Two Way Communication Based Centralized Metering System

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Abstract—**In advancement of technology, things are becoming simpler and easier for us. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. Automation greatly decreases the need for human sensory and mental requirements. Automation plays an increasingly important role in the world economy and in daily experience. Automatic systems are being preferred over manual system. Through this project we have tried to show automatic control of metering and billing at consumers end through GSM based.Two way communication based central metering system is an electronic device that allows the system to measure the usages of various parameters like electricity, water flow,consumption of domestic cooking gas. Provision of electricity thief is also given in here to avert it. We are using ARM 7 as a processer in this operation. GSM based home automation using AMR is a system that implements the emerging applications of the GSM technology which enable the users to carry out some task from anywhere in the world via a GSM network, and the system will automatically control home appliances. The system is made up of a GSM amplifier unit, ARM 7 controller, power control and a power supply unit. These sub circuits are designed using passive and active electronic components like capacitors, resistors, diode, regulators, transistors, electromagnetic relay, microcontroller and battery.**

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I. INTRODUCTION

Two Way Communication Based Meters are electronic measurement devices used by utilities to communicate information for billing customers and operating their electric systems. For over fifteen years electronic meters, have been used effectively by utilities in delivering accurate billing data for at least a portion of their customer base. Initially, the use of this technology was applied to commercial and industrial customers due to the need for more sophisticated rates and more granular billing data requirements. The use of electronic meters came into service to the largest customers of the utility and over time gradually expanded to all customer classes. This migration was made possible by decreasing cost of the technology and advanced billing requirements for all customer classes.

Smart meters are the next generation of combination of electricity meter, water meter or gas meters and the difference compared to the old meters is that they are able to transmit and receive data. Smart metering is one way to help customers understand their electricityconsumption and help them to save energy. Through a quick feedback and monthly bills, with statistics over the electricity used, the customers will get a better understanding of their electricity consumption.This model has designed and implemented wireless sensor network for measuring utilities such as electricity, water,gas. Because of disadvantages of traditional meter reading such as errors in reading, inaccuracy, external conditions affecting readings, delayed work,energy theft, we have implemented meter reading system based on Centralized metering system technology. This system performs tasks such as taking meter reading, distribution of bills, sending notice, cutting and reconnection of flow automatically.

An automatic remote meter-reading system based on GSM is presented in this paper. This paper is useful to obtain meter reading when desired so meter readers don't need to visit each customer for the consumed data collection and to distribute the bill slips. Microcontroller can be used to monitor and record the meter readings. In case of a customer defaulter, no need to send a person of utility to cut-off the customer connection. Utility can cut off and reconnect the customer connection by short message service (SMS). Furthermore, the customer can check the status of consumption just by sending a simple SMS request. In this system energy meter readings are being transferred by making use of GSM.

Water utility customers also have an important role in leakage control. It is essential that this resource can be captured– not only because it is an increasing scarce supply but also because of its embedded energy and the greenhouse gas footprint it represents. Although in many parts of the country water might be considered the cheapest utility commodity, water loss is still very costly to customers and water utilities.

II. WHY TWO WAY COMMUNICATION BASED METERS SHOULD USE?

Customer Side

Smart Metering gives customers real-time consumption information via display device that translate the meter reading into a form the customer can easily understand. These devices help customers change their consumption, should they wish to do so, without having to wait for the end of the month or the end of the quarter to view the results from conservation initiatives. Displays tailored to the specific needs of the user, such as those comparing current use with neighborhood averages or with consumption in previous months, may help consumer further focus on conservation.

Utilities Side

Utilities can use time-of-use or interval data to better analyze and the scheduling of generation or supply withdrawal from storage fields or reservoirs.

Interval data matched to customer type and location is particularly helpful in identifying needs for network or pipeline repairs or changes. It can also point to the location and size of leaks or theft.

Some Smart Metering systems permit meters to send "last gasp" messages when they are going out of service. These help utilities identify the location and extent of an electrical outage or a break in a water or gas main.

