

RESEARCH ON SELF-SUSTAINED ETOILET FOR HOUSEHOLDS/ URBAN-SEMI URBAN PUBLIC/ COMMUNITY SANITATION

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ABSTRACT

The universal challenge of providing affordable toilets is often hindered by the trade-off between cost and the functionalities which need to address three critical issues viz. A) Cleanliness B) Conservation of resources and C) Sustainability of toilets. We, the pioneers of electronic toilets have identified that the above issues are prevailing universally and this has a direct bearing on the health of communities. Hence, we concentrate on the following areas where the outcomes shall be in favor of providing sustainable solutions for the above three critical issues. Our design of the research is to develop sustainable solutions for the above cited areas, so that it can be used effectively in households, slums or in urban/semi urban locations and cities to benefit the city dwellers and the large floating populations. Hence the universality of our solutions is the most important outcome of our research. We also propose modular solutions so as to make the toilet, easily adaptable and customizable to the demands of the respective regions, while focusing on a cost-effective, sustainable, and affordable solution. Our research direction is to provide affordable sanitation that ensures clean and hygienic environment while recovering recyclable components. To further consolidate we focus on Cleanliness, Conservation, Cost effectiveness, Modularity and Universality in our research outputs.

Keywords: CLEANLINESS, CONSERVATION, COST-EFFECTIVE, MODULAR, SUSTAINABILITY, UNIVERSALITY

INTRODUCTION

India is the world's seventh largest country by geographical area but when it comes to population, it ranks second with over 1.2 billion people. Despite being one of the world's fastest growing economies, India still has to grapple with serious environmental issues related to air, water, soil and noise pollution. This leads to further living hazards for inhabitants of urban areas, and destroys the natural habitat of India's biodiversity due to improper waste management and disposal. A study in 2007 found that the discharge of untreated sewage is the single and most important cause for surface and ground water pollution in India.

Although much advancement have been seen and heard of; in technologies as well as public infrastructure, the sanitation sector still remains weak. In most cases, the public provision provided for sanitation is also not being used effectively by the public as the facilities lack proper hygiene and cleanliness. One another facet which is also seen to contribute significantly towards the deteriorating sanitation system is the lack of appropriate maintenance, insufficient manpower to maintain the units and the unscientific waste disposal methods. Introduction of a technology intervention to this sector can prove to be the best solution in changing the overall sanitation environment. But even then challenges persist which comes forth in the form of the cost of technology and the scalability of technology. Even though many measures have been suggested and initiated so as to eradicate these issues, the reach of such measures has not always been successful and effective.

In this context we have developed a sustainable sanitation model with a unique ambience – "eToilet" India's first Electronic Public Toilet. This product has made effective use of Information, Communication and other Engineering technologies for solving the major inherent issues of public sanitation such as lack of

cleanliness and lack of adequate manpower support to manage the units. **eToilet** offers utmost cleanliness, sustainability, ease of maintenance and better sanitation.

Features of 'eToilet'

- Automatic Payment Collection & Access Controls
- Automatic Door Opening
- Alerts to Users
- Display Boards
- Sensor-based interior facilities
- Automatic Closet Washing & Platform Cleaning
- Traditional Power & UPS
- Water Tank
- SMS alerts to Control Room
- Safety to Women & Children
- Remote Monitoring & Shutdown
- Biological treatment of sewage
- Sturdy built-up
- User fee collection and external advertisement panels
- Touch free cleaning
- Web & Mobile Reports on Unit Status

The basis of our research will be directed on two key areas, viz, optimum usage and minimum wastage of the prevailing water resources. For this various modular solutions have been identified such as **Power flushing**- which uses very meagre amount of water for flushing the toilets unlike the existing toilets which wastes around 7 litres per flush.

Atmospheric water generation is also another solution in which the atmospheric water is used in toilets for flushing and other purposes. Even though technologies are readily available, the cost for the same is very high and is unaffordable. Therefore, concentration must be towards providing low cost technologies by which water can be conserved as well as sanitation can be improved. Therefore, a natural evolution of our intervention in the sanitation sector has led us to this research ultimately to ensure cleanliness, sustainability of toilets and conservation of resources.

