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Deermining The Location of Wi-Fi Access Points Based on Crowdsourced Data

Philip Mcdonnell

DETERMINING THE LOCATION OF WI-FI ACCESS POINTS BASED ON CROWDSOURCED DATA

Philip McDonnell

ABSTRACT

[0001] The disclosure includes a system for determining the location of Wi-Fi access points based on clustering of user device data. In an example scenario, for users that are inferred to have visited a store, one or more Wi-Fi access points in proximity to the store are determined. Next, a likelihood that each of the users visited the store is determined based on user data. In another step, clusters of the users for each of the Wi-Fi access points are generated. The Wi-Fi access point associated with the store is determined based on the likelihoods that the users visited the store and the clusters.

KEYWORDS

- Wi-Fi access points
- Location model
- Consumer survey
- Store visit conversions
- Conversion tracking

BACKGROUND

[0002] Brick and mortar retailers are interested in data that helps determine how to encourage customers to visit their stores. One useful source of data comes from conversion tracking, which is a process to determine correlation between online user activity relating to a

store and the user then visiting the physical store. For example, the user may view an online advertisement for a store and then travel to the physical store.

[0003] It may be difficult to determine whether a user actually visited the physical store. Conversion tracking may be based on user data that indicates that the user visited the physical store based on the user answering survey questions, geolocation data associated with the user, etc. However, such user data may be imprecise. The user may respond inaccurately in a survey about visiting the store or the geolocation data may only indicate that the user was in the general vicinity of the store when in fact the user was in a nearby store.

DETAILED DESCRIPTION

[0004] Figure 1 illustrates a diagram of an example system that includes a server 101, user devices 115a, 115n, Wi-Fi access points 120, and a network 105.

[0005] The user devices 115a, 115n may be computing devices that each include a memory and a processor. The user devices 115a, 115n are coupled to and communicate with the network 105. Users 125a, 125n interact with the user devices 125a, 115n, respectively.

[0006] User device 115a includes a Wi-Fi application 103a. When a user 125 associated with a user device 115 visits a physical store, the Wi-Fi application 103a determines access point data. The access point data may include a list of Wi-Fi access points 120 that are visible to the user device 115. The access point data may also include signal parameters (e.g., signal strength) associated with visible Wi-Fi access points 120. Wi-Fi application 103a may transmit the Wi-Fi access point data to Wi-Fi application 109b on server 101. Server 101 may store the Wi-Fi access point data in database 199.

[0007] Referring to Figure 2, a graphic representation 200 of a user device 115 in a physical store is illustrated. In this example, there are three physical stores: store A, store B, and store C. Store A includes Wi-Fi access point A, store B includes Wi-Fi access point B, and store C includes Wi-Fi access point C. The user device 115 is located in store B. The circles associated with each of the access points represent a visual indication of signal strength of the access point as detected by the user device 115.

[0008] In the example shown in Figure 2, the user device 115 detects the highest strength for access point B. However, because the user device 115 is also close to access point C, the strength of access point C is also relatively high. It may therefore be unclear whether either or both of access points B and C are associated with store B. The user device 115 may also detect access point A, but the signal is weaker as compared to the signal of access point B or access point C.

[0009] The server 101 may be a hardware device that includes a processor, a memory, and network communication capabilities for accessing the network 105. The server 101 may include a Wi-Fi application 109b that is configured to receive Wi-Fi access point data from the user devices 115a, 115n. The Wi-Fi application 109b may identify multiple Wi-Fi access points in proximity to a physical store for users that are inferred to have visited the store. The inference may come from user data, such as a user clicking on an advertisement for the store, a search history indicating that the user searched for the store or the location of the store, a survey response stating that the user visited the store, etc. The user data may be generated by the Wi-Fi application 109 or independent of the Wi-Fi application. For example, the user data may be generated by a mapping application, a browser, etc. accessed by user 125 and may be transmitted to the Wi-Fi application 109b.

[0010] Wi-Fi application 109b may determine a likelihood that each of the users visited the store based on the user data. The user data may include geolocation data (e.g., global positioning system (GPS) data, Bluetooth beacon data, maps data, etc.), answers to consumer surveys, queries, search results, user browsing history, video data, etc. In some implementations, each type of indicator may be assigned a weight. For example, user data that includes a user search from a mapping application that includes store A as the endpoint may be associated with a weight that indicates a greater likelihood than user data that includes a user clicking on an advertisement for store A. Wi-Fi application 109b may determine the likelihood that each of the users visited a particular store based on precision data associated with answers to consumer surveys.

