DOI: 10.2298/CSIS120711032J

A Real-time Location-based SNS Smartphone Application for the Disabled Population

Hae-Duck J. Jeong[1], Jiyoung Lim[1], WooSeok Hyun[1], and Arisu An[2]

[1] Department of Computer Software
Korean Bible University
Seoul, South Korea
{joshua, jylim, wshyun}@bible.ac.kr
[2] Development G-Team of International Business Division
Mappers
Seoul, South Korea
hiphopbob@naver.com

Abstract. Smartphone usage and data consumption have been sharply rising, and the disabled have also become smartphone users as the number of users of these phones has exponentially increased in recent years. The theme of this paper is how to create a better world for the disabled using the information that people want to exchange with each other between the disabled and the general population. The main goal is also to provide the information that they need from each other in a way that can be displayed on the map in real-time. We propose a new location-based SNS application for the disabled population (except those who are visually impaired or the disabled who are not able to use a smartphone) with three major characteristics of this application to be considered as follows: (i) the person uses a Social Networking Service (SNS) by constructing a friend matching system such as Facebook or Twitter, which are the most widely-used SNS in the world; (ii) the general population registers real-time information for a specific location on the map for the disabled population using SNS. This information with photos and messages is given and evaluated by users; and (iii) this system makes it easier to see that the menu in the GUI was implemented.

Keywords: location-based SNS, Android, smartphone, GPS, disabled population, real-time system.

1. Introduction

According to smartphone usage statistics 2012, AnsonAlex.com [6] announced that Go-Gulf.com recently published an infographic containing worldwide smartphone usage statistics in 2012. 80 percent of the world's population now has a mobile phone. Out of the five billion mobile phones in the world, 1.08 billion are smartphones. With increasing prevalence of smartphones, not only people's life styles, but also trends in the future of information technology have been changed. Many applications that have a wide variety of different functions to

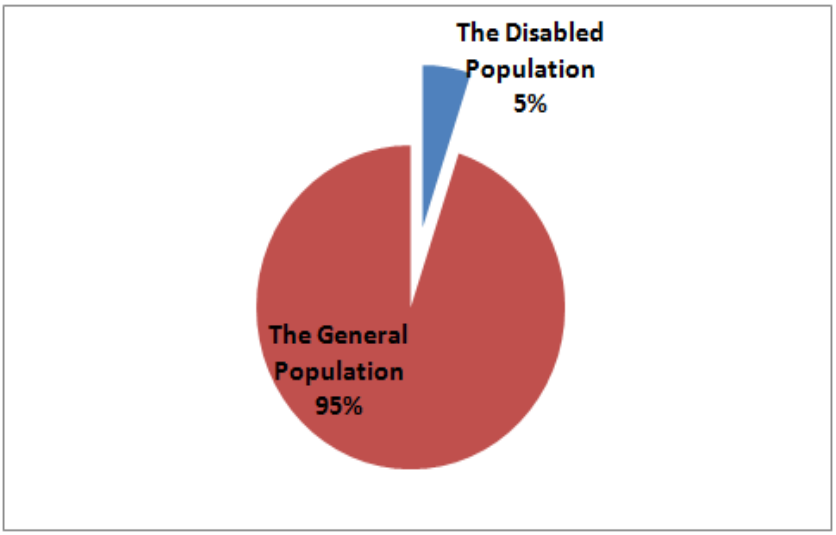


Fig. 1. Registration status of the Disabled Population in South Korea as of December 2011

access easily for the disabled, except people who are visually impaired or the disabled who are not able to use a smartphone, have been released [15], [16], and telecommunication companies also provide their products at an affordable price [8]. Use of smart technology in education for the one million disabled by including the disabled is currently being conducted in the Seoul city government office [13].

The statistics of Ministry of Health and Welfare of South Korea show that the registered number of the disabled population was five percent of South Koreans as of December 2011 (i.e., 2,519,241 disabled out of 49,779,440 South Koreans), as shown in Fig. 1 [22]. Table 1 also shows the registered numbers for different types of the disabled in South Korea as of December 2011.

National Information Society Agency (NIA) investigated the information gap index and real condition in 2011. Figure 2 shows that, according to the study, the smartphone supply ratio of both the disabled population and the average of socially disadvantaged class (including the disabled, low income users, aged people, and farmers and fishermen) in South Korea was 8.6%. The smartphone supply ratio of the general population was 39.6% as of October 2011 [25].

According to the Organization for Economic Cooperation and Development (OECD) report published in July 2012, South Korea's high-speed Internet penetration rate topped 100 percent for the first time among the group's 34 nations. Application developers around the world are targeting Korea as their gateway into Asia as they strive to integrate globalization with social media. Figure 3 provides quick insight on the current leading SNS applications in South Korea [24].

Table 1. The registered numbers for different types of the disabled in South Korea as of December 2011 [22]

Types of the Disabled	Numbers
Liver	8,145
Epilepsy	8,950
Brain Lesions	260,718
Visual	251,258
Kidney	60,110
Heart	9,542
Face	2,715
Language	17,463
Autism	15,857
Intestinal Fistula	13,098
Psychiatric	94,739
Intellectual	167,479
Physical	1,333,429
Hearing	261,067
Respiratory	14,671
Total	**2,519,241**

