RESEARCH SCHEME on POWER (RSOP)
Central Power Research Institute (CPRI) Bangalore)
Ministry of Power, Govt. of India

Project Title:
Development of Remote Energy Metering System towards the Estimation of Zonal Energy Consumption with AMR

1. Introduction

This project tries to bridge the following industrial needs with the developments of (i) indigenous digital meter with wireless AMR facility, (ii) Wireless Personal Communication Network (PCN) and (iii) EMS system. These are to meet up the primary requirements for modern power management.

2. Objectives of the project

Objectives of the work is to develop the following items

a)   Development of SMART Energy Meter to measure the following parameters in real time basis
         i. voltage, ii. Current, iii. Power factor, iv. Killo –Watt- Hour (KWH)
         v. Apparent Power, KW and KVAR, vi. Frequency

b)   Incorporation of Automatic Meter Reading (AMR) facility.

c)   Development of a Personal Communication Network (PCN) for centralised monitoring of the developed energy meters using its AMR facility.

d)   Development of a customised software for utility and energy management with the data base created from PCN.

3. Proposed Schematic

The schematic of proposed installation sites are shown in Fig.1. Three developed meters are to be installed at any three locations and tested its overall functioning from the department. The department is considered to be the central location.

Table: 1. EMS installation locations

Sl. No.	Proposed Installation Locations	Distance to be covered
1	Department of Applied Physics at Razabazar Science College Campus	Central Location
2	University Main Campus at College Street Building	1.5 Km (zone 1)
3	Palit Building at our departmental campus	~0.5 Km (zone 2)
4	Students Vidyasagar Hostel Building	~ 1 Km (zone 3)

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CU Tech Hall

1 km

0.5 km

Palit Building, CU

Dept of Applied Physics, Rajabazar
campus
(as central control Station)
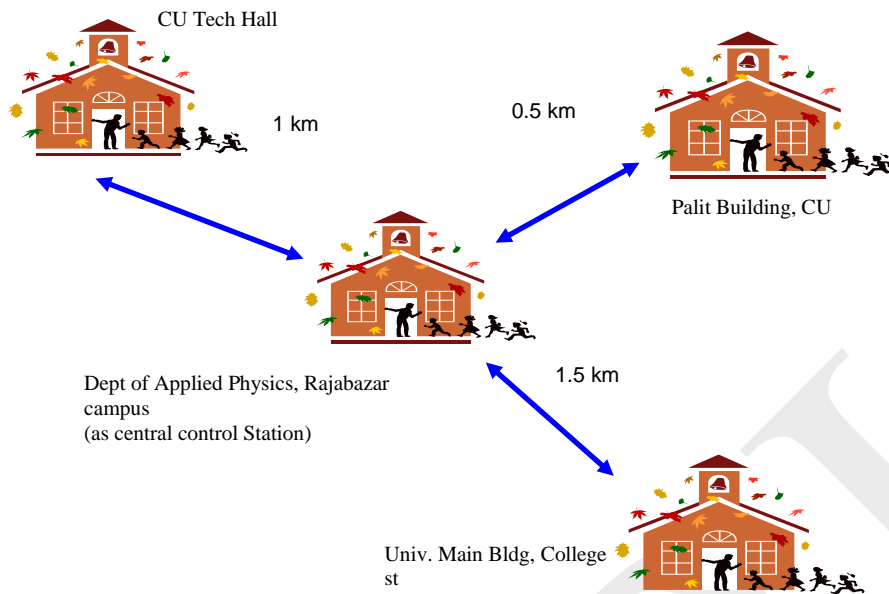
1.5 km

Univ. Main Bldg, College
st

Fig.1. Overview of the proposed system

The firmware of the micro-controller is written following our self-developed Sample Shifting Technique algorithm using basic and assembly languages. Following sections elaborates the experimental procedure as follows:

4. Outcome or deliverables

A dedicated microcontroller based digital energy meter is developed with storage features of electrical parameters like voltage, current, power factor, frequency, Watt-hour, KVA, KVAR, KW on real time basis for a specified period of time. A Zigbee wireless module at 2.4 GHz following IEEE 802.15.4 protocol is incorporated within the meter to provide AMR facility. Fig.1 to Fig.3 shows various assembly conditions of the energy meter. Sample shifting technique (SST) is utilized in its firmware to evaluate various parameters along with individual harmonic components

Fig.4 to Fig.13 shows development of the Personal Communication Network (PCN) with three remote sites and centralised monitoring system by using our developed energy meter at the respective buildings incoming bus bar.

A state-of-the-art software is to be developed for data base management and for analysis of the received stored data from the energy meter. The software will be smart enough to access different meters from different premises. The design of the software is such that it can easily be upgraded by adding more modules for the future extension in respect of the premises' numbers. Fig.15 shows a typical GUI snapshot of the developed software to keep track of the individual meters for AMR in the PCN system. **All these constitute the EMS for our University campus buildings.**

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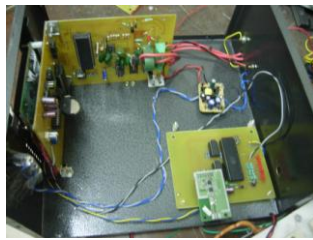**Central Power Research Institute (CPRI) Bangalore)**
Ministry of Power, Govt. of India

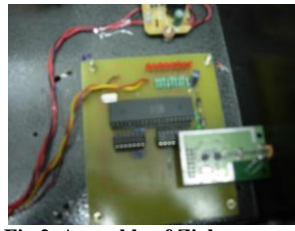**Fig.1. Assembly of Energy Meter**

Fig.2. Assembly of Zigbee Module for AMR facility
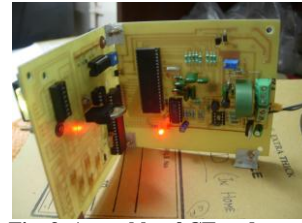

Fig. 3. Assembly of CT and processor board

Fig.4 Antenna MAST at PG Hostel

Fig.5 Antenna MAST at Palit Building Rooftop

Fig.6 Antenna MAST at Departmental Rooftop

Fig.7 Antenna MAST at CollegeStreet Campus Rooftop

Fig.8. Swich mounted in a box for 5.8 GHz to LAN converter

Fig.9 EM Installed at Departmental incomer

Fig.10 Meter Installed at Palit building's incomer

Fig.11 Meter Installed at PG Hall's (men) incomer

Fig.12 Meter Installed at College street Campus's incomer

Fig. 13. Server based System at department laboratory

Fig.15. Software snapshot for Server based Software

Fig. 14 Testing of EM Assembly with R-L Load