

Smart Toilets and E-Toilets

Paul A. Adekunte¹, Matthew N. O. Sadiku², Janet O. Sadiku³

¹International Institute of Professional Security, Lagos, Nigeria

²Roy G. Perry College of Engineering, Prairie View A&M University, Prairie View, TX, USA

³Juliana King University, Houston, TX, USA

ABSTRACT

Smart toilets, which are also known as e-toilets or electronic toilets or intelligent toilets or modern day bidet, are revolutionizing bathroom experiences worldwide as well as sanitation and hygiene with cutting-edge advanced features and technologies. They are comfortable and convenient, and come with automatic flushing, self-cleaning capabilities, heated seats, bidet functions, and personalized settings. The paper examines the pros and cons of both smart toilets and e-toilets and their benefits to man.

KEYWORDS: Smart toilet, e-toilet, bidet functions, UV sanitation, hygiene, sustainability, data security and privacy, eco-friendliness, user experience

How to cite this paper: Paul A. Adekunte | Matthew N. O. Sadiku | Janet O. Sadiku "Smart Toilets and E-Toilets"

Published in
International Journal
of Trend in
Scientific Research
and Development
(ijtsrd), ISSN: 2456-
6470, Volume-9 |
Issue-4, August

2025, pp.15-21, URL:
www.ijtsrd.com/papers/ijtsrd97183.pdf



Copyright © 2025 by author (s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



INTRODUCTION

Smart toilets and e-toilets are revolutionizing bathroom experiences worldwide with cutting-edge technology and innovative features, as shown in Figures 1 and 2. First and foremost, what are smart toilets? Smart toilets which are also referred to as e-toilets or intelligent toilets are equipped with advanced features that enhance hygiene, comfort, and convenience. These toilets most often come with automatic flushing, self-cleaning capabilities, heated seats, bidet functions and personalized settings [1, 2, 3].

A bidet is a plumbing fixture designed for personal hygiene after using the toilet, as shown in Figures 3 and 4. It typically uses a stream of water to clean the genital and anal areas, providing a more thorough and hygienic cleaning experience than toilet paper alone. The various types of bidets are:

- Standalone Bidet: This is a separate fixture next to the toilet, requiring additional space and plumbing.
- Bidet Attachment: A device that attaches to an existing toilet seat, providing bidet functionality without the need for a separate fixture.

- Integrated Bidet Toilet: This is a toilet with a built-in bidet feature, often with advanced features like heated seats, massaging jets, and self-cleaning nozzles.

HISTORICAL BACKGROUND

The history of smart toilets and e-toilets is very fascinating and spans over several decades. The modern toilet was developed by a man named Sir John Harrington in 1596 [4].

In the 1700s, Bidets were introduced throughout numerous European countries as a standard for hygiene and in some countries, as contraceptive measures [5, 6].

Early Beginnings: The concept of smart toilets was first introduced in 1964 by American inventor Aronld Cohen, who created the world's first smart toilet with foot-operated functions. However, it wasn't until the 1980s that Japanese manufacturers like TOTO began to popularize the technology, introducing electronic bidet functions and heated seats [7], as shown in Figure 5.

Development and Popularization: TOTO's innovations played a significant role in shaping the modern smart toilet; the company's introduction of electronic toilet seats in 1980 marked the beginning of a new era in toilet technology. Over time, smart toilets evolved to include advanced features like self-cleaning nozzles, air dryers, and even built-in deodorizers.

Some Key Milestones:

- 1964: Aronld Cohen invented the world's first smart toilet.
- 1980s: Japanese manufacturers like TOTO popularized smart toilet technology, as well as in Europe and North America [8].
- 1990s: Smart toilets were introduced to China, marking the beginning of the domestic smart toilet industry.
- By the 2000s, numerous vendors including AXENT Switzerland, American Standard, TOTO, Duravit, and Kohler introduced one-piece, design-conscious electronic bidets. As more suppliers entered the market, electronic bidet toilets became more uniquely-designed while manufacturers began testing the incorporation of more advanced toilet functions and tools [6].
- 2014: Smart toilet models began to emerge in the American market.

