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Intelligent Automation System of Power Distribution System

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Abstract—*In the present power scenario of India, the biggest goal is to provide quality power to the customers and to minimize the loss i.e AT& C loss (Aggregate Technical and commercial Loss) to make the power sector economically strong. But this is a herculean task to find out the points where the loss is more and where is less because the area of jurisdiction is very scattered. The solution to this problem is proper Energy Accounting which will help to pinpoint the loss making pockets and if the pockets get identified the remedial action can be taken in the heavy loss making pockets.*

In APDCL, we have selected DTR (Distribution Transformers) as our target node and set the objective to generate proper DTRwise Energy Audit to identify the loss making points and that Energy Audit should be generated automatically without any kind of human intervention. Luckily a project was started by GOI "R-APDRP" which had targeted to identify the loss of power distribution system and then minimize the loss and under this project 67 Towns of Assam had been selected. GOA also selected 5 more towns for this loss-reduction project.

So to find out the loss making points i.e DTRs, meters have been installed in every DTRs and to capture the data available in the meter AMR system have been introduced. In all DTR meters and meters at HT consumer premises, intelligent Modem have been connected which has the capability to capture whatever data available in the meter and send it to a central system via GPRS connectivity. The modems are termed as intelligent as it can store data even at the time of GPRS failure in its inbuilt memory card and send the data whenever gets the GPRS signal, as a result the possibility of data-loss is very minimum and hence reliability factor is very high. The Modem collects mainly 5 types of data in a meter --- instantaneous, History, Tamper, Load survey and midnight data and sends those data to our metering server at Six Mile data centre in a fixed interval. The communication link between remote AMR devices and the Data Acquisition servers at Data Centre is established over a secure VPN protocol.

Already we get success to generate DTRwise Energy Audit in Nos. of towns based on the Energy data received from meters via Modems and can pinpoint the loss making pockets and APDCL management has already started to take remedial action. Another major achievement that we are getting is that we are able to monitor the High valued consumer closely via this MDAS (Meter Data Acquisition System) and thereby can reduce the power theft happened in many industries which helps our company to become profitable. Moreover, the load-survey graph etc helps the field engineers tremendously.

1. RESEARCH PAPER ON

Intelligent Automation system of Power Distribution system

Automation of Metering system through MDAS & MDMS

In the present power scenario of India, the biggest goal is to provide quality power to the customers and to minimize the loss to make the power sector economically strong. The Distribution loss can be better termed as AT& C Loss (Aggregate Technical and commercial Loss) which means the loss has 2 components Technical & Commercial Loss. This AT & C Loss is very high in almost all the parts of India (25.83% in 2012-13 as per pfcindia.com) and in Assam this loss is 30.04% in the FY 2014-15. As a result the development in the power sector gets hampered and the customers are also deprived of quality power supply. But this is a herculean task to find out the points where the loss is more and where is less because the area of jurisdiction is very scattered. The solution to this problem is proper Energy Accounting which will help to pinpoint the loss making pockets and if the pockets get identified the remedial action can be taken in the heavy loss making pockets.

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termed as intelligent as it can store data even at the time of GPRS failure in its inbuilt memory card and send the data whenever gets the GPRS signal, as a result the possibility of data-loss is very minimum and hence reliability factor is very high. The Modem collects mainly 5 types of data in a meter --- instantaneous, History, Tamper, Load survey and midnight data and sends those data to our metering server at Six Mile data centre in a fixed interval. The communication link between remote AMR devices and the Data Acquisition servers at Data Centre is established over a secure VPN protocol. This is achieved by using a M2M Gateway which acts as a VPN server at the Data Centre and authenticates valid configured AMR devices. This creates a transparent path for the central servers to poll live data from the field, whenever required.

The Basic Technology used is

- Intelligent GPRS Modem will poll the local energy meter and store data in a file.
- This file will then be pushed to allocated Data Acquisition servers at the Data Centre through M2M Gateway using FTP protocol.
- The Data Acquisition servers can also poll 'on-demand' live data from these locations, if required.
- The Intelligent GPRS Modems will be synchronized in time with central NTP server.

The Communication technology that we are using

The Meter data communication to the CDCS would be GPRS based.

