ABSTRACT

The *E-scooter* V1 has been introduced as a micro-mobility solution within Universitas Telkom; however, its ergonomic aspects, particularly the handlebar design, have not been comprehensively evaluated. This study aims to analyze and redesign the handlebar of the *E-scooter* V1 based on users' musculoskeletal complaints using a combined approach of the Nordic Body Map (NBM) and *Rapid Upper Limb Assessment* (RULA) methods. The respondents consisted of 30 Industrial Engineering students from Universitas Telkom, selected through simple random sampling using the Slovin formula to ensure data representativeness.

The initial stage of the research involved test riding the *e-scooter* along a looping route from the Manufacturing Building to the TULT Building. After the ride, respondents completed the NBM questionnaire to identify bodily discomfort. Preliminary results showed dominant complaints in the left upper arm (80%), left forearm (80%), and right wrist (80%). These findings were validated and further analyzed through posture assessment using the RULA method, which provides ergonomic risk scores based on upper body posture observations. The RULA results indicated that the majority of respondents fell into the medium-risk category (score of 4), signaling the need for immediate ergonomic intervention.

Based on the combined findings from the NBM and RULA assessments, an anthropometric analysis of respondents' height, arm length, and sitting posture was conducted to redesign a handlebar better suited to the majority of users. The design process uses a quantitative approach with calculations using basic trigonometry formulas to produce the optimal height difference of the handlebars to reduce the burden on the arms and wrists. The final solution is a new handlebar prototype design that has an adjustability feature at a certain height, so that it can accommodate various variations in user posture.

The prototype underwent static testing with respondents. Evaluation results demonstrated a significant reduction in NBM complaints and a decrease in RULA scores to low-to-moderate risk levels. This confirms that a user-centered design approach, grounded in NBM and RULA data, is effective in enhancing user comfort and health. This study offers practical contributions to the development of ergonomic micro-mobility solutions and provides a critical foundation for user-oriented product development in campus environments.
Keywords — *E-scooter, Nordic Body Map, RULA, Handlebar, Ergonomics, Musculoskeletal, Anthropometry*