SMART PUBLIC RESTROOM

INTRODUCTION:

IoT (Internet of Things) technology has enabled a wide range of applications in various domains, and one such domain is the management of public restrooms. The use of IoT technology in smart public restrooms can provide better service to users, optimize maintenance and cleaning schedules, and save water and energy. Here are some of the IoT applications in smart public restrooms: Automated monitoring: IoT sensors can be installed in public restrooms to detect the occupancy of each stall, the availability of toilet paper, soap, and other supplies. Automated monitoring can help staff to respond promptly to the needs of the restroom users. Predictive maintenance: IoT sensors can IoT Applications in Smart Public Restrooms IoT (Internet of Things) technology has enabled a wide range of applications in various domains, and one such domain is the management of public restrooms. The use of IoT technology in smart public restrooms can provide better service to users, optimize maintenance and cleaning schedules, and save water and energy. Here are some of the IoT applications in smart public restrooms: Automated monitoring: IoT sensors can be installed in public restrooms to detect the occupancy of each stall, the availability of toilet paper, soap, and other supplies. Automated monitoring can help staff to respond promptly to the needs of the restroom users. Predictive maintenance: IoT sensors can A smart washroom is a customizable solution that integrates operational and environmental smart washroom sensors and IoT technology, in commercial and retail washrooms, to provide a clear view of data in real-time.

Smart restroom sensors and mobile device integration make smart restroom technology enablement seamless and easy. The opportunity to improve restroom management is here. And the time to get smart about restrooms is now. Building leaders must be strategic about deploying their cleaning resources with a heightened awareness of building hygiene in today's post-pandemic era. Their efforts must be visible and reassure building occupants that their health and safety are at the forefront of the facility management team's efforts. Adding smart restroom technology that makes it easy for building managers to meet the public's expectations is not only suitable for occupants, but it's also good for business.

History of the development of smart toilets :

1. The origin of smart toilet

When it comes to smart toilets, people first think of Japan. Once, our relatives and friends have moreor less experience of going to Japan to carry the cover of a smart toilet. Therefore, most people thinkthat the smart toilet originated in Japan and was invented by the Japanese. However, this is not thecase, American Aronld Cohen invented the world's first smart toilet in 1964. Aronld Cohen's originalintention was not for commercial profit, but for filial piety and for the "convenience" of his father whohas been sick for many years. This smart toilet "originator" that took Arond Cohen for nearly twoyears is a foot-operated integrated machine with two functions of washing and drying. After Aronld Cohen improved and applied for a patent for the first smart toilet, he formed a smarttoilet production company for mass production. However, due to the inherent concept of theAmericans, Aronld Cohen's products have not been recognized by the American people. According to the "New York Times " report[3], Aronld Cohen's company sold only 200,000 products in the 45years since its establishment. Faced with such a dilemma, Aronld Cohen was forced to license thepatent of the smart toilet to Japan's TOTO company. Unexpectedly, after TOTO's improvement, smart toilets have gained a new life in Japan. At present, the penetration rate of smart toilets in Japan exceeds 80%. Even some special occasions such as public toilets are also equipped with smart toilets. The reason is Mainly because of Japanese traditional cultural concepts, smart toilets have prospered inJapan. Japan is one of the few countries in the world that values toileting and even worships "toilet gods". Japanese folks believe that worshipping "toilet gods" can contribute to fertility and family prosperity.

The first stage (1990-1995)

The first stage of the development of domestic smart toilets was 1990-1995, also known as the"birth period of China's smart toilets". In the third year after TOTO introduced smart toilets to Chinain 1990, in 1992, electronic sanitary ware manufacturers in Taizhou began to develop related technologies for smart toilets, and China's local smart toilet manufacturing started from this. After three years of toddler business, in 1995, the first domestically produced smart toilet was born. Theelectronic components of the products during this period depended on Japanese imports. This periodwas the initial stage of domestic smart toilets, so few

manufacturers were involved, large-scale AINITproduction areas were not formed, and product output was very limited, and the market share was almost negligible

The second stage (1995-2015)

Domestic smart toilets have experienced the cradle of the first stage and began to enter its growthperiod from 1995 to 2015. In the mid-to-late 1990s, with the rapid development of the domesticeconomy, especially after 1998, the social capital environment and industry preparations became moreand more mature. The domestic smart toilet industry had an unprecedented opportunity to developrapidly, and social capital was more accurate. It is said that the gradual filling of "hot money" hascaused many private entrepreneurs to target the emerging industry of smart toilets. At the same time,the professional talents and technology in this industry are becoming more and more abundant,creating a group of pioneers in the research and development of domestic smart toilets, becoming thebackbone of domestic smart toilet production and manufacturing at that time. The technology sectorhas madeoutstandingcontributionstoChina'ssmarttoiletmanufacturing.From1995to2014, according to statistics, domestic smart toilet products reached an average annual sale of more than100,000 units, with an annual turnover of nearly 2 billion yuan. Manufacturers also developed fromseveral previous companies to dozens of companies. This period It laid a good foundation for thefurther development of domestic smart bathroom products.

