Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 4, 177-191
2024
Publisher: Learning Gate
DOI: 10.55214/25768484.v8i4.1161

Dual cellular-path (MIHP) healthy urbanism - a proactive means to sustain placemaking

Li-Yen Hsu
Architect and Planner, HSU Studio, #52, 7F-2, Chienhsin Rd., Hsinchu, Taiwan, ROC (30071); liyenhsu@ms19.hinet.net (L.Y.H)

Abstract: The importance of holistic information integrity in managing complex problems and fostering inclusive, healthy–urban environments has garnered significant attention. Distributing artificial intelligence-based topologies with dual or plural sensor-information nodes improves availability, reliability, and maintainability (ARM), ensuring holistic information integrity and promoting safe, efficient living. Bipartite spider-webs and cube-connected cycles target "the radial-ring urban-building skeleton" and "wetlands and sparsely populated areas," respectively. Also, honeycomb tori, also known mathematically as HT(m), m≥2, or a type of generalized honeycomb tori, GHT(m, 6m, 3m), have been discovered to have two Hamiltonian paths (MIHP) that are not connected to each other. Wireless communications tasks use these paths. This parallelism can create dual cipher-coding to support sensitive logistic privacy and help prevent information loss, electromagnetic interference, and unexpected changes caused by such things as clogged water. Consequently, the aforementioned methods can engage stakeholders by providing comprehensive and reliable information, fostering strong accountability, and ensuring the welfare of future generations. We can adapt this forward-thinking urbanism to areas that enhance life values, particularly in security-sensitive regions such as the acknowledged battlefield Kinmen. Here, the scalable parallelism topology aims to prevent harmful illness or substance spread, prevent sensitive or unnecessary challenges, and positively engage place-making through reliable communications and monitoring.
Keywords: *ARM (Availability Reliability Maintainability), Cipher coding, clogged water, Interference, Parallelism.*

1. Introduction

In 1851, a building called Crystal Palace was built with iron and glass for the first World Fair exhibition held in London [1]. That innovative project featured efficient construction and space flexibility, an airy, bright, and green interior atmosphere, and was more healthful than most buildings of that time [2, 3].

Since the 1970s, we have been fostering inclusive and equivalent aspirations [4]. We have been promoting innovative humanistic interests such as metropolitan or cross-border place making [3, 5, 6] ubiquitous knowledge sharing [6, 7], night-time business operation [2, 6] (Figure 1) and safe nuclear energy utilization [8, 9]. These include meeting human biological requirements [10, 11], promoting credible information [12] chained logistics (Figure 2) [7] in this post-truth era [13, 14], and forward-looking sustainable resilience and circular economy from a global perspective [15].

Besides, adaptable multi-disciplinary personnel collaboration is highly needed, including for those who must be cared for, even remotely, for countering pandemics like COVID-19 [16] (Figure 1(c), [17-19]. Generally, simple-autonomy is unfeasible, necessitating the use of an intelligence-aided barrier [17]. "Visible and invisible" (or roughly wired and wireless) sensor information systems generally assist in addressing such challenges [20, 21].

History: Received: 21 February 2024; Revised: 5 April 2024; Accepted: 1 May 2024; Published: 17 May 2024
Correspondence: liyenhsu@ms19.hinet.net

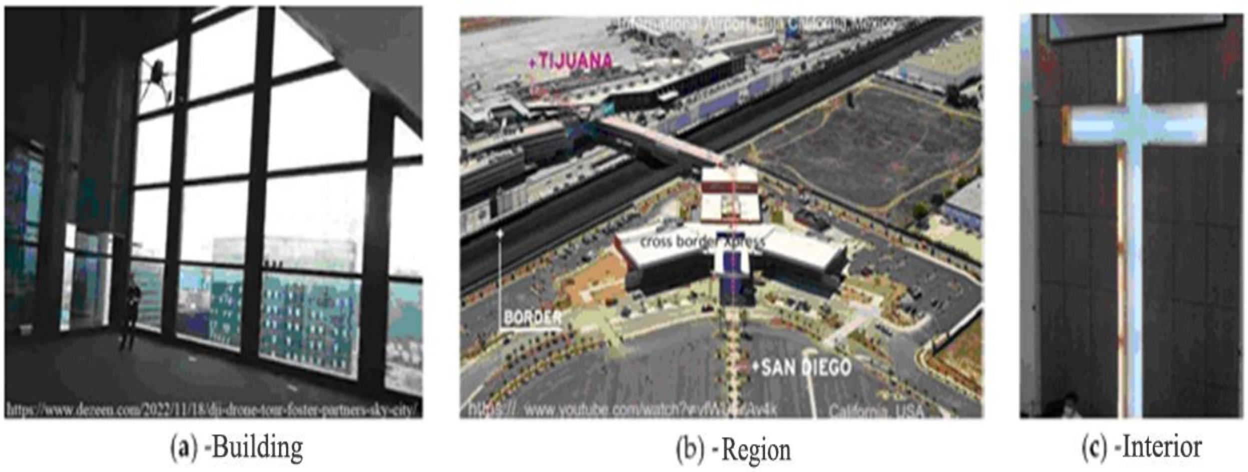


Figure 1. Needing holistic spatial information networking, e.g., on (a) prototyping air transport spots, DJI® headquarters affiliated with drones, Shenzhen, special commendation award, https://www.dezeen.com/2023/10/30/quay-quarter-tower-best-tall-building-worldwide-ctbuh/; (b) cross-border security and services, centered in Tijuana airport, Mexico; (c) missions engaged during pandemics with dual/plural surveillance and communications (https://victorychurch.org.tw), Victory Church, Taiwan.

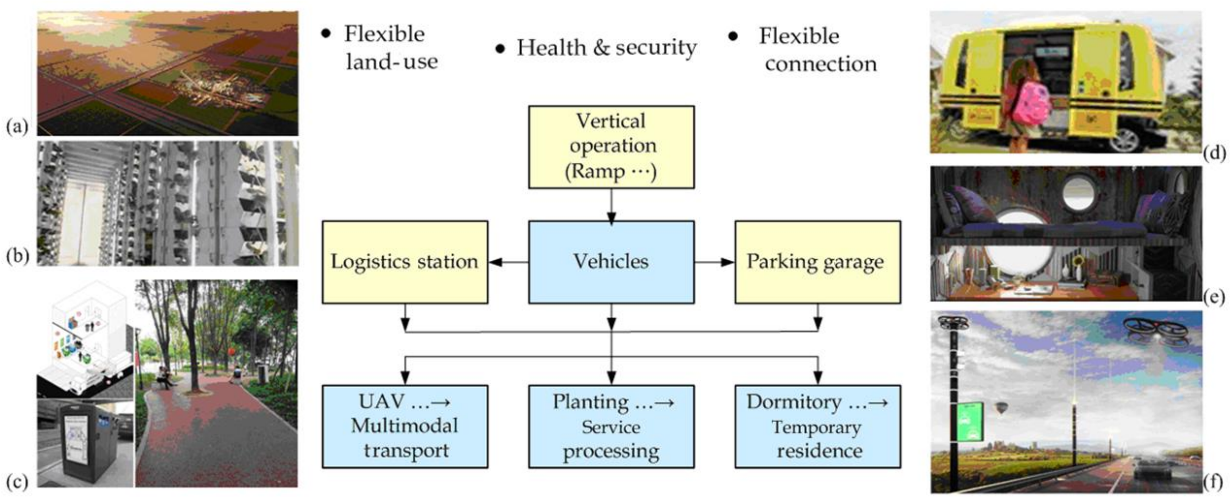


Figure 2. Urbanism chained with intelligence, e.g., (a) Energy: Suburbanization, desert transformation; (b) Food: Shipping container as vegetable plant; (c) Health: Green sidewalk with smart reverse logistics; (d) Education: Affordable, autonomous school car; (e) Synergism: Livable essentials designed in supply chains; (f) Mobility: Drone and smart road.

Similar to our utilizing two eyes, two ears, and two nostrils, the reason for adopting real-time dual/plural surveillance as the base of critical sensor information networking is that human beings need holistic, real-time resilience and recognizing ability to comprehensively deal with ambiguousness to help avoid misjudgments due to such things as blind-spots, image occlusion, electromagnetic interference, and fake information [10, 18, 19] — to live in this world.