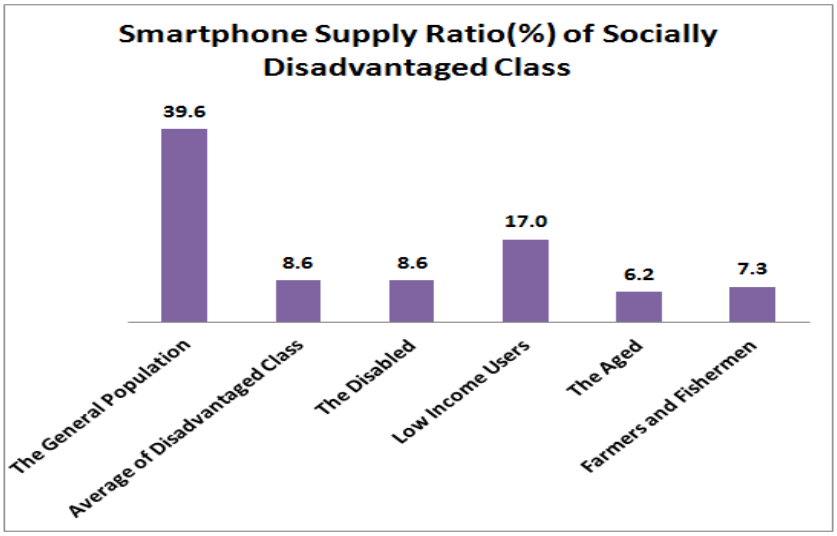


Fig. 2. Smartphone supply ratio(%) of socially disadvantaged class in South Korea in 2011. Sample sizes are 1,500 general people, and 3,700 for each of the disabled, low income users, the aged, and farmers and fishermen. The survey was investigated from August 2011 to November 2011

As of May 2012, Cyworld has the largest user base in the South Korean SNS applications with just a shy of 20 million users. Kakao Talk, a mobile-

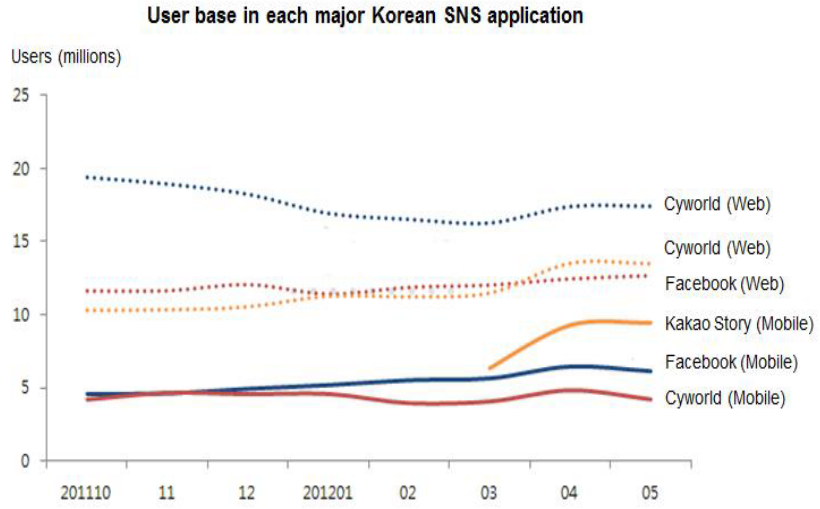


Fig. 3. The chart shown depicts the size of the user bases of the top SNS applications in South Korea as of May 2012 [24]

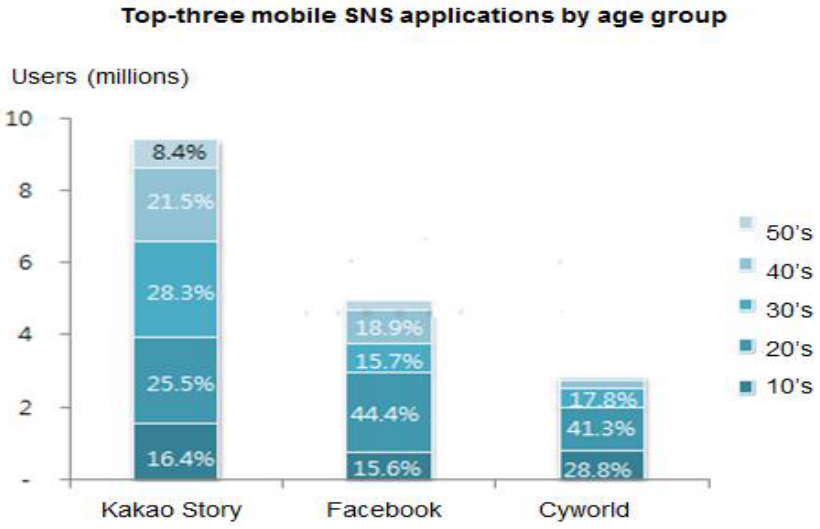


Fig. 4. Of the top three mobile SNS applications, the chart above separates user volume by age group [24]

based messenger, is the second most-used SNS application in South Korea. Facebook, the global leader in social media, ranks third in South Korea.

Figure 4 shows that Kakao Story ranks as the most popular mobile SNS application with its most active user base in their 30's. It is interesting to note that much of Kakao Story's user base is evenly distributed among users in their 20's, 30's and 40's. On the other hand, Facebook and Cyworld have the most dominant user base in their 20's.

Thereby the frequencies of use of SNS have also increased exponentially. Generally people send and receive messages in real-time through smartphones using Facebook and Twitter, use main services via registering friends and matching friends, or easily use location-based SNS such as Foursquare. Almost all the SNS smartphone applications have been developed for the general population, while ones for the disabled have not much been considered and developed yet. Thus, we propose a new system for the disabled, except people who are visually impaired or the disabled who are not able to use a smartphone, to give the information flow of such interests and activities to the disabled, and the information is evaluated by several consensuses being served. It is designed and implemented based on Android [3]. Section 2 addresses related technologies such as Android, global positioning system, and social networking system. In Section 3, the proposed location-based SNS for the disabled is discussed. Section 4 presents implementation and results of the proposed application, and finally the conclusions are described in Section 5.

