Research Article

Urban Road Landscape Design and Digital Twin Simulation Modeling Analysis

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The concept of a digital twin (DT) has lately become popular in the domains of urban planning and managed services. Densification and competing use of urban highways will result from an increase in local and foreign workers in the next years. The MFFO (modified fruit fly optimization) method for large-scale data transfer is presented in this study. The first step is to get data from the internet. A map-matching technique is also given in this section of preprocessing. Validated data may then be loaded into DT to reproduce processes. The results of DT are included in the landscape architecture and the server of the urban road network. The server’s data may be improved by modernized fruit fly optimization (MFFO) to enhance the transmission control protocol (TCP). Finally, the performances from the urban road design are examined and matched with existing techniques. The results are shown in the MATLAB simulation software. The results reveal that the proposed system increased the accuracy of digitalized urban road data protection for all secret information while also taking lesser time to execute than existing methods.

1. Introduction

The growth of a prosperous economy and a better quality of life is impossible without a strong and safe network of roads. Building information modeling (BIM) has a slew of issues, especially when it comes to planning, building, assessing, managing, and operating transportation infrastructure, such as roads, bridges, and tunnels. DT and a connected data environment may be used to improve productivity, reduce data loss, and simplify operations in a variety of ways. Infrastructure is experiencing a digital transformation, whether it is a project site, a smart building, a factory, a public service, or an entire city. In the digitization process, an important concept to keep in mind is the digital twin: a virtual counterpart to an item that is more than just a digital model. In other words, it might be a digital copy of a real-world product or process that acts as a link between the physical and digital worlds. The primary way that a digital twin adds value is by facilitating better decision-making for the physical counterpart, which, in turn, leads to positive feedback for the physical counterpart. Real-time data from the physical twin’s sensors is sent into a dynamic asset model, allowing it to be controlled in real-time based on its actual performance. A static strategic planning model for a system with long-term status data from the physical twin through corporate systems is input into the physical twin via the capital investment process. A digital twin must accurately represent a physical reality for its intended use. The basis of reality is based on the three following factors:

(i) Sources of data and the trustworthiness of the data that the twin is based on

(ii) The heart of digital representation is the model, which includes algorithm coherence, assumption truthfulness, and script competence

(iii) The clarity of the resulting representation is called visualization

It is possible to create a digital transformation (DT) for a variety of reasons, at different sizes and using a variety of modeling approaches. There are currently a number of digital twins in the built environment (see Figure 1) that serve a range of purposes.
As technology advances, we will need a DT more often. Few digital twins, on the other hand, connect or share data across companies, sectors, or nations. When it comes to constraints, interoperability ranks high. Use the DT concept of citywide infrastructure to allow cities to create, view, and evaluate their own data. Data collection and dissemination for road network design may be shown by making data available to municipal stakeholders and people.

Here, the research significance of this paper is as follows:

(i) The digital twin system is applied with 5G technology in this article for urban road landscape
(ii) The preprocessed data is fed into the digital twin for generating the urban road landscape design
(iii) Modernized fruit fly optimization (MFFO) technique is used for large transmission of information

The rest of the paper is arranged as follows: Section 2 explains the literary works that are relevant to our research. Section 3 details the proposed system. To assess the system’s performance, Section 4 makes comparisons with existing techniques. Lastly, Section 5 sums up the paper’s overall concept.

