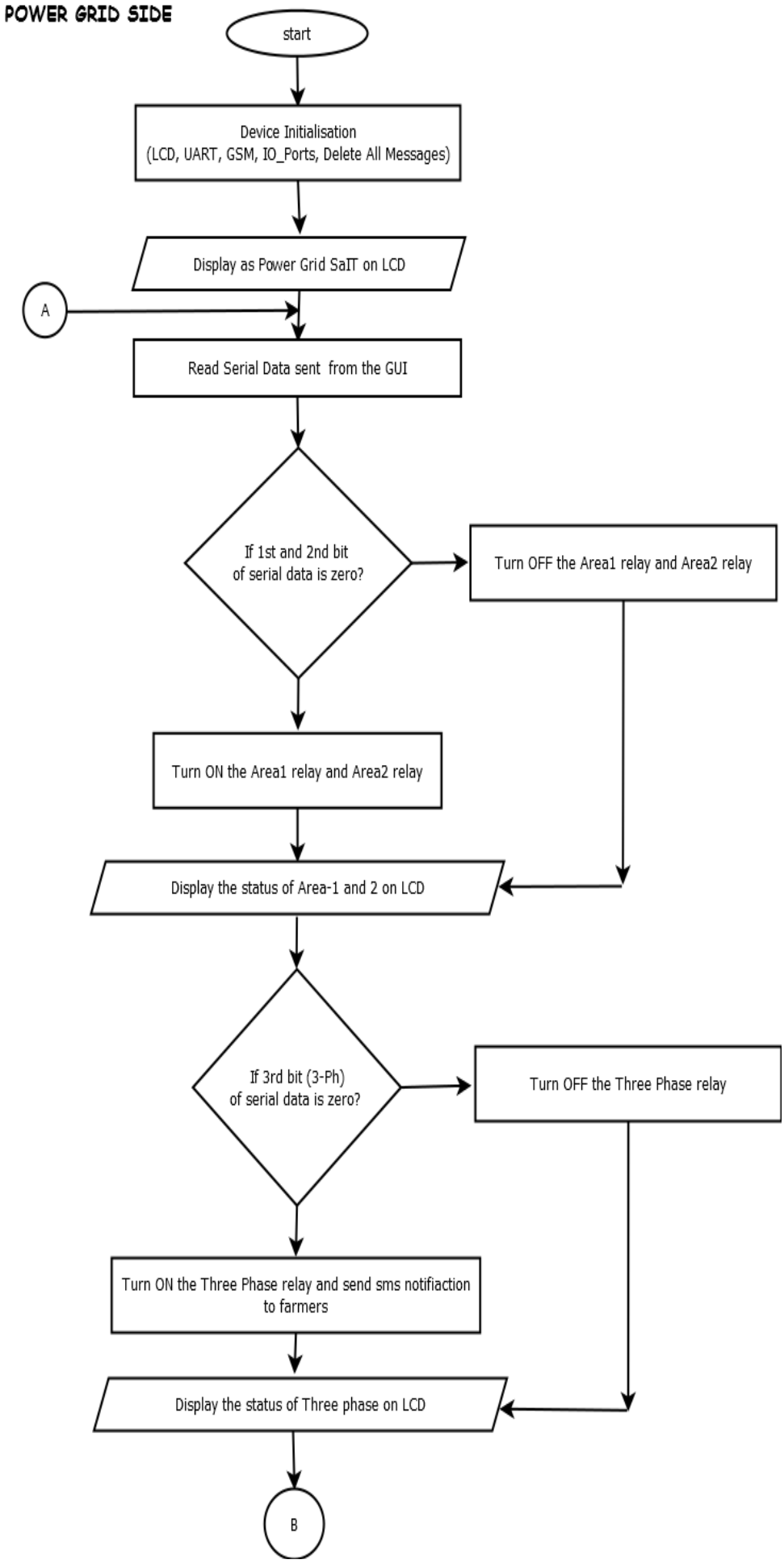


Figure.3. for Flow chart

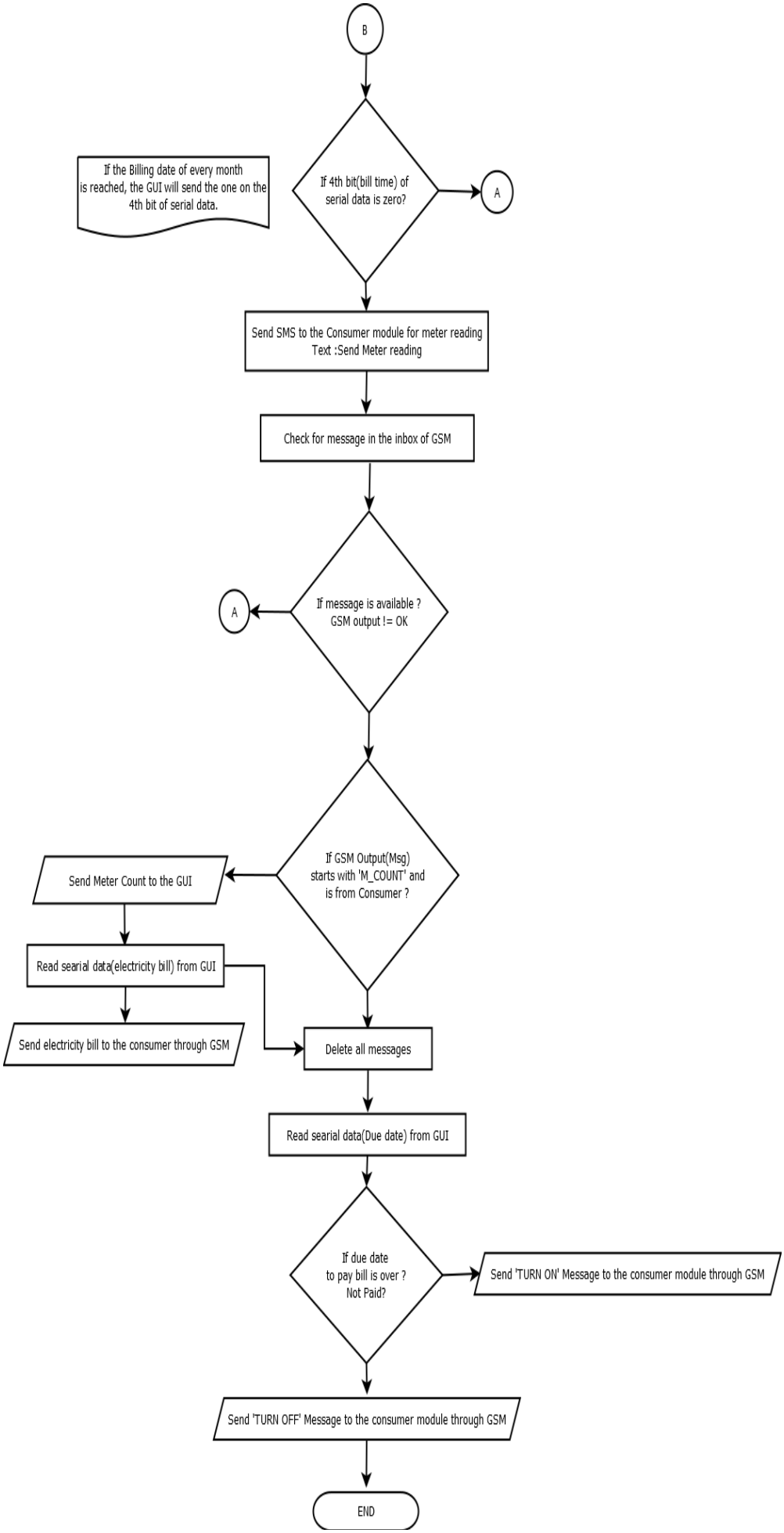


Figure.4. for Flow chart

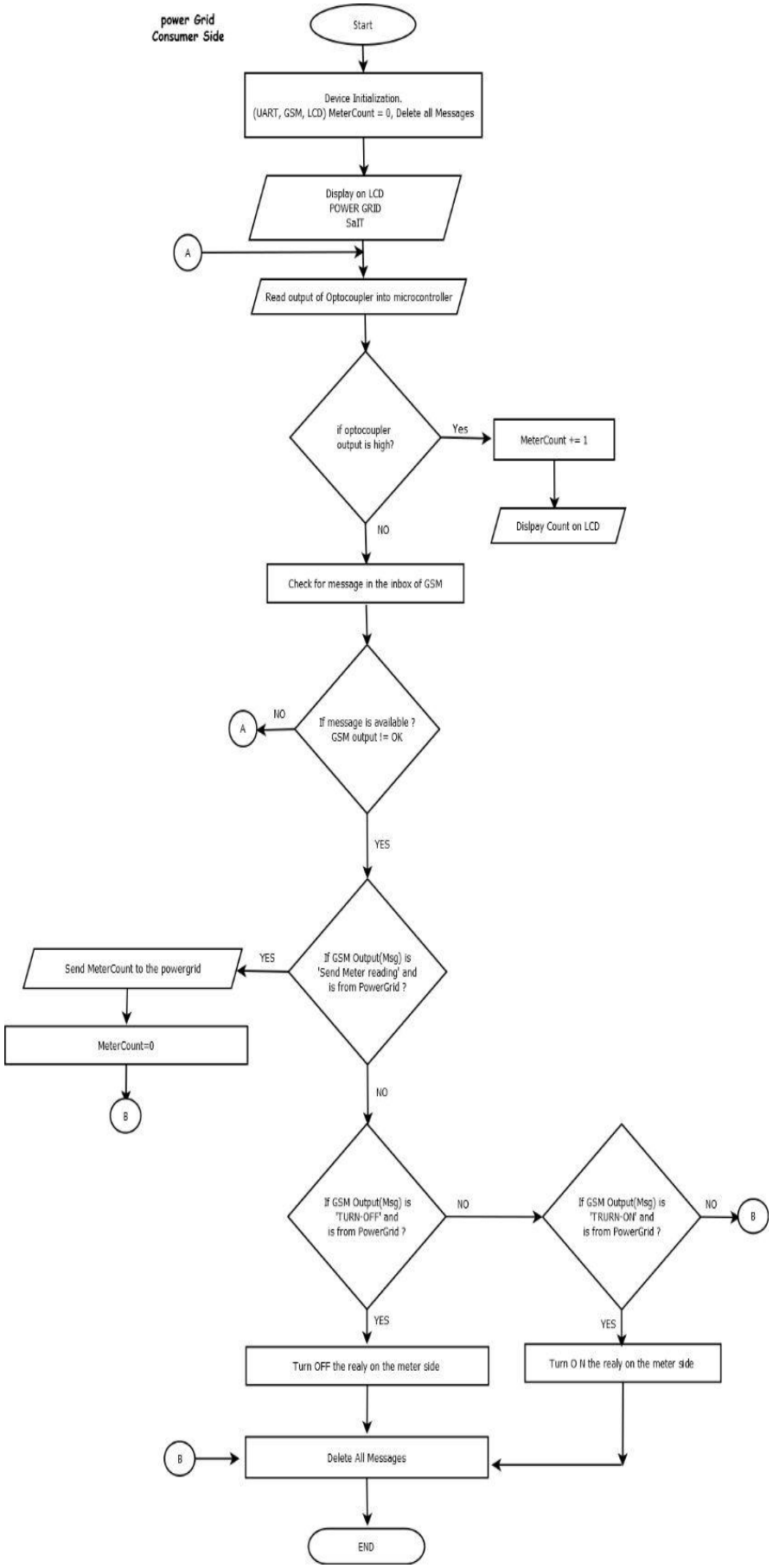


Figure.5. Flow chart for

VI. CONCLUSION

A complete working prototype of the Smart Grid System was built to demonstrate an automatic load shedding, three phase notification to the farmers and An automatic energy meter reading and billing over GSM Network. In this system the importance of a timely applied load-shedding action has been reconfirmed. We can say that by using microcontroller and GUI running on the PC, the control of load shedding can be made more easily. And also, this GSM based energy meter

reading and billing is beneficial for both energy service providing utility and consumers. This system overcomes drawbacks of conventional meter reading system and provides additional services such as power cut automatically when the electricity bill is not paid within the due date. Three phase notification to farmers helps to irrigate their land without any problem and in time, without missing the power.

VII. REFERENCES

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