
Networked Remote Meter-Reading System Based on Wireless Communication Technology

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Agenda:

- Introduction- meter reading, Bluetooth and GSM
- Motivation
- Structure of the proposed system
- Hardware design:
 1. Measuring meter
 2. Intelligent terminal
 3. Communication modules
- System management
- Actual implementation of this system
- Conclusion
- References



Introduction:

Meter reading-

- Critical first-step in the utility revenue collection.
- A labor-intensive activity.
- Helps to detect leaks, hazards and safety issues.

Bluetooth-

- Wireless technology standard for exchanging data over short distances.
- Uses short-wavelength radio transmissions in the ISM band from 2400–2480 MHz.
- standardized as IEEE 802.15.1.

GSM-

- Describes protocols for second generation (2G) digital cellular network.
- Developed by the European Telecommunications Standards Institute (ETSI).

Automatic meter reading-



Motivation:

- Hiring and training effective and efficient meter readers increases the cost of meter reading.
- Changes in industry and economy have forced Utilities to reduce operating costs.
- Demand for better customer service and satisfaction.
- Support real-time pricing initiatives, load forecasting, demand-side management, load control
- Growing need for more timely access to energy usage information.
- status and usage information is needed on an event basis to improve reliability, power quality, and to identify outages.

System structure:



