DEVELOPMENT OF SMART TOILET SYSTEM FOR OLD AGE AND SPECIALLY ABLED PERSON

Mr. Soham R. Nikam, Miss. Prachi S. Thorat, Mr. Sandesh D. Mandavkar

[1]*First Author Department & College – ELECTRICAL DEPARTMENT TSSM'S BSCOER NARHE PUNE*
[2]*Second Author Department & College – ELECTRICAL DEPARTMENT TSSM'S BSCOER NARHE PUNE*
[3]*Third Author Department & College – ELECTRICAL DEPARTMENT TSSM'S BSCOER NARHE PUNE*

---***---

Abstract –

This research paper presents the development of a novel smart toilet system designed to the unique needs of elderly individuals and persons with disabilities. The primary objective of the project is to monitor the health conditions of users while inside the toilet, this system incorporates advanced sensors, user-friendly interfaces, and automation to provide a seamless and dignified toileting experience for individuals with diverse mobility challenges.

Integral to the system is a comprehensive health monitoring component. Utilizing sensors, the system measures the user's body temperature and heartbeat. This real-time health data is crucial for timely detection of potential health issues, promoting preventive healthcare and immediate response if needed.

This research contributes to the evolving field of assistive technologies, specifically addressing the needs of aging populations and individuals with disabilities. The integration of mechanical design, health monitoring, and cloud-based connectivity exemplifies a holistic approach to smart healthcare solutions, fostering independence and improved quality of life for users.

***Key Words*:** Smart and healthy living, Emergency assistance, Care, Health.

1. INTRODUCTION

In today's world, the technologies are being drastically developed. This paper studies a smart toilet solution for ageing-well. It addresses ageing people and persons of all ages with disabilities and their needs when using a toilet inside or outside of the home in public or semi-public environments.

"Our vision is to explore the development and provision of enhanced toilet systems with health safety" that seamlessly adapt to the individual needs and preferences of each user, revolutionizing the bathroom experience for individuals with disabilities. At the core of our vision lies the concept of a motorized toilet capable of supporting various transitions, including sitting, stand-to-sit, and sit-to-stand, while offering the flexibility to replicate preferred settings to those used in the comfort of one's home.

Central to our vision is the belief in accessibility for all. By embracing universal design principles and prioritizing user input and feedback, we aspire to create toilet systems that not only meet the needs of individuals with disabilities but also provide to the diverse preferences and requirements of users across different age groups, abilities, and cultural backgrounds.

The bathroom is not only a space for personal hygiene but also a critical environment where potential health issues may arise, particularly for individuals with chronic conditions or mobility limitations. Monitoring health parameters such as heart rate, blood pressure, and movement patterns in the bathroom can provide valuable insights into an individual's well-being and enable timely intervention in case of emergencies or health concerns. However, traditional monitoring methods may be impractical in the bathroom setting, highlighting the need for innovative solutions modify to this specific context.

This project is aimed to ensuring the safety and well-being of individuals while using the washroom or toilet by integrating health monitoring capabilities into bathroom environments. The bathroom, often considered a private space, presents unique challenges when it comes to monitoring an individual's health status, particularly for vulnerable populations such as the elderly or those with chronic medical conditions. By combining advanced sensor technologies with smart monitoring systems, Health Guard seeks to provide real-time health insights and

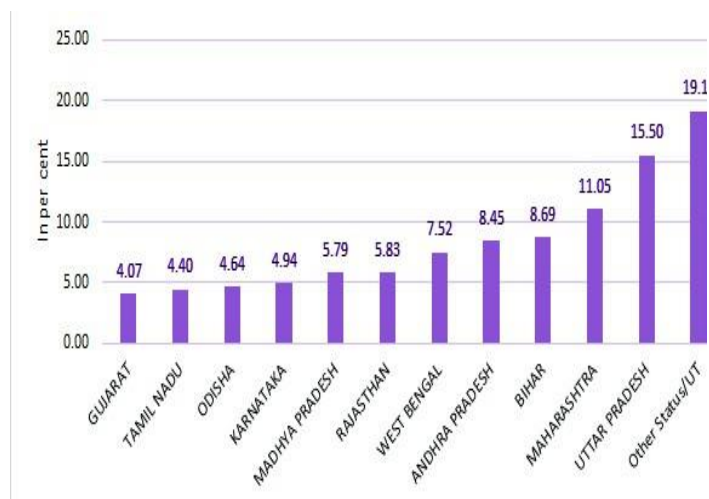emergency assistance if needed, thereby enhancing safety, peace of mind, and overall quality of life.