The third stage (2015-2020)

Xiaobo Wu entitled "going to Japan to buy a toilet cover" "boosted" the sanitary ware industry, andthen "going to Japan to buy a smart toilet cover" became a hot topic at the two sessions. The PrimeMinister was even right. This phenomenon carries on the statement emphasized that "manufacturing enterprises should upgrade [4], if domestic products of the same quality are also available, they shouldbe more competitive". At the same time, relevant government agencies and industry 2015 was a special and unusual year in the history of Chinese smart toilets. This year, an article byexpertssuccessively expressed their views on this phenomenon, which made the incident end. A great momentum. After this incident, the domestic production of smart toilets has developed rapidly. At present, thenumber of smart toilet manufacturers in my country has reached nearly 200, mainly distributed inZhejiang, Jiangsu, Fujian, Guangdong and other places. From 2016 to 2020, the market scale andprevalence rate of smart toilets increase year by year. The scale of China's smart toilet market from2016 to 2020 is shown in figure 2. The analysis of the penetration rate of smart

toilets in my countryfrom 2016 to 2020 is shown in figure 3. At the same time, according to the results of the nationalsupervision and random inspection of smart toilet products by the General Administration of QualitySupervision, Inspection and Quarantine for five consecutive years from 2015 to 2019, it can be seenthat the quality of domestic smart toilet products has been improving year by year. In 2015-2019,smart toilet products were randomly inspected, the statistical table is shown in table 1.

Operation of test toilet during the testing
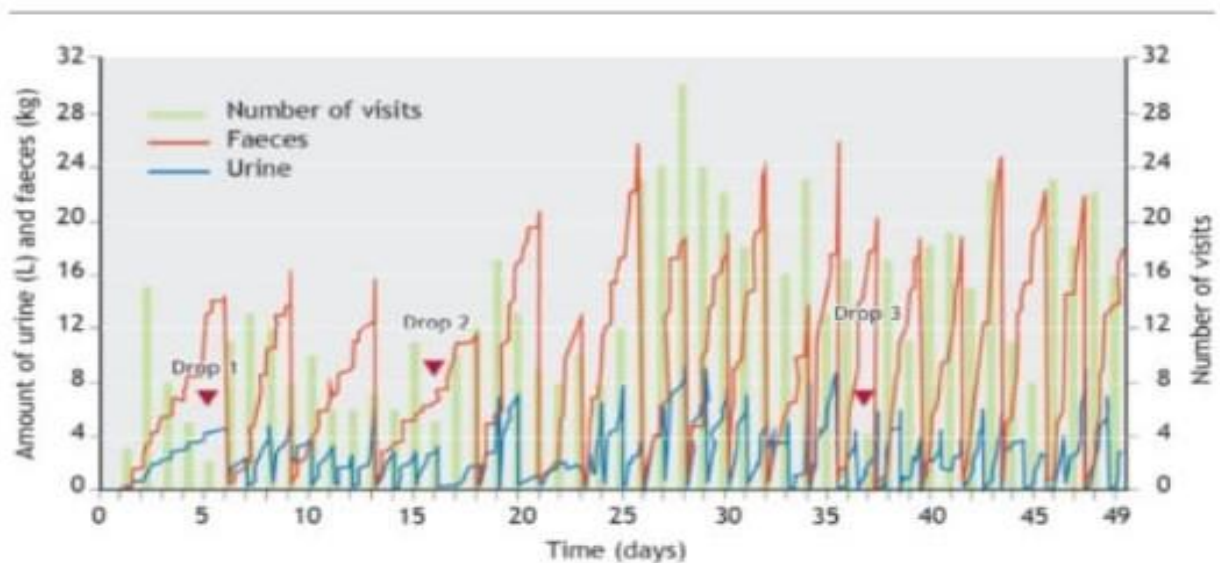
Fig:1 show the number of visits per day, as well as the amount of urine and faces collected in the storage tanks during the evaluated period until a tank emptying event took place.

The Advantages of Using Smart Toilets:

There is no secret that a smart toilet uses advanced technology in the sector of sanitation. But is that the only reason to use this piece of smart technology? The answer to it is that there are more than just one benefit of smart toilets, and we shall look into those perks in this section.

A Smart Toilet Reduces Wastage of Water-

The planet is facing a crunch in its resources, water being one of them. Several parts of the world have no access to clean water, and people in these parts of the world have been in

this crisis for a very long time now. It is, therefore, necessary for people who have access to a plentitude of this resource to pull strains on their water usage and save as much as possible. We tend to use a lot of water in toilets and bathrooms. But smart toilets reduce the wastage of water to a great extent. Smart toilets have the ability to calculate the amount of water required in every flush and uses as less as 0.6 gallons of water for the task. That, compared to a regular toilet, is quite a less quantity. Therefore, installing smart toilets in public places and living spaces makes for a brilliant idea.

