PresentAction: a disruptive mobile system designed for bridging the physical-digital gap in information sharing events

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"to my mother Felicina, and to the memory of my father Roberto, that supported
and motivated me in every step of this path"

"a mia mamma Felicina ed alla memoria di mio papa' Roberto, fonti di
motivazione e forza nei momenti di difficoltà"
Abstract

Since 1960, when the first slide projectors were manufactured and people started using slides as a support for delivering information to their audience in educational and institutional environments, not much has changed. Nowadays slide presentations are still based on the traditional interaction methods between presenter and audience that limit the experience to the live event.

Considering the worldwide raising number of smartphone users and the increasing interest by researchers in mobile education, this research aims to give its contribution to a marginally explored field: the mobile presentation systems space. Mobile presentation system is intended to be a fully mobile service that supports presenter and audience during all the phases of a slide based event and enhance the user experience by enabling interaction between physical and digital presentation spaces.

The first goal of this work was to understand if there is an underserved demand for innovation in the current presentation interaction model and what the perceived needs and wants are. People sensible to this field went through interviews and surveys, conducted from both the presenter and the audience perspectives. The results showed that about 87% of the participants had previously experienced visibility problems during presentations, causing frustration and lack of concentration damaging both audience and presenter. 80% of the people use email for sharing their slide set to the audience, a non effective way to reach all the attendants. The ability to send/get the material was considered critical both from the presenter and the audience points of view, assessing it 3.3/5 and 3.9/5 respectively. Other major problems of technical nature (software and hardware) emerged as often experienced by almost half the participants.

This preliminary qualitative investigation built the basis of the PresentAction concept that was conceived to solve the raised problems and to support presenter and audience during all the phases of a presentation (before, during and after the live session) in a single solution. The concept was the guideline of the designed and
developed system. PresentAction lets any connected smartphone user, regardless of his/her technical skills, run slideshows from already existing slide decks anywhere and at any time and automatically create complete, high quality, interactive, updatable, learning object delivered to the attending users through smart content delivery methods. The system was experimentally validated, both technically (several performance measurements) and from the end user experience point of view (system trial and surveys). The users were really satisfied, rating the developed system at 4.25/5 and with more than 80% of the participants willing to adopt this system both as presenter and audience. The users emphasized in particular the usefulness of being able to run presentations even without the support of a projector (connecting directly presenter and audience devices) and the possibility of creating a personal, mobile portfolio of "talking" slides of the events they attended. The performed experiments also demonstrated that pre-fetching based slide distribution is fundamental for increasing the number of concurrent users in the audience while keeping a real time feeling for the presentation, with limited delays in the transition between slides on their mobile device.

Finally, a new concept of slides as learning multimedia objects, merging images with audio and supporting a variety of digital on demand services, was developed and demonstrated as a superior solution, in terms of both communication costs and user experience, to accessing a complete raw video of the presentation event. Experimental evidence showed that this approach can require as low as 945 times less communication resource than current video-based solutions.
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Chapter 1

Introduction

In the past years the advancement in communication and wireless technologies made mobile technology more convenient and less expensive so more accessible. Today over 2 billions people have access to a mobile device connected to internet and the numbers keep growing, especially in economically disadvantaged areas where laptops and desktop computers are not easily affordable. Users have easy access to strong signals, even in remote locations, and benefit the integration of camera, audio channels and functionalities that provide instant access to more types of resources such as images, videos, sounds and online games [23]. In particular the technological growth of wireless and mobile technologies has made the delivery of knowledge in electronic format possible, giving birth to the so called electronic learning that ultimately evolved into the mobile learning model. As a result of this technology advancement, learners have turned into nomads as argued by Alexander (2004) [18] and as such education in the future is more likely to be conducted anytime and anywhere with any resource regardless of location. Thus, technology educators and learners are simultaneously becoming more mobile. The m-learning model applicability range from formal environments like conferences and academic lectures to more informal education environments like elementary schools.

1.1 Research in mobile education

1.1.1 Quantitative research

Each year since 2004, the New Media consortium [8] and the EDUCAUSE learning initiative [3] have released an Horizon report with the attempt to forecast the
promising technologies likely to make an impact in education on short term (within the year of the report), mid-term (the next two years) and the long term (the next 4 years). Horizon reports have a download rate of 500,000 download per year and have an estimate readership of about 1 million in 75 countries. Fig. 1.1 summarizes Horizon reports predictions from 2004 to 2010 and each report forecast two technologies on short term, mid-term and long term.

![Figure 1.1](image)

**Figure 1.1** – Technologies most likely to have an impact on education according to horizon reports from 2004 to 2010.

According to HR (Horizon Report) experts’ opinion, social web and mobile devices are currently the most important technologies for the near future. These predictions were objectively assessed [22], through a bibliometric analysis and considering the publishing evolution in mobile learning and the predicted trends were confirmed as shown in fig 1.2.
1. Introduction

The interest in mobile and ubiquitous learning greatly increased its volume over the period between 2006 and 2010 [22] and, as shown in Fig. 1.3, the research studies can mainly be divided in two categories:

- **evaluation of the effectiveness of mobile learning systems**: focus on the pedagogical value of mobile learning systems through surveys and experiments using already existing mobile systems.

- **designing mobile learning systems**: aim to define new design methods and technology that enable engineers to build effective mobile learning systems.

**Figure 1.2** – Publishing evolution for technology groups from 2004 to 2010 according to Google Scholar.
1.1 Research in mobile education

From the review of trends of mobile learning studies, based on the analysis and synthesis 164 accurately selected studies between 2003 and 2010 emerges that most of them focus on assessing the effectiveness of mobile learning; this trend is followed by mobile learning system design studies. Considering the papers’ citation frequency the categories’ order is reversed: system design studies result being the most highly cited articles highlighting the importance of applied research in mobile learning. Another interesting aspect is that research outcomes in mobile learning studies result to be extremely positive as shown in fig.1.4: 86% of the considered research articles reported positive research outcomes, while only 4% and 1% respectively reported neutral and negative results [25].
1. Introduction

The obtained results in academic research prove that m-learning is a promising field that is acquiring strong attention by researchers and expert in education. In particular emerges the need for frameworks development and identification of low-cost options for supporting large-scale m-technology integration [19].

1.1.2 Presentation systems definition

The process of learning, based on the its context, can be divided in 3 main categories [20]:

- **Formal learning**: "when the activity of learning occurs within an organised and structured context (formal education, in-company training), and that is designed as learning. It may lead to a formal recognition (diploma, certificate). Formal learning is intentional from the learner’s perspective".

- **Non formal learning**: "consists of learning embedded in planned activities that are not explicitly designated as learning, but which contain an important learning element. Non-formal learning is intentional from the learner’s point of view.” For instance internal/external business meetings, conferences represent a good example of non formal learning scenarios.
• **Informal learning**: "is defined as learning resulting from daily life activities related to work, family, or leisure. It is often referred to as experiential learning and can, to a certain degree, be understood as accidental learning. It is not structured in terms of learning objectives, learning time and/or learning support. Typically, it does not lead to certification. Informal learning may be intentional but in most cases, it is non-intentional (or 'incidental'/random)."

![Figure 1.5 – Categorization of educational context environments](image)

Different educational contexts involve different interaction models and consequently different supporting tools. One common scenario in formal learning and non-formal learning is represented by a presenter giving a structured speech to his/her audience with support of slides. This kind of scenario are defined by the author as *slide based events* and the relative supporting tools, object of this research, take the name of *presentations systems*. Since 1960s, when the first projectors were manufactured and released on market substantially nothing has radically changed in the interaction model between presenter and audience leaving space for potential improvements and innovation exploiting the powerful possibilities offered by mobile technology. This
study will consider the mobile presentation systems category (fig. 1.6), a small subset of mobile learning systems, that simplify the interaction between presenter and audience and enhance their user experience.

![Diagram showing the relationship between e-learning, mobile learning, and mobile presentation systems.]

**Figure 1.6** – e-learning systems

### 1.2 Market exploration

Focusing on the presentation system (see previous section), the market currently offer few options and here follows a list of the most relevant tools (concerning functionalities and number of users) in the mobile presentation systems area.

- **Slidecast** was a premium feature offered by Slideshare that enabled the users to upload mp3 files to associate to the presentation’s slides. Slidecast had been activated in 2007 and it was discontinued in April 2014 because it didn’t become as popular as expected from the Slideshare’s management perspective. Slideshare’s users didn’t really like the taken decision and many of them declared it was a valuable functionality for which they would have paid a premium subscription. The idea probably didn’t take off because the feature didn’t give support during the production phase of the audio recording [12].

- **Slidedog** is a tool that enables the presenter to combine different media with the goal to provide a smooth multimedia presentation. The system, from a
user point of view, is composed by a desktop application in which is possible to drag and drop different kind of files and reorder them. The audience can follow the live presentation using its mobile device as a second screen through a web browser, ask questions to the presenter and participate to pools. The presenter can control the slideshow using a web browser based remote controller. All the presentation’s native features like animations are maintained. Currently the Desktop application is available just for Windows users and the mobile application is browser based. The product was launched in 2013 and claims to have 50.000 users around the world [13].

- **Sopreso** is a presentation assistant software that enables the presenter to interact with the audience during the live presentation, with pools and get questions. The audience can follow the slideshow from its mobile device, get the presenter’s business card in a digital format and download attachments if any. The presenter must install a desktop application (available for Windows and IOS platform) and the audience mobile app is browser based [15].

One first important observation is that they have been launched in the last two years and none of them represent a de facto standard tool for supporting slide based events. This demonstrated that presentation systems are at their early days. Sopreso and Slidedog provide support (for the presenter and audience) limited to the live session. Furthermore Sopreso and Slidedog can not be technically considered, mobile systems because of their dependence on a desktop application (from the presenter perspective).

