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Barun ICT Research Center conducts research on various ICT issues to explore socially desirable solutions.
Barun ICT Research Center aims to contribute to healthy and ethical ICT society.

The Wise and Positive Power Against COVID-19

Covid-19 and IT are inseparable. To illustrate, IT is being used in diverse areas in response to the pandemic, including the AI platform Blue Dot which predicted Corona, telemedicine for diagnosis, online video conferencing, and virtual lectures for social distancing. Fortunately, in South Korea, the government is taking effective measures to utilize the capability of IT, such as big data that identifies movements of confirmed patients, safety applications for those under self-quarantine, and apps to help alleviate the shortage of face masks. Furthermore, it brings attention to the medical staff and others who are greatly affected by the crisis.

The prolongation of Covid-19 puts an economic and psychological burden on all of us whose daily lives have been changed. Nevertheless, this is a situation in which we can benefit from social distancing, and therefore we should be flexible to adapt. However, social distancing may also lead to social isolation. Here, IT can be helpful in reducing the feelings of isolation and helps us maintain our normal interactions. Although we cannot visit movie theaters or outdoor events, we have access to OTT service such as Netflix and AR-based places. On social media, information about games at home for children who cannot go to kindergarten is being shared. Also, many SNS users who stay most at home have participated in the #7days7covers challenge in which they post covers of their favorite books for seven days. Meanwhile, the World Health Organization (WHO), that provoked controversy by classifying game addiction as a type of disease last year, recently started the #PlayApartTogether campaign to encourage social distancing.

The implications of the pandemic are significant. In particular, when IT is used to assist with something positive, it can create social values such as trust and further lead to economic value. On the other hand, when it is abused as in fake news or price gouging of essentials, IT can have a social cost and lead to confusion. Moreover, it can be highly thought provoking, raising important questions of how citizens deal with the personal information of the confirmed cases, elderly people who cannot be tracked through the internet, and the right to education of low-income students as the middle and high schools start the new semester online.

The aspects of our lives and the IT industry that the crisis has altered will not be temporary changes. Rather, the new possibilities of ICT revealed through the crisis leave us with countless new experiences and changes even when it passes. Barun ICT Research Institute of Yonsei University will continue to contribute to the creation and distribution of social values through ongoing research to ensure that digital benefits are safely and equally enjoyed.

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BARUN ICT SKT Insight

How to Respond to Fake News

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We are living in an era of fake news. Unfortunately, this is causing serious political and social problems all over the world. One of the recent examples is the anti-Korean fake news produced by right-wing Japanese media that suggests that "the emergence of a nuclear-armed North-South Korean reunification is becoming materialized", which was produced in response to the trade conflict between South Korea and Japan. Other examples include recent news regarding singer Yoo Seung-jun (Steve Seung-jun Yoo) being able to enter South Korea on a tourist visa, and more.

Why Does Fake News Spread So Rapidly?

To begin with, considering the development of the Internet, the field of information technology, and the expansion of social media such as Facebook and Twitter, the main causes of the expansion of fake news are on the production side. The inherent nature of social media, where content can easily spread through individual users' networks without any verification, provides a perfect environment for its diffusion. Furthermore, advanced information technology allowing anyone to easily produce online news or content, along with the decrease of the reliability on traditional media, including print newspapers and broadcast television, are also cited as reasons.

From the consumption side regarding users who embrace fake news, cascade effect and group extremism, the terms presented by Professor Cass R. Sunstein at Harvard University in his books On Rumors and Going to Extremes, contribute to the problem. The social cascade effect illustrates people's tendency to follow what others say or do, or if an acquaintance believes in certain news, he or she will believe it too. Group extremism is used to explain when an individual's view becomes more extreme after interacting with a group with similar thoughts. That is, the more users encounter fake news written primarily around biased content, the more they selectively accept information, called "confirmation bias", which strengthens existing ideas, resulting in further spread.

The Butterfly Effect of Fake News?

The primary harm of fake news is malicious agitation fueled by those with personal intentions. Fake news such as "Hillary sold arms to the Islamic State," and "The Pope supports Trump," which appeared in the last U.S. presidential

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election, are some of the representative examples. The Japanese right-wing media's anti-Korean fake news mentioned above can also be seen as an attempt to agitate not only domestic but international public opinion to promote political and economic benefits. Fake news like this can trigger social unrest and hinder social unity by deepening polarization between classes and ideologies.

However, the more serious problem is that most people who consume fake news do not have the adequate ability and time to check sources or facts of the data used to back it up. In return, the producers and distributors of fake news are exploiting such information asymmetry and anonymity that impede identifying the sources of data on the Internet.

Efforts to Solve the Problem of Fake News

Various studies are being conducted at home and abroad to solve fake news problems by utilizing artificial intelligence (AI) technology. For instance, Professor Cha Mi-young at KAIST's Computer Science Department is conducting a fake news detection study using AI as one of the mid- and long-term research tasks of Yonsei University's Barun ICT Research Center. According to the study, after collecting fake and real news examples, AI can learn the information patterns in each by using words and phrases. As a result, this leads to the creation of algorithms, including about 50 criteria, which detects fake news. Meanwhile, Hoaxy, developed at Indiana University in the U.S., is said to be capable to identify fake news by visualizing and providing a user's response to news that centers around social media. The figure below shows Twitter's content network on the Hoaxy platform, where blue indicates normal content, and yellow or brown means abnormal or fake.