2. Related Technologies

A few related technologies of the proposed SNS smartphone application for the disabled, except people who are visually impaired or the disabled who are not able to use a smartphone, are Android, global positioning system (GPS), and SNS as follows.

2.1. Android

Android is a Linux-based open mobile platform for mobile devices such as smartphones and tablet computers. It is composed of not only an operating system, but also middleware, user interface (UI), browser, and application. It also includes C/C++ libraries that are used in components of various Android systems. Android architecture is divided into five hierarchical categories: applications, application framework, libraries, Android runtime, and Linux kernel [2], [5], [18]. The proposed application was designed and developed on Android.

2.2. Global Positioning System (GPS)

Basic Concepts of GPS The GPS is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth. The current GPS is composed of three major segments. These are a space segment, a control segment, and a user segment. The United

States Air Force develops, maintains, and operates the space and control segments. GPS satellites broadcast signals from space, and each GPS receiver uses these signals to calculate its three-dimensional location (latitude, longitude, and altitude) and the current time [1], [12], [21]. The space segment consists of 24 to 32 satellites in medium earth orbit and also includes the payload adapters to the boosters required to launch them into orbit. The control segment is composed of a master control station, an alternate master control station, and a host of dedicated and shared ground antennas and monitor stations. The user segment is made of hundreds of thousands of the US and allied military users of the secure GPS precise positioning service, and tens of millions of civil, commercial, and scientific users of the standard positioning service. The GPS will be used to mark user's current location in the proposed application.

Navigation Equations of GPS The receiver uses messages received from satellites to determine the satellite positions and time sent. The x, y, and z components of satellite position and the time sent are designated as $[x_i, y_i, z_i, t_i]$, where the subscript i denotes the satellite and has the value $1, 2, \cdots, n$, where $n \geq 4$. When the time of message reception indicated by the on-board clock is t_r, the true reception time is $t_r + b$, where b is receiver's clock bias (i.e., clock delay). The message's transit time is $t_r + b - t_i$. Assuming the message traveled at the speed of light, c, the distance traveled is $(t_r + b - t_i)c$. Knowing the distance from receiver to satellite and the satellite's position implies that the receiver is on the surface of a sphere centered at the satellite's position. Thus, the receiver is at or near the intersection of the surfaces of the spheres. In the ideal case of no errors, the receiver is at the intersection of the surfaces of the spheres. The clock error or bias, b, is the amount that the receiver's clock is off. The receiver has four unknowns, the three components of GPS receiver position and the clock bias $[x, y, z, b]$. The equations of the sphere surfaces are defined by

$$(x - x_i)^2 + (y - y_i)^2 + (z - z_i)^2 = ([t_r + b - t_i]c)^2, i = 1, 2, \cdots, n \quad (1)$$

or in terms of pseudoranges, $p_i = (t_r - t_i)c$, as

$$p_i = \sqrt{(x - x_i)^2 + (y - y_i)^2 + (z - z_i)^2} - bc, i = 1, 2, \cdots, n. \quad (2)$$

These equations can be solved by algebraic or numerical methods such as Bancroft's algorithm, trilateration, multidimensional Newton-Raphson calculations, and additional algorithms for more than four satellites below [10], [12].

– **Bancroft's algorithm**
  Bancroft's algorithm involves an algebraic as opposed to numerical method and can be used for the case of four satellites or for the case of more than four satellites. If there are four satellites then Bancroft's method provides one or two solutions for the four unknowns. If there are more than four satellites then Bancroft's method provides the solution which minimizes the sum of the squares of the errors for the over determined system [7], [12].

– **Trilateration**
The receiver can use trilateration and one dimensional numerical root finding. Satellite position and pseudorange determines a sphere centered on the satellite with radius equal to the pseudorange. Trilateration is used to estimate receiver position based on the intersection of three sphere surfaces so determined. In the usual case of two intersections of three sphere surfaces, the point nearest the surface of the sphere corresponding to the fourth satellite is chosen. Let d denote the signed distance from the current estimate of receiver position to the sphere around the fourth satellite. The notation, d(correction) denotes this as a function of the clock correction. The problem is to determine the correction such that d(correction) $= 0$. This is the familiar problem of finding the zeroes of a one dimensional non-linear function of a scalar variable. Iterative numerical methods, such as those found in the chapter on root finding in Numerical Recipes [23] can solve this type of problem.

– **Multidimensional Newton-Raphson calculations**
Alternatively, multidimensional root finding methods such as the Newton-Raphson method can be used [23]. The approach is to linearize around an approximate solution, say $[x^{(k)}, y^{(k)}, z^{(k)}, b^{(k)}]$ from iteration k, then solve the linear equations derived from the quadratic equations above to obtain $[x^{(k+1)}, y^{(k+1)}, z^{(k+1)}, b^{(k+1)}]$. Although there is no guarantee that the method always converges due to the fact that multidimensional roots cannot be bounded, when a neighborhood containing a solution is known as is usually the case for GPS, it is quite likely that a solution will be found. It has been shown that results are comparable in accuracy to those of Bancroft's method [17]. This algorithm was used to implement our proposed system.

– **Additional methods for more than four satellites**
When more than four satellites are available, the calculation can use the four best or more than four, considering number of channels, processing capability, and geometric dilution of precision (GDOP). Using more than four is an over-determined system of equations with no unique solution, which must be solved by least-squares or a similar technique. If all visible satellites are used, the results are as good as or better than using the four best. Errors can be estimated through the residuals. With each combination of four or more satellites, a GDOP factor can be calculated, based on the relative sky directions of the satellites used. As more satellites are picked up, pseudoranges from various 4-way combinations can be processed to add more estimates to the location and clock offset. The receiver then takes the weighted average of these positions and clock offsets. After the final location and time are calculated, the location is expressed in a specific coordinate system such as latitude and longitude, using the WGS 84 geodetic datum or a country-specific system [9].

