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Intelligent metering solution for water management

Introduction:

World has reached to a point where first time we find that more population is now living in urban areas than rural & as per estimates by next 30 years 70% of world population shall be living in cities. This exponential growth in urban population has put lot of pressure on available resources. In order to accommodate this in a sustainable way, we need to manage the resources in an efficient & intelligent way so as to maintain quality of life for the urban population.

One of the most important resource for sustainability of life in a city is Water & especially the potable water. Water is a finite resource on earth, No new water can be created & in order to withstand the burgeoning urban population it is important to manage this resource efficiently & intelligently. Over the years this factual understanding of the situation has led to the focus of utilities towards sustainable approach to urban water management.

The utilities are trying to cope up with following challenges: Covering cost of production & distribution, updating old infrastructure in order to meet customer demands for equity in billing, bringing down NRW by containing the transmission losses for the clean water. Slowly the role of water service providers is evolving from just supply orientation as provider of water towards more sustainable urban water management by adopting various demand & supply management strategies. The various measures being undertaken by water service providers are Water Metering, water accounting & leakage management, accurate billing & education of consumers. However to meet these objectives it is important that water network data from the field is available accurately, reliably & at desired frequency so that meaningful analysis of this data can be made leading to developing & effective implementation of strategies for Smart & efficient water network management. The recent development in the field of electronics and communication has made it possible for the field devices such as water meters to not only perform their basic function of water metering but also providing useful data remotely which can help asset management check theft & leakages in the water network & also provide more comprehensive consumption data to consumers so as to transform their consumption behavior. The smart water meters has great potential of transforming the urban water management. The focus of this paper is on the role of Smart water meters in achieving the above goals of improving customer service with accurate billing and demand- supply management, containing water loss by effectively managing leakages & pilferage, consumer awareness & education for avoiding wastage of clean water. In different sections of this paper we shall discuss Need for water metering, history of water meters, different water meter technologies. Advent, capabilities & rationale for deployment of Smart water meters & finally we conclude by outlining future challenges & opportunities for smart water metering.

Need for Water Metering:

While 70% of earth is covered with water, fresh water is only 2.5% of it & only 1% of fresh water is easily accessible. This is a finite resource. Over the years in urban areas per capita consumption of water is increasing whereas sources of this precious resources are gradually depleting thereby widening the gap between demand & supply. Water metering can help planning water network to ensure equitable & educate supply to all consumers at first place.

Further utilities or the water providing organizations are struggling with financial sustenance & thereby resulting in shortage of manpower to effectively & efficiently maintain the aging water networks. Smart water metering techniques can help utilities in not only increase their revenue by providing accurate & reliable measurement of consumption but can also assist in developing strategies to cut down on NRW by bringing down water loss due to leakages & pilferages. This is possible by having real time data analysis & self- diagnostic capabilities for asset management. Smart water metering can also help modifying the consumption behavior of consumers as well as educating the consumer for using this scarce resource effectively by priding consumption trends. Electricity metering has shown that by providing effective consumption trends, it has been possible to bring down the consumption by 5-10%. Water metering essentially offers the opportunity to improve the balance between providing access to potable water, a utility's right to receive payment for services rendered, and the joint responsibility of all to preserve scarce water resources.

History of Water Metering:

Water metering story began in early nineteenth century & gradually expanded with growth in urbanization & industrialization. The water metering technologies have evolved over the years to meet the changing needs of the time for data on water consumptions as well as reliability of data & longevity of the meters in operation so as to reduce life cycle costs & costs associated with overall water network management.

In earlier days water was not metered however evolution started with imposition of flat usage fee in proportion to size of property. Slowly the importance of consumption based charges was understood & this led to faster technological advancement in water metering technologies. All the available metering technologies historically as well presently can be broadly classified in two types: Velocity based or displacement based meters. The oldest documented meter was based upon displacement principal, known as Worthington duplex piston meter. Later on mechanical meters based upon velocity measurement such as Turbine, multi-jet, turbine meters with magnetic pick up came into picture. However these technologies were fraught with problems of wear & tear over a period of time. Variation in reading due to ageing & over reading due to presence of air. This resulted in evolution of technologies which were though based upon velocity measurement, however overcome the problem associated with mechanical meters by exploiting electrical & acoustics properties without involving any physical obstruction in the flow path. This led to the modern day meters called electromagnetic & ultrasonic flow meters. Both technologies provide highly accurate measurement over a wide range & reduced maintenance requirement over lifecycle due to absence of any moving part.

