

# The Application of Digital Transformation in Smart TV

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## ABSTRACT

Legacy industries, legacy businesses, and conventional products have lost their competitive edge in the digital transition era. The new digital ecosystems have benefitted people's daily lives in various ways due to several digital technology breakthroughs. Despite the fact that the digital transformation has applications in many businesses and upgrades device hardware and software, certain products have not progressed fully. The paper will investigate potential digital transformation technologies that can be applied to the current smart TV and improve the user experience. In the methods part, this paper will introduce four feasible digital transformation technology innovations for the smart tv, including the touch screen technology which allows users to control the smart tv by fingers, the IoT technology to make smart tv as a background wall, the biometric technology enables users to have a personalized experience by voiceprint and fingerprint activation, and the iris recognition technology.

**Keywords:** Smart TV, Digital Transformation, IoT, Biometric technology.

## 1. INTRODUCTION

Nowadays digital transformation creates a new competitive environment for traditional industries or companies. For those companies who try to adapt to this new environment, more and more interactive data are generated with the help of all kinds of sensors. With all this data, the production efficiency can be improved in its production ecosystem and more data-driven complement services can be offered in its consumption ecosystem. There is no doubt that higher efficiency and more useful services bring greater competitiveness. By the way, digital competitors who compete with similar data will replace the traditional competitors who compete with similar products in this new environment. All these changes have shown digital transformation's subversive impact on legacy business and the importance for legacy businesses building their own digital platform [1] to adapt to this new environment. Smart TV is a typical example of how to adjust the competitive strategies and build a digital platform with new technology in the new environment. In general, existing smart TVs possess a CPU which means they can offer some personalized recommendations by your watching history and

recognize voice instructions with the AI assistants after they hook up to the Internet. In addition to improving the user experience, cooperating with streaming video platforms, not only gives more options for customers to choose when they watch TV, but also helps establish its new digital platform. In the IoT age, smart TVs' big screens also give them the advantage to become the control center of a Smart house, which eventually gives them the chance to build a full-tethered digital platform [2] to compete in the new environment.

Even though the technology of traditional smart TV is constantly improving, the usage rate is decreasing year by year. Because traditional smart TVs have many drawbacks, such as the TV resources of traditional smart TVs are not rich enough, limited by channels and copyrights, there currently doesn't have TV channels and manufacturers that can contain all the content, and the application store has a relatively limited range of options. In addition, the control and playback methods of traditional smart TVs are inflexible, and the remote control has not changed. Many complex operations cannot be realized through the old TV remote control. TV picture quality is not high-definition. A streaming

device is a kind of network TV broadcast mode that transmits real-time TV signals through a network data stream. This is completely different from traditional smart TVs. " streaming devices enable the content of various devices to be played directly on the TV, so that information can be shared. Compared with traditional smart TVs, streaming devices allow users to watch and listen while downloading, instead of waiting for the entire compressed file to be downloaded to their own computer to watch the network technology, which makes users more convenient and saves a lot of time.

This paper discusses four different ways to bring digital transformation to smart TVs, which are touchable screens with touch technology, background wall with IoT technology, biotechnology, and iris technology, and the data map is investigated to diversify the way of smart TV.

**2. METHODS**

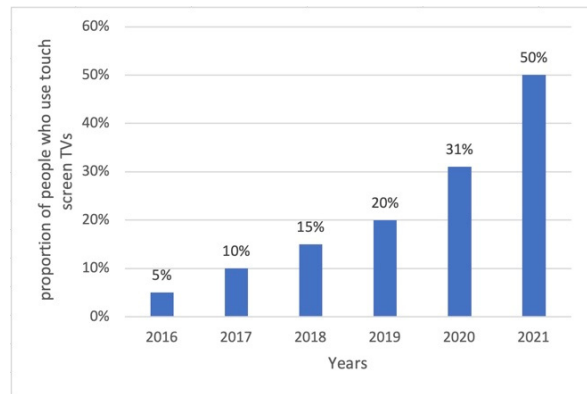
This part will go through four methods for bringing digital transformation ideas to smart TVs. The first way is incorporating touch screen technology into smart devices and explaining how touch screens affect human health. Second, a smart TV can be used as a background wall to adorn the home, and some statistical data and information are provided to support why a smart TV can be used to decorate the home and how to use the Internet of Things technology on smart TV to be a background wall. The third option is to incorporate biotechnology into smart TVs, which are the voiceprint and fingerprint technologies, and how they give a tailored experience for consumers. The final method is smart TVs can identify playback functions by tracking user behavior using iris and gesture detection technology.