Features and Benefits of Modern Smart Toilets:

Some of the notable features and benefits of modern smart toilets include [9]:

1. **Heated Seats:** This provides a comfortable seating experience.
2. **Bidet Functions:** Offer advanced hygiene and cleaning capabilities.
3. **Self-Cleaning Nozzles:** Ensure the bidet nozzle is clean and hygienic before and after each use.
4. **Water Efficiency:** Some models use as little as 0.8 gallons for liquid waste and 1.28 gallons for solid waste.
5. **UV Sanitation:** Some premium models employ UV light technology to eliminate 99.9% of bacteria and viruses. This invisible guardian works silently in the background, sanitizing the bowl surface continuously or between uses, depending on the model.
6. **Anti-Bacterial Surfaces:** Manufacturers have developed special glazes and coatings that make it difficult for bacteria to gain a foothold e. g. the TOTO's CEFIONTECT glaze.

7. **Temperature-Controlled Settings:** Beyond seat heating, smart toilets offer temperature control for various functions such as:
 - Water temperature for cleaning
 - Air dryer temperature
 - Ambient air deodorization
 - Room heating (in premium models).
8. **Soft-Close Lid:** This prevents the lid from damage.
9. **Adjustable Water Pressure**
10. **Automatic Flush**
11. **Motion Sensor Activation**
12. **App Control and Customization**
13. **Bluetooth and Voice-Activated Controls**
14. **Remote Control Functionality**
15. **Built-In Health Sensors**

There is also the need for public toilets (restrooms or public restrooms or comfort station) – which are facilities provided for the general public for personal hygiene and sanitation, as shown in Figure 6. They can be found in various locations such as: shopping malls and retail stores, restaurants and cafes, public transportation hubs (airports, train stations, bus terminals), parks and recreational areas, public buildings (libraries, museums, government offices), and roadside rest stops. Public toilets serve essential purpose in maintaining public health and hygiene.

SMART TOILETS Vs E-TOILETS

While often used interchangeably, “smart toilets” and “e-toilets” can have slightly different connotations depending on the context [10, 11]:

Smart Toilets: (i). They typically refer to high-end toilets with advanced features like:

- Heated seats
 - Bidet functions
 - Advanced flushing systems
 - Integration with smart home systems
 - Health monitoring capabilities (e. g. analyzing waste for health insights)
- (ii). Emphasize luxury, comfort, and technological integration.

E-Toilets:

1. Often used to describe toilets that use electronic or automated systems for flushing, cleaning, disinfection, and waste management.
2. May focus more on functionality, hygiene, and sustainability, especially in public or high-traffic settings.
3. It can as well include features like self-cleaning, water conservation, and remote monitoring.

Some of the key differences are:

1. Smart toilets tend to focus on user experience and luxury features, while e-toilets emphasize functionality and hygiene.
2. Smart toilets are often designed for residential use, while e-toilets are commonly found in public spaces or high-traffic areas.

However, the distinction between the two terms can be blurry; some manufacturers and user might use them interchangeably. The specific features and focus of the toilet will determine whether it can be considered a “smart toilet” or an “e-toilet.”

CHALLENGES FACING SMART TOILETS AND E-TOILETS

Some of the key challenges faced by and hindering the widespread adoption of smart toilets and e-toilets include:

1. Technical Challenges: This has to do with:
 - Installation and Maintenance Complexity: Smart toilets require professional installation and regular maintenance to ensure optimal functionality, which can be intricate and costly. This includes software updates, sensor calibration, and plumbing modifications.
 - Reliability and Durability: Complex electronic components can be prone to failure, and long-term performance of sensors and other technologies need to be proven [9-12].
2. Economic Challenges
 - High Initial Costs: Smart toilets are very expensive than the traditional toilets, making them inaccessible to budget-conscious consumers. The advanced features like self-cleaning mechanisms, integrated bidet functions, and AI capabilities contribute to the high cost.
 - Long-term Maintenance Expenses: Regular maintenance, repairs, and replacement of parts also add to the overall cost of owning a smart toilet [9-11].
3. Social Challenges
 - User Acceptance: Some consumers may be hesitant to adopt smart toilets due to their concerns for privacy, complexity, or simply a preference for traditional toilets, as shown in Figures 7-9.
 - Consumer Awareness and Education: Many potential users may be unaware of the benefits and features of smart toilets which can limit its adoption [11].
4. Data privacy Concerns
 - Data Collection and Security: Smart toilets collect sensitive health information, raising the concerns about data protection and potential misuse. For

this reason, manufacturers must ensure robust encryption to mitigate these risks [13].

