

Arm Based Automatic Energy Meter Reading of Grid Connected Home with Solar Power

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Abstract - This project is mainly based on two concepts such as energy meter automation and it's controlling, grid connected solar energy system. Recently, solar electrical energy system is the best way of producing electricity and one can produce it at home itself. Also it is possible to produce more energy, but one's home may not need that much power. So that one can store remaining electricity in the batteries or he can give it to the Electricity Board. As per the electricity usage tariff rate of the electricity board, he can also produce bill amount for the excess electricity which he produced in his homes roof and fed into the grid through proper billing method.

Key Words: Arm Controller, GSM Module, Energy Meter, Relay, Light Sensor.

1. INTRODUCTION

There are lots of problems with traditional method of energy meter reading and it has increased further. Main reasons to this increase are, population growth, environmental conditions like rainy season and cloudy atmospheres, banal location, etc. After the entry of micro- controller becomes a latest technology, it could have many developments in various industrial factors for decreasing manual human efforts. Also in traditional meter reading of kWh consumption in which consumers energy consumption written in a paper by electricity staff, chances of happening human error is more. Also unavailability of consumers while electricity board staff visits the consumers house for meter reading is wastage of time [4].

Now a day's the number of consumers increased suddenly but there is no new power productions in according to its demand. In order to reduce a portions of those problems, large consumers who need much more electricity can produce solar energy on the roof of their house or building [5]. EB line connected homes can give a portion of their own solar energy to the electricity board, and they can get it back during the night time or on cloudy days and hence they can avoid batteries.

1.1 Problem statement

Now a day's electricity is an important thing in this world and without electricity the world become dark. So production of electricity has much more importance. Energy production by using solar panel is one the simple and easily method but it require battery to store the excess solar energy at day time for utilizing it for night time. Battery needs more care and usual maintenance, it is not practical among the consumers. Also the electricity board will have to recruit the staffs for collecting their consumers meter reading and producing electricity usage bill amount. But it is difficult to collect meter reading, because of the environmental conditions like rainy season, banal locations, also it is difficulty in rural areas.

1.2 Problem Statement

Recently, number of consumers using grid connected electricity increased. But in proportion to that there is no electricity power generation and therefore power availability is a major problem in most of the regions. So energy pay back concept can solve some of the problem by producing electricity themselves with solar power and thereby you can save your electricity bill. Also in traditional type of meter reading, Electricity board require extra staff to visit their consumers home to collect their energy meter reading manually. But there is a chance of human errors while writing it on paper and also meter reading person can adjust the meter reading for getting something from the particular consumers. So automatic energy meter reading and monitoring system can solve such problems by getting their consumers energy consumption details every time through GSM technology.

1.3 Existing System

The presently existing system in rural areas, have impulse energy meters in which the energy consumption will be measured in kilo Watt hour (kWh) and each house has a unique reference number. The person from the EB has to visit each house, enter the reference number into the SBM (Spot Billing Machine) which has data base stored.

The previous month reading will be stored with the balance details, if consumer has not paid the bill. When the person enters the present reading details of energy meter into SBM, it takes the difference between the present and previous month and gives the number of units consumed. For that number of units amount will be calculated based on tariff with minimum charges included and the ready bill will be generated.

Electricity board/company side requires a GSM module interfaced with a personal computer PC. In this system there are two types of powers, one is solar energy produced by the consumer itself on their own plot or over the roof of their home/buildings and another one is grid connected supply from electricity board/company. So that consumer can use both supplies simultaneously. They can use solar supply produced by themselves in day time and also they can supply excess power to the utility grid provided by the electricity board with the same tariff credited for them when they use grid supply. Night time or unavailability of solar power, consumer can get back supply from grid which is already connected to the consumers home. Only excess usage of energy from grid supply of EB is paid by the consumer to the electricity board.

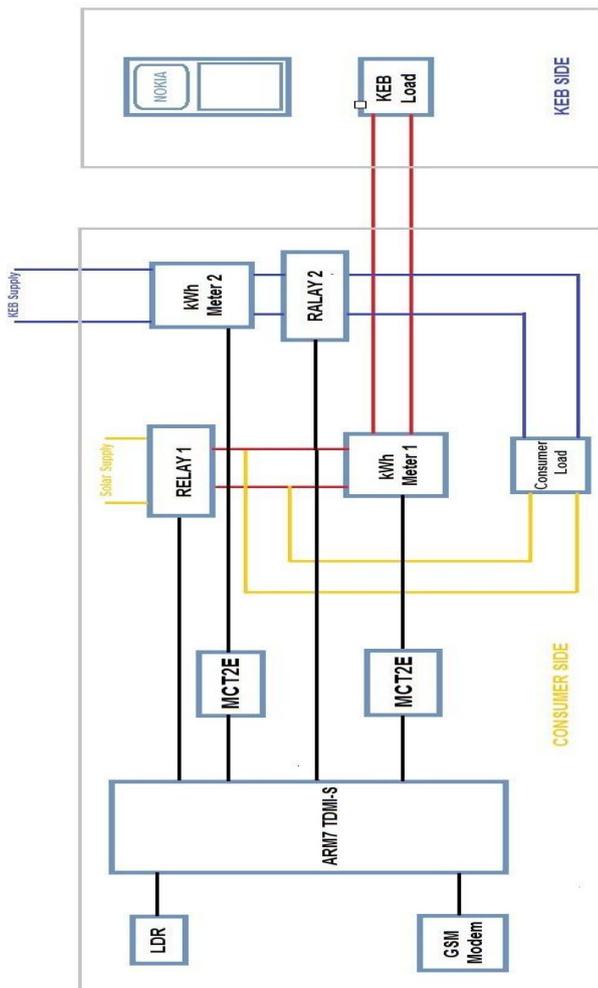


Fig-1: Block diagram of proposed solution

2. METHODOLOGY

Knowing the problems related to the existing traditional meter reading and the situations we are facing during the unavailability of the electricity due the power shortage, this project put forward a solution to overcome the existing problems. In Fig. 1, shows the main block diagram of this project. This project requires some hardware parts such as ARM processor, kWh meters, relays, breakers, Light dependent resistor LDR, GSM modules, loads etc. Consumer side includes ARM processor, meters, relays, loads and GSM module.

