ÇANKAYA UNIVERSITY FACULTY OF ENGINEERING
COMPUTER ENGINEERING DEPARTMENT

Project Report

CENG 408

Innovative System Design and Development I

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Visual Assistance for Blind People

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1. Literature Review

1.1. Introduction

Our visually impaired people follow the yellow lines on the sidewalks with a wand or stick. However, this solution cannot prevent to disrespect. There are people who visually impaired that miss the lane because of the parked cars on it. As a result, they are being lost. Our aim is to give a support while alerting if there is an object on the sidewalk and to eleminate this obstacle as much as possible.

In this paper, we are going to discuss what will be done with this technology. In this way, it will be easier to see the pros and cons of our project. Moreover, we will mention the work done and planned works with this technology.

People with visually impaired have difficulty in taking directions or finding the way when they go from one location to another. One of our goals is to find a solution to this problem. There are some projects that are using image processing. However, because of its cost, it seems too difficult for us to reach their points. Our aim is to produce as much solution as we can produce at low cost. Another problem with this issue is the lack of understanding of pedestrian crossings and traffic signs. Therefore, people with visually impaired have a lot of difficulty in crossing a road.

We have tried to mention the information you can obtain at the end of this report above. Apart from these, we are going to mention about the aim of the image processing, the challenges, and the issues to be considered.

1.2. Abstract

The Project that we prefer finding solutions to people's problem by keeping pace with developing technology our purpose is to help visually-impaired people's difficulties in their lives. In the document, we state the technologies that we want to use, usage areas of these Technologies and why this technology is preferred. Image processing is a technology that eases our lives in different aspects even if we are not aware of it. In other words, various mechanic machines use image processing technology in real life. Thus, we can realize the objects which escape from the attention of us. Also, our lives can be made more secure by course of used Technologies in the areas like national security.

1.3. Image Processing

1.3.1. What is Image Processing?

Image processing is an important and rapidly developing area which takes place in signal processing scope. Image processing is a process that tries to create a new picture as a result of changing the view and attributes of the real-life images that are become numerical picture. [2]

1.3.2. Benefits of Image Processing

Even if eyesight of the people is designed as far as sensitive and excellent, human eyes have a certain capacity. By the help of growing technology, there are no borders and capacities. If the accurate technologies are used, human eye can distinguish more images apart from each other diffusively. We can come up with more performance with using this software's and technologies by decreasing the error margin as much as possible according to algorithms that will be developed. [2] For example, there can be blind spots on the both left and right rear-view mirrors that are originated from the volume of cars even if every possible situation is taken into consideration while designing cars. However, by the help of the technology that we use, even if you miss, the red dots on the mirrors indicate that there is an object. This technology is developed by the help of image processing. Despite it does not indicate what the object is, knowing that there is an unknown object may say your life. Apart from all these, if we want to talk about technologies that are used in military services, situations that threaten the national security for countries can be handled more effectively by the help of used technologies in warplanes and unmanned air vehicles. Pilots of warplanes can examine the situation better from their screens, inform their commanders effectively and orders can be given efficiently. [8]

1.3.3. Usage Areas of Image Processing

Image processing is used frequently in the areas as military industry, underwater screening, security, criminal laboratories, medicine, robotic, traffic, astronomy, radar systems, animal breeding, oil exploration, physics, art, space sciences, biomedical etc. As an example, in military services, identifying and reporting the unknown objects that are seen in borders, identifying contraventions of vehicles according to type of it while measuring the speed in the traffic. In medicine, devices that are developed with image processing technology help the doctors in many operations. In robotics, generally, machine learning and image processing are used together to make the robots learn specific objects and make moves in a sensible manner.

1.3.4. Difficulties in Image Processing

There are some remarkable points while developing a technology with using image processing. Most important point is that deteriorations in object-glasses of cameras. These deteriorations cause difficulties on identifying the objects. Lightning situations should be considered, and shootings or transmissions should be done with an expedient camera. Also, if lightning is not done appropriately, objects cannot draw attention of camera because of extra light beams. [5] Another difficulty in that subject is blur view in motions. Object that moves continuously can be perceived again and again. Algorithms that will be used are very significant accordingly. On the other hand, camera can have difficulty to focus on the continuously moving object because of motion blur.

1.4. Image Processing Technology

1.4.1. Used Programming Languages

Several programming languages can be used to implement image processing. However, while implementing this technology, performance of the chosen language on the application must be considered.

C++, Java, Python, C# are the languages that are commonly used on image processing, but most preferred language is Python on modern-day technologies. However, as far as we know, Java is cross-platform language and this language can be preferred against Python in some situations.

1.4.2. Used Technologies

1.4.2.1. PaintbrushJS [3]

PaintbrushJS is a browser-based image processing library that allows us to apply various filters to images on a website. Thus, we can obtain more functional images without damaging their original versions.

1.4.2.2. AForge.NET

AForge.NET library is founded by Andrew Kirillov in 2006, and it provides us to make both manual and automatic processes on the image that is obtained on computer environment. While doing these processes, AForge.NET provides us to use various mathematical operations and work on both inputs and outputs. In other words, AForge.NET helps us to perform a visual art on computer environment.

1.4.2.3. OpenCV [8]

OpenCV is an open-sourced image processing library. It had been started to develop by INTEL in 1999 but now it is developed by various companies and communities. It was developed by C programming language, however developers kept pace with developing technology and they have continued to develop this library with C++ programming language. OpenCV is a free-platform library nowadays. Thus, it can be developed and works on all operating systems. Another benefit of OpenCV is that there are more than 2500 algorithms for both machines learning and image processing.

1.4.2.4. Pythons History

Python is a programming language developed by Guido Van Rossum in Amsterdam in the early 90s. Contrary to popular belief, his name is not from the python snake, but from the show of the comedy band MonthyPython, which Rossum loved so much.

Python is an object-oriented, interpretive, modular and interactive, high-level language. Programming languages are the bridge between machine logic and human logic. The fact that a language is closer to the machine logic results in the ability to work on the machine faster. However, approaching machine logic requires distancing from human logic and making language more difficult to learn. If a programming language moves away from machine logic and approaches human logic, it is called a high-level Python, so it is a high-level language. It is easier to learn than most languages.

With Python, you can accomplish many tasks you need with a small number of lines of code.

You can easily write many programs in Python, such as desktop applications, web applications, data analysis and visualization applications.

Example from Java:

```
class merhaba
{
public static void main(String args[])
{
System.out.println("Merhaba Dünya!");
}
}
```

Python language with “Merhaba Dünya”:

```
print("Merhaba Dünya")
```

1.1. Related Works

1.1.1. OrCam [1]

In modern-day technology, we can easily say that OrCam is one of the best technologies that have ever developed. This product that makes the life easier for people consists of two components: A camera inside frame of glasses and a microprocessor. Additionally, this frame can be used with any kind of eyeglass. Another benefit of it is that it can work with the devices which are used by hearing impaired people.
However, this product is mostly practical for visually impaired people. It provides a feature so that these people can identify and learn the objects and writings just by using their fingertips.

Also, this product can identify which light is active on traffic lights. Additionally, OrCam can learn and save the information of who is using it and reminds you when you come across with it in different environment. Thus, life can be made easier for visually impaired people. This product not only helps us to identify the objects but also find them. This product is submitted with a set of data to the customers. In addition to these, this product has a high capacity of learning so that it can remind you for the things that you forget. A scientist from Israel has worked on this device in 2010 and still researches are being made on it.

1.1.2. Obstacle Distance Detection System For Sight-Disabled People [7]

In this project, necessary parameters which are taken by two USB cameras are calculated in MATLAB platform. Thus, system aims to warn the visually-impaired people with gathered results and calculated distances.

There are three steps while this process is executed. First step is calibration step to make the system works correctly. If calibration cannot be made correctly, parameters cannot be calculated properly, and correct distance map cannot be obtained. Second step is stereo matching. In this step, distance map is obtained according to the images that are gathered from cameras. Thus, necessary distances can be measured. In the last step, there is an electronic hardware that contains a microcontroller. Thus, communication is obtained with a hardware and informing a visually-impaired person is provided.

This project is developed by Nerin KANAY and Umut Engin AYTEN in Yıldız Technic University and they mainly aim to inhibit the accidents that visually-impaired people cannot take precautions.