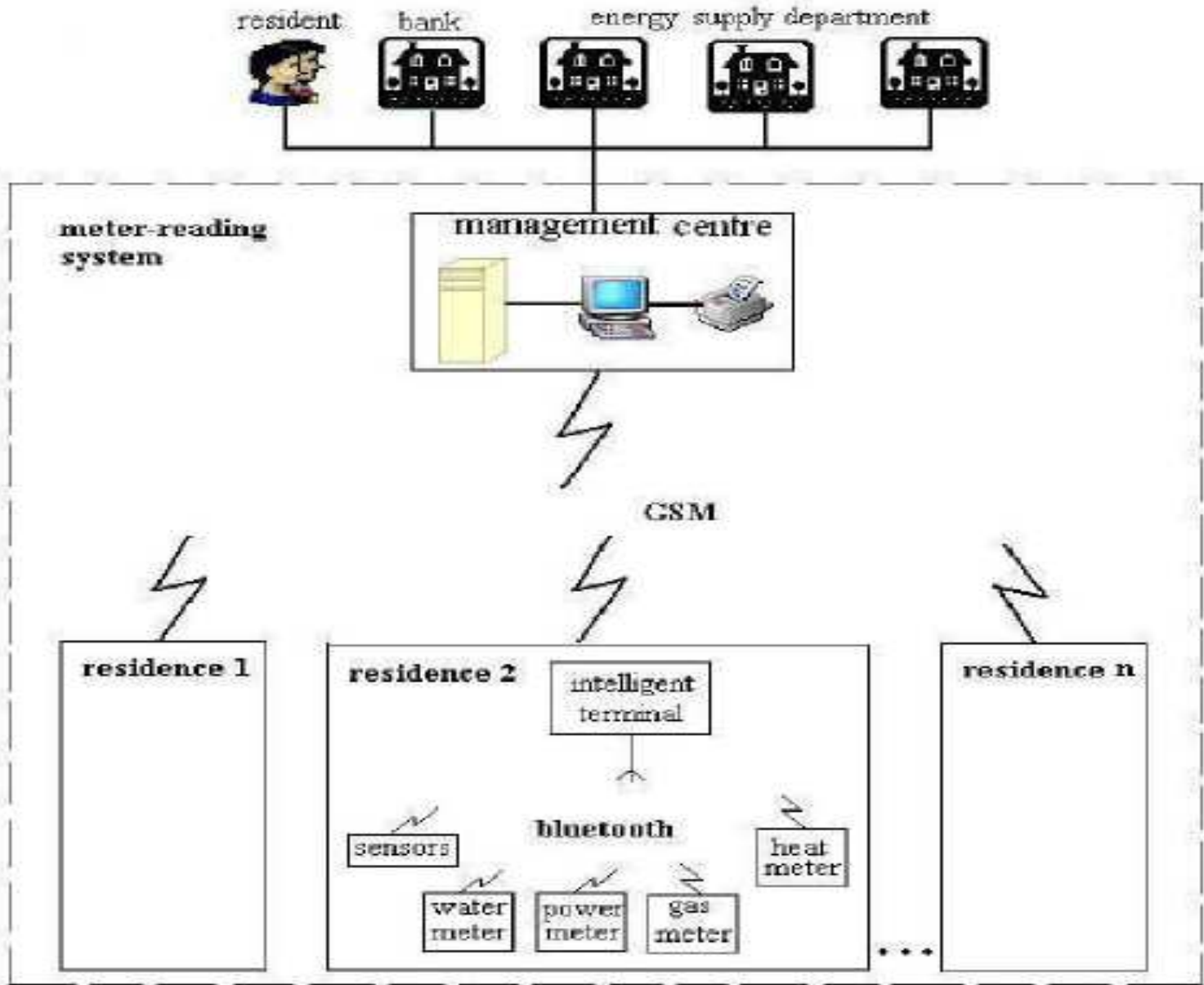


Fig.1 Structure diagram of meter-reading system



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- Consists of terminal sensors, measuring meters, *intelligent terminals*, wireless communication network and management centre.
 - The intelligent terminal is used to acquire data from meters and control the energy-consuming devices in residence.
 - The core of the intelligent terminal is composed of *ARM MPU S344BOX* and embedded operating system “*uclinux*”.
 - Communication between the intelligent terminals and management centre is through GSM.
 - The measuring meter and the intelligent terminal use bluetooth as the communication method.
 - Meter reading, bill computation and fault detection can be finished at the management centre itself.



Hardware design:



Measure meters-

- Consists of sensor circuit, transducers and mechanical measuring meters.
- New meters also include microcontrollers and digital LCD display.
- Depending on the sensor used, the mechanical data is converted to analog or digital quantities
- Data sources for the meter reading system.

Intelligent terminal-

- Consists of a central process unit, data-acquisition & storage module, wireless communication module, sensor-monitoring module, device-controlling module and display module.

1) Samsung S3C44BOX microprocessor:

32-bit ARM7TDMI RISC microprocessor (66MHz) that includes-

- Internal SRAM, LCD controller, 2-channel UART with handshake, 4-channel DMA, System manager, 5-channel timers with PWM, I/O ports, RTC, 8-channel 10-bit ADC, JIC-BUS interface, IIS-BUS interface, Sync, SIO interface and PLL for clock.
- Also includes thumb de-compressor, an on-chip ICE breaker debug support, and a 32-bit hardware multiplier. Thus, the S3C44BOX minimizes overall system costs and eliminates the need to configure additional components.

Intelligent terminal-

2) Peripherals:

The following peripherals have been connected to the microprocessor-

- AMD's AM29LV160 as FLASH memory-
address is defined from 0x0000, 0000 to 0x001f, ffff.
- Hyundai's HY57V641620 SDRAM-
required to run the embedded operating system (uclinux). Its address is defined from 0x0c00 0000 to 0x0c7f ffff.
- nRf903 as Bluetooth Wireless Communication Module-
it's a single chip multi-channel UHF transceiver that operates in the unlicensed 433MHz, 868MHz and 915MHz ISM-/LPRD bands.
nRF903 provides a standard connection of SPI interface, so it can be interfaced with MAX3232 chip easily.
- PDA160160 LCD as the display device





Fig.2 Samsung SC344B0X
ARM processor.



Fig.3 AMD AM29LV160
FLASH



Fig.4 Siemens TC35 Arduino



Communication modules-

1) **Bluetooth Wireless Communication-**

- Within a range of 20 meters, it offers outstanding features such as agility, low-cost and flexibility.
- nRf903 chip is used for bluetooth communication between meters and the intelligent terminal.

2) **GSM Wireless Communication-**

- Has very wide coverage around the world.
- The management centre and the intelligent terminals form star model network via GSM.
- The management centre broadcasts the acquisition signal and operation commands to the intelligent terminals.
- Siemens TC35 GSM module has been used for communication between intelligent terminals and the management centre.