However, we need more than mere technical efforts. Users who consume news or content should also endeavor to effectively address fake news issues. Various media outlets around the world, including the British BBC, provide guidelines and checklists to identify it. In South Korea, Yonsei University's Barun ICT Research Center developed a fake news checklist with Dong-A Ilbo to help the public judge news correctly.

How to Respond to Fake News

Various efforts are being made to identify and respond effectively to fake news. But at the end of the day, it is we who eventually decide to accept it or not. Readers need to be discerning and think twice about the sources and facts of the content that they encounter in daily life while being aware of the potential harm that fake news can bring. This effort will be the first step to the creation of healthy public opinion and society. Moreover, it will be the most effective way to prevent people or groups who seek to distort public opinion with fake news from entering the media ecosystem.

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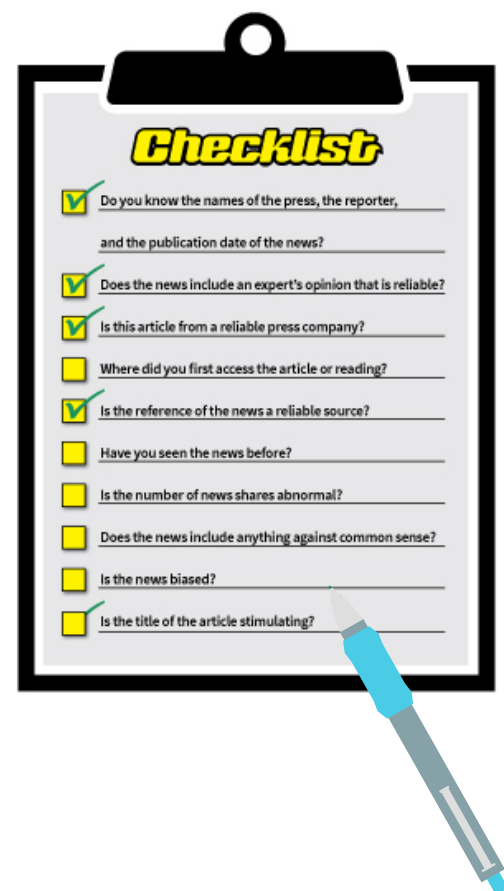
The Economics of Para-social Interactions during Live Streaming Broadcasts: A Study of Wanghongs

Jin Seon CHOE

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With the development of information and communication technology (ICT), many companies are actively using the internet as a channel for delivering product information. However, there are limitations in that customers cannot try or experience the product if they only access it online. To reduce the uncertainty of consumers and to build good customer relationships, companies are using social media to provide product information and respond to questions and opinions in real time. As part of this effort, Live Streaming Broadcasts (LSB) featuring celebrities for product introduction and sales is being used. Famous celebrities in China, known as Wanghong, strategically build social relationships with viewers through real-time streaming broadcasts, and some e-commerce companies use the influence of Wanghong to sell their products. For example, in May 2016, China's largest e-commerce company Taobao, introduced a real-time streaming broadcast service starring Wanghong, and over the first three months, more than 10 million customers signed up. Wanghong promotes products during the broadcast, and e-commerce companies provide the convenience so that customers can easily purchase products presented in the broadcast with just a few clicks.

The information technology of a real-time streaming broadcasting platform can increase Wang Hong's social attraction, and sales of products can also be affected by the increased social attraction. In this study, social attractiveness was classified into five categories. First, "relationship rewards" means that customers feel closer to Wanghong when they receive financial rewards from them, and the ability to provide products or electronic coupons to viewers through lottery in real-time streaming broadcasting is implemented. Second, "self-disclosure" refers to Wanghongs providing their personal information and interacting with viewers by sharing their daily life through real-time streaming broadcasts, increasing social attraction. The third and fourth elements are "attractive interactivity" and "informative interactivity". Instant chat or direct messaging during real-time streaming broadcasts is emotionally interactive by asking questions directly to viewers. It can influence informational interaction by being used as a tool to help with answering product-related questions. Lastly, "amount of information provided" serves to reduce consumer uncertainty about products by providing abundant information related to it, such as product prices and ingredients. This is used during real-time streaming broadcasts to list Wanghong's recommended items.