2.3. Social Networking Service (SNS)

The number of SNS users in South Korea is on the sharp rise. This is in line with the SNS craze that is taken over the entire world. In 2010, a report estimated that one out of every 14 people in the world were SNS users. In South Korea alone, there were 24 million SNS users reported in July of 2010 [19]. SNS is not just something that is in with the younger generation, either. More and more older people are following in the footsteps of their younger counterparts. Gartner indentifies that one of the top 10 consumer mobile applications for 2012 is social [11]. The keyword called social is one of the hot issues and furthermore it has seriously to be considered as one of the important information technologies. As applications have been developed for mobile devices, a new paradigm has come with social relations among people (namely, social SNS becoming more important). Who the experts or issue makers are and who are connected with them have become important in the current SNS age [20].

An SNS is an online service, platform, or site that focuses on building and reflecting social networks or social relations among people who share interests and/or activities. An SNS consists of a representation of each user, his/her social links, and a variety of additional services. Most social network services are web-based and provide means for users to interact over the Internet, such as e-mail and instant messaging. Online community services are sometimes considered as a social network service, though in a broader sense, because social network service usually means an individual-centered service whereas online community services are group-centered. Social networking sites allow users to share ideas, activities, events, and interests within their individual networks [14]. Some examples of these relations-centered popular social networking websites are Facebook, LinkedIn, MySpace, Twitter, and Cyworld. Many other social networking websites are slowly gaining ground with more users signing up every month. Particularly, Facebook is one of the most widely-used SNS in the world. Currently, there are over 800 million users worldwide. It was started by a Harvard student, Mark Zuckerberg, in 2004. It originally started as a site for university students. It's now for anyone over the age 13 with a valid email address. It helps you stay connected with your friends. You can post pictures, video clips, status updates, and wall messages to your friends. There are many game applications and a chatting feature as well. With smartphones, you can access your Facebook account wherever you are [19].

3. Proposed Location-based SNS for the Disabled

Almost all the SNS smartphone applications have been developed for the general population, while ones for the disabled, except people who are visually impaired or the disabled who are not able to use a smartphone, can hardly be found. Thus, we proposed a new SNS smartphone application for the disabled. Major concepts for the proposed system include the following.

3.1. Major Concepts of the System

The proposed location-based SNS system under Android includes 10 features for the disabled, except people who are visually impaired or the disabled who are not able to use a smartphone [4].

- Function of displaying RSS (Really Simple Syndication or RDF Site Summary) information supported by Seoul city with public toilet information installed for the disabled on the map. It consists of receiving RSS information in real-time and easily seeing near public toilets.
- Function of board and public notice. Anyone can write a message on a board and administrative committee members upload public notices for users without any difficulties.
- Function of registering membership and automatic login. Users easily register membership through GUI and can upload one's photo. When a user first logs in, one can then login the system through the automatic login function without the typing effort of login ID and password.
- Function of marker registration on the map. As one of the most important functions in the proposed system, users register a marker at a current position. Users can see a marker of a particular location to be able to register it, and an event in real-time on the map will be able to be given when passing near the place. Real-time information such as photos and messages is registered.
- Function of evaluating real-time information. The disabled and the general population evaluate for markers. The advantage of the evaluation system is that their accumulated points obtained from markers, which were registered positions, were evaluated with points that would become reliable information. The range of evaluation points is from 1.0 to 5.0.
- Function for management of friends. It is an important social regional part in SNS such as searching friends, adding friends, requiring friends and complying with their requests, etc. It shows who requests me as a friend through a specific column in a database, and it is implemented to be able to know peer-to-peer relationships using identifiers in a database.
- Function of showing one's opinion and thought such as News Feed of Facebook.
- Function of TTS (Text To Speech). It provides automatic conversion of text streams to voice on a smartphone giving what the meaning is for a touched location. The disabled and/or the general population are useful if they use Text-To-Speech (TTS) function for the purpose of double-checking texts.
- Function of voice recognition. Using voice-recognition engine supported by Android, we use services supported that call words converted from one's voice instead of buttons, and recognize them.
- Function of navigating in an area. It can only see markers within a 500m radius to reduce much overhead because there are too many markers displayed on the map. One of major concepts of the system has function of navigating in an area that we can easily find where the nearest restroom is

and estimate how far the distance is from the current place to the nearest restroom within a 500m radius on the map.

Thus, the implemented system provides 10 major functions plus additional ones such as modification of personal information, editing photos, member's management, and so on.

3.2. Administration Mode

The management for the proposed system must be through the administration mode. The administrator maintains the system to bridge between the disabled and the general. People have access to all features except they cannot create new additional applications and define specific operations. The administrator also has all the authority including uploaded comments, and managing members' information. On the other hand, the administrator manages each member's information and has the right of access for members to provide security protection. Furthermore, every member including the disabled and the general population can become this administrator by himself/herself, because of the way this proposed system was particularly designed and implemented. There are two aspects in this system: while one administrator covers the general (for example, the general population provides information on the map that the disabled need.), the other manages the disabled (for example, the disabled give the general information to upload on the map.).

3.3. System Configuration and Action

Configuration and action of the proposed system is explained in this section. As shown in Figure 5 its abstract structure consists of Android 2.1, PHP, MySQL, XML, and Apache, and the proposed system was implemented through data transmission between a server and a terminal. There are several processing steps of the data transmission as follows: Send information from an Android terminal and receive it in the post method of PHP. Mainly three types of libraries, AdoDB 5 library for accessing databases, nusoap library for using public information in Seoul, and GD library for importing related images, have been used in this application. Then process query statements in a MySQL database and receive the result in PHP, and then return back to the Android. When sending information that is required in PHP, it is sent to the Android terminal which uses it after constructing it in XML method.

