

# CLIMBBOOK: PLATFORMA ZA UPRAVLJANJE PENJAČKIM DVORANAMA

## *CLIMBBOOK: PLATFORM FOR MANAGING CLIMBING GYMS*

Mario Tušek<sup>1</sup>, Željko Kovačević<sup>2</sup>, Aleksandar Stojanović<sup>2</sup>

*1 Zagreb University of Applied Sciences, Vrbik 8, 10000 Zagreb, Croatia, Student*

*2 Zagreb University of Applied Sciences, Vrbik 8, 10000 Zagreb, Croatia*

### SAŽETAK

Ovaj rad predstavlja ClimbBook, sveobuhvatnu platformu dizajniranu za upravljanje penjačkim dvoranama. Cilj je platforme unaprjeđenje operativne učinkovitosti, sigurnosnih protokola i korisničkog iskustva. Sastoji se od modularne arhitekture koja koristi ASP.NET Core okvir i SQL Server baze podataka, omogućujući skalabilnost i prilagodljivost različitim dvoranama. Ključne prednosti platforme uključuju automatizirano rezerviranje i zakazivanje, praćenje opreme u stvarnom vremenu te integraciju korisničkih povratnih informacija, čime se pojednostavljuje upravljanje dvoranom i doprinosi profesionalizaciji penjanja kao sporta. Platforma koristi najnovije Microsoft tehnologije za optimizaciju poslovanja. Svojom skalabilnošću i fleksibilnošću omogućuje vođenje svih poslovnih procesa, uključujući dolazak korisnika, uređivanje penjačkih smjerova i upravljanje tečajevima, te pruža dodatnu vrijednost kroz SQL Server Reporting Services sustav. Platforma također koristi SQL Server Integration Services za izvoz podataka prema korisnicima, a kroz rad je opisano i kako platforma može transformirati upravljanje penjačkim dvoranama kroz povećanu operativnu učinkovitost i analitičku preciznost.

**Ključne riječi:** *upravljanje penjačkim dvoranama, automatizirano zakazivanje, operativna učinkovitost, ASP.NET Core, SQL Server Integration Services*

### ABSTRACT

This paper introduces ClimbBook, a comprehensive platform designed for managing climbing gyms. The platform aims to improve operational efficiency, security protocols, and user experience. It consists of a modular architecture that uses the ASP.NET Core framework and SQL Server databases, providing scalability and adaptability to different gyms. The platform's key advantages include automated booking and scheduling, real-time equipment tracking, and user feedback integration, which simplify gym management and contribute to the professionalization of climbing as a sport. The platform uses the latest Microsoft technologies to optimize operations. Its scalability and flexibility enable the management of all business processes, including user entry, route setting, and course management, while adding value through the SQL Server Reporting Services system. The platform also uses SQL Server Integration Services for data export to users, and the paper also describes how the platform can transform climbing gym management through increased operational efficiency and analytical precision.

**Keywords:** *climbing gym management, automated scheduling, operational efficiency, ASP.NET Core, SQL Server Integration Services*

## 1. UVOD

### 1. INTRODUCTION

In the rapidly growing field of indoor sports, climbing gyms represent a significant segment that combines recreational activity with rigorous physical challenges. Managing these facilities presents unique complexities ranging from security and equipment maintenance to user engagement and resource allocation. As interest in climbing continues to grow, fuelled in part by its inclusion in the Olympic Games, the need for robust, specialized management systems has become essential.

This paper presents a comprehensive application designed specifically for the management of a climbing gym. The system uses the principles of modern information and software engineering to offer solutions that improve the user experience. By addressing the specific needs of climbing facilities, this application not only simplifies management tasks, but also contributes to the growth and professionalization of climbing as a sport.

Climbing gym management research is primarily focused on optimizing gym operations, improving user experience, and integrating technology for improved service delivery [1]. Some studies [2, 3] have investigated the role of digital platforms in streamlining gym operations, suggesting significant improvements in planning, membership management, and equipment tracking. Another key area of analysis is user engagement and retention strategies, with works such as [4, 5] highlighting that targeted marketing and community building practices can increase gym attendance and loyalty. Technological advances, especially in the field of mobile applications and user interface design, have been extensively explored in [6, 7] which propose models for interactive platforms that not only facilitate transactional activities, but also enrich the user experience by providing personalized training modules and progress tracking. Together, these works establish a framework for the development of comprehensive digital solutions, such as ClimbBook, specifically built for the climbing gym sector, addressing both managerial and client needs.

