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DEVELOPMENT OF FACILITY EVALUATION SYSTEM FOR THE USE OF DISABLED PEOPLE

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Abstract

Disabled people face a lot of challenges in their daily lives. This study aims to develop a mobile application software for disabled people to evaluate venues, facilities such as hospitals, schools, shops, restaurants and ATMs according to their needs. This mobile application allows users to rate and comment on places, view the precautions taken and to search and list the places that has the required arrangements for various types of disabilities. The study also aims to increase public realization for this civil responsibility initiative. The program has been developed using Java and can run on Android devices.

Keywords: Disabled people, Mobile application, Android, Evaluate, Rate, Comment

ENGELLİLERİN KULLANIMI AMAÇLI MEKAN DEĞERLENDİRME SİSTEMİ GELİŞTİRİLMESİ

Öz

Günümüzde engelli insanlar günlük yaşantılarında birçok zorlukla yüzleşir. Bu çalışmanın amacı, engelli bireylerin hastaneleri, okulları, mağazaları, restoranları ve ATM'leri ihtiyaçlarına göre oylayıp değerlendirebilecekleri bir sistem geliştirmektir. Bu mobil uygulama, kullanıcıların bulundukları yerleri değerlendirip yorum yapmalarını, mekânlarda alınan önlemleri görüntülemelerini ve çeşitli engel türleri için gerekli düzenlemeleri olan yerleri aramalarını ve listelemelerini sağlar. Uygulama Java ile geliştirildi ve Android cihazlarda çalışmaktadır.

Anahtar Kelimeler: Engelliler, Mobil uygulama, Android, Değerlendirme, Oylama, Yorum yazma

1. Introduction

The first world report on disability, produced jointly by World Health Organization and the World Bank, suggests that more than one billion people in the world today experience disability [1]. The percentage of disabled people to the whole population of Turkey is 12.29% [2]. This is one of the highest rates around the world. There are approximately 9,83 millions of disabled people in our country, but we don't see that much of them in the streets. Simple tasks that ordinary people perform on a daily basis as routine are extremely delicate and difficult to those suffering from disabilities. People with disabilities are having lots of difficulties because the venues and public places are not designed with their needs in mind [3-6].

In the age of technology, social platforms are powerful tools to influence a business, whether it is good or bad. People share their experiences, give recommendations or talk about the inconvenient services. Social platforms allow users to spread information about places and services, and this has a great impact on future customer experiences. Disabled people cannot visit every location due to architectural or other kinds of difficulties, so with a social platform like the one, developed within the scope of this study they can know the conditions of a specific location beforehand.

Today, there are apps and websites nearly for every purposes needed. For disabled people, there are web sites, blogs and mobile applications listing accessible hotels and museums in some cities. There are some mobile applications that aim to help with a specific problem of a person with a disability type. There are some small social platforms that consist of disabled people, but they do not share and review venues. They all target just one type of disability, most of them has the data that is outdated, limited, and non-expandable. There is a mobile app called WheelMate [7] that lists toilets and parking lots that are accessible for wheelchair users. But it does not have reviews, user cannot find any other type of venue, and it targets only wheelchair users.

With the project developed in this study, everyone with all types of disabilities can express their own experiences and reviews about almost every location or venue that they have visited. The data is constantly expands with user ratings. This project is a completely new idea that will help to fulfill multiple social needs of a big part of population.

This project aims to give an opportunity to disabled people for their accessibility to rate the facilities on their vicinity areas. With a mobile application that is easy to register, users can evaluate the places they have visited, search and find venues and get their locations. This app includes a poll system for the voting and rating the condition of the restaurants about disability criteria and Google Maps® for taking an address description. Venues are listed by their proximity. The places name and location data are gathered using Foursquare® [8].

Each disability group has its own problems. For example, the problems of a wheelchair user and a person with hearing impairment are not the same. For wheelchair users, architectural issues are a big problem whereas it is irrelevant for hearing-impaired people. The poll questions are prepared with detail and it includes the problems of people with many kinds of disabilities.

2. Method

The application software developed in this study is an internet-based and smartphone-enabled application. Project aims to find venues easily for disabled people's needs. Users can send ratings and comments electronically for various places by using this system. It is developed on Android Studio® using Java® programming language. The data on the venues are provided using Foursquare API. It has centralized data storage for keeping all evaluations and comments. The application can filter the venues for specifications, distance and consideration points. Users can also add comment to places and see the locations on Google Map and get directions from current location. The database is created using MySQL®. As depicted on Figure 1, Server Module is connected to the database. It takes the data and sends it to the User Module through internet.