1.1.3. Seeing Al [6]

Seeing AI which is the most functional product in the implemented projects guides the visually-impaired people on what is going on around them. This application is introduced in Microsoft Build Conference, but it has not released yet, researchers are still working on it.

Application was designed as a cross-platform application so that it can work on both smartphones and smart glasses. Thus, expenditure on this application can be decreased on customer side. For example, user can hold his/her phone like s/he is taking a photograph or clicking on his/her glasses to give an examination order to the application so that it can examine and report to the user about the environment. Thus, application tells everything including the people’s gestures to the visually-impaired person. This application which is prone to be developed can be practical in different working areas.

2. Software Design Description

2.1. Introduction

2.1.1. Purpose

The purpose of this Software Design Document (SDD) is providing the details of project titled as "Visual Assistance for Blind People".

First of all, our target audiences are blind or low vision people. This assistance service aims, help to disabled people in their daily life. Assistance service has online website, family relatives or volunteers will help to get information of what is standing in front of them.

There will be two data base parts. One is Local another is Online part. Local has local variables such as contacts of the family. These informations are private. There is no need to publish other users. Also, local user can upload an image of a new face or a new object instantly. Online part has common datas. For instance, a tree or car. There will be access from web site to volunteers and user's family relatives or friends. They can upload an image for a new item. There will be a weekly controls and updates to confirm the datas before publish to users.

On the other hand, the service provides distance concept. It will calculate the distance between user and the object. However, the program works only for objects. The user doesn't need to know a face's distance. In order to provide a better comprehension, this SDD includes various diagrams such as UML diagram of the project, activity diagram and block diagram.

2.1.2. Scope of Project

This document includes brief and complete description about the design of Project which is named as Visual Assistance for Blinde People.

We are going to use Phyton Programming Language while implementing our project. The main reason to use Phyton is that it provides us with the convenciences that it provides in the implementation process of the software development as well as its ability to work in harmony with every environment. Python programming language is a language that does not need complation like in C or C++. This reason makes Python faster than others. We prefer to use MySQLdb as a storage system. MySQLdb has a Python interface that provides secure connection between Python and the MySQL. In this way, we can use MySQL easily and safer while using Python. Because of that MySQL can work as remote database and also local database, it will help us about data storage. If our user has a network problem while using our product, it is able to work on local database to avoid service interruption with less work time.

Panels which are will be used by both users and authorized people will be programmed by using PHP programming language. The reasons for using PHP language are that it is object oriented language, it is processed by servers and can run with MySQL perfectly. Also we will use markup languages to visualize our project like HTML5 & CSS3. Main purpose to use these is making our porject easy to use for everyone. In this way, each part of the product we will make, will work together with using the same database to provide common work place. It is aimed to provide a better experience to users . An API that is coded by using Python language will work on the connection between platforms and data transmitting.

2.1.3. Glossary

Table Glossary of
SDD

Term	Definition
Database	The infrastructure which is keep data in a regular basis.
Block Diagram	The type of schema which the components in the system are displayed in blocks.
SDD	Software Design Document.
UML Diagram	It is a modelling language which is used in Software Engineering.

2.1.4. Overview of Document

Detailed information of the remaining parts' content is clarified completely in this part. Part 2.1. is a architectural design section which represents information about the development phase of the project. In this section, detailed explanations were identified about Class Diagram. On the other side of architectural design, user types which are related with project were explained. Basically, short explanations were identified about given authorizatioıns and permissions. Also, there are some brief information about security countermeasures and presented properties.

In section 2.4, a map was created by defining the operation of the processes and activity diagram and a brief information about that diagram is represented. Databases which will be used were separated into two parts and these two parts were explained.

In this project, user safety and information privacy are prioritized. So, an article about how can we provide these things is placed into this document.

2.2. Architecture Design

2.2.1. Project Design Approach

For developing the project, we have planned to use Python programming language for searching face, object and also for calculating the distance. Python is easy to use and the libraries of Python is current technology. The main reason to use Python is that it provides us with the conveniences that it provides in the implementation process of the software development as well as its ability to work in harmony with every environment. Python programming language is a language that does not need completion like in C or C++. This reason makes Python faster than others. We need to broadcast datas to at the same time. That’s why we prefer Python.

For keeping the data's we will use MySQL with MySQLdb. MySQL is also easy to use and the interface of that works perfectly with not only Python also website. It fits us. MySQL and Python connects each other with MySQLdb attachment. Python and MySQL are perfect match. Thus, the product at the end can include less bugs and errors and with this kind of product, it is easier to attract the people.

2.2.2. Why Python

Python is a scripting language, which means it can be run without the need to compile, unlike languages such as C and C ++. This still makes it easier to develop programs with Python. Many things you need to write a program in Python, data structures, functions are already available to you. In this way, as in other languages to solve a problem without having to design to the finest details, you can write presentations with the infrastructure in a much more rapid way. Python has a simple syntax. This makes it easier and more enjoyable to write programs, as well as more easily understand the programs written by others. Python allows you to do much with little code.

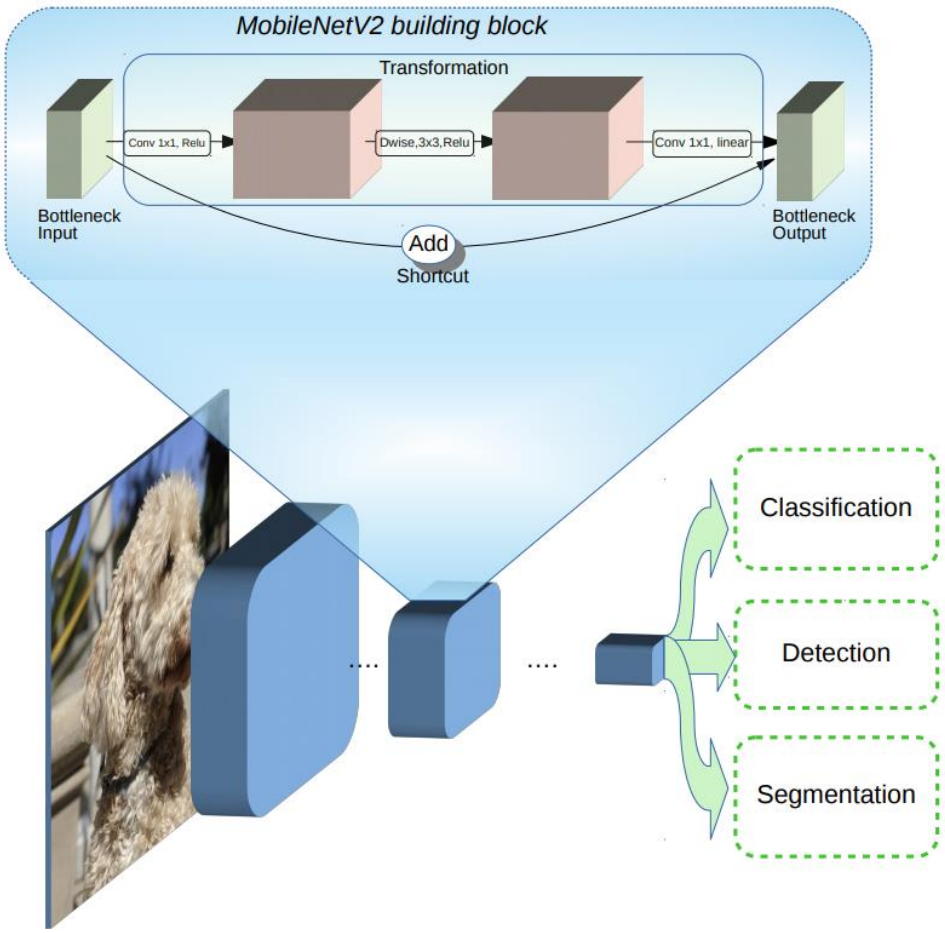
The Python language is the center of many world-famous attractions with its advantages. Organizations such as Google, Youtube, Yahoo always need Python programmers. Russom worked on Google until 2012 and then transferred to Dropbox. This is an indication of the currentity and popularity of the Python language.

We are going to use Phyton Programming Language while implementing our project. The main reason to use Phyton is that it provides us with the conveniences that it provides in the implementation process of the software development as well as its ability to work in harmony with every environment. Python programming language is a language that does not need completion like in C or C++. This reason makes Python faster than others.

