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ORIGINAL RESEARCH ARTICLE

Synergy of digital economy and green economy in sustainable development policy

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ABSTRACT

Sustainability challenges and ICT perspectives are at the heart of current thinking on global economic and social development. The current development and growth process is based on unsustainable foundations due to irresponsible resource consumption and negative environmental impacts as well as greenhouse gas emissions. People need to find ways to integrate the digital economy and the sustainability of the green economy. Therefore, this paper firstly describes the intersection of digital economy and green economy, secondly introduces the security system of digital economy and green economy, then based on this, the SURF (Speeded-up robust features) algorithm is used to locate and improve the data aggregation system of digital economy and green economy, and finally, the algorithm simulation experiment is conducted. The experimental results found that the aggregation algorithm based on digital economy and green economy has 19% higher accuracy than the traditional algorithm. At the same time, the calculation speed is increased by three to five times. The above results show that the SURF algorithm is applied to the sustainable development research of digital economy and green economy with significant effect.

Keywords: internet digital economy; living green climate economy; green information technology; internet of things

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1. Introduction

The digital and green economy has been high on the environmental policy agenda in recent years. As a comprehensive economy, the digital economy has a significant impact on economic growth, production, and lifestyles in many countries and regions, and plays an important role in changing the international economic structure. However, the development of the digital economy has also brought about negative impacts, such as the depletion of environmental resources and an increase in carbon emissions. At the same time, a green economy, with sustainable resource use and environmental protection at its core, promotes the synergistic development of economic growth and environmental protection. The digital economy and the green economy have complementary advantages and potentials, and in-depth exploration of the mechanism and path of their synergistic effects and the use of the SURF algorithm to effectively combine the two to achieve synergistic development. This is of great significance for both the formulation of sustainable development policies and the innovation of green digital economy models.

Liu[1] saw the digital economy as a new form of economic and social development after agriculture and the industrial economy. It is a new driving force for global economic development. Therefore, research on the digital economy is of great importance. Teece[2] argued that the issue of value creation posed different challenges to innovators in the digital economy than innovators in the industrial economy and required an understanding of the dynamics of platforms and ecosystems. These challenges are compounded by the technologies that underpin the digital economy. Chihiro[3] believed that the internet has given people unprecedented services and conveniences and has radically changed the way people do business and live. In contrast to these achievements, however, productivity in industrialized countries is currently in sharp decline. This raises the question of a possible productivity paradox in the digital economy. Therefore, the limitation of GDP statistics in measuring progress in the digital economy has become an important issue. Aletdinova[4] focused on the traditional digital economy in agriculture and compares it to a range of other digital economies with varying degrees of computerization. Digital economy capacities fall into three types: Governance, ICT and environmental capacities. Liang[5] assessed the level of development of the digital economy in different provinces and cities by developing a digital economy indicator framework. The SBM-Malmquist overproduction model was used to measure the gross factor productivity of the service sector. It also analyzed the development level of the digital economy in each province and city and the impact of the digital economy on the gross factor productivity of China's service sector. Finally, it suggested how to optimize the digital economy in China's service sector.

Gasparatos[6] provided an overview of the impacts of different modes of renewable energy development on ecosystems and biodiversity and their implications for the transition to a green economy. While the increased use of renewable energy is currently at the core of green economy efforts, renewable energy can have impacts on ecosystems and biodiversity. Nevertheless, the expansion of renewable energy is not in doubt, as it has been shown to bring significant environmental and socio-economic benefits. However, it should be noted that biodiversity is exposed to negative impacts that need to be taken into account when designing renewable energy policies. Komarova[7] discussed the importance of biological crop protection methods as a perspective in the development of a global green economy and analyzed current trends in the transition to organic farming in mainstream agricultural science. Taking into account previous experience with the use of biological and organic substances, another method of chemical treatment is proposed. This would only be done in areas where pest infestations are common, in border areas and in fishing grounds, reducing the use of pesticides by almost half. He presented the results of a field study on the spatial distribution of beneficial insects and animals in irrigated farmland. The research on green economy and sustainable development was one of the important researches of Altaai. The green economy is very important for the development and growth of all sectors of society, as it is the basis for sustainable development and the main pillar of economic growth. Therefore, it attracted the attention of researchers and scientists. The green economy is considered a resilient and ideal model for sustainable development, especially for economic growth. The green economy affects all areas of life, as it is essential for reducing poverty and deprivation, improving living standards and ensuring people's well-being[8].

Digital economy strategies should recognize the benefits of creating synergies between ICT and the forces driving green economic growth. It should be recognized that in order to create these synergies, innovative policy formulation and governance processes are required. The economic, social and environmental forces that constitute the global sustainability challenge would drive innovation not only in the ICT sector, but also in entire economy and society. ICT would play a key enabling role in addressing these challenges.