III. SERVICE-

Two way communication based smart meter for gas, water, and electricity may bring down the total cost and permit utilities to respond cost-effectively to an option many consumers request as a tool to help them budget.

IV. SMART METERING'S COSTS AND BENEFITS

While discussion of smart metering, many utilities hesitate when they see the large financial commitments involved. Will they be able to recover the costs?

There are ways, however, to mitigate the risks involved.

Fewer meter readers,which means lower total costs for salary,benefits,and workers compensation.

Less wasted time in attempts to pinpoint the size and source of an outage.

Remote rather than expensive and occasionally risk on-site disconnects.

Lower risk to public safety from downed power lines and lack of exterior safety lighting during outage.

Better accuracy in the actual meter readings,resulting in fewer calls to the contact center.

Remote programming that enables customers to use new products that might be offered by the utility or by a third party.

V. SMART METERING SYSTEM AND COMMUNICATION-

Smart meters also allow the customers to track their own energy use on the Internet .The two-way nature of Smart Meter Systems allows for sending commands to operate grid infrastructure devices, such as distribution switches and re-closers, to provide a more reliable energy delivery system. This is known as Distribution Automation.Smart Meter Systems are varied in technology and design but operate through a simple overall process. The Smart Meters collect data locally and transmit via a GSM to a data collector. This transmission can occur as often as 15 minutes or as infrequently as daily according to the use of the data. The collector retrieves the data and may or may not carry out any processing of the data. Data is transmitted via a GSM to the utility central collection point for processing and use by business applications. Since the communications path is two - way, signals or commands can be sent directly to the meters, customer premise or distribution device.

The smart energy meter redeems the traditional Ferraris wheel, electronic or digital meters. It has bidirectional communication capability for remote control and tariff based operation. The customer has up-to-date price, load and cost info about gas-, water, and electricity consumption. The smart meter is a basic end-user element of the smart grids, too.The meters can have different communication tools, here we are using GSM.
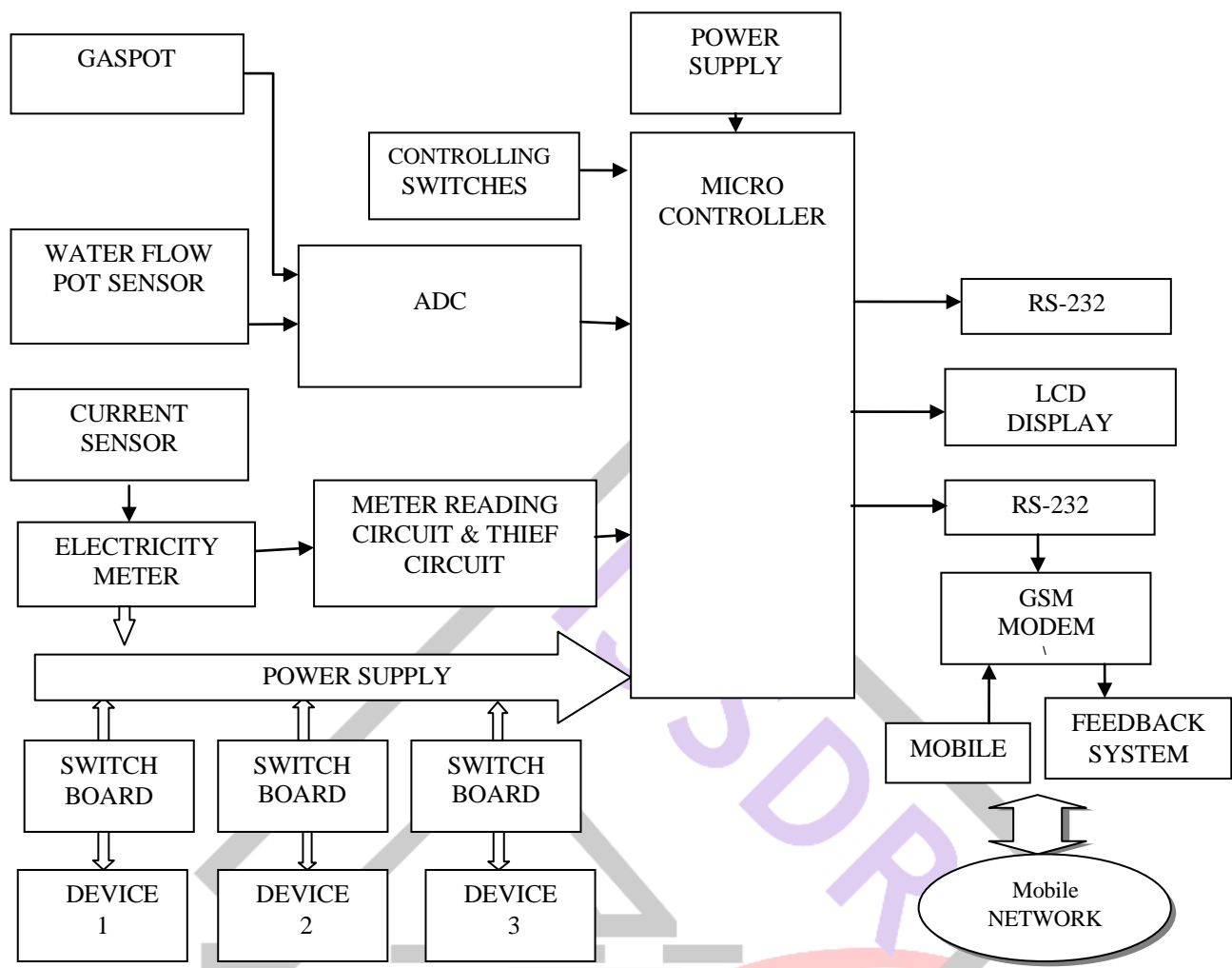
VI. PROPOSED SYSTEM-