The results of the study show that these five elements promote the para-social interaction (PSI) between Wanghong and potential customers through real-time streaming broadcasts to form customer relationships. Furthermore, it increased the likelihood of purchase by consumers watching the broadcast. This study broadened the perspective of the existing e-commerce literature by researching a new type of e-commerce real-time streaming broadcasting and proposed five ways to utilize information technology to maximize sales by increasing the social appeal of Wanghong. By doing so, it provides practical implications for e-commerce companies. 🎛

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The Effect of Consumers' Cognitive and Practical Knowledge in Accepting Mobile Banking
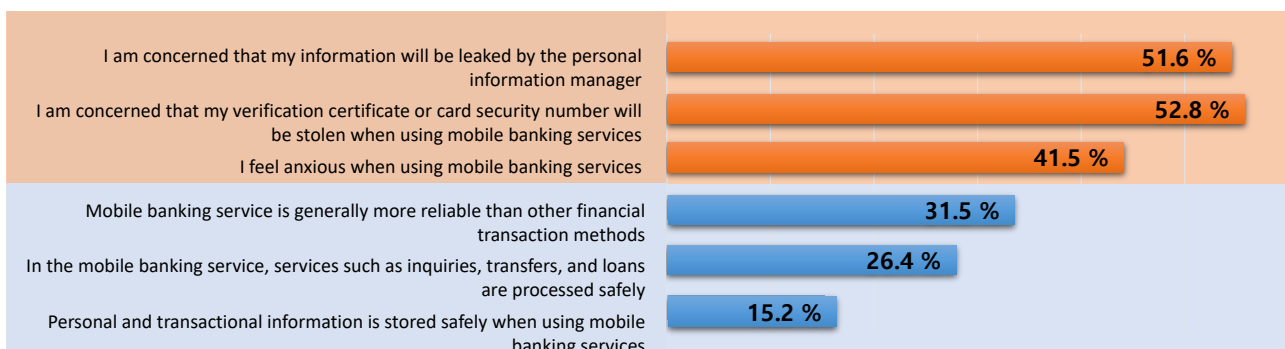
Miyea KIM

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Currently, the use of mobile banking services has become widespread; 6 out of 10 adults in Korea use it. The proportion of users in their 60s and 70s also accounted for 8.9%, confirming that the adoption of mobile banking services is rapidly taking place in all age groups. The main reasons users accessed the services are convenience (53.7%) and various benefits (29.3%). However complicated procedures (32.8%) and lack of trust in services (32.8%) remain challenges to be solved (Bank of Korea, 2019). As evident in the reasons why users do not use mobile banking services, many still have low confidence in the options despite the many benefits.

This study emphasizes the importance of consumer knowledge as one of the factors that shape trust, reducing the perception of risk to customers and leading them to accept mobile banking services. Accordingly, consumer knowledge was presented as a leading factor influencing acceptance of mobile banking services, and the effect of consumer knowledge on acceptance through trust was examined.

As a result of the study, consumer knowledge can be divided into cognitive knowledge (the degree of realizing the knowledge need for the use of mobile banking services), and practical knowledge (the ability to use mobile banking services). The influence on trust was derived differently according to the type of consumer knowledge. In other words; results showed that practical knowledge has a greater effect on acceptance through trust than cognitive knowledge, and it showed the influence of practical knowledge on mobile banking acceptance. This study suggests that financial consumer education, especially on practical knowledge about using mobile banking services, is essential to deliver as much practical knowledge as possible to form trust. 🔬

I am concerned that my information will be leaked by the personal information manager	51.6 %
I am concerned that my verification certificate or card security number will be stolen when using mobile banking services	52.8 %
I feel anxious when using mobile banking services	41.5 %
Mobile banking service is generally more reliable than other financial transaction methods	31.5 %
In the mobile banking service, services such as inquiries, transfers, and loans are processed safely	26.4 %
Personal and transactional information is stored safely when using mobile banking services	15.2 %

Anxiety vs Trust in Mobile Banking Services

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BARUN ICT in Media 🎙️

Stop COVID-19 Fake News! Right Attitude to Information on Confirmed Cases

[SKT Insight SKT 5GX ICT Column, Yonsei University Barun ICT Research Center] 20.02.19
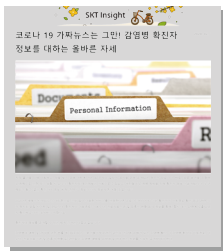
Novel infectious diseases have unknown causes and no vaccine. Thus, many experience great anxiety about their spread and possible infection This inflated fear triggers people to search for related information more aggressively and spread their findings via social media and messaging platforms. In this process, fake news spreads even further by feeding on our fears and negative emotions. If fake news like 'ㅇㅇ spooky stories' with unknown sources is spread widely, it may negatively affect how people react to treatment of infectious disease. Further, confirmed patients can suffer from severe physical and mental aftereffects due to insults and privacy violations if contact tracing details are publicized. Disclosure of confirmed patients' information is an exception to privacy laws to prevent further infection. Publicizing it allows government agencies to respond quickly to disease management and individuals to prevent infection. However, such information should not be exaggerated for fake news and consumed as gossip, while its original purpose gets forgotten. With Covid-19 being an ongoing issue, public anxiety is still widespread. However, at times like this, we need deliberate critical thinking toward information consumption so as not to be swayed by rumors about confirmed patients spread by fake news. 🐥

Sources : https://www.sktinsight.com/120678

Responding to COVID-19 with AI, Big Data, Cloud, 5G

[SKT Insight SKT 5GX ICT Column, Yonsei University Barun ICT Research Center] 20.03.04