2. Intersection of digital economy and green economy

The current approach to global economic and social development focuses on two issues: the potential of information and communication technologies (ICT) and the challenges of green economy sustainability. ICT applications and developments consume a lot of energy, especially the higher energy demand associated with cloud computing and data centers, which may lead to an increase in carbon emissions. The rapid replacement of ICT generates a large amount of corresponding e-waste, which can affect the environment and human health if not properly recovered and recycled. There are deficiencies in the green economy in terms of policy, investment, technological innovation and consumer behavior: relevant policies and regulations are not yet sufficiently developed, consistent and stable, and lack long-term predictability; it is difficult and risky to finance green projects with access to investment funds and there is a lack of investors who understand the green economy; there are still technological bottlenecks in areas such as energy storage and transmission; and there are still deficiencies in the current awareness and needs of consumers, with a low level of acceptance and recognition of green products and services by many people.

The latter also has important implications for people's lives, livelihoods and economies. It is also clear that the new ICT would have a profound impact on the economic and social relations between people, communities and governments[9]. The Internet has changed the way people communicate, access to information and traditional socio-economic rules. The convergence of economic, social and environmental issues in a global world has led to a paradigm shift in the concepts of green growth and green economy. In the context of globalization, economic, social and environmental aspects are converging[10]. Digital and the green economy are two key areas that drive China's structural economic transformation and become the main drivers of China's high quality and sustainable economic development. These are the two most promising areas for future Chinese investment. The synergies between the green and digital economy can be summarized as follows. The green economy encompasses the whole digital economy, integrates green concepts into the digital development process and contributes to the development of a green digital economy. They are interlinked and interact with each other[11]. The digital economy is defined as a set of economic activities that contribute to increasing productivity and optimizing the economic structure, including the various infrastructures and services that can support the digitization of economic activities. The green economy aims at a coherent development of the economy, society and the ecological environment, and it is a balanced economy that integrates the various traditional industrial economies. The two main new forms of the future economy, the digital economy and the green economy, work together and influence each other[12]. The digital economy supports the greening of the traditional economy and represents a new path to green development. This is manifested in particular in the fact that the digital economy, by supporting the technological revolution and accelerating the industrial transformation towards electronifization, digitalization and intelligence, contributes not only to increasing the efficiency of the allocation of social resources, but also to integrating all aspects of the national economic cycle. Compared to the diminishing marginal returns to tangible social resources such as labour, land and minerals, digital technology is a new intangible social resource that increasingly supports innovation in technology, production models and environmentally friendly products. It can effectively link front-end and back-end, online and offline, and create a whole industrial chain, including production, transport, consumption and recycling, and then play an important role in improving resource efficiency and reducing pollutant emissions[13]. In addition, digitally designed and developed green consumer products and platforms can increase public participation and a sense of gain in green consumption, can promote the dissemination of green concepts, and create an informed and positive environment for all those who want to engage in green consumption. The green economy supports the digital economy and enables green, low-carbon and sustainable development of the digital sector. The use of digital technologies in the green economy would be beneficial for promoting innovation in green technologies, increasing the efficiency of the green economy, saving energy, reducing emissions, and promoting a low-carbon economy and green growth. It can effectively contribute to energy conservation and emission reduction targets and support the transformation of the green economy. Digital solutions can reduce global CO_2 emissions by 1.21 billion tons by 2022, as shown in **Figure 1**[14].

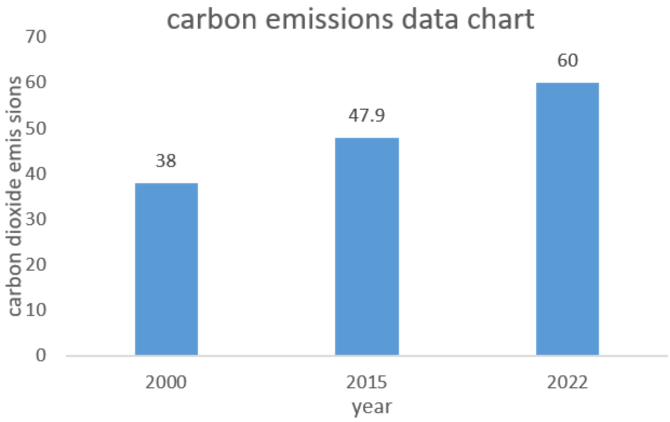

Figure 1. Carbon dioxide emissions data graph.