**2.1. Touch Screen Technology**

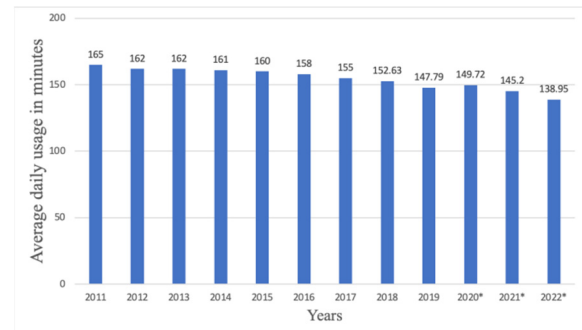
The touch screen is a touch screen device with a touch function added to the traditional TV, so that the traditional TV can be touched and can control the work of the system. With industry software in various application fields, it can be widely used for information query, advertising display, command, and control. Can provide users with a more intuitive interactive platform. The advantage of the touch screen is that there is no radiation, because if there is radiation, then people touching the TV for a long time will affect your health, while the touch screen TV has no radiation, which makes the visual effect better. And the prospect of a touch screen is very good. Compared with traditional TVs, touch-screen TVs are much lighter in size and easy to install. If there is any situation, it is relatively simple to disassemble. Moreover, the resolution is large and the definition is high. The touch-screen TVs were originally used glass plates, and its display angle is much better than that of a traditional TV

Figure 1 depicts the proportion of people who use touch screen TVs from 2016 to 2021. Over time, it can be found that people prefer touch screen TVs over traditional TVs and touch screen TVs, and the proportion of use has increased significantly.

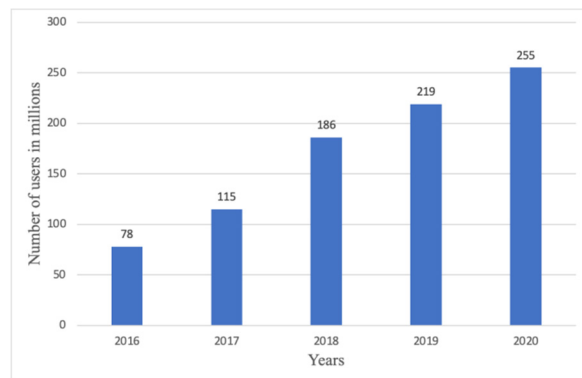
The digital sensor of the touch screen of the smart TV can monitor human vision and eye health. If the test detects visual fatigue, it will automatically adjust the appropriate brightness and mode to help the eyes watch in a more comfortable way, and can match the corresponding pictures or videos. to help relieve eye fatigue. Second, users can also control the screen by moving their hands remotely, and control the TV.



**Figure 1.** Proportion of people who use touch screen TVs from 2016 to 2021(in percentage) [3]



**Figure 2.** Average daily time spent watching television in China from 2011 to 2019 with estimates until 2022 (in minutes) [5]



**Figure 3.** Annual number of active smart television users in China from 2016 to 2020 (in millions) [6]

## **2.2. Background Wall with IoT**

Another future smart TV technical breakthrough is that the screen could be utilized as a background wall that changes the display based on the environment. People are beginning to explore the decorative significance of furniture as their living conditions grow. Because of their huge screens, smart TVs are ideal for displaying colorful graphs, as well as audio and video, which may be used to help beautify the home. Figure 2 depicts the amount of time Chinese users spend watching TV on a daily basis from 2011 to 2022, and as the years pass, the figure displays a clear downward trend, indicating that Chinese users spent less and less time watching TV over time. However, according to Figure 3, The number of active TV users in China is increasing year after year, which indicates that while the amount of time users spends watching TV is falling, the number of consumers who buy and use TV is rising. Jungwoo et al (2015) state that the increasing number of smart tv users might be a result of the popularization of smart devices [4]. Therefore, a background wall with IoT technology should be compatible with several smart devices, and this technology will increase the number of smart tv users.

Based on these two figures, we suppose that even though Chinese customers do not spend a lot of time watching programs and shows on their smart TVs, there are still more and more customers purchasing smart TVs for the potential purpose of beautifying their homes. Therefore, when no one is watching, smart TVs can be turned into a beautifying wall using sensors and IoT technology.

