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# Utilizing IoT to Develop a Sustainable and Environmentally Friendly Smart City System

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**Abstrak**

Pemanfaatan IoT dalam smart city menawarkan berbagai manfaat. Meningkatkan efisiensi dan kualitas layanan publik. IoT dapat digunakan untuk mengoptimalkan sistem transportasi publik, penerangan jalan, dan pengelolaan sampah. Penelitian ini merupakan peneltian narrative review yang bertujuan untuk menilai, mengidentifikasi, menganalisis dan meringkas literatur terkait pemanfaatan IoT untuk mengembangkan sistem smart city yang berkelanjutan dan ramah lingkungan. Kriteria inklusi meliputi; 1) Literatur berkaitan dengan topik penelitian tentang IoT, sistem smart, smart city, ramah lingkungan; 2) Database yang digunakan adalag Google Scholar; 3) Literatur yang digunakan adalah literatur dalam 10 tahun terakhir; 4) literature teserdia dalam full text. Hasil review jurnal menunjukkan bahwa pemanfaatan IoT untuk mengembangkan sistem smart city berkelanjutan dan ramah lingkungan meliputi peningkatan kualitas hidup masyarakat, smart environment, smart living, dan tata kelola yang baik. Membangun kota pintar yang berkelanjutan dan ramah lingkungan adalah proses yang berkelanjutan yang dapat dilakukan dengan menerapkan solusi-solusi yang tepat dan komitmen yang kuat dari semua pihak Penerapan solusi Smart City yang berkelanjutan dan ramah lingkungan menawarkan banyak manfaat untuk masa depan.

**Kata Kunci:** *IoT, Sistem Smart, Smart City, Ramah Lingkungan*

**Abstract**

Utilizing IoT in smart cities offers various benefits. Improving the efficiency and quality of public services. IoT can be used to optimize public transportation systems, street lighting, and waste management. This research is a narrative review research that aims to assess, identify, analyze, and summarize literature related to the use of IoT to develop a sustainable and environmentally friendly smart city system. Inclusion criteria include: 1) Literature related to research topics about IoT, smart systems, smart cities, and environmental friendliness; 2) The database used is Google Scholar; 3) The literature used is literature from the last 10 years; 4) literature is available in full text. The results of the journal review show that the use of IoT to develop a sustainable and environmentally friendly smart city system includes improving people's quality of life, smart environment, smart living, and good governance. Building a sustainable and environmentally friendly smart city is an ongoing process that can be done by implementing the right solutions and strong commitment from all parties. Implementing sustainable and environmentally friendly Smart City solutions offers many benefits for the future.

**Keywords:** *IoT, Smart Systems, Smart Cities, Environmentally Friendly*

## INTRODUCTION

The smart city concept has become a global trend in recent years. A smart city is defined as a city that uses information and communication technology to improve the quality of life of its citizens. One of the main goals of a smart city is to achieve sustainable and environmentally friendly development. IoT is one of the main technologies that can be used to develop sustainable and environmentally friendly smart cities. IoT enables real-time data collection from various connected devices, such as sensors, actuators, and machines. This data can then be analyzed to optimize various aspects of life in the city. Utilizing IoT in smart cities offers various benefits. Improving the efficiency and quality of public services by using IoT to optimize public transportation systems, street lighting, and waste management. For example, IoT sensors can be used to monitor traffic density and adjust traffic light timings in real time. This can help reduce congestion and increase travel time efficiency.

Reduce environmental impact: IoT can be used to monitor and control greenhouse gas emissions, air pollution, and energy consumption. For example, IoT sensors can be used to monitor air quality and provide warnings to the public when air pollution levels exceed safe limits. This can help improve air quality and public health. Increasing community participation by using IoT can provide a platform for the community to be involved in decision-making related to city management. For example, IoT platforms can be used to collect input from the public on various issues, such as spatial planning and waste management. This can increase government transparency and accountability. The development of a sustainable and environmentally friendly smart city by utilizing IoT requires collaboration between various parties, including the government, private sector, and society. The government needs to provide infrastructure and regulations that support smart city development. The private sector needs to develop innovative and affordable IoT solutions. The public needs to be involved in the decision-making process and educated about the benefits of IoT.

## METHOD

This research is a narrative review research which aims to assess, identify, analyze and summarize literature related to the use of IoT to develop a sustainable and environmentally friendly smart city system. Inclusion criteria include: 1) Literature related to research topics about IoT, smart systems, smart cities, and environmental friendliness; 2) The database used is Google Scholar; 3) The literature used is literature from the last 10 years; 4) literature is available in full text.

## RESULTS AND DISCUSSION

### Sustainable Smart City Concept

The concept of a Sustainable Smart City is increasingly attracting attention amidst various challenges and opportunities in the modern era. Sustainable Smart Cities offer innovative solutions to create cities that are safe, comfortable, efficient, environmentally friendly, and able to improve people's welfare sustainably. Utilization of technology, namely integrating information and communication technology, is the key to optimizing various aspects of life in the city. Smart mobility is an intelligent and integrated transportation system to reduce congestion and exhaust emissions. Smart energy is efficient and sustainable energy management, including the use of renewable energy. Smart environment is real-time environmental monitoring and management to maintain air and water quality. Smart governance is government governance that is transparent, accountable, and participatory. A smart economy is an innovative and sustainable economy

with the support of digital technology. Smart living: Improving people's quality of life through various smart services, such as e-health, e-education, and smart home.