2. Scopes (Connecting Complexities)

2.1. Need to Counter Wicked Problems

The term healthy city was evolved by the World Health Organization, and its principles publicized in the 2012 Lancet Commission can be briefly recognized as the following: The principles of a healthy city include availability, equity (inclusiveness), maintainability, intelligence, and reliability

[3, 22]. Given the recognition of life-threatening issues, like pandemics and terrorist attacks, in the context of healthy city development [11, 22], it is imperative to develop resilient technologies and relational facts [21, 23-25]. Sustainable environmental control with holistic intelligence is getting more attention; safety related collaboration needs experts' alertness and knowledge contributions [12, 25-28].

Nevertheless, urban wicked problems, which, as Rittel & Webber announced in Rittel and Webber [29] are hardly formulated, forecasted, or responded to in real-time, can ubiquitously exist, have gotten more attention [30-32]. Performance in terms of availability to respond to uncertain conditions can be supported by design with flexibility (or adaptability) [32-34]. As Last [35] claimed, the conduct of war must be linked to the strategic aim at every level, which is unquestioned; so must it be for either placemaking or peacekeeping, especially in areas with security sensitiveness, e.g., the former battlefield, Kinmen.

Topology is relevant to such infrastructure because it is a science of patterns, particularly those that indicate regularity [26, 36]. Prototyping in this field can justify urbanism and inherent adaptation. It had better be proactive; consequently, the cellular communication [37] related network infrastructure, which is critical for developing autonomous vehicles, and drones [6, 26], is presented in section 3. In other words, it is intended to support "smart cities" and "ITS" (intelligent transportation systems) [27, 36-40].

2.2. Hi-End Integrity has Computational Complexity

Pattern topology had been studied by L. Euler in 1736 for *"Seven Bridges of Königsberg". L. Euler generalizes this type of problem as an Eulerian circuit–traversing each graph link exactly once* [41]. An undirected graph that traverses each node of the graph exactly once can be a Hamiltonian cycle if the first node and the last node are connected with one link, or a Hamiltonian path if the first node and the last node are not connected [41]. *If no repetition or loss exists, handling all work units one by one accountably is efficient and effective; Hamiltonian graphs are known to have computation complexity or difficult solving characterization—similar to wicked problems.*

Since mathematical justifications can confirm the performance of relational patterns, the prototyping process begins with pattern configuration. As in Section 1, we consider dual and plural surveillance as analogous to patterns with high security and integrity intentions. Surveillance devices in both line-of-sight (possible direction-varying) and non-line-of-sight (or radio) modes can be used together, i.e., device availability is reasonably hoped. For maintainability, it is hoped that the pattern applies Hamiltonian properties to inspect and repair devices systematically without loss [42]. On performance reliability, both node and edge fault- tolerance need to be considered.

2.3. Enhance Integrity, Synergism, and Adaptability

The community can be featured with social coordination, mobility, and cyber infrastructure (Figure 2) [24, 43-52]. Except for building up ubiquitous environments, knowledge sharing and personnel collaboration, which generally require real-time truthfulness, cannot be negotiated [7]. Well, the human resource chain had better be holistic, e.g., shown in Figure 2(**e**)—, to promote collaboration through humanistic care and to utilize required knowledge in time, e.g., on handling concerned invisible electromagnetic interference [19]. Trust-building is the foundation [5, 53-55] for creating interests and keeping peace, yet trust can hardly thrive without "intelligent" accountability [14, 32, 56, 57] in this post-truth era [13, 58].

This is done to aid in the clarification of emotional and incorrect information through multi-channel communications and to facilitate the transmission of real-time, detailed, and accurate information, thereby promoting good governance and stakeholder collaborations [27, 28, 32, 35, 59]. Such performance enables the adaptation of structures for parking (Figure 2(**e**)) and supply chaining (warehouses) to cost-saving, efficient, humanistic architectures, such as "Conjunctive Points," a creative industry office in Los Angeles, USA, and the Museum of Contemporary Art located in Toronto, Canada [60, 61]. Consequently, the pervasive performance of ARM (availability, reliability, and maintainability) [62-64] has to be the accountable, dependable capability that inherently ensures information integrity, sensing availability, flexible spatial connectivity (Figure 3), and holism [26].

According to Barnes [59] "'connectedness' and `connectivity' can pertain to the characteristics of the distance between individuals, the quantity of paths between them, the existence of a path, or the persentage of potential paths that exist." Using this understanding of graph theory, we examine a dependable, flexible, and widespread cyber infrastructure [21, 37, 65, 66] (Figure 4) in conjunction with MIHP as follows:

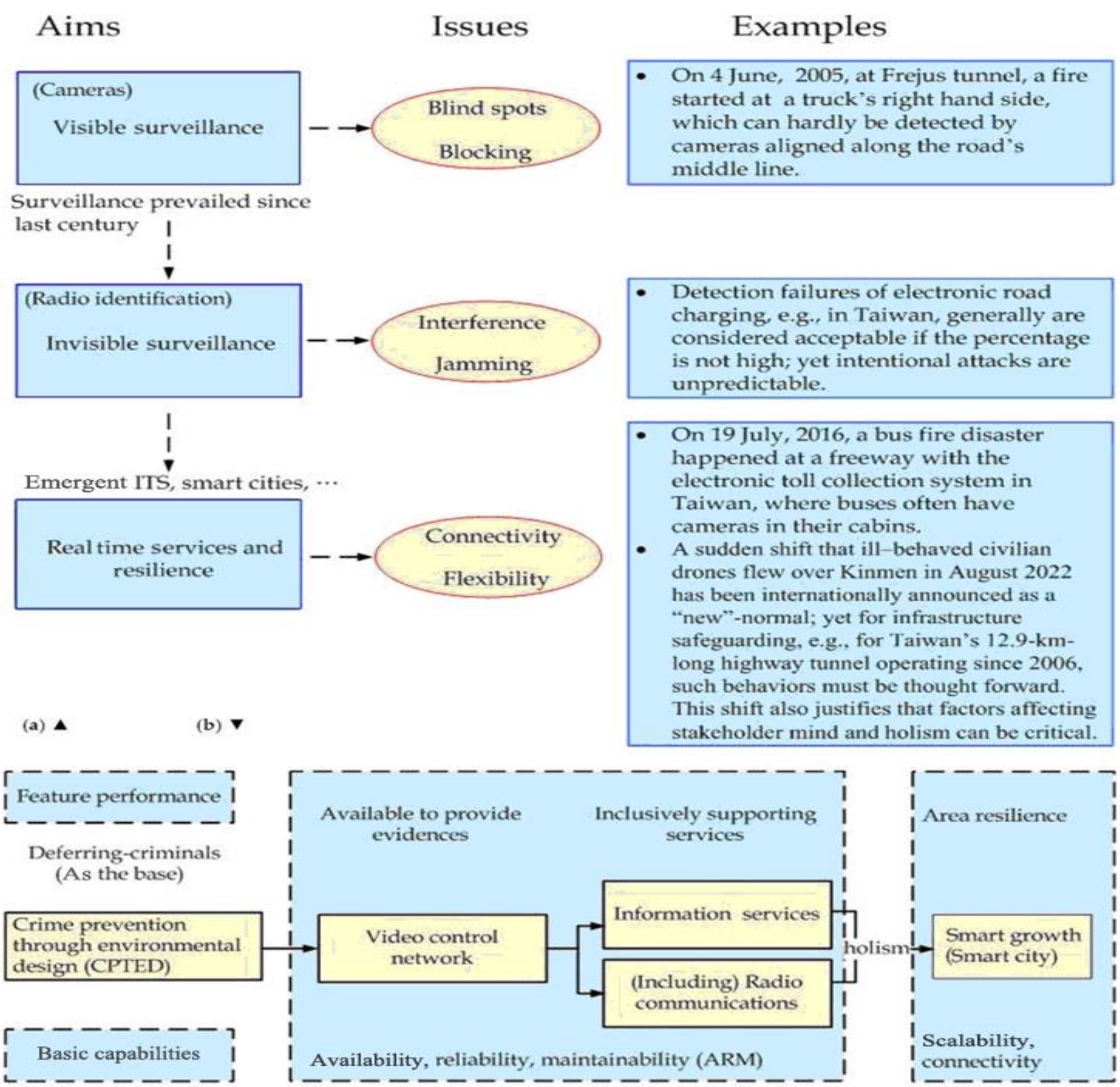


Figure 3. Holistic surveillance for sensitive facilities and areas in the post-truth era, shown as: (a) Facts of the Need; (b) Dual (Plural) surveillance capabilities- ARM, scalability, connectivity- highly demanded in the post-truth era.