The ClimbBook platform, although specifically built for climbing gyms, shares several technical similarities with general business management

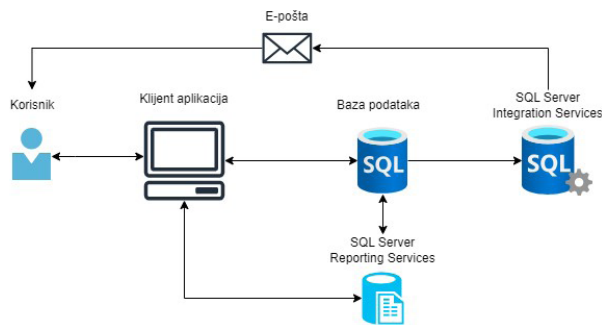
systems and platforms used in the tourism sector. Just as business management tools streamline operations through features such as resource allocation, employee scheduling, and customer relationship management [8], ClimbBook integrates these functions to improve gym efficiency and customer service. Similarly, its user interface and engagement features mirror those found in tourism activity platforms [9], which facilitate bookings, provide personalized recommendations and track user preferences to improve the overall user experience. This crossover of technical features confirms ClimbBook's versatility and adaptability in addressing the specialized needs of climbing gyms while leveraging proven technologies from other industries. This paper describes in detail the architecture of the system and its basic modules. Its goal is to contribute to the literature on sports facility management by providing a customized, efficient solution that is comparable to existing systems.

## 2. ARHITEKTURA SUSTAVA

### 2. SYSTEM ARCHITECTURE

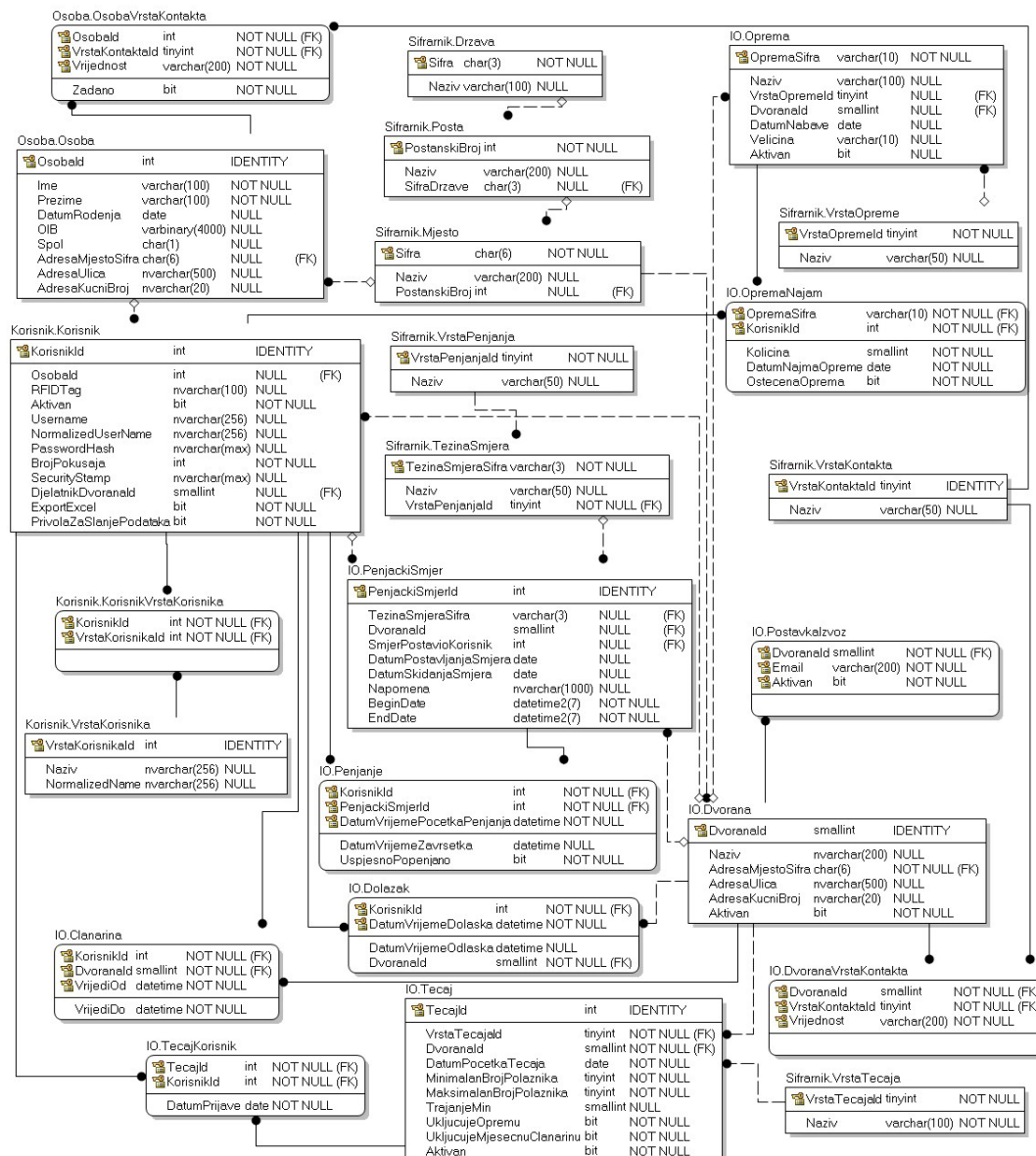
The system consists entirely of Microsoft solutions. The client application with which the user interacts was created as a web application applying the Model–View–Controller (MVC) pattern of software architecture [10] using the ASP.NET Core programming framework [11] and Microsoft Visual Studio 2022 tools. To create the graphic part of the interface, the Razor syntax and the JavaScript programming language is additionally used. A database is used for data storage and all business logic, and it is also the most important part of the system architecture. Communication between the web application and the database takes place using the Entity Framework Core plug-in. The database is developed on the relational database management system (RDBMS) Microsoft SQL Server 2019. In order to add value to the data stored in the database, the system uses reports that are managed using the SQL Server Reporting Services (SSRS) system. The mentioned system communicates with the client application, and at the request of the user, the requested reports are delivered to the client application. In addition to reports, the system also uses the SQL Server Integration Services (SSIS) platform to retrieve different sets of data, which