[0011] Wi-Fi application 109b may generate clusters of users for each of the Wi-Fi access points. For example, the clusters may include the location of access points detected by user devices. The clusters may also include the strength associated with each access point detected by the user devices. The clusters may be determined based on an aggregation of user devices that satisfy a threshold distance to the Wi-Fi access points and/or a threshold strength of the Wi-Fi access points detected by the user devices.

[0012] Wi-Fi application 109b may determine which of the Wi-Fi access points is associated with a corresponding store based on the likelihoods that the users visited the store and the clusters. For example, if a large number of user devices detected relatively similar access points, then the access points were likely in the same locations. If the likelihoods indicate that most of the users were at the physical store, then the largest cluster for a Wi-Fi access point is determined to be associated with the physical store e.g., the Wi-Fi access point is within the physical store.

[0013] This process of using likelihood that users visited the store and clusters, solves the problem illustrated in Figure 2, where signal strength alone does not clarify which access points are associated with a particular store. Using the likelihood and clusters approach allows determination of which access points are associated with which store, based on data from different users in different locations within the store. The location of the access points may be used for conversion tracking to help determine the correlation between user activity online relating to a store and the user then visiting the physical store. Future visitors to the physical store may then be identified on the basis of the determined Wi-Fi access point being visible to their user device.

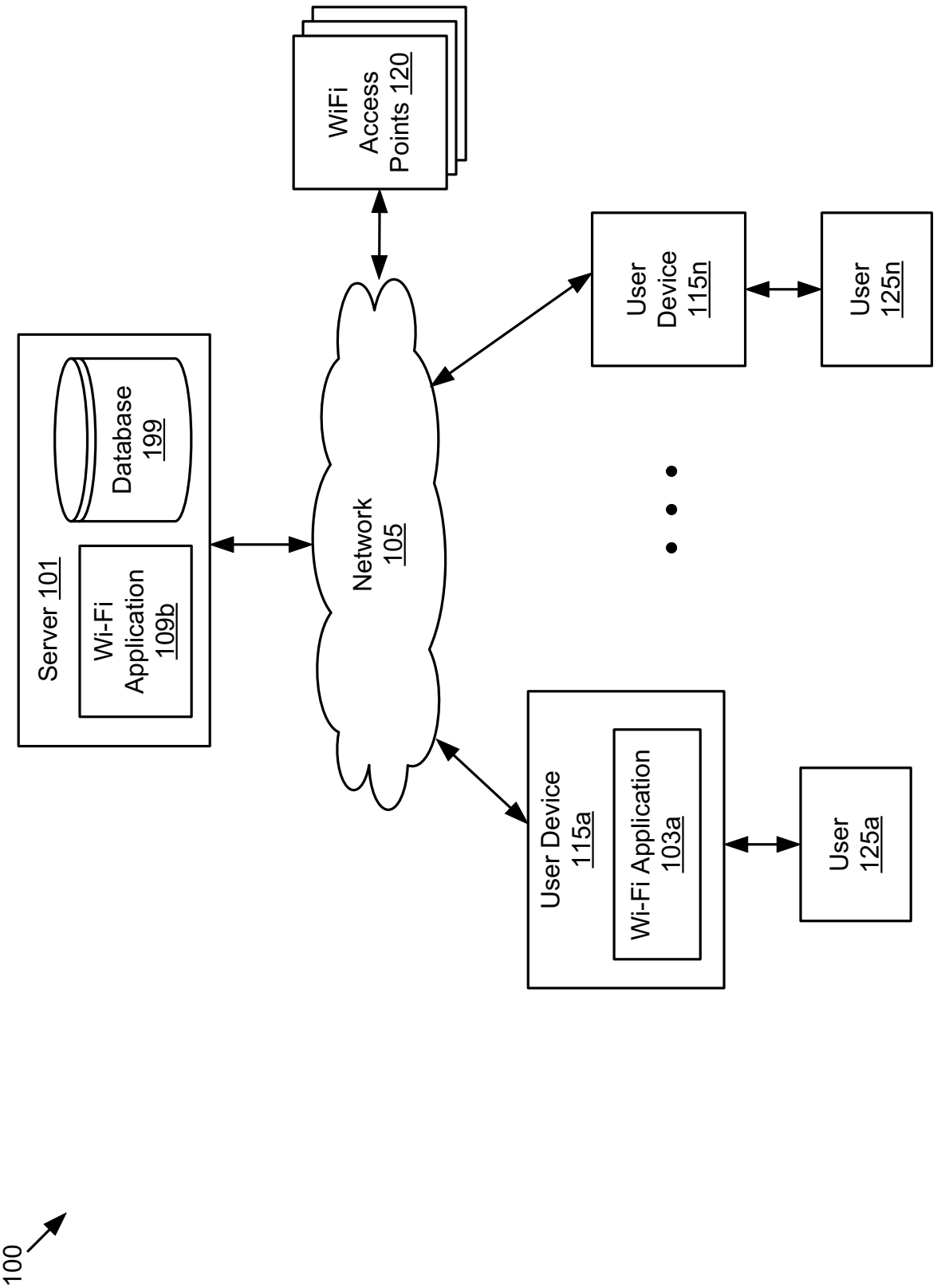
WiFi Access Points 120
Server 101
Database 199
Wi-Fi Application 109b
Network 105
User Device 115n
User 125n
User Device 115a
Wi-Fi Application 103a
User 125a
100

