



Univerzitet u Novom Sadu  
Fakultet tehničkih nauka u Novom Sadu



# **Razvoj *rent a car* aplikacije i definisanje produkcionog okruženja korišćenjem različitih AWS servisa**

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Jelena Nedović - PR58/2016

# Sadržaj

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- Uvod
- Stanje u oblasti
- Korišćene tehnike i tehnologije
- Specifikacija sistema
- Implementacija sistema
  - Klijentska strana
  - Serverska aplikacija
  - Baza podataka
- Prikaz implementiranog rešenja
- Zaključak

# Uvod

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- **Razvoj turizma**

- putovanja u svrhu trgovine, osvajanja ili širenja verskih učenja
- obrazovne svrhe
- *Thomas Cook* – prvo komercijalno turističko putovanje i prva turistička agencija
- masovni turizam (nova tehnička otkrića, razvoj informacionih tehnologija)

- **Osnovni motiv**

- pružanje mogućnosti korisniku da odabere najpovoljnije ponude leta ili iznajmljivanja automobila u skladu sa njegovim željama i mogućnostima



# Uvod

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- **Tema rada**

- razvoj dela sistema koji predstavlja aplikaciju *Rent a car* servis i zajednički delovi sa aplikacijom Avio-kompanija servisom

- **Glavni cilj**

- izrada veb aplikacije *Rent a car* servis koja omogućava prijavljenim registrovanim korisnicima da pronađu i rezervišu željeni automobil za željeni period i destinaciju uz *online* plaćanje
- Danas, u svetu digitalne tehnologije i interneta kada su personalni računari i telefoni lako dostupni ljudi se sve više okreću *online* načinu traženja potrebnih informacija i usluga. Iz tog razloga razvijena je veb aplikacija kojoj korisnik može lako da pristupi uz pomoć već pomenutih uređaja uz ograničenje da korisnici moraju imati pristup internetu.



# Stanje u oblasti

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- Danas postoje brojne sajtovi s različitim vrstama oglasa za *online* rezervisanje i plaćanje rezervacije
- Najveću sigurnost daju već poznati i afirmisani sajtovi za rezervisanje karata za letove, autobuse, vozove, iznajmljivanje automobila ili mesta za boravak
- **Postojeći sajtovi za iznajmljivanje automobila**
  1. *Booking*
  2. *Momondo*
  3. *Kiwi*
  4. *Skyscanner*



# Stanje u oblasti

- Kiwi sajt za iznajmljivanje automobila

## Let's find your ideal car

Pick-up Location

Belgrade, Central Serbia, Serbia

☒ Drop car off at different location

Drop-off Location

Novi Sad, Vojvodina, Serbia

Pick-up Date:

Thu 11 Feb 2021

10 15

Drop-off Date:

Fri 19 Feb 2021

10 00

☐ Driver aged between 30 – 65?

Driver's age 30

Purpose of rental (optional) ☐ Business ☒ Leisure

- ☒ No credit card fees
- ☒ No amendment fees
- ☒ 24/7 phone support

Search



Cars

In partnership with [Rentalcars.com](#)

€ Euro

English

Manage booking

Let's find your ideal car

Pick-up [Change](#)

Belgrade

Thu 11 Feb 21

10 15

Drop-off

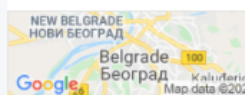
Novi Sad

Fri 19 Feb 21

10 00

Search

Location Information



Filter pick up location:

Showing all pick up locations

Filter drop off location:

Showing all drop off locations

Supplier

☐ Avis

Pick-up  
Belgrade

11 Thu 10 :15

Drop-off  
Novi Sad

19 Fri 10 :00

	Economy cars	Intermediate cars	Compact cars	SUVs	Estate cars	Conv
All Cars						
	5 Seats 1 Large bag 1 Small bag	5 Seats 2 Large bags 1 Small bag	5 Seats 2 Large bags	5 Seats 3 Large bags	5 Seats 3 Large bags	4 Seats
	From 116,37 €	From 121,13 €	From 140,71 €	From 158,22 €	From 215,87 €	From

**Opel Corsa** or Similar

- 5 Seats
- 1 Large bag
- Air Conditioning
- 4 Doors
- 1 Small bag
- Automatic gearbox

Economy

**Special Offer:**  
Price includes winter tyres fee

Price for 8 days:  
**116,37 €**

Free Cancellation

Supplied by:

**AVIS** Avis Rental terms

8.1 Excellent (500+ reviews)

Fuel Policy: Like for Like

Mileage: Unlimited

Belgrade Airport

Included in the price:

