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Speculative Design for Sustainable Urban Mobility: E-Bike Futures and Data-Driven Innovation

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This study aims to investigate the potential of future public bicycle services in Taipei to achieve net-zero emission strategies and Sustainable Development Goals (SDGs) by using a speculative design. It proposes a sustainable energy model for future public bicycle service. Given the challenges of global environmental change, issues such as sustainable development and net-zero emission strategies have attracted much attention in recent years. More than 130 countries worldwide have put forward the "2050 net-zero emission" declaration and action. Taiwan is no exception, and in this case, the target strategies for electrification of vehicles and power storage are mentioned, emphasizing the importance of sustainable transportation. The study aims to conceptualize the future of e-bikes as a pivotal element in achieving sustainable development in urban settings.

This study uses the User Experience Questionnaire (UEQ) and the System Usability Scale (SUS) to explore the public's perceptions of the YouBike 2.0 service and its apps in Taipei City. It was found that users perceived YouBike to be supportive and environmentally friendly. The overall acceptance was positive but prioritized fun over utility and had poor perceptions of the current app. These results validate the critical role of YouBike in encouraging people to gradually switch from cars to bicycles and significantly reduce carbon emissions. Still, they also reveal the potential for promoting more environmentally friendly E-Bikes in the future. At the same time, it highlights the importance of optimizing the app service to achieve a better user experience.

Afterward, this study implemented a pilot survey on the bicycle pedal power through data-integrated micro-electricity calculations, which apply micro electricity generation technology to bicycle charging and micro electricity installations in the city, such as traffic signals and streetlights. In addition, advanced technologies such as artificial intelligence, geo-location, and real-time data are integrated with applications to promote sustainable urban mobility, with a particular emphasis on the reconciliation of thick data and big data to provide a more comprehensive and in-depth understanding of the needs of urban mobility, thereby optimizing service strategies and enhancing user experience.

Finally, this study ventures into speculative design to address the pressing need for sustainable urban mobility solutions, focusing on integrating e-bikes within the framework of net-zero emission goals, public bike systems, and smart city transportation. The study aims to conceptualize the future of e-bikes as a pivotal element in achieving sustainable development in urban settings. At the heart of this research is exploring speculative design scenarios that incorporate future e-bike design and data-driven analysis into a comprehensive public bike system, aligning with net-zero emission targets. This involves reimagining where e-bikes are seamlessly integrated into the fabric of smart city transportation networks, offering an eco-friendly, efficient, and accessible mode of transport. By projecting into speculative future scenarios, the study provides valuable insights for policymakers, urban planners, and technologists, guiding them toward strategic decisions that balance technological innovation with the broader objectives of sustainable urban development and environmental stewardship.

This study contributes a visionary perspective on the role of e-bikes in transforming urban mobility, presenting a roadmap for cities to navigate towards a sustainable, efficient, and net-zero emission future through the application of speculative design and data-driven Innovation.

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