Figure 6 shows a sequence diagram of these steps for a basic message information exchange between users and the abstract structure. When requesting information, one sends it to a database through a few steps and takes it from the database via the mediator PHP. For example, when sending data of a photo type, after storing a photo in a specific path of a server in PHP, an address of the server with the specific path that the photo is stored in the database is combined. A string of a linked type is stored to reduce overhead in a database.

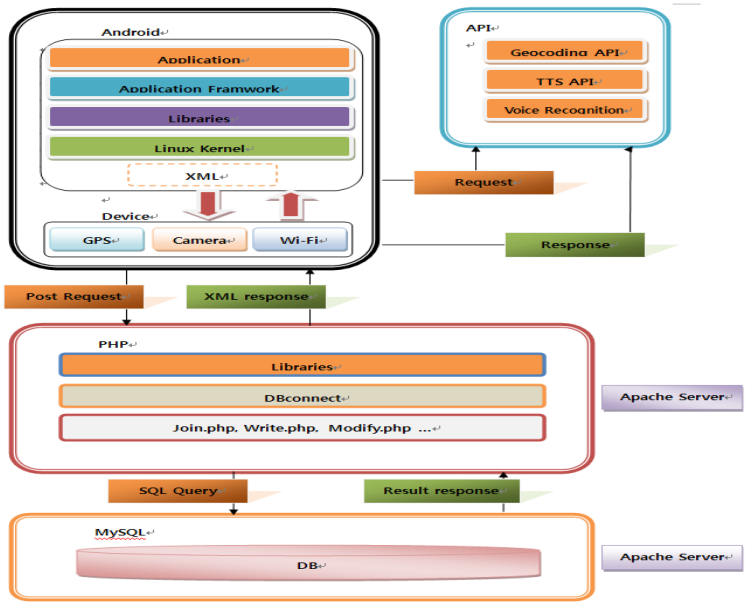


Fig. 5. The abstract structure of the proposed system

Thus, a string of the photo's link path only has to be sent to the terminal instead of bring the whole photo file in a database or send it back to the Android terminal.

One of several non-commercial DBMS products such as MySQL, SQLite and PostgreSQL was taken into account rather than commercial ones because they are free or opensource. MySQL was considered when designing a physical data model in this application. Figure 7 shows a physical data model for the proposed system using the MySQL database management system.

Figure 8 shows the whole state diagram of the proposed system. The structure is composed of the initial main menu that is divided into all submenus between start and end of the system. The system considers that configuration of the initial main menu for the disabled is very important. Fig. 9 also shows a flowchart of writing scenarios which sends the data, including coordinate values and information of photos from input fields, to the database using PHP. Figures 10 and 11 show flowcharts for friend matching and inserting coordinate values, respectively.

4. Implementation and Results of the System

Figure 12 and Figure 13 show implementation and results of the proposed application including 10 functions as mentioned in Section 3. There are six selected menus in Figure 12 and Figure 13 such as main menu, registration, on TTS,