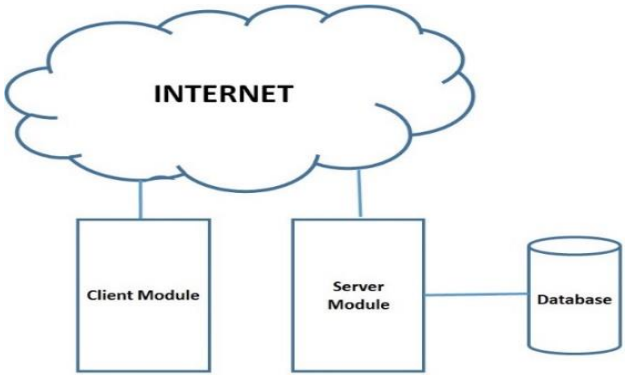

Figure 1. System overview.

The product software can be available on any Android devices. The primary users of the mobile applications will be owners of Android smartphone devices. These users will only need basic knowledge of their devices, as the application will be intuitive and easy to use.

The design model represents explicitly the structure and organization of the system. Packages and corresponding classes are presented with a brief description. As depicted on Figure 2, Administrator Package and User Package are managed through a Web Service.

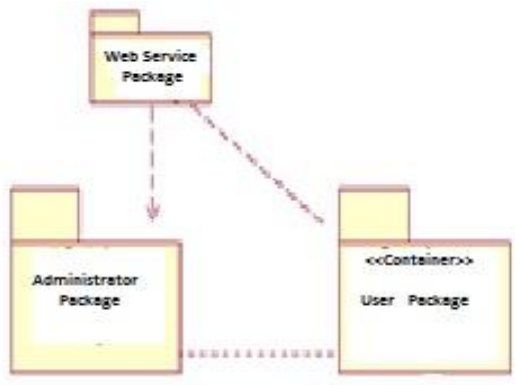

Figure 2. Design model packages Level-1.

The system allows customers a poll system for voting places about disabled people's criteria. The application can filter the venues for specifications, distance and consideration points. The users will also add comment on places and show it in Google Map and set a course from user's current location. Figure 5 provides an overview of the use cases developed in the project. It registers user information that consists of username and password. When user's information is approved, it will then allow them to make one or more considerations and comments about the venue.

The system has 7/24 availability. The product is designed to fail gracefully, marking unrecognized text appropriately and continuing. Exceptional errors, such as segmentation faults, should not occur within the useful time of 1 year. If the product does indeed fail, the mean time to repair will vary depending on the nature of fault. Should the fault be transient error in the underlying platform, all that should be required will be the time taken for the job to be restarted. A fatal error in underlying platform may require as much time as it takes to restart the system. A semantic error within the program will most likely require repair by reprogramming the part of the product, which is time-dependent on the technician repairing the product.

As functional requirements, the app is listing venues by their distance (using Fousquare API), searching venues, filtering for users chosen needs (disability types), and viewing venues on Google Map, adding comments and voting venues (questionnaire) are functioning.

Foursquare API gives access to a huge database of different venues from all around the world. It includes a rich variety of information such as the place's addresses, popularity, tips and photos. The access to the API is available for free and provides an easy setup. As shown in Figure 3, Foursquare API is integrated using given link that has the parameters as category IDs, names, locations and distances. These data is gathered using JSON from the database. A simple HTTP request has been developed which will return JSON data. As shown in Figure 4, JSON data is parsed using JSON Parser class, and then the data is shown in the UI.

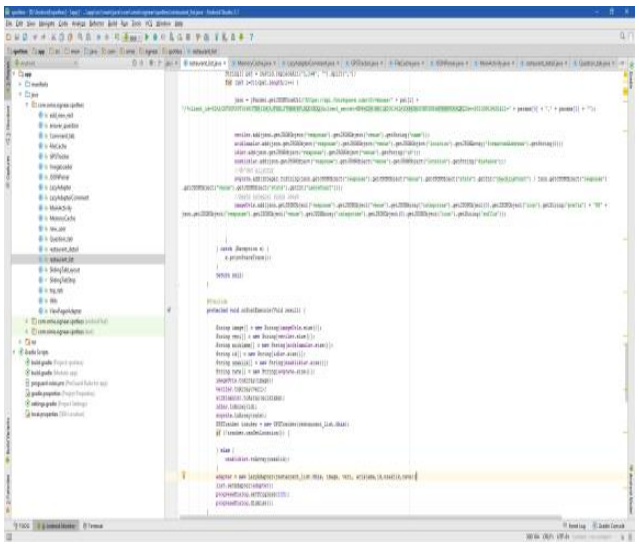

Figure 3. Integrating Foursquare API.