Carbon emissions and economic growth are decoupled in 2022. CO_2 emissions are reduced by 12.1 Gt in the digital emissions scenarios. Deepening the green economy and the concept of energy saving and emission reduction can help the digital economy reduce CO_2 emissions and achieve sustainable economic growth. As the digital economy develops rapidly, digital technologies such as blockchain would have an impact on the green growth of manufacturing industries. In fact, ICT plays an important role in increasing the efficiency of the green economy by promoting technological innovation and modernizing industrial structures. The use of blockchain can propel companies towards a green transformation characterized by greater efficiency, which can reduce sulfur dioxide emissions and pollution control costs and help reduce the tipping point of environmental regulatory intensity[15]. The deepening of the concept of green economy and energy conservation and emission reduction can help the digital economy reduce carbon emissions and achieve sustainable development. At present, the concept of green and sustainable development has been gradually integrated into all aspects of the digital industry: First, the energy consumption of the digital industry is transitioning to renewable energy. For example, many of the largest technology companies, such as Google, Apple and Microsoft, have achieved or approached 100 % of renewable electricity. The second is to improve the efficiency of mobile networks. For example, Ericsson and Nokia have improved network efficiency through modern solutions and integrated construction of antennas and base stations, saving about 40% of energy consumption. The third is to build zero-carbon data centers. For example, Google’s data center in Hamina, Finland, is built in a former paper mill building. The servers are cooled with water from the Baltic Sea, and uses 100% wind power. The fourth is to reduce the carbon emissions of digital hardware manufacturing. For example, Intel has taken measures to significantly reduce the fluorinated gas emissions of its chip manufacturing plant, which has led to a 10% reduction in its emissions in 2020 compared with 2010[16]. With the increasing emphasis on green economy and energy conservation and emission reduction, only by developing the digital economy on the premise of being environmentally friendly can people ensure the sustainable and stable improvement of digital technology. As China’s digital technology innovates and the digital economy develops rapidly, digital technologies such as cloud computing, AI (artificial intelligence), big data and digital twins are gradually penetrating into various fields such as ecology, energy and finance. Based on the current status of digital technologies and their applications, the paper would look at three perspectives to promote the development of the green economy. First, from the perspective of energy production, digital technology can help the energy sector solve the shortcomings of clean energy, so as to speed up the process of promoting energy structure adjustment. Second, from the perspective of energy consumption, digital technology can help the three major carbon emission sectors of industry, construction and transportation to accelerate the green transformation of energy conservation, emission reduction and digitalization. Third, from other perspectives, digital technology can also play an important role in carbon sequestration, carbon monitoring and carbon finance, etc. The application of green economy and digital economy can be seen in **Figure 2**[17,18].

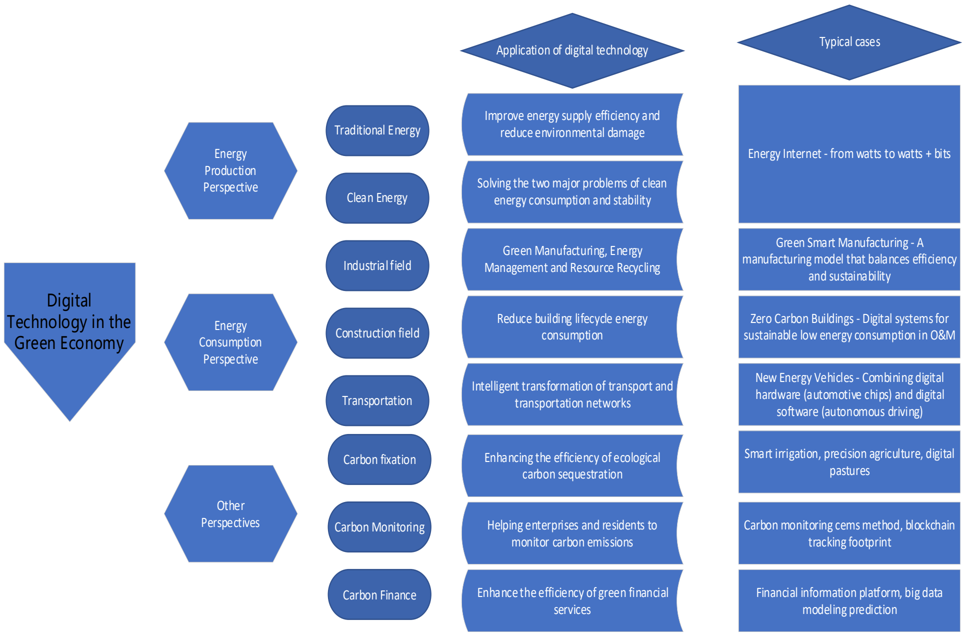

Figure 2. Intersection of the green economy and the digital economy.

One of the most crucial steps toward carbon neutrality and the advancement of a green economy is the restructuring of the energy production structure, and the use of digital technology in the sector of energy production can hasten this process. On the one hand, digital infrastructure (5G, industrial Internet, data center, AI, etc.) is deeply integrated with energy infrastructure to realize the informatization, digitization, networking, and intelligent transformation of traditional energy systems. On the other hand, the two elements of “energy” and “data” are bound together. Through the full circulation and use of data elements, the efficient circulation of other production elements in the energy system is promoted, thereby driving the improvement of total factor productivity of the energy system, as shown in **Figure 3**[19,20].