2. Related Works

The work in [1], firstly, asserts that the “know-how” and genuine practical experience gained through DT real-world implementation, such as through various DT pilot projects, case studies, and proof-of-concept initiatives, constitutes the “know-how” and genuine practical experience on which DT research and practices can develop and mature. It goes on to say that this sort of information is inadequately recorded and is often left unrealized and underutilized [2]. Distributed digital twin (DDT) is a term that we coined to describe a concept that deals with the distributed nature of resources across different stakeholders and platforms while providing the foundation for integrating both preexisting historical data and real-time data for physical things like landscape objects [3]. A digital twin is a computer model of a real process, person, location, system, or instrument. Digital twins were created with the intention of improving production processes by simulating individual components with great accuracy. It is now feasible to construct digital twin smart cities using increasingly massive and precise building information models (BIM) paired with huge data provided by the Internet of Things (IoT) sensors in a smart city [4]. It is an exploratory project to explore the role of digital twins in asset lifecycle management decision-making. The research highlights the present confluence between asset management’s demands for decision assistance with the possibilities for decision support provided by digital twin modeling [5]. A digital twin is suggested to support industrial design to analyze the design and assist the designer in avoiding design errors. With frequent modifications in the design phase in mind, a modular method was developed to aid in the creation of a flexible digital twin and the implementation of matching alterations. Designers can swiftly examine multiple designs and uncover design issues using flexible digital twins [6]. We propose our concept for the cyber-physical production system (CPPS) toward a smart shop-floor at scale using DT in this article. The first section of this article looks at a product manufacturing digital twin (PMDT), which focuses on the production phase in a smart shop-floor [7]. This study provides an architectural framework for a digital twin-based cyber physical production system (CPPS) that overcomes the performance barrier. The suggested architecture framework consists of five services that address the performance challenge of customized manufacturing, and it runs on data from the suggested products, processes, planning, facility, and resources (P4R) digital model [8]. The workshop layout issue is tackled via twin data fusion, impacts on the human fusion, and data analysis and optimization in this research, which focuses on discontinuous manufacture workshop layout improvement based on the digital twin. It is necessary to first develop a digital twin-based workshop partitioning subframework before doing simulation analysis to improve the workshop partitioning. As a follow-up, the framework of digital twin-based equipment layout optimization is presented, in which
real-time data collection and value addition are used to make layout decisions. Real-world smart manufacturing platforms are built using optimum control strategies and the GRAF-CET algorithm to optimize logistics scheduling during system operation in this work [9]. Production lines are optimized using a genetic algorithm, and digital twins are employed to give predictive analysis technical help for upgrading and reengineering [10]. The elements of driving in distribution centers are addressed in this work. It describes how to design, develop, and test an autonomously driven truck and a virtual simulation environment (VSE) in a distribution center [11]. This research focuses on traffic flow optimization using self-organizing microlevel control and reinforcement learning [12]. Long-range navigation in urban areas using learning and rule-based agents, in which vehicles represented by agents change their decision-making for rerouting depending on local environmental sensors [13]. The temperature measurement system architecture (TMSA) is a design for a unique mobile sensing system that leverages individuals as mobile sensing nodes in a network to gather spatiotemporal features of pedestrians in urban areas [12]. The current paper presents a conceptual architecture for autonomously maintaining, updating, and managing intelligent transportation systems via digital twins. The accuracy of time-of-arrival forecast based on autogenerated routes on which the vehicle’s real-time position is mapped may be improved using this virtual management simulation [15]. This talk will go over the promise of the so-called “digital twin” and how it may help with virtual hardware validation to help with quick development at the lowest cost in terms of time and labor while attaining optimal designs via “virtual validation.” The topic of digital twins has grown to prominence as the way of the future [16]. This research suggests the use of a digital twin technique as part of a larger cyber-physical system (CPS) to improve the planning and commissioning of human-based industrial processes using simulation-based methods. It is accomplished via (i) sensor data integration and motion detection of human actions on a manufacturing floor, and (ii) an organizational learning method for collecting implicit job execution information [17]. To define regional-scale patterns of wildfire occurrences, the random forest model was used to study the spatial relationship between historical fire episodes in the Zagros Mountains (Iran) and other geo-environmental parameters [18]. Uncertain programming and the greedy randomized adaptive search method (GRASP) are utilized to construct a unique optimization framework and provide a solution approach for producing cost-efficient designs in this paper, which deals with an uncertain transport network design (TND) issue [19]. The aim is to find the quickest route to the desired place in a realistic environment with changing traffic circumstances. As a result, a huge amount of traffic data may be necessary, and the route may need to be updated on a regular basis. We handle the rerouting issue in this way, answering questions like when, how frequently, and where rerouting is beneficial [20]. The suggested system aims to reduce dense air pollution at traffic intersections by equitably distributing real-time traffic and employing diversion proposals to reduce the number of crowded traffic junctions. The proposed integrated recommendation framework uses the Internet of Things (IoT) architecture to provide real-time data and spatial datasets to minimize air pollution and exposure time for commuters traveling through certain intersections [21]. The Steiner pollution-routing problem (SPRP) is introduced in this study as a realistic form of the PRP that can account for the real-world operational circumstances of urban freight distribution.