The maximum capacity of the number of venues are limited only by the number of venues on Foursquare. Maximum online users are limited by server capacity.

The user interface would depend on the mobile phones implementations. The input to the system would be through the user's username and password while logging in the system. As shown in Figure 5-6, there are Sign-up page, Login page, Select Category Page, Listing page, Detail page, Evaluate page, Comment page, Filter page, Filter Results page, and also the Google Maps page which users can get the directions of the venue from current location.

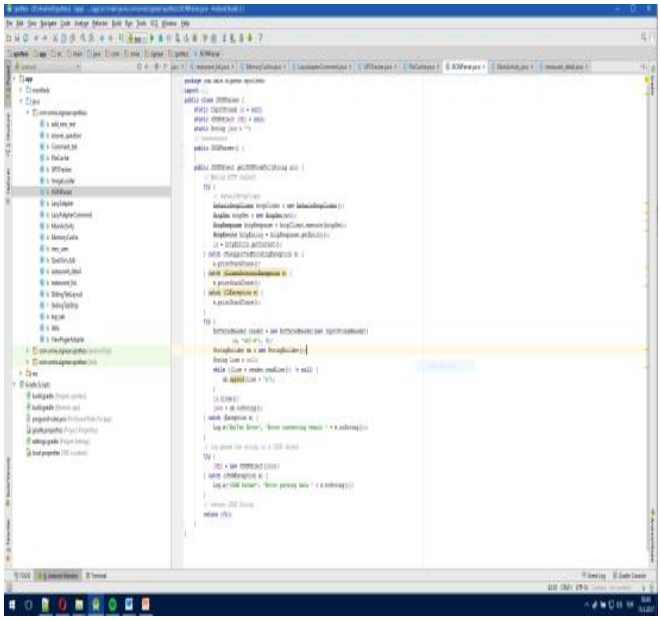

Figure 4. JSON parser.

The mobile application uses to construct native applications for Android smartphone devices. The applications need to use resources of the phones such as the CPU, RAM and GPS.

Common disabilities that affect a person's use of an Android device include blindness or low vision, color blindness, deafness or impaired hearing, and restricted motor skills. Android has several accessibility-focused features baked into the platform, which make it easy to optimize applications for those with visual or physical disabilities. However, it's not always obvious what the correct optimizations are, or the easiest way to leverage the framework toward this purpose [9-11]. The system is recognized by the accessibility functions on the phone. That means, blind users can activate their phones accessibility, or use the app TalkBack®. With the service enabled, user can listen to the spoken feedback of any navigation on the screen.

The user can edit the type size and settings of the software by enabling or disabling the software. The user can also protect it by applying a username and password to the system.

2.1 Use Cases

The use case model on Figure 5 and work flow diagram on Figure 6 describe the functions of the system. This use case represents discrete units of interaction between user and the admin. A use case is a single unit of meaningful work; for example login to system, signup with system and adding places are all use cases. Each use case has a description which describes the functionality that will be built in the proposed system. A use case may 'extend' another use case with its own behavior.

