



Original software publication

## MobiQ: A modular Android application for collecting social interaction, repeated survey, GPS and photographic data



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### ABSTRACT

The MobiQ app for Android smartphones is a feature-rich application enabling a novel approach to data collection for longitudinal surveys. It combines continuous automatic background data collection with user supplied data. It can prompt users to complete questionnaires at regular intervals, and allows users to upload photographs for social research projects. The app has the capability to collect GPS location data, and calls and text frequency (excluding content) unobtrusively. The app transmits data to a secure cloud rather than storing research data on the phone, but can also store data temporarily if a data connection is unavailable; hence, MobiQ offers data security advantages over text- or web-based surveys using phones. MobiQ has been pilot tested in the field in a social science research project and is able to collect longitudinal social research data. Due to its modular and flexible design, MobiQ can easily be adapted to suit different research questions. Furthermore, its core design approach which allows for long-term power efficient data collection can be re-used outside the social sciences domain for other kinds of smartphone-based data-driven projects. Projects that have a requirement for communications-based, sensors-based, user-based data collection or any combination of these may find our code and design approach beneficial. For example, MobiQ code and architecture has been successfully adapted to build an app for a project investigating smartphone-based implicit authentication for mobile access control.

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### Code metadata

Current code version	v 0.3
Permanent link to code/repository used of this code version	<a href="https://github.com/ElsevierSoftwareX/SOFTX-D-16-00014">https://github.com/ElsevierSoftwareX/SOFTX-D-16-00014</a>
Legal Code Licence	GPLv2
Code versioning system used	git
Software code languages, tools, and services used	Java, Android SDK, Eclipse IDE
Compilation requirements, operating environments & dependencies	Eclipse IDE or Android Studio, Android SDK
If available Link to developer documentation/manual	<a href="https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/MobiQApplicationMap-2.pdf">https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/MobiQApplicationMap-2.pdf</a> <a href="https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/installing-project-in-eclipse-luna.pdf">https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/installing-project-in-eclipse-luna.pdf</a> <a href="https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/APIs-online-guides-references.pdf">https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/APIs-online-guides-references.pdf</a>
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## Software metadata

Current software version	v1.0
Permanent link to executables of this version	<a href="https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/MobiQapp.apk">https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/MobiQapp.apk</a>
Legal Software Licence	GPLv2
Computing platforms/Operating Systems	Android
Installation requirements & dependencies	
If available, link to user manual - if formally published	<a href="https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/App-configurations.docx">https://github.com/suleimanyerima/MobiQ-survey-app/blob/master/App-configurations.docx</a>
Support email for questions	<a href="mailto:syerima@dmu.ac.uk">syerima@dmu.ac.uk</a>

## 1. Introduction

MobiQ is a smartphone application developed to enhance longitudinal survey data capture. Traditional methods of data collection (i.e. paper-based surveys) can be costly to conduct over a long time period. In addition, as longitudinal surveys are completed by a cohort of participants at regular intervals such as annually, the long period between surveys may limit the extent to which dynamic phenomena such as social attitudes, behaviours, health status etc. are captured. In recent decades, one approach to this challenge has been the manufacture of bespoke devices, used for 'Ecological Momentary Assessment' (EMA, i.e., real-time administration of survey items) around phenomena which readily fluctuate [1–3]. While issuing devices such as accelerometers and pedometers to participants is standard in physical activity research where distance or acceleration are being measured [4,5], the quality of data is dependent on participant compliance in carrying the device. By comparison, smartphones are carried routinely, which means data collection via phone overcomes these problems [6]. In addition to enabling EMA on the android platform, MobiQ also offers a novel approach to measuring real-time social connection free from recall bias by using phone and text message contact as a measure of social interaction. MobiQ can also provide information about participants' geographical position and thus provides a measure of interaction with the built environment.

MobiQ incorporates a modular and flexible design with several re-useable core components, hence making it easily adaptable to suit different projects. The app has been built to transparently perform the following primary functions:

- (a) Administer questionnaires twice-weekly (Mondays and Thursdays) at regular intervals.
- (b) Collect anonymised destinations of calls and texts from the phone. Collect anonymised phone number, phone make and model.
- (c) Collect intermittent location reading via the phone's GPS.
- (d) Allow users to send comments to the research team. Enable users to send photographs to the research team.
- (e) Allow users to autonomously pause and/or resume app operation at any time.
- (f) Send all collected data to a secure online server when an internet connection is available.
- (g) In the absence of an internet connection, securely store the data until a connection becomes available.

MobiQ has been successfully applied in the field for a pilot study concerning youth social and behavioural research. The project (Using smartphones to enhance longitudinal survey methods) was undertaken to explore the novel application of smartphones in enhancing longitudinal surveys in the social sciences. Since the app was developed primarily to collect data over a long period of time, the design has also been leveraged in other smartphone-based data-driven projects outside of the social sciences, for example in [7,8] and [9] for behaviour-based user implicit authentication.

## 2. Motivation and significance

Smartphones potentially provide an effective tool for objective measurements of social interactions in ways that could offer novel opportunities beyond the capabilities of traditional paper survey methods. As Eagle noted, the devices which people carry for communication purposes can effectively serve as sensors, providing insight into relational dynamics of individuals [10]. Traditional data collection tends to provide a 'snapshot' of the social world, rather than capturing the 'moving parts'. Social research relies on administering surveys at discrete intervals giving little or no insight into incremental change in social ties and individual behaviour between intervals. Depiction of the social world from research data are typically devoid of personal, social or geographical context, and liable to recall or information bias [11]. With the use of smartphones, a dynamic, rich and multi-faceted dataset can be obtained by collecting geographically sensitive social network data, regularly elicited self-reports of behaviour and participant-contributed photo-journals. Furthermore, the use of smart-phones enables cost-effective and time-saving methods to observe social networks over a sustained period.

Motivated by the need for a multi-faceted dataset, time-saving potential and cost-effectiveness, our interdisciplinary research project investigates using smartphones to enhance longitudinal survey methods. The project draws on expertise from Social Sciences, Geography, Computing, Digital Humanities and Public Health with the aim of assessing whether smartphone apps could benefit research projects across human sciences. The primary research question the project sought to answer was: to what extent can data collected using a smartphone improve our understanding of social worlds, simultaneously measuring (i) social networks and their operation, (ii) individual behaviour and (iii) how these relate to the physical environment. A secondary research question asked was: what are the ethical considerations to performing these studies, particularly in relation to the pilot test case of collecting information about illicit drug use. While other online surveys and survey phone applications were available (e.g. Qualtrics [12], Bristol Online Surveys [13], ODK (Open Data Kit) [14]), none of these met all the project requirements for: periodic and continuous survey data elicitation, passive GPS and social contact data monitoring, and the security of data collection and handling. For these reasons, the team built MobiQ, a bespoke Android application for the project. The design concepts are transferrable to other mobile OS platforms. Additionally, since MobiQ is modular, its passive elements could be integrated with other survey applications like ODK which is also open source.

The team is releasing MobiQ as an open source tool to aid other researchers who might be interested in exploring research projects from any discipline that could benefit from smartphone based data collection. MobiQ has been successfully applied for the study presented in [15]. Other recent findings made in our research studies involving MobiQ collected data will be reported in separate publications. In this paper, our main focus is on the design and implementation of the MobiQ software.

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