2.2.3. Ssd Mobilnet Cocov2

MobileNetV2 is a significant improvement over MobileNetV1 and pushes the state of the art for mobile visual recognition including classification, object detection and semantic segmentation. MobileNetV2 is released as part of TensorFlow-Slim Image Classification Library, or you can start exploring MobileNetV2 right away in Colaboratory. MobileNetV2 is also available as modules on TF-Hub, and pretrained checkpoints can be found on github.

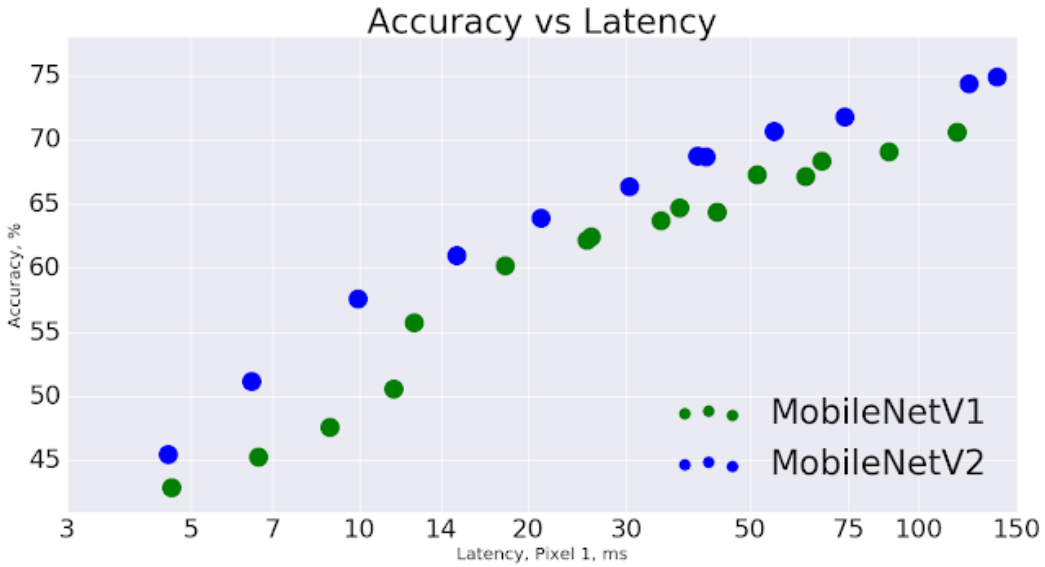
MobileNetV2 builds upon the ideas from MobileNetV1 [1], using depthwise separable convolution as efficient building blocks. However, V2 introduces two new features to the architecture: 1) linear bottlenecks between the layers, and 2) shortcut connections between the bottlenecks1. The basic structure is shown below.



The intuition is that the bottlenecks encode the model's intermediate inputs and outputs while the inner layer encapsulates the model's ability to transform from lower-level concepts such as pixels to higher level descriptors such as image categories. Finally, as with traditional residual connections, shortcuts enable faster training and better accuracy.

How does it compare to the first generation of MobileNets?

Overall, the MobileNetV2 models are faster for the same accuracy across the entire latency spectrum. In particular, the new models use 2x fewer operations, need 30% fewer parameters and are about 30-40% faster on a Google Pixel phone than MobileNetV1 models, all while achieving higher accuracy.



MobileNetV2 is a very effective feature extractor for object detection and segmentation. For example, for detection when paired with the newly introduced SSDLite [2] the new model is about 35% faster with the same accuracy than MobileNetV1. We have open sourced the model under the Tensorflow Object Detection API [4].

Model	Params	Multiply-Adds	mAP	Mobile CPU
MobileNetV1 + SSDLite	5.1M	1.3B	22.2%	270ms
MobileNetV2 + SSDLite	4.3M	0.8B	22.1%	200ms

To enable on-device semantic segmentation, we employ MobileNetV2 as a feature extractor in a reduced form of DeepLabv3 [3], that was announced recently. On the semantic segmentation benchmark, PASCAL VOC 2012, our resulting model attains a similar performance as employing MobileNetV1 as feature extractor, but requires 5.3 times fewer parameters and 5.2 times fewer operations in terms of Multiply-Adds.

Model	Params	Multiply-Adds	mIOU
MobileNetV1 + DeepLabV3	11.15M	14.25B	75.29%
MobileNetV2 + DeepLabV3	2.11M	2.75B	75.32%

As we have seen MobileNetV2 provides a very efficient mobile-oriented model that can be used as a base for many visual recognition tasks. We hope by sharing it with the broader academic and open-source community we can help to advance research and application development.

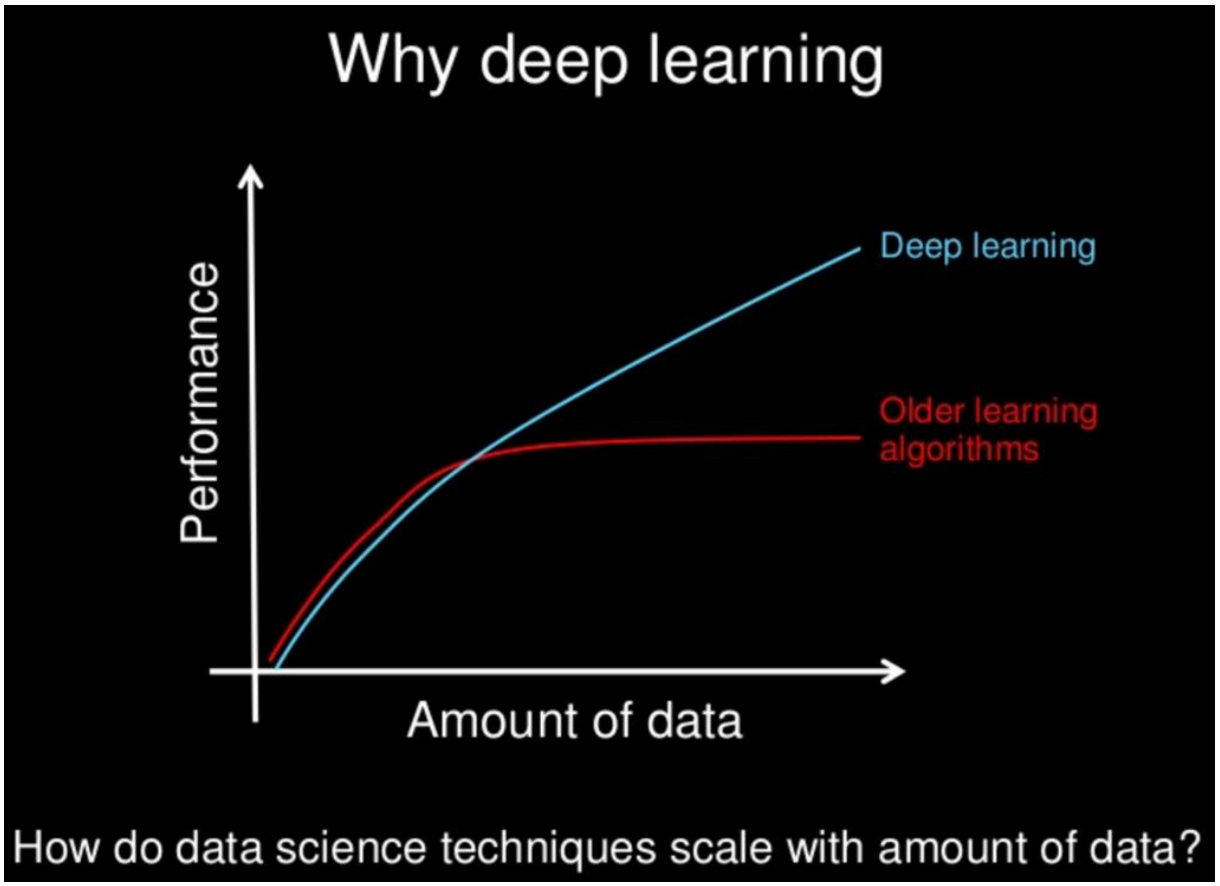
2.2.4. Deep Learning

Deep learning is an artificial intelligence function that imitates the workings of the human brain in processing data and creating patterns for use in decision making. Deep learning is a subset of machine learning in artificial intelligence (AI) that has networks capable of learning unsupervised from data that is unstructured or unlabeled. Also known as deep neural learning or deep neural network.

How Deep Learning Works?