On February 23rd, the government upgraded its Covid-19 response crisis alert to the highest rating of "serious" as the number of confirmed cases rose exponentially. As the situation continued for an extended period of time – and while emphasizing prevention efforts such as wearing masks, hand washing, and cough etiquette - AI, big data, cloud, and 5G are being used to address secondary transmission of the disease. With the data (credit and transportation card records, CCTV footage, mobile location information, etc.) released by the Korea Centers for Disease Control and Prevention (KCDC), apps and web services that provide information on confirmed cases have emerged. In addition, related information is provided through emergency disaster messages sent automatically to all mobile phone users within a predetermined relevant zone. Recently, China has been actively using smart medical technology to respond to Covid-19 as well. Remote medical care, drones used to patrol, detect heat, spray sterilizers, or deliver masks, daily necessities, and medicine to isolated areas have all taken place. In Korea, there are moves to use artificial intelligence speakers to operate indoor devices in hospital rooms or to contact nursing stations, while some companies are moving to allow employees to work from home to minimize the possibility of infection. As Korea boasts excellent IT infrastructure such as wired, high-speed Internet and cloud, we hope that IT solutions will be used to prevent infections contracted while using public transportation and in the workplace and improve corporate competitiveness. 🐥

Sources : https://www.sktinsight.com/121030

[Focus] 'Digital Divide' Revealed by COVID-19

[Weekly Chosun] 20.03.11
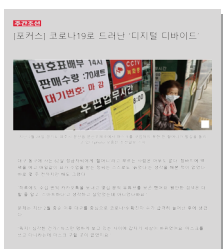
Mr. Chung (62) goes to yoga class everyday wearing jeans and carrying a backpack. Even until a few weeks ago, he had never considered himself "old". However, the situation has changed as the number of confirmed cases of Covid-19 increased sharply in Daegu and buying masks became extremely difficult. One day he had to go out to get groceries even though people had been advised to refrain from going outside.

Mr. Chung's story is not new and already have been looked at with other digital divide issues before the pandemic. According to the Digital Divide Survey, the digital devices used by old people is quite high at 90.1 percent. However, whether they knew how to use computers and mobile devices showed a sharp decrease to 50 percent. This implies that seniors do not know how to utilize digital devices properly, even if they do own them. Oh Joohyun, a research professor at Barun ICT Research Center, Yonsei University, explained that "Older people only consume content through digital devices, but they cannot utilize digital platforms". Furthermore, she stressed that "To practically utilize the Internet, such as obtaining information to help prevent infectious diseases or purchase daily necessities, it is necessary to have not only information service group education opportunities, but also digital assistants whom older people can repeatedly ask questions to and, thus, cross entry barriers to information services". As the advent of Covid-19 shows that the digital divide can threaten and cause inequality among individuals, it is necessary to recognize that it is an urgent social problem and come up with measures that will ameliorate its affects. 🐥

Sources: https://n.news.naver.com/article/053/0000027138

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Self-driving Cars will Change Our Lives

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When imagining future cities, self-driving cars always appear as part of it. While acting to solve transportation problems, it is also one of the engines of growth of the 4th Industrial Revolution. Now, it is being brought from our imaginations to reality.

Autonomous vehicles are operated according to the computer's instructions from several sensors on the front and rear of the vehicle that monitor the road [1]. Self-driving is divided into levels 0 to 5. Level 2 is partial autonomous driving (around the feet and hands), level 3 is limited autonomous driving (the degree of not relying on your eyes and entrusting driving to a vehicle in certain situations), and level 5 is fully autonomous driving (no pedal or steering wheel required). In order to commercialize level 5 a nearly perfect system must be built.

Commercialization of autonomous vehicles is possible when vehicle control, route creation, situational awareness, location information, and other factors are completed [3]. 5G communication technology plays a key role in recognizing driving environments such as roads, vehicles, pedestrians, and traffic lights, and determining whether lane maintenance or changes are needed. For example, autonomous vehicles must be able to detect dangers in order to prevent accidents by receiving signals from the control tower [4]. If there is no 5G with fast speed and minimal delay, quick judgment and control are impossible, likely leading to an accident.

Meanwhile, German automobile manufacturers said they plan to mass-produce fully self-driving cars by 2025. With only five years left, what changes will the popularization of self-driving cars bring? First, autonomous vehicles can provide great benefits both to industry and society. People will be free from steering wheels and can therefore have available time in their vehicles. Unlike being trapped in a subway or bus during long commutes and unable to do anything productive, they could use their time more efficiently, such as working or studying. In addition, those who have difficulty in holding the steering wheel due to physical disabilities will be able to enjoy these advantages. This is because people who could not drive due to safety risks will be able to move freely by car. For the disabled or the elderly who have difficulty using public transportation, it is highly likely that self-driving cars will assist their ability to travel.

