Chapter 2
Cloud-Enabled Smart Energy Management for Sustainable Urban Development: A Review

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ABSTRACT

Cloud computing enables remote resource use, data analysis, and efficient data management. Its energy consumption in the US has increased from 1.8% to 4%, with data centres using nearly 73 billion kWh by 2020. Smart cities, relying on non-renewable energy, face obstacles in energy management. Thus, switching to cloud solutions is crucial for sustainability. This paper explores transitioning from traditional energy consumption to sustainable cloud-based systems in cities. Previously, cities relied on physical resources like data centres and servers, which consumed significant dirty energy. The cloud now plays a vital role in developing smart cities by optimizing cost, energy, climate impact, transport, and storage. The paper analyses algorithms and Virtual Machine (VM) scheduling to reduce data transmission time. It also highlights challenges in using middleware for smart city applications, including security, reliability, quality of service, and reviews existing literature. The focus is on the current state, requirements, and potential transformation for smart cities.

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1. INTRODUCTION

1.1. Cloud Computing

The cloud computing is an assembly of strong matches networks hardware, software and internet cloud. Cloud background can provide computing the power to the users from the virtualized resources pools and creates a communications links for the wireless communications. A type of distributed cloud computing, cloud depends upon the resource providing on demand access. Cloud is a model for strengthening omnipresent, on-request accessing to a mutual pool of customizable computing resources provided as PCs, servers, storage, applications and services (Alhindi et al., 2022). As an alternative of the owning and preserving the physical servers and the infrastructures, businesses and individuals can ingress and use these resources on a pay-as-you-go basis arrangement he cloud service supplier. Popular cloud services providers include Amazon Web Services, Microsoft Azure, Google Cloud Platform, IBM Cloud and Oracle Cloud. Many cloud users have Green Data Centers that include using renewable energy source, implementing energy efficient cooling systems, and adapting best practices for design and operation of these centers. Cloud computing uses shared resource model instead of having different physical infrastructure. It doesn't occupy a lot of space and allocated the space dynamically as per need.

1.2. Models of Cloud System

Cloud computing consists of Deployment model and Service model. The Service model includes Infrastructure as a service which provides virtualized resource on the internet which can be rented by the users for storage and used and networking infrastructure. It also includes Platform as a Service that provides platforms such as operating system and development framework where user can build and deploy application without caring about infrastructure. Another one is Software as a Service (SaaS) which eliminates installation and maintenance of a software and user can directly work on the platform. The Deployment model consists of public, private and hybrid cloud.

1.3. Energy Consumption

In 2014, the data centers utilized nearly 1.62% of total energy consumed in the world, although the consumption by the year 2020 is of the number of 140 billion KWh. The usage is estimated to double every 5 years and is responsible for emitting nearly 2% of CO2 into the atmospheree (Karuppasamy et al., 2017).