5. Sustainability and Integration

- Integration with Existing Infrastructure: Smart toilets may require modifications to existing plumbing and electrical systems, which can be a challenge for homeowners.
- Sustainability: While smart toilets can conserve water, their production and disposal may have environmental implications [9].

OVERCOMING THE CHALLENGES TO SMART TOILETS AND E-TOILETS

In overcoming the enumerated challenges associated with smart toilets and e-toilets, the following strategies need to be seriously considered:

1. Address High Initial Costs
 - Need to develop cost-effective models with essential smart features to make them more affordable for a wider audience.
 - Highlight long-term benefits, such as water conservation and reduced utility bills, to justify the initial investment.
2. Simplify Installation and Maintenance
 - Provide comprehensive installation guidelines and consult professional plumbers when needed.
 - Regularly clean and maintain the toilet, following the manufacturer's guidelines, to ensure optimal functionality.
3. Improve User Acceptance and Education
 - Educate consumers about the benefits and features of smart toilets, addressing concerns and misconceptions.
 - Emphasize the importance of proper use and maintenance to ensure a positive experience, as shown in Figure 10.
4. Enhance Data Security and Privacy
 - Need to implement robust encryption and secure cloud storage to protect user data.
 - Clearly communicate data collection and usage policies to users, ensuring transparency and trust.
5. Focus on Sustainability and Eco-Friendliness
 - Design smart toilets with water conservation in mind, using features like dual-flush options and efficient flushing mechanisms.
 - Explore opportunities for integrating smart toilets with smart home and building management systems to optimize energy usage and reduce waste.

By addressing these outlined challenges and also incorporating user-centric design, smart toilets can become more accessible, user-friendly, and

sustainable, ultimately enhancing overall user experience [11, 12, 14, 15].

Some of the types of toilets are as follows:

By Flushing Mechanism

1. Gravity-flush Toilets
2. Pressure-Assisted Toilets
3. Dual-Flush Toilets
4. Double-Cyclone/Tornado Flush
5. Vacuum Toilets
6. Siphonic Toilets
7. Washdown Toilets

By Installation Style

8. One-Piece Toilet
9. Two-Piece Toilet
10. Wall-Hung/Wall-Mounted Toilet
11. Floor-Mounted Toilet
12. Back-to-Wall Toilet

By Usage or Location

13. Squat Toilet
14. Composting Toilet
15. Portable Toilet
16. Incinerating Toilet
17. Chemical Toilet
18. Bucket Toilet

Smart & Luxury Toilets

19. Smart Toilet
20. Bidet Toilet Combo
21. Bidet Attachment/Seat

Cultural and Regional Variations

22. Japanese Washlet
23. Turkish Toilet
24. Indian Toilet
25. Western Toilet

CONCLUSION

Smart toilets and e-toilets represent a significant advancement in bathroom technology, offering enhanced hygiene, comfort, and sustainability. However, while challenges exist, addressing these concerns through innovative design, education, and user-centric approaches can unlock the full potential of smart toilets and its adoption by consumers in improving the overall quality of life.

REFERENCES

- [1] "Experience the future: A comprehensive guide to intelligent smart toilets and their innovation," October 3, 2024, <https://www.medium.com/experience-the-future-a-comprehensive-guide-to-intelligent-smart-toilets-and-their-innovation>
- [2] H. Saleem (October 9, 2024), "Smart toilets: A new era in bathroom technology,"