Deep learning has evolved hand-in-hand with the digital era, which has brought about an explosion of data in all forms and from every region of the world. This data, known simply as big data, is drawn from sources like social media, internet search engines, e-commerce platforms, and online cinemas, among others. This enormous amount of data is readily accessible and can be shared through fintech applications like cloud computing. However, the data, which normally is unstructured, is so vast that it could take decades for humans to comprehend it and extract relevant information. Companies realize the incredible potential that can result from unraveling this wealth of information and are increasingly adapting to AI systems for automated support.

Important: Deep learning learns from vast amounts of unstructured data that could normally take humans decades to understand and process.



Deep Learning Versus Machine Learning

One of the most common AI techniques used for processing big data is machine learning, a self-adaptive algorithm that gets increasingly better analysis and patterns with experience or with newly added data.

If a digital payments company wanted to detect the occurrence or potential for fraud in its system, it could employ machine learning tools for this purpose. The computational algorithm built into a computer model will process all transactions happening on the digital platform, find patterns in the data set and point out any anomaly detected by the pattern.

Deep Learning, a subset of machine learning, utilizes a hierarchical level of artificial neural

networks to carry out the process of machine learning. The artificial neural networks are built like the human brain, with neuron nodes connected together like a web. While traditional programs build analysis with data in a linear way, the hierarchical function of deep learning systems enables machines to process data with a nonlinear approach.

2.2.5. Google Text to Speech

High-fidelity speech synthesis
Google Cloud Text-to-Speech converts text into human-like speech in more than 100 voices across 20+ languages and variants. It applies groundbreaking research in speech synthesis (WaveNet) and Google's powerful neural networks to deliver high-fidelity audio. With this easy-to-use API, you can create lifelike interactions with your users that transform customer service, device interaction, and other applications.
Features

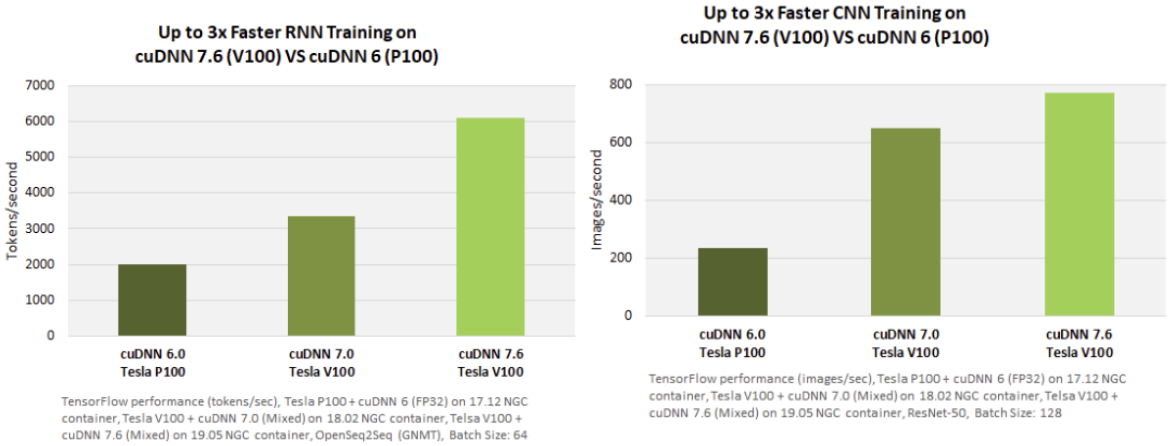
- Support 64 different languages
- Can read text without length limit
- Can read text from standard input
- Automatically pre download the next sentences while playing the current one to avoid long pauses between sentences
- Automatically store downloaded data in a local cache
- Can apply any SoX effect to the audio while playing it

Why We Use Gtts?
The reason we use Google Text to Speech is that it can perform multiple languages. In this way, our program becomes software connected to the Internet. Google's own Gtts algorithm is a paid algorithm. This algorithm is used on the program offers users the ability to voice 50 times. It also offers the possibility to purchase its own software for users who want to continue.
In the first part of the 407 report, we switched to Google's system instead of the systems we claim to use on the web base. In this way, we saved the situation by reducing the density in our database.

2.2.6. Cuda & Cddn

The NVIDIA CUDA® Deep Neural Network library (cuDNN) is a GPU-accelerated library of primitives for deep neural networks. cuDNN provides highly tuned implementations for standard routines such as forward and backward convolution, pooling, normalization, and activation layers.

Deep learning researchers and framework developers worldwide rely on cuDNN for high-performance GPU acceleration. It allows them to focus on training neural networks and developing software applications rather than spending time on low-level GPU performance tuning. cuDNN accelerates widely used deep learning frameworks, including Caffe,Caffe2, Chainer, Keras,MATLAB, MxNet, TensorFlow, and PyTorch. It doesn't work at Amd. Amd is using CPU. For access to NVIDIA optimized deep learning framework containers, that has cuDNN integrated into the frameworks, visit NVIDIA GPU CLOUD to learn more and get started.



2.2.7. Data

Our program detects the objects the camera sees one by one while processing the image. The method of the program was recorded as data of 90 different objects which can be seen frequently in daily life. When our program sees any object, it first starts to compare it with the data at hand. Therefore, the program can recognize any object from different angles. In other words, the system constantly compares with the data available and tells us the names of the objects.

2.2.8. Class Diagram

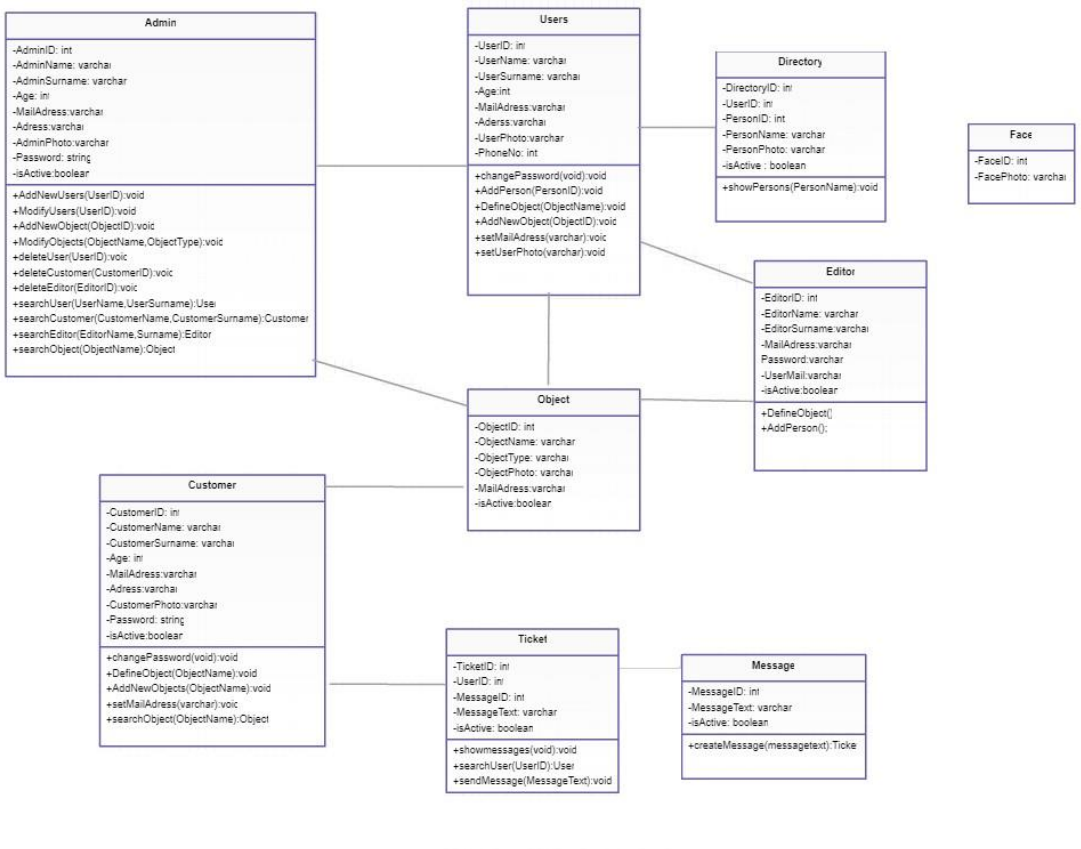


Figure 1 Class Diagram of Visual Assistance for Blind People

Figure 1 shows the relationships between connection and connection. The center of the Visual

Assistance for Blind People project is object oriented. Editing and naming of undefined objects can be done by all users on the system. Customers and users can edit their personal accounts. The admin group has all the functions on the system. Admin group users can edit, delete, add and search objects. The message generation function can provide functions such as user search and message display through the table it is connected to. The editor has functions that allow users to define objects and to identify user's guides for which they are relatives. The functions in tables are generally used to describe undefined objects. In this database system that operates on both sides of the server and local area, the importance of reaching objects is of great importance for the users. In this system where the objects need to be correctly communicated to the users, besides the artificial intelligence, there is a need for the customer and editor group.