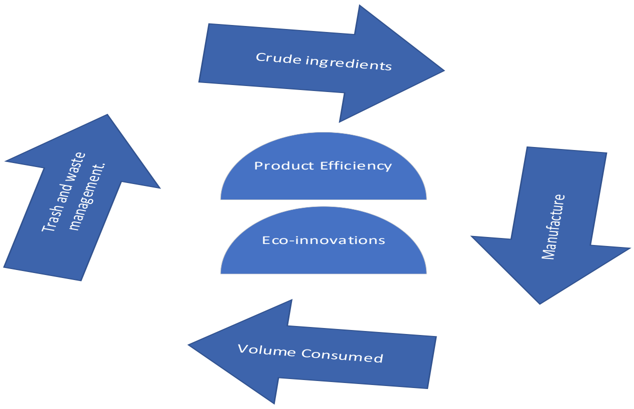

Figure 3. Green growth circular economy.

The development of green industry requires the accelerated development of a green production system with high technological content, low resource consumption and reduced pollution. It clearly mentions the integrated development direction of the Internet, digitalization and green manufacturing requires improving the level of intelligent management of energy, resources and environment, and promoting the sharing of production factors and resources. Using the sharing economy model to tap the potential of resources and data and promote the digitalization of green manufacturing is an important part of the current development.

3. Security systems for the digital economy and green economy

Nowadays, more and more integration development directions can be seen everywhere in life. The needs of people have evolved in this situation. All facets of production and people's lives are impacted by digital inclusion and the green economy. Numerous new business models and forms have emerged as a result of ongoing industrial innovation and integration, helping to restructure and modernize the economy and advance sustainable economic growth. Supply-side structural reforms are changing future business models and people's lives. Digital aggregators and the digital-based economy and green sharing have an impact on people's lives. Compared with traditional business models, data aggregation (DA for short) is more effective in optimizing and allocating resources, and lead to significant improvements in many areas. The daily lives and jobs of individuals are directly tied to data collection. The growth of the digital and green economies is now being driven by cloud computing and big data analytics. It has given new impetus to China's economic development and laid a new foundation for promoting high-quality economic growth and sustainable development. The digital network economy, as a kind of intangible economy, is the driving force for digital industrialization of the whole society, digitalization of the green economy, digitalization of industry, transformation of production and consumption patterns, and promotion of economic growth. Because of this, digital and green aggregation system management is even more important.

Secure Data Aggregation (SDA) technology resolves the problem of small number of nodes in Wireless Sensor Networks (WSN) and also ensures the security of personal data through DA. The advantages of DA technology in WSN are obvious. The convergence of the digital economy and the green economy is promoting the era of shared resources. The era of shared resources is also a new opportunity for the digital economy to face new challenges as it breaks away from traditional advertising and creates a new direction for advertising. The sharing economy is moving towards the digital highway. By adopting the digital economy and using the SURF (Speeded-up robust features) algorithm, rapid progress can be achieved. The SURF algorithm is powerful and its integration of data collection and field screening into the computation reduces the data search time. The DA is the summation of all the data and enables fast field screening. WSN is an efficient way to collect and transmit data in the IoT environment, which is a self-organised multipoint network of hundreds of small electronic sensors. DA is a computing process in which each node (or nodes) aggregates data from other nodes to reduce raw data transmission. DA is an important computational technique in WSN. The data is analyzed and classified and the current state of the network is reconstructed. The data collection algorithm is shown in **Figure 4**.

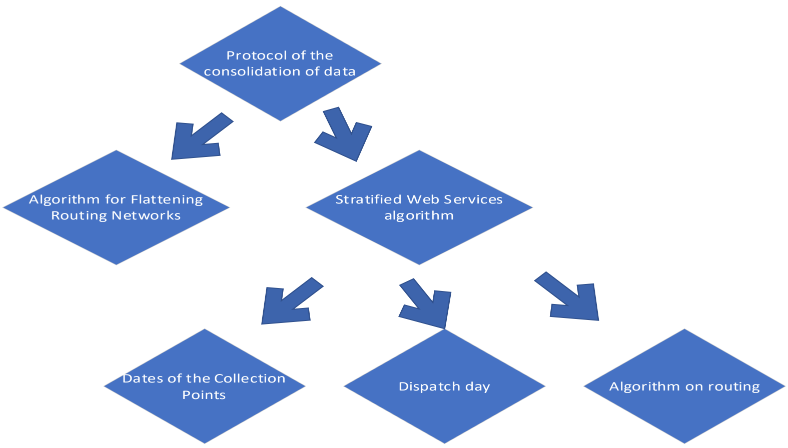

Figure 4. Common routing algorithm for data collection.

Data must be sent to a higher level aggregation node. The advantages of using DA techniques in WSN are obvious. Sequential DA not only promotes data transfer performance and energy efficiency, it also has some down sides. Therefore, the data collection technique should improve its energy efficiency, and it ensures secure network data collection without compromising security. After perturbation, the statistics are not significantly different from the original data. The main task of WSN is to detect, collect and process data from sensors in the coverage area of the network and to transmit it to the network operator. The safety is the critical foundation and reassurance for this assignment. Security problems or unreliable data collection can cause delays, confusion and even disruption of the entire network. As RF operations consume more energy than CPU commands, the cost of communication must be reduced. **Figure 5** shows a block diagram for packet date generation.

