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# Multi-Factor Authentication for Enhanced Security of Mobile Health Data Collection Systems

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# MULTI-FACTOR AUTHENTICATION FOR ENHANCED SECURITY OF MOBILE HEALTH DATA COLLECTION SYSTEMS

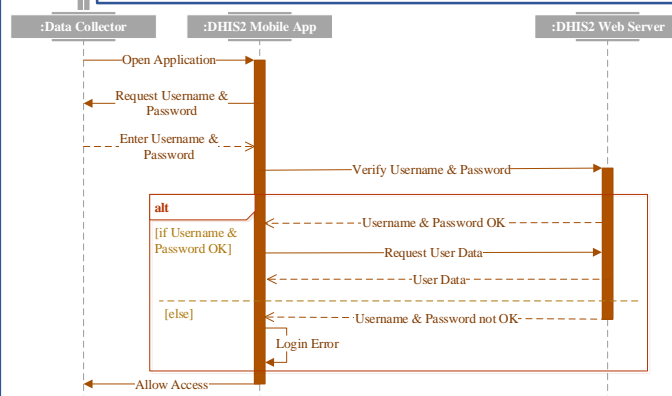
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Makerere University, School of Public Health



## Introduction

This paper describes an additional enhanced authentication method for Mobile Health Data Collection Systems (MHDCS) compared to the commonly existing method of using usernames and passwords for field data collectors. The mechanism introduced in this study was developed to overcome the authentication security challenges faced during the collection of electronic primary health data through MHDCS by adding location and time as additional features of user authentication.

Sequence diagram showing the current user interaction with the DHIS2 system



## Methods

### Requirements Gathering

Document analysis was the technique used during data collection for requirements. During the testing of the prototype, purposive sampling was conducted with a face-to-face approach for the participants. A system demonstration and user testing exercise was conducted and feedback from Key Informant Interviews was used to evaluate the user-perceived usefulness and perceived ease of use.

### Design and Development

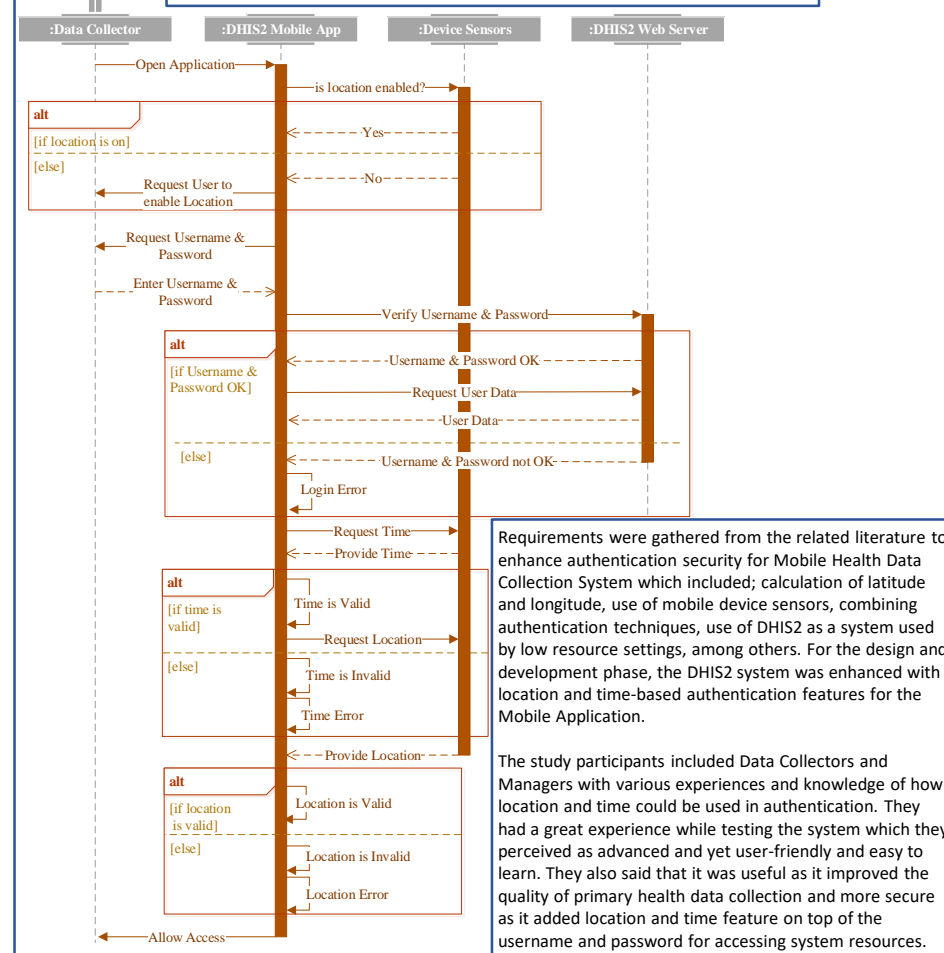
In the design and development of the artifact of this research study, Design Science Research Methodology (DSRM) approach was used because it is more practical and focuses on the development and performance of the designed artifact with a clear intention of improving its functional performance.

### Testing and Evaluation

Feedback from Key Informant Interviews was used to evaluate the user-perceived usefulness and perceived ease of use for DHIS2 Android Data Capture App with enhanced security during authentication. This was used to show if there was a general interest in the solution by presenting a problem and its solution to the stakeholders.

## Results

Sequence diagram showing user interaction with the enhanced DHIS2 system



Requirements were gathered from the related literature to enhance authentication security for Mobile Health Data Collection System which included; calculation of latitude and longitude, use of mobile device sensors, combining authentication techniques, use of DHIS2 as a system used by low resource settings, among others. For the design and development phase, the DHIS2 system was enhanced with location and time-based authentication features for the Mobile Application.

The study participants included Data Collectors and Managers with various experiences and knowledge of how location and time could be used in authentication. They had a great experience while testing the system which they perceived as advanced and yet user-friendly and easy to learn. They also said that it was useful as it improved the quality of primary health data collection and more secure as it added location and time feature on top of the username and password for accessing system resources.

## Discussion

The results from this study presented interesting views about the study whose purpose was to enhance the authentication security of data collectors using MHDCS during primary health data collection, and to evaluate performance and acceptability of the technology for effective and efficient location and time based authentication as means of improving the quality of primary health data collection.

Location and time-based authentication are additional factors of authentication and they can act as additional features of the classic authentication factors such knowledge-based, object-based, and identity-based authentication that is described in section 1.1 to make systems more secure and valid.

The participants generally appreciated the system as they found it secure as it makes it harder for attackers to impersonate location coordinates [39] during authentication. User-friendly as the location and time additional features were perceived as advanced and yet easy to learn. The system was said to be portable as all the system resources could be accessed using a mobile device.

## Conclusion

The results show that location and time as additional features of authentication improve the security of accessing system resources and improve the quality of primary health data collection.

The results show that location and time-based authentication is a generally feasible and acceptable solution in the health sector. Majority of the participants were comfortable and willing to adopt the enhanced technology for future electronic primary health data collection exercises.

## Future Direction

A follow-up study is recommended for further evaluation of this enhanced prototype in a working environment to monitor the acceptability and adaptability by the end users and to compare the changes in the quality of electronic primary health data when the enhanced system is in use as compared to without it.

Health facilities that are involved in primary health data collection should consider adopting MHDCS with location and time-based authentication as a way of improving the quality of primary health data collection.

Finally, the appropriate stakeholders i.e. data collectors, data managers and generally all the health facilities need to be sensitized about the importance of collecting high-quality primary health data in order to make suitably informed decisions and allocation of resources.

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