# Leveraging the Internet of Things for Sustainable Waste Management and Improved Customer Engagement in Taiwanese University Beverage Culture

IEEE Tainan Section Sensors Council

Jong-Chao Yeh [1,*], Kherion Jay Miranda [2], Wei-Cheng Chiu [2], Rong-Bin Lai [3] and Kao-Wei, Chen [3]

Article ID:J240275

[1] Department of Fashion and Performance, Kun Shan University, Tainan, Taiwan
Tel:+886 6 2727175#338; Fax: +886 6 2051380, * jcyeh@mail.ksu.edu.tw (corresponding author)
[2] Department of Mechanical Engineering, Kun Shan University, Tainan, Taiwan
[2] opbob10348@gmail.com; h2owcc@gmail.com
[3]Green Energy Technology Research Center, Kun Shan University, Tainan, Taiwan
[3] xc00731@gmail.com; wei072@hotmail.com

## Abstract

This study aims to employ Internet of Things (IoT) technology to formulate sustainable waste management strategies while fostering social responsibility within Taiwanese university (USR) beverage culture and aligning with the United Nations Sustainable Development Goals (SDGs). Using the unique context of Taiwan's beverage culture as a case study, the research focuses on the waste generated from disposable cups in tea and beverage shops. This study not only examines the environmental impact of waste disposal, especially concerning non-biodegradable materials like plastics and polystyrene widely used in Taiwanese communities and university campuses but also integrates a customer relationship management (CRM) perspective to gain comprehensive insights into university students' attitudes toward sustainable dining. The research methodology primarily involves devising a recycling and reusable system to provide university administrators with tangible plans for social responsibility and SDGs implementation. Additionally, it incorporates CRM strategies by personalizing the customers (students) experience at the beverage shops on campus. The machine will be able to test and give feedback on the beverage used in the cup, and its effect before washing cleaning and preparing for reuse. This is to encourage students' active participation in sustainable dining behaviors. Qualitatively, interviews and observations are employed to understand current waste disposal practices and students' attitudes towards sustainability. To better manage student behaviors related to cup usage and disposal, the study proposes the application of IoT devices for real-time monitoring within university campuses. By integrating IoT technology into waste management strategies, this research aims to present a holistic solution to minimize environmental impact and stimulate social responsibility and sustainable practices within universities. The findings have substantive implications for university administrators in terms of social responsibility and achieving SDGs. Simultaneously, the study offers universities more strategic customer relationship management approaches to promote student engagement and identification with sustainable development.

## Research Methods


Figure1. the concept of this study

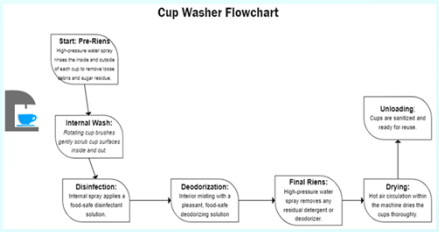


Figure 2. Flow Chart showing cup washer process

## Predictions and Discussion

As sustainability gains importance, governments may introduce regulations and incentives to encourage the use of IoT for waste management. Continuous advancements in IoT technology are expected, lead-ing to even more sophisticated solutions for waste management, potentially involving AI and machine learning for further optimization.Overall, the integra-tion of IoT in waste management has the potential to drive significant changes towards a more sustainable future. Collaboration is key to effectively address environmental challenges. Finally, after relevant dis-cussions, Figure 3 draws the machine model imag-ined in this study and Figure 4 show the concept of the cup holder on the top. The detailed construction is presented in Figure 5.

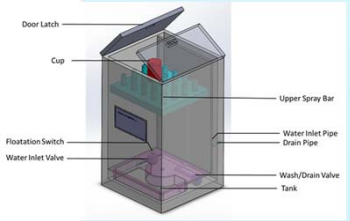


Figure 3. Machine formal styling

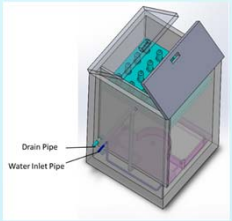


Figure 4. Machine back shape

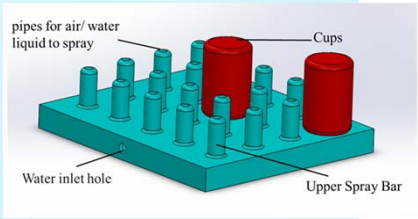


Figure 5. Cup holder placement

## Conclusions

This study, through an in-depth exploration of Tai-wan's beverage culture and the application of Inter-net of Things (IoT) technology in university social responsibility and waste management, has yielded significant conclusions and insights. Firstly, improp-er waste disposal, particularly concerning disposable cups, poses a severe environmental impact, present-ing a common challenge in both Taiwanese commu-nities and university campuses. The implementation of IoT technology enables real-time monitoring of the usage and disposal of disposable cups, minimiz-ing their environmental impact. This comprehensive solution not only contributes to academic knowledge but also holds practical significance. Our investiga-tion and data analysis reveal a heightened awareness of sustainable development among university stu-dents, emphasizing the potential advantages of IoT technology in addressing such challenges. In summary, this study provides compelling evi-dence for the importance of IoT in promoting sus-tainable practices and mitigating the environmental impact of daily tasks.