Meter Data Acquisition System

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Abstract— Meter data acquisition is critical to determining consumption and baseline data. However, as the meters can be geographically dispersed over a large area, meter communication infrastructure is a core part of this total system.CMS provides MDAS with a comprehensive communication infrastructure for data acquisition from various meters. The options for the communication infrastructure are GPRS, CDMA or PSTN. CMS provides the entire suite of products (modems, gateways, data concentrators, front-end processors, etc) for acquiring the data from various meters. MDAS is to acquire meter data from meters within the distribution system and consumer meters for: System performance monitoring and decision support. Monitoring and collecting data of consumer energy usage, billing, CRM, tamper, outage detection and notification. Monitoring energy flows in the energy supply chain to provide information for energy auditing.

Reeling under an average AT & C losses of around 33%, it is quite impossible for power distribution sector to keep up the desired economic pace without major reforms in the Power sector, especially in Distribution. System Integrator has been working closely in Power distribution sector to address AT & C loss reduction, bring transparency, improve customer satisfaction and increase employee productivity through right convergence of IT & Automation. Technology innovation can only benefit the sector and system integration has major role to play in empowering the power distribution utilities. There is a huge need for specialized, customized and upgraded system solution for the power sector and System Integration Power solutions can help utilities to make a significant leap in Field Automation and reducing their Aggregate Technical and Commercial losses. The objective of Meter Data Acquisition Solution Provider is to collect meter data of DT and consumer meters at desired frequencies remotely and make available for DISCOM operations.

Keywords: Data Concentrator Unit (DCU), Meter Data Acquisition Solution (MDAS), Automatic Meter Reading (AMR), Common Automatic Meter Reading (CAMR).

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I. INTRODUCTION

Meter data acquisition is critical to determine consumption and baseline data. However, the meters are geographically dispersed and meter communication infrastructure is the core. Inesh provides MDAS with a comprehensive communication infrastructure for data acquisition from various brands of Single Phase and Three Phase meters.

Meter data acquisition system, supply necessary hardware, software and communication equipment in the Substations, DTs and select consumers in the towns for the purpose of centralized meter data logging. The substation Data logger PC will acquire data from Feeder Meters and will transmit the same to Sub division office server through a GSM/CDMA Modem, whereas the Sub division office Data Acquisition server will acquire data directly from all Distribution Transformers.

II. LITERATURE SURVEY

Neeraj A. Kulkarni, S.O. Dahad (2007) Intelligent **Portable Data Acquisition System with Predictive Features:** Day by day advancement of technology advances the industry and agricultural field. So continuous monitoring is required in industry and agricultural field. Monitoring established in many ways. Data acquisition does monitoring easily. Data acquisition unit mentioned in this paper have sensor circuitry.

This sensor circuitry connected to AVR ATMEL microcontroller. AVR ATMEL microcontroller is main processing unit in this project. This microcontroller sends sensors value to android mobile. Android mobile application which is designed in ECLIPSE software. Android mobile transfers the data to the server and to the client module which is designed in NETBEANS software. Client module controls the devices which are connected to microcontroller. Client module can remotely switch ON and OFF devices. In the field of industry, agriculture continuous monitoring of farm and industry is important in today's scenario. So that system is require which monitors the farm and industry and transfers the monitored data to remote location. The objective is that to design such data acquisition system. Enhancement of technology, researchers desire to obtain their sensor data faster and to make remotely data available over longer distance Data acquisition is defined as the process of taking a real world signal as input, forward to the computer, for further processing, analysis, and storage. Component of data acquisition system includes sensors that convert physical parameter to electrical signals, signals conditioning circuitry to convert sensor signals into a form that can be converted to digital values, and analog to digital convertor, which convert conditioned sensor signal to digital values. Data acquisition system is controlled by software programs developed by programming language JAVA in eclipse and NETBEANS

software. So the main that to design complete hardware and software section for remotely data acquisition and remotely controlling using software which are mentioned above. "Predictive features" involves in this paper, software takes the further decision by applying ID3 algorithms on the database which are available on server. [3]

Poonam Sharma (2013) **Meter Data Acquisition System in Power Utilities:** The project envisages to implement Automatic meter-reading of various makes of energy meters installed in the 33/11 KV Sub-stations using the Data Concentrator Unit (DCU). The meter data from these Substation feeder meters shall be transferred to Centralized Data base server. This Module collects data from network of metering device installed at incoming & outgoing feeders with in substation. The NG-9601 device is a reliable & consistency solution for processing data from the metering device using Modbus communication protocols. It can handle different interfaces developed on the single FPGA chip which allows data processing in real time. [2]

Apurva J. Mane1 (2016), Review on Interactive Embedded Data Acquisition System for Real Time Application