3. Method

In terms of incident truthfulness and responsiveness, plural (dual) surveillance combined with 'multiple-input multiple-output' (MIMO) technologies has been widely used in various environments [2, 20, 67, 68] (Figure 3). To support resilience in live streaming, systematic maintenance and dynamic cipher coding on privacy protection can be rationally operated through order and parallelism (Figure 4)—i.e., through applications of 'mutually independent Hamiltonian paths' (MIHP) [41] properties.

Spider-web (SW) [21, 41] networks are prototyped along (main) paths, which can be the radial-ring and essentially the very adaptable, resilient urban-building skeleton [21, 69, 70]. Moreover, researchers prototype plural surveillance-based cube-connected cycles for deployment in wetlands and sparsely populated areas [21] and study honeycomb tori (HT) to promote aerial vehicles flying over off-paths [38] through cellular communications.

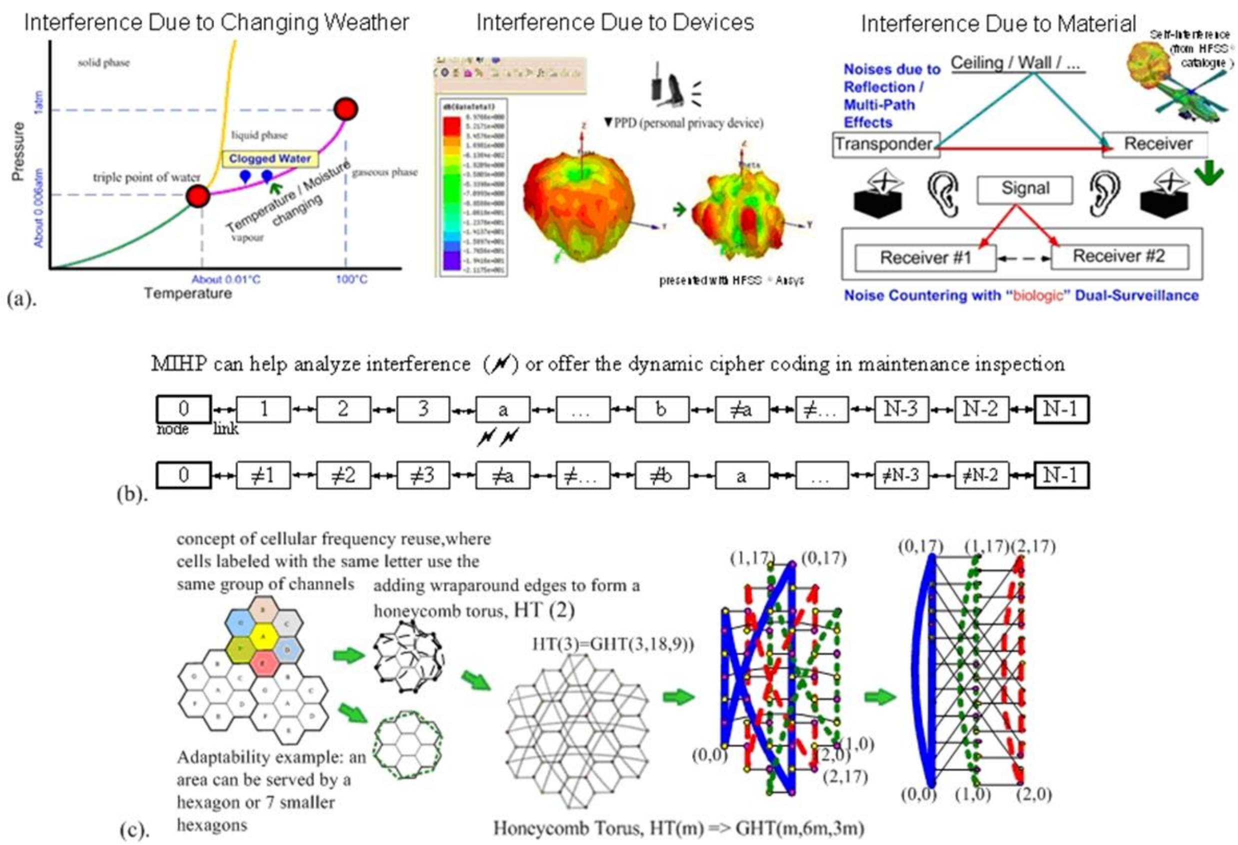


Figure 4. Dual cellular-path approach, shown as: (a) potential interference reasons; (b) to diagnose interference and to create privacy related ciphering via MIHP; (c) study MIHP of HT(m) from establishing MIHP of generalized honeycomb tori, GHT(m,n,n/2).

3.1. AI Oriented Prototyping: Developing Dependable Availability

Disasters mentioned in Figure 3 can justify the use of artificial intelligence (AI)–based prototyping just as humans' multisense and plural (dual) sensor-information surveillance can help deal with unexpected incidents. More specifically, we can accommodate olfactory bio-sensors to help prevent smuggling, bombs, and fires [21]. This can also justify designing a reliable networking prototype with adaptability. A consensus on Hsu [21] has been reached regarding the establishment of resilient roadside dedicated short-range communications (DSRC) [40] for the problems mentioned.

We can detect interferences (due to radio frequency or material properties), radio multi-path effects, and other unexpected faults by analyzing acquired data for various positions and corresponding time

ISSN: 2576-8484
Vol. 8, No. 4: 177-191, 2024
DOI: 10.55214/25768484.v8i4.1161

sequences using MIHP (Figure 4; see section 3.2). To dynamically support thorough recordings and transmissions, we could have a series of such plural (dual) surveillance sensor-information nodes along a path (Figure 5) at positions worthy of attention, which would feature diagnostic responses or alarms due to their systematic, comparable parallelism.

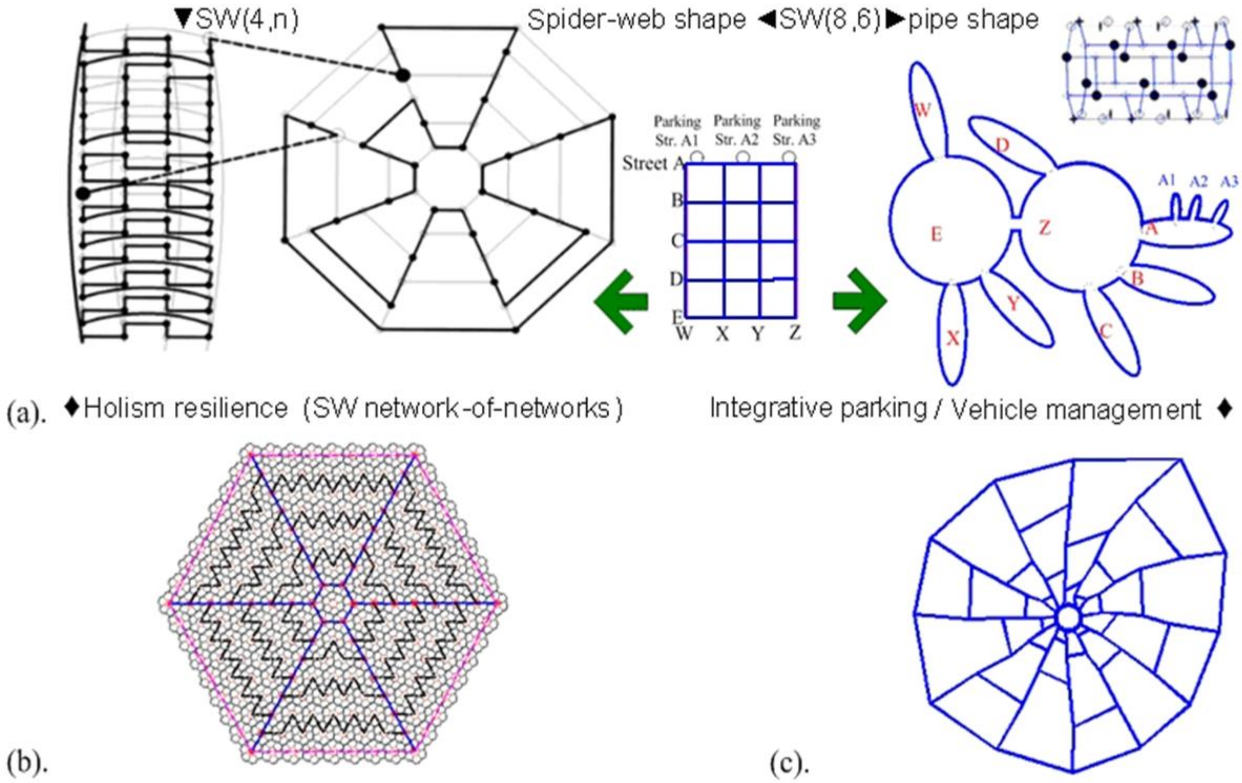
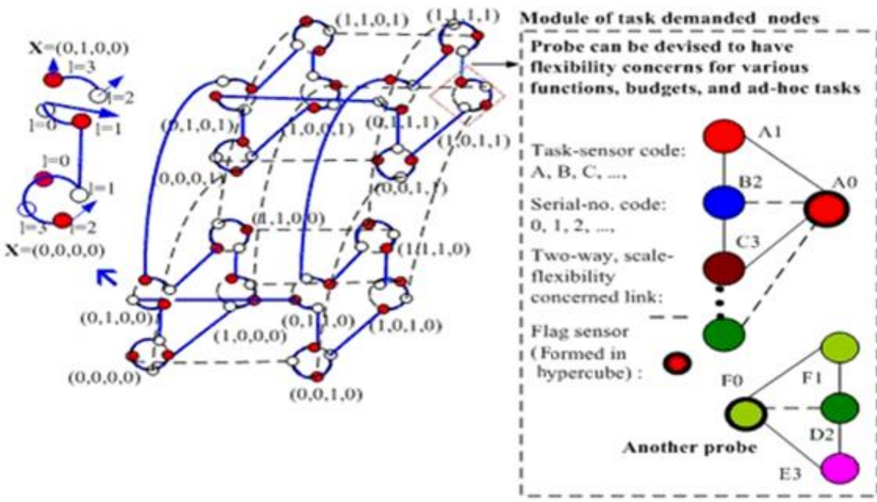


