DETECTING POOR TELECOM CONNECTIVITY USING DEVICE STRENGTH

Organisation – Ministry of Communications
Category – Software
Technology Bucket – Software - Mobile App development
Problem Code – PJ234
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Our Idea

- The goal is to develop an android mobile application in order to detect the device signal strength and send it to a central server along with geo coordinates of the user.
- The realtime cellular signal strength and location (latitude and longitude) values are obtained using a telemetry module.
- Data collection takes place as a background process (sticky task)
- Data is stored on an Google cloud database to ensure accessibility and scalability.A python based database (TinyDB) is deployed on the Google App Engine (cloud) , which acts as the communication link between the android application and the server.
- A website with an interactive dashboard for visualization and data analytics is provided based on the data collected.
- Interface to let the users look at the data that is being collected, anonymized and transferred to the cloud

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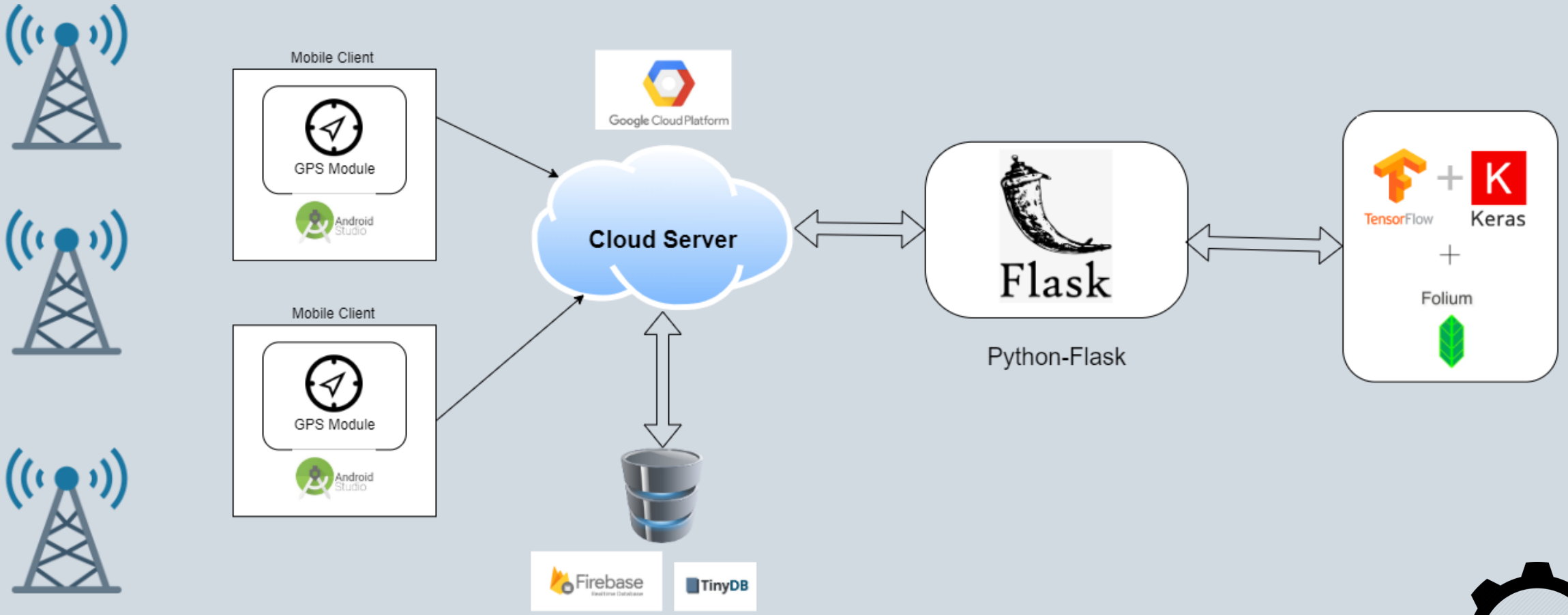
- A custom trained machine learning algorithm specifically built for this application is applied and modelled on the data to make predictions for regions and time frames where data is currently unavailable.
- A model inspired by STF-RNN: Space-Time Features-based Recurrent Neural Network for Predicting People's Next Location is used for signal predictions
- The server consists of a Python script which connects to both TinyDB/Firebase and the local MySQL database to provide various functionalities to the users. It makes sure all the processes are concurrent and stable and makes sure there is no inconsistency in the data.
- The server side python script collects the signal strength and the location co-ordinates of the user and identifies if the strength is strong medium or weak and plots it on a map using the Folium module.
- ITU and RSSI standards are used to set thresholds for signal strength detection and data modelling.
- Government authorities can use that information to assess the poor coverage regions and take necessary steps to address the issue of poor coverage.

TECHNOLOGY STACK



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TECHNOLOGY STACK

- Spatio-temporal data is collected from the users, anonymized and stored in their phones.
- This (viewable) data is then exported to the cloud where it is stored in FireBase/TinyDB.
- This data can be accessed by the flask server and is visualized as an interactive map/dashboard using Folium.
- The collected data is also used to train deep learning models using TensorFlow which will be able to predict the signal strengths at various locations and time.

USE CASE / FUNCTIONALITIES

- **Secure Login:** The server will maintain a record of credentials to ensure that only authorised personnel have access to the collected data and privileged fucntionalities.
- **Data export:** Detected poor signal strength along with geolocation and timestamps can be recorded and sent to server upon permission from device user.
- **Synchronous data transfer:** Reliable transmission of data ensured with synchronisation mechanisms.
- **Encryption Security:** Secured data transmission with encryption/decryption techniques
- **Detect different signals:** It can detect strength of signals from various sources such as LTE, 3G ,2G , WIFI etc.
- **Location accuracy estimator:** Accuracy of the geo locator can also be measured and approximated.
- **Offline support:** It can also detect location (latitude and longitude coordinates) without internet.
- **Temporal and Spatial features:** Spatial and temporal timeline visualisation of signal strength

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USE CASE / FUNCTIONALITIES

- **Interactive dashboard:** Admin has a dashboard to view the visualizations of the locations and their respective signal strengths on an interactive map.
- **Statistics and Data Analytics:** Analytics features integrated with the dashboard help admin easily gain required insights and view data as per desire.
- **Lightweight app:** NoSQL DB which makes the app lightweight.
- **Prediction and extrapolation:** Admin can obtain predicted values within a certain level of accuracy for regions with lack/insufficient data.
- **Privacy Concern:** UI to allow the users to look at the data collected, anonymised and transferred
- **Intuitive UI:** User friendly interface offering simplicity and practicality.

Show Stoppers/ limitations

- User permissions required for real-time data collection.
- Accuracy of prediction models dependent upon on collection of data following deployment of system.
- Supporting modules must be selected such that long term support is provided for users.