iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** IV **Month of publication:** April 2024

DOI: https://doi.org/10.22214/ijraset.2024.60895

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

A Study Article of DLMS to IOT Protocol

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Abstract: ***The DLMS (Device Language Message Specification) protocol plays a crucial role in energy metering and management. It provides a standardized communication framework for exchanging data between utility meters and data collection devices. The protocol enables interoperability, remote meter reading, and supports efficient management of energy consumption, billing, and grid operations. The DLMS protocol is essential for Internet of Things (IoT) applications as it provides a standardized method for communication between Internet of Things devices and energy meters. This facilitates the seamless integration of energy data into IoT platforms, enabling efficient monitoring, analysis, and management of energy consumption in smart grid and smart city deployments. To this end, we have developed a prototype DLMS to IoT gateway that is based on either STM32 or any other IoT module. However, we encountered a challenge in testing the prototype since we couldn't get any digital meter to conduct hands-on testing..***

Keywords: Device Language Message Specification protocol, Energy Management, Data Mapping, Internet of Things Integration, Smart metering

I. INTRODUCTION

In the realm of energy management and smart metering, the convergence of DLMS (Device Language Message Specification) with Internet of Things gateways heralds a transformative era. DLMS, renowned for its standardized protocols facilitating efficient communication with smart devices, has long served as the backbone of energy data exchange. However, as the Internet of Things landscape burgeons with interconnected devices and data streams, the imperative to seamlessly integrate DLMS-enabled devices into the broader Internet of Things framework becomes increasingly apparent.

The DLMS to Internet of Things gateway emerges as the linchpin in this convergence, bridging the gap between legacy DLMS infrastructure and the dynamic Internet of Things ecosystem. By acting as a conduit for data exchange, this gateway empowers stakeholders to harness the collective intelligence of DLMS-enabled devices within Internet of Things platforms, thereby unlocking a wealth of opportunities for real-time monitoring, analytics, and control. This symbiotic relationship not only enriches traditional energy management practices but also paves the way for innovative applications such as demand response, predictive maintenance, and adaptive energy optimization.

Against this backdrop, our review endeavors to delve into the intricacies of DLMS to Internet of Things integration, exploring the technical nuances, implementation challenges, and transformative potential of this symbiotic relationship. Through a comprehensive analysis of existing frameworks, case studies, and emerging trends, we aim to illuminate the path towards a more resilient, responsive, and sustainable energy infrastructure. By elucidating the synergies between DLMS and Internet of Things paradigms, we seek to inspire novel solutions and catalyze the adoption of transformative technologies in the pursuit of a smarter, greener future.

II. TYPES OF METERS

Metering in electrical refers to the measurement of electrical energy consumption, typically in terms of kilowatt-hours (kWh), for residential, commercial, and industrial purposes. Electrical meters are devices used to measure the amount of electricity consumed by a customer or a specific electrical circuit over a given period of time. These meters play a crucial role in billing customers accurately for their electricity usage. In Meter we have single phase Energy meter and three phase energy meter. If we consider single phase energy meter that is use in domestic appliances it can use directly in Residence because it has Low current requirement and we can connect directly to the load. Now if we consider Three phase energy meter that we can’t able to connect directly with load because it has higher current Requirement and it may damage meter. So meter connects to the load though a step down transformer. At that time we use Current Transformer

There are various types of electrical meters used for different purposes:

1) *Analog Meters*: These are traditional meters with a rotating disc or dial that displays energy consumption. Analog meters are gradually being replaced by digital meters due to their lower accuracy and inability to provide detailed data.

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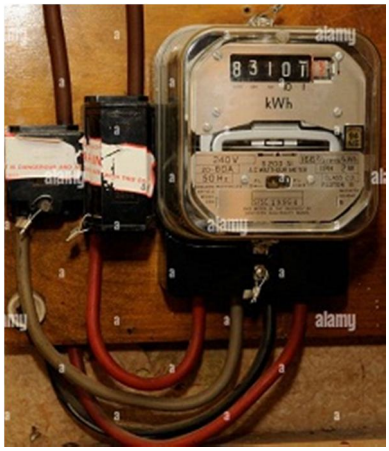

Fig 1.0 Analog Meter

2) *Digital Meters:* Digital meters use electronic displays to show energy consumption. They offer higher accuracy and can provide additional information such as real-time usage, peak demand, and historical data. Digital meters are becoming increasingly common in modern electrical systems.