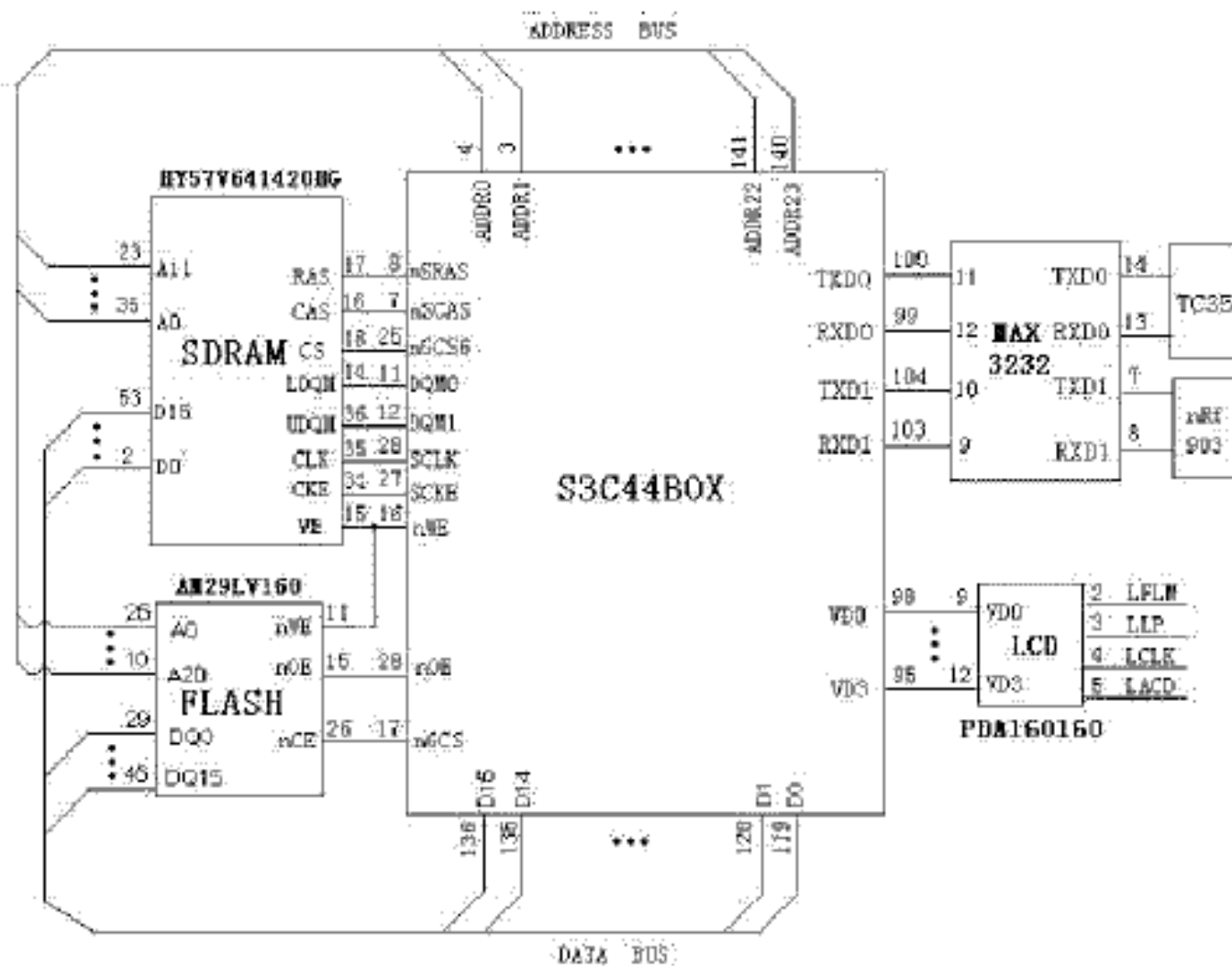


Fig.6 Block diagram of the intelligent terminal

System management:



1) **Remote Automatic Meter-reading-**

- The communication structure of management computer and the intelligent terminals is one host and multi-slave.
- Commands are sent from the management computer according to the address of the intelligent terminal. The corresponding terminal then transmits its data to the management computer.
- The management computer sends meter-reading command (asking frame) according to the address of the intelligent terminal.
- The intelligent terminal compares the address in the asking frame with its own. If there's a match, it transmits data to the management computer.

2) **Database Management-**

- SQL Server 2000 is the background database.