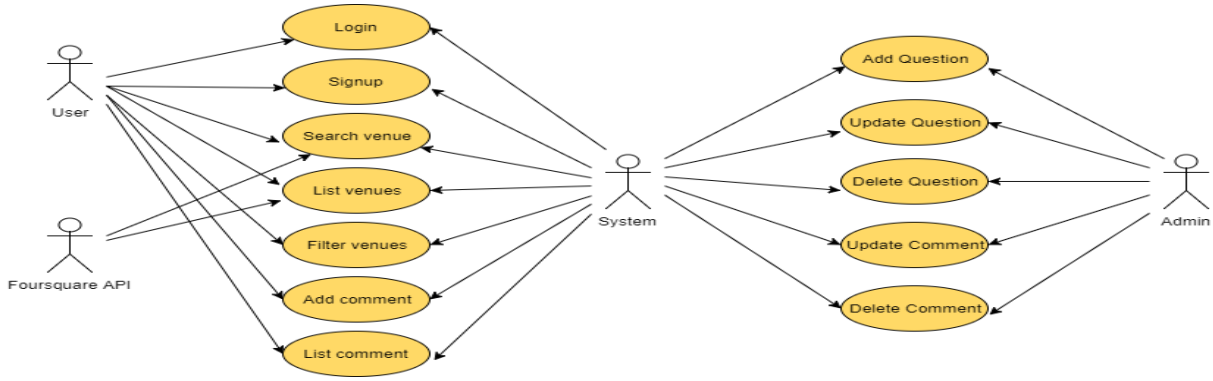

Figure 5. Use case model

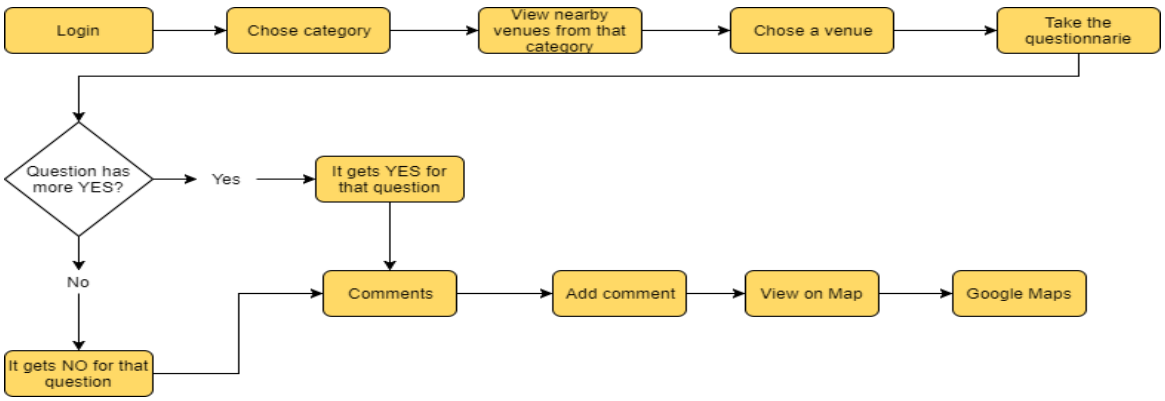

Figure 6. Workflow diagram

- User must sign up and login the system
- After login, user choses a category (Restaurants, Arts and Entertaintment, Shops, Metro Stations, Hotels and ATMs)
- The system lists the nearby venues using Foursquare API (max distance: 1000 metres)
- User can search places by name
- Places are ranked by the user's answers for the questionnaire.
- -Question number

  1, 2, 4 for physical disabilities
  3, 5, 6 for blindness
  5, 7 for deaf/muteness
- If the place gets more YES than NO for a question, it is considered to have got YES for that question.
- User can filter places by the type of the disability.
- User can comment about a place.
- Admin can Update-Delete a comment.
- Admin can update the questionnaire (add- delete- update a question)

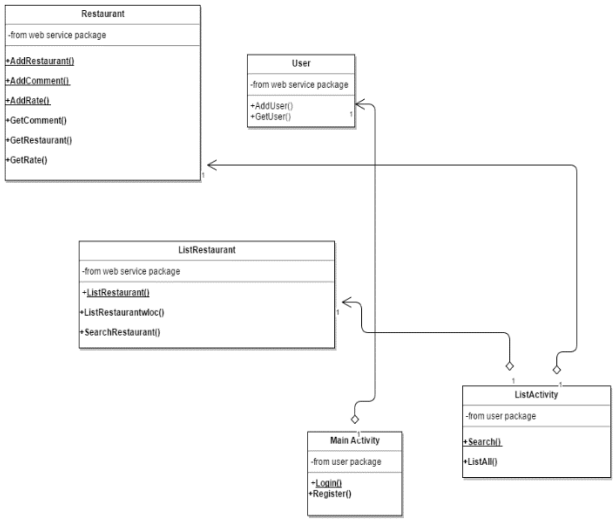

Figure 7. Design model: Design class diagrams.

The system consists in four major components: a Client Module, a Server Module, a Database, and an Administrator Client Module. Client Module must execute on Android devices. The Server and the Database components should be located on the same host.

Shown in Figure 7, in the Restaurants category, there is a class called Venue, it has the functions AddVenue (), AddComment(), AddRate(), GetComment(), GetVenue () and GetRate(). This class gets the data using a web service (API). The relations with other classes are shown below. ListActivity is the name of the Activity, it has the functions Search() and ListAll(). Main Activity is the main page activity. The User Class has AddUser() and GetUser, it sends this data to Main Activity, where the page goes to ListRestaurant class, which has the functions ListRestaurant(), ListRestaurantwloc() and SearchRestaurant(). This class also works with an API.

