INTRODUCTION

- Dishwashers use water and chemical as main source for cleaning but also cleverly uses Time, Mechanical force and Temperature together
- Cup washers in market are not capable of cleaning all types of cups
- Most cup washers use water as primary source for cleaning
- Energy consumption is not focused

Objectives:

- Develop a water efficient cup washer that cleans any type of cup, preferably under 30 seconds
- To minimize the usage of chemicals used for cleaning the cups

LITERATURE SURVEY

TITLE	AUTHOR	PUBLICATION DETAILS	DESCRIPTION
Reduction of microorganisms in dishwashers with using steam	Dennis Johansson	Karlstad University, Sweden, Dec 2017	• Steam is an effective, chemical-free method for sterilizing bacteria • The placement and distribution of steam influence the sterilization time • Steam sterilization consumes more energy than a regular rinse cycle • Using two steam generators enhances sterilization time and uniform distribution. However, using two steam generators increases power consumption
Study on steam as a rinse agent in dishwashers	Jenny Larsson	Karlstad University, Sweden, Aug 2014	• Using steam as a rinse aid in dishwashers, replacing rinse aids • The study found steam to be effective in removing water spots and hard water mineral deposits, enhancing glossy finish • Steam also helps in drying the dishes • However, some drawbacks exist, like increased energy consumption and non-uniform steam distribution for enclosures that are big and loaded
Local disinfection using steam in a dishwasher	Marcus Eklund	Blekinge Institute of Technology, School of Eng, Sweden, Nov 2013	• Quality Index Calculation: Heat and time to calculate sterilization quality • Temperature Impact: Sterilization is quicker at temperatures >80 °C. • Hygiene Enhancement: improved hygiene standards • Microorganism Efficacy: Effective against various microorganisms. • Exposure Time: Steam exposure times for effective disinfection.

PATENT AND MARKET SURVEY

Cup and Glass Cleaning Device

Dhavalbhai Prakashbhai Nai, 2021

- It is a portable and semi-automatic machine
- capable of cleaning multiple cups
- operating a single handle

Auum

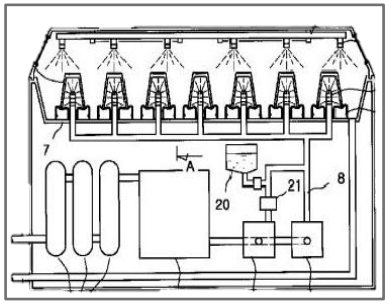
Patentee: Auum, 2020

- Dry steam technology
- Heats upto 140 °C
- Uses 20 ml only
- Able to clean only the Bodum Glasses given

Cup Cleaning Device

Kim, Sung-soo, 2015

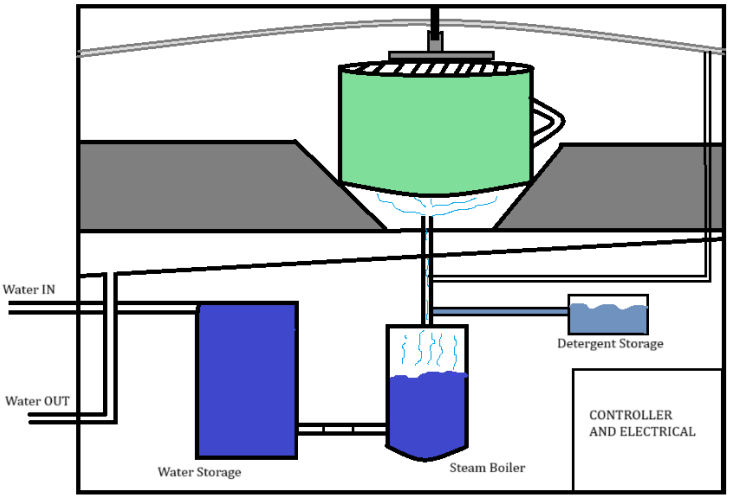
- Washed inside and outside with purified water sprayed at high pressure
- Sterilized with UV rays along with high temperature steam sprayed at high pressure