3) **Resident Seeking-**

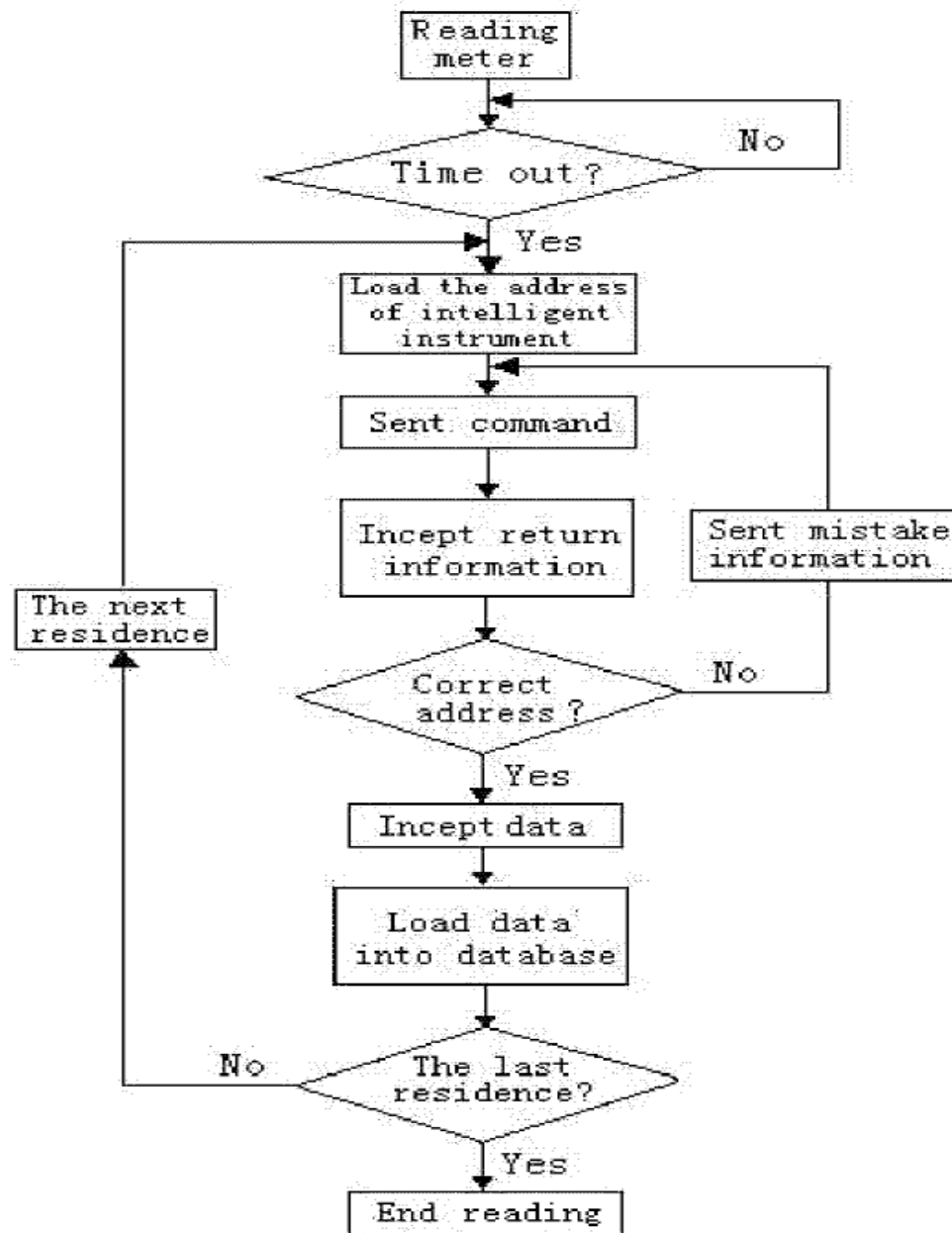
- The resident could find data about utility usage on a particular day or for any given week.

4) **Remote Monitoring-**

- Designed to control energy consuming devices at a residence.
- Data about remote monitoring and malfunction information will be recorded in the database for future reference.