FIG.1.   BLOCK DIAGRAM OF PROPOSED SYTEM

The use of advanced technologies such as digital metering has become extremely necessary to achieve greater efficiency, theft reduction, losses to improve revenue collection. The utilizes and planner should now focus on best use of electronic technology to develop a full smart system which is capable of offering long term benefits and solutions in addition to theft reduction and usage reduction. In future this project can be used for measuring gas,water consumption.These meters are connected to GSM module and data can be transmitted over GSM networks and bills can be automatically issued to the particular customer through SMS. In this system, we can break the connection if users not pay the bills in time.There is no need for electricity officials to visit the spot to disconnect the connections i.e., everything can be controlled over the GSM module. As well user can turn off or turn on equipment.

VII. HARDWARE DESCRIPTION-

1.   GSM MODULE-

FIG.2. GSM MODULE

One of the key features of GSM is the subscriber identity module (SIM). It is usually known as SIM card. The SIM is detachable smart in appearance and is used for the subscription of information and phonebook. This allows the retrieval of information after switching handset on. The SIM card also enables users to link each other irrespective of different network operation. For the purpose of this project work to be achieved a SIM card on any network is required to establish a link between a user and its Household equipments to squeeze 3.1Kh2 audio between 5.6 and 13kbits/s.

2. ARM 7 MICRO CONTROLLER-

FIG.3. ARM 7 CONTROLLER

In order to keep the ARM 7 both simple and cost-effective, the code and data regions are accessed via a single data bus. Thus while the ARM 7 is capable of single-cycle execution of all data processing instructions, data transfer instructions may take several cycles since they will require at least two accesses onto the bus (one for the instruction one for the data). In order to improve performance, a three stage pipeline is used that allows multiple instructions to be processed simultaneously.

3. ENERGY METER-

FIG.4. ENERY METR

An electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device.Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour. Periodic readings of electric meters establish billing cycles and energy used during a cycle.In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. "Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-costperiods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response shedding of loads during peak load periods.