Smart Toilets Have Several Environmental Benefits-

Smart toilets gave smart 'cleaning up' options that reduce the toxins put out into the environment to a large extent. Smart toilets make use of bidets or what we know as jet sprays (or hand faucets) for cleaning up, and this reduces the usage of toilet paper significantly. The amount of toxic waste, toilet papers and plastics dumped into the environment after every use of the restroom by just one individual, is horrifying. And that when multiplied by the total number of people inhabiting the planet, is a scary figure. A smart toilet makes sure that you do not have to use toilet paper to clean up, and even if you do, the quantity in which you do so will be quite less. This, thus, reduces wastage of resources and felling of trees to make the toilet papers. Therefore, a smart toilet helps in maintaining the balance of nature by preserving the resources.

A Smart Toilet Has Hygienic Benefits-

The most important benefits that make smart toilets smart are the hygienic benefits that these toilers are loaded with. Many might think that using water to clean up is gross. But when you really think about it, using water is the best way to maintain basic sanitary hygiene. It reduces your risk of contracting an infection and therefore, keeps you healthy. Using toilet papers is neither hygienic nor is beneficial for the environment. Having smart toilets installed in public restrooms can help people who do not have access to primary and clean sanitation, live a healthy life and also help many aged and differently-abled individuals to be comfortable while using the restrooms. Plus, these toilets flush out the excreta with great swiftness and perfection, and are, therefore, the smartest way to practice healthy sanitation.

The Disadvantages of Smart Toilets

Cost: The higher cost of smart toilets can be attributed to various factors. The incorporation of advanced technologies, such as touchscreens, motion sensors, and water-saving mechanisms, requires additional engineering, research, and development costs. Moreover, the production of specialized components and the integration of complex systems contribute to the overall price. Additionally, the limited supply and demand for smart toilets compared to traditional toilets can also impact the cost. While the initial investment may be higher, it is important to consider long-term savings that may result from water efficiency and energy-saving features.

1. Complexity: The complexity of smart toilets can manifest in multiple ways. Installation often involves more than just basic plumbing knowledge. It may require additional electrical wiring, water supply adjustments, and compatibility checks with existing infrastructure. Professional installation can ensure proper functioning and prevent potential issues. In terms of everyday use, the advanced features and controls of smart toilets can include a variety of settings, such as water temperature, pressure, nozzle position, and air-drying options. Users need to familiarize themselves with these settings, which may require referring to user manuals or spending time experimenting with different configurations to find their preferred settings.

2. Maintenance and Repairs: Maintenance and repairs for smart toilets can be more complex than those for traditional toilets. If any of the electronic components malfunction, such as the control panel, sensors, or motorized parts, it may require the expertise of a specialized technician or contacting the manufacturer for support. These components may not be readily available in local hardware stores, potentially leading to longer repair times and higher costs. Routine maintenance, such as cleaning the nozzles or checking for leaks, may also involve specific instructions and cleaning agents to ensure the longevity and performance of the smart toilet.

3. Reliance on Power and Connectivity: Smart toilets require a power source to operate their advanced features. They typically need to be connected to an electrical outlet to power the integrated systems, such as seat heating, bidet functions, or automatic flushing. In the event of a power outage, these features may become unavailable until power is restored. Some smart toilets may offer backup battery systems to mitigate this issue, but they may have limited capacity. Similarly, connectivity interruptions, such as Wi-Fi or Bluetooth signal loss, can disrupt certain features that rely on wireless communication, such as remote

control via smartphone apps or integration with smart home systems. Users should consider backup power solutions or evaluate the impact of temporary unavailability of certain features when choosing a smart toilet.

4. Privacy and Security Concerns: The inclusion of sensors and connectivity capabilities in smart toilets can raise privacy concerns for users. Sensors are used to detect a user's presence, adjust settings, or activate certain functions automatically. While this can enhance convenience, some individuals may find it intrusive to have their toilet usage monitored or tracked. Additionally, if the smart toilet connects to the internet or a home network, there is the potential for data breaches or unauthorized access to the system. To address these concerns, users should carefully review the privacy policies of smart toilet manufacturers, ensure secure network connections, and consider models that prioritize privacy features, such as data encryption or user anonymity.

5. Compatibility and Interoperability: The smart toilet market is still evolving, resulting in a lack of standardized protocols and technologies across different manufacturers. This lack of compatibility can lead to challenges when attempting to integrate a smart toilet with other devices or systems in a smart home environment. For example, if a user wants to connect their smart toilet to a centralized home automation system, they may encounter difficulties if the toilet uses a different communication protocol or does not have compatible interfaces. Compatibility issues may limit the extent to which users can control or monitor their smart toilet alongside other smart devices in their home.