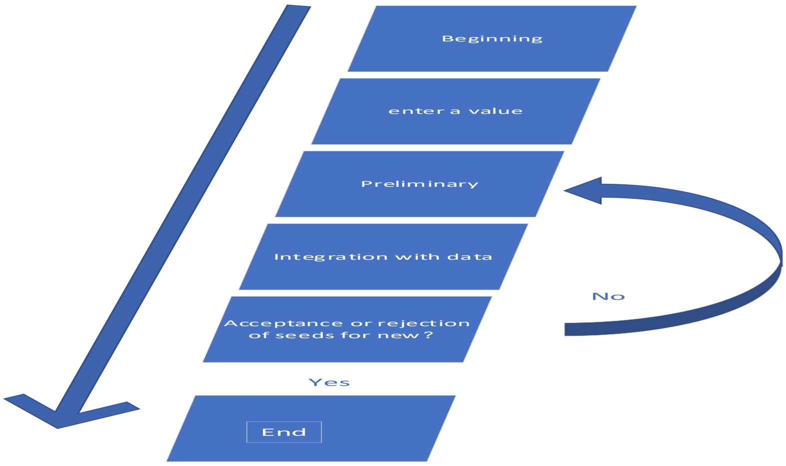

Figure 5. DA generation flow chart.

DA allows to combine data from multiple sensors in a data centre into a single data unit. DA significantly reduces the number of data nodes in a WSN, saves energy, extends network lifetime and reduces data duplication. In DA, the aggregation nodes (also called cluster nodes) collect data and transmit to base depot. Data gathering and safe access to base station reports are also features of database discovery tools. Topological tree protocols and cluster protocols are two categories of data collecting procedures. Data is transmitted from sensor nodes (child nodes) to parent nodes during tree decomposition, and decomposition is carried out at the parent node level. Aggregating insecure data can thwart network-wide data collection operations. However, it is useless to study the security of sensor networks if the main task, in other words, data collection, is not accomplished. Therefore, the main task of the security mechanisms in WSN is to ensure the secure connection of all nodes and implement secure aggregation of data on suitable nodes. Currently, two main approaches in WSN, data collection and security, have been intensively studied. However, the securities of data collection methods have not been well studied.

4. Application of the SURF algorithmggregation

The SURF algorithm is essentially identical to the SIFT algorithm. The SIFT algorithm is a symptom recognition algorithm proposed in 1999. In 2004, the algorithm was further developed through the study of scale-invariant, radiative-invariant and local-invariant detection methods. The SURF algorithm is mainly made up of three parts: symptom extraction, symptom description generation and symptom comparison. Although the SHIT algorithm is unique with respect to the local features of the data, it is relatively robust to these features. Since the SIFT algorithm is very time consuming, the SURF algorithm was developed. The positioning using SURF consists of the following steps: data clustering, Hess matrix estimation, spatial mapping and accurate positioning. The SURF algorithm is designed not only to be robust to data, but also to include data clustering and spatial filtering in its computation. Data fusion involves the information obtained by computing the original data. Each fused dataset is represent as total of raw data. The aggregated data has a value of $I_{\Sigma}(x, y)$ at a certain data point, (x,y) in data is the total of raw data from the original $I(x, y)$ to the entire data area. The formula is:

$$I_{\Sigma}(x, y) = \sum_{i=0}^{i \le x} \sum_{j=0}^{j \le y} I(i, j) \tag{1}$$

$I_{(x, y)}$ is the raw data for each data point and (i, j) is the sum of all the data calculated after aggregation. Its simply a matter of calculating the aggregated data and addition or subtraction of the raw data. DA speeds up calculations because after examining all the data to be aggregated, one completes the aggregation of each raw data point by independently adding and subtracting rectangular data values. The larger the rectangle, the greater the savings in calculation time.

The node's Signal and Energy measurements are:

$$\begin{gathered} H_0: x_i(t) = n_i(\mathrm{t}) \\ H_1: x_i(t) = s_i(t) + n_i(\mathrm{t}) \\ \mathfrak{H}_i = \sum_{t=1}^{M} |x_i(\mathrm{t})|^2 \\ i = 1, 2, ..., N, \end{gathered} \tag{2}$$

This shows that M converges to a Gaussian distribution. Let the noise samples independent in space and time and uniformly distributed (i, i, d), then:

$$\begin{gathered} \mathrm{E}\{\xi_i|\mathrm{H}_0\} = \mathrm{MO}_i^2 \\ \mathrm{E}\{\xi_i|\mathrm{H}_1\} = \mathrm{MO}_i^2(1+\mathrm{C}_i) \\ \mathrm{D}\{\xi_i|\mathrm{H}_0\} = 2\mathrm{MO}_i^4 \\ \mathrm{D}\{\xi_i|\mathrm{H}_1\} = 2\mathrm{MO}_i^4(1+2\mathrm{C}_i) \end{gathered} \tag{3}$$