4. FLOW METER-

FIG.5. WATER FLOW METER

Features
• Simple maintenance
• Field replaceable measuring unit
• Bearings are constantly flushed during operation to eliminate deposit of solids
• Optional electrical output: EV (Volume) or EF (Rate of Flow)
• Compatible with Dialog® automatic reading system

5. LCD-

FIG.6.LIQUID CRYSTAL DISLPAY

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even customer characteristic (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

6. SERIAL MAX 232-
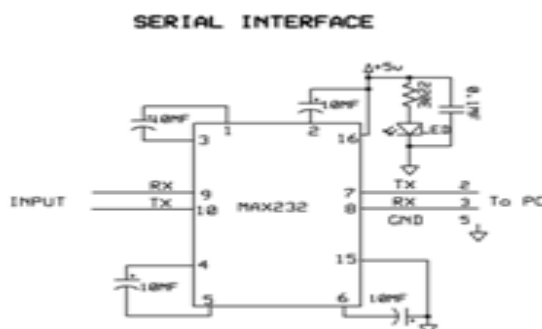
This unit is used to send and receive the signals given by the microcontroller. It is used for the serial communication between external GSM and microcontroller. It also converts the data into serial manner and send to the microcontroller.The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps andexternal capacitors.

7. RELAY-

A relay is an electro-magnetic switch which can be used in case of using a low voltage circuit to switch on and off a light bulb (or anything else) connected to the 220v mains supply, i.e., it is an electrically operated switch.. The coil current can be on or off so relays have two switch positions and most have double throw (changeover).Relays allow one circuit to switch a second circuit which is completely separated from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit.

ROLE OF GSM IN THIS PROJECT-
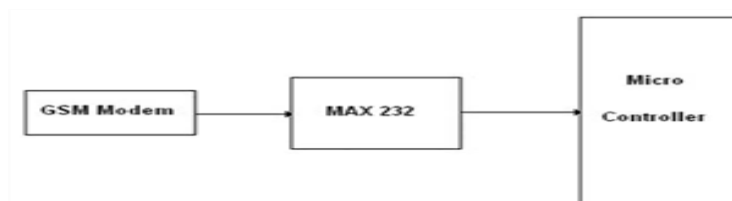
Using this GSM communication network we can send information such as data, messages, tariff amount and intimation etc. without using human effort and sends this information through GSM module to each of the consumers. It is very useful in reducing expenses for meter reading and errors during manual meter reading.

VIII.   CONCLUSION-

Two way communication based smart meter has been designed and tested successfully.
• It is highly accurate and reliable.
• This metering system eliminates the human intervention in meter reading, bill calculations and billing delivery.
• If more such system are implemented, it can be connected to a server and functioned as mobile network.
• Eventually it is beneficial to both consumer and utility.
• Many cases of energy thief have been registered over past years which could be reduce using this system.

For developing country like India where major chunk of population lives below poverty line will become alert while consuming electricity if their bills reach them weekly or monthly as desired by them.Today utility owners are using energy based tariffs when distributing electricity, if implementing a load-demand based tariff the possibilities to control the consumption pattern increase because the economical revenues become more connected to the peak loads within the system. However, the monthly revenues are varying depending on which tariff is being modelled.Further investigations needs to be done in order to determine the adequate pricing level from the utility operators' as well as the customers' points of view. AMR Business Case Automatic meter reading systems contribute to an increased knowledge of different consumption patterns on an individual basis. Combining individual electricity consumption series with large-scale data handling methods could provide powerful tools for evaluation, forecasting and simulation of electricity consumption. The control system of this project is a cost effective with the controlling more than 4 appliancessimultaneously as this system is very beneficial for the home appliances power control so as to reduce unnecessary power consumption.