According to Jen Clark, “The Internet of Things is the concept of connecting any device (so long as it has an on/off switch) to the Internet and other connected devices.” [7]. In the other words, when the devices with sensors are connected to an IoT platform, the platform can then collect users’ data from these multiple sensors. The powerful IoT platform can evaluate and prioritize useful data while filtering out insignificant data. The data that has been evaluated and processed will be sent back to the different devices and then they are able to provide practical information and services to users with unique needs. IoT technology has benefited people’s lives in many ways, for example, an intelligent sweeping robot employs an artificial intelligence chip and Internet of Things technology to precisely locate and scan the unfinished cleaning areas throughout the house, saving energy while effectively avoiding missed cleaning and repeated cleaning, and thus improving cleaning coverage [8]. At the same time, it can be connected to the network via a mobile phone, which can then be used to direct the sweeping robot remotely.

Similarly, the smart TV's built-in digital sensor can detect human motion and iris, and once it detects that no one is watching the TV for a long time, the smart TV will

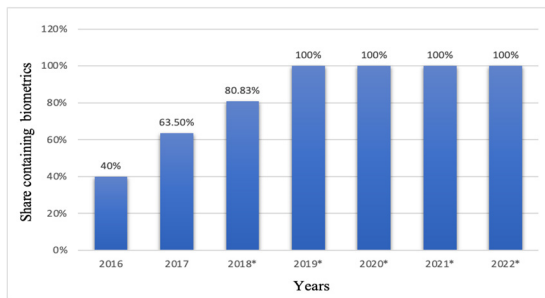
transmit the data to the built-in sensor, which tells the sensor that no one is watching and pauses the program, and instead displays some pleasing pictures or audio and video. Smart TVs can communicate user data to IoT platforms using sensors and IoT technology, which collect data from users' watching habits and ambient data. The data is then analyzed and processed by the IoT platform, which allows the smart TV to choose relevant audio and video pictures to display. The IoT technology will easily recognize certain circumstances. For example, when a user is doing chores on a tranquil autumn afternoon, the smart TV will automatically display him or her some pleasant autumn leaves pictures and music based on preferences obtained from other devices, such as cell phones. The user will then appreciate the benefits of the smart TV as a backdrop to their home when there are stunning vistas and soft music displayed just like being in a music concert [9].

## **2.3. Voiceprint and Fingerprint**

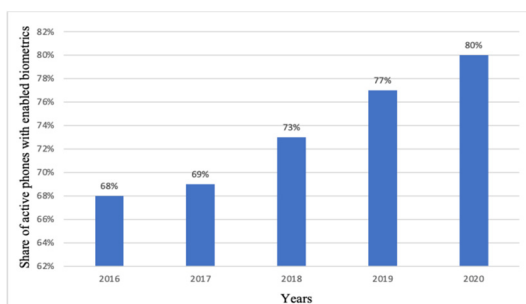
As a multi-user electronic product, it is also very necessary for smart TVs to meet the different needs of different users. For example, children may prefer watching cartoon programs while elderly people may prefer to watch nostalgic programs. To establish an account for every user and switch to a real-time user’s account automatically can be very helpful for smart TVs to adapt to the different needs of multiple users. Possessing some biometric technology systems like voiceprint recognition or fingerprint identification [10] can be very helpful to achieve this goal. With these kinds of technology, Smart TVs can log in or switch user accounts automatically when the device receives some voice instructions or fingerprints. After users input information data like users' age to the smart TVs in different user accounts, smart TVs can open teenager or elderly mode automatically. It will bring great convenience to multiuser families with children and elderly people. Another advantage is that it can protect every user’s privacy since each account is independent. These two advantages will increase the competitiveness of one product and make it become customers’ priority selection.

The market share of smartphones containing biometric technology has established a wonderful case which indicates these new technologies could bring enormous benefits. Figure 4 shows the share of annual smartphone shipments containing biometric technology worldwide was increasing very fast from 2016 to 2018. And it also shows the speculation in 2018 as all the smartphone shipments will contain biometric technology from 2019. Figure 5 indicates that from 2016 to 2020 there also has been a 12% increase in the share of active phones with biometrics enabled in North America, Western Europe, and the Asia Pacific in these five years. All these data show the success of biometric technologies

in the smartphone market. So, it is reasonable to suppose that the prospect of smart devices containing biometric technology is excellent.



