

third layer was called the *interaction layer* where residents and tourists interact with each other. If an animation reflected a real activity, the moving object became a tool for social interaction: users could click the object to communicate with it.

In the Kyoto railway station, we installed a disaster evacuation system that tracks passengers to help them navigate [6]. As the sensors, we placed twenty eight cameras in Kyoto station, and captured the movements of passengers in real time. A 3D virtual city system was used to reproduce the passengers' behavior. A bird's-eye view of the real space was reproduced on the screen of the control center so that evacuation leaders in the center could easily monitor the station. The leader can point at particular passengers on the screen, and talk to them through their mobile phones. We also implemented a large-scale outdoor evacuation system. A simulation with three thousand agents controlled by evacuation scenarios was performed in parallel with an experiment in the real space. The leader could issue high level instructions to the evacuees, and precise navigation instructions were automatically generated by the agent for each evacuee.

3. SMART CITY AND BEYOND

3.1 Smart City

A large amount of literature has been published on smart cities. The definitions of smart cities and comparison to related concepts are found in [7, 8]. Though the conceptual relatives of the smart city include digital city, intelligent city, virtual city, ubiquitous city and information city, since the substantial volume of activities were under the name of digital city, we focus on comparing the concepts of digital city and smart city in this article. According to [8], digital cities provide innovative services based on broadband communication and service-oriented computing, while smart cities apply technologies of self-monitoring and self-response systems to complex social problems including scarcity of resource, inadequate and poor infrastructure, energy shortages and price instability, global environment, and human health.

The above definitions include two separate aspects. One is the technological aspect, which highlights the difference between digital cities with the rise of the Internet, and smart cities being challenged in the era of IoT. The other is the social aspect, which distinguishes roles in human society: digital cities *explore cyber space* while smart cities *exploit physical space*. Both digital and smart cities represent paradigms, which are the general approaches adopted by a community for carrying out research and development. If we take the former technological aspect, it will become difficult to discuss the next stage of smart cities, but the latter social aspect can trigger the broad discussion of future cities. The rest of the article outlines recent and future evolution in human societies.

3.2 Socialization of Commerce

One evolution is to network for-profit activities. A typical example is *Industrie 4.0* in Germany. The initiative aims at networking a large number of manufacturing companies to create a nation-wide supply chain. Large scale factories in developing countries for *mass production* are no longer necessary. Instead, a network of many companies for *mass customization* will appear regionally.

There are several related activities. Michael Porter proposed the concept of CSV (creating shared value) which could reshape capitalism and its relationship to society. A for-profit sector *Y Combinator* will conduct a trial in support of universal basic income in Silicon Valley. The design firm IDEO now has both for-profit

(.com) and non-profit (.org) organizations and employees move from one to the other flexibly. In France, it is now illegal to waste food. Supermarkets must sign contracts with non-profit organizations to collect and distribute the food. Unfortunately, since the efficiency of for-profit and non-profit organizations are far different, the connection is not seamless at this moment. However, we can discover potential problems from their courageous challenge.

3.3 Commercialization of Society

Another evolution is the commercialization of citizens' ordinary life. Networking of unused resources in society can reveal profitable resources. A typical example is called the *sharing economy* such as Uber and Airbnb. Most cars in large cities are idled in parking lots. It is reasonable to share them to reduce environmental burden. Related non-profit activities called *sharing cities* have been launched in Seoul, Amsterdam, and so on. Although most of their activities are non-profit, sharing cities are creating substantial values by recycling resources. Similarly, newly created social innovation companies are viewing their market as a long tail investment.

We can expect the convergence of the two evolutions in the future, i.e., for-profit and non-profit activities will be connected seamlessly to sustain our society [9].

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