2.2.9. Architecture Design of Visual Assistance for Blind People

2.2.9.1. Editor Operations

Summary: This system consists of the operations that editor can do for user. This is an interface that editor can create a support request. Editor also can follow every situation of these support requests. Besides, editor can create a user list for users.

Actor: Editor

Precondition: Editor should have an account which can reach the panel.

Basic Sequence:

• Editor should login to the system with username and password. • Editor should add a new person by clicking "Add New User" button with taking a picture of the user's face and related information about the picture. • Editor should identify the new person by clicking "Save" button. • Editor should correct the missing or wrong information about the users. • Editor should create a support request from the user menu by clicking "Requests and Complaints" button. • Editor should follow the situation of his/her support requests by clicking "My Open Requests" button from the user menu. • Editor should logout from the system by clicking "Logout" button.

Exception: Database error can be occurred.

Post Conditions: None

Priority: Low

2.2.9.2. Admin Operations

Summary: This system consists of the operations that admin can do in the behalf of his/her authorizations. Admin can reach all the information of user and change them. Thus, admin have an authorization to fix the problems. Also, admin can do deletion, correction and confirmation.

Actor: Admin

Precondition: Admin should have an account that access the panel.

Basic Sequence:

• Admin should login his/her own panel with his/her username and password. • Admin should confirm the objects which are waiting for confirmation by clicking "Objects" button from the menu on the panel. • Admin should correct the names of the object which are written wrong from the menu on the panel. • Admin should see the unsolved support requests by clicking "Requests" button on the panel. • Admin should see the profiles of the users by clicking "Users" button on the panel. • Admin should assign an "Editor" role to the user by clicking "Change As Editor" button on the right of the user's row in the list of all users. • Admin should update the information of editors who forgets their information. • Admin should do synchronization operation with the locat database that is connected to the user. • Admin should logout from the system by clicking "Logout" button.ş

Exception: Database error can be occurred.

Post Conditions: None

Priority: Low

2.2.9.3. Reporting System

Summary: Users and editors should follow the result and solution process of the situations which they found wrong by reporting them. Thus, system becomes better and provides a better user experience. Likewise, missing parts that are identified by users and editors should be reported too. Users should know whether an action is performing on these issues or not.

Actor: Editor, user, admin

Precondition: Actors should have the product.

Basic Sequence:

• User should enter the reporting system and create a new report. • Admin should give an answer to the issue which is reported by user after it was examined. • Users should follow the issues and works on them by report. • System should give a detailed information about the report after it is completed.

Exception: Database error can be occurred.

Post Conditions: None

Priority: Medium

2.2.10. Activity Diagram

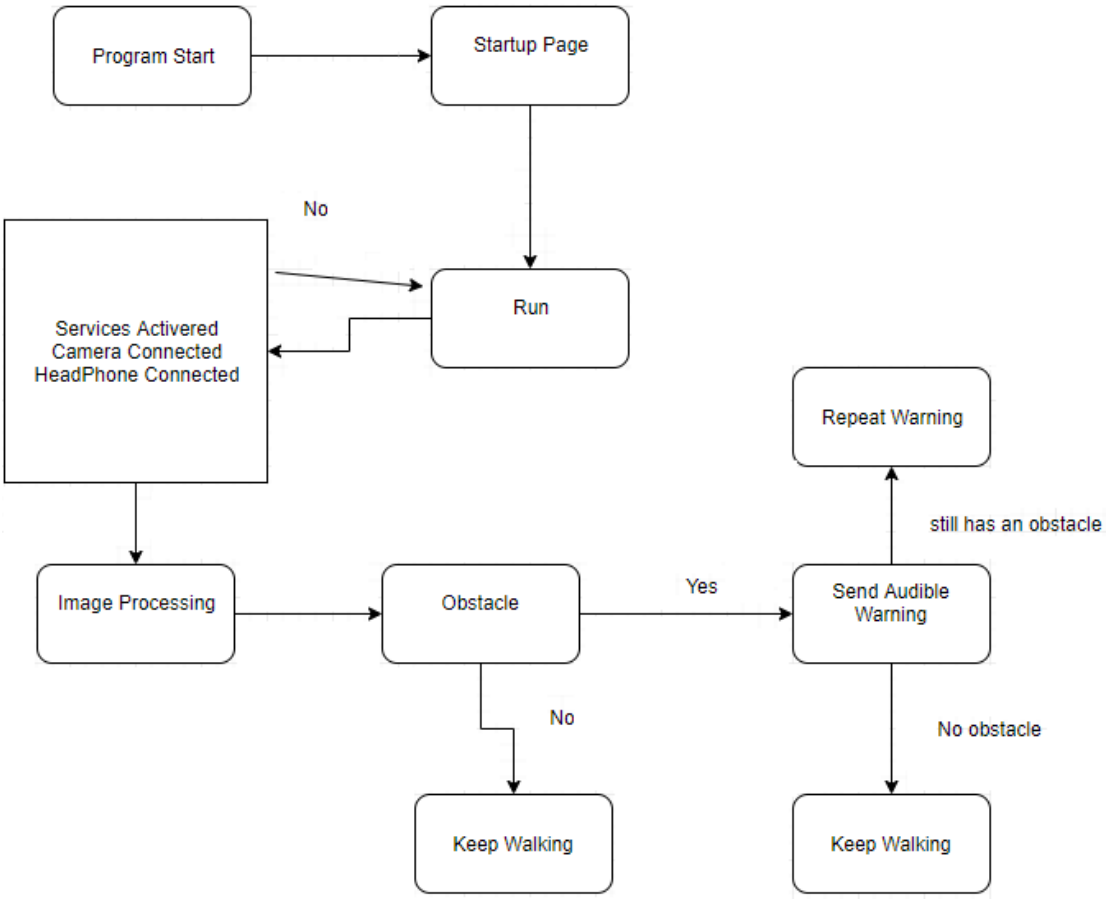


Figure 2 Activity Diagram of Visual Assistance for Blind People

Figure 2 shows how Visual Assistance for Blind People sytsem Works as an activty diagram. After the program is started, the user is redirected to the start page. Firstly, the services are checked as soon as they start working. It is important that the camera and headset connections are working. In case our services and connections are not active, the system provides return. When connected, the image processing process starts. The main focus of our system is to enable the user to walk. If the system sees an obstacle during image processing, the user is notified when the buzzer is activated. If the obstacle is still closing the area of our user, the warning is activated again. In cases where there is no obstacle, users can continue their movements without warning. We are looking for simple and useful ways to ensure that users can walk in this logic process without being harmed.