3. Proposed Work

The study’s background was built on the concept of digital twins. An asset’s digital model is included in this layer, along with other information (e.g., meteorological data, cultural context) that is necessary to support the higher levels. Information models for cities are part of the CIM, which is based on the same principles as the BIM. City applications (e.g., urban planning) may now benefit from the use of urban models, information, and methodologies as decision-support tools (e.g., geographic information systems (GIS)). In DT, a variety of models and model types may be used to accomplish a variety of goals. Real-time status/control, asset management (e.g., asset management model), infrastructure/city planning (e.g., CIM), scenario modeling, and decision assistance are some examples of these. There are predetermined standards and well-organized modeling methods that must be adhered to in order for DIs at the building and city levels to be built in the first place. The urban road administration’s activities are becoming increasingly complex. It relies on antiquated, static procedures and tools while only engaging a small number of citizens and stakeholders in important decisions. Furthermore, as more parts of the decision-making and planning processes are digitized, they will become more illustrative, understandable, and intelligible. In this paper, we propose a modernized fruit fly optimization (MFFO) technique for the large transmission of information. Firstly, we collect the data from net applications. Then collected data can be preprocessed, and the map-match method is included in this part. From this, the data can be validated and the data can be fed to DT to replicate processes. The outcome of the DT is initialized into the urban road landscape architecture and server. The data from the server can be optimized using MFFO to enhance the TCP (Figure 2). The novelty here is we are using the optimized protocol for structure reproduction.

3.1. Dataset Collection. The dataset includes the structure of the road infrastructure and the length of each link, relying on Openstreetmap Maps information. We do not count links in the road infrastructure that have few or just no Global Positioning System (GPS) orbits. Floating car orbit data is typically acquired by remote sensors put in each floating car at predetermined intervals. The GPS trajectory data of cabs in Chengdu, China, is collected for this study. The geographic position in geographical coordinates, taxi state,
actual speed, and sample rate are included in each path segment (file). All cabs have the same global positioning equipment, ensuring that the path examples gathered from multiple cabs are accurate. The paths’ sampling rate remains unchanged at once for every ten seconds. Whenever a cab lifts or leaves off people, the state of the cab changes from vacant to filled. Data is gathered for 45 days, from 0:00 on June 1, 2015, to 23:59 on July 15, 2015. During the data collecting era, more than 12,000 cabs generated a total of 3.01 billion raw GPS path records, resulting in a total of 3.01 billion unprocessed GPS path specimens.

3.2. Preprocessing. Because of numerous radio wave masking and disturbances in the city, the signal in cab services may be impacted or even stopped. As a consequence, certain unusual path examples may be obtained and incorporated into the original dataset. Preprocessing the original GPS trajectory data before map comparison is, therefore, critical. We consider three sorts of path samples to be aberrant specimens and eliminate them from the dataset based on our actual GPS path analysis of data:

(i) Without crucial data, such as cab identification and rpm data, path specimens were taken
(ii) Samples of the path with a latitude or longitude of 0°
(iii) With its subsequent path nodes, path specimens with the same location data but varying speed values

3.3. Map-Matching. The precise placement of the cars, which generates the predicted courses of the paths on the map, provides an accurate map match. This approach was chosen for the following reasons: (1) it is among the most widely mentioned in current history and can manage the minimum and maximum probed information with enormous data sizes, and (2) by matching this technique to hidden Markov design and other map-matching algorithms, the efficacy of this approach is proven.

3.4. Data Validation. For the generated link trip speed data, we undertake validation steps. For further information, check the topic “Technical Validation.” This part checks whether the link movement speed data can accurately follow actual-world link movement speeds in the web. The speed information set is validated by combining quantitative analysis and academic evaluation.

3.5. Digital Twin Technology. Digital twins utilize numerous various sensors provided by 5G to show the actual landscape in the virtual world and connections with the same design, allowing surveillance, simulations, information visualization, service verification, and provider participation in the appropriate physical surroundings. The digital twin captures the data from the data platform and uses it for surveillance, visualization, planning, modeling, verification, and actions. This technology is used to create the digital urban road design. Finally, the authentication procedure is carried out using multifunctional devices like smartphones to meet computerized twin-based solutions adapted to customer data.

