

INFORMATION TECHNOLOGY SYSTEM FOR ESTABLISHING INDUSTRY CONTACTS IN THE PROCESS OF ARCHITECTURAL DESIGN

Ireneusz J. JÓŹWIAK^{1*}, Alicja M. KRUPA²

¹ Military University of Land Forces, Faculty of Management, Wrocław; ireneusz.jozwiak@awl.edu.pl,
ORCID: 0000-0002-2160-7077

² Wrocław University of Science and Technology, Faculty of Architecture, Wrocław;
alicja.krupa2021@gmail.com, ORCID: 0000-0002-8796-2549

* Correspondence author

Purpose: The aim of the work is to present the concept of an application that enables people from various industries to establish contacts in the process of architectural design.

Design/methodology/approach: The best solution to the problem would be to develop and design application and implement it on Android devices.

Findings: Different types of business models will be compared with their effectiveness and popularity. In addition, the advantages and disadvantages of different strategies will be reviewed.

Research limitations/implications: The work focuses on presenting the concept of an application that facilitates establishing contacts between representatives of architecture industries.

Practical implications: This is an important issue for future users as it allows for product improvement.

Originality/value: The application can be a preliminary step to developing a conflict management strategy.

Keywords: information technology, architectural design, strategy, implementation, Android.

Category of the paper: Research paper.

1. Introduction

Along with technological progress and the development of computerization, new virtual forms of communication have emerged. All modern forms of communication, such as telephone, SMS, e-mail have a disadvantage – the lack of interaction with another human being. However, a direct conversation of a business partner is a necessary condition for an entrepreneur to establish cooperation. To solve this problem, it is necessary to offer

an IT system supporting the process of establishing industry contacts in the field of architecture. In the available literature on the subject, there are computer programs such as AutoCad (AutoCAD Web App, 2021), Revit (Revit, 2021), ArchiCad (ArchiCad, 2021). From all those programs mentioned above, only ArchiCad can model and manage building information (BIM-Building Information Modeling). After analyzing the existing solutions, no work was noticed in the field of establishing mobile industry contacts. The aim of the work is to present the concept of an application that enables people from various industries to establish contacts in the process of architectural design.

In the available literature on the subject, apart from the above-mentioned computer programs, there is no application supporting the establishment of industry contacts. The best solution to the problem would be to develop and design application implemented on Android devices (Stasiewicz, 2013). This system is the most popular system for mobile devices in Poland (Android, 2021). Its great advantage is the lack of fees or development licenses, and thus the lack of initial costs required to start the architectural design of the facility. There are four applications on the market that facilitate contacts between businessmen:

- Meeting Application (Meeting App, 2021; Google Play and Meeting App. Shop, 2021),
- IBM Conference App (IBM Conf App, 2021; Google Play and IBM Conf. App. Shop, 2021),
- EventPilot Application Conf. App. (Google Play and Event Pilot Conf., 2021; Google Play and Event Pilot Conf. Shop, 2021),
- Conference Management Application (Conf. Management, 2021; Google Play and Conf. Management, 2021),

Table 1 shows the number of downloads, average ratings, and the number of app ratings.

Table 1.

Table of the number of downloads of average ratings and the number of ratings of the application (Górski and Jamka, 2015)

	Meeting Application	IBM Conference	EventPilot	Conference Management
Number of downloads	1000-5000	1000-5000	1000-5000	100-500
Average grade [max 5]	4,2	4,4	3,2	5,0
Number of ratings	29	38	25	3

2. Functional and non-functional requirements of the application

The application is created for people representing various industries that must appear in the design process. This means, in particular, meeting new people representing various industries, establishing business contacts with them, and exchanging experiences between them. Users should be able to present their design concepts.

The user will be able to start using the platform after registering in the application by logging in, for example, on the social networking services, such as Facebook. He can also register and login with his own e-mail address and password. After logging in to the program, the user has the opportunity to see all the industries available to him. These data can be entered into the system via the website. The application will allow you to view industries and activities scope of an industry representative.

The architect designs the concept of a given building. Next, the project has to go through the hands of a constructor, environmental engineers, electrical and electronic engineers, dendrologists, geodesy engineers. Often, architects complain about difficult contact in order to conduct consultations and speed up the implementation of changes to the project. The article presents the concept of a strategy for the improvement and acceleration of contacts between various industries representatives in the field of architectural design. This system will be intended for people who may often be based in very distant places in the country or the world. Thereby, system users really need help in reaching the right person who will quickly consult the project assumptions for a given industry.

