

Development of Cyber-Physical Systems Framework for Smart Cities

Asset Management

Abstract:

Urban Local Bodies (ULBs) in India face significant challenges in managing underground utility infrastructure such as water supply, sewerage, drainage, electrical, and telecommunication networks, due to fragmented data management and inadequate documentation practices. Over 60% of existing utility location records fall into uncertain quality categories (ASCE Quality Levels C-D), resulting in frequent utility strikes during construction and planning constraints for urban development. The absence of lifecycle-integrated data collection mechanisms and systematic asset management frameworks perpetuates these operational inefficiencies.

This research aims to develop a cyber-physical system (CPS) framework specifically designed for city asset management in data-scarce, resource-constrained environments. Infrastructure prioritization patterns were first analyzed across 70 cities under India's Smart Cities Mission to establish empirical evidence of systematic under-investment in underground networks. Building on these findings, an event-based data collection framework was developed to enable systematic data acquisition for both existing (brownfield) and newly installed (greenfield) utility assets. Furthermore, the development of a CPS framework with operational applications including GIS-based conflict screening and augmented reality-based field visualization enabling practical deployment in Urban Local Body smart cities applications.