### 1.3 Problem statement

The goal of this thesis is to explore the mobile learning field, focusing in particular on mobile presentations tools, taking into consideration the research trends in m-learning together with the qualitative research conducted by the author and the available systems on the market. A first objective is to come up with a concept, based on the emerging user needs and wants. The concept will then define the guidelines for a possible presentation tool design. Its implementation will then be validated from the users’ experience point of view and from the technical perspective estimating performances, resource consumption and constraints [24].
The approach adopted can be summarized in four phases:

1. Users’ needs and wants definition, from a presenter and audience perspective, through interviews and surveys.

2. Creation of innovative, user centered concept considering the products already available on the market, users’ perceived need and wants, and users’ interviews.

3. Development of a possible design using the concept as guideline.

4. Technical and user experience evaluation of the developed system. The system will be technically validated through performances and efficiency tests. The users will be asked to assess the system after hands-on experiments.
1.3 Problem statement
Chapter 2

Concept definition

In this chapter will be determined which the perceived users’ need and want are though surveys and interviews and a concept that possibly satisfy them will be proposed.

2.1 User needs and wants assessment

2.1.1 Preliminary observations and interviews

An important driver of the research presented in this thesis, less formal but very valuable, is represented by the qualitative research coming from the author’s interviews on the field.

Attending 15 conferences, with an estimated audience that range between 30 and 250 people, was possible to notice that at least one third of the audience take notes during the presentation or take pictures of the current projected slide. In many cases the room’s brightness made these actions difficult. In big conference rooms the people on the back and the ones on the side had problems to read the text on the screen, partly because of their position respect to the screen and partly because of the text density and dimension. It addition it emerged that is often difficult to ask questions and make observations in front of a big audience, raising a barrier between the speaker and the audience. After the live session is typically difficult to access the material of the presentation because it is difficult to find, the presenter forget to upload/send the material.

Typically the presenter has to bring with him/her the slides on a usb stick or his/her
laptop to connect to the projector if not provided. This implies problems like forget/break the usb stick, software not compatible with the presentation file, aspect ratio mismatch between projector and slide format. In addition, it is difficult to get feedback after the performance and keep in touch with the attendants.

Another observation, that is more an opinion than an objective fact, is that the web is plenty of content management services providing online courses ranging from software development to cooking classes like Coursera, Conferize, Parleys, etc. Most of the content management services mainly focus on content distribution coming from third parties. Most of the times content creation is an expensive operation because requires special equipment (like HD cameras and microphones), technical skills to use it and possibly audio/video editing skills.

\subsection*{2.1.2 Surveys}

Surveys were used in order to evaluate possible users' needs and wants based on their previous experiences. The list of the questions and a summary of the answers can be found in the appendix B.

The survey has been submitted to a sample of 16 young adults (median 26 years old) that were whether students (of communication systems, computer science or tourism) or workers (engineers, researchers, etc.).

The sample selected is very sensible to the theme of presentation with the majority (37.5\%) of the interviewed people presenting slideshows between 5 and 10 times per year and almost a fifth presenting slideshows more than 20 times per year. In 50\% of the cases the audience is composed by less than 20 people, whereas the other half of the people interviewed is used to present slideshow in front of an audience ranging from 20 to 50 people.

The application is inserted in a field completely known by the people interviewed but the results that are obtained from the questionnaire (in terms of evaluation of the efficacy of the application) should not be extended to a large population of adults because of the small number of people interviewed (16) and the large prevalence of student in the sample. Nevertheless the results will highlight whether the observations coming from the interviews and the author’s observations are confirmed.
Surveys results
In general the main problems of the setting up of a presentation are software problems (for 43.8% of the sample) and transfer of files (31.3% of the sample). Only a quarter of the people interviewed admit not to have problem in general.
A set of questions has been submitted in order to understand the most important aspects for who is showing the presentation over the different phases (before during and after the presentation). In the following histogram the median value assigned to these aspects is reported (in a scale from 1 to 5, where 1 is "Not important at all" and 5 is "Very important"). The first set of question is from the presenter point of view, whereas in the second plot the people are asked about their experience as audience.

The evaluations are homogenous over different categories and they underline a general interest and care about the presentations. This means that the people interviewed are generally sensible to the themes treated by this application. The mean most important aspect is to rehearse before the slideshow, followed by being able to interact with the audience and making the material available and getting an evaluation.
A similar analysis can be performed on the results obtained asking questions to the sample regarding their audience experience, as shown in the following bar-chart.
2.2 The concept

The concept consists of a mobile service for smart content management ranging from content creation and editing to optimized content distribution tailored for mobile devices. The concept aims to support slide based events like conferences, academic lectures and internal/external business meetings. The actors involved by the system are:

- **Presenter** in the role of content creator/editor/publisher and administrator.

From this bar chart it is clearly visible that the most important aspect for the audience is the transmission of the material, soon followed by the possibility of taking personal notes. From the other questions asked it is important to notice that in more than 80% of the cases, emails are used as instrument to keep in touch or to transmit material, aspects that are considered very important. Moreover from the audience point of view there is a remarkable dissatisfaction in the projection (87.5% of the sample, at least once, have had problems with reading the projected slide on the screen) and in the opportunity of ask questions during the presentation (87.5% of the sample had, either often or sometimes, the wish of asking a question without being able to do so).

Summarizing, what is considered most important from both of the sides (audience and presenter) is the transmission of the material. Nevertheless some other problems that have been diagnosed through the questionnaire regarding the projector and all the 'hardware structure'.

**Figure 2.2** – Summary of the most important needs/wants from the audience point of view.
2. Concept definition

- **Audience** as the attendant of the event; in the case of a lecture the students or in the case of a conference the attending people, in the role of the consumer of the material, second level editor and second level publishers.

- **External content provider** as content publishers to enrich the slide information. The content could be published could be accessed for free or buying the premium version or in alternative pay on-demand. [21].

From these actor’s point of view, the system has the following interfaces:

- **Presenter mobile app**
- **Audience mobile app**
- **Web browser interface**

The main actors are represented by presenter and audience and the system aims to provide them an easy way to interact with each other. The functionalities provided by the system to presenter and audience can be temporally categorized in

- **Before live**: the functionalities that can be accessed before the live session and are useful to prepare the presentation.

- **Live**: the functionalities accessible during the live session like live questions, synchronized presentation.

- **Post live**: the functionalities accessible after the live session like content delivery, updates, follow ups.

### 2.2.1 Presenter’s functionalities

From the presenter point of view the system allows the presenter to have a repository of his/her presentations in the cloud, available everywhere and at any time enabling slideshows and meeting in any moment and in any kind of environment because the projector and the conference room become optional.

**Before live**

- **Slide deck upload**: 43.8% and 31.3% of the people declared to have had software and file transferring problems before the presentation. In order to
overcome these problems, the system enables the presenter to upload a presentation file on the cloud through a web interface or from the presenter’s mobile app. The presenter can choose among the files stored on the device or in the cloud (Google Drive, Dropbox, etc.)

- **Rehearse function**: as the surveys highlight, the most important aspect from the presenter view is the possibility to rehearse. The presenter could use the presenter app as a tool to rehearse for practicing. He/She can choose a presentation among the ones available on his/her account, and browse it in full screen mode by swiping left/right and audio record the performance. At the end of the rehearsal session the user can listen to the audio recording, on a per slide basis, in order assess his/her performance.

**Live**

- **Remote control and performance recording**: the presenter selects the intended presentation among the ones available on his/her account and he/she selects the nearby screen on which the slideshow will be running. The mobile device works a remote controller of the main screen (that can be virtual or physical); details about the screen management are explained in section 2.3. When the presenter changes slide from his/her mobile device all the connected devices (projector, laptop, audience’s devices...) are notified and synchronized. During the live performance the audio is recorded through the mobile device microphone on a per slide basis.

- **Interaction with the audience**: the surveys highlight the strong interest that the presenter have in being able to interact with the audience (ask and being asked questions) during the live session and get feedback at the end of the performance. The presenter can launch polls during the live session to get the audience’s feedback and eventually broadcast the result. In addition the presenter can receive written questions on a per slide basis that can be answered at the end of the presentation or in the post live.

**Post live** The participants, from the presenter point of view, expressed interest in keeping in touch with the audience and providing them the material of the presentation.

- **Deliver material**: is often difficult to reach the audience after the live session and distribute them the presentation’s material, as testified by the surveys’
results. After the live session the presenter decide if to distribute the presentation’s material and the related multimedia material to the audience’s devices. In case the presenter doesn’t distribute the content of the presentation no trace of the material will be stored on the audience’s devices.

- **Push updates**: the presenter can replace images, update recordings, attach additional descriptions, links and information for each slide of the slide deck and push the updates to the audience that previously attended the presentation.

- **Discuss with the audience**: the presenter can engage discussions on a per slide basis through social networks or internal forum for more professional applications.

2.2.2 Audience’s functionalities

As can be seen in 2.2 the audience is very sensible in receiving the material of the presentation. From the audience point of view, the system automatically creates a mobile lightweight enriched portfolio containing alive and updatable content (partially) accessible offline, anywhere and at any time. The audience app offers a wide range of functionalities to support the entire presentation’s lifecycle from the audience perspective.

**Before live**

- **Event registration**: The user can register to the conference for which has received the invitation on the audience app.

**Live**

- **Slideshow on mobile device**: 87.5% of the interviewed people are remarkably dissatisfied by the poor visibility of the projected slide. The audience app enable the audience actors to attend the presentation from their mobile device by connecting to the nearby screen. The user can zoom in and zoom out and possibly read additional information (like a description) about the current slide by swiping his finger on the screen. The audience app is synchronized with the presenter app in real time.

- **Interact with the presenter**: the interviewed people, from the audience perspective, expressed interest in being able to interact with the presenter
2.2 The concept

during the live session and 87.5% of the people remarked the difficulty of asking questions to the presenter in front of a large audience. During the live session the people in the audience can write questions to the presenter on specific slides by pressing a question mark icon on the intended slide. Another way to interact with the presenter during the live session is by participating in polls launched by the presenter. At the end of the presentation the audience can give feedbacks about the presentation, assessing the performance on a scale between 1 and 5 stars.

**Post live**

- **Interact with the material**: the user can search among the stored slide decks and browse the intended one. Each slide is composed by an image, its audio recording and possible additional information (like website, link to papers, explanation of formulas, etc.). The user can interact with the slide, listen to the recording, highlight keywords and launch services (like translator, search engines, make Wolfram solve an equation, etc.) in the native app.