Fig 1. Disabled population in India

By implementing smart toilet systems for the safety and convenience of disabled individuals in India could be a beneficial initiative. These systems can incorporate various features to enhance accessibility and address the specific needs of people with disabilities. Here are some potential features that could be included:

Wheelchair Accessibility: Designing toilets with spacious layouts to accommodate wheelchairs and providing grab bars for support.

Height-adjustable Fixtures: Including toilets and sinks with adjustable heights to accommodate individuals with different mobility needs.

Emergency Call Systems: Installing emergency call buttons or systems that can alert caregivers or authorities in case of accidents or emergencies.

Hygiene Assistance: Providing features like bidets, automatic seat cleaners, and hands-free soap dispensers to promote hygiene and independence.

Privacy and Security: Implementing measures to ensure privacy and security, such as locking mechanisms and privacy screens.

Above all points we are cover in our project i.e. human automatic seating system as well as human safety also.
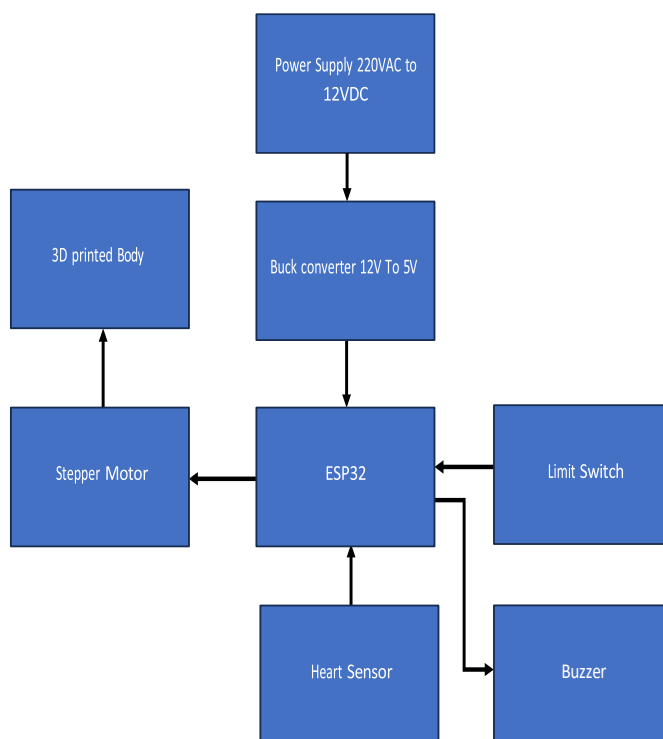
2. BLOCK DIAGRAM

Fig 2. Block diagram of smart toilet system

3. COMPONENTS

1. **ESP 32 :** The ESP32 is a versatile microcontroller developed by Expressive Systems. It features a dual-core processor, Wi-Fi and Bluetooth connectivity, and a wide range of GPIO pins, making it suitable for a variety of IoT applications.

2. **Heartbeats sensor :** These wearables have light-emitting diodes (LEDs) and sensors that rest against the skin in that area. The sensor uses LED light to detect the tiny expansions of the blood vessels underneath the skin's surface.

3. **Stepper motor :** A stepper motor is designed to break up a single full rotation into a number of much smaller (and essentially equal) part rotations. For practical purposes, these can be used to instruct the stepper motor to move through set degrees or angles of rotation.

4. **Limit switch :** A limit switch is a type of sensor that is used to detect the presence or absence of an object within a certain range of motion. It consists of an actuator often a lever that is mechanically linked to a set of contacts.

5. **Buzzer :** Magnetic buzzers operate using electromagnetic principles. When power is applied, current runs through the coil of wire inside the buzzer, which produces a magnetic field. The flexible ferromagnetic disk is attracted to the coil when the magnetic field is activated, then returns to rest when the magnetic field is off.