Among them, except for $C_i = \sum_{t=1}^{m} S_i^2(t)/MO_i^2$, the counting service for this statistic obeys the following distribution:

$$C_i\xi \sim \begin{cases} N(MO_i^2,\ 2MO_i^2), H0 \\ N(MO_i^2(1+C_i),\ 2MO_i^2(1+2_{Ci}), H_1 \end{cases} \tag{4}$$

On the basis of the energy estimate, node i yields a binary random variable φ:

$$\begin{gathered} \xi_i < \wedge \Longrightarrow \varphi_i = 0 \Longrightarrow \mathrm{H}_0 \\ \xi_i \geq \wedge \Longrightarrow \varphi_i = 1 \Longrightarrow \mathrm{H}_1 \end{gathered} \tag{5}$$

The local detection thresholds ∧ of nodes is the same, and the local false alarm probability i of N nodes is as follows:

$$\begin{gathered} P_{fa}^i = Pr(\xi_i \geq \wedge |H_0) = Q\left(\frac{\wedge - E\{\xi_i|H_0\}}{\sqrt{D\{\xi_i|H_1\}}}\right) \\ P_d^i = Pr(\xi_i \geq \wedge |H_i) = Q\left(\frac{\wedge - E\{\xi_i|H_1\}}{\sqrt{D\{\xi_i|H_1\}}}\right) \end{gathered} \tag{6}$$

The characteristics of the generated data have some influence on the generalizability of the data, and good characteristics are usually characterized by repeatability, uniqueness and high reliability. The SURF algorithm treats the raw data using box filters of different sizes instead of pyramids. Since the data is combined, the computational speed is the same despite the size of the box filters. The design principle of the differential response point feature pyramid of the SURF algorithm is the same as that of the summation differential pyramid of the SIFT algorithm, and the first set of scales is obtained by directly eliminating overlaps between rows and columns and removing samples.

Let's assume that message sender *D* has a communication (*q* is a large prime number) to send, taking care of $p > s$, *D* is in the sending process, element $(t-1)$ $(i-1, 2......., t-1)$ would order multiple items in the form of selection in a finite field:

$$\mathrm{f}(\mathrm{x}) = \sum_{i=1}^{t-1} \mathrm{a}_0 + \mathrm{a}_i \mathrm{x}^i \ (\mathrm{mod p}) \tag{7}$$

D: Adding information sent as a constant to the polynomial, i.e. $s = \mathrm{f}(0) = \mathrm{a}_0$. D: Generating encrypted message S_r $(\mathrm{r} = 1, 2, ..., \mathrm{n})$ for each transponder:

$$\mathrm{S}_r = \mathrm{f}(\mathrm{X}_r) = \sum_{i=1}^{t-1} \mathrm{a}_0 + \mathrm{a}_{i\mathrm{X}_r^i} \ (\mathrm{mod p}) \ (\mathrm{r} = 1, 2.....\mathrm{n}) \tag{8}$$

The message is sent by multiplier *D*, which forwards it to final receiver *R*. *R*: If a transponder has sent an encrypted message, the original message can be retrieved using the interference type: Long range.

$$S = f(0) = \sum_{i=1}^{t} f(X_i) \prod \sum_{v=1,\ v\neq 1}^{t} \frac{-X_y}{X_I - X_v} (\mathrm{mod}\,p) \tag{9}$$

The data operators are discrete and scalable. Spectral aliasing due to insufficient discretization of the data operators. If the rate of change is low, a new structure is created in one-dimensionally filtered data, and a new structure is created in two-dimensionally filtered data.

5. Algorithm simulation experiment

In order to verify the superiority of the algorithm proposed in this paper, the following data were used in the experimental analyses: accuracy of graph nodes, survival rate, algorithmic data accuracy, number of manipulables, data slicing operation, data accuracy.

Several cooperating sensor nodes in a given area report the processed observations to a common node. Once the contributions from all sensor nodes are received, the collection node applies a specific strategy to collect the contributions and makes an overall decision. These sensor nodes' bandwidth and energy are constrained though. Additionally, the system is exposed to many forms of attacks due to its position. These elements make securing WSN a challenging undertaking. The cluster head node in a cluster topology WSN is responsible for gathering data from the entire cluster and sending it to the base station. The ability of the cluster head node to completely utilize the information of the entire cluster makes it the most crucial node in the cluster architecture and is therefore a must for both security and accuracy. In data collection technology, the security of the wireless network must ensure that other users cannot access the user's personal data. The transmitted data is intercepted and the connection is broken, the attacker cannot access the user's sensitive data. Like traditional networks, WSN face various security threats. The decision-making process (the local sensing capability) of local sensor nodes is also compromised. The effectiveness of sensing relays on the reliability in the network, as shown in **Figures 6–8**. In addition, BX involves more pieces of data to check the messages, as the number of shards increases.