Figure 5. Spider-web network applications: (a). Area-based DSRC networks; (b). e.g., collaborating with wireless cellular networks; (c).e.g., collaborating with radial-ring urban configurations.
Source: Keeble [69].

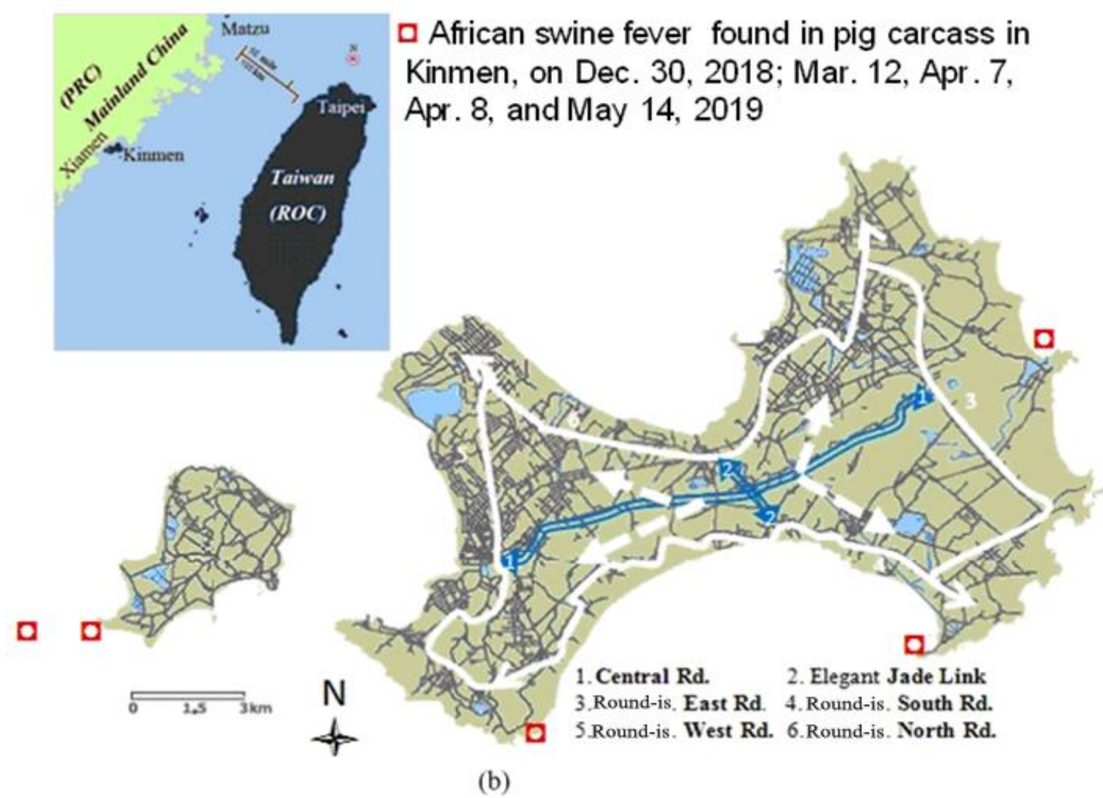
Except for the difficulties of countering boat collisions, smuggling, and expelling other potential hazards in relatively less-noticed terrains, waterways can have very adverse conditions owing to water's physical, and radio interference possibilities [21]. Hence, surveillance for this type of sensor information network is potentially waterborne-based [21, 71, 72] (Figure 4, 6). Failures in communication or surveillance can easily cause accidents by concealing or camouflaging monitored vehicles or entities behind other entities.

Moreover, terrorists often target crowded places, such as airports, for attacks at any time and any location, even occurring concurrently at several different locations. Hence, plural (dual) surveillance-based sensor information networks are more appropriate for busy or critical passages, including waterways. They are crucial in combating the effects of climate change and the rise in sea levels.

Surveillance's employing parallel mechanisms, which may already exist on airports' airsides, can help prevent airport incidents. Airfields can deploy collaborative fault-tolerant radars or groups of multiple sensors to address sensitive issues like blind spots and false images and to promptly repair facilities. Nevertheless, such capabilities can be further improved by sensor-information networks' holistic performance. Generally, an area-based resilient sensor-information network [21] systematically integrates sensory devices along the path and at exterior or interior positions; additionally, it integrates cellular communications, global positioning systems, and geographic information systems (Figure 5, 6).



(a)



(b)

Figure 6. Buoyant probe perspectives, shown as: (a) Relationship between cube-connected cycles (CCC) and hypercubes, e.g., with CCC4 and the ring networked module; (b) Evidence of forward-thinking on dealing with issues of cross-border health and security.

Note: Hamiltonian cycle shown as the bold line.
CCC can be viewed as a configuration of 2^a processor nodes, which make up Q_a- the hypercube, and a processor has n subnodes formed in a ring.

Source: Government.

We can adapt such networks to facilitate operations in sensor information networking, even when one lane of a path is under maintenance, and to accommodate both forward and backward surveillance directions, possibly with different scopes. Moreover, such networks are scalable; they can be designed to add the number of lanes in a path section and to be extended along a path or survey area (e.g., water) to flexibly respond to future requirements [21].

We expect Honeycomb tori (HT) to manage drone (also known as unmanned aerial vehicles) traffic. Roadside surveillance finds it difficult to detect these drones because they are small and likely located far away, leading to increased concerns [21, 38]. Such drones are being considered to be legally utilized, e.g., for logistic applications; however, they should be detectable, manageable along each lane of the path, as well as in areas off roadside surveillance.

A node's degree refers to the number of links connecting; networks with consistently lower degrees are typically more cost effective [73]. The mathematically regular optimal-degree (degree being three, the minimal links to a node to fit dual-surveillance requirements along a busy path) spider-web (SW) network is prototyped to build wireless or heterogeneous sensor information networks on paths (Figure 5), and a special interference-free cellular communications [21, 37, 74, 75] off paths. Another degree–three Honeycomb torus network, HT(m) m≥2, which is isomorphic to a specific generalized Honeycomb torus (GHT) network, GHT(m, 6m, 3m), is prototyped for general cellular communication applications [37, 41, 65, 76-78] with fault tolerance (properties: 1-edge Hamiltonian and 1p-Hamiltonian; see next sub-section) that can be used for enhancing maintenance efficiency and effectiveness.

3.2. Mathematical Evidence - Highlighting Connectivity, Maintainability, and Reliability

Let G = (V, E) be a graph if V is a finite set and E is a subset of { (a, b) | (a, b) is an unordered pair of V}. A path is delimited by (x_0, x_1, x_2, …, x_{n-1}). A path is called a Hamiltonian path if its nodes are distinct and span V. A cycle is a path of at least three nodes such that the first node is the same as the last node. A cycle is called "a Hamiltonian cycle" or "Hamiltonian" if its nodes are distinct except for the first node and the last node, and if they span V (41).