- **Discussion**: sometimes doubts can raise after the live session and this is remarked by the surveys’ results as shown in the first row of fig 2.2. The user can engage in a discussion on the single slides with the author and the other members of the audience on the social networks or the internal chat. This functionality is in line with the increasing importance of social media in mobile learning.

- **Edit material**: as from the surveys emerges the willing, from the audience point of view, to take notes on the presentation the material can be customized by adding personal notes in space (on the image) and time (on the recording) for a specific slide. For instance is possible to associate a note, link or a file to particular keywords at a specific point of the recording. Whenever that slide will be played, the user will be visually shown the content available for that keyword by highlighting it at the proper minute and second when the recording is playing.

- **Share material**: As from the previous researches emerges the growing importance of social media in mobile learning. The system offer the possibility to the user to share the slides and the attached material (like recording and personal
notes) individually with other users having the same app. Share rights are set by the presenter, that owns the slide object.

2.2.3 The tile

The interaction model and type of media involved by the system give birth to a concept of learning unit as representation of a single slide; this concept of super slide will take the name of "Tile". A tile is a powerful digital learning object combining different types of media and services; it is composed by the representative slide’s image, the related audio recording, possibly a description, links to other resources (like papers), phone/email contacts (according to the mobile phone contact format). The services offered vary tile by tile, providing a way to find additional material and customize the tile. For instance is possible to highlight a piece of text and translate it into another language or find related videos; in the case of a slide about math, an icon of Wolfram will appear on the right side of the image and it will enable the user to visually show the trend of a mathematical function for instance. In addition the tile is customizable, for instance the user could take notes in space (in the image) and time (at a specific point of the recording). The tiles are alive and updatable and whenever a change is made by the presenter the corresponding audience is notified. These learning objects are independent from each other and can be individually shared with other users. The tile passing from hand to hand becomes a crowdsourced super learning object offering a rich quantity of content to interact with, online and offline.

2.2.4 Screen management: virtual and physical projectors

From the surveys and interview results problems regarding the projector and the hardware structure more in general have been diagnosed and the described concept aim to solve this problem as follows. The slideshow can take place according to different configurations:

- With the support of a physical shared screen like a projector screen or a television; in this case scenario the mobile phone’s screen is used as a second screen.

- Using the personal mobile device screen as main screen; in this case the main screen is considered virtual since the users are synchronized to an invisible shared screen.
2.2 The concept

In the first scenario the presenter can control the projector with his laptop. The presenter can change slide through the presenter app or the laptop’s keyboard. In alternative presenter app can be directly connected to a smart projector and on slide change the variation is reflected on the main screen.
In the second scenario, the audience attend the slideshow from their personal mobile device screen, which is synchronized in real time with the presenter’s screen.
Chapter 3

System design and implementation

The result of the implementation process is a fully functional system realizing a subset of the concept’s functionalities, described in chapter 2. This chapter will face the design and architectural decisions taken and the algorithms developed during the implementation phase.

The system architecture is based on the classical client-server interaction model. The clients of the system are represented by:

- Android Presenter app. It enables the presenter to control the slideshow on the selected screen, record the audio of the performance and eventually distribute the material to the audience.

- Android audience app. It enables the audience actor to follow the slideshow on his/her personal mobile device during the live performance and later on receive updates and interact with the interactive material.

- Web browser client. Let the presenter to manage his account and use the laptop as a controller for the main screen (projector/TV).

The server side is composed by the following independent components:

- Database. It is the central repository and it stores data about the users of the system, the uploaded material and information about the interactions between users.

- HTTP server: it manages the communication between the client and the database and between client and client.
• Real time server: it is in charge of keeping the presenter clients and the audience clients synchronized during the presentation.

In the following sections will be explained how the components interact between each other and, for each component, the logic behind the implementation.

3.1 Data model

From the analysis of the concept described in chapter 2 a possible solution for the data model of the system was implemented through a relational database as shown in the following ER schema. Each identified entity has been mapped into a table with the proper attributes.

• screens: represent the registered screens along with their position (latitude and longitude). The aspect ratio, stored as a float, helps the system avoid image distortion (details explained in the next sections). Ibeaconid and direction property are not currently used.

• permission: specifies which users have right to take control of which screens. The association is identified by the couple of identifiers email, the identifier of the user, and posterid, the identifier of the screen. Administrator is the username of the user that defined the permission. This functionality is not currently implemented.

• Active posters: keeps a list of the current screens in use. Each entry is identified by a screen id, its user and which slide deck is active.

• Session_id: is a pin number to protect the access to the browser based controller.

• Users: contains the user’s information. Role can assume the values "presenter" or "audience" based on the level of service chosen by the user. RegistrationId is a identifier assigned by Google Cloud Messaging to the userâ€™s device. This
structure implies that each user can have one and only one registered device. Each user is identified in the system by its email address.

- Slidesets: store the uploaded slide decks in the system. Each slide deck is characterized by a presentation name, its owner, the number of slides that compose it.
  Customized_json is a file containing additional information about the slide deck that is created through a web interface. This functionality is not currently available. Audio is a not used attribute.

- Tiles: represent the repository of learning units for the system. Each tile represents a "super" slide, characterized by an image, an audio track (if available), indicate a file containing the recognized keywords on the image by the OCR, slide number in the slide deck and a set of other properties that can be set by the presenter through customized_json. Each learning object is independent and is assigned a unique identifier. Tiles are updatable and different versions of the same learning object are distinguished by the property version. Type assumes value "slide" when the slide is firstly created in the database until the live performance. When the learning object is distributed the type is changed to "tile".

- Userpresentations: it keeps the associations between users that attended presentation and the presentation. This information are used for pushing updates later on and for data mining purposes. Each row is identified by email(attendant user name), the presentation and its presenter.

- Usertiles: it keeps track of which users have which tiles. It may seem redundant considering the table above but in reality a user may delete some tiles so knowing which user has which slide deck represent incomplete information. This table keeps track exactly of which user has what tile. This functionality is not currently developed.
Among the available DBMS on the market MySql (version 5.6.16) was chosen to implement the data model. Its characteristics make it a suitable and scalable solutions for web based applications. The version [10]

3.1.1 Tiles as learning objects

The service’s learning unit is the "Tile". A tile is the representation of a super slide and it combines the slide image, a set of keywords and their position on the image, an audio recording and a set of attributes that provide additional information about the slide content.
The tile object is created at upload time and it remains alive and dynamic until it is deleted from the central repository. The presenter actor that created that object can modify it, change the associated audio track, modify the image that represents it, etc., and push the updated version of tile to the audience devices. The audience actor has access to the tile material and can run services on it like translator, search engine, solve equations through Wolfram, etc. Tiles are represented in the data model in the entity Tiles.

In the next cycle of development the user will be able to take notes on the tile and share it with other users. In this way the tile’ users become second level editors and distributors.

3.2 Server implementation

The HTTP server act as a middle layer:

- between the clients and the database. All clients’ request pass through an HTTP request that is processed by the HTTP server, that in turn access the database through a SQL script.

- between clients and other server components that produce information and material to enhance the user experience (like the OCR to scan keywords and Power Point to create images from the presentation).

responses are provide in form of

- HTTP pages to web browser clients.

- JSON formatted answers to mobile apps. JSON is a lightweight data-interchange format; it is language independent and makes information communication easy between components using different platforms and programming languages.
3.3 Slide deck upload and processing

When the presenter upload a new slide deck the file format is checked and if it is compatible with the file formats supported by the system, it is stored and a new slide deck object is created in the database. The uploaded slide deck passes through a chain of components that process it and store into the database the results.

3.3.1 Slide deck conversion and image processing

The uploaded file is passed to a VB script that, through the Power Point APIs, convert the slide deck into a collection of images of a fixed resolution based on the
aspect ratio of the slide set. Taking into consideration the two most common aspect ratio formats, the following is the output produced by the script:

- 16:9 slides are converted into png images with resolution 960x540
- 4:3 slides are converted into png images with resolution 720x540

The above output is obtained using the default configuration defined by the PowerPoint APIs but is to tune the scripts parameters to modify the output resolution. Images are saved in PNG format in order to benefit of its lossless compression property so that no image data is lost when saving an image.

The produced images are stored in the users’ folder referring to the appropriate slide deck at server side. The VBA script makes use of the APIs provided by PowerPoint 2013 in order to avoid any conversion problem but open source solutions like JODConverter and PyODConverter are valid alternative.

In order to be able to show the slides with their original aspect ratio, independently from the aspect ratio of the screen (mobile device and projector) and avoid distortion, some image processing is applied. A php script takes the images created at the previous step, and for each one, the complementary version is produced.

![Figure 3.3](image)

**Figure 3.3** – The original image with aspect ratio 4:3, on the left side, is duplicated and converted in the 16:9 version as shown on the right.

More concretely if the image has aspect ratio 4:3, the 16:9 version is created adding a couple of black bands on the right and left side. Fixed the image height y in pixel, the expected width x’ is computed; the difference dx between x’ and the original width x represent the width of the left and the right bands combined. A new canvas of width x’ and height y with black background is created and the original
image is placed over it and translated left of \(\frac{dx}{2}\) considering as origin the top left corner.

![Image](image.png)

**Figure 3.4** – The original image with aspect ratio 16:9, on the left side, is duplicated and converted in the 4:3 version as shown on the right.

On the other hand if the starting image has aspect ratio 16:9, the 4:3 one is created by adding a black band on the bottom and one on the top. Fixed the image width \(x\) in pixel, the expected height \(y'\) is computed. The difference \(dy\) between \(y'\) and the original height \(y\) represent the height of the upper and the lower band combined. A new canvas of width \(x\) and height \(y'\) with black background is created and the original image is placed over it and translated down of \(\frac{dy}{2}\) considering as origin the top left corner.

On screens with aspect ratios greater or equal than 16:10 will be shown the 16:9 version and the 4:3 version in case of aspect ratio less than 16:10. In this way all possible the most common screens aspect ratio are supported with minimum distortion.