3.6. Initialization of 5G Network. At the commencement of the procedure, the 5G model is proposed. 5G networks offer lower latency, more stability, and ultrahigh speeds, to name a few benefits. In an urban setting, such minimal latency offers new opportunities for augmented and virtual reality technologies. Individuals may no longer be limited by capacity or geographical constraints. If 5G is implemented more widely across industries, independent artists and art groups may be able to experiment with immersive technologies that can connect everyone at any time or place with less constraint. Low latency is necessary for a clear connection and the
display of interactive activities, and 5G has a fair probability of producing remarkably stable, faster connections. As it is far better at giving bigger volumes of data, it is meant to ease traffic load. Thanks to 5G, users may expect a better, smoother, and more consistent service. It would also enable the completion of the most difficult activities that were before impossible to complete because of large file quantities and slowdowns.

3.7. TCP. It is a web option that grants network applications and machines to convey. Its reason is to transmit data throughout the web and make sure that the information and instructions are deposited strongly via the network. TCP helps to connect over the providers which aims at preceding info transmission, providing that it supports effective till suggest additional. Then, it dissolves big amounts of information into small packages while enduring data altogether. TCP keeps up a link among services or sensors till they complete exchanging data as an internet transport. It calculates how the initial comment must be split into packets and numbers, and it reconfigures the packets and transmits them to certain other connected devices, including firewalls, secure portals, and toggles before sending them to their final destination. TCP also handles the transfer of any missed packets, performs flow, and guarantees that all transmissions meet their objectives.

3.8. Modernized Fruit Fly Optimization (MFFO). The beginning swarm position may have a significant impact on the speed with which the swarm converges and the end outcome. As a first step, MFFO selects the best of the population size (PS) randomized possibilities to decide the first fruit fly swarm position. At the time of the final run, this estimate of the beginning swarm location leads to a faster response time and a superior algorithmic result.

The computation of the sources of food has a significant impact on computational efficiency. The experimental and theoretical study of the clustering technique involves the standard flow randomness of 

$$y_{mn}$$ data points. In working with difficult nonlinear and multifunctional situations, this is frequently not the best option. We present a new variable beta that is utilized to generate sources in enhancing converge and the overall performance of MFFO. Algorithm 1 and Figure 3 depict the entire approach for creating the MFFO.

- **Initialization stage**: equations (1) and (2) generate a random distribution of fruit flies in the search area.

  $$A_i = A_{-axis} + \text{Random Value}, \quad \text{(1)}$$

  $$B_i = B_{-axis} + \text{Random Value}. \quad \text{(2)}$$

  The term “Random Value” denotes a randomized vector, which is sampled from a uniform dispersion.

- **Path construction stage**: equations (3) and (4) could be used to calculate the distance and odor strength number of every fruit fly.

  $$\text{Dist}_i = \sqrt{A_i^2 + B_i^2}, \quad \text{(3)}$$

  $$P_i = \frac{1}{\text{Dist}_i}, \quad \text{(4)}$$

  **Dist**$_i$ represents the distance between the $i^{th}$ individual and the location of the food, and $P_i$ denotes the odor strength assessment number that is the reciprocal of distance.

  **Fitness function estimation stage**: equations (5) and (6) could be used to express it, correspondingly.

  $$\text{Smell}_i = \text{Function} (P_i), \quad \text{(5)}$$

  $$[\text{best Smell}, \text{best Index}] = \max (\text{Smell}_i). \quad \text{(6)}$$

  **Smell**$_i$ denotes the odor concentration of the individual fruit fly, best Smell and best Index denote the largest components and its indices along various measurements of odor vectors, and max(\text{Smell}_i) represents the maximal smell concentration among the fruit flies.

  **Movement stage**: equations (7)–(9) show how the fruit fly maintains the track of the best scent concentration value and uses vision to fly toward it.

  $$\text{Smell best} = \text{best Smell}, \quad \text{(7)}$$

  $$A_{-axis} = A(\text{best Index}), \quad \text{(8)}$$

  $$B_{-axis} = B(\text{best Index}). \quad \text{(9)}$$

4. Results and Discussion

This section looks at the performance and stability of the proposed platform. The aforementioned concept was implemented using the MATLAB simulation program. The
Algorithm initialization.
Set the population size PS and maximum number of iteration $I_{\text{max}}$

