ROLE OF IOT AND CYBER-PHYSICAL SYSTEMS IN GREEN ENVIRONMENTAL MANAGEMENT

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Introduction - Environmental sustainability has become one of the most critical concerns of the twenty-first century. Industrialization, rapid urban growth, deforestation, climate change, and excessive energy consumption have created severe environmental imbalances across the globe. Conventional environmental management techniques are often unable to provide real-time monitoring, predictive analysis, and efficient resource optimization. Consequently, advanced technological systems are increasingly being integrated into environmental governance frameworks.

The Internet of Things (IoT) refers to interconnected smart devices capable of collecting, transmitting, and processing data through digital networks. These systems enable automated monitoring and intelligent decision-making across multiple sectors. Cyber-Physical Systems (CPS), on the other hand, combine computational technologies with physical infrastructures to create synchronized and responsive operational environments. The integration of IoT and CPS has significantly transformed environmental management practices through automation, real-time analytics, and intelligent control systems.
Smart environmental technologies are widely applied in waste management, pollution monitoring, renewable energy management, water conservation, and sustainable agriculture. IoT-enabled sensors help measure air quality, temperature, humidity, and carbon emissions continuously. CPS-based infrastructures enhance industrial sustainability by improving operational efficiency and minimizing environmental risks.

The growing importance of green environmental management has encouraged governments and organizations to invest in smart ecosystems and sustainable digital transformation. These technologies contribute not only to ecological preservation but also to economic efficiency and social well-being. The present study explores the role of IoT and Cyber-Physical Systems in strengthening green environmental management practices and promoting sustainable development objectives.

Keywords - Internet of Things (IoT), Cyber-Physical Systems, Smart Technologies, Green Ecosystems, Sustainability, Smart Cities, Environmental Monitoring, Renewable Energy, Sustainable Development, Artificial Intelligence.