The commercialization of self-driving cars has now become a real possibility in the near future. The Ministry of Land, Infrastructure, and Transport introduced the world's first safety standard for self-driving cars (Level 3) this January. As a result, the launch and sale of self-driving cars that automatically maintain lanes even without holding the steering wheel has become legally possible since July [5]. The long-term pending amendment to the insurance policy also provided a legal basis as it passed the National Assembly last month [6]. Currently, preparations for commercialization seem to be in progress. However, there are also problems; wouldn't commercialization be meaningful only when there is an effort to grasp the problems caused by autonomous vehicles in the future and to respond to them? 🔁

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BARUN ICT Column

Is IoT Essential to Exercise? IoT Meets Sports

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Sports are a great form of entertainment that people have enjoyed for thousands of years, and is deeply rooted in our society. IoT was first applied to sports through wearable devices. While in the past sports have evolved around a player's basic competence, training, and coaching, modern sports are evolving towards leveraging precise data gained through competition and training. In the conventional training method, it was impossible to accurately measure the athlete's body condition and performance during training. This was because they had to rely only on the coach's observation and intuition [1]. However, by using wearable devices such as smart watches and suits, it is possible to measure the distance and speed of athletes, as well as data such as heart rate and balance, thereby enabling more efficient training [2].

The problem is that enough training data cannot be collected just by using wearable devices attached to the player. As a result, technology that utilizes IoT has begun to appear not only in players, but also in the ball or the goalpost used during play. The world's first smart golf ball, Graph Golf, ranks shots based on the golf ball's location data [3]. Results can be checked through an app using AI analysis. A smart ball is also useful for baseball, a sport in which the quality of the ball plays a very important role in the game. Ball trajectory, speed, and rotation are all recorded, allowing pitchers to set their own training program based on this information [4].

With the advancement of technology, a means to assist coaches and players with wearable devices and smart balls has been developed, so players can create more efficient training programs through high quality data.

The interesting thing about IoT is that it's not just used by players and coaches. Fans who are passionate about sports can also enjoy spectating more through IoT. KT Wiz, a Korean professional baseball team, provides a mobile app called Wizzap to fans, which allows them to issue tickets and enter the stadium quickly using NFC. You can also tag the NFC on a player's uniform sold at the stadium, link to the player's fan page, and check the player's records and videos [1].

Sports attracts all sorts of people, and the value of sports data collected and given to consumers through IoT is endlessly valuable. It is expected that IoT will create not only better skills and strategies in players, but also more enjoyable sports for consumers.

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Identification Card in Smartphones, Can It Protect Privacy?

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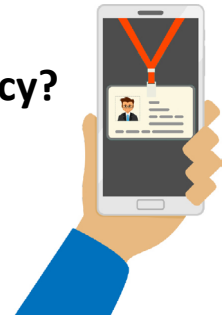
Personal information leakage is one of the most common crimes in modern society. As the use of the Internet is so integrated into daily life, personal information leakage is also increasing. In particular, various companies such as banks face this issue regularly; many people have suffered or are worried of such accidents. Although there is currently a widespread effort to prevent it, there is still a long way to go.

One of the proposed methods to prevent the damage from such personal information leakage is a smart phone-based mobile identification card. Instead of a plastic card that could be forged or stolen, the method of storing and using a digital form of identification card in smartphones was introduced to increase safety and convenience [1]. The plan is to start with government employee or student ID and gradually after verifying safety, expand usage from 2022. The digital issuance of an identification card or driver's license will also be decided after legal review. It also increases the issuance of electronic certificates that can be stored on smartphones and used for government offices and banking [2]. The plan is to expand the service to 300 areas, such as resident registration and seal certificates by next year. This will also help to reduce paper use and build a more convenient system.

In addition to simply storing identification cards on mobile phones, there are continuous attempts to combine them with various ICT technologies. An example is the development of a digital identification card that combines biometric technology and blockchain.

It is intended to commercialize a non-face-to-face identification service using biometric recognition technology such as face, voice, the eyes' iris, fingerprint, and vein pattern recognition. At domestic airports that are already using these technologies, it is no longer necessary to bring identification cards. This is because the ID can be registered along with the identifying vein pattern and fingerprint information [3]. Personal authentication through identification is now appearing in combination with biotechnology.

In addition to convenience, the biggest advantage of digital ID is that it helps eradicate personal information leakage. As mentioned earlier, it is difficult to forge digital identification. However, there are also concerns raised about the new forms of identification. A new method of personal information leakage may be developed. In addition, there is the question of whether the elderly or vulnerable who are not able to use the Internet can use digital ID cards well. At this point, when digital identification is still under development, there is more need to consider what is the most efficient way to protect personal information.

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Precision Agriculture through IoT Combats Excessive Irrigation in Vietnam

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Although Vietnam is the third-largest rice exporter in the world, it is still predominantly a hands-on and experience-based agricultural nation [1]. For example, farmers usually water their crops based on traditional knowledge rather than referencing data on weather, rainfall, or groundwater levels. In Dalat, a central highland 1,500 meters above sea level where water is scarce, Vietnamese strawberry farmers still believe that they need to irrigate until water drips from the soil, despite scientific research showing that they need to water less in order to reap the best harvest [2]. Excessive irrigation can interfere with growth or kill crops, increase expenses, and deplete limited groundwater. To prevent excessive irrigation, Vietnam-based startup MimosaTEK has developed an Internet of Things (IoT) platform for precise irrigation that allows small farmers to easily access and manage irrigation levels, saving both crops and water.