The specular versions of the original images are stored in a different folder and based on the aspect ratio of the screen on which the images have to be shown the proper version will be delivered.

### 3.3.2 Optical Character Recognition

The produced images are passed to an external tool in charge of making character recognition. The tool take the image as input and it produces a file containing the list of the recognized keywords along with their position, in pixel, on the analyzed pic-
3. System design and implementation

The position is specified as coordinates of their containing rectangles as follows.

PresentAction, 97,500,500,97,350,350,370,370
USER, 97,154,154,97,373,373,388,388
EXPERIMENT, 164,305,305,164,373,373,388,388

Starting from the most right element, the parameters represent: y bottom left, y bottom right, y top right, y top left, x bottom left, x bottom right, x top right, x top left and the remaining part is the recognized text. The text could contain any possible character, comma separator included.

The text file is stored on the server side and sent to the audience mobile device together with the related picture of the slide enabling the audience actor to highlight the text on the slide and use functionalities like translator, Google search, Youtube, etc. A detailed explanation about how this functionality is implemented on the mobile device will be given in the Presenter app section.

The OCR tool has been implemented as a Matlab script that is launched from the php script through the command line. Matlab2014a provide an image processing toolbox [7] built on top of the popular open source OCR library Tesseract [17]. The power of this tool is represented by the capability to return, for each word, the coordinates of its bounding box an the word itself.

3.4 Clients

3.4.1 Presenter app

The presenter app prototype offers a subset of the functionalities described in section 2.1. The presenter app has been developed for Android platform and has been written in Java using Eclipse as development tool. The functionalities implemented are:

- Before Live: training mode
- Live: remote control and recorder
- Post: push tiles to the audience, update recordings, push updates to the audience
The presenter app communicates with the audience clients through the central server and interact with the server components as shown in the following activity diagram.

**Figure 3.5** – The activity diagram shows the logic process followed by the application, and the interactions with the server components, in order to launch a presentation through the presenter app.

From the architectural point of view the presenter app is structured as follows.
3. System design and implementation

Figure 3.6 – Represent the presenter app activities structure and how the activities are connected between each other.

SignInActivity.java is the first activity loaded when the presenter app is launched. It is in charge to manage the user login. OnCreate private preferences are checked for already existing credentials. The authentication is performed through an AsyncTask that check the user credentials against the central database. If no stored credentials are found or are not valid a sign in forms is shown to the user. If the authentication succeed the activity ListViewExampleActivity.java is loaded and an async task is charge to request the list of the available presentation for that account to the central server, which response is a json formatted list of strings. Once the json file has been parsed the list of presentation is shown on the UI through a listview.
Selected a slideset, the presenter app sends its location information (latitude and longitude) to the central server that respond with a JSON list of the nearby screens, and for each screen its information like latitude, longitude, aspect ratio, etc. An async task is responsible for reserving the selected screen to presenter actor ordering the central database to create a record in the table active screens; no one else can take control of that screen until the current user releases it. The screen can be already busy at booking time for two reasons:

- The screen is under control of the presenter but another presentation is active; in this case the presenter can force another presentations for the selected screen.

- The screen is under control of another presenter. The user has to wait until the screen is released to take control of it.

If the activation succeeded PresentationController activity is launched. It enables the presenter to control the slideshow remotely. The controller is implemented as a hybrid between native and HTML5 for fast prototyping purposes. They UI is built in HTML5/CSS and it makes use of Supersized [16], a plugin for background slideshows management. The real time sync is managed by socket.io client library. For a more detailed discussion about real time synchronization see section 3.5.

The recording functionality is accessed through the option button. The audio is recorded on a per slide basis and each time the presenter actor changes slide through the webview based controller the new slide number is passed to the native code through an interface class so that the recording for the current slide is terminated and stored and a new recording is initialized for the upcoming slide. The management of particular scenarios is managed as follows:

- If the presenter goes back to the previous slide a new recording is initiated as it was a new slide. It is distinguished from the previous recording through its sequence number in the live session, for example if the slide sequence is 1, 2, 3, 2 the second recording of slide 2 is assigned the sequence number 4.

- If the presenter jumps back of two slides and the transition is fast enough the slide in the middle is ignored and the portion of audio registered during the transitions will be attached to the beginning of the arrival slide recording. A timer keeps track of how much time the presenter spent on the current slide, and if this is less than one and a half seconds it is considered as a transition...
slide. The threshold has been decided by the programmer after some user test in order to set the optimal value.

File naming follow this format: sequencenumber_slidenumber.3gp, where

- sequencenumber is an integer number that defines the order in which the audio tracks have been recorded.
- slidenumber indicate to which slide, according to the order in the slide deck, the recording is referred to.

When the presenter terminates the slideshow AudioTracks activity is launched. The list of the recording is shown on the UI through a listview and the presenter can listen to the preview of the recordings, delete or upload to the server. Recordings are uploaded with POST method. By pressing the distribute button the presenter app sends a request to the central server to update the current tiles considering the audio files uploaded.

The algorithm associate each audio file to the proper slide and in case there is more than one audio file for the same slide this is forked giving birth to two different and independent tiles.

The tiles are then distributed to the audience that previously checked in the event by connecting to the screen during the presentation. More details about content delivery in section 3.4.2.

### 3.4.2 Smart content delivery

The tile distribution in carried out by the backend through Google Cloud Messaging services [6]. GCM is a service that enable client-server lightweight messaging. In particular enable the server to push material to the client’s device without the the client’s request.

Each audience device is identified by a registration_id in order to be able to be reached by the central server. The registration_id is firstly assigned to the user’s device from GCM service by calling the Google services APIs the first time the audience app is launched and the user logged id. Once the client has been assigned a registration_id this is communicated, by the audience app, to PresentAction’s server that associates it to the user and stores it into the database.

When the presenter distribute new tiles or an update of an old tile is pushed from
3.4 Clients

the presenter app, the central server receives a request for distribution to the au-
dience. The proper users are selected from the database (users_presentations table) and so their registration_id (from the users table). The information is sent in JSON format and is structured as follows: presentation name, presenter username, version and file’s URL pointing to the tiles content. Defined recipients and message content, the request of delivery is submitted to the GCM connection servers. GCM service guarantee that the message is delivered to the intended client even when the client is not active at delivery time (for instance the user’s phone is off).

Figure 3.7 – GCM architecture where in this case 3rd party App Server is represented by the central server of PresentAction [5]

The audience app listens for incoming messages through a broadcast receiver that will pass the message to a service that is in charge to process it. The service, based on the attributes specified in the message, download the the tiles’ description. Then the Json response is parsed and for each tile all the related material is downloaded and the the phone’s repository is updated as follows:

- a new tile entry is created if it didn’t previously exist.
- if previously existing, the tile is updated to the last version

When the service finished its task, notify through a broadcast message the UI thread to update the front end.
3.4.3 Audience app

The prototype of audience app offers a subset of the functionalities described in the section 2.2.

The audience app has been developed for Android platform and has been written in Java using Eclipse as development tool. The functionalities implemented, divided by publishing phase are:

- Live: check in and attend the presentation from mobile device
- Post: receive tiles and receive updates, browse the tile sets. For each slide play audio recording if available and highlight keywords on the slide to use translator, search engine and related videos (all the services are provided in the app). Twitter and Facebook access enable the user to engage discussions with other users and the presenter about the each slide.

The audience app communicates with the presenter clients through the central server and interact with the server components as shown in the following activity diagram.
Figure 3.8 – The activity diagram shows the process implemented by the audience application, and the interactions with the server components, to attend a live presentation and receive the related material.

From the architectural point of view the audience app is structured as follows:
3. System design and implementation

Figure 3.9 – Represent the audience app activities structure and how the activities are connected between each other.

SignInActivity is the first activity loaded when the presenter app is launched. It is in charge to manage the user login. OnCreate private preferences are checked for previously stored credentials; AsyncTask is in charge to authenticate the user against the central database. If no stored credentials are found or are not valid a sign in forms is shown.

Once the user is authenticated, the thumbnails of the attended presentations are loaded in the UI from the phone’s database. The first image of the tile set is taken as the thumbnail image. When a new tile set or a tile update is received, the corresponding thumbnail’ border becomes green to visually communicate the state change.
3.4 Clients

On SelectPoster click, the list of the nearby screens is requested by passing latitude and longitude as parameters. The response is a json formatted list containing the screens’ information. The information are parsed and their name is show on the screen together with their distance respect to the user’s location on the UI through a listview.

Once the screen is selected, Slideshow activity is charge to retrieve the active presentation from the central server. A background thread send the selected screen’s id the central server that will check the activescreens table which is the active presentation and will send as a response its description in a json format.

The images representing the slides are entirely downloaded upfront in order to minimize the synchronization delays. The synchronization problem is discussed in detail in section 3.5.

The mobile screen is tied to the presenter’s screen in order to keep the audience focused on the slideshow and when the presenter terminates the presentation the slideshow is automatically closed on the mobile devices. The tiles are not available to the audience until the presenter distributes them.
3. System design and implementation

Figure 3.11 – browseslideset activity’s UI shows the tile’s thumbnails ordered as presented in the live session.

When the user tap on the thumbnail of a tile set on the main screen Browseslideset activity is launched. Browseslideset shows the tiles thumbnails that compose that tile set, ordered according to the sequence followed during the live slideshow as shown in fig 3.12. If there are slides that have not been used during the live slideshow these are placed at the end, ordered by their slide number.

Figure 3.12 – InteractiveSlideActivity UI shows the tile’s available service when the switch is turned on.

In order to open a tile the user tap on its thumbnail and InteractiveSlideActivity will be launched. The image shown on full screen mode on the UI through a ZoomableImageView, a customized imageview that let the user zoom in and zoom out the image. When the switch is on is possible to highlight keywords by swiping
the finger on the screen and a search string is built by concatenating the words in the order they have been highlighted. InteractiveSlideActivity is a mash up of different services that aim to enrich the content tile’s. In particular, the actual version of the prototype, enable the user to pass the built search string to Google translate to get a translation and hear the pronunciation, look for related Youtube videos and expand the information set through Google search. The services are implemented through a webview, that shows the result in the app.