6. **3D Printed body :** The design of model in project has been printed using 3D printing technology. The model has been printed in different different small parts due to small size of the 3D printer. Then the parts has been joined and assembled using normal hot glue gun as per the decided design.
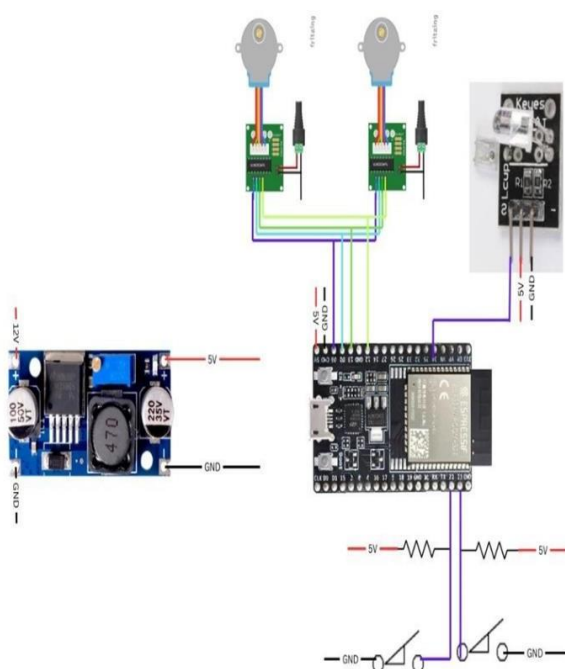
4. CIRCUIT DIAGRAM

Fig 4. Circuit diagram of smart toilet system

5. SOFTWARE METHODS:

1. **CATIA SOFTWARE:** CATIA is software which is used for creation and modifications of the objects. In CATIA and design and modelling feature is available. Design means the process of creating a new object or modifying the existing one. Drafting means the representation or idea of the object. Modelling means create and converting 2D to 3D. By using CATIA software, create the model of the mechanical design.
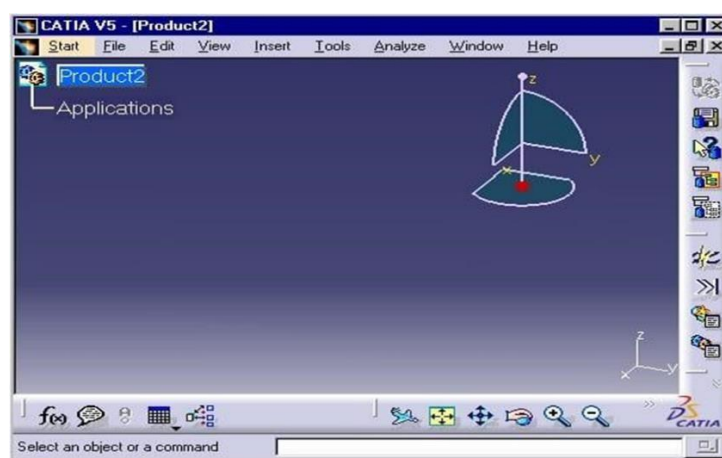

Fig.5.0. CATIA SOFTWARE FRONT PAGE

Here are the steps to create a new file for designing in CATIA software:

1. Open CATIA software on your computer.

2. Once the software is open, select the type of document you want to create. For example, you might choose "Part Design" for creating a 3D part, or "Assembly Design" for creating an assembly of multiple parts.

3. After selecting the type of document, you'll be prompted to choose a template. Choose the appropriate template based on your project requirements.

4. Once the template is selected, click on "OK" or "Create" to proceed.

5. A new file will be created, and you can start designing by using various tools and commands available in CATIA.6. Save your work periodically to avoid losing any progress. You can do this by clicking on "File" in the menu bar selecting "Save" or "Save As" to specify a location and filename for your CATIA document.
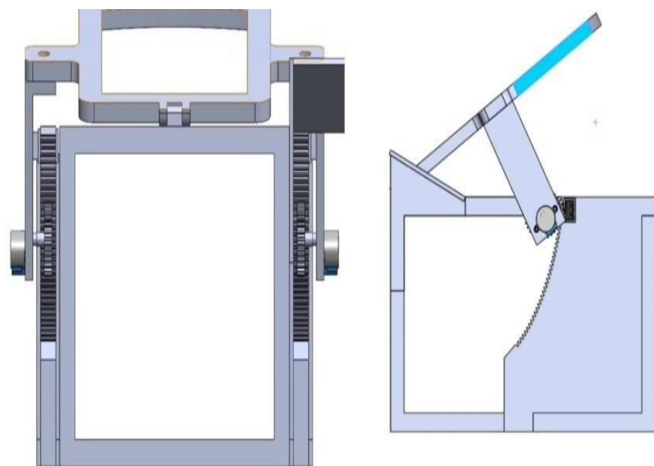
Fig.5.1. 3D printed body view