THE BASIS OF OUR RESEARCH

We have identified our research areas based on two major premises viz:

- a) Dirty toilets especially in the public and communities cause spread of diseases and
- b) Water can be used more judiciously in toilets in order to conserve the precious resource.

a) Diseases caused due to dirty toilets

A document prepared by WHO in cooperation with UNICEF and WSSCC titled: 10 Things You Need to Know About Sanitation where in paragraph 4 the document states that: "Infection with trachoma is the leading global cause of preventable blindness: trachoma is closely linked to poor sanitation and is one of the best examples of an infection readily preventable through basic hygiene."¹

Human excreta have been implicated in the transmission of many infectious diseases including cholera, typhoid, infectious hepatitis, polio, cryptosporidiosis, and ascariasis.²

¹Dirty Toilets and Poor Sanitation cause Blindness - Physically and Mentally – 29 Jan 2012 20:42

<http://forum.susana.org/forum/categories/26-health-hygiene-and-disability-issues/978-dirty-toilets-and-poor-sanitation-cause-blindness-physically-and-mentally>

² <http://www.unwater.org/wwd08/docs/10Things.pdf> 10 Things You Need to Know About Sanitation - Prepared by WHO in cooperation with UNICEF and WSSCC.

b) Water Usage in Toilets

According to the United States Geological Survey, each person uses approximately 80 to 100 gallons of water at home per day. Surprisingly, the largest use of household water goes to flush the toilet. On average individuals flush toilets 5 times per day and this can add up to over 25% of total water use in the home.

The National Commission on Urbanisation of India (1988) recommended that a per capita water supply of 90-100 litres per day is needed to lead a hygienic existence, and emphasised that this level of water supply must be ensured to all citizens (quoted in Ramachandraiah, 2001)³

The above data clearly points out the need for conserving, recycling, and planning the use of water which has already become a scarce natural resource.⁴

WHAT WE PROPOSE TO DEVELOP

Based on the above factors, being a company operating in a highly neglected area of sanitation and providing technology for addressing the critical challenges of sanitation; we are undertaking a research to assess where appropriate technology can be applied to effectively address these challenges. We have identified that the deployment of technology integrated with conventional approaches would drastically make a striking impact on the effectiveness of the system.

Sterilization

Sterilization is a term referring to any process that eliminates or kills all forms of microbial life present on a surface, in a fluid, in medication, or in a compound such as biological culture media. An automated sterilization mechanism with reduced or nil usage of chemicals is proposed to be developed. Sterilized automated systems form to be a critical element not only in terms of bringing down the mortality rate cropping up due to the dearth of efficient disinfection systems but would also contribute to the overall well-being of the community as a whole. The proposed disinfection system is enhanced by a technology convergence mechanism wherein the automatic cleaning cycle goes way beyond the normal flush system- the toilet bowl and seat, hand pipe and floor are disinfected and completely dried after each use and this process takes minimal time.

Two technologies for this project have been identified:

- An automated sterilization unit for seat covers– This unit serves the necessary module where it is capable of making the seat covers germs free with the help of sterilization technology.
- An automatic seat cover- This module serves the technology of bending out the toilet seat covers when the requirements arise. The focus of this project in public toilets as well as in household toilets are in the following two ways:
 1. For house toilets, a switch mechanism for bending out the seat covers and for recombining the seat cover back to sterilization unit when the requirements arises is to be introduced.

³ Water Poverty in Urban India: A Study of Major Cities – ABDUL SHABAN - Tata Institute of Social Science, Mumbai – Seminar Paper – UGC-Summer Programme – June 30- July 19, 2008) –

http://jmi.ac.in/upload/publication/Water_Poverty_in_urban_India.pdf

⁴ DRAFT NATIONAL WATER POLICY (2012) AS RECOMMENDED BY NATIONAL WATER BOARD IN ITS 14TH MEETING HELD ON 7TH JUNE, 2012 – Ministry of Water Resources – Government of India –