A bipartite graph G = (V, E) is a graph such that V = A ∪ B and E is a subset of { (a, b) | a∈ A and b ∈ B}; if G – F remains Hamiltonian for any F = {a, b} with a ∈ A and b ∈ B, then G is 1_p-Hamiltonian. A graph G is a 1-edge Hamiltonian if G - e is Hamiltonian for any e ∈ E. Moreover, if there is a Hamiltonian path between any pair of nodes {c, d} with c ∈ A and d ∈ B, then the bipartite graph G is Hamiltonian laceable. Notably, laceability is used with respect to connectivity to ensure that extended areas are integrated (or vice versa) and an area can be managed hierarchically yet effectively.

The bipartite spider web network, SW(m, n), is the graph with the node set { (i, j)| 0 ≤ i < m, 0 ≤ j < n}, where m and n are ≥4 and are even integers such that (i, j) and (k, l) are adjacent if they satisfy one of the following conditions: (1) i = k and j = l ± 1; (2) j = l and k = i + 1 (mod m) if i + j is odd or j = n - 1; (3) j = l, k= i – 1 (mod m) if i + j is even or j = 0. SW(m, n) (Fig. 5) is proved to be 1-edge Hamiltonian and 1p-Hamiltonian [74]. Thus, the fault tolerance involved is systematically based (i.e., prototyped to capably deal with unexpected incidents at any time and location to an extent, including several locations concurrently). Moreover, SW(m, n) is Hamiltonian laceable [75] Figure 5(**a**).

The definition of a hypercube is given as follows. Let u = $b_{n-1} \dots b_i \dots b_0$ be an n-bit binary string. For any j, 0 ≤ j ≤ n-1, we use $(u)^j$ to denote the binary string $b_{n-1} \dots \underline{b_j} \dots b_0$. Moreover, we use $(u)_j$ to denote the bit b_j of u. The Hamming weight of u, denoted by wH(u), is the value of |{0 ≤ i ≤ n-1|$(u)_i$ =1}|. The hypercube Q_n consists of 2^n nodes and $n2^{n-1}$ links. Each node corresponds to an n-bit binary string (Figure 6(**a**)). Two nodes, u and v, are adjacent if and only if v = $(u)^j$ for some j; link (u, $(u)^j$) is termed j-dimensional. The Hamming distance between u and v, denoted by h (u, v), is defined as the number of elements in {0 ≤ i ≤ n-1 | $(u)_i \neq (v)_i$}. Hence, two nodes, u and v, are adjacent if and only if h (u, v) = 1.

The cube-connected cycle graph, CCC_n, has $n2^n$ nodes labelled as (l, $\boldsymbol{x}$), where l is an integer between 0 and n − 1 and $\boldsymbol{x}$ is a processor node with an n-bit binary string. Two vertices (l, $\boldsymbol{x}$) and (l', $\boldsymbol{y}$) are adjacent if and only if $\boldsymbol{x} = \boldsymbol{y}$ and $|l - l'| = 1$ or $l = l'$ and $\boldsymbol{y} = (\boldsymbol{x})^l$. In the $l = l'$ case, x and y only differ in position l.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 4: 177-191, 2024
DOI: 10.55214/25768484.v8i4.1161

The edges that connect (l, $\boldsymbol{x}$) to its neighbours ($l + 1$, $\boldsymbol{x}$) and ($l - 1$, $\boldsymbol{x}$) are called cycle edges. Moreover, these cycle edges form a cycle of length n called a fundamental cycle and is defined by $\boldsymbol{x}$, which can represent a node (or a probe) composed of ring-networked processors. L(n) is the set of all possible lengths of the cycles in CCC_n (Figure 6(a)). For n = 2, CCC_n is simply a cycle graph of length 8.

Two Hamiltonian paths, $P_1 = (u_1, u_2, \dots, u_n(G))$ and $P_2 = (v_1, v_2, \dots, v_n(G))$, of G from u to v are independent if $u = u_1 = v_1$, $v = u_n(G) = v_n(G)$, and $u_i \neq v_i$ for every $1 < i < n(G)$. A set of Hamiltonian paths, $\{P_1, P_2, \dots, P_k\}$, of G from u to v are mutually independent if any two distinct paths in the set are independent from u to v; SW(m, n) was found to exhibit the performance of at least two MIHPs between any pair of bipartite nodes [21, 66]. Notably, MIHP can be considered for parallel, packet wireless information transmission, besides diagnosis and provision of additional ciphered information, which is considered important for offering real-time private information to logistic consigners.

Assume that m and n are positive integers, where m≥2. The honeycomb hexagonal mesh HM(n) is the graph with the node set $\{(x_1, x_2, x_3) \mid -n + 1 \leq x_1, x_2, x_3 \leq n \text{ and } 1 \leq x_1 + x_2 + x_3 \leq 2\}$. Two nodes (x^1_1, x^1_2, x^1_3) and (x^2_1, x^2_2, x^2_3) are adjacent if and only if $|x^1_1 - x^2_1| + |x^1_2 - x^2_2| + |x^1_3 - x^2_3| = 1$. The honeycomb (hexagonal) torus HT(n) is the graph with the same node set as HM(n). The edge set is the union of E(HM(n)) and the wraparound edge set $\{(i, n - i + 1, 1 - n), (i - n, 1 - i, n) \mid 1 \leq i \leq n\} \cup \{(1 - n, i, n - i + 1), (n, i - n, 1 - i) \mid 1 \leq i \leq n\} \cup \{(i, 1 - n, n - i + 1), (i - n, n, 1 - i) \mid 1 \leq i \leq n\}$ [77]. Assume d an integer and (m - d) being even. The generalized honeycomb torus, GHT(m, n, d) is the graph with the node set $\{(i, j) \mid 0 \leq i < m, 0 \leq j < n)$ such that (i, j) and (k, l) are adjacent if they satisfy one of the following conditions: (1) $i = k$ and $j = l \pm 1(\mathbf{mod}\ n)$; (2) $j = l$ and $k = i - 1$ if $i + j$ is even; and (3) $i = 0$, $k = m-1$, and $l=j+d(\mathbf{mod}\ n)$ if j is even. GHT(m, 6m, 3m) is isomorphic to honeycomb torus, HT(m) [21, 76]; besides, GHT(m, n, n/2) is 1-edge Hamiltonian if n≥4; 1p-Hamiltonian if n≥6 or m = 2, n ≥ 4 [77] and Hamiltonian laceable, n ≥ 4 [78]. Honeycomb tori are proved having the MIHP performance to enhance the application of honeycomb hexagonal mesh in wireless communication [37]. The full study result is presented at [65]; the result is searched through smaller scaled GHT(m, n, n/2).

4. Features

To effectively maintain a lot of nodes, especially security-related ones, they should be inspected one after the other without any loss or repetition [42]. The mathematical Hamiltonian shows that this can be done. The Hamiltonian cycle can also enhance edge fault-tolerance (reliability); 1–edge Hamiltonian and/or 1p–Hamiltonian can further enhance fault-tolerance, aiding in the repair of network elements without requiring a probe application. The bipartite SW network's proven laceability helps establish network hierarchies and the aerial, morphological connectivity, or space adaptability required to promote smart urban growth.

The bipartite SW network is naturally dual-node prototype-based. However, it can also be adapted, specifically, for example, to merge sub-nodes. For the probe application, the cube-connected cycle is considered; it can support availability on both terms—Hamiltonian cycles and plural surveillance. Prototyped mathematical models can also support scalability, which helps accommodate different conditions, such as the path width and the traffic volume.

One road-segment can be considered a single link and integrally combined into a spider-web-like network, following the theoretical concept of radial-rings extending from the center. Such radial-ring networks possess link fault tolerance. Therefore, in terms of local governance, the network provides reliable information and control over the entire area it covers. Area networks made up of roads or paths as links are usually reliable (both nodes and links can handle faults), available (they can prevent occlusions and find vehicles in real-time), and maintainable (they have a good way of doing security-based inspection in a logical order).

In general, mathematical networks are prototyped with fault tolerance, Hamiltonian order (operating maintenance without loss and repetition), connectivity, scalability, countering electromagnetic interference, protecting privacy through cipher coding, and reliable accuracy through plural (dual) detection. Moreover, the grid path pattern can be adapted to the radial-ring pattern [69], with which the spider-web network prototype can consequently form a resilient area (path) network of (sensor information) networks that offers availability (holism), flexibility (future land-use coordination), and adaptability (facility coordination) [21].

To put it another way, this research aims to enhance the resilience of the area by addressing issues like road segments severely damaged by earthquakes or terrorist bombs. The proposed prototype, not discussed here, likely adapts to the resilience of multiple paths. The emerging pervasive logistic and security demand may justify the further application of other network types, including those with more flexibility. The incorporation of spider-web networks and Honeycomb Tori, e.g., with MIHP, can potentially increase operational flexibility, integrity promotion, and privacy-related cipher coding for cellular or wireless sensor information networking, as shown in Figure 4, 5(b), [21, 65].