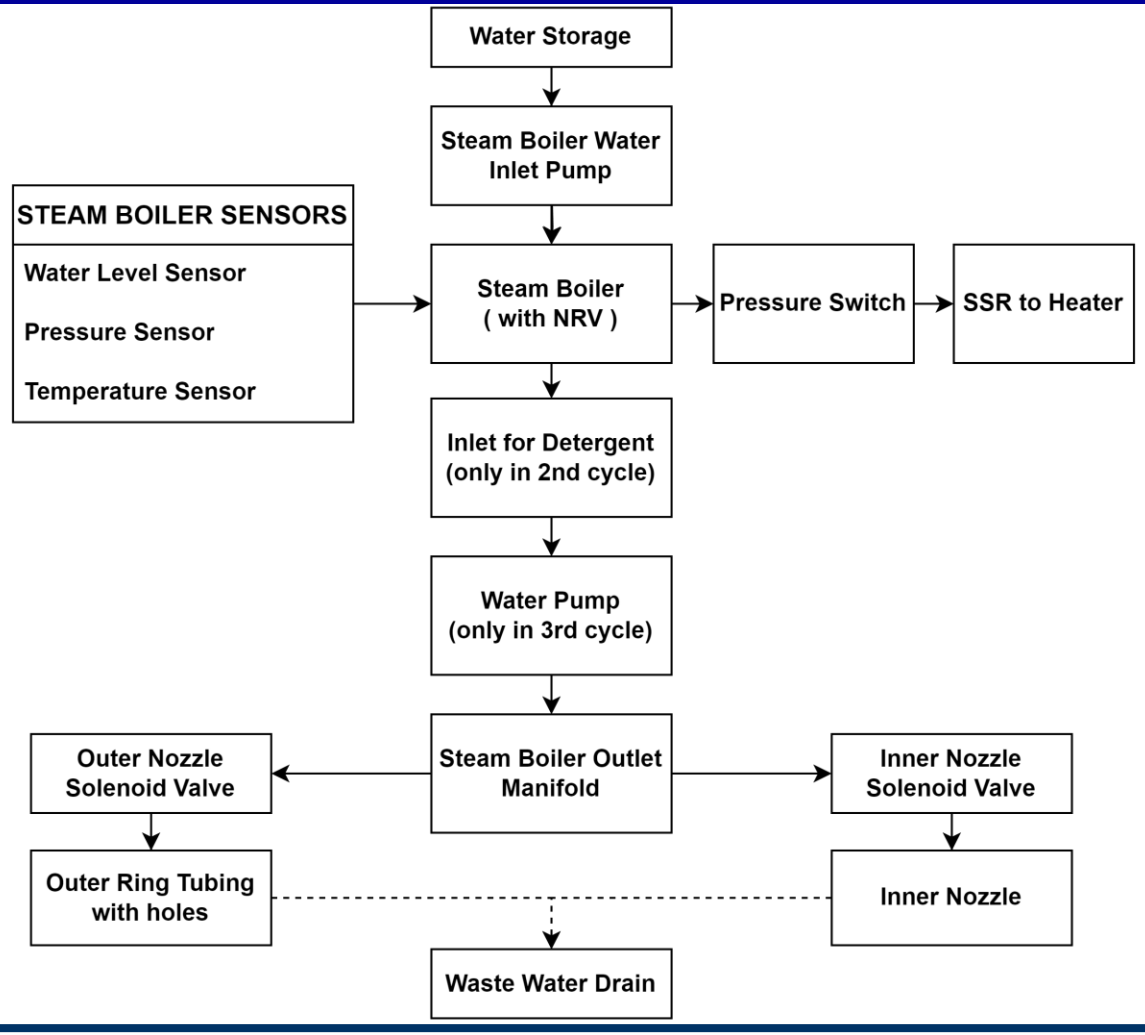


Cup Rinser

- Only rinse cups
- Not suitable for Indian usage
- Fast and easy to use
- Not clean the outside of cups

