DEVELOPMENT OF A MOBILE-BASED ANIMAL WEIGHT EQUALIZATION TOOL

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ABSTRACT

This paper presents the development of a mobile-based animal weight equalization tool tailored for livestock management. Traditional methods of weight equalization lack effectiveness, leading to variability in experimental outcomes and hampering farm profitability. Our proposed solution addresses these challenges by introducing a mobile application to streamline weight equalization processes. Utilizing advanced algorithms for randomization and group allocation, this tool removes scientific rigour in experimental design. Accessible via mobile devices, it empowers researchers and farmers to efficiently implement weight equalization, minimizing variability in experiments and enhancing agricultural scalability. This development represents a significant advancement in livestock animal management practices, promising improved research validity and profitability in the African agricultural sector.

Keywords: Animal, WETool, Mobile application, Research, Sorting

INTRODUCTION

Weight equalization (WE) involves dividing or grouping animals equally in pens or treatment groups to ensure that the weight of all animals in each group is balanced. Sorting, the process of determining social grouping based on weight, is essential for reducing dominance-related variation in production (Arogundade *et al.*, 2021). For example, sorting pigs by body weight is a common approach to minimizing variation in final pig body weight and achieving efficient packer weight specifications (Abner, 2021). Weight equalization is a crucial aspect of animal farming in Africa, essential for maintaining balance in sales, medical treatment, and overall livestock management. Traditionally, farmers have relied on subjective methods such as feeling the animals' bodies, visual inspection, or considering their heights to achieve weight balance. However, these approaches have proven ineffective, leading to challenges in profitability and scalability for agricultural businesses in the region (Rodrigues da Costa *et al*., 2021). In this work, we have developed a supporting tool that carries out WE in an effective way which eases off the distribution of experimental subjects and reduces the variation in experimentation groups in animal experimentation.

The lack of a scientifically rigorous method for weight equalization in animal farming has resulted in suboptimal outcomes for farmers. This is evident in the variability of experimental results, impacting profit margins and hindering the ability to scale agricultural operations effectively. Current practices, such as random allocation of animals for treatment and subjective assessment methods, contribute to poor scientific validity in research findings (Du Sert *et al*., 2020). Efficient weight equalization in animal farming is critical for reducing variability within experiments and improving overall farm management. This research develops an effective method for carrying out weight equalization in animal experimentation, addressing the limitations of current practices and enhancing the scientific validity of research findings. Hence, a mobile-based weight equalization tool (WETool) is developed. The use of mobile technology offers efficiency and a faster weight equalization process.

Randomization is crucial for reducing bias and ensuring accurate comparisons among treatment groups in animal experimentation. It involves generating a random list of subject allocations at the beginning of the trial and decoding the allocation codes at the study's completion (Jo *et al*., 2023). Traditional methods of allocation, such as alternating subjects between groups, are insufficient for

achieving true randomization. Hence, advanced computer software is often necessary to facilitate the random allocation process (Coart *et al*., 2023).

Motivation

In research endeavours, ensuring uniformity in ancillary variables such as animal weight across experimental groups is paramount (Poole *at al.*, 2020). Yet, the process of randomly allocating animals to these groups poses significant challenges. Common approaches involve categorizing animals based on weight into light, moderate, and heavy groups, aiming for similar pen weights. However, this method often yields notable discrepancies. Alternatives like using numbered or coloured chips or dice can be cumbersome and intricate (Chechile, 2020). To streamline this process, a mobile application is proposed. This tool would automatically assign animals to experimental units, ensuring mean weight parity across groups, thus eliminating manual errors and reducing experimental variability.

MATERIALS AND METHODS

WETool was developed as a mobile application adopting a quick sorting technique, Z score outlier detection with the sinusoidal arrangement as the main technique to partition and sort the experiment subjects into experimental units or groups. WETool was developed on the Ubuntu Linux 14.04 Operating System using Java development kit 1.7 and Java runtime environment 1.7 and evaluated with a set of data. Figure 1 shows the process flow used for the operation of the application.