5. Discussions after Experiencing Wicked Covid-19

5.1. Supporting Resilience with Parallelism

Given that wicked, global–changing disasters have occurred more frequently, the appropriateness of the ITS's plural (dual) surveillance approach appears to need to be studied. Similar to how people use their two eyes, two ears, and other sensory devices, a real-time, reliable surveillance system requires similar environmental management mechanisms. These mechanisms must be available to counter blind spots, distinguish small differences, confirm receiving messages, and/or ensure node fault-tolerance and reliability. This research employs a design based methodology for systematic availability prototyping.

For a fairly large number of nodes to be effectively maintained, especially ones that deal with security, they should need to be inspected one after the other without any loss or repetition [42]. This is a known mathematical operation called the Hamiltonian. The Hamiltonian cycle can also support some edge fault-tolerance (reliability); further fault-tolerance can be supported through 1–edge Hamiltonian and/or 1p–Hamiltonian, which can casually assist in the repair of network elements (different from the need for a probe application). The bipartite SW and GHT networks' proven laceability helps establish network hierarchies and the aerial, morphological connectivity, or space adaptability needed to promote smart urban growth. For the probe application, we consider the cube-connected cycle, which can support availability in both Hamiltonian and plural surveillance scenarios. Prototyped mathematical models can also support scalability, which helps accommodate different conditions, such as adjusting the path expansion, extension, and traffic facilities.

5.2. Enhancing Mobility through Wireless Corporation

The incorporation of spider-webs and honeycomb tori, e.g., with MIHP, can potentially increase operational flexibility, integrity promotion, and privacy related cipher coding for cellular or wireless sensor information systems, as in Hsu [21] and Hsu [65]. The VANET (vehicular ad-hock network in ITS), through stochastic passing vehicles' assistance, can easily go missing. To promote radio information integrity along paths, dedicated short range communications (DSRC) are needed, and the plural (dual) surveillance approach is suggested [21]. The need for advancing surveillance control technologies that interact with cellular communications, such as managing radio-advanced unmanned vehicles, has increased in recent times. Consequently, we can enhance the MIHP performance of SW and HT by providing privacy protection through active radio frequency identification (RFID) coding [21]. We can integrate multiple (dual) surveillance nodes with MIMO technologies and cellular communications to explore their inherent application potential.

In general, prototyped mathematical networks have fault tolerance, Hamiltonian order, connectivity, scalability, countering electromagnetic interference, protecting privacy through cipher coding, and reliable accuracy through plural (dual) detection. The grid path pattern can be adapted to the radial-ring pattern [69], with which the spider-web network prototype can consequently form a resilient area (path) network of (sensor information) networks, which offers dependable networking holism (availability, reliability, and maintainability) [41, 62-64], flexibility (future land-use coordination), adaptability (transportation, logistic coordination) [21], and synergism. In the Taiwan area, we critically need to respond to new changes in potential geologic faults to protect nuclear electricity plants and maintain interactive peace- and place-building across the Strait [21] (Figure 3(**a**)). We propose the provision of three types of sensitive and reliable sensor information networks integrated with modern cellular communications to enhance security and development in the area.

5.3. Assuring Humanistic Living Features with Synergism

International and/or cross-border business benefits from transparent inter-communication mechanisms, which should naturally link to transportation and logistics. Therefore, this topic pertains to "managing uncertainty" and underscores the significance of avoiding blind spots and developing fault-tolerant mechanisms in surveillance systems. As a result, what this study is establishing is an infrastructure for promoting community security and information quality, which can benefit businesses and travellers.

There is a growing recognition that effective strategy formation is not solely dependent on vertical or top-down organizational structures. Bottom-up organizations may develop more constructive strategies. However, the formation of horizontal communications and interactions through reliable information platforms can lead to improved outcomes. If suitable mechanisms clearly identify the pros and cons, horizontal strategic collaboration is feasible even for competitive organisations. Trust is essential for collaboration and can be a type of social capital or infrastructure [57]. Real-time spatial–temporal information can provide more reliable information to consumers or tourists, benefiting business and tourism promotion.

This approach emphasizes the networking for temporary settlements (Figure 2(**e**),7(**b**)) through plural (dual) surveillance and/or connecting them to a pre-existing main network. Moreover, we can establish holiday markets and pandemic facilities [79] to encourage urban healthy living and local development and utilize wireless cellular communications as an alternative. Flexible spatial connections not only provide spatial resources, but they also produce more powerful, integrated capabilities.

Globally, there is a growing push to green buildings in response to the trends of climate change and aging societies. In addition, the cultivation of plants is encouraged (Figure 2) [80]. Flexible building uses can be reasonably negotiated so that vehicle ramps can be constructed in buildings, particularly for the podiums and basements of building towers. This situation is identical to that involving ramps in parking and logistical structures (Figure 7); hence, it is configured as a holistic topography with plural surveillance-based sensor information networks.

For instance, proposals for vertical neighbourhoods with adaptable building uses exist [51]. This is a rational approach for suburbia or coastal development [21]. It cannot only provide accommodation for seasonal demand but also support related logistic processing. Through careful design (e.g., with modular building elements), a development with smart growth orientation can be considered. Furthermore, such facilities could provide temporary social residences for vagrants at night, thereby benefiting inclusive social developments in contemporary cities (Figure 7(b)).

Parking and logistical structures with open exteriors and structural systems that can be modularised are potentially low-cost yet capable of having reasonable living quality. Such features can significantly lower the initial capital required for suburbia or coastal developments, especially when identifying and effectively adapting vertical neighbourhoods. Specifically, ceiling heights should be sufficiently high for rational logistical operation and access (e.g., for vans), prioritising inclusive design orientation [21, 51]. Regarding logistical structures, their accommodation of drones or aerial vehicles in the near future is inevitable (Figure 7) [44, 46].

