**Step-by-Step Guide: Harnessing Geofencing with R for Enhanced Data Collection in Kobotoolbox**

**Say goodbye to manual location checks and hello to streamlined data collection!** Geofencing, a powerful tool that combines location technology with data analysis, lets you automate data collection within predefined geographical boundaries. This blog post takes you through a step-by-step guide, using R, to integrate geofencing with Kobotoolbox and boost your data collection efficiency. This will involve two major’s steps.

1. Getting the vertex for your location of interest.
2. Uploading vertex to KoboToolbox (link to a video)

**Imagine this:**

* You enter a designated study area, and **data collection triggers automatically**. No more remembering to press buttons or check locations!
* Your data comes from **precisely where you need it,** thanks to the power of geofencing boundaries. No more worrying about stray data points or missed locations!
* Kobotoolbox forms **adapt based on location,** with possibilities of dynamically changing questions or displaying relevant information for specific areas.

**Let's dive in!**

## Step 1: Shape Up Your Boundaries

First, define your geofencing areas. Grab the shapefiles for your target zones – these handy files store information about geographical boundaries. Our example uses a sample shapefile named " Sample\_locations" with details like Sites, Zones, House, and Blocks. Download it here: [link to your sample shapefile]. Check and plot data table.

A screenshot of a computer program

Description automatically generated

#Plot the Check.

Sample\_locations |> ggplot() + geom\_sf() + geom\_label(aes(x =

st\_coordinates(st\_centroid(geometry))[, 1], y =

st\_coordinates(st\_centroid(geometry))[, 2], label = paste(House)),

size = 3, fill = "lightblue", color = "black", size = 1) + theme\_void()

## Step 2: Extract Those Coordinates

Now, use R's st\_geometry function to extract the precise latitude and longitude values from your shapefile. We'll store these coordinates in a separate data frame for easier manipulation.

## Step 3: Craft Your Spatial Data database

Time to combine the extracted coordinates with the original shapefile data! Using R's superpowers, we'll create a powerful "spatial data frame" – think of it as a detailed map with all the location information you need for geofencing wizardry.

# Extract coordinates using the same CRS as the original data

polygon\_vertices <- lapply(st\_geometry(wau\_test\_v2), st\_coordinates)

# Map each polygon\_vertices list to its OBJECTID row

mapped\_data <- Map(function(vertices, objectid) {

data.frame(OBJECTID = objectid,

p\_longitude = vertices[, "X"],

p\_latitude = vertices[, "Y"])

}, polygon\_vertices, wau\_test\_v2$OBJECTID)

# Combine the mapped data frames into a single data frame

mapped\_data <- do.call(rbind, mapped\_data)

**Step 4: Generate Your ID Nodes**

Each location within your geofenced areas needs a unique identifier. We'll use R's grouping and counting skills to generate these "ID nodes" for each study site(Houses) within your study area. Now, every data point you collect will have a clear address within your geofenced world.

# Use the same CRS (Coordinate Reference System) as the original data when creating wau\_test\_df

wau\_test\_df <- wau\_test\_v2 |>

as.data.frame() |>

left\_join(mapped\_data, by = c("OBJECTID" = "OBJECTID")) |>

st\_as\_sf(coords = c("p\_longitude", "p\_latitude"), crs = st\_crs(wau\_test\_v2))

**Step 5: Integrate with Kobotoolbox**

Congratulations! You now have a spatial data frame enriched with precise coordinates and unique identifiers, ready to be seamlessly integrated with Kobotoolbox. Unleash the power of location-aware data collection, with automatic form triggers and data collection tailored to specific geographical zones.

**Beyond the Code:** Here are some additional tips to take your geofencing journey to the next level:

* **Real-world examples:** Think about using geofencing to study air quality in specific city districts, automatically triggering data collection at designated times.
* **Challenges and solutions:** Consider potential challenges like battery drain on data collectors and GPS limitations. Optimize data collection forms and schedule strategically to mitigate these.
* **Dive deeper:** Explore our GitHub repository (link here) for the full code buffet and detailed tutorials to become a geofencing master.

Don't let your data collection be stuck in the manual age! Leverage the magic of geofencing with R and Kobotoolbox to supercharge your fieldwork efficiency and precision. Start unlocking the potential of location-aware data collection and experience the power of automation, precision, and streamlined workflows!

You can check how to integrate the output into Kobotoolbox. Check this video on how to here.