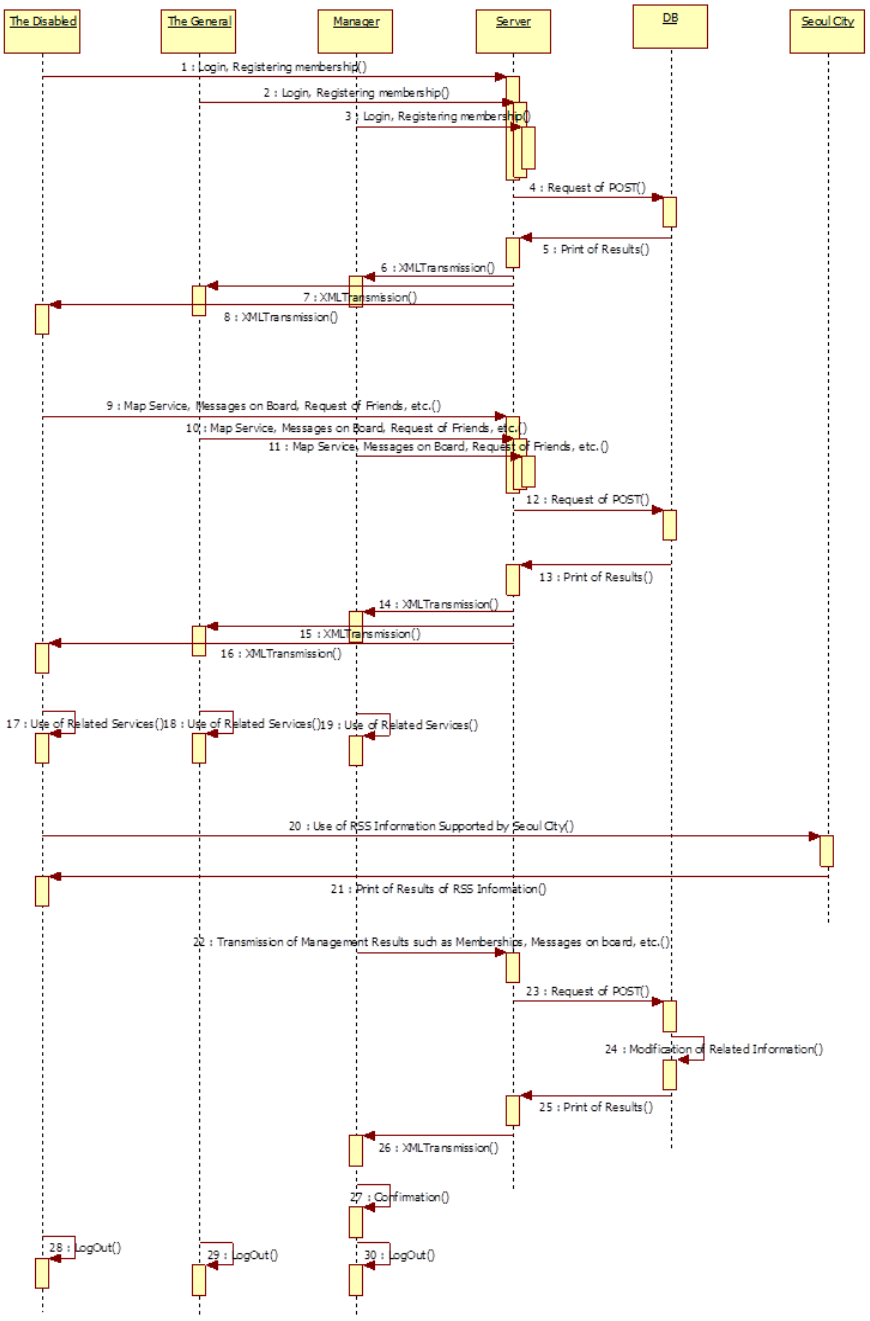


Fig. 6. A sequence diagram for a basic message information

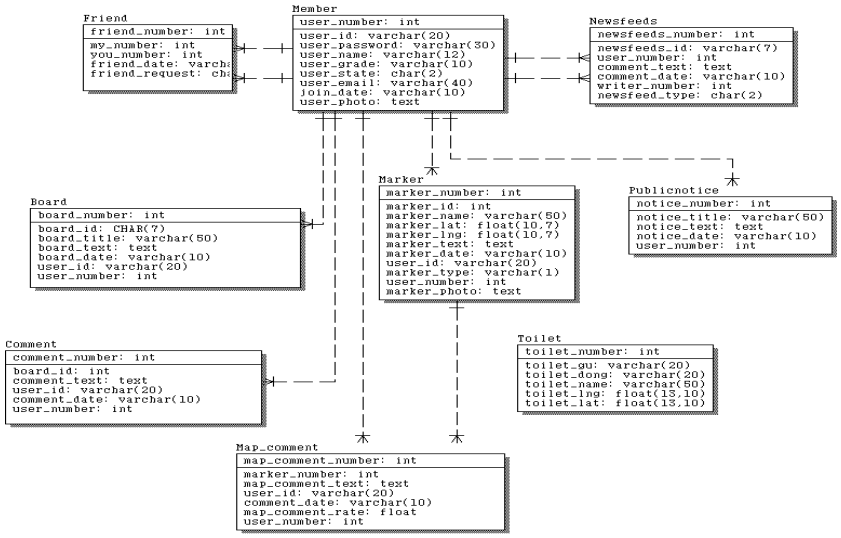


Fig. 7. A physical data model for the proposed system

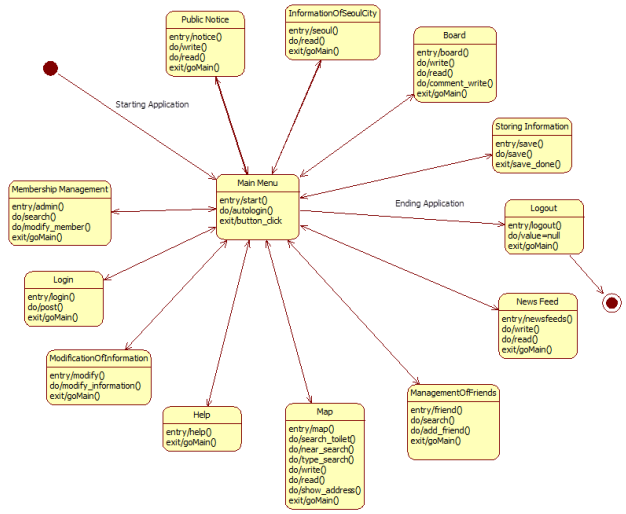


Fig. 8. The proposed state diagram

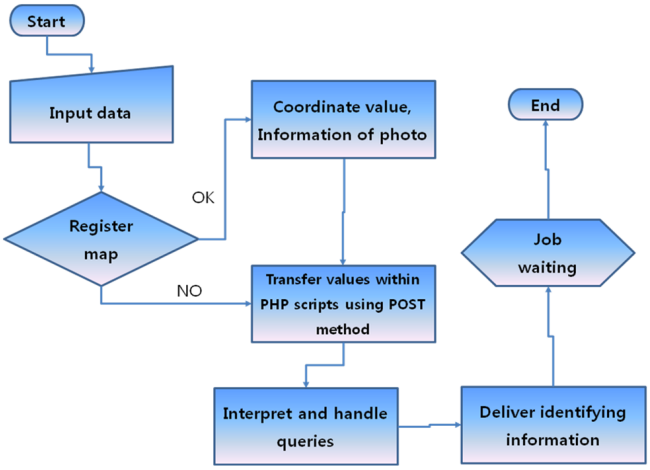


Fig. 9. A flowchart for writing scenarios

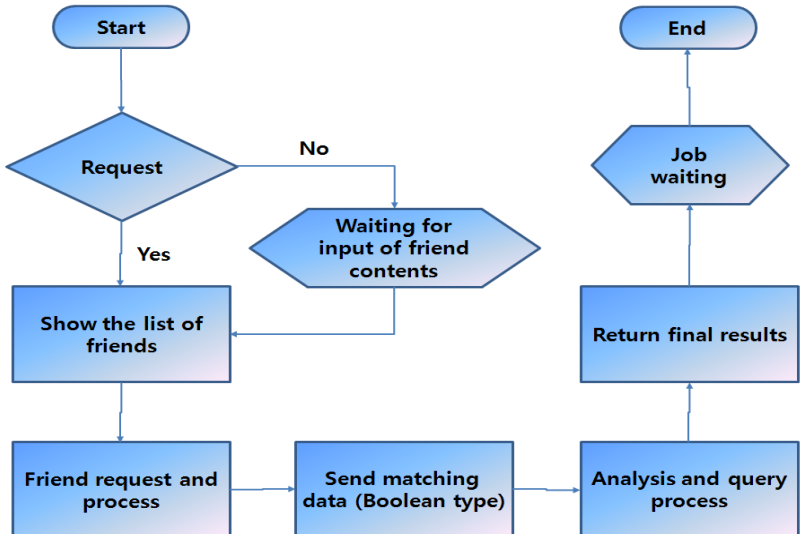


Fig. 10. A flowchart for friend matching

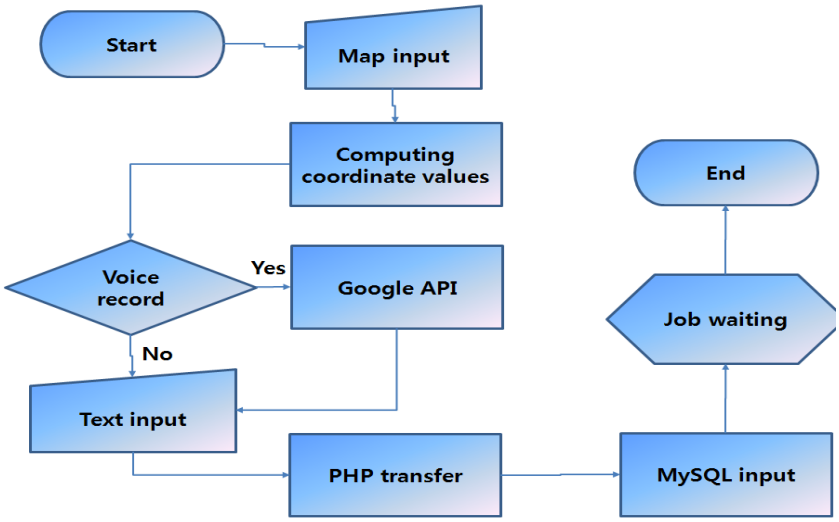
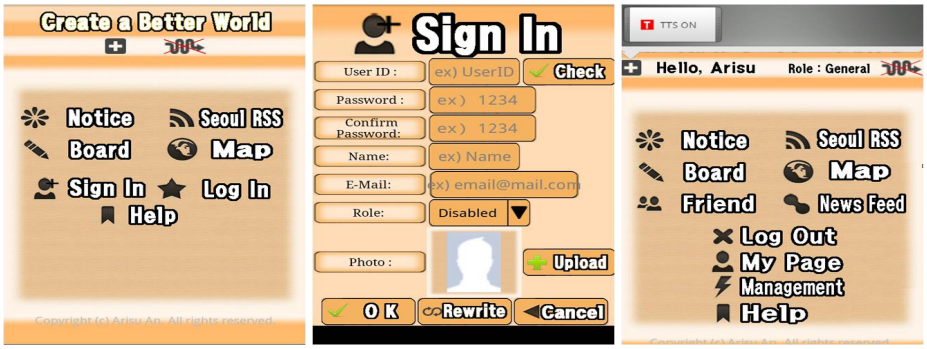


Fig. 11. A flowchart for inserting coordinate values



(a) Main menu (b) Registration (c) On TTS

Fig. 12. Some of selected menus

(a) User's current location (b) Nearby public toilet (c) Toilet information

Fig. 13. Some of selected menus (continued)

user's current location, nearby public toilets, and information about the toilets. The disabled, except people who are visually impaired or the disabled who are not able to use a smartphone, can not only easily use this system with 10 functions plus other ones because big identifiers have been added, but also it will be handy to find near public toilets installed for the disabled on the map. The GUI-based main menu was designed and implemented to easily access because the main menu plays an important role in the disabled and is seriously taken into account and is linked to all other submenus [4]. In addition, soft colors were used to make it feel comfortable and peaceful because the disabled generally handle applications and computer systems more difficulties than the general population.

5. Conclusions and Future Works

A location-based SNS system for the disabled, except people who are visually impaired or the disabled who are not able to use a smartphone, was proposed and implemented in this paper. The system was based on GUI overall and was easily constructed. Furthermore, soft colors were used to make it feel comfortable and peaceful. The proposed application has taken into account ways to best organize, post and get messages in real-time, even though it consists of so many complicated functions. Our results with a real terminal showed that users can get nearby information wherever GPS information is received. According to the need, users can also use the information about public toilets basically provided by Seoul city. Another advantage of the proposed system is that without visiting a specific location in person, users can see and find all events that happen in that place in real-time and a variety of information in advance. Further study to improve performance will be considered to get faster response speeds. This application may cause bottlenecks in the data flow since there is no function to manage photos and data that both require quick process within a short

period of time. On top of that, more complex menus by using hypertext will be considered in the future work. Even though this application was designed and implemented with the help and support of special education professionals for the disabled, the experimental results will also be done by asking the disabled population to use the proposed system later.

Acknowledgments. The authors would like to thank to funding agency for providing the financial means. Parts of this work were supported by a research grant from Korean Bible University, South Korea. We also thank Robert Hotchkiss and reviewers for his invaluable and constructive remarks and suggestions.