IX. APPENDIX-

Consumer Module Experimental Setup
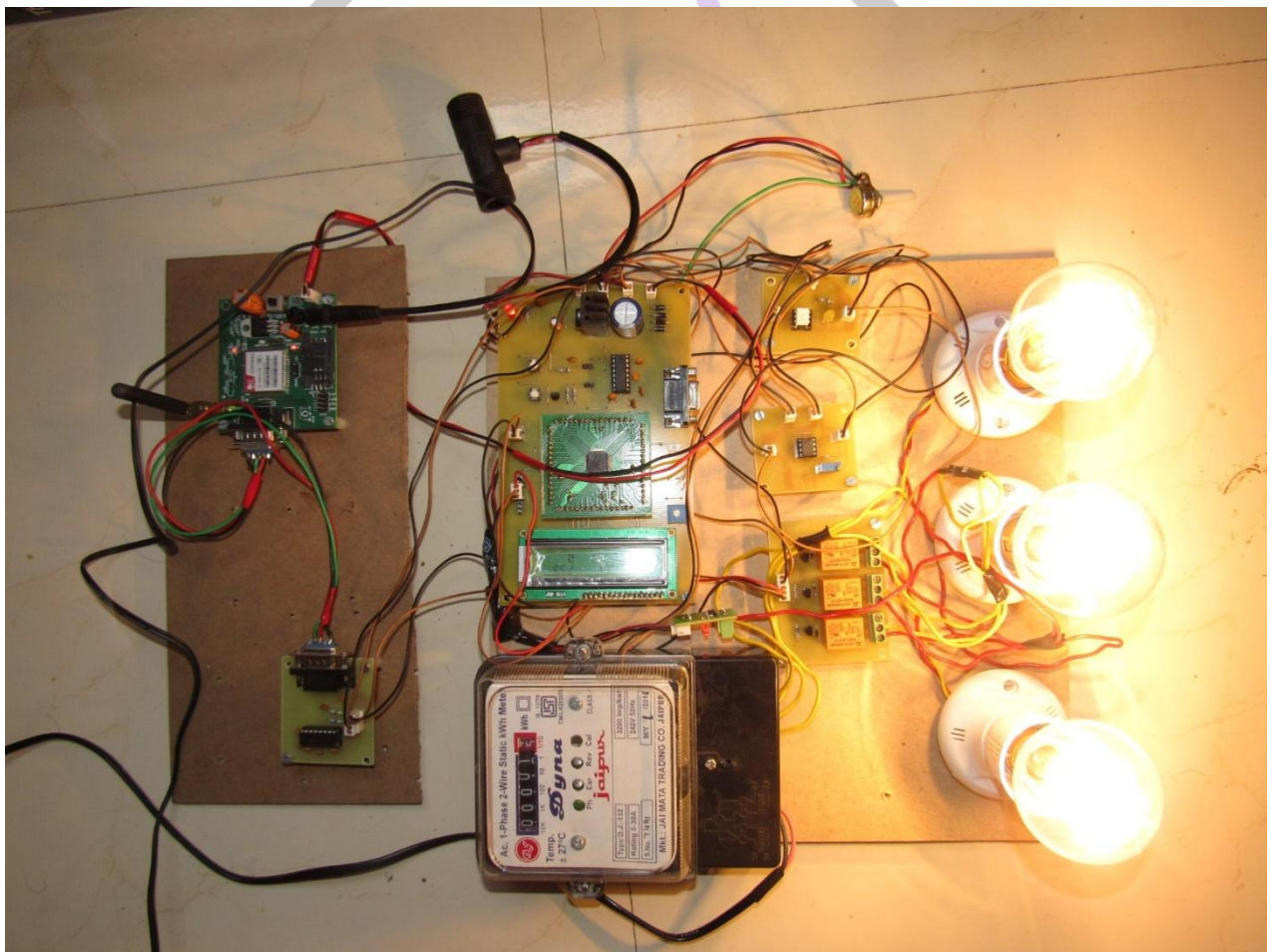
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