DOI: 10.55214/25768484.v8i4.1161

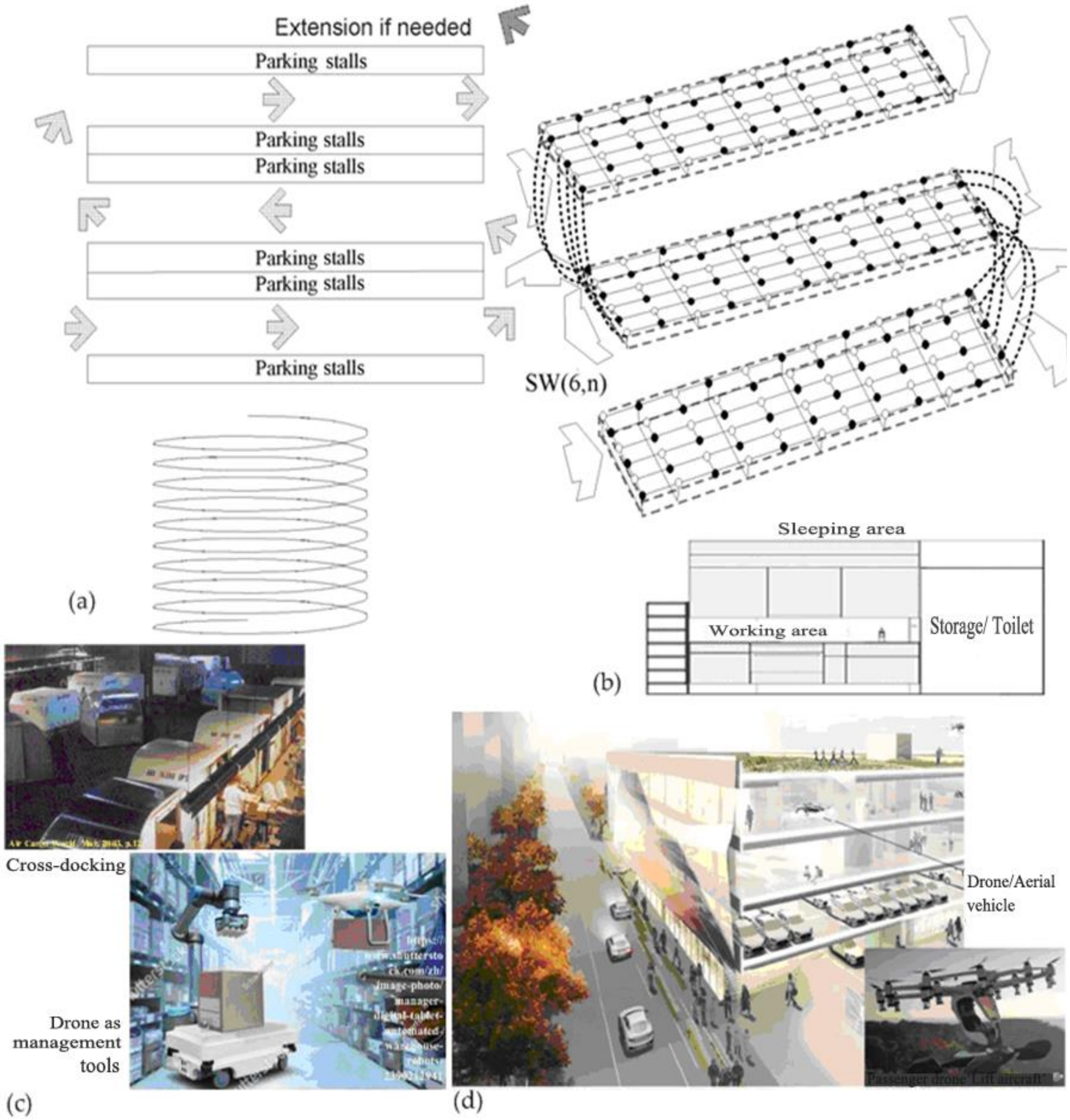


Figure 7. Synergistic vehicle path for adaptive prototyping, shown as: (a) synergistic circulation path; (b) living unit accommodated in a stall space; (c) parking space worked as logistic space; (d) architecture supported with future multimodal transport availability [21, 44] Figure. 1(a)).

6. Conclusions

Globalization activities significantly contribute to the contemporary economy. Participation in openness or incorporation in a knowledge-based economy is receiving increasing attention. If we can recognize the synergy between security and information services, a just-in-time economy can promote the use of computational transportation facilities, thereby benefiting tourism and business.

We suggest plural surveillance-information networking, especially in the era of wireless telecommunications, just as mankind uses two eyes for seeing, two ears for hearing, and two nostrils for smell to well sense and communicate the changing environments and related information.

The mutually Hamiltonian Paths property (MIHP) can be utilized for parallel analyzing interference and supporting cipher coding to offer privacy. Similarly, Honeycomb tori can offer the alternative pattern, i.e., cellular communication. It is found that the honeycomb tori, HT(m) $m\geq 2$, can have dual MIHP.

Funding:
This study received no specific financial support.

Institutional Review Board Statement:
Not applicable.

Transparency:
The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Competing Interests:
The author declares that there are no conflicts of interests regarding the publication of this paper.

References
[1] R. Schmidt and S. Austin, *Adaptable architecture: Theory and practice*. New York: Routledge, 2016.
[2] M. Gottdiener and L. Budd, *Key concepts in urban studies*. London: Sage, 2005.
[3] J. Corburn, *Healthy city planning: From neighbourhood to national health equity*. Abingdon: Routledge, 2013.
[4] R. Venturi, "Complexity and contradiction in architecture," *Department of Architecture & Planning, NED University of Engineering & Technology, City Campus Maulana Din Muhammad Wafai Road, Karachi*, pp. 1-53. 1997
[5] R. Shibley, L. Schneekloth, and B. Hovey, "Constituting the public realm of a region: Placemaking in the Bi-National Niagaras," *JAE*, vol. 57, no. 1, pp. 28-42, 2003.
[6] L. A. Herzog and C. Sohn, "The co-mingling of bordering dynamics in the San Diego–Tijuana cross-border metropolis," *Territory, Politics, Governance*, vol. 7, no. 2, pp. 177-199, 2019. https://doi.org/10.2139/ssrn.2719596
[7] T. Yigitcanlar, T. Inkinen, T. Yigitcanlar, and T. Inkinen, "Benchmarking city performance," *Geographies of Disruption: Place Making for Innovation in the Age of Knowledge Economy*, pp. 159-197, 2019.
[8] C. Risen, "Electricity substation, Virkkunen & Co," *Journal of the American Institute of Architects*, vol. 109, no. 3, pp. 35-37, 2020.
[9] Ministry of Economic Affairs and Employment, "Finland's integrated energy and climate plan, government administration department," Retrieved: https://ec.europa.eu/energy/sites/ener/files/documents/fi_final_necp_main_en.pdf. [Accessed 7 Feb, 2024], 2019.
[10] E. De Leeuw, "Cities and health from the Neolithic to the anthropocene," *Healthy Cities: The Theory, Policy, and Practice of Value-Based Urban Planning*, pp. 3-30, 2017. https://doi.org/10.1007/978-1-4939-6694-3_1
[11] K. Lynch, *A theory of good city form*. Cambridge: MIT Press, 1981.
[12] R. J. Orsato, *When does it Pay to be green?. In sustainability strategies: When does it pay to be green?* London: Palgrave Macmillan UK, 2009.
[13] R. Keyes, *The post-truth era: Dishonesty and deception in contemporary life*. New York: St. Martin's Press, 2004.
[14] M. Seadle, *The measurement of information integrity*. Routledge, 2022.
[15] P. Makovsky, "Climate change: The road to permanent resilience (editorial)," *Journal of the American Institute of Architects*, vol. 111, no. 7, p. 80, 2022.
[16] T. Haeusermann, "The dementia village: Between community and society," *Care in Healthcare: Reflections on Theory and Practice*, pp. 135-167, 2018. https://doi.org/10.1007/978-3-319-61291-1_8