MimosaTEK works by placing sensors that evaluate environmental factors, such as moisture in the soil, precipitation, temperature, and wind speed in a farmers' greenhouse or fields. After measuring numerous factors in real time, the algorithm computes the data and recommends the optimal irrigation schedule. Farmers can access the app on their smartphone to plan water usage according to the data. MimosaTEK users reported that the app has helped them save up to 50% on water and electricity to irrigate their farms and increase yields by up to 25% [3]. Farmers can also remotely operate their irrigation system through the app, saving time they would otherwise have to spend in the field.

However, despite various economic and environmental benefits, MimosaTEK as well as other advanced agricultural solutions still face a variety of cultural obstacles. It is extremely difficult to convince farmers, especially small landowners, to change the production methods their families have used for generations, let alone spend money to install and update a precise irrigation system. To address this issue, MimosaTEK has held several workshops and events to provide training to farmers on better methods of irrigation and instructions on how to use the MimosaTEK products. After working hard to help farmers make initial investments, MimosaTEK set the price of infrastructure installations per small farm at approximately $500 [4]. In an era of increasing demand for food, it is vital that agricultural-based countries such as Vietnam adopt and popularize IoT applications in agricultural production. This will transform the sector from a qualitative, experience-based one into an algorithm-based field with data and statistical analysis. 🔬

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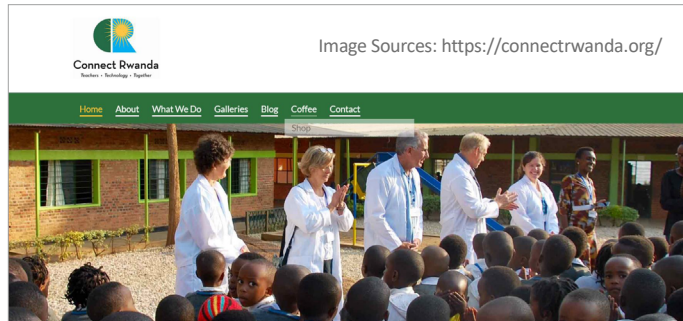
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"Connect Rwanda" Campaign Helps Rwanda Close the Digital Gap

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Image Sources: https://connectrwanda.org/

   "Connect Rwanda" is an ongoing campaign launched by the Rwandan government to collect one million smartphones for the purpose of giving them to the poor. The campaign continues to this day with the government's efforts to bring together people and institutions by donating smartphones and connecting unprivileged people online.

   The campaign aims to further increase the penetration rate of smartphones in Rwanda, which is currently less than 20%. The Ministry of ICT and Innovation revealed that, while 10 million Rwandans own cell phones, only 1.6 million have smartphones [4]. Rwanda has been rapidly adopting digital technology at the government level, which raises the need for more Rwandans to use smartphones. As Paula Ingabire, Minister of ICT and Innovation states, "Today, Rwanda has digitized various services and many companies are currently adopting e-commerce. Thus, smartphones are a necessary tool to enable citizens to traverse the digital value chain" [4].

   The campaign succeeded in attracting the attention of many businesses, government institutions, and individuals. Rwanda's President Paul Kagame has launched a campaign by pledging to donate 1,500 Mara smartphones, the first manufactured in Africa by Mara factories located in Rwanda [1]. The police also showed a commitment to the campaign by promising to distribute 1,200 smartphones [3]. Kigali Bank (BK) has also become the largest contributor so far, with donations of 200 million Rwandan francs, which amount to approximately 2,000 Mara smartphones [2].

   The "Connect Rwanda" campaign is a meaningful step forward in Rwanda's development. One of the country's current goals is to increase the literacy of youth between the ages of 16 to 30 by 2024. However, because many families in cannot afford a smartphone, the "Connect Rwanda" campaign is a meaningful solution that can help them achieve their goals. This campaign is a glimpse into Rwanda's willingness to ensure that no one, including the poor, is left behind. By January, around 40,000 smartphones were donated to lower-income families, and this number demonstrates that the campaign has been receiving enthusiastic support [2].

   Indeed, President Paul Kagame remarked that "smartphones should not become a luxury item" and encouraged people to "challenge themselves to make smartphones an everyday tool enabling all Rwandans to fulfill their potential" [1].

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The Role of ICT in Combating Epidemics

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   Elon Musk, Bill Gates, and Warren Buffet agree that this is the best time to be alive in the history of the planet [1]. Their rationale is that the world has seen positive outcomes in all facets of human development, particularly in medical infrastructure and cutting-edge technology that prevent death from unidentified epidemics. However, despite these developments, epidemics remain difficult to combat when viruses are new to researchers and the infection rate is beyond human control. The recent cases of Ebola, SARS, MERS, and the current Covid-19 are prime examples.