Fig 1.1 Digital Meter

3) *Smart Meters:* Smart meters are advanced digital meters equipped with communication capabilities, allowing two-way communication between the utility provider and the meter. They can transmit data remotely, eliminating the need for manual meter readings. Smart meters enable features like time-of-use pricing, remote disconnect/reconnect, and real-time monitoring of energy consumption.

Fig 1.2 Smart Meter

4) *Prepaid Meters:* Prepaid meters require customers to pay for electricity upfront, similar to how prepaid mobile phone plans work. Customers purchase credit in advance, which is then deducted as they use electricity. Prepaid meters help in managing energy costs and avoiding unexpected bills.

Fig 1.3 Prepaid meter

5) Sub-Meters: Sub-meters are additional meters installed downstream from the main utility meter to measure electricity usage in specific areas or individual appliances within a building. They are commonly used in multi-tenant buildings, commercial properties, and industrial facilities to allocate energy costs accurately.
6) Revenue Meters: Revenue meters are highly accurate meters used by utility providers to measure energy consumption for billing purposes. They are subjected to strict regulatory standards to ensure accuracy and reliability in billing customers.

These are some of the common types of electrical meters used for metering electricity consumption. The choice of meter depends on factors such as the application, accuracy requirements, communication capabilities, and regulatory standards.

III. DIFFERENCE BETWEEN ANALOG METER AND DIGITAL METER

Comparison of Smart Meter and Conventional Meter

	Smart Meter	Conventional Meter
Display	Digital meter with numerical display	Analog meter with spinning dials
Measure	How much and when electricity is used (typically hourly with date and time stamp)	How much electricity is used over a billing period (typically one or two months)
Recording	Automated meter reading: meters send data electronically to distribution companies through a wireless network	Manual meter reading: distribution company staff physically visit ratepayer premises to record data
Communication	Two-way communication between meters and distribution companies	No communication capability
Credit for Above:	Office of the Auditor General of Ontario	
Useful Lifetime	**5 to 7 Years, per Mr. Gaines of FirstEnergy**	**20 to 30 to 40 Years**

Table 1.1 Difference between Analog and Digital Meter

IV. WHAT IS IOT AND IT'S PROTOCOL

Internet of Things consists of smart devices that communicate with each other. It enables these devices to collect and exchange data. Besides, Internet of Things has now a wide range of life applications such as industry, transportation, logistics, healthcare, smart environment, as well as personal, social gaming robot, and city information. Smart devices can have wired or wireless connection. As far as the wireless IoT is the main concern, many different wireless communication technologies and protocols can be used to connect the smart device such as Internet Protocol Version 6 (IPv6), over Low power Wireless Personal Area Networks (6LoWPAN), ZigBee, Bluetooth Low Energy (BLE), Z-Wave and Near Field Communication (NFC). They are short range standard network protocols, while SigFox and Cellular are Low Power Wide Area Network (LPWAN).standard protocols.[1][2][4]

V. CURRENT SCENARIO IN ENERGY METERING AND RESEARCH GAP

While we are considering Analog or Digital Meter System, at that time we see that we have physical Meter in Our Residences or In Factories. Now Government Person visit at our Premises and Take reading from our energy meter and give Bill to us. As of now government wants more Staff for making billing process so we think that we make project Based on Digital meter. So, we decide to make Meter which is responsible for Observing Whole power requirement of Residential and Industrial Departments. so as of now as per government rules and regulation we can't able to Touch their internal Program and Circuit diagram so we make one kinds of energy meter which is more relevant for Our requirement. We make that instrument which measure the power consumed by a consumer for a specific time period and it's unit is **Unit.** If consumer consumed 1 kilowatt power in 1 hour then 1 unit count in meter. In general case we get one LED in Meter (analog Meter) which has impulsion that is 6400 imp/KWH. That means meter will count 1 unit after completion of 6400 times of flashing.