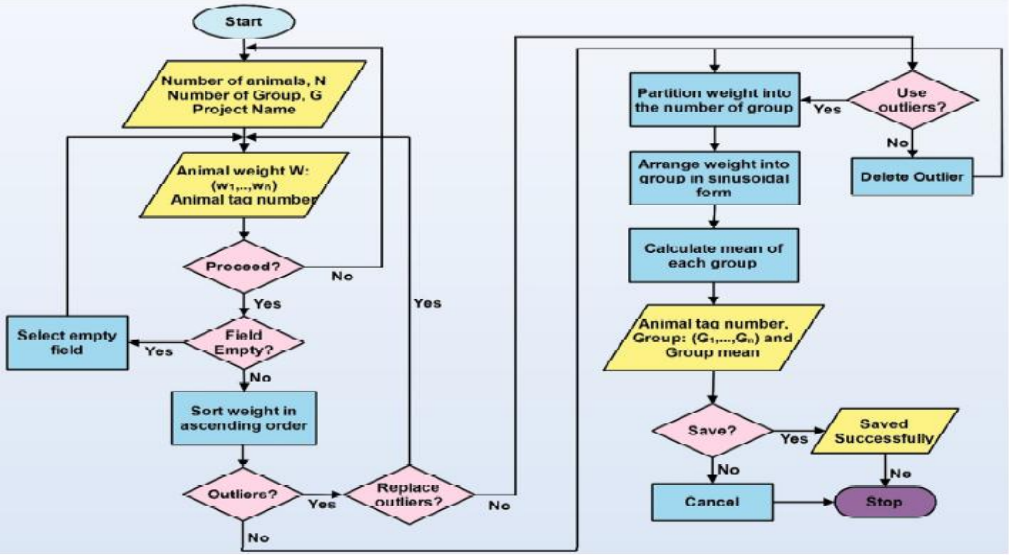

Figure 1. WETool process

Application

This section describes the WETool application showing each aspect of it. It reveals how the application works and its process of operation. Figure 2 shows the sign-up/ login interface. Here, the user inputs an email and password as a registered user or signs up as a new user. Figure 3 shows a home screen where a new sorting operation is carried out or previous sorting output is checked. In Figure 4, a project detailed interface is seen. When a user clicks on "sort new objects", he enters details about the project. The number of replicates and the number of treatments are named. These are synonymous with the "number of objects" and "number of groups" respectively. Based on the number of replicates (or the number of objects) entered, input fields are created for each replicate and a button to add the object (or replicate) as seen in Figure 5. As seen in Figure 6, after entering and adding all required values, the button to proceed that was previously inactive becomes active automatically. Figure 7 shows the sorted group where the application sorts into the required number of treatments (or groups). A button is made available to save the project. Each group shows the objects in them when it is tapped on as seen in Figure 8. When the "save sorting" button is pressed, it shows this screen to confirm that the name you initially filled in at the beginning is what you want to save it with. If the user proceeds, then it saves and returns the user automatically to the home screen as seen in Figure 9. Figure 10 shows the “previous sorting” screen with the functionality to delete any sort job of choice.

Conclusion

Weight equalization is a fundamental aspect of animal farming in Africa, with significant implications for farm profitability and research validity. By addressing the limitations of current practices and implementing robust methods such as randomization. In this paper, a mobile-based application for carrying out weight equalization for livestock is presented. The tool can be scaled and used for other aspects of animal management.

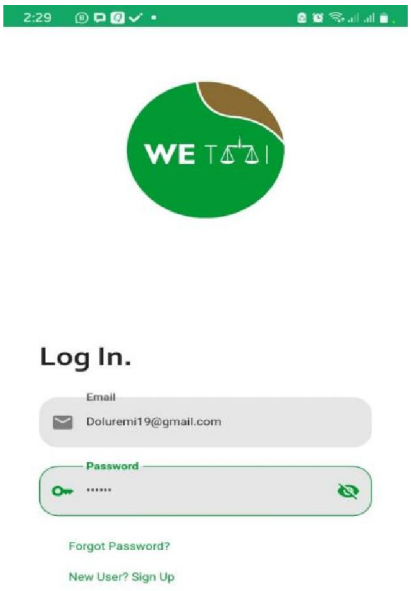

Figure 2: Log in/Sign up Screen with forgot password and email verification functionalities

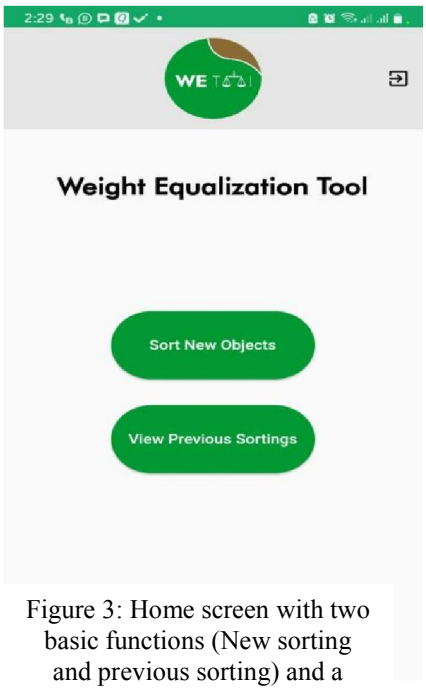

Figure 3: Home screen with two basic functions (New sorting and previous sorting) and a logout button at the top right