<https://www.medium.com/smart-toilets-a-new-era-in-bathroom-technology>

- [3] "What does a smart toilet do? Exploring the tech of smart toilets," <https://dggexporttrade.com/what-does-a-smart-toilet-do-exploring-the-tech-of-smart-toilet>
- [4] "A brief look into the history of smart toilet technology," September 14, 2022, <https://theodorlesstilet.com/a-brief-look-into-the-history-of-smart-toilet-technology>
- [5] V. Bullough (2001), "Encyclopedia of birth control," ABC-CLIO.
- [6] "Intelligent toilet," Wikipedia, the free encyclopedia, <https://en.m.wikipedia.org/intelligent-toilet>
- [7] M. Gong et al. (November 2020), "Research and analysis on the development of intelligent toilet," *Journal of Physics Conference Series*, vol. 1684, no. 1, 012038.
- [8] G. Manjoo, "Electronic bidet toilet seat is the luxury you won't want to live without," *The New York Times*, 21 December 2017, www.nytimes.com/2015/04/30/technology/personaltech/electronic-bidet-toilet-seat-is-the-luxury-you-wont-want-to-live-without.html?_r=0
- [9] H. Walker, "Smart toilets: Features, benefits & best models explained," <https://pureluxy.com/smart-toilets-features-benefits-and-best-models-explained>
- [10] Government of India, Swadhh Bharat Mission (Urban) – eToilets under public sanitation infrastructure.
- [11] Research Article, "Technological Innovations in Sanitation: E-Toilets and Smart Toilets," *International Journal of Environmental Science*, 2021.
- [12] Big Ted (12 February 2025), "Challenges in smart toilet market," <https://toiletbloom.com/>
- [13] "Smart toilets and urinals: A deep dive into the future of restroom." <https://flyriver.com/>
- [14] HealthEvoke (April 9, 2025), "The rise of smart toilets: How they can detect health issues early," <https://www.healthevoke.com/>
- [15] C. Showers "Why smart toilet are the future of clean living?" <https://medium.com/>



Figure 1. Intelligent toilet

Source: https://www.google.com/search?sca_esv=6db176930c53557b&sxsrf=AE3TifM6q2zdCj5ps4lJOWhHazRGax8yTg:1750854422341&udm=2&fbs=AIijpHxU7SXXniUZfeShr2fp4giZ1Y6MJ25_tmWITc7uy4KlEoJTKjrFjVxydQWqI2NcOha3O1YqG67F0QIhAOFN_ob1aWGQOelbxvw0PKo40QtwvZMGAT8mh52EQduMaEwrkL_OWJKMRsfwjGjYSpRBIZ1JDaBjTRFJHK6nc3h7Df_ewEX8XvmvbWbC3KO9R3Wzz8jDjRXDvvSfLP0DDBhoo8LSWAeOg&q=images+on+smart+toilets+and+e-toilets+by+wikipedia&sa=X&ved=2ahUKEwjfpb_yIyOAxXiQUEAHbFzGSsQtKgLegQIExAB&biw=1036&bih=539&dpr=1#vhid=9h5ohHd6dsKeIM&vssid=mosaic



Figure 2. eToilet

Source: https://www.google.com/search?sca_esv=6db176930c53557b&sxsrf=AE3TifM6q2zdCj5ps4lJOWhHazRGax8yTg:1750854422341&udm=2&fbs=AIijpHxU7SXXniUZfeShr2fp4giZ1Y6MJ25_tmWITc7uy4KlEoJTKjrFjVxydQWqI2NcOha3O1YqG67F0QIhAOFN_ob1aWGQOelbxvw0PKo40QtwvZMGAT8mh52EQduMaEwrkL_OWJKMRsfwjGjYSpRBIZ1JDaBjTRFJHK6nc3h7Df_ewEX8XvmvbWbC3KO9R3Wzz8jDjRXDvvSfLP0DDBhoo8LSWAeOg&q=images+on+smart+toilets+and+e-toilets+by+wikipedia&sa=X&ved=2ahUKEwjfpb_yIyOAxXiQUEAHbFzGSsQtKgLegQIExAB&biw=1036&bih=539&dpr=1#vhid=yv9lkHd24Eo5UM&vssid=mosaic



Figure 3. Bidet

Source: https://www.google.com/search?q=images+on+bidet+functions+by+wikipedia&sca_esv=031453346484e3fe&udm=2&biw=1036&bih=539&sxsrf=AE3TifM0x4lb1jaPjz3UpXwy5ZvgGL1fXQ%3A1750938048445&ei=wDFdaOf7GqKNhbIPi_GBwQg&ved=0ahUKEwjn25rDgIOAxWiRkEAHYt4IIgQ4dUDCBE&oq=images+on+bidet+functions+by+wikipedia&gs_lp=EgNpbWciJmltYWdlcyBvbiBiawRldCBmdW5jdGlbnMgYnkgd2lraXBIZGlhSKnPAIDgZFjXhQJwAngAkAEAmAHIAqAB1TWqAQkwLjEwLjE5LjK4AAQzIAQD4AQQYAgCgAgCYAwCIBgGSBwCgB_sKsgcAuAcAwgcAyAcA&scient=img#vhid=KhHnK-vdTWxqiM&vssid=mosaic