2.2.11. Database Diagram

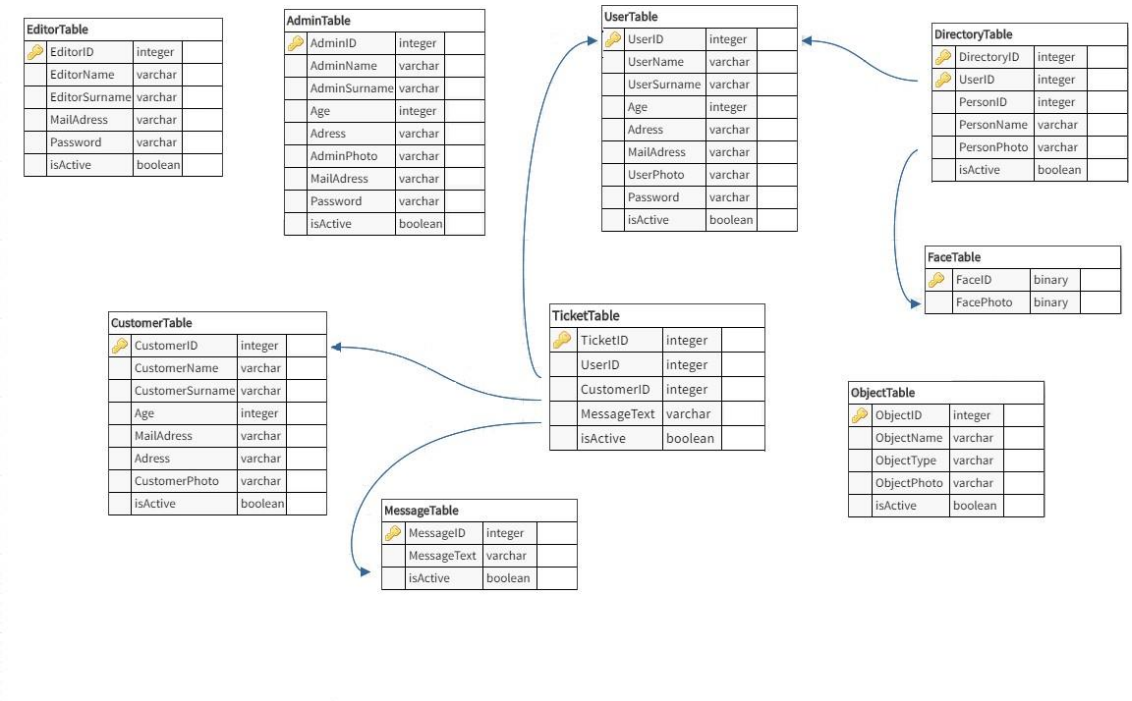


Figure 3 Database Diagram of Visual Assistance for Blind People in Global

Figure 3 shows the database diagram of the Visual Aid for the Visually Impaired System. The sections where the Editor, User and Admin tables are separated by the types of users in the system. User table space for the visually impaired. The people in the Customer table were identified as people working in the website and development area. Users created in the Editor table are users dedicated to identifying unidentified objects that are shared on the website. Object table for each object in a detailed way to record the database according to the type. The Directory Table enables the visually impaired user to register his contacts with his face recognition system. The Ticket Table and Message Table are working together. A section dedicated to communicate with users who have problems through the website.

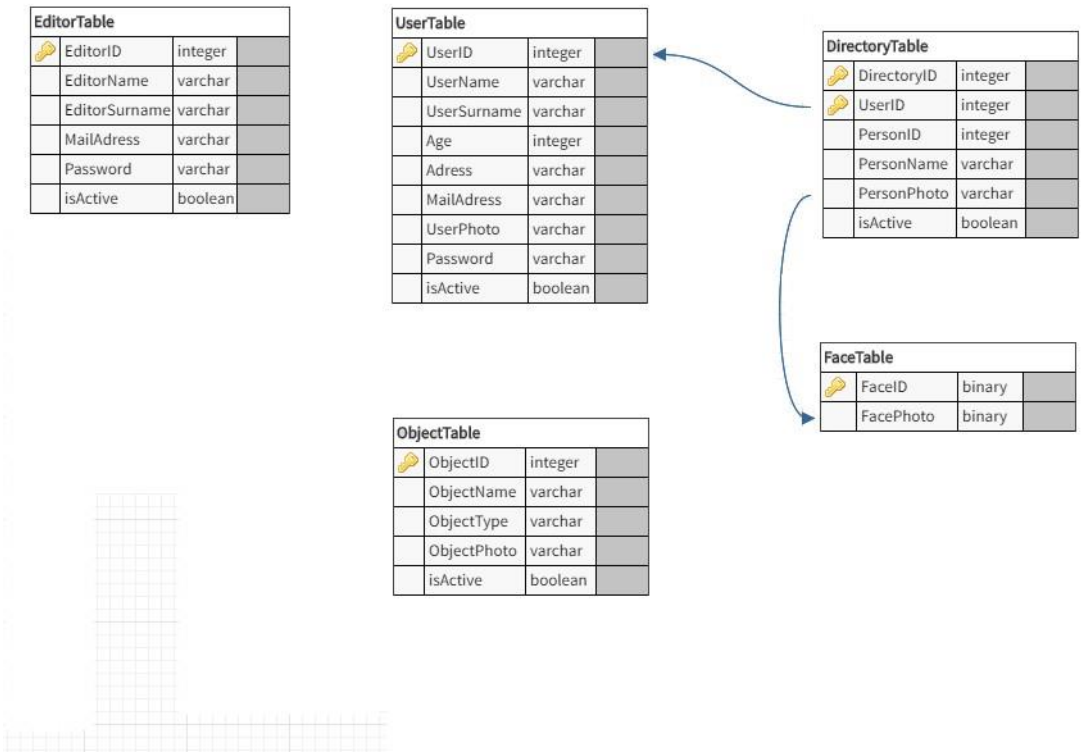


Figure 4 Database Diagram of Visual Assistance for Blind People in Local

First of all, the reason of our 2 different database design is to keep minimum data at the local and to obtain a fast running system. Admin, Costumer, and Ticket and Message tables were not used in the local database compared to server side. In this way, we keep user information, information about the objects and the guide in the local section. The table and data density in the server area will increase in quantity over time, but users need to operate their devices without interruption. Considering the performance and battery life of the product, one of the places where we should be thrifty in the system is the database. 2.6. Use Case Realizations

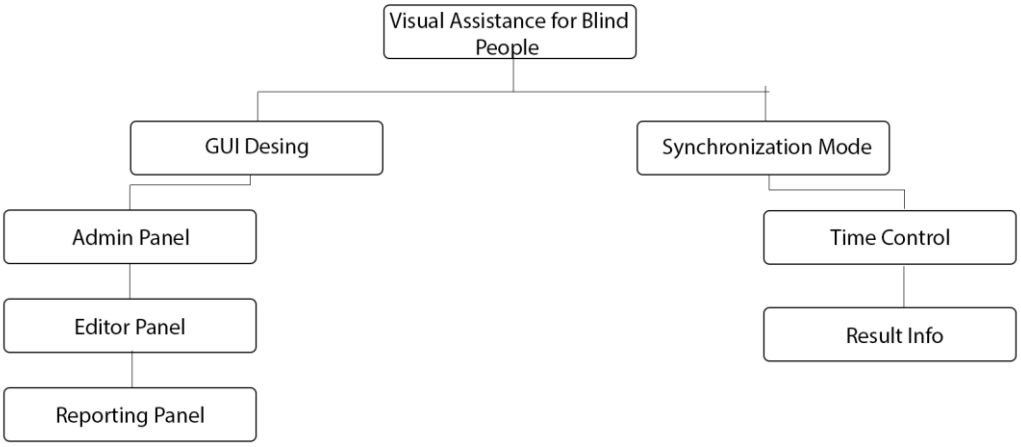


Figure 5 Components of Visual Assistance for Blind People

2.2.6.1 Brief Description of Figure 5

In Figure 5, two main modules and their properties are stated. These are GUI Desigb and Synchronization Mode. These modules have five sub-modules in total. Detailed information is given below.

2.2.6.1.1. GUI Design

2.2.6.1.1.1. Admin Panel

The admin panel will be done using PHP programming language. Admin will be able to access users' data through the panel. This panel shows user settings and also editing panel in it. In this way, the user will get help with that. Design will be done using HTML5 & CSS3 as much as possible to give the user a better experience. JAVASCRIPT will be consulted where necessary. Access to admin panel will be possible with username and password. Extra security measures will be taken after the test plan has been completed.

2.2.6.1.1.2. Editor Panel

Editor panel is a panel that can be used by relatives of the user. Editor panel will be done using PHP programming language. The support panel can be created via the editor panel and these requests can be checked regularly. In addition, password change operations can be performed. A list of contacts will be available to the user and a new contact will be available from the editor panel. The actions will be performed on the local server. When the synchrozation mode is activated, it will only transfer the necessary data to the global server. Editor will be able to add new object through panel.

2.2.6.1.1.3 Reporting Panel

The reporting panel is a separate panel where the only editors can log in with their user name and password and report errors about the system. Admin has given the priority especially this matter. This part was added to the project considering the development of the project. In this way, the users are intended to transfer their experiences better. With these reports, developer teams develop better.

2.2.6.1.2. Synchrozation Mode

2.2.6.1.2.1. Time Control

This sub-module is included in the project for the realization of synchrozation without being installed on the system. By creating a queue at the times determined by the system, data will be exchanged by running an API between all user devices registered in the system by performing a synchronization between the global and local database. Therefore, the time control will perform a healthier process by determining the hours we will load on our server.