   With the advent of ICT however, it has become easier for governments to access and analyze real-time data of epidemics. Subsequently, projects and resources can be adequately targeted and deployed with immediate effect. Different types of data systems, such as cell data records, roaming, IoT, location-based and social media data, are simultaneously analyzed and provided to platforms, which then produce accurate reports with the information. These reports aid governments and organizations in making right decisions regarding health emergencies in the region [2]. South Korea is an excellent example of a country that uses ICT to conduct data analysis and provide real-time information to the public. In the middle of the havoc of Covid-19, Koreans receive an emergency notification on their mobile phones of any updated case of an infected patient, along with their current location and recently visited areas. Moreover, a real-time updated map of those infected is easily accessible online, so that people may refrain from visiting those areas. This process not only shows the expertise of the South Korean government in utilizing ICT platforms, but also proves the awareness and capabilities of a technologically savvy public who can contain epidemics with the information available at their fingertips.

   India, on the other hand, having one of the largest populations with mobile phone connections, has failed to utilize its available ICT infrastructure in healthcare sectors. Despite the government's numerous efforts to make India a digital economic power in every sense, the pandemic revealed their lack of capacity to utilize ICT infrastructure. The already inadequate healthcare infrastructure leaves the population vulnerable to preventable diseases such as dengue and malaria. Learning ICT and data analysis for creating a database that tracks the spread of disease will help prevent any spread of epidemics within the country. As noted by the World Economic Forum, "technology cannot stop the spread of the epidemic, but it can educate, warn and empower those on the ground and those that need to be aware of the situation to significantly reduce the impact" [3]. Not only India, but all countries should provide technology that improves the lives of people. As can be seen in exemplary cases like South Korea, ICT has become an advantageous asset to prevent the widespread causalities in times of global or regional health emergencies.

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The Usual Suspect of Social Chasms

Written By **Seoyoung LEE**
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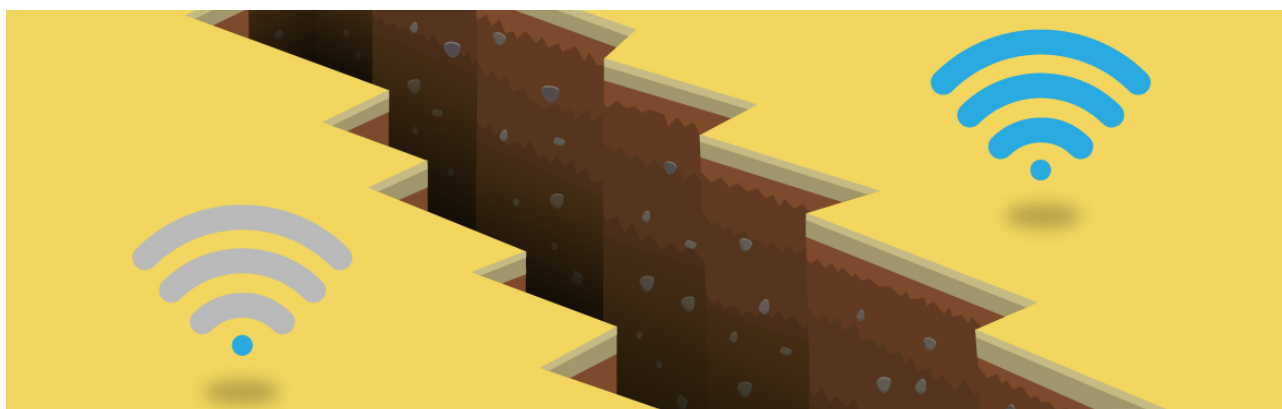
On September 1, 2019, the UN Secretary General's High-level Panel on Digital Cooperation reported that an increasingly digitized world has the risk of leaving behind more and more marginalized people from proper healthcare [2]. In the past, digital illiteracy, or ignorance of the Internet world, merely resulted in minor inconveniences such as fewer membership discounts due to one's lack of awareness on how to join online shopping sites, or register special cards. There was not much to refer to a "gap" or "disparity" in such matters. In the present, however, as the Fourth Industrial Revolution (4th IR) has expanded humankind's life radius to the online world at an unprecedented level, our existing social loopholes have both widened and deepened. The report's ominous announcement of our future demonstrates this explicitly; the inequalities and the classification produced by the 4th IR have grown from a couple of coupons to our right to life. Thus, the unequal digital world raises a burdensome question: How are we going to address the challenges that arise due to digital inequalities? Robinson et al., specialists in multiple fields; Shivdeep Dhaliwal, a journalist specializing in emerging and disrupting technology; and Aim Sinpeng, a lecturer in government and international relations, open discussion on how digital inequalities affect our lives and how to make appropriate responses to the trials driven by them.

All three authors agree that based on how we apply technology to reality, the consequences of digital inequality may differ significantly—it could either exacerbate or mitigate current real-life inequalities. However, whereas Robinson et al. and Dhaliwal take a humanitarian view integrated with social science, Sinpeng focuses on the administrative aspect and accuses the flaws of current policies regarding digital inequality. Among these writers, I concur with Robinson et al. the most, as they have not only succeeded in scrutinizing the current phase of digital inequalities but have also provided the appropriate guidelines to future research. I believe that the key point to addressing digital inequalities in the 4th IR relies on our scrupulous yet comprehensive understanding of it, and that the government should invest more resources to dig deeper into the issues of both offline and online inequalities, thereby devising the most effective and caring policies for unjust division.