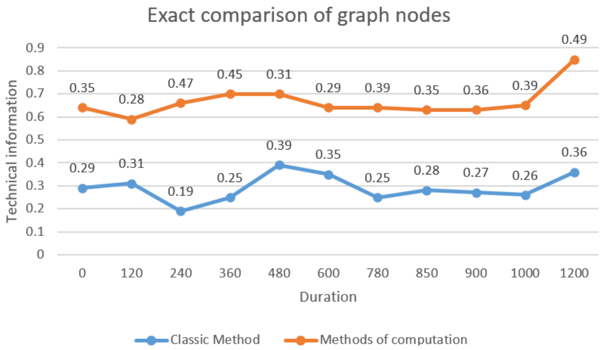

Figure 6. Exact comparison of graph nodes.

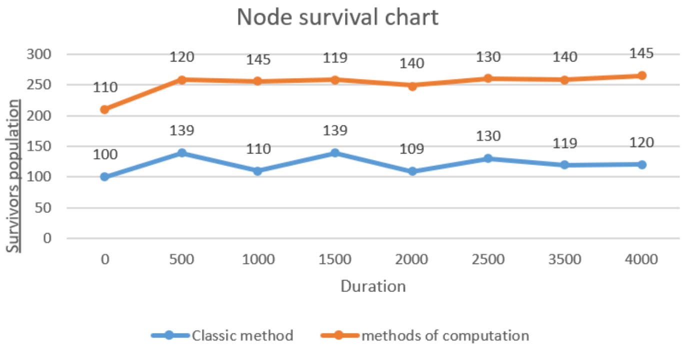

Figure 7. Node survival chart.

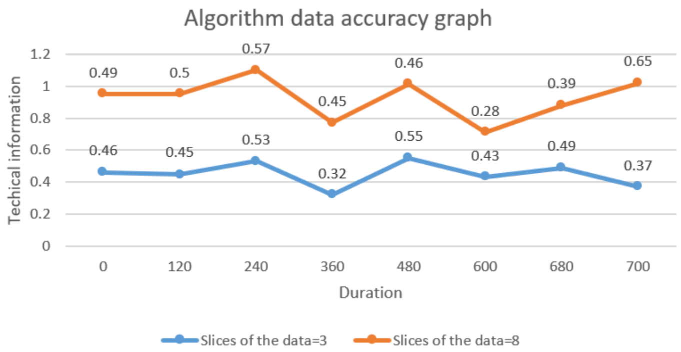

Figure 8. Accuracy of the Algorithm for Different Data Disks.

Data can only be received if the amount of data received from the base station is below a certain threshold, which ensures the safety of the cluster operator. ISSA truncates aggregate data for cluster managers and the truncated data can be homogenized to reduce traffic. Different data segments are randomly selected and different results are calculated, which can be corrected by cross-checking to improve the accuracy of the data collected from the cluster master node. Collecting data from spatially distributed sensor nodes provides a reliable statement of the state of the phenomenon. It is also possible that one or more sensor nodes (compromised by an attacker) intentionally modify their local observations to reduce the detection capability of the node collecting the data. To reduce the load of transmission and processing on the sensor nodes, each of them uses energy detection to create bit-local test statistics and reports the test statistics to the aggregation node, as shown in **Tables 1–3** and **Figures 9–11**.

Table 1. Operands can be compared.

	0	**50**	**110**	**170**	**230**	**290**	**350**	**410**	**470**	**530**	**700**
Classic methodology	2.8	2.6	2.2	3.3	3.6	3.5	3.1	3.5	3.2	4.1	4.3
Method of operations	3.6	3.2	4.1	4.3	3.0	3.7	3.5	3.4	3.87	4.7	5.5

Table 2. A comparison between the table data slicing and slicing operations.

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Classic methodology	3.6	3	4.3	2.8	3	3.8	3.4	4.3	3.2	4.3	4.3
Method of operations	2.3	4.5	4.2	3.6	3.3	3.5	3.6	3.6	4.2	3.8	4.6

Table 3. Comparison between data accuracy.

	0	**50**	**110**	**170**	**230**	**290**	**350**	**410**	**470**	**530**	**700**
Classic methodology	3.6	3.4	3.0	3.3	3.6	3.5	3.1	3.5	3.2	3.9	4.1
Method of operations	4.4	4.2	5.2	5.1	4.0	3.0	3.4	4.6	3.6	4.5	5.3

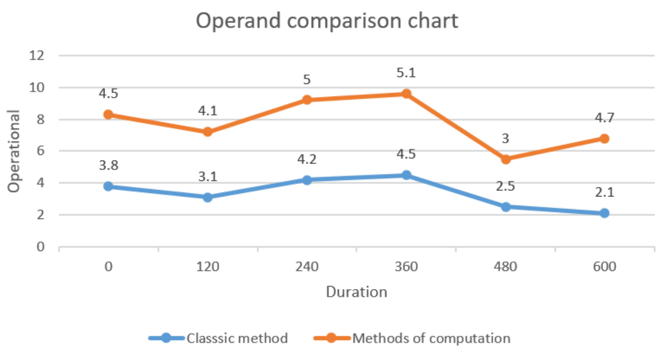

Figure 9. Operand comparison.