Communication system should meet following requirements:-

i. All communication between Intelligent Modem and CDCS should be through operator independent secured Virtual Private Network (VPN) tunnel which shall be managed centrally between each Intelligent Modem and the CDCS.

ii. Transfer of data from Intelligent Modem to CDCS should be on TCP/IP over GPRS with dynamic/Virtual IP at GPRS device at Intelligent Modem and static/public IP at CDCS.

iii. For communication with CDCS, each Intelligent Modem shall transfer the data to CDCS using TCP socket communication as well as FTP. In both cases there shall be no requirement to assign static IPs to the GPRS Modems.

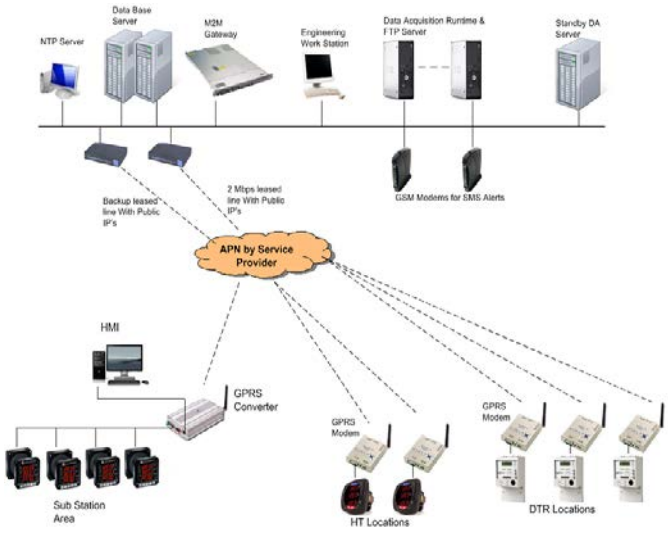
iv. A fixed public IP shall be provided for the internet landing point at CDCS.

v. The GPRS Intelligent Modem should be able to run the Meter protocol driver locally to read each type of meter and transfer the data over the secure VPN channel in readable format to the Control Centre

vi. Intelligent Modem should be Dual Band capable of operating at 900 and 1800 MHz Modem should support both Data and SMS transmission.

vii. The Intelligent Modem shall have internal power backup through battery or super-capacitor so that it can report power outage and restoration as an event.

Architecture of the system



What APDCL is achieving

- Already we have been successful in generating the DTR wise Energy Audits in most of the towns from the system itself based on the Energy data received from meters via Modems and billing data from the billing database and can pinpoint the loss making pockets . As the Loss making points are being identified so it becomes easier for APDCL management to take corrective action as per these Energy Audit Reports.
- Another major achievement that we are getting is that we are able to monitor the High valued consumer closely via this MDAS (Meter Data Acquisition System) and thereby can take preventive action against the theft-prone Industries/areas. This helps to reduce the power theft happened in many industries to a great extent.
- The Billing of the High Valued consumers are now prepared based on the energy data received without any human intervention via AMR system through the Modems connected in the meters and hence the bills are more accurate and prepared in proper time. This has benefitted APDCL financially as e-bills are made available to the consumers instantly and the cost involved in printing and delivery of the bills has been minimized.

- Through the system, various MIS reports can be generated for planning & monitoring, which helps APDCL Management to take quick decisions and hence to take corrective actions, wherever necessary.
- The tamper events occurred in any HT customers are recorded in this system and this will be sent to the concerned APDCL officers via SMS and also through E-Mail. Hence APDCL Officers can closely monitor the tampers and any other activities happened in the High valued customers in real-time.

Benefit to the society

- I am serving my organization APDCL to reduce the loss through a full-proof reliable AMR system. If APDCL can become a profit-making organization after successful implementation of this system then the normal public will be benefitted as they will get quality power and possibly in a lower tariff in the long run.
- As we are able to keep a close eye on the high-valued customer through the AMR system, the power-theft as well as Loss is getting reduced. So a huge quantity of Electricity may be saved which will help to provide Electricity to some additional house-holds and this will eventually help in achieving 24x7 quality and reliable power.
- The monitoring of Distribution parameter via AMR system helps to provide better service to the customers. E.g from AMR system we can remotely find out the unbalanced Distribution Transformers and field officers can take corrective action for balancing them. This will help in eliminating the excess stress on the distribution system and the quality of the supply will be improved.
- The Distribution Network planning can also be done through the AMR system and hence installation of new DTR, new feeder, new sub-station etc can be done in load-centre which will be beneficial to the public.

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