As part of the application requirements, it is necessary to define its main functionalities. Based on the analysis of existing solutions and user feedback, a list of functionalities of the platform for establishing contacts between representatives of various industries in the process of architectural design was defined:

1. user registration by entering an e-mail address and password,
2. user registration using an account on the Facebook social network,
3. viewing the profiles of other registered people,
4. adding people to the group of debaters,
5. inviting people to make contact,
6. consultation with industry representative on the details of the project,
7. the option to send an opinion on industry consultations.

The application supporting the establishment of industry contacts should consist of a mobile application and an administration panel. The mobile application should be made for the Android platform. Implementation should take place in an environment using Java and XML. This is due to the fact that it can be done easier by using libraries such as AngularJS (AngularJS, 2021). The application programming interface should be developed using the Node.js (Node.js, 2021) environment.

The basic stage of developing the technical documentation of the project is adopting the design assumptions of the application. The following are functional and non-functional requirements. The basic functional requirements include the so-called User Stories, which are a set of user requirements for the system. The first type of user is the end user, in other words, the owner of an Android phone with the appropriate application installed. Another type of user is the system administrator who manages the content available to end users via the website (Górski, and Jamka, 2015). The controller is responsible for entering and sharing information

into the app. However, the most important thing is to add a list of event participants and enter their details.

Taking into account the future development of the application, it just sounds reasonable to adopt functional requirements.

In order to ensure the proper operation of the mobile application, the basic components of the website should be implemented, without focusing on its graphic interface, but only on the selected functionality. When analyzing the existing mobile applications, the need to create an application that meets the requirements of:

- the application is to work on devices with the Android operating system installed, which is to support newer versions of the system,
- the application must have a built-in bilingual function, i.e. allow the user to switch the application language to the English version,
- the application user must have e-mail accounts configured on the phone to ensure proper operation of the application in relation to the e-mail account,
- the application user should have a Google account configured on the mobile phone to ensure the application works in relation to the functions offered by Google, such as: synchronization with the Google calendar and Google e-mail account.

The most important non-functional requirements include bilingual operation of the system, cooperation with the Google calendar and e-mail account, and compatibility with older operating systems.

The website requirements should also be mentioned. It must have a graphically friendly interface, and must meet market standards as well as be compatible with existing web browsers. It is important that the graphical interface is end-user friendly. Below are the basic rules that should be followed, to obtain a user-friendly product:

1. the application must have a transparent, intuitive and aesthetic interface,
2. the application cannot have multiple nested functions,
3. the application is to display texts in both Polish and English,
4. the application must graphically comply with the adopted norms and standards.

The product should consist of two interacting modules: the mobile application and the admin panel. In order to ensure the proper operation of all functionalities of the application, an internet connection between mobile devices and the admin panel should be ensured. The data will be transferred through the application programming interface, which is the point of information exchange between the mobile application and the server with the database.

3. Application design

The basic element of the application design is the presentation of system use cases along with their scenarios. The actors of the system, i.e. the users of the application, will also be presented. The following are the individual use cases of the system in chronological order:

- registration via Facebook,
- user registration via e-mail address,
- logging in using Facebook,
- logging in with an e-mail address,
- logging out of the mobile application,
- changing the password to the mobile application,
- event selection screen,
- viewing participants' profiles,
- selecting a participant for the meeting,
- sending an invitation to a meeting,
- viewing the participant's presentation,
- consultation with a representative of the industry on the details of the project,
- viewing the map and location of the event,
- sending the user's business card,
- displaying a page about the authors of the application,
- sending feedback about the application.

In accordance with the accepted design standards, the application must be easy to use. This means that the end user of the mobile application must be able to use the main functions easily. This approach ensures that the application will be well received by its users. Application functionality and use cases should be presented in the use case diagram as well as in the activity diagram. Due to the limited number of pages of the article, these diagrams are not presented in the article.

The database for the platform supporting the establishment of industry contacts in the field of architecture should be created in a relational scheme (Nixon, 2021; Mazur, 2004). Careful design of the database will facilitate the implementation of the system.

The proposed design of the mobile application should be implemented.

4. Implementation of a networking support platform

The proposed platform supporting establishing contacts between representatives of various industries is based on two main components: a mobile application and a website.