2. BLYNK IOT : The Blynk Server checks the network used in the connecting process between ESP32 and the blynk application. Checks ESP32, the Blynk application token and the program code, as well as the hotspot name and password used. The information written in the program code must match the Wi-fi information to allow ESP32 is connected to Wi-Fi- as a place to exchange commands between smart phones and ESP32.
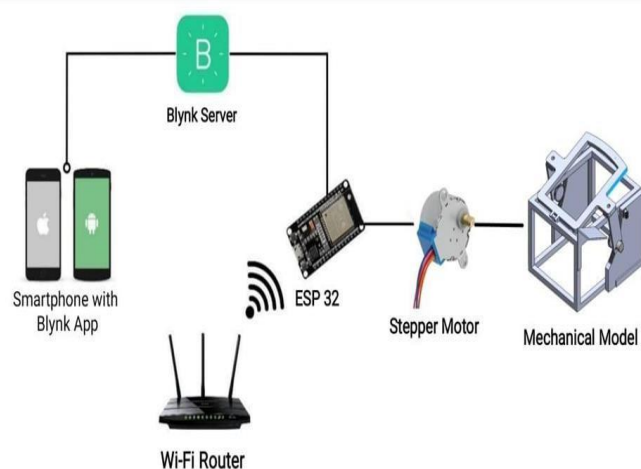

Fig .5.2 BLYNK IOT

To be able to run the system, user need to install the Blynk application on a Smartphone, then after that do the system coding on the computer to be able to connect Blynk with the ESP32. After the code has been written, the system code is entered into the ESP32, which will later function to connect the relay module to the Smartphone via the internet network**.**

6. CONCLUSION:

The development of a Smart Toilet system for ageing population and people of all ages with impairments/disabilities can provide new business opportunities for economic markets. The frame for innovations, new markets in these direction and development of new prototypes in massive Research, Development and Innovation RDI projects is currently favorable. The final goal should consist in evaluating prototypes in real life and disseminate findings of impact. Projects like Toilet may contribute to a positive development in thinking about shaping of public and semi-public space in a way that enables elderly persons and/or disabled persons to better participate in public life. The advantages of toilets for people with disabilities are fast and safe hygiene, the high-quality materials they are made of, the standard equipment that simplifies the use, the quality interior lighting for a pleasant experience while using the toilet.

7. ACKNOWLEDGEMENT:

8. REFERENCES :

[1] Pranali Sonekar, Aishwarya Surwayanshi, Kalyani Chandurkar, "Smart Sensible Washrooms", International Journal for Research in Applied Science & Engineering Technology, May 2019

[2] E. Elakiya, K. Elavarasi, R. P. Kaaviya Priya, "Implementation of Smart Toilet (Swachh Shithouse) using IoT Embedded Sensor Devices", International Journal of Technical Innovation in Modern Engineering & Science, March 2018

[3] P. Wolkoff, "Indoor air humidity, air quality, and health – An overview", International Journal of Hygiene and Environmental Health, vol 221, April 2018

[4] Sangwan S., Chugh N. and Tiwari P. K., "Smart Toilet– An IoT Solution", International Journal of Advance Research in Science and Engineering, Nov. 2017

[5] Parth M. Sarode, "Design and Implementation of Automatic Flush System for Sanitation in Public Toilets", International Journal of Researches in Biosciences, Nov 2015

[6] Mohamed Ashiq, K Karthikeyan, S Karthikeyan, "Health condition sensors detect information provider", International Journal of Engineering and Advanced Technology, February 2013,

[7] J.F.M. Molenbroek, et al., "A Friendly Rest Room: Developing toilets of the future for disabled and elderly people", IOS press, Dec 2011