The emphasis on Sustainable Smart Cities prioritizes sustainability principles in all aspects of development. Efficient and responsible use of natural resources. Environmental preservation and biodiversity. Development of environmentally friendly infrastructure. Implementation of a sustainable lifestyle. Community participation is the key to the success of a Sustainable Smart City, which lies in the active participation of the community in the planning, implementation, and use of technology. Increasing digital literacy and public awareness. Community empowerment through education and training. Opening space for dialogue and community participation in decision-making.

**Benefits of Sustainable Smart Cities**

Improving the quality of life can be done by people enjoying better public services, a cleaner and healthier environment, and easier access to information and education. Increasing economic competitiveness can attract investment and create new jobs, thereby encouraging economic growth and improving community welfare. Reduction of greenhouse gas emissions and environmental pollution: Implementing green technology and sustainable lifestyles can help combat climate change and preserve the environment. Increasing the efficiency and effectiveness of government governance: The use of technology can help the government provide public services that are more transparent, accountable, and responsive.

**Challenges in Realizing a Sustainable Smart City**

Limited funds: Requires significant investment to build the required infrastructure and technology. Skills and human resources: Competent human resources are required to operate and maintain technology. Cooperation and coordination: Requires strong cooperation between government, the private sector, and society. Cybersecurity: It is important to ensure data security and people's privacy in the digital era. Main Principles of a Sustainable and Environmentally Friendly Smart City System. Building a sustainable and environmentally friendly Smart City requires a solid foundation based on several main principles. Good and Participative Governance. Transparent and accountable government: Ensure access to public information and community participation in decision-making. Multi-stakeholder collaboration: Involving various parties, such as government, private sector, community and academics, in Smart City planning and implementation.

Appropriate Use of Technology. Smart Information and Communication Technology (ICT): Leveraging technology to increase efficiency, effectiveness, and transparency in various sectors, such as transportation, energy, and waste management. Open and secure data: Provide easy and secure data access for communities and stakeholders to drive innovation and data-based decision-making. Focus on Sustainability. Use of renewable energy: Increase the use of renewable energy sources such as solar, wind, and water energy to reduce greenhouse gas emissions. Sustainable natural resource management: Conserve natural resources such as water, land, and forests through sustainable management practices. Emissions and pollution reduction: Implement strategies to reduce greenhouse gas emissions, air pollution, and water pollution.

**Improving the Quality of Community Life**

Provision of quality public services: Improving access and quality of public services such as education, health, and transportation. Creation of safe and comfortable public spaces: Providing public spaces that are inclusive, environmentally friendly and easily accessible to everyone. Community empowerment: Providing opportunities for the community to be involved in the development and management of Smart City. Sustainable

Economy. Creative economy development: Supporting small and medium enterprises (SMEs) and creative industries to encourage inclusive economic growth. Implementation of a green economy: Encouraging environmentally friendly and sustainable economic practices. Job creation: Increase job opportunities and improve people's standard of living. Consistent and integrated application of these principles can help create a Smart City that improves people's quality of life. Protect the environment. Support sustainable economic growth.

Building a smart city that is sustainable and environmentally friendly requires implementing integrated solutions that cover various aspects of people's lives. Here are some solutions: **Smart Mobility**: 1) Efficient public transportation, namely increasing the use of public transportation with an integrated, time-saving and affordable system. Implementation of an integrated electronic ticket system. Optimization of public transportation routes and schedules. Use of electric and hybrid vehicles; 2) Smart mobility, namely encouraging the use of smart mobility solutions, public bicycles, and scooters. Carpooling and ride-hailing. An intelligent navigation system that takes into account traffic conditions and pollution; 3) Reducing exhaust emissions, namely implementing regulations and incentives to reduce the use of private vehicles and promote environmentally friendly transportation.

**Smart Environment.** Smart energy management, utilizing renewable energy such as solar panels and wind turbines. Implement a smart grid system to optimize energy distribution. Increasing the efficiency of energy use in buildings and homes. Smart water management: Monitor and control water leaks. Implement a smart irrigation system to save water. Recycle and reuse water. Smart waste management: Implementing an effective waste sorting system. Recycle and compost waste. Reduce the use of single-use plastic. Environmental quality monitoring: Monitor air, water, and soil quality in real time to identify and address environmental pollution.

**Smart Living**. Energy-efficient buildings apply energy-efficient building design and technology. Natural ventilation and lighting. Effective thermal insulation. Energy-saving equipment. Smart home: Implement smart home technology to save energy and increase comfort, such as automatic lighting and climate control systems. Energy-efficient smart appliances. A green environment can increase green open space and implement environmentally friendly landscaping systems. Access information and public services by providing an online platform to access information and public services, such as licensing services, tax payments, and public complaints.

**Good Governance**

Transparent and accountable government: Increasing transparency and accountability in government management. Community participation: Involving the community in decision-making regarding city development. Collaboration between stakeholders by encouraging collaboration between government, the private sector, and society to achieve sustainable city development goals. Implementing these solutions requires significant investment and long-term commitment from governments, the private sector, and society. However, the benefits will be enormous, including improving people's quality of life, cleaner air, a greener environment, and easier access to public services. Increase the efficiency and effectiveness of city management by reducing operational costs and improving service quality. Encourage green economic growth by creating new jobs and attracting investment in the green technology sector. Strengthen cities' resilience to climate change by reducing greenhouse gas emissions and improving adaptation to the impacts of climate change.

## CONCLUSION

Building a sustainable and environmentally friendly smart city is an ongoing process that can be done by implementing the right solutions and strong commitment from all parties. We can create a city that is more livable and sustainable for future generations. The implementation of sustainable and environmentally friendly Smart City solutions offers many benefits for the future of cities, including improving the quality of life, creating a healthier environment, increasing efficiency and productivity, increasing community involvement, and building a sustainable future.

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