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A HANDOVER SCHEME BASED ON AN ADAPTIVE BASE STATION MAP

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Abstract — As the use of global positioning system (GPS) has been popular, location and velocity information obtained from GPS has been used to assist the handover process. In this paper, for GPS-enabled mobile units, we propose a new handover scheme using an adaptive base station map. The adaptive base station map stores/updates the information on the base station, which could provide most stable services at the mobile unit's current location. In general, since users spend most of their time in a specific area such as near their companies, near their homes, or on their way to and from home, a very detailed base station map can be made for these areas within a short time. Therefore, it can be expected that the proposed scheme perform more effectively within the radius of the user's main activity.

Keywords— Handover, GPS, Adaptive Base Station Map

I. INTRODUCTION

In mobile cellular systems, handover is the process of maintaining a mobile unit's active connections from one base station to another base station according to the movement of the mobile unit [1]. When a mobile unit moves, the mobile unit continuously monitors surrounding base stations' signal strength, and performs handover at an appropriate time to maintain stable service. Thus, the processes of continuously monitoring surrounding base stations and determining a proper handover time are burdensome to the operation of the mobile unit. Various techniques have been studied to reduce the burden on the mobile unit during the handover process; specifically, as the use of global positioning system (GPS) has been popular, location and velocity information obtained from GPS has been used to assist the handover process [2]-[4].

In this paper, we propose a new handover scheme using an adaptive base station map for GPS-enabled mobile units. The mobile unit generates its own base station map by using the location information obtained from GPS: the base station map stores the information on the base station, which could provide most stable services at the mobile unit's current location; it continuously updates the base station information according to the movement of the mobile unit. Thus, the mobile unit having its own base station map can perform handover without a process of searching for available base stations and comparing received signal strength from base stations.

II. PROPOSED HANDOVER SCHEME

We propose a new handover scheme using an adaptive base station map for GPS-enabled mobile units. It consists of a base station monitoring unit (BSMU), an adaptive base station map-generating unit (ABSMGU), and a handover processing unit (HPU). Fig. 1 shows a block diagram of the proposed handover scheme.

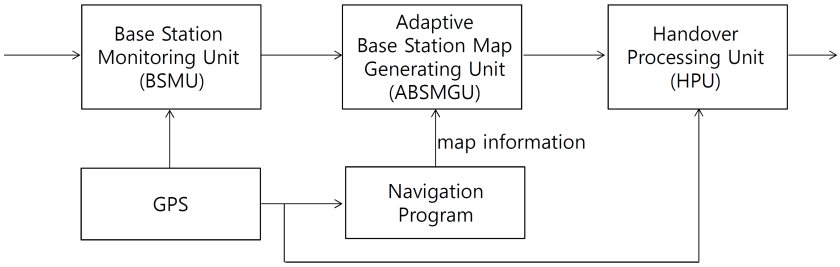

Fig. 1 Block diagram of the proposed handover scheme.

A. Base Station Monitoring Unit (BSMU)

When a mobile unit is activated, there is no information on the base station map. Thus, based on a conventional handover procedure, the BSMU continuously monitors and compares received signal strength from surrounding base stations. At the moment when the connected base station is changed due to the handover, the BSMU collects the information on the new serving base station and location of itself. For example, the collected information can be in the form of the following:

(current_location, moving_direction, previous_serving_BS_ID, new_ serving_BS_ID) (1)

Where *current_location* is the mobile unit's location information obtained from GPS; *moving_direction* represents the moving direction of the mobile unit along the street; *previous_serving_BS_ID* and *new_serving_BS_ID* are the identification numbers of the disconnected base station and the newly connected base station, respectively. Whenever the serving base station is changed, the BSMU transfers the collected information of (1) to the adaptive base station map-generating unit.

B. Adaptive Base Station Map Generating Unit (ABSMGU)

The ABSMGU generates/updates a base station map by synchronizing the base station information and the location information reported from the BSMU. Specifically, the base station map includes information on a handover region around which handover occurs frequently–a handover region can be determined by combining the information on *current_location*'s and *moving_direction*'s reported at adjacent locations. In addition, for each handover region, candidate base stations and their handover frequencies are stored and continuously updated.