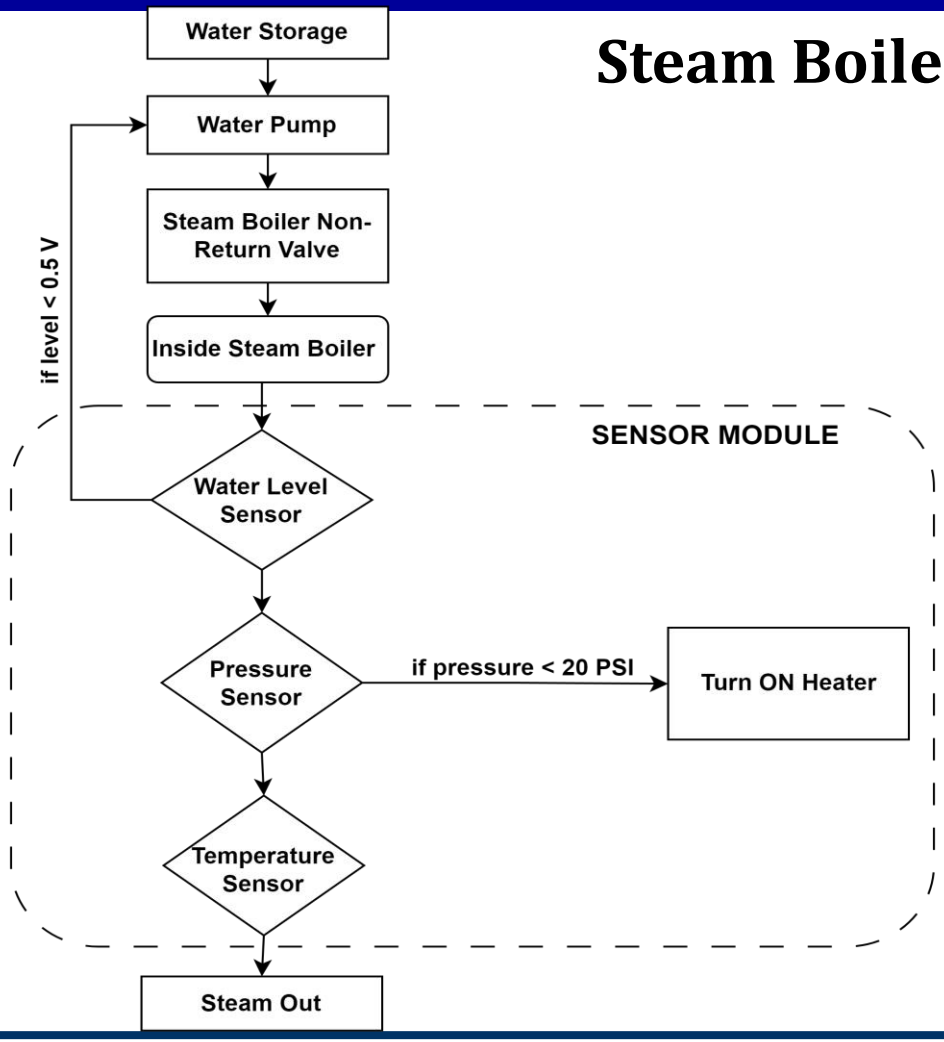
METHODOLOGY

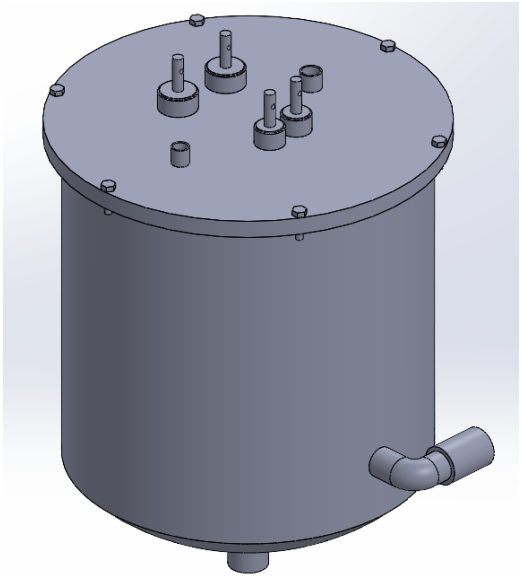




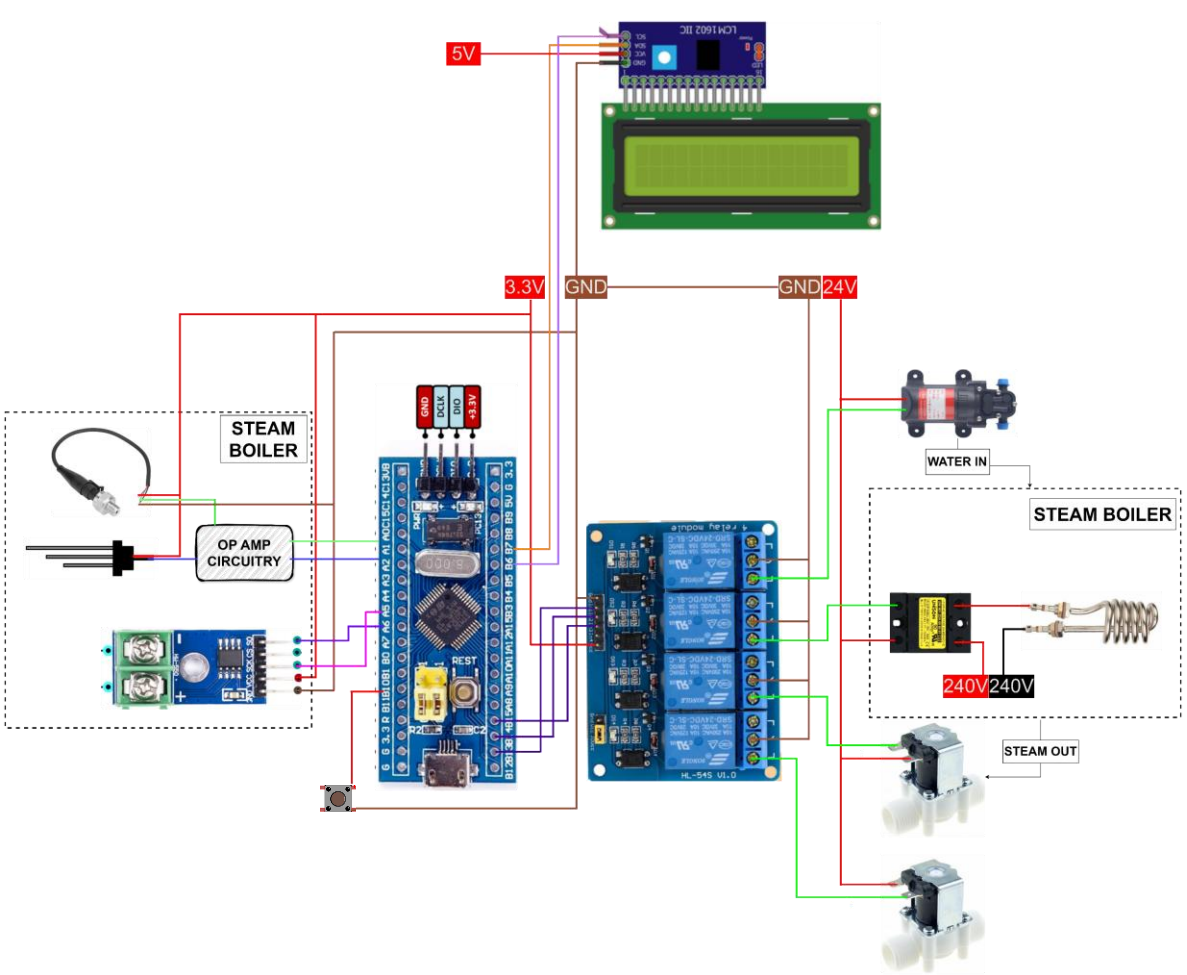