The three experts agree that our ability to fully take advantage of the 4th IR determines how digital inequalities unfold in the upcoming future. In addition, they all demand more validated standards to more accurately analyze and assess current states of digital inequalities. Robinson et al. contend, "Digital inequalities can reinforce existing social inequalities and even exacerbate them …" and that our ability for accurate analysis of the situation may either deteriorate or mitigate the digital divide [3]. In the same vein, Dhaliwal follows that the digital divide can be aggravated when smart cities and smart regions exist in proximity with the less smart parts of particular areas while he discusses how smart cities should be designed [1]. Furthermore, Sinpeng concedes with the former two writers, stating that "reducing digital inequality depends on much more than access to products" [4]. Thus, Sinpeng attests that technology does not stand for itself, but rather depends upon our capacity to utilize it. Therefore, it is reasonable to conclude that all three authors agree that when it comes to the role of technology in the world of digital inequalities, it can either worsen the existing social inequalities or play a vital role in bridging those gaps.

Although the three authors concur with each other on the position of technology in digital inequalities, they take different tracks on the methods of dealing with the digital divide. Singpeng takes an administrative approach to contrast the successful and futile policies initiated to bridge the gap caused by the digital divide, whereas Robinson et al. and Dhaliwal take a more humanitarian view. They assert that endeavors to leave no one behind and protecting the minority are the key determinants of a promising society amid the 4th IR. Sinpeng sharply points out that the government should use their resources effectively to devise policies that would alleviate the digital divide, but only with a long-term vision. As a solution to the digital divide, Sinpeng proposes an appropriately mapped-out policy that deals with not only technical access, but also the socio-economic infrastructure to maximize the advantages of access to technology. However, Robinson et al. and Dhaliwal reveal a more humane perspective. Robinson et al. do not request a more ethical answer to coping with digital inequalities explicitly. Rather, they exemplify the negative effects and influences of digital inequality on social minorities such as women, children, the elderly, as well as racial minorities, and strongly argue for extended research for a better future, indicating an attempt to accommodate human rights to address the hardships of digital inequalities. Meanwhile, Dhaliwal explicitly presents a humanitarian view; he firmly demands approaches and strategies for "inclusive and equitable development", in which "'no one is left behind'" [1]. Sinpeng speaks solely about the government's role and how it should change on the one hand, while Robinson et al. and Dhaliwal adopt a broader scope that discusses human rights on the other.

Having read the three articles, my view on digital inequalities aligns the most with Robinson et al.'s. Although Sinpeng's acute commentary rings a warning bell for government officials and contributes to lessening the failures of such initiatives, I support the more humanitarian approach of Robinson et al. and Dhaliwal's since they provide a much more stereoscopic view of the issue, thus enriching our understanding of the phases and trials of the 4th

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IR. Furthermore, between the two, I especially concur with Robinson et al. since they have put forward the most balanced view of the topic. While Dhaliwal's overall compassionate frame is appealing, he does not mention specific means to fulfill it. In contrast, Robinson et al. encompass clearer and more objective goals and methods, especially in social science studies. For example, upon presenting an analysis of digital gender stratification, the authors suggest that "[t]his pattern points to the role of social and economic macrostructures in generating and sustaining digital inequality in terms of gender … Future research is needed to examine in more detail how these patterns emerge in different countries …" [3]. Likewise, throughout other discourses about race and ethnicity, they follow the same pattern by starting with their concerns about social minorities: "[The] disadvantaged minorities have less social capital. According to the stratification hypothesis, this pattern would be repeated in the online world" [3]. They further call for a thorough investigation into the "group-specific values" [3]. Though these guidelines may not be the exact blueprint for alleviating digital classifications, they nevertheless do not embellish the obvious and ideal roadway, which is also impressive because I personally deem this frame of thought as a desirable solution to addressing the challenges of digital inequalities.

I believe that the most important factor in confronting the digital divide relies on the ability to diagnose the current state accurately. If the diagnosis is unclear, so will the prescription. The government should invest more human and financial resources to face the impending wave of digital inequalities. Otherwise, society may have to go through civil strife induced by the digital gap. Many people, including me, do not have enough resources or databases to keep track of our constantly changing world in the swirls of the 4th IR. This has become a much more significant issue compared to the past since. Indeed, according to the three writers it has become evident that indifference towards digital inequalities can yield serious social strife. As a result, governments, societies, and the world now must bravely confront the phases of digital inequality to fundamentally resolve hardships.

In a nutshell, while I generally agree with the three authors' common argument that the success of the future society depends on our performance in handling technology with stability, I believe Robinson et al. have the best potential to serve our aim in closing the gaps between digital classes. The chasm has started to widened; from discounts or coupons in the past to the fields of healthcare or education in the present, which is already deeply associated with our basic rights. Then, questions arise along with the challenges: What is it going to take in the future? How wide will the chasms worsen? With this in mind, humankind should consciously delve deeper into the sinkhole of digital inequalities for a promising 'smart' world where humanity prospers. 🜨

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