As described in section 3.3.2 each tile comes with a text file containing the text recognized at upload time by the OCR on the image. InteractiveSlideActivity makes use of the custom view ZoomableImageView in order to show the image full screen on the mobile device and enable the audience to interact with the text. ZoomableImageView render the tile’s image and load the list of words and their position, in the resolution of the image, into a proper data structure. When the switch is turned on, and the user touches the screen the onTouch event is fired and the coordinates in pixel x and y, respect to the resolution of the screen, are processed in order to compute (x’,y’) in the picture resolution; at this point is checked if (x’,y’) is part of any of the words’ bounding boxes; if so the coordinates that identify the rectangle are mapped to screen coordinates and the rectangles is drawn on a canvas having the slide image as background and the matching word is concatenated to the search string.

3.5 Screen management

As discussed in the section virtual and physical projector of the previous chapter, the presenter actor can interact with the main screen in three different ways:

- connecting the laptop to a projector/TV through HDMI or VGA or DVI and using the presenter app or the laptop’s web browser interface as a controller. This method will be referred as standard screen mode.
Figure 3.13 – The projector is a passive element in this scenario and it simply shows the laptop’s screen, that is synchronized with the presenter app and the audience devices

- Controlling the slideshow from the presenter app without the support of any main physical screen. The audience attend the slideshow on the personal mobile device’s screen as main screen enabling slideshows anywhere and at anytime; this method will be referred as virtual screen mode.
3.5 Screen management

Figure 3.14 – The communication between presenter and audience pass through a central server, responsible to notify all the devices that joined the event. In this case the audience’s main screen is represented by the personal mobile device’s screen.

- Connecting to a smart projector/tv running the projector application. This method will be referred as **smart screen mode**.
3. System design and implementation

In any of the above cases, the communication between the presenter app and the audience app always pass through the sync server. The sync server, is responsible to keep the synchronization between the current slide on the presenter app and the current slide showed by the audience device and, on slide change, communicate in real time the new slide number to the audience devices. The real time synchronization is managed by Socket.io. Socket.IO is a JavaScript library for real time web applications. "It enables real time, bi-directional communication between web clients and server" [14]. The server-side library run on top if node.js [9] while the client-side runs in the browser. Both components have nearly identical APIs. Node.js is an event-driven framework using a non blocking I/O model efficient and lightweight for real time applications.

3.5.1 Distributed architecture

An alternative to the centralized architecture for slide synchronization is a distributed system in which the presenter directly sends the the slide number to the audience’s devices.
From a practical perspective the presenter would directly maintain the socket communications with the audience devices after a connection set up phase. During the connection set up phase, once the presenter has taken control of the screen, the presenter's socket is published on the central server and the audience devices connecting to the same screen, look up in this central repository for the associated socket and eventually connect directly to the presenter. Whenever a slide change occur the presenter broadcast the new slide number to the connected clients.

The distributed architecture approach makes the slide synchronization independent from the central server so that if the server goes it doesn't affect the user experience during the live session and the presentation's material (downloaded upfront) doesn't go wasted. On the other hand the presenter would need to maintain, in case of large audience, hundreds of simultaneous TCP connection active causing a possible collapse.

3.5.2 Sync server

It keeps track of the active presentations and, for each one, the current slide number and the attending users. It is responsible to keep synchronized the audience's devices with the presenter's controllers. The communication between clients and server is event based and the events management is ruled as follows:

- "connection". It is triggered when a new client connects. The socket is automatically stored in the server data structures by the framework and the TCP connection is maintained alive for future communications. The event "connected" is sent back to the user as a feedback.

- "new user". Triggered when the new client send its information in order to be registered. A list of parameters is received: role, username, room/screen name and presentation name. The role can assume two possible values based on the connecting client: "presenter" or "audience".

In the first scenario a new room/screen is instantiated and initialized so that it becomes available to audience. As a feedback the server triggers the event "slide changed" communicating the current slide current number, that was initialized to 0. In case a presenter was already in the room and the new user has a presenter role this is simply added to the list of the presenters. This is the case when the presenter is in standard screen mode and he/she uses the smartphone as a controller because both laptop and mobile device are registered as
presenter and are registered with the same name, what distinguish them is the socket id.

In case the role of the new client is "audience", the username and role specified are assigned to the newly created socket and it is associated to the specified room and the number of attendant people in the audience is incremented by one unit. In order to synchronize the new client, that could have joined in the middle of the presentation, a "slide changed" event is generated to updates the slide number.

- "slide changed". Triggered when a presenter client change the current slide. The current slide number is updated in the database structures and the event is broadcasted to all the other users in the room.

- "disconnected". Triggered when a client disconnects. If the disconnecting user is in the audience, the number of people in the audience is decremented and the TCP connection is closed. In case the disconnecting user is a presenter the server can react in two ways. If it is the only one, or the last one, it means that the slideshow finished and in order to clean up the room all the users in the audience are disconnected and the data structure of the room and its related information are destroyed in order to keep sync server as lightweight as possible. In case there are other presenter users still active the number of presenters is simply decremented.

3.5.3 Screen clients

There are two client's implementations:

- Web browser interface, in the case of standard screen mode. The implementation makes use of the official client side Javascript library and the syntax and event management is very similar to the server side.

- Embedded in the audience/presenter Android native app. The implementation makes use of an unofficial java implementation of the client library of socket.io by nkzawa [4]. The audience user is a particular case of the presenter user that is not able to send "changed events" events.
Firstly the client connect to sync server on the proper port and the server reply with a "connected" event if the TCP connection has been successfully created. As a reaction of the connected event the client send a "new user" event and the parameters for the user registration. The list of the passed parameters is:

- **Role.** It can assume the values "audience" or "presenter" based on the client role.

- **Username.** The email address that identifies the user in PresentAction.

- **Room.** Screen name or conference room name where the slideshow takes place. The space of this attribute is indirectly limited to the values stored in the table `screens`.

- **Presentation.** Name of the active presentation.
If the registration is successfully managed the client receive a "slide changed" event that synchronize the client with current slide for the selected screen. Whenever the presenter changes slide a "slide changed" event with the new slide number is sent to the sync server that, in turn, broadcast the update to all the users in the room.

If sync server closes the connection for any reason the event "disconnect" is triggered at client side and it is redirected to the default landing page [noactivepresentation.html](#).

**Figure 3.16** – Synchronization between presenter and audience with details about the messages content.
By contrast if the client closes the connection, as in the case the browser is closed or the activity managing the controller is destroyed, the client trigger the event "disconnect" at server side that will manage the situation properly.

### 3.5.4 Standard screen mode

The web browser based controller runs on the laptop and the presenter app register to the sync server as presenter user. Any slide change on one of the two controllers is communicated to the other and the audience clients as described in the previous sections.

### 3.5.5 Virtual screen mode

The only active presenter user is the presenter app controlling the slideshow. Any slide change is communicated to the audience clients as described in the sections above.

### 3.5.6 Smart screen mode

It includes the benefit of having a main shared screen for the audience, as the in the standard screen mode, and the benefit of being able to get rid of the laptop by using the presenter app as the only controller.

Smart projectors/screens that support android can install the projector app, a slightly modified version of the audience app.

**Projector app**

It is a simplified version of the audience app that is always active on the same screen. The main activity create a thread running on the background of the application responsible to listen for new presenter’s connections. When a presenter take control of the screen, the sync server send an event to the projector app that will react by fetching the images of the presentation and will act as a member of the audience keeping the synchronization with the presenter app.
3. System design and implementation

**Figure 3.17** – Synchronization between presenter and smart projector (projector app) with details about the messages content.

**Projector ”Smartization”**

The "old" generation of projectors do not embed any intelligence, so do not support apps. They can be divided into two categories, DLNA enabled and traditional, based on the functionalities offered.

DLNA is a technology standard for connected devices and streaming media, established by Sony and Intel in 2003. In order to make the presenter app communicate directly with the projector the presenter app must implement a DLNA Digital Media
Render in order to push content to the projector that is located on the same LAN [2]. The implementation must follow the public guidelines published by DLNA in order to be compatible with DLNA enabled devices. Although today a wide range of projectors and TV support the DLNA standard the implantation of compatible apps is time consuming.

Traditional projector are controlled through HDMI, VGA or DVI adapter. It is possible to turn this category of devices into smart projectors by plugging Android Mini Pc (typically through HDMI). Android mini Pc is a pc on a stick device that runs Android OS and behaves as it was a regular Android device. It possible to connect to the LAN, download apps from the Google market and run the installed apps. This strategy easily enable any screen to become a smart screen and enable Android developers to implement applications for a wide range of devices that is not anymore limited to the smartphone category. In the implementation of PresentAction was utilized a Rikomagic Android mini PC running Android 4.1 on which has been installed the projector app [11] [1].
Chapter 4

Results

In this chapter will be discussed the technical performances and estimated resources consumption of the developed system and the users’ experience validations through experiments and surveys.

4.1 Technical results

4.1.1 Video versus tiles

One first important result demonstrate the benefit of using tiles as learning objects in place of video. Video represent a media critical to manage for mobile devices because of the file size implied. The bandwidth consuming operation of streaming/-downloading videos implies higher costs for the user’s data plan and battery life reduction affecting the overall user experience.

In order to give a concrete estimation of the benefit that the concept of tile brings respect to video an experiment was conducted.

One of the participants to the experiment, while giving the presentation with PresentAction, was video recorded. The video recordings were taken with three different video qualities (as shown in table 4.1) through three mobile phones. As can be seen in table 4.1 the file size grows very quickly.
4.1 Technical results

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Compression</th>
<th>Data rate</th>
<th>File size</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>720x480</td>
<td>H.264</td>
<td>750Kbyte</td>
<td>487MB</td>
<td>11:11</td>
</tr>
<tr>
<td>1280x720</td>
<td>H.264</td>
<td>1.5 Mbyte/s</td>
<td>969MB</td>
<td>11:11</td>
</tr>
<tr>
<td>1920x1080</td>
<td>H.264</td>
<td>2 Mbyte/s</td>
<td>1.34GB</td>
<td>11:11</td>
</tr>
</tbody>
</table>

Table 4.1 – File sizes for low, medium and high quality video.