FIG 1

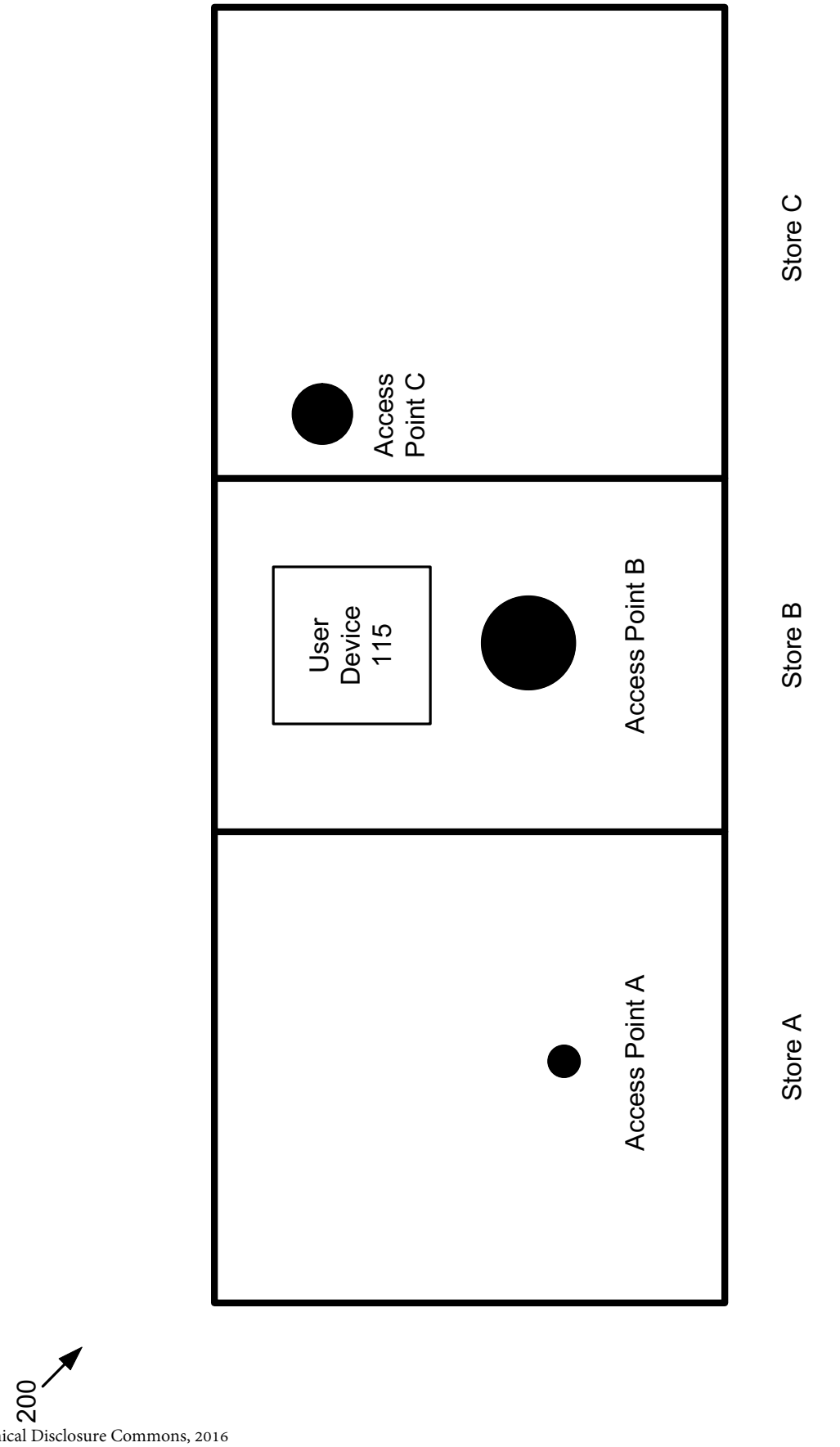
Store C
Store B
Store A
Access Point C
User Device 115
Access Point B
Access Point A
200

FIG 2