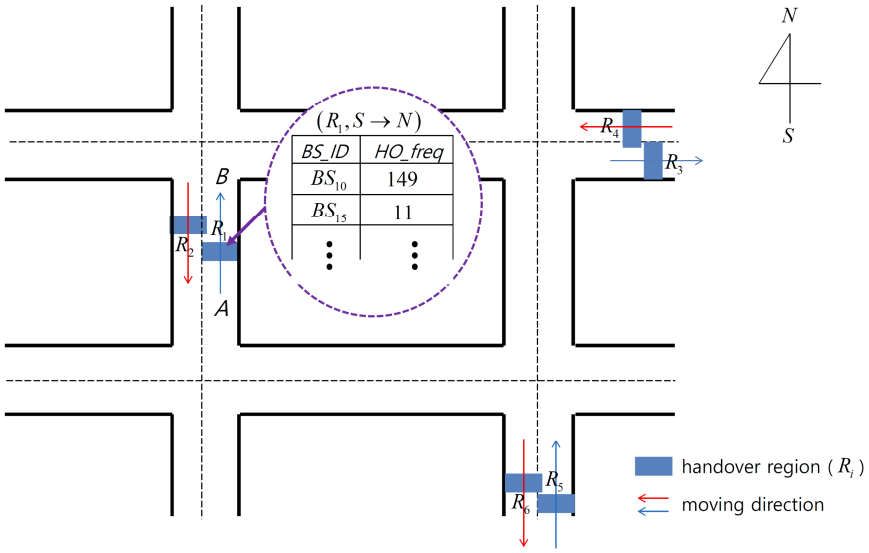

Fig. 2 An example of the adaptive base station map (in the form of map)

The base station map can be implemented in a map form in which base station information and handover region information are added to map information–recently, mobile units can easily use map information since there are so many popular applications using map information, such as navigation programs.

Fig.2 is a possible example of the adaptive base station map, where the stored information for a handover region R_1 is shown in a form of table: $S \rightarrow N$ represents the moving direction corresponding to R_1 (that is, from south to north); *BS_ID* represents a candidate base station identification; *HO_freq* represents accumulated frequencies of handover performed toward the base station of *BS_ID*.

In general, a user possessing/using a mobile unit often moves with a certain radius of motion or a constant path, and consumes a lot of time at a specific area. For example, if you are a worker, you travel along a regular commute route and spend a lot of time near the company and near the house. Therefore, a very detailed base station map can be made for these areas within a short time.

C. Handover Processing Unit (HPU)

The handover processing unit (HPU) performs call processing including handover based on the adaptive base station map generated by the ABSMGU. Assume a mobile unit is moving from the position *A* to the position *B* in Fig.2. HPU can easily calculate the current location, *A* and the moving direction, $S \rightarrow N$ from the GPS information. From these information, HPU recognizes that the mobile unit is approaching the handover region R_1, and prepares to perform the handover to the most reliable base station–it can be done by just selecting the base station which has the largest *HO_freq* value in the table of candidate base stations (in this example, HPU selects the base station of BS_{10}). That is, the handover can be performed without the process of checking the quality of the mobile communication signal or searching the available base stations separately.

It is worthwhile to note that by using the information of the current location and the moving direction, HPU can predict that the mobile unit is approaching a specific handover region, so that it can prepare the handover in advance–it is more effective in the environment where a mobile unit moves fast.

III. CONCLUSION

We proposed a new handover scheme using an adaptive base station map for GPS-enabled mobile units. The adaptive base station map includes the information on handover regions–for each handover region, candidate base stations and their handover frequencies are stored and continuously updated. Base on its own base station map, HPU can predict that the mobile unit is approaching a specific handover region, and furthermore it can get the information on the statistically best candidate base station for the handover region. Therefore, the handover can be performed without checking the quality of the mobile communication signal or searching the available base station continuously. Particularly, since the base station map is generated first for the area where the mobile unit is mainly active, the proposed scheme can be more effective within the radius of the user's main activity

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