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**Science, Technology, Research and Innovation for Development
(STRIDE)**



**Design and Manufacturing Feasibility of a Novel
Smart Electric Folding Bicycles in the Philippines**

GRANTEE: De La Salle University (DLSU)

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INDUSTRY PARTNER: NYFTI, Inc.

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Environment-friendly and portable bicycle

Electric bicycles or e-bikes come in many shapes and forms and are becoming a popular choice for transportation. Their popularity is attributed to the rise in fuel costs, rider appreciation for a more environment friendly solution, and ease of road congestion. However, most e-bikes are designed based on the geometry and function of an engine-propelled motorcycle or scooter. While there are add-on electric kits for bicycles, they are uncommon in the Philippines and the system is different from that of an e-bike.

The problem with e-bike designs is the requirement for electrical charging, which is not widely and readily available to the public, especially if compared to gasoline stations for conventional motorcycles. Furthermore, full-size e-bikes may find limited adoption in urban settings because of limitations in storage space and available public parking areas. Efficiency is also an important factor in transportation; current e-bikes utilize a simple battery monitoring display which will only indicate battery life and speed. This system is inefficient because it cannot adapt to driving patterns, driving routes, charging periods, and traffic conditions.



Prototype of the e-bicycle

Milestones

The project implemented by DLSU on smart electric folding bicycles and made possible through USAID STRIDE, provided major improvements addressing basic concerns in e-bike manufacturing. DLSU's Smart Electric Folding Bicycle has a frame and electric drive propulsion system. Several approaches and experiments were conducted to arrive at the final frame design. Among the methods undertaken were the concurrent design methodology, graphical kinematic analysis, multi-criteria optimization, and finite element analysis. The design was made in accordance with ISO 4210.

The final design of the folding frame includes bicycle components such as wheels, pedals, brakes, and electrical components.



Members of the research team test and demonstrate the e-bikes

The folding bicycle frame can also be utilized as a normal bicycle. Compared to other commercially available folding bicycle frames, DLSU's e-folding bicycle offers a compact and practical folding orientation. The fold design, which is patent pending, uses the standard 305 wheel or 16-inch wheels, almost half the diameter of full-sized bikes. The smaller wheel allows for a more compact fold design.

The smart e-folding bicycle has two electronic components: the hardware and the software. The hardware components of the electronics are the battery pack, controller, and wiring. This affects the folding bicycle frame in both riding mode and folded cart/rolling mode, and therefore design of the hardware was considered in conjunction with the folding bicycle frame design. The mechanical and electrical components of the smart folding bike contains several functions that make the folding bike electric and smart.

Moving forward

To date, the development of this smallest e-bike, with the geometry of a full-sized bicycle, which is the first in the world, has started in collaboration with NYFTI, Inc.