In 1963 IBM produced computers which specialized in data acquisition system. Firstly they produce IBM 7770 DAQ system and than their higher version which is IBM 1800 data acquisition and control system. These are very expensive data acquisition system. Their improved version launched in 1974 by techmar / scientific solution named as S 100 computers and data acquisition card. In 1981 first data acquisition pc introduced by IBM personnel computer and scientific solution. After that various processor are used for the data acquisition and transmission of data to a longer distance. Various microcontrollers are used for the data acquisition and transmission. RS 232 cable is used for interfacing between microcontroller and personnel computer. In 1998 Edwards uses a system which has 2 PC 104 which are connected to central monitoring system. This system was designed for analysis and monitoring potential failure of a design in field condition. In 2001 Adcock et al. use a microcontroller ad RF modem to transmit data back to PC. Their system was designed to replace traditional data acquisition system used in wind tunnel. In 2002 hamels used a PIC controller and RF transmitter to collect data. This system have sensor network which are used in TDMA technique. In 2003 lohachit describes system that uses RF modem to collect water quality data from a remotely controlled boat. These systems collect water from depth. In 2009 paper is published in world academy of science which uses microcontroller and LABVIEW software for totally integrated smart energy system. In 2009 Ali Ziya Alkar and Mehmat aatif karaca explain the embedded DAQ system communicates with GPRS

which accessible through web. In 2011 manivannan M and kumaresan explains design of data acquisition system using ARM 9 platform in a published paper to ICETECT. [4]

III. IMPLEMENTATION

An MDAS implementation commences with the installation and connection of modems to various makes of Energy meters in the field across an entire state. The modem has to be configured with the appropriate parameters (baud rate, make of meter, network service provider (NSP) access point name (APN), etc.). It must be installed with the right communication cables for the different makes of meters. Meter data should be successfully polled to a back-end compatible application at central data centre (CDC) over a GPRS network. That data should be sent at regular intervals, i.e. hourly or daily, based on requirements.
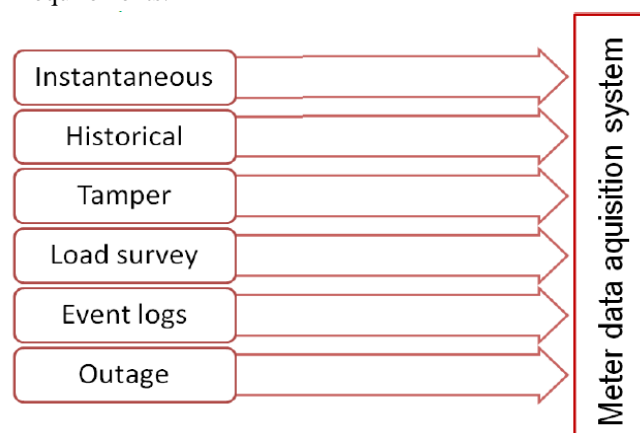

Figure3.1 Meter Data Acquisition System

Meter data acquisition is critical to determining consumption and baseline data. However, as the meters can be geographically dispersed over a large area, meter communication infrastructure is a core part of this total system.CMS provides MDAS with a comprehensive communication infrastructure for data acquisition from various meters. The Scope of Meter Data Acquisition Solution Provider is to collect meter data of DT and consumer meters at desired frequencies remotely and make available for DISCOM operations. This Scope is achieved by supply, installation and commissioning of Common Automatic Meter Reading (CAMR) units with GSM/ GPRS modems at remote meter terminals of identified HT/LT consumer locations and the Distribution Transformer locations. These units will collect the data from the meter units and send to the central data center in the predefined format at regular intervals. Meter data received will be processed for

➢ Billing data extraction
➢ Analysis of metering healthiness
➢ Analysis of system conditions such as

The scope also includes maintenance of remote CAMR units in case of non response up to a period of 5 years. The Intervals

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for meter data acquisition is programmable for each blocks of data. The default times are as below:

Instantaneous	15 Minutes
Historical	Once in 10 days
Tamper	On Occurrence
Load Survey	Daily
Event Logs	Daily
Outage	after Power resumed

Table3.1 Intervals for meter data acquisition

The collected power consumption reading is sent to the central billing server where it is stored. Many commercial servers as well as management software are available in the market. However the cost of such server and software management system are very expensive. To decrease the cost of the proposed AMR system, in-house software is developed using ASP.net and is used to control the central server. The implemented meter data management system will have the following functions:

a) Remote metering: The meter reading is sent automatically to the server and customers can remotely get their consumption at any time.

b) Bill issuing: The billing system shall provide monthly bill for customer who does not remotely access the server.

c) Customer tracking: The billing should include better customer tracking, bill forwarding, identification of customer financial accounts information, and use of monetary deposits for account closing requirements.

d) Apply different tariff for different customers: Houses, schools, factories are treated different and the bill should be calculated according to the corresponding tariff assigned by electricity authority in Bahrain.