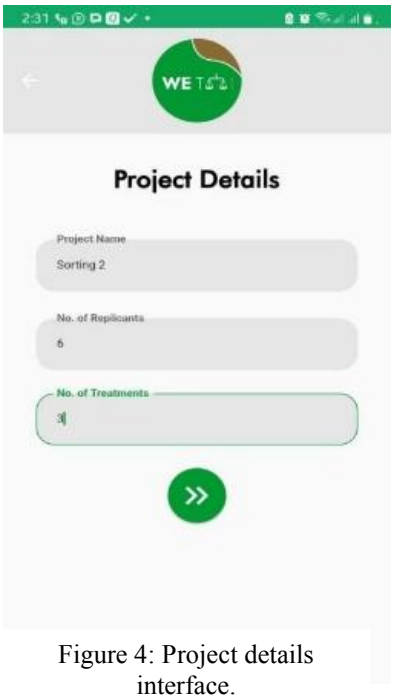

Figure 4: Project details interface.

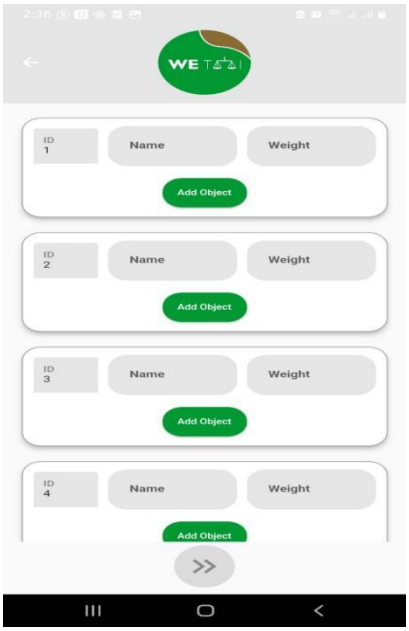

Figure 5: Sorting output interface.

Figure 6: Interface showing the Sorting and labelling

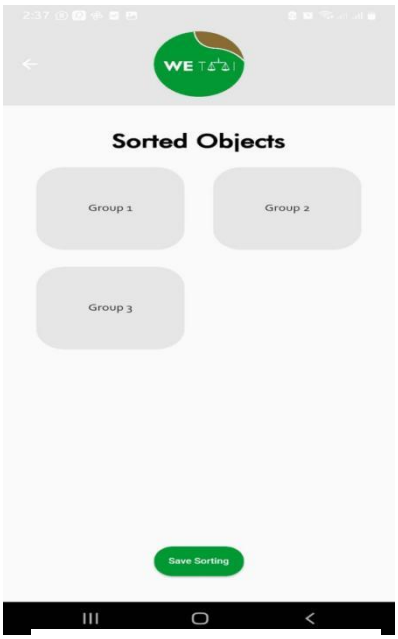

Figure 7: Interface showing the Sorting groups

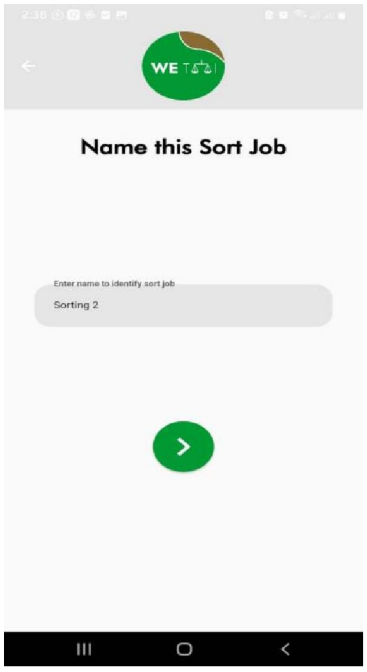

Figure 8: Group sorting output interface.

Figure 9: Group 1 view interface.

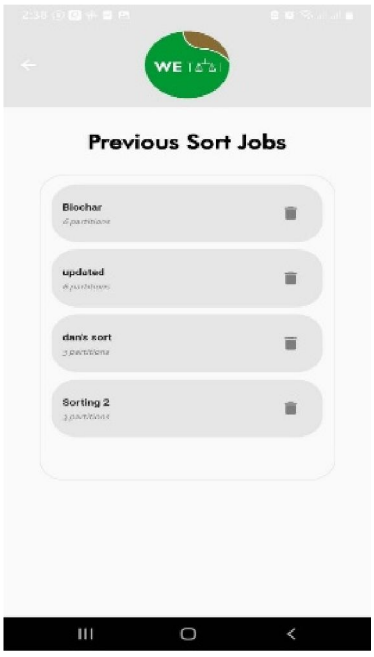

Figure 10: The "previous sorting" screen with the functionality to delete any sort job of choice.

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