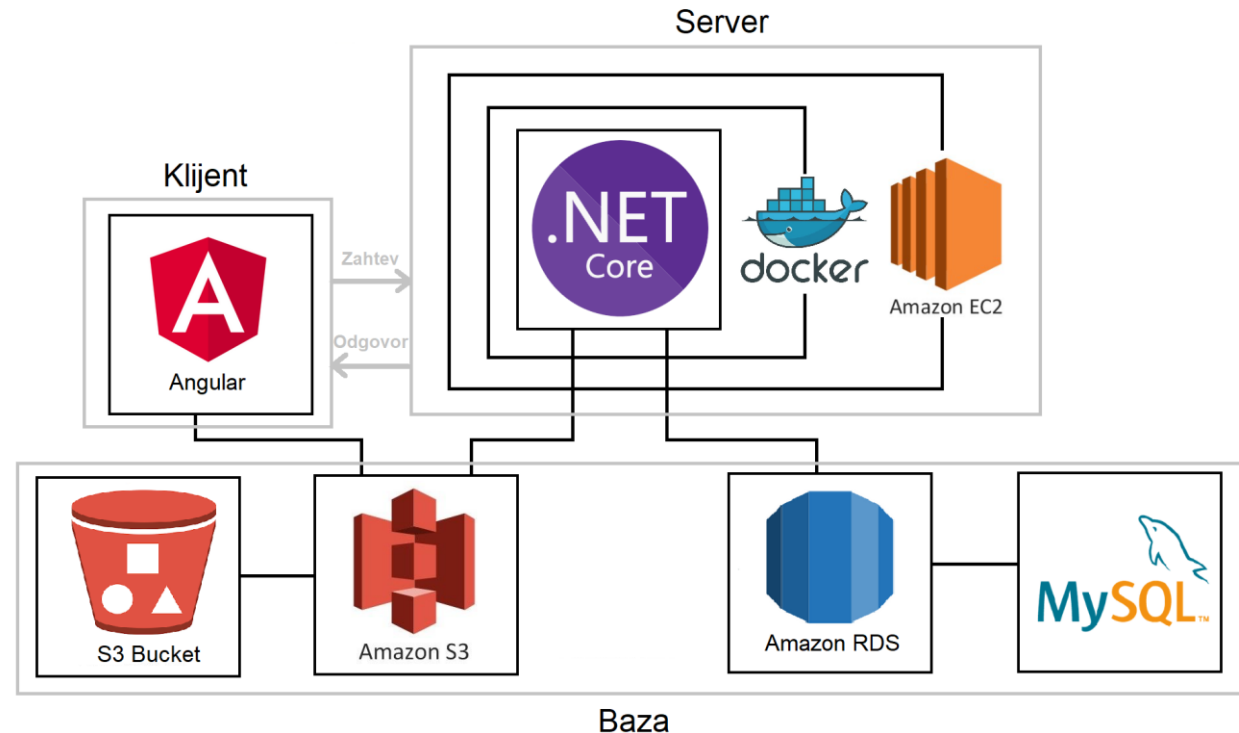
- Cancellation
- Amendments
- Theft Protection
- Collision Damage Waiver

[View deal](#)

[Save for later](#)

