

# Bluetooth Enabled Energy Meter for Smart Housing and Smart Cities

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**Abstract**— This research work primarily focused on energy meter reading, processing and transmitting information of energy consumed by a consumer. This work is based on application of Bluetooth technology embedded system development. Design is well focused on its flexibility, faster data transfer, low power consumption, cost effectiveness, data security, small size and light weight.

In this work, an embedded controller is interfaced with the digital energy meter to get consumed power information in digital form. Then processes these pulses to calculate number of units consumed.

The consumer will be able to check the consumption displayed on the LCD screen and also on the devices paired with the smart energy meter for continuous operation.

The exponential increase in smarter and better metering, billing and payments systems rising is demand. We proved a solution for a smart energy metering system for future upcoming Internet of Things (IoT) era WiFi enabled smart cities.

**Keywords**— Smart city, smart home, Bluetooth, low power, low cost, energy meter, embedded processor, watt hour pulses, interface, LCD display.

## I. INTRODUCTION

Traditional electric meters have been used since early in the late 19th century. The meters were analogous to sand watch. This style of metering has survived without major changes or technological advancement for more than 100 years. Traditional meters work independently to provide accurate readings used to determine costs for service.

Over time these meters slowdown giving wrong readings and must be calibrated periodically. It has been said that traditional electric meters have done nothing more than keep track of how much energy is consumed, which is not bad because that is their purpose, tracking consumption.

The meters are read every month and then usage is billed to the consumer. For traditional metering to be monitored, a greater number of technicians may be necessary to maintain the accuracy of the device, which causes billing and processing to be more expensive makes peak time usage hard to nonlinear measurements.

Due to the advent of digital technologies most accurate and sensitive digital measuring systems integrated with wireless

communication technology. These traditional meters can be replaced with the smart meters which make use of Bluetooth module[2,3] and GSM module transmit the billing information.

Wireless communication has become an important feature for commercial products and a popular research topic within the last ten years. Smart meters are innovative and advanced utility meters that can record business or residential utility usage in real time, with great detail. These meters identify energy consumption in more detail than a conventional meter.

In a networked energy services smart grid system, each meter can use wireless communication for local to communicate with its peers in a webbed network.

## II. SYSTEM DEVELOPMENT

Smart meters are the new generation of electricity meters. They show you how much energy you are using tariff in the home, state or region of usage in real time and bring an end to estimated power losses and unpredictable power loss problems.

In this researched system, we made use of a common embedded microcontroller. The low-power, high-performance CMOS 8-bit most popular microcontroller AT89S52. It is with built-in 8K bytes of in-system programmable Flash memory and various input and output ports. The device is compatible with the industry-standard popular 80C51 instruction set and pin-out. The on-chip Flash allows reprogrammed in-system.

The Embedded system operates in high speed information exchange and it will send the message to the near consumer who is using Bluetooth interface connectivity(Pair). This system is useful for both the user and the electricity board as it reduces manual operation at data acquisition at upcoming smart homes and uploading automatically user data smart grid.

Smart meter by energy supplier, as part of a national upgrade to our energy system. This means the end of estimated bills. No more having to read the meter or trying to work out your bill. No more strangers coming into your home for meter readings.

A smart meter only get accurate bills from energy supplier. Smart meter become more energy efficient by minimizing hidden loses in the smart cities too.

Smart meters are paving the way for a more energy efficient future. They make it easier for us to identify the situations where we're using / losing a lot of energy and might want to make changes to reduce loss in distributed systems.

They are also a crucial step towards the development of the smart grid, a whole new way of running our energy network. Energy suppliers will be better equipped to plan and manage electricity to match supply and demand curve.

### III. WORKING METHODOLOGY

The embedded system consists of the following four blocks. The controller AT89S52 is essential that interfaced with all the other components. Energy measurement using (ADE7758) is another important processor used for live reading of electricity consumption and to communicate with the server and operates according to the server commands. The block diagram of the system is shown below Fig (1).

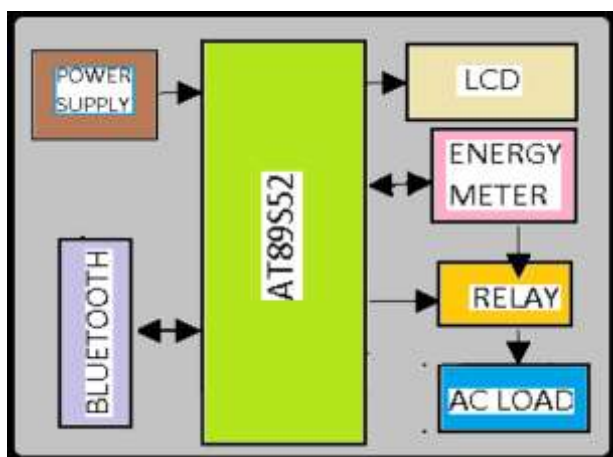


Fig (1) Tested Embedded System H/w blockdiagram for Smart Meter production.