Flowchart-



Actual implementation:



The AMR/AMI system-

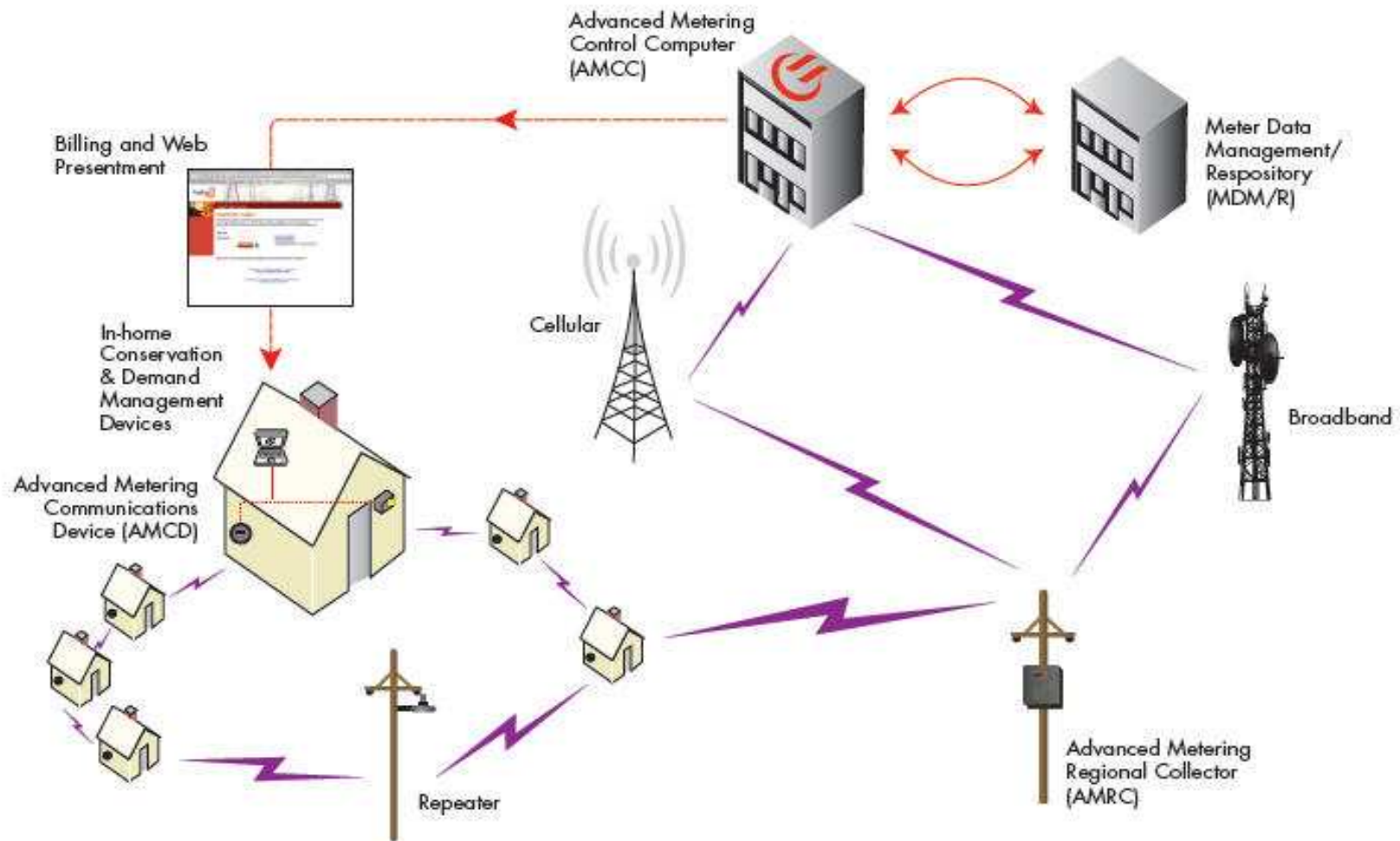


Fig.7 The AMR/AMI system structure

Conclusion-

The system has many significant excellences, such as:

- Accurate meter reading, no more estimates.
- Improved security and tamper detection for equipment.
- Energy management through profile data graphs.
- Less accrued expenditure.
- Less financial burden correcting mistakes.
- Improved billing and tracking of usage.
- Power outages may be restored faster with greater meter communication capabilities.



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3. http://www.ascentgroup.com/research/sum_mr.html