Figure 4. Bidet

Source: https://www.google.com/search?q=images+on+bidet+functions+by+wikipedia&sca_esv=031453346484e3fe&udm=2&biw=1036&bih=539&sxsrf=AE3TifM0x4lb1jaPjz3UpXwy5ZvgGL1fXQ%3A1750938048445&ei=wDFdaOf7GqKNhbIPi_GBwQg&ved=0ahUKEwjn25rDgIOAxWiRkEAHYt4IIgQ4dUDCBE&oq=images+on+bidet+functions+by+wikipedia&gs_lp=EgNpbWciJmltYWdlcyBvbiBiawRldCBmdW5jdGlbnMgYnkgd2lraXBIZGlhSKnPAIDgZFjXhQJwAngAkAEAmAHIAqAB1TWqAQkwLjEwLjE5LjK4AAQzIAQD4AQQYAgCgAgCYAwCIBgGSBwCgB_sKsgcAuAcAwgcAyAcA&scient=img#vhid=ZDV50EiYkAvRdM&vssid=mosaic



Figure 5. Toilets in Japan

Source: https://www.google.com/search?sca_esv=6db176930c53557b&sxsrf=AE3TifM6q2zdCj5ps4IJOWhHazRGax8yTg:1750854422341&udm=2&fbs=AIJpHxU7SXXniUZfeShr2fp4giZ1Y6MJ25_tmWITc7uy4KleoJTKjrFjVxydQWqI2NcOha3O1YqG67F0QIhAOFN_ob1aWGQOelbxvw0PKo40QtwvZMGAT8mh52EQduMaEwrkL_OWJKMRsfwjGjYSpRBIZ1JDaBjTRFJHK6nc3h7Df_ewEX8XvmvbWbC3KO9R3Wzz8jDjRXDvvSfLP0DDBhoo8LSWAeOg&q=images+on+smart+toilets+and+e-toilets+by+wikipedia&sa=X&ved=2ahUKEwjfppb_yIyOAaxXiQUEAHbFzGSsQtKgLegQIExAB&biw=1036&bih=539&dpr=1#vhid=_nd0ohGcii0QZM&vssid=mosaic



Figure 6. Public toilet

Source: https://www.google.com/search?q=images+on+types+of+toilets+by+wikipedia&sca_esv=031453346484e3fe&udm=2&biw=1036&bih=539&sxsrf=AE3TifPiklAYGucHmB0ghUlf3TGPCLE9XA%3A1750937987931&ei=gzFdaODJOOWKhbIPIKb00As&ved=0ahUKEwigl62mgIOAxVIRUEAHRSTE7oQ4dUDCBE&oq=images+on+types+of+toilet+by+wikipedia&gs_l=EgNpbWciJ2ltYWdlcyBvbiB0eXBlcYBvZiB0b2lsZXRzIGJ5IHdp2lwZWRpYUihW1CICVjDN3ABeACQAQCYAe8CoAHIF6oBCDAuMS4xMS4xuAEMyAEA-AEBmAIAoAIAmAMAIAYBkgcAoAfJBLIHALgHAMIHAMgHAA&scient=img#vhid=7bJlsR-DmhkMmM&vssid=mosaic



Figure 7. Toilet

Source: https://www.google.com/search?sca_esv=6db176930c53557b&sxsrf=AE3TifM6q2zdCj5ps4IJOWhHazRGax8yTg:1750854422341&udm=2&fbs=AIJpHxU7SXXniUZfeShr2fp4giZ1Y6MJ25_tmWITc7uy4KleoJTKjrFjVxydQWqI2NcOha3O1YqG67F0QIhAOFN_ob1aWGQOelbxvw0PKo40QtwvZMGAT8mh52EQduMaEwrkL_OWJKMRsfwjGjYSpRBIZ1JDaBjTRFJHK6nc3h7Df_ewEX8XvmvbWbC3KO9R3Wzz8jDjRXDvvSfLP0DDBhoo8LSWAeOg&q=images+on+smart+toilets+and+e-toilets+by+wikipedia&sa=X&ved=2ahUKEwjfppb_yIyOAaxXiQUEAHbFzGSsQtKgLegQIExAB&biw=1036&bih=539&dpr=1#vhid=D2zOyikeNOTdXM&vssid=mosaic