# Korišćene tehnike i tehnologije

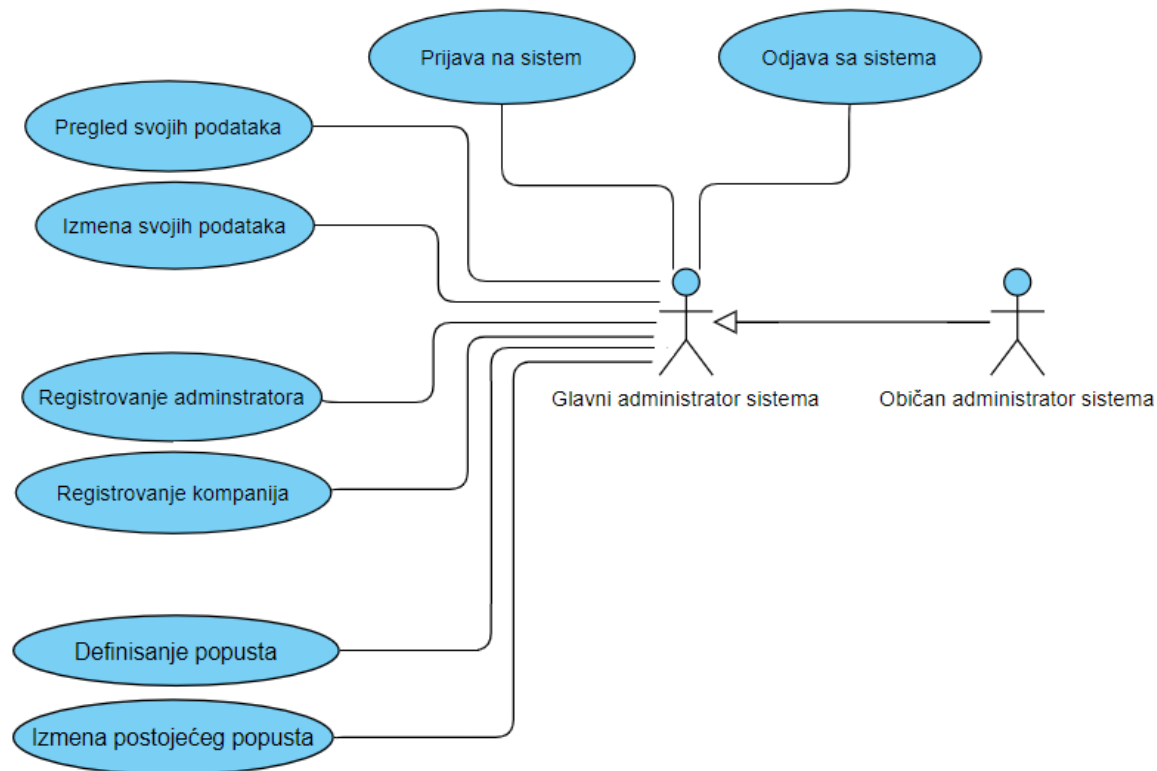
- Struktura ovog sistema sastavljena je od klijentske i serverske strane i baze podataka
- Klijentska i serverska strana su povezani pomoću REST-a
- **Klijentska strana**
  - *Angular 9*
- **Serverska strana**
  - *ASP.NET Core Framework*
  - *Docker (i Kubernetes)*
  - *AWS EC2*
  - *Entity Framework Core*
- **Baza podataka**
  - *AWS RDS MySQL*
  - *AWS S3*