//Initialize fruit fly swarm location in the search space $n$
For $m = 1, \ldots, S$
    $y_{mn} = \text{lowerbound} + (\text{upperbound} - \text{lowerbound}) \cdot \text{rand}()$, $y = 1, \ldots, n$
End For

$\Delta \leftarrow \text{arg}(\text{min}_{m=1,2,\ldots,S} f(Y_m))$ //set swarm location

//Set optimal solution and iteration counter:
$Y^* = \Delta$
Iter = 0
Repeat
//Smell–based (osphresis) foraging phase
For $n = 1, \ldots, S$
    //generate food source $y_{mn} = y_{m,1}, y_{m,2}, \ldots, y_{m,n}$
    $\alpha = \text{chaos()}$ //Determine chaotic parameter
    $y_{mn} = y_{mn} + \alpha (y_{mn} - y_\ast)$ $i = 1, \ldots, S, n = 1, \ldots, n$
    //Limit the result
    If $y_{mn} > \text{upperbound}$ then
        $y_{mn} = \text{upperbound}$
    End if
    If $y_{mn} < \text{lowerbound}$ then
        $y_{mn} = \text{lowerbound}$
    End If
End For
//Vision-based forging phase
$Y_{\text{best}} = \text{arg min}_{m=1,2,\ldots,S} (f(Y_m))$
//Find global best solution
If $f(Y_{\text{best}}) < f(\Delta)$ then
    $\Delta = Y_{\text{best}}$
EndIf
If $f(\Delta) < f(Y^*)$ then
    $Y^* = \Delta$
EndIf
Until the maximum number of iteration is reached: $\text{Iter} = I_{\text{itermax}}$

Algorithm 1: Chaotic FOA pseudo code.

Figure 4: Throughput vs number of vehicles.
suggested modernized fruit fly optimization is used to improve the large transmission of information.

4.1. Throughput. The quantity of a product or service that a firm can create and provide to a customer in a certain length of time is known as throughput. When compared to the existing approach, the proposed method increased the throughput, as shown in Figure 4 and Table 1.

4.2. Delay. It is the length of the transmission process, regardless of the amount of time it takes to transmit the signals.

4.3. Execution Time. The proposed protocol has a low range of execution time (Table 3), which is lower than other conventional methodologies shown in Figure 6.

4.4. Success Rate. Figure 7 refers to the ratio of data packets supplied to the receiver against those sent by the sender. The protocol’s performance reduces when the packet loss is at its highest (Table 4).

| Table 1: Comparative analysis of throughput. |
|---------------------------------------------|
| S. no. | Number of vehicles | Random and sum [17] | Max. greedy algorithm [18] | Min. greedy algorithm [18] | Digital twincentric approach [13] | MFFO (proposed) |
|-------|--------------------|---------------------|---------------------|---------------------|-------------------------------|------------------|
| 1     | 0                  | 83.45               | 89                  | 90                  | 91.56                         | 92.67            |
| 2     | 2000               | 84                  | 90                  | 91                  | 92.78                         | 93.68            |
| 3     | 4000               | 86                  | 91                  | 92                  | 93.49                         | 95.41            |
| 4     | 6000               | 88                  | 93                  | 93                  | 94.69                         | 96               |
| 5     | 10000              | 90                  | 94                  | 94                  | 95                            | 97               |
| 6     | 12000              | 92                  | 95.5                | 95                  | 96                            | 98               |

| Table 2: Comparative analysis of delay. |
|----------------------------------------|
| S. no. | Number of vehicles | Random and sum [17] | Max. greedy algorithm [18] | Min. greedy algorithm [18] | Digital twincentric approach [13] | MFFO (proposed) |
|-------|--------------------|---------------------|---------------------|---------------------|-------------------------------|------------------|
| 1     | 0                  | 0.60                | 0.57                | 0.56                | 0.41                          | 0.32             |
| 2     | 2000               | 0.62                | 0.59                | 0.58                | 0.43                          | 0.34             |
| 3     | 4000               | 0.64                | 0.61                | 0.60                | 0.47                          | 0.36             |
| 4     | 6000               | 0.68                | 0.63                | 0.62                | 0.49                          | 0.38             |
| 5     | 10000              | 0.70                | 0.65                | 0.64                | 0.51                          | 0.40             |
| 6     | 12000              | 0.72                | 0.69                | 0.67                | 0.53                          | 0.42             |

\[ AD = \frac{(Ps - Pr)}{Pr} \]  