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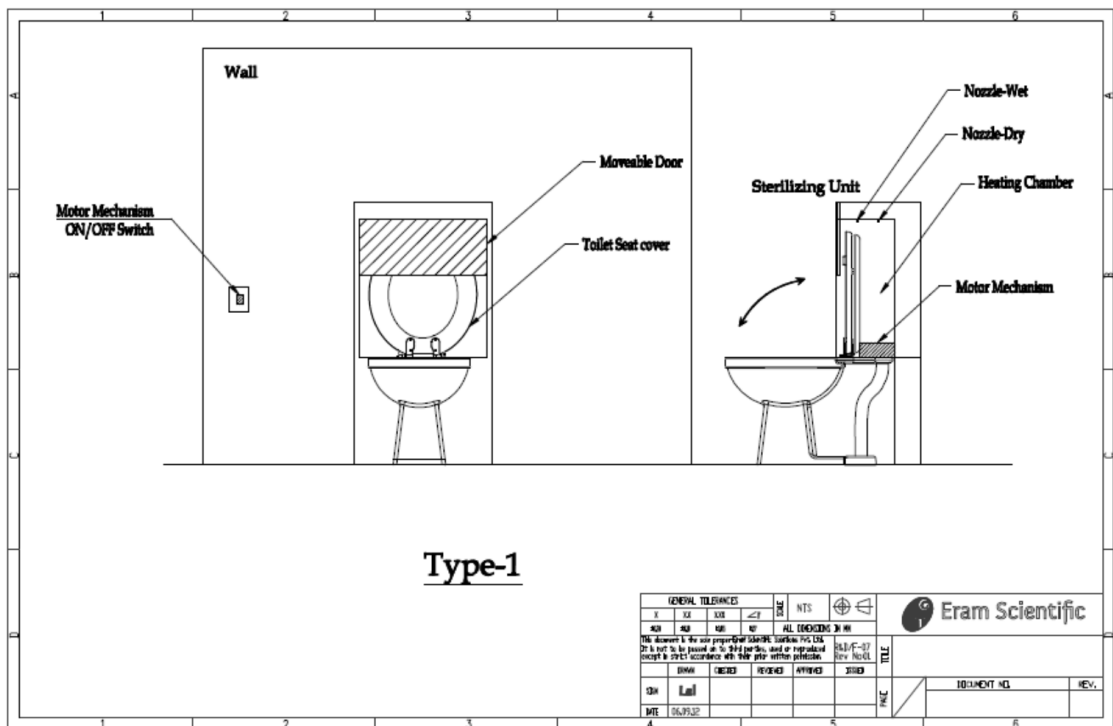


Figure 1: Switch Mechanism

- For the public toilet, this system comprises of a pedal which is capable of bending out the seat cover for the usage. This pedal system can be on the floor near to the toilet.

Thus for majority of time the toilet seat cover will be in the sterilization unit near the back side of the closet and automatically it will be sterilized by ensuring total germs free and anti-bacterial. By introducing this system for the society, hygienic conditions for the toilets can be ensured, and the presence of germs which can be harmful for human beings can be minimized.