References

1. Difference between Tokyo Datum and WGS-84 Datum. http://kin.naver.com/qna/
2. Aguero, J., Rebollo, M., Carrascosa, C., Julian, V.: Does Android Dream with Intelligent Agents? Advances in Soft Computing 50, 194–204 (2009)
3. An, A., Jeong, H.D., Lim, J., Hyun, W.: Design and Implementation of Location-based SNS Smartphone Application for the Disabled Population. In: The Sixth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing: Future Internet and Next Generation Networks (FINGNet-2012). pp. 365–370. Palermo, Italy (2012)
4. An, A., Jeong, H.D., Lim, J., You, I.S., Hyun, W.: The Real-time Interactive Information Supporting System for the Disabled and General Population (2011)
5. Android: Android Operating System, Wikipedia. http://en.wikipedia.org/wiki/Android OS
6. AnsonAlex: Smartphone Usage Statistics 2012. http://ansonalex.com/infographics/smartphone-usage-statistics-2012-infographic/ (2012)
7. Bancroft, S.: An Algebraic Solution of the GPS Equations. IEEE Transactions on Aerospace and Electronic Systems AES-21, 56–59 (1985)
8. Choi, K.S.: Coming out the Cost of a Smartphone for the Disabled and the Elderly. Digital Times (2011)
9. Dana, P.: Geometric Dilution of Precision (GDOP) and Visibility. University of Colorado at Boulder
10. Darwin, I.: Android Cookbook. O'Reilly Media, Inc. (2012)
11. Gartner: Gartner Identifies 10 Consumer Mobile Applications to Watch in 2012. http://www.gartner.com/it/page.jsp?id=1544815
12. GPS: Global Positioning System, Wikipedia. http://ko.wikipedia.org/wiki/GPS)
13. Jeong, D.L.: Smartphone Education for the One Million Disabled in Seoul. Welfare-news.net (2011)
14. Kim, J.Y., Son, D.H., Kim, H.J.: Trend of SNS Technology. Korean Institute of Information Scientists and Engineers 29(11), 9–16 (2011)
15. Kim, S.I.: Meaning and Prospect of Siri. http://www.digieco.co.kr/KTFront/report/ (2011)
16. Kim, T.K.: Design and Implementation of Korean TTS Service based on Android OS. Master's thesis, Department of Computer Engineering, Wonkwang University (2011)

17. Kumar, B.H., Reddy, K.C., Namassivaya, N.: Determination of GPS receiver position using Multivariate Newton-Raphson Technique for over specified cases. International Journal of Applied Engineering Research 13(11), 1457–1460 (2008)
18. Lee, C.Y., An, B., Ahn, H.Y.: Android based Local SNS. Institute of Webcating, Internet Television and Telecommunication 10(6), 93–98 (2010)
19. Lee, H.S., Clyde, J.: English Speaking Professional Program of EBS FM Radio. Doosan-donga, Korea (2011-2012)
20. Lim, S.S., Kim, H.A., Heo, W.R., Jung, K.: A study of Optimization of Spread of Information and Phenomena of Phase Transition in a Social Network. Korean Institute of Information Scientists and Engineers 29(11), 37–43 (2011)
21. Liu, H., Xia, F., Yang, Z., Cao, Y.: An Energy-Efficient Localization Strategy for Smartphones. Computer Science and Information Systems 8(4), 1117–1128 (2011)
22. Ministry of Health and Welfare of South Korea: The Registered Numbers for Different Types of the Disabled in South Korea as of December 2011 (2012)
23. Press, W., Flannery, B., Teukolsky, S., Vetterling, W.: Numerical Recipes: The Art of Scientific Computing. Cambridge University Press, Cambridge (1986)
24. SeoulSpace: Quick Statistics on the Leading SNS Applications in South Korea. http://seoulspace.co.kr/2012/07/30/quick-statistics-korea-sns-applications/ (2012)
25. Yun, H.W.: Smartphone Supply Ratio 8.6% of Socially Disadvantaged Class. Weekly Kyunghyang, No. 973, http://weekly.khan.co.kr/khnm.html?mode=view&artid=201204251118011&code=116 (May 2012)

Hae-Duck Joshua Jeong (hdjjeong@gmail.com) is an associate professor in the Department of Computer Software at Korean Bible University, Seoul, South Korea. He received his Ph.D. in Computer Science and Software Engineering from the University of Canterbury, New Zealand. He is the author or co-author of more than 80 research publications, including more than twenty patents. He has also been the co-chair of NeoFusion'2012-2013, IMIS'2009-2013, FINGNet'2011-2013 and MUE'2007 as well as a member of numerous technical program committees for international conferences. Dr. Jeong is on the editorial board and a reviewer for various domestic and international journals. He is the corresponding guest editor or guest editor of IJICIC, ComSIS and MCM. His research interests include teletraffic modeling, stochastic simulation, multimedia telecommunication networks, intrusion detection system, social networking service, and real-time system. Member of IEEE NZ, KIPS, KSII, and ORSNZ.

Jiyoung Lim (jylim@bible.ac.kr) received her B.S. and M.S. degrees in Computer Science at Ewha Womans University, South Korea, in 1994 and 1996, respectively and received her Ph.D. degree in Computer Science and Engineering from Ewha Womans University in 2001. She is currently an associate professor of Computer Software at Korean Bible University, Seoul, South Korea. Her research interests include wireless/sensor network security, and M2M network security.

Wooseok Hyun (wshyun@bible.ac.kr) is an associate professor in Computer Software at Korean Bible University, Seoul, South Korea. She received her

Ph.D. in Computer Science from Gyeongsang National University, South Korea. She is the author or co-author of more than 30 research publications, including five patents; organization chair of MUE'2007; reviewer of various domestic and international journals. Her research interests include ubiquitous computing, intelligent system, fuzzy system, information retrieval system, and artificial intelligence. Member of KIISE, KIPS, KMMS.

Arisu An (hiphopbob@naver.com) is a researcher in the Development G-Team of International Business Division at Mappers, South Korea. He received his B.E. in Computer Software at Korean Bible University in 2012. His research interests include social networking service, real-time system, digital map, GIS solution, and GPS navigation map.

Received: September 30, 2012; Accepted: January 31, 2013.