are then delivered to specific users via e-mail. The architecture of the mentioned system is shown in Figure 1.

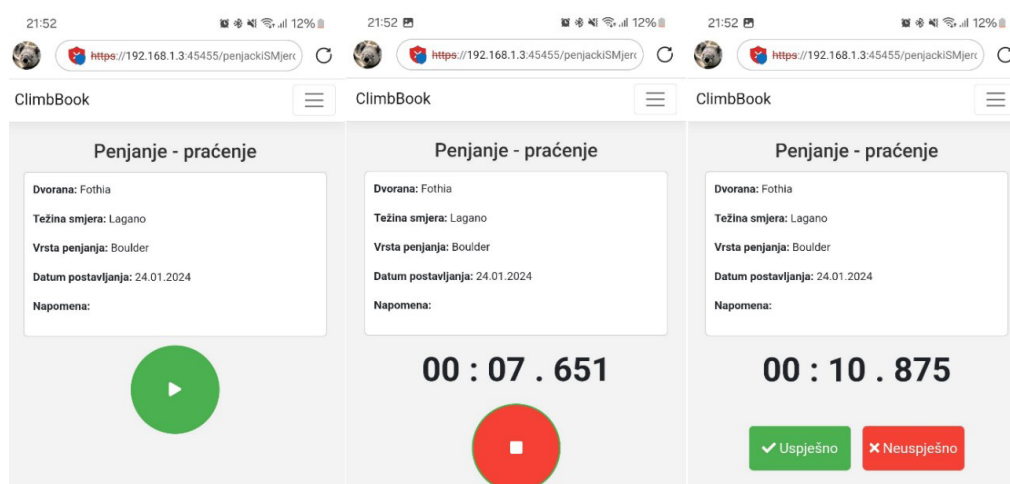


Slika 1 Arhitektura sustava  
Figure 1 System architecture

The database development is founded on three business processes that take place within climbing halls. The first business process is the arrival of users in the hall. The mentioned process starts from the moment the user arrives at the climbing hall until they leave the hall. Throughout the process, user-related tables, membership fees and user climbing records are used. Another business process is focused on arranging the climbing routes in the hall. Editing climbing routes is actually a process of parallel preparation of climbing walls and their administration through the system. Data on employees and climbing directions are used within the mentioned process. The third business process is related to