The selected architecture supports the sizing and timing requirements through the implementation of a client-server architecture. The client portion is implemented on Android device. The components have been designed to ensure that minimal disk and memory requirements are needed on the android portition. Main screens are presented at Figure 8-10.

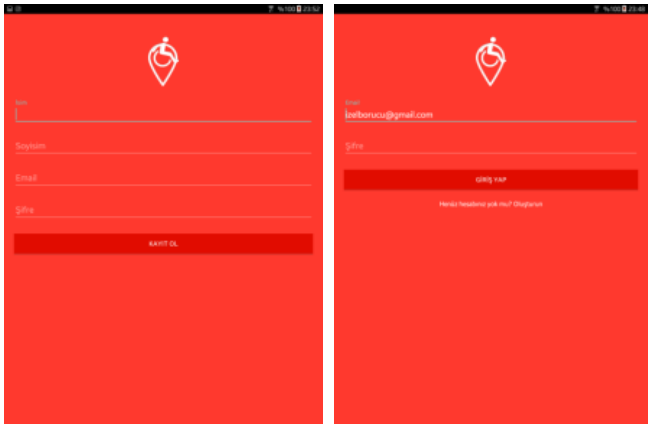

Figure 8. Sing up page and Login page.

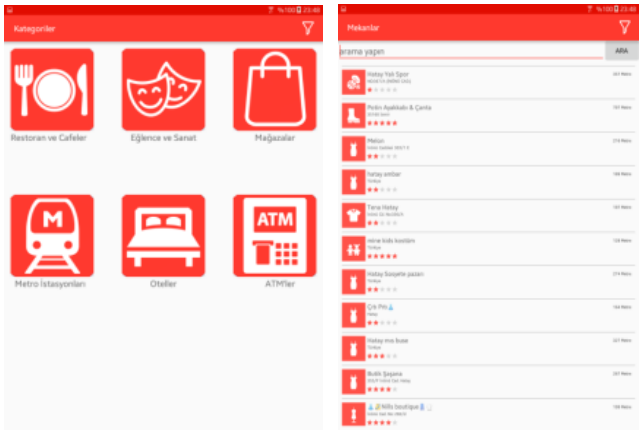

Figure 9. Select category page and listing.

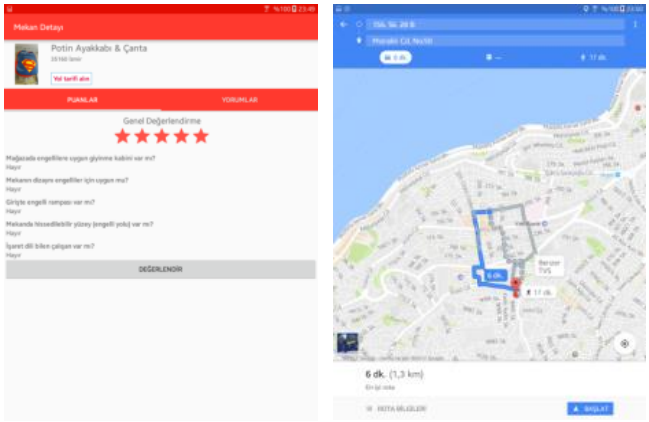

Figure 10. Venue details and direction (Google Maps) pages.

2.2 Testing

2.2.1 Requirements for testing

The listing below identifies those items (use cases, functional requirements, and non-functional requirements) that have been identified as targets for testing. This list represents what will be tested. All interfaces actions; database accesses and internal calculus are also listed.
We have tracked the following measurements:

- System's response time
- Mean time between two failures

- Total number of defects
- Severity of each defect
- Mean time required to find a defect

A series of different tests are performed to fully perform Mobile App for disabled people. The primary purpose of these tests is to reveal the limits of the system and measure all of its abilities. Three step tests ae performed for the system. These tests are; SLT1 (System Level Test1-Unit Test), SLT2 (System Level Test2-Integration Test) and OLT (Operational Level Test-System Test).

SLT1: Each module is the first stage test that works separately. It was done when a specific module develops. The functionality of the modules is tested. Test cases are created.

SLT2: Each module is the first stage test that works together. The first beta test.