METHODOLOGY

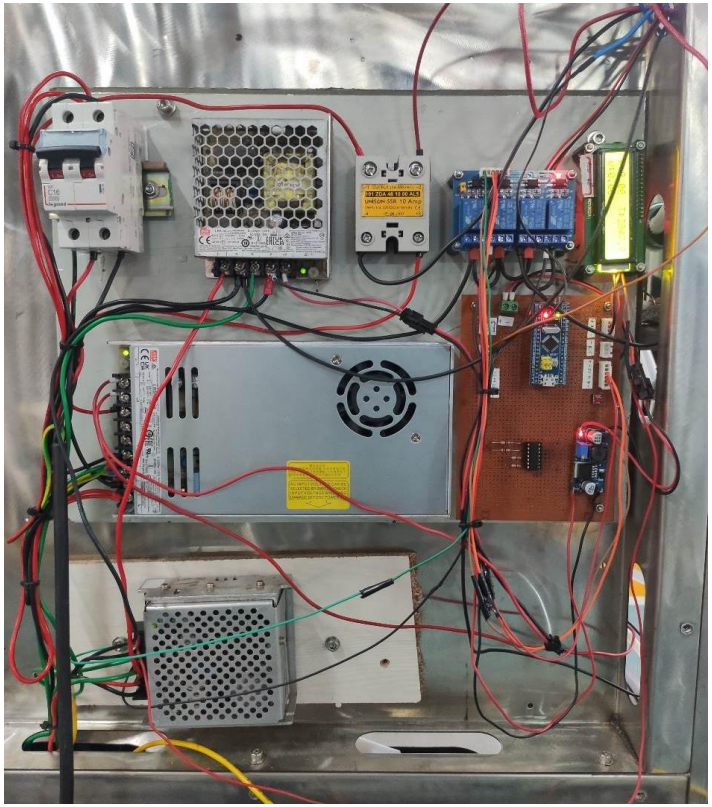
Steam Boiler Module



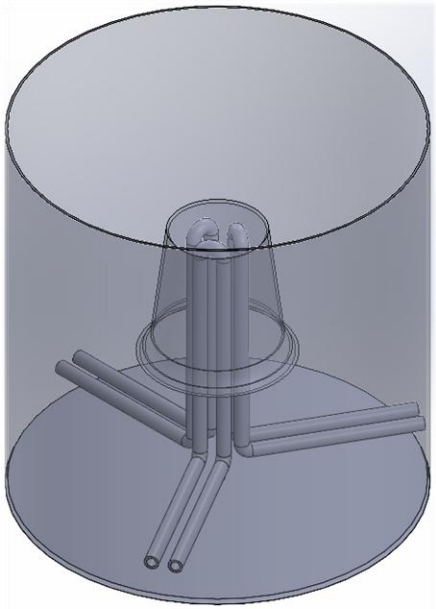