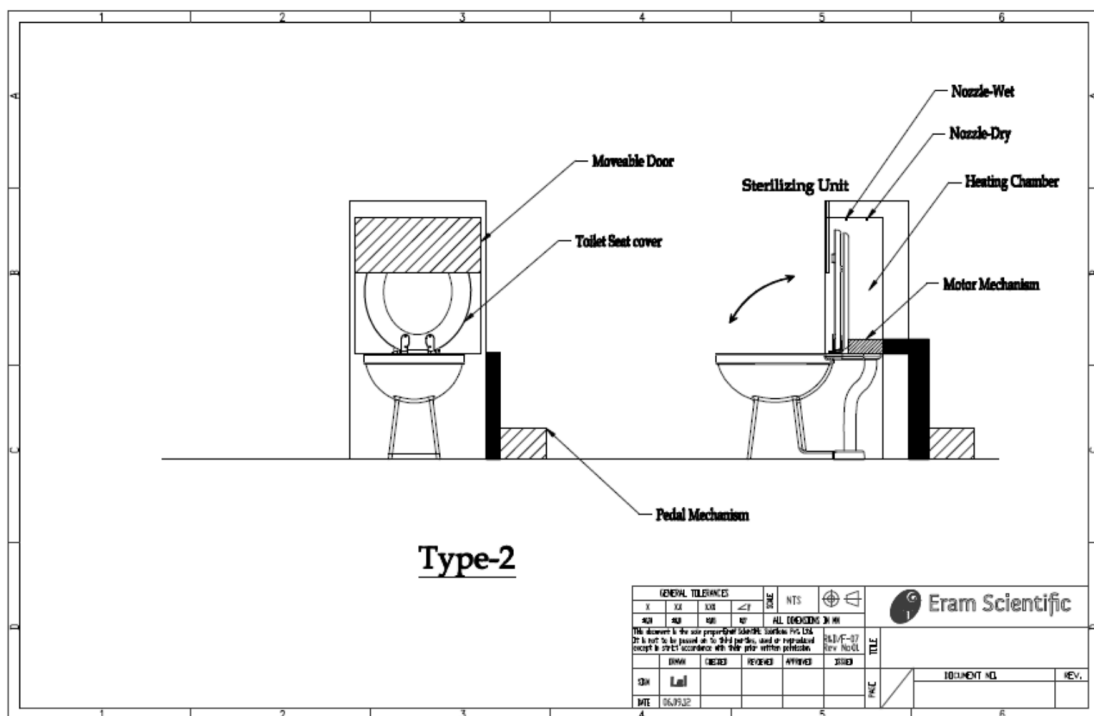


Figure 2: Pedal Mechanism

Sucking mechanism

Suction is the flow of a fluid into a partial vacuum, or region of low pressure. The pressure gradient between this region and the ambient pressure will propel matter toward the low pressure area. Therefore, developing a sucking mechanism for toilets in which it can suck the solid particles with high pressure so that water consumption of the toilets can be reduced to half the quantity is proposed to be developed.

A Water sucking /Power flushing mechanism- Power flushing is proposed which would help in further reducing water consumption. An impeller mechanism with specially designed profile is used to clear off the solid waste. Shaft of the support motor will be provided with sealing protection. Motor with high rpm and special winding will be provided to ensure torque. The sucking mechanism includes the design of an efficient motor system in which it is capable of sucking the solid particle present in the closets. This system is being proposed for every transaction, even though it is urinal or for solid excretion, an automatic triggering of motor can be done when the flush switch is activated.