OLT: After the software is finished, the software will be tested for compliance with the Software Requirements Specifications (SRS) document. Test conditions that test each requirement has written. The test cases will be made by the test team after the development of the modules

2.2.2 Unit testing

Unit Testing is a level of software testing in which individual units components of a software are tested. The goal is to verify that each piece of software works as designed. It usually contains one or more entries and usually one output.

2.2.3 Integration test

Also known as integration testing, integration and testing. Program units are combined and tested in groups in multiple ways.

2.2.4 System test

System testing is done to determine if the requirements of a software are met exactly and correctly. This test, performed after the integration test, takes the integrated system that emerges after the integration test as input and applies its tests on it. The result is a system that is defined by the SRS document and fulfills all the requirements defined here in a complete and accurate manner.

2.2.5 Software tools

Selenium IDE is used for automated testing. Selenium is an open-source testing tool that allows users to test Web-based applications through the browser. It is a type of test used to test whether the written functions are working. Afterward passing the test suite, which is converted to a Java JUnit test. We used Unit Test through Visual Studio. JUnit is a library that allows testing to be done with Java.

2.2.6 Tests results

13 test cases were executed in total. No errors detected. Results were grouped by package.

Table 1. Test results.

Test case	Status
SLT1	Passed
SLT2	Passed
OLT	Passed

3. Conclusion

Disabled people have a big percentage of the population, that we could be a part of any time. Everybody can become a disabled person as a result of a disease or an accident. There are more than a billion disabled people in the world, nearly 5 million disabled people in Turkey. Although this number is huge, there are very few examples of web or mobile based disabled-friendly applications in the literature. There are some available mobile applications that target disabled people, but none of them eliminate the need for finding accessible places for multiple types of disabilities. With this project, we aim to create a social platform like Foursquare that will encourage people with disabilities to go out and find places that is more considerate towards their needs. The problem of disabled people's living standards can be minimized. It will, however, take time, empathy, and a combined effort on the part of many people. Organized, conscious, and evaluative people which are active on social responsibility activities in the community would help disabled people in worthwhile pursuits at the cities. More accessible places for their standards, especially those voted, commented, reviewed with project by the citizens, would offer to change and integrate the life for these people in the most positive way. By voting and commenting people would help promote inter-generational activities that could improve the social responsibility feeling, helping disabled people to solve their problems they face every day.

This project can be taken a step further by adding more categories and streets to it. Some streets can be tagged by disabled people as "more convenient". Also, venues can be approached with a sponsorship. This would encourage the owners to have better conditions on their venues. If this application can be used effectively, we will surely see an increase in standards of venues for the disabled people's criteria and sensible society.

4. Acknowledgment

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5. References

[1] World Health Organization, "World Report on Disability", 2016, ISBN 9789240685215, Retrieved from http://www.who.int/disabilities/world_report/2011/report.pdf

[2] Türkiye İstatistik Kurumu, Türkiye Özürlüler Araştırması Temel Göstergeleri, 2002, Retrieved from http://www.engelsiz.hacettepe.edu.tr/belge/ozida.pdf.

[3] Burkhauser, R. V., Schmeiser, Maximilian D., Weathers, R. R., "The Importance of Anti-Discrimination and Workers Compensation Laws on the Provision of Workplace Accommodations Following the Onset of a Disability", *Industrial & Labor Relations Review,* 2012, 65 (1).

[4] Darling, P., "Disabilities and the Workplace", *Business NH Magazine*, 2007, 24 (8).

[5] Braille, L., "Method of Writing Words, Music, and Plain Songs by Means of Dots, for Use by the Blind and Arranged for Them", 1829.

[6] "How Braille began", Retrieved from http://www.brailler.com, [Accessed on May 2017].

[7] WheelMate, Mobile App to find wheelchair-accessible toilets and parking spaces. http://www.wheelmate.com

[8] Lunden, I., "Foursquare Aims At A Moving Target As It Tries To Close Another Round Of Funding TechCrunch", 2013.

[9] Arditi, A. and Rosenthal, B., "Developing an objective definition of visual impairment", *Vision '96: Proceedings of the International Low Vision Conference*. Madrid, Spain, 1998, pp. 331–334.

[10] Johnson, D. J., and Helmer R. M., "Learning Disabilities", *Educational Principles and Practices*, 1967.

[11] Vuran, S., "The sociometric status of students with disabilities in elementary level integration classes in Turkey", *Eurasian Journal of Educational Research (EJER)* 2005, 18