The tile collection generated by PresentAction accounts for 1.412Mbyte in total. The biggest contribute, in this case, is represented by the audio recordings that account for 1MB in total (as show in table 4.2). The audio quality set was 12Kbits/s (default value).

<table>
<thead>
<tr>
<th>Number of tracks</th>
<th>Total size</th>
<th>Total duration</th>
<th>Data rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>1MB</td>
<td>11:11</td>
<td>1.5Kbytes/s</td>
</tr>
</tbody>
</table>

Table 4.2 – Tiles’ audio recordings summary.

The second contribute, in term of size, is represented by the collection of PNG images as show in table 4.3

<table>
<thead>
<tr>
<th>Number of images</th>
<th>Total size</th>
<th>Resolution</th>
<th>Bit depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>405Kbyte</td>
<td>960x540</td>
<td>variable</td>
</tr>
</tbody>
</table>

Table 4.3 – Tile’s images summary.

The third and last component is represented by the json file, carrying additional information and services available for each tile and the OCR files, containing the tiles’ text(table 4.4).
In this experiment, the tiles brought to a file size of 345 times smaller than the size of the low quality video and 949 times smaller than the full HD quality video.

Let's compare now PresentAction's tiles with the video lectures service provided by one of the most prestigious European engineering school, Polytechnic of Turin. The offered service let the user download a lecture in 3 different formats:

- Video lecture. The presenter is shown in the video together with the current slide.
- Talking slides. The information involved is the slide deck images and the presenter's explanation. It can be considered the direct equivalent of the tile for the type of media involved
- Audio without any kind of visual information

Let's consider the material available for the course Information Systems (2015), composed by 43 lectures each one varying between one 1 and 1 hour and a half. The video lectures are characterized, after the post processing and optimization operations, by a bit rate of 261kbit/s (resolution 1024x768 and used codec h264/aac); the talking slides are characterized by an average bit rate of 158kbit/s (resolution 800*600 and codec h264/aac). Considering a lecture 11 minutes and 11 seconds long, the result would be 21.89 Mb and 13.25 Mb. Although the file dimensions involved are much smaller respect to smartphone recordings, the values are still too high for a smartphone user. The corresponding tile set, considering the values collected in the previous experiment, would be 90% smaller than the talking slides provided by the e-learning system of Polytechnic of Turin.

Coursera is one of the most popular e-learning services of the web and its material is accessed by millions of people every day. The course "Logic: language and information 2" was taken as a sample to estimate the tile's benefits compared to the Coursera material. The course is composed by 43 video lectures which bit rates ranges between 129kbit/s and 190kbit/s. Considering a lecture 11 minutes and 11
seconds long the result would be around 11MB. The corresponding tile set would save 88% of the size occupied by the video lecture recorded with the lowest bitrate.

4.1.2 Pre-fetching versus slide on demand

During the live session presenter and audience must be synchronized with the lowest delay possible in order to guarantee a good user experience. In order to achieve this goal the content is pre-fetched on presenter and audience apps when they connect to the screen so that when the current slide change the corresponding image is already available on the mobile device giving the user a real time feeling. In this conditions the delay generated by the slide change event can be considered negligible. The alternative is represented by on demand approach, in which at each slide change event the proper slide is fetched (downloaded and shown).

Some experiment were run in order to estimate the system performances and the bandwidth delays with an "heavy" slide deck characterized as follows:

- Image total dimension 12MB. First image file size: 623Kbytes
- Resolution 960x720 with 32 bit depth. Consider that color representation on high quality displays on mobile phones is 24 bits.
- OCR files total dimension 14.6Kbyte
- JSON file 7.11Kbyte

Wi-Fi network

The first experiment aims to get an idea on the system’s delay trend on a Wi-Fi network increasing the number of devices trying to get access to the channel simultaneously. The aim is to point out the advantages of the prefetching system developed versus the slide on demand system.

Considering the total time to download the entire slide deck, increasing the number of devices that concurrently try to access the channel, it increases rapidly approaching 25 second in case of 8 devices as in fig. 4.1. Samples were collected with 1, 2, 3, 6, 7, 8 devices and each point on the diagram represent the mean value over the set of measurements in the various replications. The traced, red lines along the interpolated function represent the error, which is notably small.
4. Results

Figure 4.1 – Total time to download trend increasing the number of connected devices

The images representing the slides are downloaded asynchronously and sequentially when the user connects to the screen. In this condition the critical delay is represented by the time to download the first slide, which delay is estimated as shown in fig. 4.2. As in the previous case samples were taken for 1, 2, 3, 6, 7, 8 devices then the mean value and variance were calculated.

Figure 4.2 – Time to download the first slide increasing the number of connected devices
Fig. 4.3 shows that 50% of the connected devices manage to download the first slide in max 1.5 but considering and 95% in 4.6 seconds.

![Figure 4.3](image)

**Figure 4.3** – first slide’s time to download estimation in 50th and 90th percentile

Although the performances were measured with the pre-fetching architecture, consider the time to connect to the sync server negligible, the cost of download for the first slide can be seen as an approximation of the response time for the slide on demand strategy. The results demonstrate that the system wouldn’t be scalable since the delay increases significantly increasing the number of simultaneous download. Two optimistic estimations of the expected delay are shown in green and red in figure fig. 4.4.
4. Results

For 20 users simultaneously connected the estimated delay ranges between 4 and 6.3 on every slide change lowering dramatically the user experience during the live session. By contrast with the prefetching architecture this cost would be paid just on the first slide or totally skipped by connecting some seconds before the presentation starts.

Public networks

In table 4.5 are summarized the system’s performance on public networks. The experiment was conducted considering a tile set characterized as described in the previous section. The values in table 4.5 represent the mathematical average of a set measurement (30) performed on 3G and 4G in Kista (Stockholm) during a Sunday afternoon.

<table>
<thead>
<tr>
<th>Network</th>
<th>TTD 1st slide [s]</th>
<th>Total TTD [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G</td>
<td>0.66</td>
<td>8.79</td>
</tr>
<tr>
<td>3G</td>
<td>1.31</td>
<td>9.89</td>
</tr>
</tbody>
</table>

Table 4.5 – Performances on public network

Although is difficult to provide a precise delay estimations since the public network is under the service provider control, the result are can be considered satisfactory since the delay wouldn’t affect the user experience.
4.2 User evaluation

In order to estimate the perceived value of the built prototype and more in general the vision of this project, the user experience has been assessed with a hands-on experiment. The same people that participated to the first survey, were divided in groups of four people each and each group scheduled in a different time slot. The assessment was composed by 2 parts:

1. The participant in turn gave a short slide based presentation (between 5 and 10 minutes in average) in front of the other attendants using PresentAction presenter; the attendants used PresentAction audience.

2. Survey post to evaluate if the system proposed solve the problems emerging from the previous survey, and the built system can be considered satisfactory. The list of the questions and a summary of the answers can be found in appendix B.

4.2.1 Final surveys results

After having used the application, the sampled people answered a set of questions to evaluate their perception about PresentAction's features. From the presenter point of view, the median results presented in the following bar chart shows that in general the people interviewed are interested in the features of these app (the results are always positive) and the most liked aspect is the possibility of avoiding the use of the projector.
Results are very homogeneous and it seems that in general the individuals interviewed do care about the aspects faced by the application. In accordance with the dissatisfaction regarding the dependency to the projector and the hardware/software/structure, the highest results are obtained when it is asked an opinion about being able to give slideshows anywhere independently from the hardware structure. This aspect is followed in terms of importance by the opportunity of having a cloud repository and being able to distribute the slides of the presentation.

Even from the audience’s point of view there is a positive homogeneity. All the features of the application are considered important from the audience point of view with again a pick on the opportunity of receiving the material and having it accessible from the mobile device.

**Figure 4.5** – Most appreciated functionalities from the presenter’s point of view, and respective relevance on a scale between 0 and 5
4.2 User evaluation

The social network aspect, in this case, is not given a great value: in the set of questions this item is given the lowest grade, moreover, when the sample is asked a specific question, more than a half of the sample would not use the social networks as a platform to interact with the other people in the audience and the presenter.

4.2.2 Final opinions

At the end of the questionnaire the people sampled are asked general opinion about the app and how should it be developed. They are in particular asked how they would evaluate the insertion of another feature (in a scale 1 to 5) and the most appreciated idea is to receive slides and audio of presentations they cannot attend.
4. Results

Results even more interesting are obtained when they are explicitly asked to grade the app, why, and personal opinions and suggestions. The application is evaluated a good application, scoring 4.25/5. When the people are asked if they would use the app as a presenter the majority of the opinion where positive (14 people over 16 answered "yes") and they appreciate different things. The most recurrent reasons were the fact that it is easy to use, is hardware independent, useful and it allows audio recordings.

Even when they are asked an opinion about the audience mode they seem satisfied (13 people over 16 say that they would use it). The recurrent reasons are that with that they can follow better the presenter, it is easy, they could have additional info/material and the audio recordings are very useful. On the other hand, dissatisfied individuals would prefer that it would be allowed to browse previous slides and to take notes via Evernote or similar apps.

When the people interviewed are asked if they have any opinion or suggestion they show enthusiasm towards the idea, on the other hand they give some suggestion such as:

- the releasing of the screen could be done by a timer after some time of inactivity

- the possibility to the presenter to launch rapid surveys to the audience

- launch hashtags and subscribe to them
4.2 User evaluation

- next and previous slides icons should stay hidden until the screen is touched
- the possibility to temporary unlock the synchronization with the presenter so that the attendant can go back to the previous slides (or forward)
- ability to listen with earphones the current presentation (live streaming) so that the presentation can be attended from remote
- combine presenter and audience app and add a button to switch between "presenter" and "audience" mode
- use open cloud like Google drive, Dropbox, etc.
- improve the graphic interface

These suggestion are always given as improvement to the concept that, from the almost totality of the sample, is considered a good idea.
Chapter 5

Conclusions

The first round of surveys and interviews defined the problems, from the presenter and audience perspective, for all the phases of the presentation (before, during and after the live session) validating the author’s observations and interviews as described in details in section 2.1. The first phase’s results were transformed in functional and not functional requirements that brought to the concept of a fully mobile presentation system supporting the users from content creation to smart content distribution as detailed in section 2.2. A fully functional system, composed by two native Android mobile apps and the backend, was developed and technically characterized as explained in detail in chapter 3.

