

EGU21-6019

<https://doi.org/10.5194/egusphere-egu21-6019>

EGU General Assembly 2021

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Technical Considerations for Building a Landslide Tracker Mobile App

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Substantially complete landslide inventories aid the accurate landslide modelling of a region's susceptibility and landslide forecasting. Recording of landslides soon after they have occurred is important as their presence can be quickly erased (e.g., the landslide removed by people or through erosion/vegetation). In this paper, we present the technical software considerations that went into building a Landslide Tracker app to aid in the collection of landslide information by non-technical local citizens, trained volunteers, and experts to create more complete inventories on a real-time basis through the model of crowdsourcing. The tracked landslide information is available for anyone across the world to view. This app is available on Google Play Store for free, and at <http://landslides.amrita.edu>, with software conceived and developed by Amrita University in the context of the UK NERC/FCDO funded LANDSLIP research project (<http://www.landslip.org/>).

The three technical themes we discuss in this paper are the following: (i) security, (ii) performance, and (iii) network resilience. (i) Security considerations include authentication, authorization, and client/server-side enforcement. Authentication allows only the registered users to record and view the landslides, whereas authorization protects the data from illegal access. For example, landslides created by one user are not editable by others, and no user should be able to delete landslides. This validation is enforced at the client-side (mobile and web apps) and also at the server-side software to prevent unintentional and intentional illegal access. (ii) Performance considerations include designing high-performance data structures, mobile databases, client-side caching, server-side caching, cache synchronization, and push-notifications. The database is designed to ensure the best performance without sacrificing data integrity. Then the read-heavy data is cached in memory to get this data with very low latency. Similarly, the data, once fetched, is cached in memory on the app so that it can be re-used without making repeated calls to the server every time when the user visits a screen. The data persists in the mobile database so the app can load faster while reopening. A cache-synchronization mechanism is implemented to prevent the caches' data from becoming stale as new data comes into the database. The synchronization mechanism consists of push-notifications and incremental data pulls. (iii) Network resiliency considerations are achieved with the help of local storage on the app. This allows recording the landslides even when there is no internet connection. The app automatically pushes the updates to the server as soon as the connectivity resumes. We have observed over 300% reduction in time taken to load 2000 landslides, between the no-cache mode to cache mode during the

performance testing.

The Landslide tracker app was released during the 2020 monsoon season and more than 250 landslides were recorded through the app across India and the world.