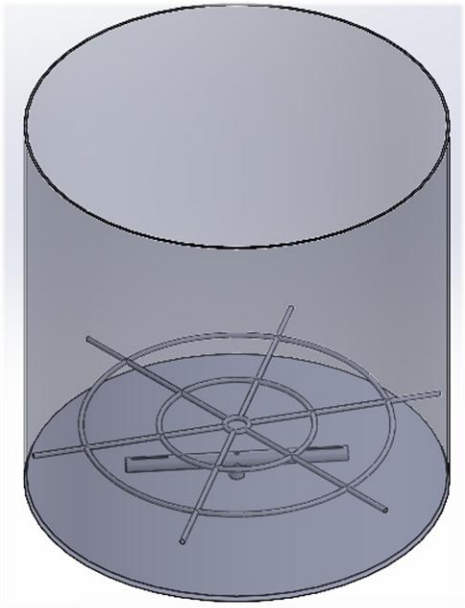
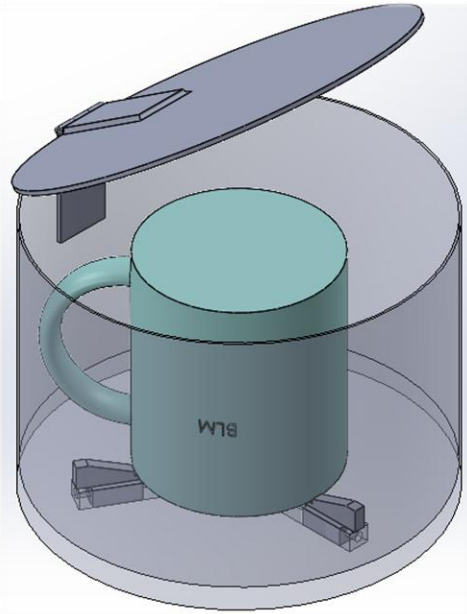
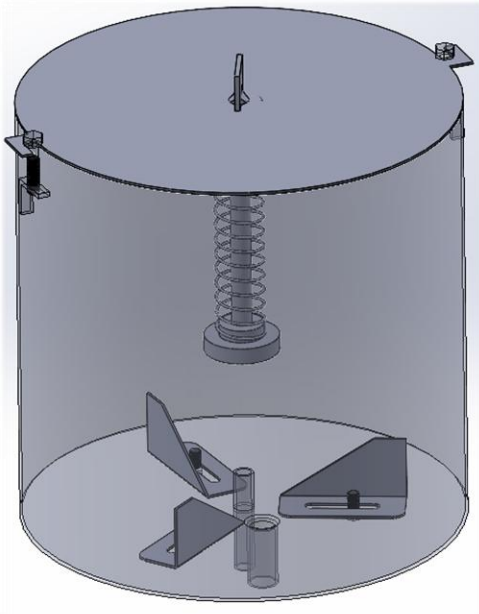