2.2.6.1.2.2. Result Info

This sub-module is intended for the purpose of transmitting information to the user. All synchrozation processes that are performed regularly in the database will be recorded with time and date formats and this information will be displayed in the editor panel. When a setback occurs, the result information can be checked and the necessary operations can be done manually. If the system makes synchrozation, the user will be informed regularly about this situation.

Project Work Plan

START DATE: 23.09.2018		23.09.2018 30.09.2018	01.10.2018 07.10.2018	08.10.2018 15.10.2018	16.10.2018 23.10.2018	24.10.2018 31.10.2018	01.11.2018 07.11.2018	08.11.2018 15.11.2018	16.11.2018 22.11.2018	23.11.2018 29.11.2018	30.11.2018 07.12.2018	08.12.2018 15.12.2018	16.12.2018 23.12.2018	23.12.2018 30.12.2018	04.01.2019
WEEKS		WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14
WEEK 1-5															
PPF	TEAM														
TEAM SETUP	TEAM														
PSF	TEAM														
GH	TEAM														
PWP	Buğra Gülay														
Week 5 - 10															
LR	H. Enes Dirik														
SRS	Y. Anıl Değirmenci														
WEB	Buğra Gülay														
WEEK 11-15															
SDD	TEAM														

PR / PTF	TEAM													
PRES	TEAM													

3.Software Requirements Specification

3.1. Introduction

3.1.1. Purpose

This document describes visual assistance service for blind or low vision people. This asistance service aims to provide a life without hindrances for disabled people. There are classifications for this service to be installed on the system. This visual assistance service has two cameras to see faces and objects. Also calculate the distance where the object is and sends the information to the headphone. The Sofware Requirements Specification document (SRS) describes the hardware and software (functions and it's activity).

3.1.2. Scope of Project

The system we want to develop is used with different characteristics of different companies in the World. Some companies transfer the objects to the users via the server, some of them just working on the users by reading the text on paper. The most advanced system for visually impaired people has been developed by the company OrCam. The company can provide information about objects with the glasses they use. The difference between the projects we develop as software is minimal. In this project, the most significant feature of our own project compared to other companies is the price difference. According to sources, the price of this product is around 50 thousand dollars. A blind person must have very good income to buy this product. But in projects developed for people in need of help, those with low financial conditions should also have. Therefore, if we can fulfill the promises we want in the project we will develop, we would like to present it with an appropriate sales price.

3.1.2.1. What We Do

• Image processing; identify objects that the camera sees.

• Distance measurement; measuring the distance without hitting objects by seeing the objects around the user while on the move.

• Audible warning depending on the distance of objects; report the situation by making a user with a buzzer after the distance measurement.

• Audible warning system; A warning mechanism that converts the text into a sound by finding the objects found in the library after image recognition.

3.1.2.2. What We Will Do For

• Visually impaired

• People with vision difficulties

3.1.2.3. What Are Our Goals

• To enable a visually handicapped person to walk as far as possible without the need of a staff member.

• To ensure that users do not hit when approaching objects. Active distance measurement allows the user to walk without hitting obstacles.

• These objects to recognize certain objects; car, sheet, garbage containers, etc. Improved alert with advanced object recognition algorithm.

• Alert (3 meter - 2 meter - 1 meter) when approaching objects.

• The system should be able to select the objects by actively examining all aspects of the image being monitored and to inform the users of the obstacles.

• To ensure that the visually impaired people have a product by keeping the costs low. Compared to other firms working on the same problem, we need to produce a cheaper product to meet the needs of consumers. Our goal is that the people who need; visually impaired people to buy the product.

3.1.3. Glossary

Table 1 Glossary of SRS

Term	Definition
Software Methodogy	The software methodology determines how the project progresses and how it works.
Stakeholders	Any person or company who has rights on the project.
Software Development Lifecycle	Terminology that defines the phases of the software development.

3.1.4. Overview of Document

On the first part of the document, we have oppurtunity to mention our goals that we want to reach at the end of the project. Besides, we have talked about whom this project will be done and differences from similar projects. Moreover, we have mentioned the requirements of the project, the software development methodology which we are going to use and the functionalities that the product will have.

3.2. Overall Description

3.2.1. Product Perspective

This product will develop for blind or low vision people. The aim of this service is to help someone blind or low vision however, this service works with the stick. The most important purpose of this service which will process broadcast, is to protect the user from a possible accident. If user wants to open an account to relatives, the relative or close family member can introduce contacts to this service, in this way the software recognize the contact and tell the user. This contact list prepared by relative of the user. A support system will be created considering the bug's. At the same time, a reporting system was considered considering the possibility of taking the project further.

3.2.2. Development Methodology

The methodology we plan to use when developing the project is the agile software methodology. In the interviews we had before, we had access to a few people to help us. Agile software development; It is necessary to implement the activities of the software development process in a recursive manner and gradually improve the software product by using the values created by Agile union and by applying the principles. We prefer this methodology as it should be a project developed with the user. After sharing the demos we need to take regularly, we will be able to get a project process that is open to change and development according to the user's ideas.

3.2.3. User Characteristics

3.2.3.1. User

2.3.1.1. User must be blind people

3.2.3.2. Editor

2.3.2.1. The editor must be a relative of the user

2.3.2.2. Editor must have enough authority to use system on the software.

3.2.3.3. Admin

2.3.3.1. Admin must have knowledge of software maintenance process.

2.3.3.2. Admin must have enough authority to edit user data on the software.

2.3.3.3. Admin must have knowledge of software platform.

3.3. Requirements Specification

3.3.1. External Interface Requirements

3.3.1.1. User Interface

There are not any external user interface requirements.

3.3.1.2. Editor Interface

The required interface will be designed with HTML5 & CSS3. It needs a computer and a web browser. The user must have a user name and password to access the interface.

3.3.1.3. Admin Interface

The required interface will be designed with HTML5 & CSS3. It needs a computer and a web browser. In order to access the interface, you must have a user name and password with admin authority.

3.3.1.4. Hardware Interface

There are not any external hardware interface requirements.

3.3.1.5. Software Interface

There are not any external software interface requirements.

3.3.1.6. Communications Interface

There are not any external communications interface requirements.

3.3.2. Functional Requirements

3.3.2.1. Login System Use Case

Use Case :

• Login as Editor

• Login as Admin

• Forgot Password

• Logout

Diagram :

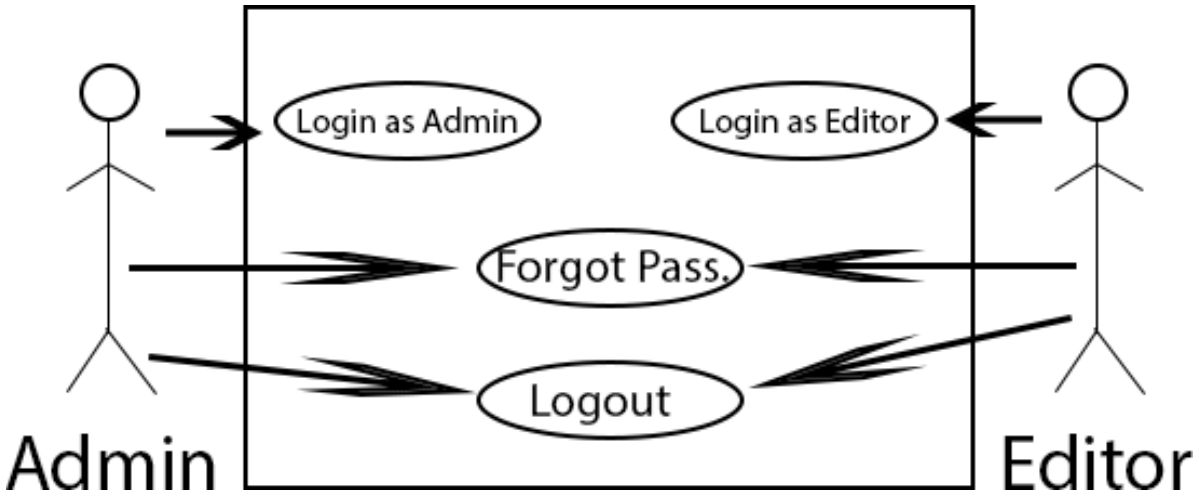


Figure 6 Login System's Use Case Diagram

Brief Description:

Persons with editor and admin authority will be able to use the login system. There are two separate panels defined in these two roles. Both user types will be logged in with the user name and password defined. If users forget their passwords, the system can send e-mail to the registered address and request a password change. Users will be able to leave their user accounts when needed.