At the end of the process the system was validated from the technical and user experience point of view as detailed in chapter 4. The results obtained in each one of these phases can be considered a contribution to the mobile learning field, with special focus on the presentation systems.

It can be concluded that the implemented system let any connected smartphone user, regardless of his/her technical skills, to give slideshows from already existing slide decks anywhere and at any time. It automatically creates complete, high quality, interactive, updatable, learning objects that can be delivered to the attending users through smart content delivery enabling a mobile, interactive, personal portfolio creation. From the audience perspective the mobile phone screen can be used as secondary screen or primary screen in case no projectors are available. The developed system take into consideration the mobile devices constraints, in particular bandwidth consumption, battery life and memory utilization by defining a new kind of the media able to deliver more information than a video with a file size more 90%
smaller. The experiments over the Wi-Fi network demonstrated that the bandwidth delay grows exponentially for large number of devices simultaneously competing for the channel. This phenomenon affect negatively the user experience, making the implemented pre-fetching strategy (over the on demand architecture) a must for real time content delivery. The system gave positive results on 3G and 4G public networks although is difficult to give a precise delay estimations since the telecom operator has control over it.

The general enthusiasm of the people interviewed (that can be seen in the questions answered after the trial of the app) are the strongest positive indicator (details in appendix B section "Survey post"). The system was evaluated 4.25/5 with more than 81% of the participants willing to adopt the system if it was available on the market. These results are supported by the correspondence with the identified needs in the preliminary investigation (details in appendix B section "Survey pre"). From the presenter perspective was underlined the need to rehearse and consequently the training mode was really appreciated; the most common hurdles come from technical problems with hardware and software so they appreciate the fact that all the set-up is automated and they can even avoid to use laptop and projector to give a presentation. From the audience point of view the people interviewed do really care about the transmission of material and hence they appreciate the possibility of having audio recording and additional info, moreover they mention that sometimes they have problems in reading the projector, follow the presenter and ask questions and hence they really appreciate the possibility that the app gives in this sense.

5.1 Future work

From the user experience perspective, the descriptive statistics just shown are results of a preliminary survey that did not have the aim of proofing the superiority of this system, but mote to explore if the research on this field could be of some interest. In this sense the study is very small (only 16 units) and hence it does not allow inference. Moreover it regards only a small portion of all the population that could potentially use this app. In this sense in the future it will be submitted a larger questionnaire to people from different fields (business men, teachers, professors,...) on the needs they have regarding presentation. Moreover a pre-post questionnaire
can be submitted to a smaller stratified sample of these, to see how the perception of some problems changes when this app is used.

In the next development cycle more functionalities will be added to the system based on the user’s feedback received, in particular animation and video will be supported and a digital laser pointer functionality will be implemented.

From the technological perspective, the cutting edge I-beacon technology will be deployed for screen advertisement giving birth to portable physical/virtual screens and overcome the GPS indoor limits.

The concept of tile will be extended to support many more type of media (like videos, phone contacts, etc...) and other applications. The tile’s template adapt its characteristics to represent different objects and concepts; for instance the representative tile of a shoe model would be composed by the shoe picture in all the different colors available, brand, model, available sizes and a list of the available resellers in the area that automatically updates as the user moves around. The user could associate the tile a list of other items (likes trousers, shirt, etc...) from other brands; the user can eventually share the customized tile with friends having the tile’s app. Another practical tile’s application is to distribute item’s description in museums. As the user walk by the portraits the smartphone app automatically collects the corresponding tiles though the I-beacon technology and selectively store them permanently. Additional material could be suggested to deep in the topic or personalized guided visits could be proposed based on the user’s interests. The tile concept will be further investigated in order to determine its market potential.
Bibliography


revolutionize-home-theater-projectors/(2015-04-12).


Appendix A

Screenshots

Presenter app

Figure A.1 – Login activity (Left), select presentation activity (center), select screen activity (right)
**Figure A.2** – Controller’s activity

**Figure A.3** – Controller’s activity; it is possible to jump directly to the intended slide
**Figure A.4** – Slideset activation message in case a slide set from the same user is already active in the selected screen

**Figure A.5** – Upload recordings and distribute tiles
Audience app

Figure A.6 – Login activity on the left and tile set collection
**Figure A.7** – Tile set content

**Figure A.8** – Live session synchronized slideshow
Figure A.9 – Tile’s Additional information

Figure A.10 – Tile’s services
Figure A.11 – Video search engine

Figure A.12 – Search engine research

Figure A.13 – Translator
**Figure A.14** – Facebook integration

**Figure A.15** – Twitter integration
Appendix B

Surveys’ questions

B.1 Demands investigation questions

This section contains the list of asked questions during the initial user needs/wants assessment and a summary of the collected answers. The first section of the questionnaire focuses on presenter’s view assessment while the second section focuses on the audience assessment. Both the sections are subdivided in questions focusing on the before presentation phase, live phase and post live phase.
Background

How old are you?
22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 20, 59

What do you do?

- Studenti, software engineering
- R&D staff
- working in finances
- computer science
- university student
- student computer science
- visiting student for my master thesis
- worker engineer
- research engineer
- student
- student communication systems
- research worker
- student tourism
- student MSc
- PhD student

Presenting experience assessment

How many times do you present slideshows (conferences/meetings/lectures) in a year?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>3</td>
<td>18.8%</td>
</tr>
<tr>
<td>between 5 and 10</td>
<td>6</td>
<td>37.5%</td>
</tr>
<tr>
<td>between 10 and 15</td>
<td>4</td>
<td>25%</td>
</tr>
<tr>
<td>between 15 and 20</td>
<td>1</td>
<td>6.3%</td>
</tr>
<tr>
<td>&gt; 20</td>
<td>2</td>
<td>12.5%</td>
</tr>
</tbody>
</table>
Which type of audience sizes have you been presenting to last year?

Before the slideshow

How important is for you to rehearse before a slideshow?

How do you rehearse?
Have you ever had problem setting up the presentation? If yes specify which ones?

- Slides distortion (wrong aspect ratio): 9 (56.3%)
- Software problems: missing software, not compatible version: 7 (43.8%)
- Transfer file to another computer: 5 (31.3%)
- Forgot the file of the presentation: 2 (12.5%)
- Never had problems: 4 (25%)
- Other: 1 (6.3%)

- Silently flipping through the slides: 9 (56.3%)
- Speaking loud: 9 (56.3%)
- Full show mock up with projector: 1 (6.3%)
- Using recording devices to see or hear your performance: 1 (6.3%)
- With help of friends and family as mock up audience: 1 (6.3%)

Other: 1 (6.3%)
During the slideshow

How important is for you to be able to interact with the audience (ask questions or polls to the audience and get feedback) during the slideshow?

- Not important at all: 1
- Very important: 5

How important is for you to be able to interact with the audience (receive questions or comments from the audience) during the slideshow?

- Not important at all: 1
- Very important: 5
After the slideshow

How important is for you (as a presenter) to make the material of the presentation available to the audience?

<table>
<thead>
<tr>
<th>Importance Level</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Not important at all)</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>18.8%</td>
</tr>
<tr>
<td>5 (Very important)</td>
<td>5</td>
<td>31.3%</td>
</tr>
</tbody>
</table>

How many people do you estimate receiving directly or indirectly (e.g. through a person you share slides with) your slides in a year?

<table>
<thead>
<tr>
<th>Estimated Recipients</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5</td>
<td>6</td>
<td>37.5%</td>
</tr>
<tr>
<td>between 5 and 10</td>
<td>3</td>
<td>18.8%</td>
</tr>
<tr>
<td>between 10 and 20</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>between 20 and 50</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>more than 50</td>
<td>3</td>
<td>18.8%</td>
</tr>
</tbody>
</table>
Which of the following ways do you use to share slides?

- Email: 13 (81.3%)
- Facebook: 4 (25%)
- LinkedIn: 1 (6.3%)
- Slideshare: 1 (6.3%)
- Blog: 0 (0%)
- Other: 3 (18.8%)

How important is for you to keep in touch with the audience after the slideshow?

- Not important at all: 2 (12.5%)
- 2: 3 (18.8%)
- 3: 4 (25%)
- 4: 7 (43.8%)
- Very important: 5 (0%)

Which of the following ways do you use to keep in touch?

- Email: 15 (93.8%)
- Facebook: 3 (18.8%)
- LinkedIn: 1 (6.3%)
- Slideshare: 0 (0%)
- Blog: 0 (0%)
- Other: 2 (12.5%)
How important is for you to get an evaluation (on content/format/quality) of your slideshow from the audience?

![Bar chart showing importance ratings for slideshow evaluation]

- Not important at all: 1 (0%)
- 2: 4 (43.8%)
- 3: 1 (6.3%)
- 4: 4 (25%)
- Very important: 5 (25%)

Audience experience assessment

How many times do you participate to slideshows (conferences/meetings/lectures) in a year?

![Pie chart showing participation frequency]

- <5: 0 (0%)
- between 5 and 10: 5 (31.3%)
- between 10 and 15: 1 (6.3%)
- between 15 and 20: 3 (18.8%)
- >20: 7 (43.8%)
During the slideshow

How important is for you to interact with the presenter during the slideshow?

Not important at all: 1 0 0%
2 3 18.8%
3 6 37.5%
4 6 37.5%
Very important: 5 1 6.3%

Have you ever had problems with reading the projected slide on the screen?

Yes 14 87.5%
No 2 12.5%

How important is for you to take notes during the slideshow?

Not important at all: 1 1 6.3%
2 2 12.5%
3 5 31.3%
4 6 37.5%
Very important: 5 2 12.5%
After the slideshow

Do you take pictures of the projected material slide during the slideshow?

- Yes 7 (43.8%)
- No 9 (56.3%)

How important is for you to get the material of the slideshow?