Slika 2 Fizički podatkovni model  
Figure 2 Physical data model



*Slika 3 Evidencija penjanja*

*Figure 3 Climbing recording*

attending courses. In order to enable the course management, the database contains tables related to courses and links to users so that they can attend courses. For the purpose of organization and easier administration, objects within the database are divided into five schemas, while data management is carried out through stored procedures divided by tables and the actions they perform. Figure 2 shows the physical data model of the system that meets all the business processes mentioned.

### 3. ISTAKNUTE FUNKCIONALNOSTI NOVOG SUSTAVA

#### 3. SELECTED FUNCTIONALITIES OF THE NEW SYSTEM

The task of this platform is to facilitate the administration of climbing gyms, and at the same time provide gym participants with detailed monitoring of their personal development. The platform consists of several important functionalities, namely a client application that is divided by roles, a reporting system and a data export system.

#### 3.1. KLIJENT APLIKACIJA

##### 3.1. CLIENT APPLICATION

Some of the key functionalities managed by the halls are users, courses, rental of climbing equipment and administration of climbing routes. In order to collect as much data as possible and thereby increase the value of the platform,

when arriving and leaving the hall, users log in and out using radio-frequency identification (RFID) cards. When the gym members start their training, before each start, they scan the QR code next to the climbing direction they have chosen. Opening the scanned QR code link displays the web application interface using GET calls and parameters related to the selected climbing direction. Once the user is ready to climb, they start the counter by pressing the green button and stop it when finished by pressing the red button. After stopping the counter, a selection appears to define whether the climbing was successful or unsuccessful. Figure 3 shows the listed steps through the web application.

### 4. REZULTATI

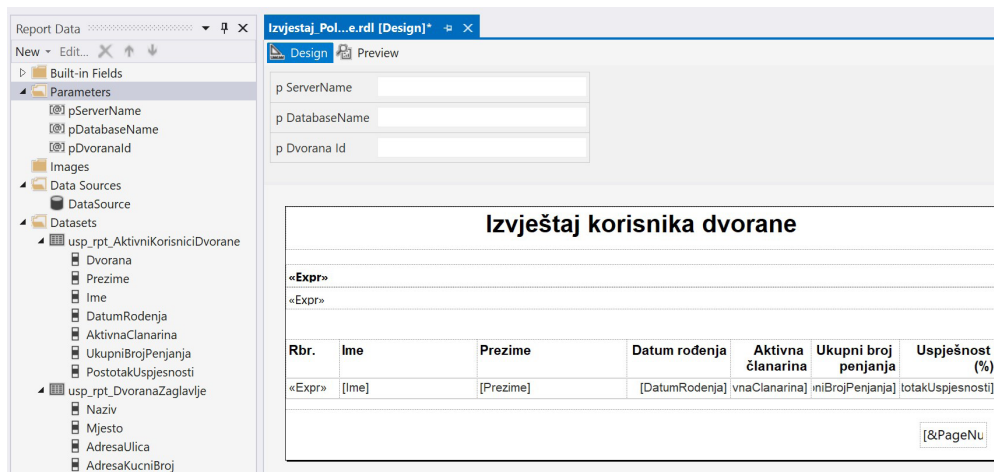
#### 4. RESULTS

The result of this work is a platform that enables the management of climbing halls and the simultaneous collection of data by clients with the aim of delivering various analytical reports. Below is a description of the options provided by the reporting system and the purpose and goal of exporting the processed data.

#### 4.1. IZVJEŠTAJI

##### 4.1. REPORTS

The paper consists of two reports, for which the SQL Server Reporting Services (SSRS) system was used for display and creation. It is a Microsoft system that enables creation, management and



*Slika 4 Dizajn izvještaja korisnika dvorane*

*Figure 4 Design of the gym user report*

publication of reports. It consists of three main components: Windows service, report catalogue and online portal. In addition to the above, it also contains 2 databases where information such as the name and description of the report, parameters, launch properties and the data needed to connect to data sources can be found. Using the online portal, or online application, it is possible to publish reports, export reports in different formats, and customize the subscription and delivery of reports [12].