# Specifikacija sistema

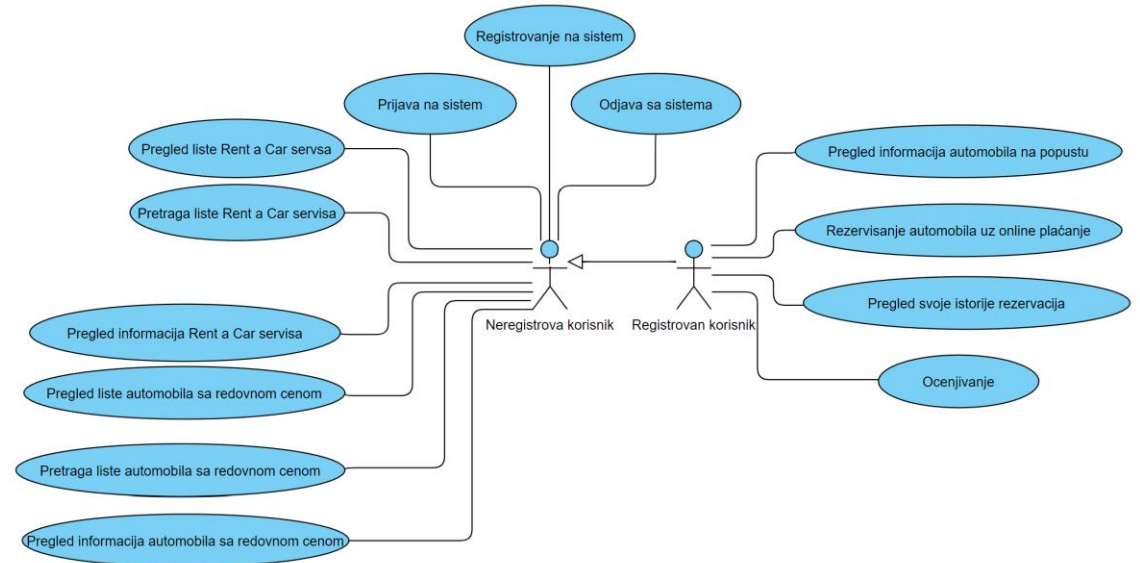
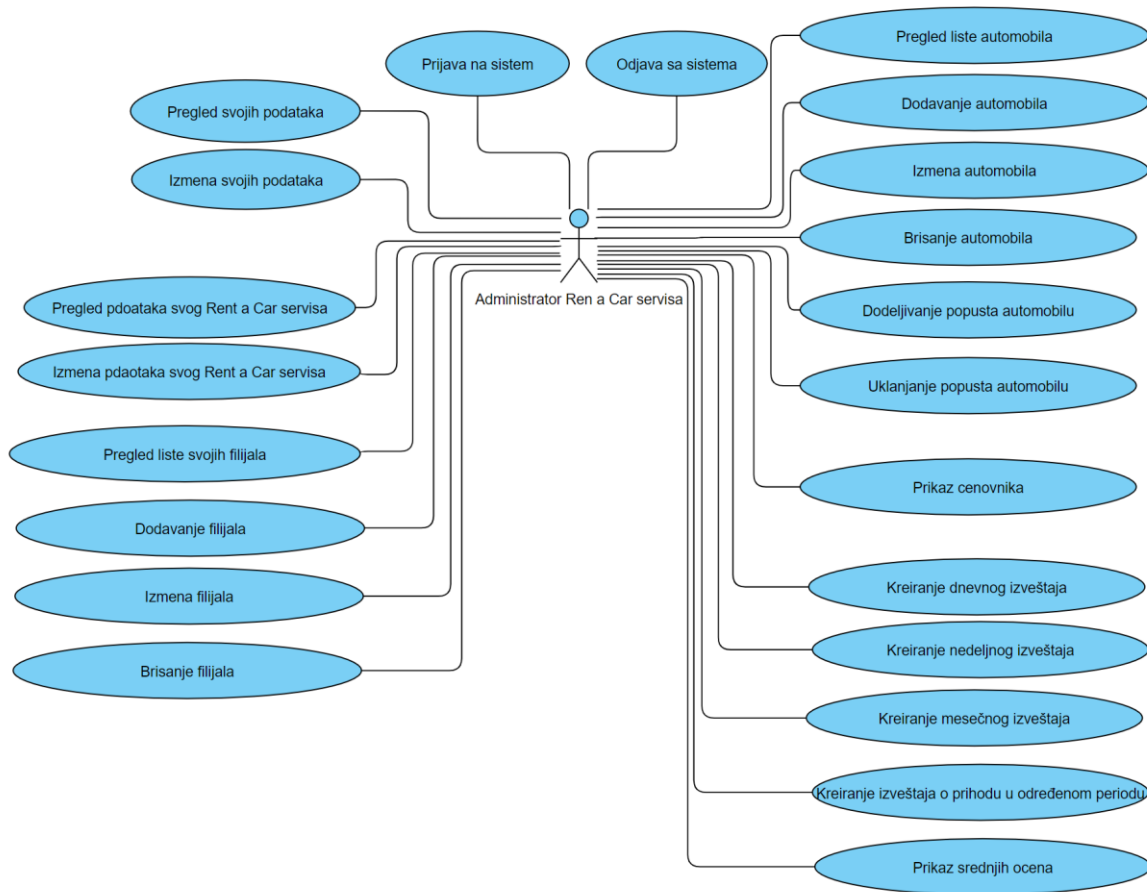
- **Aplikacija podržava šest tipova korisnika:**

1. Glavni administrator Sistema
2. Običan administrator Sistema
3. Administrator avio-kompanije
4. Administrator *Rent a car* servisa
5. Registrovan korisnik
6. Neregistrovan korisnik





# Specifikacija sistema



# Implementacija sistema

- **Klijentska aplikacija**

- Navigacija između različitih prikaza:

Rutiranje + *Guard*

```
{ path: "cars", component: CarsComponent,  
  canActivate: [AuthGuard],  
  data:{ roles: ['REG', 'UNREG'] }  
}
```

```
const roles = next.data[ 'roles' ] as Array<string>;  
  
if (localStorage.getItem('token') != null) {  
  const decodedToken = jwt_decode(localStorage.getItem('token'));  
  const userRole = decodedToken['role'];  
  var contains = roles.includes(userRole);  
  
  if (contains && userRole === 'REG') {  
    return true;  
  } else if (contains && userRole === 'ADMIN_CS') {  
    return true;  
  } else if (contains && userRole === 'ADMIN_SYS') {  
    return true;  
  } else if (contains && userRole === 'ADMIN_AC') {  
    return true;  
  } else if (contains && userRole === 'ADMIN_SYS_ONE') {  
    return true;  
  }  
} else {  
  if (roles.includes('UNREG'))  
    return true;  
}
```