3. IMPLEMENTATION IDEA

Both solar and grid powers are supplying through relays I and II respectively. kWh meters are placed in between both relays and loads. Meter I is used to read solar power consumption and Meter II is used to read grid connected power. kWh meters are interfaced with ARM development board through optocoupler ICs to read and transmit energy meter data regularly. A GSM module is interfaced with ARM development board to transmit and receive data between consumers as well as electricity board. At a time only one power supply is used and is controlled by relay circuits which are interfaced to ARM board. Mostly, day time solar power is used and excess power is supplied to the utility grid provided by the electricity board. Meter I can measure the energy consumption of electricity board at this time and then send it to the electricity board through GSM technology. Similarly, at night time or cloudy day's grid connected power supply is used and energy consumption of consumer at this time can be read by Meter II and is also transmit to the company via GSM. Also, we can see all data in LCD display provided by the development board. LDR is used to identify day and night time and is interfaced with ARM development board to avail any one supply at a time by giving a signal to the particular relay, then corresponding breaker can active the circuit with either solar or grid power supply.

The excess electricity used by the consumer is credited to the consumer. Electricity board can send their consumers electricity bill via SMS through wireless technology by using GSM module. Also, in case of any dues in consumers bill, electricity board can interrupt their power supply to that particular consumer by sending an SMS back through the same GSM module, then ARM processor will give a signal to the relay to interrupt the circuit without sending a person to the corresponding consumers home. Hence, electricity board can reduce much more human effort. GSM interfacing with ARM microprocessor is done through universal asynchronous receiver transmitter UART.

Relay interfacing is done with I/O port of ARM processor and ARM development board needs 12V DC adaptor for its power supply. Apart from hardware part, this system requires some software's like Keil uVision4, Philips LPC2000 Flash Utility Version 2.2.3. Keil software is mainly used for writing programming codes for ARM processor and Flash utility software needs to upload the program hex file to the flash.

serial UART interface for GSM connections, ground point, Vcc, Vin, USB port for connecting with PC to upload program, 12V input power supply point, attached LCD display for showing energy consumptions etc. Other components required for this project is GSM modem, SPST relay unit, DPDT relay unit, LDR, kWh meters, MCT2E optocoupler IC, 40W/60W/100W bulb as load and its holder, connecting wires. Every component has to interface with ARM development kit by using connecting wires. ARM processor requires some programs written in C Language which has to upload into it by using Keil and LPC2000 Philip ash utility software to write and upload programs respectively. Fig. 2 shows the complete chip interfacing diagram of this project.

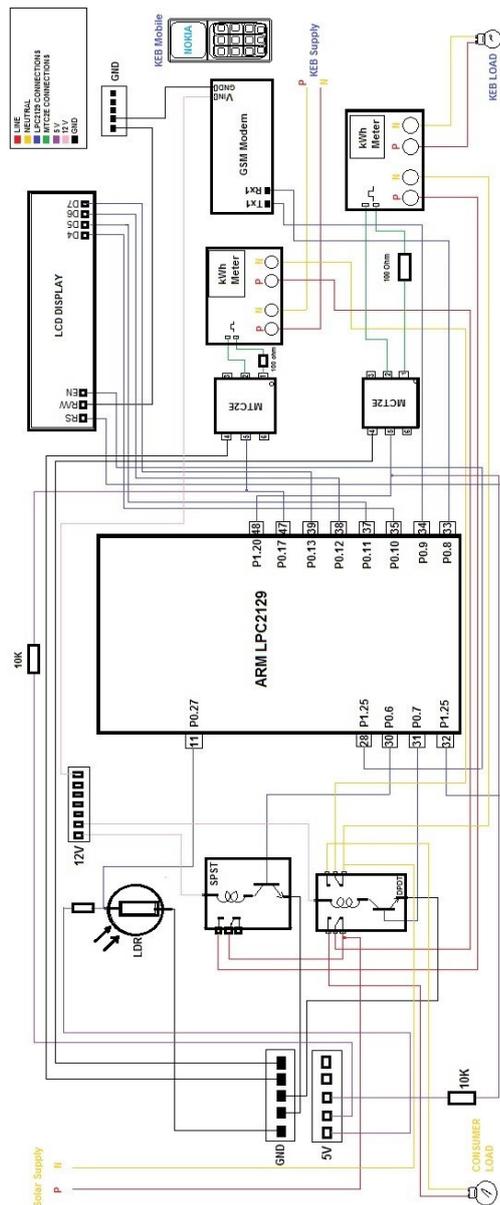


Fig-2: Complete Chip interfacing diagram

Main goal of this proposed project is to put forward a concept to decrease power availability problem and hence avoid power cut. Also, to collect consumers energy meter readings without visiting their home. Implementation of this project is done by using TDMI-S ARM development board which includes LPC2129 ARM microprocessor in built

4. CONCLUSION

This project is done by combining three concepts such as automatic energy meter reading, relay breaker control systems and grid connected home with solar panels system. This project mainly applicable among consumer's who can provide solar panel over the roof of their own home or buildings to produce solar power for saving their electricity bill or with business mind to earn something by selling the solar power to the KEB by means of connecting to the grid provided by the KEB. Also, it will reduce current theft, human efforts and it can reduce problems like power cut, load scheduling etc.

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