Here, \( Ps \) is the time taken to the sent packet (Table 2), and \( Pr \) is the overall time consumed shown in Figure 5.
Table 3: Comparative analysis of execution time.

| S. no. | Number of vehicles | Random and sum \[17\] | Max. greedy algorithm \[18\] | Min. greedy algorithm \[18\] | Digital twincentric approach \[13\] | MFFO (proposed) |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------|
| 1      | 0                 | 0.65              | 0.61              | 0.51              | 0.38              | 0.30           |
| 2      | 2000              | 0.71              | 0.68              | 0.57              | 0.43              | 0.34           |
| 3      | 4000              | 0.76              | 0.74              | 0.64              | 0.48              | 0.38           |
| 4      | 6000              | 0.80              | 0.78              | 0.68              | 0.54              | 0.44           |
| 5      | 10000             | 0.85              | 0.80              | 0.79              | 0.59              | 0.48           |
| 6      | 12000             | 0.89              | 0.83              | 0.82              | 0.62              | 0.52           |

Figure 6: Execution time vs number of vehicles.

Figure 7: Success rate vs number of vehicles.
4.5. **Ratio of Redundancy.** When compared to the other methodologies, the optimized TCP methodology (Table 5) shows less latency over the network, as shown in Figure 8.

**5. Conclusion**

As a first step toward making a broad variety of vital technical advancements (like self-driving vehicles) and support possible, we create a digital twin simulation tool in this article. It is important for implementing the urban planning goal. An in-depth understanding of what is really going on is possible when data from several sources is combined and examined. There are so many industries and enterprises that might profit immensely from the database that was established. In comparison to current methodologies, the proposed MFFO gives better results for digitalized urban road architecture. Simulations show that the proposed approach for protecting digitalized urban road data for all secret information is more accurate and takes less time to implement than current methods. Throughput and success rates were also improved as was the delay and redundancy ratio. It is our intention to devote most of our future efforts to the creation of the digital twins of actual landscapes. The proposed system expresses satisfying results over structure reproduction in digital twin technologies when compared to other existing mechanisms, however, one disadvantage over the proposed system was the success of technology is dependent on internet

**Table 4: Comparative analysis of success rate.**

| S. no. | Number of vehicles | Random and sum [17] | Max. greedy algorithm [18] | Min. greedy algorithm [18] | Digital twincentric approach [13] | MFFO (proposed) |
|-------|--------------------|---------------------|---------------------------|---------------------------|----------------------------------|-----------------|
| 1     | 0                  | 85                  | 84                        | 89                        | 91                               | 91.89           |
| 2     | 2000               | 87.45               | 86                        | 90                        | 92                               | 92.67           |
| 3     | 4000               | 89.76               | 89                        | 92                        | 93                               | 94.37           |
| 4     | 6000               | 90                  | 91                        | 93.9                      | 94                               | 95.78           |
| 5     | 10000              | 92                  | 93                        | 94.5                      | 95.7                             | 97.56           |
| 6     | 12000              | 93                  | 94.6                      | 95.8                      | 96.9                             | 98.62           |

**Table 5: Comparative analysis of ratio of redundancy.**

| S. no. | Number of vehicles | Random and sum [17] | Max. greedy algorithm [18] | Min. greedy algorithm [18] | Digital twincentric approach [13] | MFFO (proposed) |
|-------|--------------------|---------------------|---------------------------|---------------------------|----------------------------------|-----------------|
| 1     | 0                  | 76                  | 73                        | 58                        | 66                               | 54              |
| 2     | 2000               | 78                  | 75                        | 61                        | 68                               | 56              |
| 3     | 4000               | 80                  | 79                        | 63                        | 70                               | 58              |
| 4     | 6000               | 83                  | 80                        | 65                        | 72                               | 61              |
| 5     | 10000              | 86                  | 84                        | 68                        | 74                               | 63              |
| 6     | 12000              | 89                  | 86                        | 70                        | 76                               | 65              |

**Figure 8: Ratio of redundancy vs number of vehicles.**
connectivity. Here, our system speed was sometimes slow because of the lack of network connections. Our future work will be based on improving the performance speed of the system over cloning digital twin technology.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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