The application for the Android platform is the most important part of the system. It is the only item that the end user has access to. It should be developed in a native environment using Java and XML. The development tool used in the development of the application should be Android Studio, produced by Google. For version control management, we use GIT (Bell, and Beer, 2021), which is GNU GPL licensed software, and Bitbucket, which is the most popular web hosting service.

The website should be made with the use of HTML5, CSS, PHP and JavaScript (Stark, and Jepson, 2013). The library is AngularJS, which will support the development and testing of web applications based on the MVC pattern. It is suggested to use a MySQL (Nixon, 2021) database which has high speed.

The platform API should be developed based on the Hapi.js (Hapi.js, 2021) and Sequelize (Sequelize, 2021) frameworks. Their main advantage is their ease of use. Both are widely used now, which will mean supporting a large number of users.

The interface should be made available via the Heroku platform. This platform is the most commonly used solution in the case of websites that are the subject of creating an analyzed at work application. Application implementation should take place in stages presented in the literature (Android Dev., 2021; Collins, Galphin, and Keeper, 2021).

According to the recommendations for Android users (Android Dev., 2021), the application design should distinguish the following parts (Collins, Galphin and Keeper, 2021):

1. Activities.
2. Adapters.
3. Database.
4. Fragments.
5. Models.
6. Networking.
7. Util.
8. Widgets.

Implementation of the application should take place in the following stages: designing the appearance of the application and the necessary views, creating the application logic and connecting the application with the database via API. Android views are programmed in XML. Once the views were ready, the next step was to create the logic. The primary class here is the Main Activity (Main Activity, 2021) class. Operating on fragments is a big problem here. They are necessary for the developed platform to have several views. Thanks to the

implementation of the `getFragmentByTag` (`GetFragment`, 2021) method to change fragments, it was possible to switch between views, i.e. navigate through the application.

The peculiar task was to create a mechanism responsible for inviting participants to contact. It was necessary to use the built-in calendar into which the application should enter selected data. The `populateView` and `setupCalendar` methods are used here. Multilingual functionality is natively built into the system. This is described by the Android Developers website (`Android Dev.`, 2021).

The final step is to connect the application to the API to access the data in the database. This was achieved thanks to the `Gson` (`Gson`, 2021) library, which converts Java objects to their JSON (`JSOM`, 2021) representations.

The PHP language should be used to create the website backend and the application programming interface. The above-mentioned frameworks from the Node.js environment should be used for implementation.

5. Application testing

An important element in software development is testing it at every stage of design and after its completion. Testing at every stage of work allows you to avoid costly system errors. As a result, the end user will receive the product without defects. The following tests should be performed: use case testing, immunity testing from the console, and monkey tests (`Android Dev. – monkey tests`, 2021).

When testing the software, the focus was on the mobile application that has contact with the end user. The scenario of the selected test to validate registration via email is presented below as Test 1.

Test steps no. 1 are as follows:

- a. the scenario concerns the registration of an account that has already been registered,
- b. purpose of the test: validation test in validating user registration data,
- c. test method, user actions:
 - application download,
 - installing the application on a Smartphone with the Android operating system,
 - launching the Business Connector application,
 - selecting the "Register" option,
 - the data for which the account has been previously created is entered,
 - pressing the "Register" button,

- d. test method, system responses:
 - displaying a message about the installed application,
 - displaying the initial screen with registration and login options,
 - displaying the registration screen,
 - the system checks the data entered into the system and displays the loading screen,
 - the system returns to the data entry screen and displays "Please try later",
- e. evaluation of the test: positive.

The above test relates to the correct functioning of user registration to the mobile application. This is a very important step, because in order to be able to use the mobile application, you must go through the registration process. During the functioning of this functionality, the authors of the work focused on registration via e-mail accounts. This functionality was tested correctly.

Similarly, as part of conducting use case tests, you should perform the following tests: validating the entered credentials, validating that the meeting invitation was sent, validating that the business card was sent, and verifying that the application feedback was sent correctly.

The resistance tests carried out from the console are automated tests of the correct operation of the mobile application (Monkey tests). Based on the recommendations contained in the literature (Android Dev. – monkey tests, 2021), parameters were adopted that test the software at a given time of the program operation. Monkey tests are run through the console.

Manual tests of third parties are used to detect errors in the application. This method has a high cost associated with the application testing time by third parties. User-identified GUI errors are implemented immediately.

The developed application showed no errors during test implemented with the use of test scenarios and system use cases.