- Not important at all: 1 (0%)
- 2 2 (12.5%)
- 3 2 (12.5%)
- 4 7 (43.8%)
- Very important: 5 5 (31.3%)

How often when you wanted to ask a question during the presentation or after you didn't manage?(because of time/queue too long/shyness)

- Always 1 (6.3%)
- Often 7 (43.8%)
- Sometimes 7 (43.8%)
- Never 1 (6.3%)
How important is for you to keep in touch with the presenter after the slideshow?

- Not important at all: 0 0%
- 2: 6 37.5%
- 3: 5 31.3%
- 4: 3 18.8%
- Very important: 5 2 12.5%

If you took pictures during the slideshow, then do you share these pictures with other people? If yes, which channel do you prefer?

- Public post on social networks: 2 12.5%
- Send via email, sms, private message: 9 56.3%
- I don’t share them: 6 37.5%

How often do you use services like Slideshare or similar?

- Rarely: 12 75%
- Sometimes: 3 18.8%
- Often: 1 6.3%

89
B.2 Questions post experiment

This section contains the list of asked questions after the application trial and the obtained answers. This survey aims to assess the implemented system’s features and the concept’s vision considering the initially identified user demands. The first section of the questionnaire focuses on presenter’s experience assessment while the second section focuses on the audience experience assessments and the third, and last section, focuses on collecting critiques, suggestions and possible additional requirements. Both the sections are subdivided in questions focusing on the before presentation phase, live phase and post live phase.
Presenting experience assessment

How valuable is for you to have your own "cloud" repository of presentations and be able to access them in any place at any time?

1 (Not valuable at all) 1 6.3%
2 0 0%
3 3 18.8%
4 7 43.8%
5 (Very valuable) 5 31.3%

How comfortable is to use your mobile device as a controller?

1 (Not comfortable at all) 0 0%
2 0 0%
3 3 18.8%
4 7 43.8%
5 (Very comfortable) 6 37.5%

How useful is the system feature that allows you to give a presentation without projector?

1 (Not useful at all) 0 0%
2 0 0%
3 1 6.3%
4 7 43.8%
5 (Very useful) 8 50%
How important is for you, from the presenter perspective, to be able to distribute the slides of your presentation?

1 (I don't really care) 0 0%
2 2 12.5%
3 3 18.8%
4 5 31.3%
5 (Very important) 6 37.5%

How important is for you, from the presenter perspective, to be able to deliver the audio of your presentation to the audience?

1 (I don't really care:) 0 0%
2 2 12.5%
3 5 31.3%
4 5 31.3%
5 (Very important) 4 25%

How important is for you, from the presenter point of view, to be able to deliver to your audience additional material?

1 (Not important at all) 0 0%
2 4 25%
3 2 12.5%
4 8 50%
5 (Very important) 2 12.5%

How important is for you, from the presenter point of view, to be able to push updates of your material to the audience?

<table>
<thead>
<tr>
<th>Importance Level</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Not important at all)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>25%</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>25%</td>
</tr>
<tr>
<td>5 (Very important)</td>
<td>6</td>
<td>37.5%</td>
</tr>
</tbody>
</table>

Would you use the training mode in order to rehearse before the pitch?

- Yes [14] 87.5%
- No [2] 12.5%

Would you use the social network integration for slides (e.g. Twitter, FB or LinkedIn) to interact with your audience?

- Yes [7] 46.7%
- No [8] 53.3%
Would use the presenter features of this app?

- Yeah. It’s useful.
- Yes, because they give the opportunity to involve the audience in a better way, both during and after the presentation.
- Yes make it quite easy and comfortable to present materials.
- Yes. I hate using my mouse for presentation.
- Yes, because it allows me to have full control over the presentation and recording with only one device. Only thing: if I want to use a projector, it is not clear how that projector has to be configured to be visible as a "screen" (maybe an application has to be installed on a pc?) but anyway is an operation that has to be done only once.
- Twitter sounds like a good way to answer questions and for the audience to post questions because it removes the shyness in the equation.
- Yes I would because for me it is important to rehearse before a presentation and I like the idea of the training mode.
- Yes because I can present without any projector related problems and the audio attached to the slide is an interesting idea.
- Yes. Projectorless mode can be very useful.
- Yes. Especially the audio registration. Probably I would like also to draw on the slides (with tablets or new device you can do that).
- Yes. Its very useful and easy to configure.
- Yes. Ease of use.
Audience experience assessment

How valuable is for you to have a repository of presentations you attended to on your mobile device?

1 0 0%
2 2 12.5%
3 4 25%
4 7 43.8%
5 3 18.8%

How valuable is to be able to follow the presentation from your mobile device?

1 (Not valuable at all) 0 0%
2 2 12.5%
3 4 25%
4 7 43.8%
5 (Very valuable) 3 18.8%

How valuable is to be able to interact with the slides text and activate services like translator, search engine, Youtube...?

1 (Not valuable at all) 2 12.5%
2 3 18.8%
3 1 6.3%
4 7 43.8%
5 (Very valuable) 3 18.8%
How valuable is to be able to get additional material to the slides (like links to papers, website, personal opinions...)?

<table>
<thead>
<tr>
<th>Grade</th>
<th>Value</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not important at all</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>12.5%</td>
<td></td>
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<tr>
<td>3</td>
<td>3</td>
<td>18.8%</td>
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<td>4</td>
<td>6</td>
<td>37.5%</td>
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</tr>
<tr>
<td>5</td>
<td>Very important</td>
<td>5</td>
<td>31.3%</td>
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</tbody>
</table>

Would you use the social networks (facebook and twitter) as a platform to interact (exchange opinions and explanations) with the other people in the audience and the presenter?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Yes</td>
<td>6</td>
<td>37.5%</td>
</tr>
<tr>
<td>No</td>
<td>10</td>
<td>62.5%</td>
</tr>
</tbody>
</table>

Grade the overall system

<table>
<thead>
<tr>
<th>Grade</th>
<th>Value</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Really bad</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0%</td>
<td></td>
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<tr>
<td>3</td>
<td>0</td>
<td>0%</td>
<td></td>
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<tr>
<td>4</td>
<td>12</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Really good</td>
<td>4</td>
<td>25%</td>
</tr>
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</table>
Would you use the app when in an audience?

- Yes it makes easy to use it on mobile platform.
- Yes, because it would give me the chance to have additional information about the topic that are presented.
- It depends. If I am really far from the presenter AND I cannot hear him well AND there is a feature that allows me to temporarily disable or delay the current presentation on my phone, I would totally use it. Also would be nice Evernote support or to any software that is notes related.
- Yes. To follow the presenter ideas.
- Yes if I can browse previous slides.
- Yes. For me the app is more interesting from the audience point of view.
- Yes because it is easier to follow a presentation with the use of your phone.
- Yes. Easy to follow and I may get additional material.
- Yes.
- Definitely. I used to record lectures with my phone or I spend a lot of time searching for chunk of information within the lecture so it is extremely helpful for me.
- Yes because it helps to focus on the presentation.
- Yes.
- When it is crowded.
- Yes, will be fun to try.
- Yeah.
- Yes. Ease of use.
Future works and possible features

How valuable would be a system feature allowing to send invitations to your presentations using the app?

<table>
<thead>
<tr>
<th>Value</th>
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<th>Percentage</th>
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<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0%</td>
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<tr>
<td>2</td>
<td>2</td>
<td>12.5%</td>
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<tr>
<td>3</td>
<td>4</td>
<td>25%</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>43.8%</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>18.8%</td>
</tr>
</tbody>
</table>

How valuable would be a system feature allowing you to receive slides and audio also for presentations you are invited to but cannot attend?

<table>
<thead>
<tr>
<th>Value</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>6.3%</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>37.5%</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>56.3%</td>
</tr>
</tbody>
</table>
How valuable would be a system feature allowing you to follow in "real time" a slide show (including audio) from a different location than the presenter?

![Survey Results Graph]

1 0 0%
2 1 6.3%
3 2 12.5%
4 6 37.5%
5 7 43.8%

Personal opinions and suggestions

- The overall idea of the application has a lot of potential. The idea of having both real and virtual screens is a winning one. The releasing of the screen could be done by a timer, along with the manual solution.
- The app is a smart alternative to projector slides.
- Make it available to some audience in real time to take feedback.
- Very nice.
- What I would add to the presenter app is:
  - a more clear explanation about the three steps for publishing a presentation (why three?) and which one of those can be done again and which only once.
  - the possibility to the presenter to launch rapid surveys (that can be prepared at home on presenAction app or website) at the audience so that they can interact quickly with the presenter. The shyness factor would be gone and not only the audience in front of the presenter will answer.
  - presenter app should be able to launch hashtags and subscribe to them. So that people from the audience can launch tweets with personalized hashtags that can pop directly on the screen or on a secondary screen (for example the presenter's) or both.
- Problems with presenter app:
  - Next and previous slides icons should stay hidden until I touch the screen (that is because I could not see all corners of the slide I was talking on).
- What I would add to audience app:
Interactivity features with the presenter (support for survey but also twitter which is the fastest social) - the ability to temporarily LOCK a slide. When the lock is released, the slide currently presented is displayed (back to presentation).

- DISABLE the presentation synchronization. In this mode you could see past slides. Re enabling shows current presented slide again.
- Would be useful to be able to listen with earphones the current presentation (live streaming) so that I can follow presentations from far away.
- Not anyone should be allowed to follow the presentation, but only members subscribed before a deadline specified by the presenter.
- I think this would be very helpful to me as a student. It would make my life a lot easier and my studying more efficient.
- I think that the application can be successful. I like the idea and I think it is very useful. What I didn't like is that you cannot freely look at the slides you want while the presenter speaks. I mean, the presenter rules everything. I would add a button that switch between "presenter" and "normal" modality during the presentation so that you can go behind and read something back that maybe you didn't get.
- I think the app is in general well overthoughted and a very useful tool in education. It is easy to use and has a lot of potentials be a successful future app!
- Lots of potential.
- Nice work. I think of using open cloud like google drive etc after patenting this idea.
- Well done! Improve the graphic interface and add gestures.