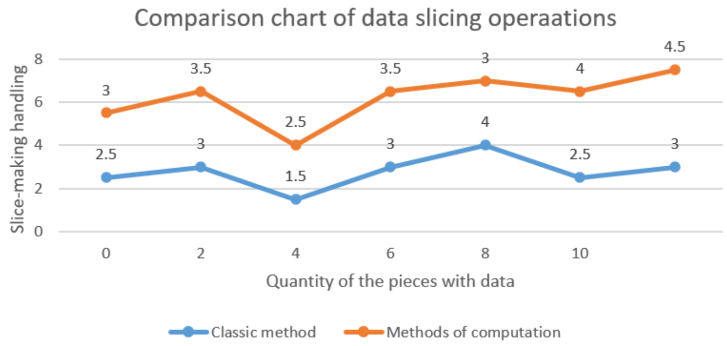

Figure 10. Comparison of data slicing operations.

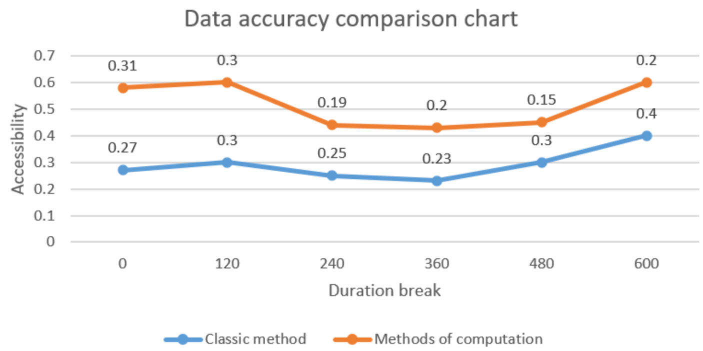

Figure 11. Comparison of data accuracy.

The above estimation correctly assumes that the nodes tested by the attacker do not know the true state of the target. Assuming that the connected nodes are not under attack, the statistical test is performed with two types of sensor nodes (attacker and non-attacker). Since the power of nodes in WSN is limited, power consumption must be addressed to protect the nodes in the cluster head. Data protection is not only about protecting against attackers, but also about preventing attackers from accessing and destroying user data. Transparent communication between sensor nodes and cluster nodes also ensures that other trusted users cannot interfere and use key messages to obtain private user data. For unknown and deterministic signal detection, an unsecured WSN consisting of N geographically distributed sensor nodes and one cluster node is considered. Privacy in WSN is not only a complex issue, but also a popular research topic. DA technology can effectively eliminate redundant packets, reduce traffic, improve packet repetition and throughput, and extend network lifetime. It is one of the most energy efficient techniques in WSN. However, in addition to enhancing energy efficiency and information availability, DA technology can have a negligible impact on security. When designing DA protocols, it is important to balance the functionality of DA with the practical security requirements of the application. This paper investigated a DA method based on the SURF algorithm for digital and green sharing economy, and significant results are obtained. The data is now more accurate and secure than ever before.

The adoption of the methods and models of this study was based on a combination of factors such as their applicability, reliability and accuracy, data availability, and forward-looking and innovative nature.

In conclusion, when performing data aggregation, the SURF algorithm, compared with the traditional algorithm, has a stronger feature extraction and matching ability, and is able to identify the target features more accurately, thus improving the precision and accuracy of data aggregation.

6. Conclusion

Through enhancing the contribution of ICT to green economic growth, the efficiency of production, distribution and consumption of goods and services is improved. This can contribute to a systemic impact that changes the behaviour, attitudes and values of citizens and consumers. The convergence of the digital economy and the green economy would create new ICT markets that would link economic recovery and help address the environmental crisis. Central to this vision is the green information society. ICT enable citizens and businesses to participate in an inclusive, innovative, secure and sustainable information society. Politics and sustainable development have emerged in different parts of the world and their convergence has created new models and opportunities for sustainable development. It has also provided opportunities for economic recovery during the recent crisis. This report highlighted the potential strategic synergies between cluster-based digital and green economy policies. The experimental results demonstrate the feasibility of using the data aggregation method based on the SURF algorithm in the synergistic study of the digital economy and the green economy, which effectively improves the accuracy and security of the research data and achieves the goals of economic growth and environmental sustainability.

Author contributions

Conceptualization, QL and PZ; methodology, QL and PZ; software, QL and PZ; validation, QL and PZ; formal analysis, QL and PZ; investigation, PZ; writing—original draft preparation, QL and PZ; writing—review and editing, QL and PZ; visualization, QL; supervision, QL. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

The authors declare no conflict of interest.

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