IV. DISCUSSION AND RESULT

Initially the focus was on bringing about structural changes like unbundling of the state electricity boards and the creation of independent generation, transmission and distribution companies. Subsequently, power generation became the focus. However, in the recent past, it has been felt that power distribution is the weakest link in the entire value chain, and that sustainable development and economic viability of the power sector is not possible unless electricity distribution issues are resolved. With these objectives in mind, India's national Ministry of Power launched the Restructured Accelerated Power Development and Reform. The Thesis essentially covers the application of information technology in distribution utilities across the country. The scheme involves implementation of:

• GIS-based consumer indexing and asset mapping
• Meter data acquisition system (MDAS) for distribution transformers and feeders
• Establishment of baseline data
• IT applications to run business processes that address consumer and integrate meter reading, billing and collection. This entire exercise is aimed at establishing baseline data and a data collection system for the distribution utilities to capture aggregated technical and commercial losses (AT&C) in a precise manner without manual intervention and also to plan and implement corrective measures in Part B.

Further, distribution utilities have to work with their respective regulatory commissions to ensure that a part of the financial benefits arising from AT&C loss reduction are passed on to the consumers within the area. The main focus:
• Adopting a systematic approach for information management
• Reducing AT&C loss to 15% Decreasing power outages and interruption in supply Improving quality and reliability of power availability improving consumer satisfaction.

MDAS is a key module of the R-APDRP. It comprises automatic meter reading of distribution transformers, feeders at substations and consumers in order to provide meter data for further accounting of AT&C losses in the areas. For solving the interoperability issue of different model of Meters installed presently in different utilities, Utility is responsible for providing meter protocol and memory map of the meters installed in their area. The proposed Data Logging system is expected to provide continuous on line monitoring and logging There are the following parameters in respect of all incoming and outgoing feeders, Distribution Transformers and consumers on real time basis : -
a) Voltage, Phase to Phase and Phase to Neutral
b) Current on each phase
c) Power factor
d) Frequency
e) Power - Active / reactive / Apparent
f) Energy – Active, Reactive and Apparent

The proposed system is expected to provide continuous on line monitoring and logging of above mentioned parameters and capability to generate Spread Sheets and MIS report as below:
a) Nameplate Data
b) Instantaneous Data
c) Billing Data
d) TOD Data.
e) Load Profile.
f) Load Survey
g) Tampers.
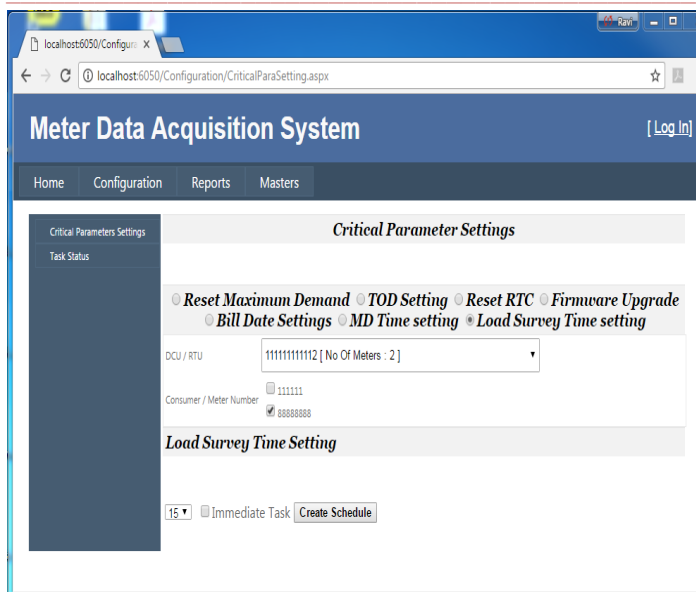e) Power On/Off and Events
f) Specific Parameters Data

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Figure 4.1 Critical Parameter Setting

V. CONCLUSION

Meter Data Acquisition System envisages implementing Automatic meter-reading of various makes of energy meters installed in Sub-stations using the Data Concentrator Unit (DCU). The meter data from these Substation feeder meters shall be transferred to Centralized Data base server. This Module collects data from network of metering device installed at incoming & outgoing feeders with in substation. The NG-9601 device is a reliable & consistency solution for processing data from the metering device using Modbus communication protocols. It can handle different interfaces developed on the single FPGA chip which allows data processing in real time.

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VI. FUTURE SCOPES

As per a report, India's power consumption which is currently at 600TWh annually is set to double by 2020. And, when it does so, India would have surpassed Russia. While there is no denying the fact that India would need more installed power generation capacity, we at Stelmec view this from a more holistic point of view. To meet this new demand, India will have to act equally very strongly and bring in strong reforms on the transmission & distribution (T&D) aspect of electricity as well. The current set of problems that India faces in the T&D are:

(1).Losses due to pilferage & theft of electricity

(2).Weak and inadequate sub-transmission and distribution systems

(3).Large scale rural electrification programs involving low tension lines

(4).Inadequate investment in upgrading and maintenance.

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