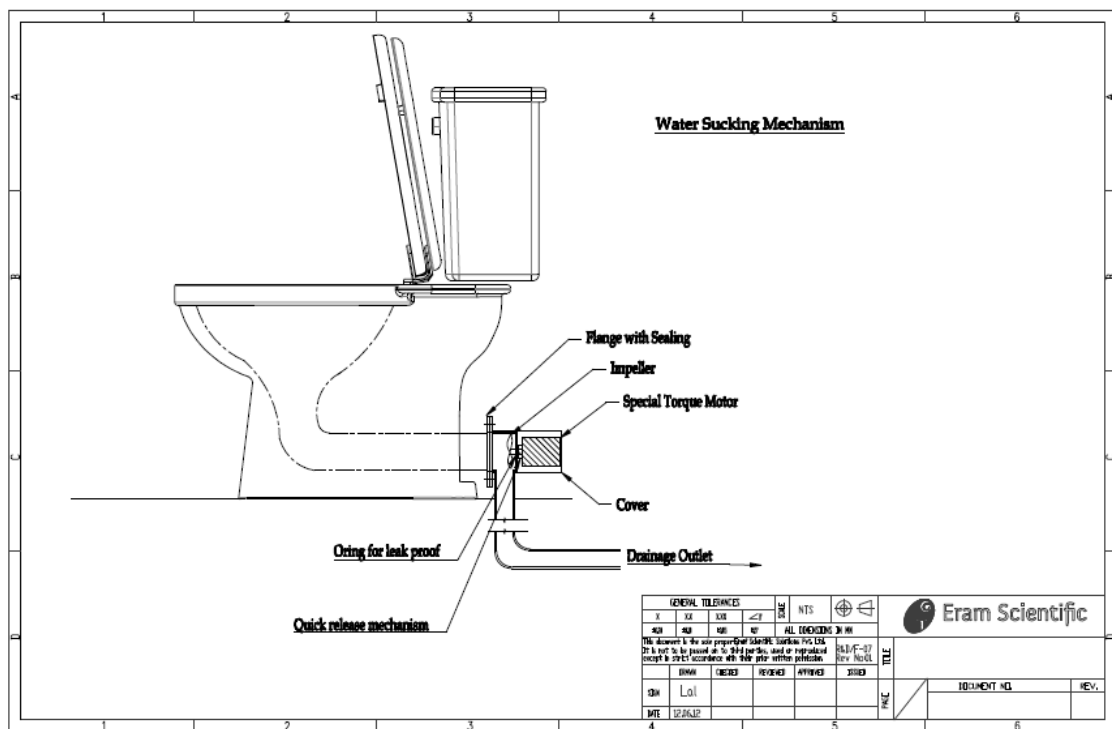


Figure 3: Sucking Mechanism

Conserving water helps to ensure that this important resource will be available for many generations to come. Even in areas where water resources are not scarce, we are likely to see increases in the use of these and other practical, water-saving technologies in our homes, places of business, and government facilities because they are cost-effective, and they help us conserve our natural resources.

OUR VISION OF THE FUTURE

Universally accessible and affordable public sanitation

The need is for a mechanism that prevents and controls disease and prevents direct human contact to human waste. This mechanism should ensure that the fundamental rights of the citizens of developing nations are not violated and no lives are lost due to negligence on part of the society towards the economically deprived and the underprivileged.

Optimum utilization and conservation of scarce resources like water and electricity

Improvising the utilisation of water for toilets needs further research and solutions. However there is still scope in solutions that already exist like power flushing systems, including sucking and pressure mechanisms and Atmospheric water generators. Development of power flushing systems will reduce water usage in flushes by a great margin but developing the same would face challenges in regions that face electricity shortages. In the same way, atmospheric power generators that capture water particles in the air to liquid form provide a very efficient option for conserving potable water but the solution is currently implementable only in areas with high levels of humidity and also involve heavy capital investment. The need, therefore, is to adapt the same in an affordable form in arid region that actually face a crucial shortage of potable water. The solution is to work in partnership with other technology developers who have a similar vision of sustainable and affordable sanitation. Such collaboration will again ensure that the benefits trickle down to a larger number of the world's citizens.

Self-sustainability of technologically advanced sanitation facilities

The sanitation sector shows immense potential for growth in economic terms. There is a great need for sustainable sanitation projects that will enable economic growth by beautifying tourist areas, providing employment, safeguarding the environment and utilising the taxpayers money in the most judicious manner. Sanitation can prove to be a booster for trade and commerce if its infrastructure is developed in a systematic manner with investment from the public and the private sector. If developed, sanitation will prove to be a growth accelerator that propels nations to achieve higher levels in their growth trajectory. To ensure this, we envisage the building of a network of connected eToilets across towns and cities which can provide reliable data regarding sanitation infrastructure in these regions

ULTIMATE VISION

Eram envisions the development of modular components which can be put to universal use in all models of toilets. This will help to achieve economies in scale leading to reduced costs which will in turn increase affordability and enable the masses to construct private toilets for their individual households. These components will be created with the ultimate aim of conserving water and electricity, high degree of adaptability to a large number of toilet technologies and strong, long lasting properties that will prevent replacement or repair for a long period of time.

Public toilets across Geographies

We also plan to develop a model of public sanitation Infrastructure that will be of global standards and will be connected through various mobile and web based technologies that will increase access and enable proper monitoring. This will also bring developing nations at par with developed countries in terms of public health and sanitation.

Benefits that will trickle down from the societal level to individuals

Eram envisions a world where every individual of the world has a private place to bathe, wash and access toilets throughout the day without having to wait or sacrifice his/her turn due to lack of resources, safety or privacy. This will be possible only through concerted efforts towards developing cost effective and sustainable toilet related technologies that can be implemented at the mass level. The effort will also involve serious resource planning including looking at alternative energy sources and recycling toilet waste to reduce the global black water footprint. We believe that when such solutions have been implemented at the mass level especially in developing nations, it will be possible for them to be adapted at the household level making all nations ultimately equal in terms of privileges available to their citizens.

CONCLUSION

The aim of our research is not just to make available an affordable sanitation infrastructure but to create a pathway for development in sustainable sanitation networks. The need of the hour is for a transformation in outlook, to develop ideas into globally scalable realities. We envision a Better, Safer and Natural World

around us, with fresh air, clear rivers, clean roads, and world-class public infrastructures and above all, a positive spirit towards working together to make it happen. We are working towards making people aware of the importance of proper waste management and hygiene by providing them with a solution that is nothing less than the fulfillment of basic human rights - The right to adequate sanitation facilities and right to human dignity.

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