6. Conclusion

Due to the limited number of pages, the article does not present the details of the application development, its implementation, and testing results. The work focuses on presenting the concept of an application that facilitates establishing contacts between representatives of architecture industries.

To support the functioning of the application, a function has also been planned that allows end users to send feedback about the application. This is an important issue for future users since it makes the future improvement of the product possible. This application can be a preliminary step to developing a conflict management strategy.

References

1. *Android Developers – Guide*. Available online <http://developer.android.com/guide/index.html>, 02.11.2021.
2. *Android Developers – Monkey Tests*. Available online http://developer.android.com/tools/help/monkeyrunner_concepts.html, 02.11.2021.
3. *Android Developers – Topics*. Available online <http://developer.android.com/guide/topics/resources/localization.html>, 02.11.2021.
4. Android. *Statystyki popularności mobilnych systemów operacyjnych*. Retrieved from <http://www.tabletowo.pl/2015/11/20/gdzie-najpopularniejszy-jest-ios-a-gdzie-android>, 02.11.2021.
5. *AngularJs*. Available online <https://angularjs.org>, 02.11.2021.
6. *ArchiCad*. Available online <https://graphisoft.com/solutions/archicad>, 07.11.2021.
7. *AutoCad Web App*. Available online <https://www.autodesk.com/products/autocad-web-app/overview>, 07.11.2021.
8. Bell, P., and Beer, B. (2021). *GitHub. Przyjazny przewodnik*. Gliwice: Wydawnictwo Helion.
9. Collins, C., and Galpin, M., and Kaepler, M. (2012). *Android w praktyce*. Gliwice: Wydawnictwo Helion.
10. *Conference Management*. Available online <http://conferenceapp.in/>, 08.11.2021.
11. *Event Pilot Conference App*. Available online <http://ativsoftware.com/>, 06.11.2021.
12. *getFragmentByTag*. Available online <https://teamtreehouse.com/community/find-fragments-by-tag>, 10.11.2021.
13. *Google Play and Conference Management*. Available online <https://play.google.com/store/apps/details?id=com.pearl.conference>, 8.11.2021.
14. *Google Play and Event Pilot Conference App Shop*. Available online <https://play.google.com/store/apps/details?id=com.eventpilot.epexpress>, 05.11.2021.
15. *Google Play and IBM Conference App Shop*. Available online <https://play.google.com/store/apps/details?id=com.ibm.cio.ibmconferenceapp>, 06.11.2021.
16. *Google Play and Meeting Application Shop*. Available online <https://play.google.com/store/apps/details?id=us.appswith.meetingapplication/>, 01.10.2021.
17. Górski, O.M., and Jamka, T.B. (2015). *Mobilna platforma wspomagająca nawiązywanie kontaktów biznesowych*. Eng. Thesis. Wrocław: Wrocław University of Technology, Faculty of Computer Science and Management.
18. *Gson*. Available online <https://github.com/google/gson>, 02.11.2021.
19. *Hapi.js*. Available online <https://typeofweb.com/hapi-js-wprowadzenie>, 04.11.2021.
20. *IBM Conference App*. Available online <http://www-01.ibm.com/software/br/conference-app/>, 20.10.2021.

21. *Java Main Activity*. Available online <https://developer.android.com/guide/components/activities/intro-activities>, 08.11.2021.
22. *JSOM*. Available online <https://github.com/koltyakov/sp-jsom-node>, 20.10.2021.
23. Mazur, Z., and Mazur, H. (2004). *Projektowanie relacyjnych baz danych*. Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej.
24. *Meeting App*. Available online <https://meetingapplication.pl>, 20.10.2021.
25. Nixon, R. (2021). *PHP, MySQL i JavaScript. Wprowadzenie*. Gliwice: Wydawnictwo Helion.
26. *Node.js*. Available online <https://nodejs.org/en/>, 03.11.2021.
27. *Revit*. Available online <https://www.autodesk.pl/products/revit/overview?term=1-YEAR&tab=subscription>, 07.11.2021.
28. *Sequelize*. Available online <https://sequelize.org>, 20.10.2021.
29. Stark, J., and Jepson, B. (2013). *Android- Tworzenie aplikacji w oparciu o HTML, CSS i JavaScript*. Gliwice: Wydawnictwo Helion.
30. Stasiewicz, A. (2013). *Android – podstawy tworzenia aplikacji*. Gliwice: Wydawnictwo Helion.