The smart energy meter working is here to give a consumed units to the user and indicate the units to the user before reaching reference units that reference unit is fixed by the server of main pc at that reference unit. Unit rate will be increase so before reaching that point smart meter indicates to the user for this purpose in this system ARM7 and energy meter and GSM network are used.

**POWER SUPPLY :** In the power supply unit we used power supply digital circuits which required to convert line AC power to low power DC from the available mains 230V/50Hz AC lines. DC voltage with the protection range of +5V and +12V for various embedded on board applications.All

**ISOLATION RELAY :** A relay is an electrically operated switch used to isolate one electrical circuit from another. Since the two circuits are isolated from one another, a lower

voltage circuit can be used to trip a relay, which will control a separate circuit that requires a higher voltage or amperage.

**ENERGY MEASUREMENT[7] :** The ADE77581 is a high accuracy, 3-phase electrical energy measurement IC with a serial interface and two pulse outputs. The ADE7758 is suitable to measure active, reactive, and apparent energy in various 3-phase configurations with system calibration features for each phase and RMS offset correction, phase calibration, and power calibration.

The ADE7758 embedded system also send automatic meter readings via on-board GSM communication to server for energy audit to the supplier at least once a hour and user receive accurate bills in time. Prepaid billing mechanisms are made optional.

**BLUETOOTH TECHNOLOGY[6] :** Bluetooth is an open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security.

Bluetooth is a short- range radio link intended to replace the cable(s) connecting portable and/or fixed electronic devices. The best features that a Bluetooth offers are robustness, low complexity, low power and low cost. We used this technology for smart home embedded networking and data acquisition.

**LCD MODULE INTERFACING[9] :** The most common type of LCD controllers, which provides a simple interface to display interactive messages. Display consists of two lines,16 characters per line that is interfaced to the controllers. The pins from D0 to D7th bit are called Data lines, RS, RW and EN pins are the control pins and remaining pins are +5V, -5V and GND to provide supply where RS is the Register Select, RW is the Read Write and EN is the Enable pin.

### IV. RESULTS

Smart Energy Measurement Embedded System take the inputs from line and indicates the units calibrated to 25mW to suit for the resistive load energy consumed after every 3 units to the paired devices through a Bluetooth terminal.

These results are benchmarked with conventional measuring systems. Results were found more precise in measurement. Additional feature of uploading data periodically to server proved that the better audit and control on theft of power issues

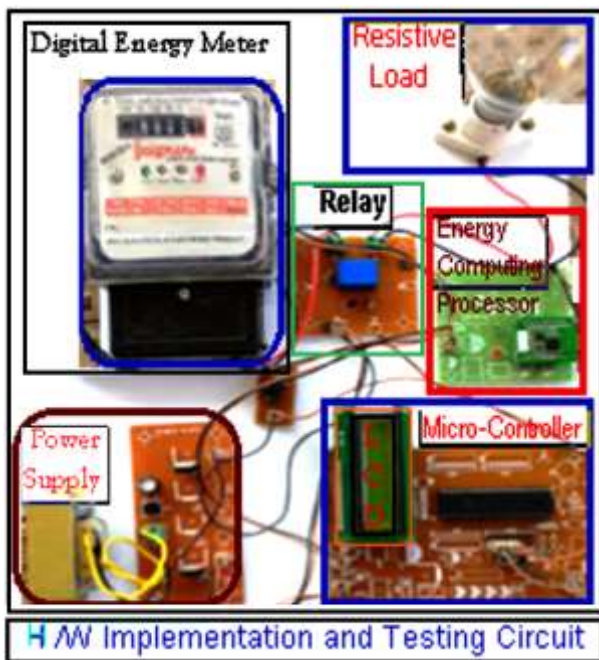


Fig (2) Smart Energy Measurement Embedded System.

#### V. ADVANTAGES

There are million homes for the energy suppliers. The goal of every home having a smart meter by 2020. Few advantages of energy meters are control over energy costs, accurate bills without human intervention, hassle free payment of bills directly to the electricity board and Smart meters are part of the government's plans to bring our national energy system up to date. They have a vital part to play in helping to move country towards a lower carbon economy and a secure energy supply.

#### VI. CONCLUSIONS

Measurement and control of power embedded management is the most essential requirement in future smart Internet of Things (IoT). Further development on low power Systems-On-Chip will improve the overall all performance and cost effective mass production for commercialization of Bluetooth Enabled Energy Meters.

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