Initial Step by Step Description:

1. The editor logs in with the appropriate username and password.

1.1. If the editor's username and password are invalid, they will be redirected to the login page again.

2. Admin will log in with the appropriate user name and password

2.1. If the username and password of the admin are invalid, they will be redirected to the login page again.

3. Admin or Editor can click "Forgot Password" button.

3.1. If the admin or editor clicks on the "Forgot Password" button, the system will ask the user the email address registered in the system

3.2. The system will send a special link for the password change to the email address entered by admin or editor.

3.3. After clicking the link, password and password repetition will be requested.

3.4. The new password entered will be updated in the system.

4. All users will log out of the system

3.4. Software System Attributes

3.4.1. Scability

All actors of the system must be warned when there is a change in the system.

3.4.2. Adaptibility

Every corrected data that is entered by editor must be saved in database system in the appropriate tables of database.

3.4.3. Usability

When the users such as editors or admins enters their attributes wrong, an error message should be displayed that explains the reason why the users failed.

3.4.4. Performance

Appearance time of the interfaces should not be more than 3 seconds.

5.Test Plan

5.1 Introduction

5.1.1Version Control

Version No	Description of Changes	Date
1.0	First Version	Apr 25, 2019
2.0	Second Version	May 22,2019

5.1.2 Scope

This document gives a brief description about what will be our test cases when we are testing our system.

5.1.3 Test Cases

TC ID	Requirements	Priority	Scenario Description
VABP.IP		H	Image Processing

TC ID	Requirements	Priority	Scenario Description
VABP.OV		H	Object to Voice

TC ID	Requirements	Priority	Scenario Description
VABP.FR		H	Face Recognition

TC ID	Requirements	Priority	Scenario Description
VABP.US		M	User System

TC ID	Requirements	Priority	Scenario Description
VABP.DM		H	Distance Measurement

TC ID	Requirements	Priority	Scenario Description
VABP.RL		H	Reverse Light

TC ID	Requirements	Priority	Scenario Description
VABP.DM		H	Distance Measurement

TC ID	Requirements	Priority	Scenario Description
VABP.RD		H	Recording in the Dark

Detailed Test Cases

VABP.IP

Test ID	VABP.IP
Test Case	Image Processing
Purpose	Define
Priority	High
Estimated Time Needed	1 Sec
Status	Pass

VABP.OV

Test ID	VABP.OV
Test Case	Object to Voice
Purpose	Detecting objects
Priority	High
Estimated Time Needed	1 Sec
Status	Pass

VABP.FR

Test ID	VABP.FR
Test Case	Face Recognition
Purpose	Saying the names of objects seen in the camera
Priority	High
Estimated Time Needed	1 Sec

Status	Fail

VABP.US

Test ID	VABP.US
Test Case	User System
Purpose	Create a web-based user system
Priority	M
Estimated Time Needed	2 Min
Status	Fail

VABP.DM

Test ID	VABP.DM
Test Case	Distance Measurement
Purpose	Measure distance to give warning to the user
Priority	High
Estimated Time Needed	1 Sec
Status	Fail

VABP.RL

Test ID	VABP.RL
Test Case	Reverse Light
Purpose	The image taken by the camera according to the light coming into the camera
Priority	High
Estimated Time Needed	3 Sec
Status	Fail

VABP.RD

Test ID	VABP.RD
Test Case	Recording in the Dark
Purpose	The camera's view in dark
Priority	High
Estimated Time Needed	1* Sec
Status	Fail

Object Tests

Test ID	Priority	Date Run	Run By	Object	Result	Explanation
obj.recognition001	L	01.08.2019	H.Enes Dirik	CellPhone	Pass	%51-%99
obj.recognition002	L	01.08.2019	H.Enes Dirik	NoteBook	Pass	%51-%99
obj.recognition003	L	01.08.2019	H.Enes Dirik	Tv	Pass	%51-%99
obj.recognition004	L	01.08.2019	H.Enes Dirik	Person	Pass	%51-%99
obj.recognition005	L	01.08.2019	H.Enes Dirik	Lighter	Failed	Undefined
obj.recognition006	L	01.08.2019	H.Enes Dirik	Dog	Pass	%51-%99
obj.recognition007	L	01.08.2019	H.Enes Dirik	Cat	Pass	%51-%99

obj.recognition008	L	01.08.2019	H.Enes Dirik	Headset	Pass	%51-%99
obj.recognition009	L	01.08.2019	H.Enes Dirik	Car	Pass	%51-%99
obj.recognition010	L	01.08.2019	H.Enes Dirik	Computer	Fail	Similarity Conflict
obj.recognition011	L	02.08.2019	Y.Anıl Değirmenci	Cup	Pass	%51-%99
obj.recognition012	L	02.08.2019	Y.Anıl Değirmenci	Bag	Pass	%51-%99
obj.recognition013	L	02.08.2019	Y.Anıl Değirmenci	Chair	Pass	%51-%99
obj.recognition014	L	02.08.2019	Y.Anıl Değirmenci	Table	Pass	%51-%99
obj.recognition015	L	02.08.2019	Y.Anıl Değirmenci	Keyboard	Pass	%51-%99
obj.recognition016	L	02.08.2019	Y.Anıl Değirmenci	Mouse	Pass	%51-%99
obj.recognition017	L	02.08.2019	Y.Anıl Değirmenci	Bed	Pass	%51-%99
obj.recognition018	L	02.08.2019	Y.Anıl Değirmenci	Bus	Pass	%51-%99
obj.recognition019	L	02.08.2019	Y.Anıl Değirmenci	Horse	Pass	%51-%99
obj.recognition020	L	02.08.2019	Y.Anıl Değirmenci	Bicycle	Pass	%51-%99
obj.recognition021	L	03.08.2019	Buğra Gülay	Motocycle	Pass	%51-%99
obj.recognition022	L	03.08.2019	Buğra Gülay	Truck	Pass	%51-%99
obj.recognition023	L	03.08.2019	Buğra Gülay	Sheep	Pass	%51-%99
obj.recognition024	L	03.08.2019	Buğra Gülay	Suitcase	Pass	%51-%99
obj.recognition025	L	03.08.2019	Buğra Gülay	Airplane	Pass	%51-%99
obj.recognition026	L	03.08.2019	Buğra Gülay	Boat	Pass	%51-%99
obj.recognition027	L	03.08.2019	Buğra Gülay	Bird	Pass	%51-%99
obj.recognition028	L	03.08.2019	Buğra Gülay	Glove	Pass	%51-%99
obj.recognition029	L	03.08.2019	Buğra Gülay	Fork	Pass	%51-%99
obj.recognition030	L	03.08.2019	Buğra Gülay	Knife	Pass	%51-%99

We have executed all test cases that we identified and 90% of them are passed. Software development activities are completed within the timeline. As a result, exit criteria is met.

4.Conclusions

This document contains an extensive information about the project that is named as “Visual Assistance for Blind People”. Main purpose of selecting the BLE Beacon device is that BLE Beacon device provides the most beneficial indoor positioning estimation across all the indoor

positioning devices. We have made a lot of research about image processing, its related technologies and similar works. We have researched the similar projects and tried to understand how the make image process and converting text to voice. After the researches, we have decided the requirements that our project should meet. As a result of gathering these requirements, we have prepared the SRS document to specialize all requirements. After that, we have decided a developing plan for our product and this plan is explained in SDD document. Within these period, we have decided our development methodology that we want to use while we are developing the project. We could not use systems such as distance measurement and face recognition in our software. The reason is that these systems do not work in harmony with the algorithm we use, and our research does not yield results. On the other hand, the web-based user system we have identified in the report is not within our project. The reason is that you cannot use Python and MySql together. We have developed the systems we promised in the project in general.

Acknowledgement

Our consultant in the project, Abdul Kadir Görür, helped us very much and supported us a lot. Thanks to him, we have made our project a bigger software by further improving. His ideas, his aids are very important to us. We would also like to thank Abdul Kadir Görür for being an idea creator and for working with us. We are also grateful to our colleagues for their support while doing the project.