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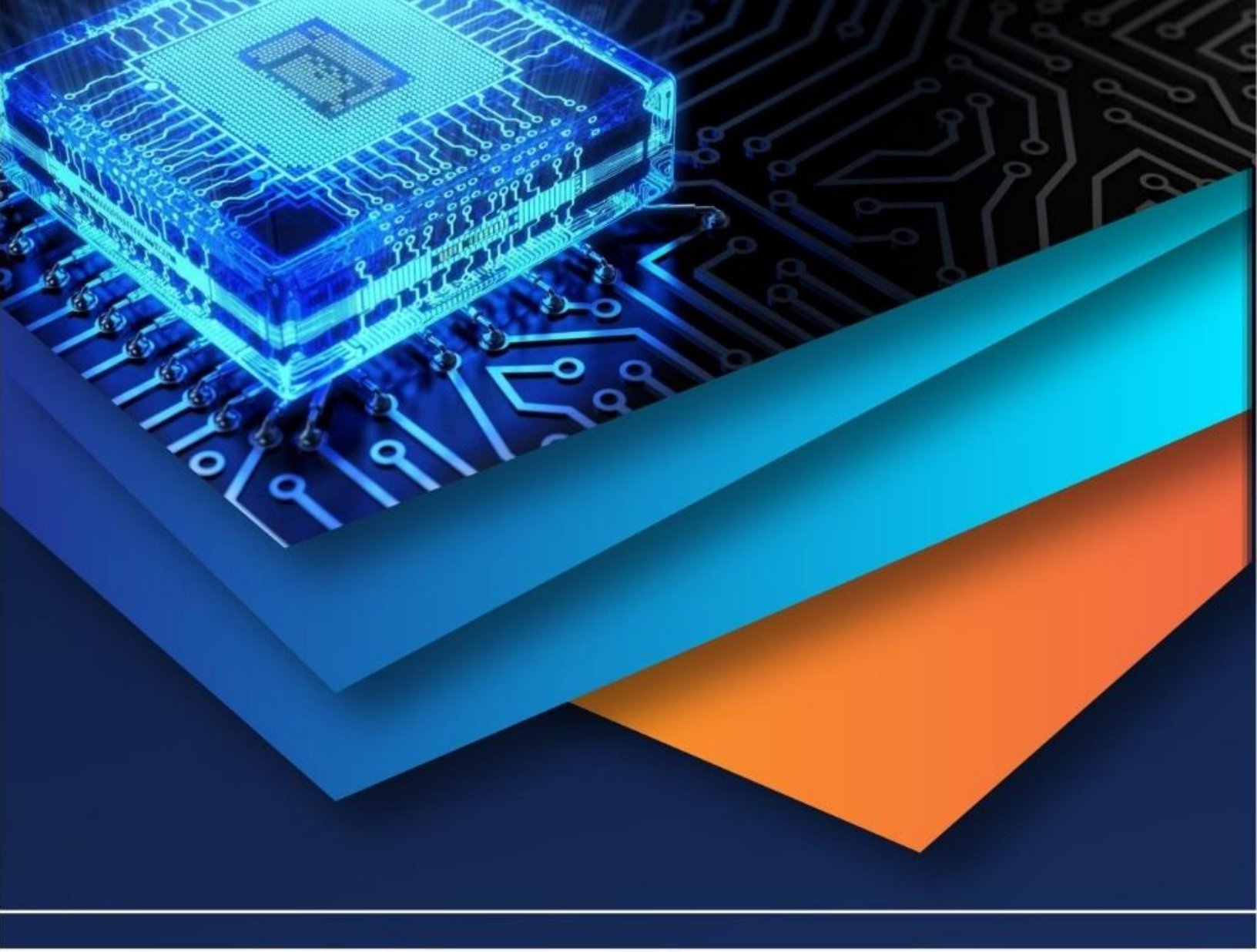

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