With advancement in electronics & communication it became feasible to build intelligence into the water meters so as to make them capable of self-diagnostics as well as data recording remote data transmission on telemetry. Past decade has seen advent of intelligent meters on these lines which has helped in evolving AMR (automatic meter reading), AMI Advance metering infrastructure) & IOT (Internet of things) for water network management.

Capabilities & Rationale for deploying smart meters:

The smart water meter are being designed to address present day challenges & to meet future needs. The meters is expected to have following capabilities

1. Accurate metering throughout its life span
2. In operation self verification to ensure icreased availability of metering assets during its life cycle.
3. Self diagnostic capabilities for effective asset mangement & preventive maintenance.
4. Capabilities of measuring very low flow down to 0.4l/s so as to help in detecting the leaks.
5. Capability to log flow data so as to give near real time data for service providers to effectively manage the network & also to plan investment on water network infrastructure. On board logging assures data integrity by eliminationg human intervention & manipulation as well as data redundancy.
6. Capability of remote bidirectional communication thru various wireless transmission techniques so as to support intiatives such as AMR ,AMI & IOT for smart water network management.
7. The power neutral design to cater to all segment of network so that non availability of conventional power does not impact the measurement or data transmission.The meter should be able to work on conventional as non conventional sources of power such as battery,solar, & wind powered meters.

Internationally, many jurisdictions are pushing ahead with large-scale roll-outs of intelligent meters following small-scale trials, typically rationalised in terms of remote access benefits e.g., reduced labour costs for meter reading, reduced health and safety risks from hard-to-access meter installations and enabling improvements to network efficiency. Studies in countries such as Australia has shown that after deploying the intelligent meters, there has been reduction in water loss due to leakages to the tune of 10%.

Utilities stand to benefit from enhanced water meter data for a two key reasons. Firstly, it provides the necessary security of supply through demand-side management when confronted by seasonal variations in rainfall, and secondly, it provides a mechanism to defer capital investments through demand reduction mechanisms.This should help developing pricing strategies such as scarcity based pricing so as to leverage out price elsticity of demand so as to propagate concious effort to conserve this scarce resource. Some experince across the world has shown that doubling the price of water has resulted in consupcion by almost 30% provided this is recognisable part of consumer income. Higher resolution of advance meters can help utilities to identify & reduce water losses in the network & managing low level leaks which hithertoo were not possible to detect & has significant potential to reduce the NRW. The high relotion time & date stamped data received by utilities from intelligent meter should help utilities to understand consumption pattern so that they can devise efficient demand management programmes. It shall also help utilities in demand forecasting & itegrated resource planning. It also helps reducing operational cost of utilities which are already facing accute financial sustenance issues by bringing down the speed of response and manhours required to attend complaint therey bringing more efficiency in the netwrok management.

Challenges:

The main technological challenge is lack of industry standard for data transfer making it very difficult for network operator to manage these intelligent resources on central system as different manufacturers have different protocols for data transmissions & outcome of which user becomes dependent on particular manufacturer for maintaining central data & different components in the network also leads to plethora of different application softwares making it difficult to implement integrated water network management. Need of the hour is to formalize water industry telemetry standards so as to safeguard the interest of users enabling them to use the meter of their choice & also enable them for easy replacement in case of inefficient performance & inadequate quality of the meter originally bought by him.

Across the water industry it is important to define the basic performance standards of intelligent meters so as to meet the desired aspirations of the consumers & utilities. Most of the times the utilities do not have required competencies to draft their requirement & end up buying meters which may not suffice the idea of intelligent metering & huge investment in developing smart network goes into drain.

Intelligent metering also require enhancement of technical capabilities of by means of education & training. Especially the maintenance staff. In many cases it has been observed that lack of competencies leads to hinderence in adapting new technologies.

Conclusion:

While there appears to be many incentives to go for intelligent metering, however it needs to be understood that it is one of the steps & not the only step required to establish a smart urban water network management programme. The technology has good potential to serve the industry as well as the consumer however blind use of technology can be a drain on already cash strapped utilities. Need of the hour is to understand the available technologies & approach holistically towards adopting the intelligent metering so that real benefits out of its deployment can be realized.

This also provide some incentives to technology providers who can not only get some business out of this but it can also open up new demand for products based upon analysis of consumption behaviour of the consumer.

With this discussion, it can be concluded that intelligent metering shall have a larger role to play in near future & demand such metering technologies is bound to grow. However the technology provider should strive for developing products which focus on the needs of both consumers & utilities & provide equitable benefits to the both. Then only the real benefits of intelligent metering shall get established.