**Figure 4.** Share of annual smartphone shipments containing biometric technology worldwide from 2016 to 2022 [11]



**Figure 5.** Share of active phones with enabled biometrics in North America, Western Europe & Asia Pacific from 2016 to 2020 [12]

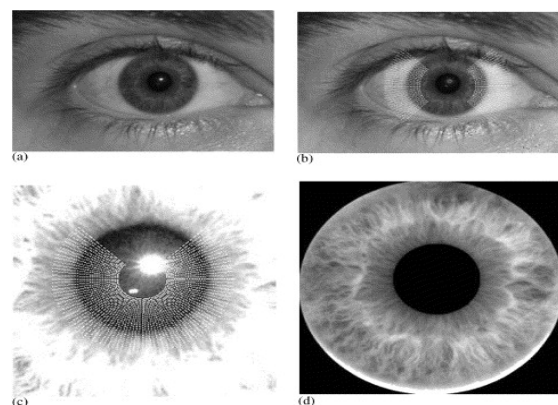
What’s more, smart TV manufacturers can get much more new data from different users’ accounts with the help of biometric technologies. All this data gives them a chance to offer more complementary services in the consumption ecosystem. For instance, watching history will show users’ preferences. So, they can cooperate with third-party entities like streaming media platforms by sharing some real-time data with open APIs on their own digital platform to offer more personalized recommendations. And according to Mohan Subramaniam and Mikolaj Jan Piskorski, “Full tethered digital platform is best suited for products with sensor data that is unique and faces few sharing restrictions on a platform.” These new data available to smart TV manufacturers are undoubtedly highly unique. And smart TV manufacturers also have high controllability to these new data. So building up a full-tethered platform is the most suitable way for smart TV manufacturers to improve their competitiveness and adapt to the new environment after digital transformation.

### 2.4. Iris Recognition

The last method is iris recognition. The iris recognition has high accuracy. In this method, we hope that this system can realize the intelligent unlocking of the iris of the smart TV and detect whether the user is

watching TV. The iris remains the same throughout life. This determines the uniqueness of the identification. Iris recognition is divided into four processes. The first process is "Iris image acquisition". Generally, a specific camera can be used to shoot the entire eye. After shooting, the formed image is transmitted to the iris recognition system preprocessing software. The second process is "image preprocessing", which processes the extracted iris map. By positioning the iris, the boundary of the iris is ensured, and then the size of the iris is adjusted to a size that the system can recognize. Finally, the image is subjected to some multi-processing to improve the recognition rate of the iris. The third is "feature extraction", which uses a specific algorithm to propose and encode the required feature points in the iris image. The last step is "feature matching", the system matches the extracted feature codes with the iris image codes in the database one by one [13]. The identity can be determined if the same irises are present in the database. We can bring iris recognition to our smart TVs. Because everyone's iris is different, the sensor can use the iris for TV unlocking or password unlocking. TV sensors can also read our iris images so we can encrypt smart TVs [14]. For example, there are two family members. But they want to use a different account to access the smart TV. For privacy, they can use an account that is not used for iris recognition to unlock and log in. This secure authentication method can be used for personal account verification. Users can purchase viewing rights or pay for membership on the smart TV. This unlocking method is also very convenient and precise [16].

Not only can it be used for unlocking, but it can also detect whether the human eye is focused on the TV. Most people forget to turn off the TV, such as the increased sleepiness caused by watching TV, so that they cannot turn off the TV that has been playing when they fall asleep. At this time, our iris recognition can also play a role here. If the sensor cannot detect the iris within a set time, it will automatically shut down and save the viewing progress. This will greatly reduce some energy consumption, while also avoiding re-seeking the progress of the last viewing [17].



**Figure 6.** How iris recognition works [15]

### 3. CONCLUSION

In general, this paper introduces some data and four methods to improve the user experience of modern smart TVs. With the modern digital transformation on various products, this paper also hopes to provide some suggestions on how to make smart TVs catch up with other smart products. We added touch screen technology, IoT technology to make smart TVs a backdrop, and biometric technology to make modern smart TVs possible. Users can also personalize the experience with voiceprint and fingerprint activation and iris recognition technology. By analyzing the data of the application of these technologies on similar products, this paper thinks these features can improve the competitiveness of existing smart TV. All these features can also improve the uniqueness of data that the smart TVs can receive. Eventually, this product can make a greater full-tethered platform and better adapt to the new environment after digital transformation.

### AUTHORS' CONTRIBUTIONS

The contribution of each user is equal.

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