[17] J. Boldt, *Conclusion: asking the right questions. In: F. Krause and J. Boldt (eds) Care in healthcare: Reflections on theory and practice.* Cham, Switzerland: Palgrave Macmillan, 2018.
[18] H. Van Der Meide, "Towards a three-dimensional perspective of space for humanizing hospital care," *Care in Healthcare: Reflections on Theory and Practice*, pp. 265-281, 2018. https://doi.org/10.1007/978-3-319-61291-1_13
[19] Y. David and W. Paperman, *Electromagnetic interference in healthcare environment. In: E. Iadanza, clinical engineering handbook.* Academic Press, 2020.
[20] C.-C. Shen, C. Srisathapornphat, and C. Jaikaeo, "Sensor information networking architecture and applications," *IEEE Personal Communications*, vol. 8, no. 4, pp. 52-59, 2001.
[21] L.-Y. Hsu, "Interactive placemaking-prototype of an intelligent urban building infrastructure for critical borderlands/Kinmen," *Modern Applied Science*, vol. 12, no. 7, pp. 128-128, 2018.
[22] B. Lucini, *The other side of resilience to terrorism.* Cham: Springer, 2017.
[23] S. Graham, *Cities, war, and terrorism: Towards an urban geopolitics. In: S. Graham (ed), Cities, war, and terrorism: Towards an urban geopolitics.* Oxford: Wiley–Blackwell, 2004.
[24] C. Tilly, "Terror as strategy and relational process," *International Journal of Comparative Sociology*, vol. 46, no. 1-2, pp. 11-32, 2005. https://doi.org/10.1177/0020715205054468
[25] L. Brugger, R. Grant, and R. Minnery, *Disaster assistance handbook*, 4th ed. American Institute of Architects, 2021.
[26] P. Andersen, D. Solomon, and D. Carson, *The architecture of patterns.* London and New York: Norton & Company W. W., 2010.
[27] I. Calzada and C. Cobo, "Unplugging: Deconstructing the smart city," *Journal Urban Technology*, vol. 22, no. 1, pp. 23–43, 2015. http://dx.doi.org/10.1080/10630732.2014.971535
[28] J. Sussman, *Perspectives on intelligent transportation systems (ITS).* Springer, 2005.
[29] H. W. Rittel and M. M. Webber, "Dilemmas in a general theory of planning," *Policy Sciences*, vol. 4, no. 2, pp. 155-169, 1973. https://doi.org/10.1007/BF01405730
[30] T. Fisher, "Public value and the integrative mind: How multiple sectors can collaborate in city building," *Public Administration Review*, vol. 74, no. 4, pp. 457-464, 2014. https://doi.org/10.1111/puar.12133
[31] D. Braha and O. Maimon, *A mathematical theory of design: Foundaions, algorithms and applications.* New York: Springer, 1998.
[32] T. McGinley and K. Nakata, "A community architecture framework for smart cities," *Citizen's Right to the Digital City: Urban Interfaces, Activism, and Placemaking*, pp. 231-252, 2015. https://doi.org/10.1007/978-981-287-919-6_13
[33] R. De Neufville and S. Scholtes, *Flexibility in engineering design.* Cambridge, MA: MIT Press, 2011.
[34] P.-A. Hillgren, A. Seravalli, and A. Emilson, "Prototyping and infrastructuring in design for social innovation," *CoDesign*, vol. 7, no. 3-4, pp. 169-183, 2011. https://doi.org/10.1080/15710882.2011.630474
[35] D. M. Last, "Peacekeeping doctrine and conflict resolution techniques," *Armed Forces & Society*, vol. 22, no. 2, pp. 187-210, 1995. https://doi.org/10.1177/0095327x9502200203
[36] N. A. Salingaros, "Architecture, patterns, and mathematics," *Nexus Network Journal*, vol. 1, no. 1-2, pp. 75-86, 1999. https://doi.org/10.1007/s00004-998-0006-0
[37] T. Rappaport, *Wireless communications: Principles and practice*, 2nd ed. Upper Saddle River: Prentice Hall, 2002.
[38] L. Hoppe and L. Awsede, *Design of control of UAV objects. In: A. Nawrat, K. Simek and A. Swieriak (eds), advanced technologies for intelligent systems of national border security.* Springer, 2013.
[39] W. Lau, "What is a smart city? We're working on it," *Journal of the American Institute of Architects*, vol. 108, no. 1, pp. 92–99, 2019.
[40] J. M. Anderson, K. Nidhi, K. D. Stanley, P. Sorensen, C. Samaras, and O. A. Oluwatola, *Autonomous vehicle technology: A guide for policymakers.* Santa Monica: Rand Corporation. https://doi.org/10.7249/RR443-2, 2014.
[41] L. H. Hsu and C. K. Lin, *Graph theory and interconnection networks.* Boca Raton: CRC Press. https://doi.org/10.1201/9781420044829, 2008.
[42] J. Knezevic, *Systems maintainability: Analysis, engineering and management.* London: Chapman Hall, 1997.
[43] K. Flynn, "Designing a trash-free future," *Journal of the American Institute of Architects*, vol. 107, no. 6, pp. 159-160, 2018.
[44] P. Scission, "Why high-tech parking lots for autonomous cars may change urban planning," Curbed, (Aug)," 2016.
[45] A. Ayobi, "Carlo ratti associati designs first smart highway system in Italy," *Journal of the American Institute of Architects*, vol. 107, no. 1, 2018.
[46] C. Risen, "Uber sky tower: Citation," *Journal of the American Institute of Architects*, vol. 108, no. 7, pp. 116–119, 2019.
[47] E. Dickinson, "Future proofing " *Journal of the American Institute of Architects*, vol. 108, no. 1, pp. 86–87, 2019.
[48] K. Keane, "Elements of a smart city," *Journal of the American Institute of Architects*, vol. 108, no. 1, p. 70, 2019.
[49] A. Hurley, "MIT on the 'Future of Suburbia'," *Journal of the American Institute of Architects*, vol. 105, no. 5, pp. 179-188, 2016.
[50] S. Sowers, "Autonomous vehicles come to babcock ranch," *Journal of the American Institute of Architects*, vol. 107, no. 10, 2018.
[51] L. Honesty, "Checking in with SCAD's parking garage micro community," *Journal of the American Institute of Architects*, vol. 104, no. 6, p. 6, 2015.
[52] A. King, "Koda house," *Journal of the American Institute of Architects*, vol. 105, no. 7, 2016.

[53] R. Grant, *Contemporary strategy analysis text only*, 8th ed. John Willey and Sons, 2012.
[54] S. Robbins and M. Coulter, *Management*, 11th ed. Prentice Hall, 2012.
[55] S. Sassen, *Epilogue (urbanizing technology). In: M. Foth, M .Brynskov and T. Ojala (eds), Citizen's right to the digital city: Urban interfaces, activism, and placemaking*, 1st ed. Springer, 2015.
[56] O. O'Neill, "Trust, trustworthiness, and accountability," *Capital Failure: Rebuilding Trust in Financial Services*, pp. 172-192, 2014. https://doi.org/10.1093/acprof:oso/9780198712220.003.0008
[57] S. Lillejord, "From" unintelligent" to intelligent accountability," *Journal of Educational Change*, vol. 21, no. 1, pp. 1-18, 2020. https://doi.org/10.1007/s10833-020-09379-y
[58] L. Laybats and C. Tredinnick, "Post truth, information, and emotion," *International Business Review*, vol. 33, no. 4, pp. 204-206, 2016.
[59] J. A. Barnes, "Graph theory and social networks: A technical comment on connectedness and connectivity," *Sociology*, vol. 3, no. 2, pp. 215-232, 1969. https://doi.org/10.1177/003803856900300205
[60] M. D'Angelo, "AIA names conjunctive points—the new city as twenty-five year award winner," *Journal of the American Institute of Architects*, vol. 109, no. 9, 2020.
[61] Architects—Alliance, "Tower automotive building," *Journal of the American Institute of Architects*, vol. 108, no. 4, 2019.
[62] D. Daley, *Design for reliability: Developing assets that meet the needs of owners*. New York: Industrial Press, 2011.
[63] G. Collas, *Reliability engineering for the future. In: K. Misra (ed). New trends in system reliability evaluation*, 1st ed. Elsevier, 2012.
[64] International Council of Systems Engineering (INCOSE), *INCOSE systems engineering handbook: A guide for system life cycle processes and activities*, 4th ed. WILEY, 2015.
[65] L.-Y. Hsu, "Infrastructure honeycomb torus with mutually independent hamiltonian paths," JISE," Retrieved: https://jise.iis.sinica.edu.tw/pages/issues/accepted.html. [Accessed 2023
[66] L.-Y. Hsu, "Scalable parallelism in spider-web networks," *International Journal Information Engineering*, vol. 2, no. 4, pp. 169–183, 2012.
[67] M. Picone, S. Busanelli, M. Amoretti, F. Zanichelli, and G. Ferrari, *Advanced technologies for intelligent transportation systems*. Springer, 2015, pp. 12-18.
[68] F. Li, *Interference cancellation using space-time processing and precoding design*. Springer, 2013, p. 2–3.
[69] L. Keeble, *Principles and practice of town and country planning*, 4th ed. London: Estates Gazette, 1969, p. 112.
[70] M. Batty and P. Longley, *Fractal cities: A geometry of form and function*. London, UK: Academic Press, 1994, pp. 7-8.
[71] D. Roemmich *et al.*, "On the future of Argo: A global, full-depth, multi-disciplinary array," *Frontiers in Marine Science*, vol. 6, p. 439, 2019.
[72] R. S. Knox and D. H. Douglass, "Recent energy balance of Earth," *International Journal of Geosciences*, vol. 1, no. 3, pp. 99-101, 2010. https://doi.org/10.4236/ijg.2010.13013
[73] I. Stojmenovic, "Honeycomb networks: Topological properties and communication algorithms," *IEEE Transactions on Parallel and Distributed Systems*, vol. 8, no. 10, pp. 1036-1042, 1997. https://doi.org/10.1109/71.629486
[74] S.-S. Kao and L.-H. Hsu, "Spider web networks: A family of optimal, fault tolerant, hamiltonian bipartite graphs," *Applied Mathematics and Computation*, vol. 160, no. 1, pp. 269-282, 2005. https://doi.org/10.1016/j.amc.2003.06.005
[75] S.-S. Kao and L.-H. Hsu, "Hamiltonian laceability of spider web networks," *JCYU*, vol. 33, no. 1, pp. 1-10, 2005.
[76] H.-J. Cho and L.-Y. Hsu, "Generalized honeycomb torus," *Information Processing Letters*, vol. 86, no. 4, pp. 185-190, 2003. https://doi.org/10.1016/s0020-0190(02)00507-0
[77] L.-Y. Hsu, F.-I. Ling, S.-S. Kao, and H.-J. Cho, "Ring embedding in faulty generalized honeycomb torus–GHT (m, n, n/2)," *International Journal of Computer Mathematics*, vol. 87, no. 15, pp. 3344-3358, 2010. https://doi.org/10.1080/00207160903315524
[78] L.-Y. Hsu, T.-Y. Lin, and S.-S. Kao, "The hamiltonian laceability of some generalized honeycomb tori," in *AIP Conference Proceedings*, 2008, vol. 1060, no. 1, pp. 302-306.
[79] A. Smith, "Architects are combating COVID-19 with site adaptation," *Journal of the American Institute of Architects*, vol. 109, no. 5, p. 122, 2020.
[80] S. Bainbridge, "A guide to rewilding," *Journal of the American Institute of Architects*, vol. 112, no. 5, pp. 36-37, 2023.