DESIGN AND IMPLEMENTATION

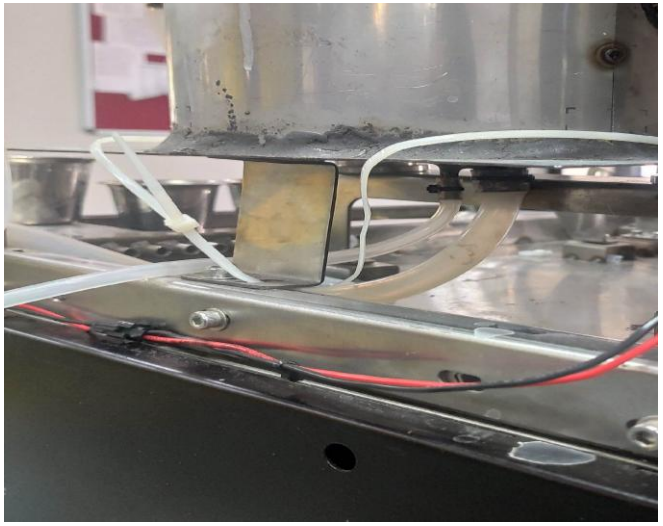


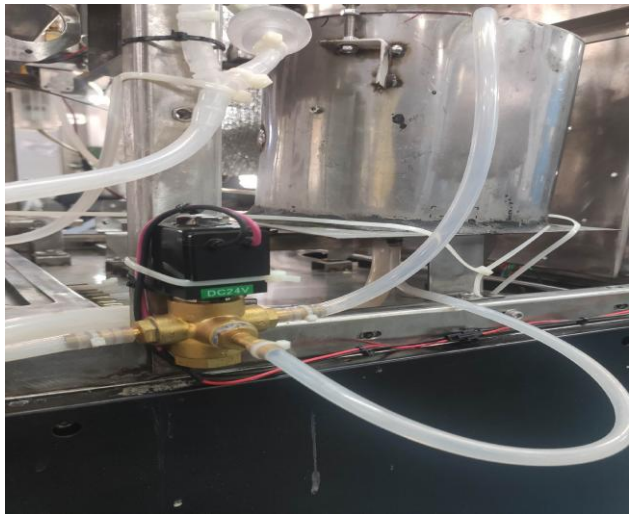


DESIGN

Concept 1	Concept 2	Concept 3	Concept 4
			
• Many steam inlet pipe required	• Complicated parts, but might be efficient	• More machining required	• Easy to develop and implement

WORKING MODEL AND PROTOTYPE





RESULTS AND DISCUSSIONS

- Fair cleaning with milk smell and light coffee stains for 30 seconds cycle
- Removes major stains and sugar deposits
- Approximate water usage 18 ml
- Random visible milk stains

- Zero coffee and sugar stains
- Very less milk and chemical smell
- Visible layers of chemical deposits inside cup
- Random milk and chemical smell

- Complete elimination of milk, coffee, sugar and chemical stains
- Glossy cups after washing the cups
- Reduced cup heat
- Rare chemical or milk smell

CONCLUSION AND FUTURE SCOPE

Conclusion:

- Steam is effective in cleaning the cups
- The total amount of water is greatly reduced compared to traditional methods
- Steam alone cannot entirely eliminate the odour of milk, thus a little amount of detergent has to be used
- Water is needed to completely rinse of the chemical used

Future Scope:

- Clean multiple cups at a time
- Use rotating brush setup for satisfactory cleaning
- Develop a simpler design to give easy access to the cup inside

REFERENCES

1. Johansson, “Reduction of microorganisms in dishwashers with steam”, M.S. thesis, Enviromental and Energy Eng, Karlstad University, Sweden, Dec 2017
2. J. Larsson, ” Dishwasher with steam injection : Study of steam as rinse aid in dishwashers”, M.S. thesis, Faculty of Health, Science and Technology, Karlstad University, Sweden, Aug 2014
3. M. Eklund, ”Local disinfection using steam in a dishwasher”, M.S. thesis, Blekinge Institute of Technology, School of Eng, Sweden, Nov 2013
4. Dhavalbhai Prakashbhai Nai, “Cup and Glass Cleaning Device”, Indian Patent 202121049081, Nov 2021.
5. Kim, Sung-soo, “Cup cleaning device”, JP Patent 5652684 B2, Jan 2015.
6. Mathieu Bourhis, Thomas Munoz, Clement Houllier, Maxime Prieto, “Device for Cleaning an Object”, US Patent 20220193736, 2020.
7. AUUM, ”AUUM Solutions”. https://www.auum.com/ (accessed Apr. 22, 2024).
8. Prahantam, ”Rapid Glass Washer”. https://prahantam.com/ (accessed Apr. 22, 2024).