The gym user report is created by the gym employees and through it data for all gym users who are active within the application and have at least one climb in the last year are visible. The report consists of a header, the name of the hall for which the report was prepared, the date and time of printing the report, and details about the individual user of the hall. In the details, the serial number of records on the report, name, surname and date of birth, membership fee status, the total number of climbs by the user in the last year and the percentage of successfully climbed directions are available. Data retrieval is carried out through 2 datasets. The data set "usp\_rpt\_DvoranaZaglavlje" is used to retrieve data about the hall and always contains only one line, while the data set "usp\_rpt\_AktivniKorisniciDvorane" is used to retrieve hall users. Figure 4 shows the design of the mentioned report together with parameters, data source and data sets and their fields.

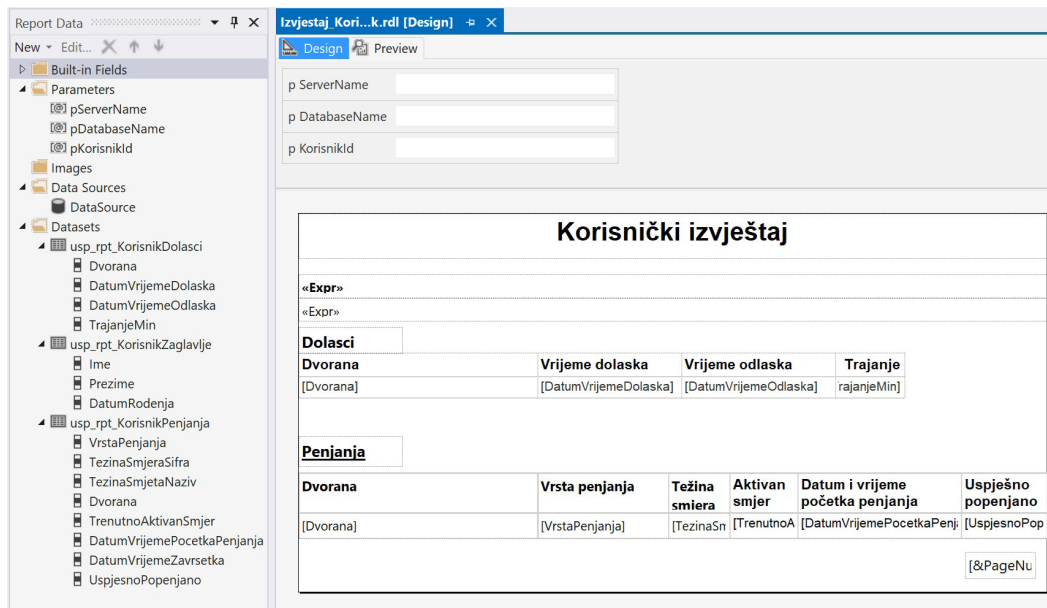
The second report entitled "User report" is intended for the gym users. The said report consists of two parts. The first part shows data on the arrivals of users in the halls, while the second part shows

the climbing of users in the climbing halls. The report receives a parameter called "@pKorisnikId" which is used to retrieve data for only one user, i.e., the one who is logged into the application. It consists of three data sets. The data set named "usp\_rpt\_UserHeader" is used to retrieve the personal data of the user who initiated the report and is used in the report header. The data set "usp\_rpt\_KorisnikDolasci" retrieves data on user arrivals in climbing halls, and here all arrivals related to the user who opened the report are retrieved without restrictions. The last dataset named "usp\_rpt\_ClimbingUser" retrieves the climbing data for the selected user, also without limits. Figure 5 shows the design of the said report.

#### 4.2. IZVOZ PODATAKA 4.2. DATA EXPORT

In order to increase the value of the data entered into the database, as part of this work, the possibility of data export using the SQL Server Integration Services (SSIS) platform was created. Three packages were created using the mentioned platform. The purpose of the package is to periodically retrieve data from the database using stored procedures in order to process it and send an email to users based on it. In accordance with the above, three packages were created under the names "ClanarinaObavijest.dtsx", "ExportVanjskimSaradnicima.dtsx" and "KorisniciIzvjestaji.dtsx".