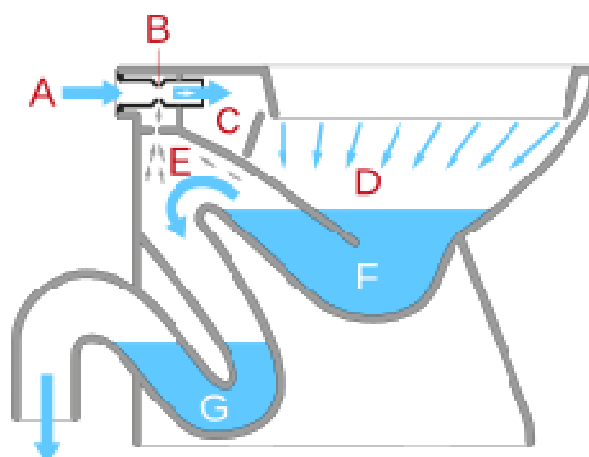


Figure 8. Flush toilet

Source: https://www.google.com/search?sca_esv=6db176930c53557b&sxsrf=AE3TifM6q2zdCj5ps4IJOWhHazRGax8yTg:1750854422341&udm=2&fbs=AIJpHxU7SXXniUZfeShr2fp4giZ1Y6MJ25_tmWITc7uy4KleoJTKjrFjVxydQWqI2NcOha3O1YqG67F0QIhAOFN_ob1aWGQOelbxvw0PKo40QtwvZMGAT8mh52EQduMaEwrkL_OWJKMRsfwjGjYSpRBIZ1JDaBjTRFJHK6nc3h7Df_ewEX8XvmvbWbC3KO9R3Wzz8jDjRXDvvSfLP0DDBhoo8LSWAeOg&q=images+on+smart+toilets+and+e-toilets+by+wikipedia&sa=X&ved=2ahUKEwjfppb_yIyOAaxXiQUEAHbFzGSsQtKgLegQIExAB&biw=1036&bih=539&dpr=1#vhid=TowqTgvQ4oCmkM&vssid=mosaic



Figure 9. Toilet

Source:https://www.google.com/search?q=images+on+types+of+toilets+by+wikipedia&sca_esv=031453346484e3fe&udm=2&biw=1036&bih=539&sxsrf=AE3TifPiklAYGucHmB0ghUlf3TGPCLE9XA%3A1750937987931&ei=gzFdaODJOOWKhbIPiKbO0As&ved=0ahUKEwigl62mgIOAxVIRUEAHRS TE7oQ4dUDCBE&oq=images+on+types+of+toilet s+by+wikipedia&gs_lp=EgNpbWciJ2ltYWdlcyBv biB0eXBlcYBvZiB0b2lsZXRzIGJ5IHdpa2lwZWR pYUihW1CICVjDN3ABeACQAQCYAe8CoAHIF 6oBCDAuMS4xMS4xuAEMyAEA-AEBmAlAoAlAmAMaAiAYBkgcAoAfJBLIHALg HAMIHAMgHAA&sclient=img#vhid=Y7JKmYb C6VNHuM&vssid=mosaic



Figure 10. Toilet

Source:https://www.google.com/search?q=images+on+types+of+toilets+by+wikipedia&sca_esv=031453346484e3fe&udm=2&biw=1036&bih=539&sxsrf=AE3TifPiklAYGucHmB0ghUlf3TGPCLE9XA%3A1750937987931&ei=gzFdaODJOOWKhbIPiKbO0As&ved=0ahUKEwigl62mgIOAxVIRUEAHRS TE7oQ4dUDCBE&oq=images+on+types+of+toilet s+by+wikipedia&gs_lp=EgNpbWciJ2ltYWdlcyBv biB0eXBlcYBvZiB0b2lsZXRzIGJ5IHdpa2lwZWR pYUihW1CICVjDN3ABeACQAQCYAe8CoAHIF 6oBCDAuMS4xMS4xuAEMyAEA-AEBmAlAoAlAmAMaAiAYBkgcAoAfJBLIHALg HAMIHAMgHAA&sclient=img#vhid=SjhLD_AX 5wYXJM&vssid=mosaic