The package called "ClanarinaObavijest.dtsx" is used to inform users about the expiration of the membership fee. It is important that the users of



Slika 5 Dizajn korisničkog izvještaja

Figure 5 User report design

the climbing hall are informed about its expiry in a timely manner so that they can extend it in time. The notification is sent to all active users whose membership fee expires within the next five days. In addition to the stated condition, the user must have an e-mail entered and it must be set as the default channel for communication. In the event that the user has an active membership fee in several different climbing halls that is about to expire, he will receive a separate notification via e-mail for each of them. In this paper, checking membership fees and sending notifications is defined to be implemented every day at 7:00 a.m., which means that the user whose membership fee expires will receive a notification about the expiration of the membership fee every day until it is extended or expires.

It is assumed that a certain group of users who attend climbing halls will have the desire and knowledge to analyse their achievements in more detail. For this purpose, an SSIS package called "KorisniciIzvjestaji.dtsx" was created, the purpose of which is to retrieve certain user data for the last year and deliver it to the user via e-mail in Excel format. There are two sheets in the specified file that is delivered to the user. The first contains data on arrivals and departures from the gym, while the second contains data on climbing. In case the user uses several climbing halls, the data can be filtered by the column containing the name of the climbing hall. The sending of the report in this paper is prepared in such a way that every Sunday

at 10:00 PM the report is sent to users who have subscribed to it.

Climbing is a skill that, in addition to recreational purposes, can also be used to rescue people from hard-to-reach areas. In Croatia, the association Croatian Mountain Rescue Service (HGSS) operates, one of whose goals is precisely this type of rescue. In order to help certain users of the system to become members of an association such as HGSS and to help the mentioned associations and some third parties find potential candidates, in this paper an SSIS package named "ExportVanjskimSuradnicima.dtsx" was created for the export of hall data to contracted third parties. Each hall has the option of defining to which third parties their data will be exported and whether it will be exported at all. In addition to the above, the consent of the system user is required to send any data. Only climbing data entered in the last 2 years is exported. Data is delivered via email, similar to previous SSIS packages, with an Excel file containing a single sheet called "Statistics".

## 5. ZAKLJUČAK

### 5. CONCLUSION

The ClimbBook platform offers a comprehensive solution for the climbing halls management, providing a modular and scalable architecture that allows easy adaptation to different types

and sizes of halls. By integrating the latest Microsoft technologies, such as ASP.NET Core and SQL Server databases, the platform improves operational efficiency, security protocols and user experience. In addition to improving operational efficiency, the platform also enables deeper analytical insight into the business processes of climbing halls. The platform with all the previously described tools helps not only in improving the current state of business, but also in strategic planning for future growth and development. Negative aspects of implementation may include the complexity of implementing the system for smaller halls with limited resources. However, the platform can still be adapted to the needs of users through modular design and flexibility. Further development of the platform will focus on integrating more advanced analytical tools, automating security protocols and expanding system functionality to further improve operational aspects and provide users with an optimal experience.

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### 6. REFERENCES

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**AUTORI · AUTHORS**

• **Mario Tušek** - Završio preddiplomski stručni studij Primjena informacijske tehnologiju u poslovanju na Fakultetu organizacije i informatike u Varaždinu. Trenutno izvanredni student diplomskog stručnog studija informatike na Tehničkom veleučilištu u Zagrebu. Stekao višegodišnje iskustvo s Microsoft tehnologijama radeći na poziciji programera stolnih aplikacija te nakon toga na poziciji SQL programera. Slobodno vrijeme posvećuje istraživanju i nadopuni znanja iz područja razvoja i optimizacije baza podataka.



• **Željko Kovačević** - Biografija autora nalazi se na web stranicama <https://nastava.tvz.hr/zkovacevic/>.

**Korespondencija · Correspondence**

zeljko.kovacevic@tvz.hr



• **Aleksandar Stojanović** - Nepromijenjena biografija nalazi u časopisu P&D, Svezak. 11, Br. 4 iz 2023. godine.

**Korespondencija · Correspondence**

aleksandar.stojanovic@tvz.hr