# Implementacija sistema

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- Slanje HTTP *post* zahteva

```
register() {  
    var myLocation = new Location();  
    myLocation.id_Location = 0;  
    if(this.registerForm.value.inputAddressCity != null && this.registerForm.value.inputAddressCity != '')  
        myLocation.addressCity = this.registerForm.value.inputAddressCity;  
  
    var body = {  
        Email: this.registerForm.value.inputEmail,  
        Username: this.registerForm.value.inputUsername,  
        Password: this.registerForm.value.passwords.inputPassword,  
        FirstName: this.registerForm.value.inputFirstName,  
        LastName: this.registerForm.value.inputLastName,  
        MyLocation: myLocation,  
        PhoneNumber: this.registerForm.value.inputPhoneNumber,  
        Role: "REG"  
    };  
  
    return this.http.post(this.sharedService.BaseURI_CarsService + '/Register_and_SignIn/Register', body);  
}
```

# Implementacija sistema

---

- Obraćanje S3 u čijem *bucket*-u su smeštene statičke slike koje se prikazuju na stranicama. Pristupa im se preko *Object* URI-a koji predstavlja jedinstvene putanje objekta.

putanja = standardni prtokol + naziv *bucket-a* + *RegionEndpoint-a* + *amazonaws.com*  
+ putanja u okviru *bucket-a*



# Implementacija sistema

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- **Serverska strana**

- Serverska aplikacija se sastoji od tri servisa, *Rent a car* servisa, *Airline-Company* servisa i servisa za rad sa popustima
- Uloge u sistemu su bitne da bi se obezbedilo da samo autorizovani korisnici mogu da pristupe određenim podacima ili da izvrše neku akciju

```
[Authorize(AuthenticationSchemes = JwtBearerDefaults.AuthenticationScheme)]  
[Authorize(Roles = "REG")]
```

- **Postavljanje slike u S3 bucket**

```
using (new AmazonS3Client(_awsAccessKey, _awsSecretKey, RegionEndpoint.USEast2))  
{  
    var putObjectRequest = new PutObjectRequest  
    {  
        BucketName = _awsBucketName, CannedACL = S3CannedACL.PublicRead, Key =  
            string.Format("BackendImages/Users/{0}", model.UserName)  
    };  
    using (var ms = new MemoryStream(bytes))  
    {  
        putObjectRequest.InputStream = ms;  
        await client.PutObjectAsync(putObjectRequest);  
    }  
}
```

# Implementacija sistema

- Implementacija online plaćanja rezervacije

```
var optionsToken = new TokenCreateOptions
{
    Card = new CreditCardOptions
    {
        Number = model.CardNumber,
        ExpMonth = model.CardExpMonth,
        ExpYear = model.CardExpYear,
        Cvc = model.CardVerificationCode
    }
};

var serviceToken = new TokenService();
Token stripeToken = await
serviceToken.CreateAsync(optionsToken);
```

```
var options = new ChargeCreateOptions
{
    Amount = model.TotalPrice * 100,
    Currency = "USD",
    Description = "Prepay for a car rental.",
    Source = stripeToken.Id
};

var service = new ChargeService();
Charge charge = await
service.CreateAsync(options);

if (charge.Paid)
{
    return Ok(resultAdd.Entity);
}
else
{
    IdentityError[] errors = new IdentityError[]
    { new IdentityError { Code = "Error", Description
= "Payment - failed" } };
    return IdentityResult.Failed(errors);
}
```

# Implementacija sistema

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- **Lokalno** - kreirani su *Linux Docker* kontejneri i *Kubernetes* programski paketi za orkestraciju kontejnera i *Docker* slike koje su servirane u lokalnim kontejnerima koristeći *Kubernetes*
  - Fajlovi: *docker* fajl, *.yml* fajl i *.yaml* fajl
  - Koraci: - kreiranje i pokretanje najnovijih *Docker* slika i kontejnera za sve servise
    - kreiranje *Kubernetes .yaml* fajl na osnovu *.yml* fajla
    - kreiranje *Kubernetes* klastera iz *.yaml* fajla koji izvršava aplikaciju
- **Cloud** - serverska aplikacija je postavljena i pokrenuta na *AWS cloud-u*
  - Kreiranje EC2 instance - *t2.micro*
    - *Security* grupa - omogućava dolazne saobraćaje (SSH, HTTP, HTTPS, CustomTCP)
  - Koraci: - instaliranje i pokretanje *Docker-a*
    - kloniranje izvornog koda serverske aplikacije
    - kreiranje i pokretanje najnovijih *Docker* slika i kontejnera za sve servise



# Implementacija sistema

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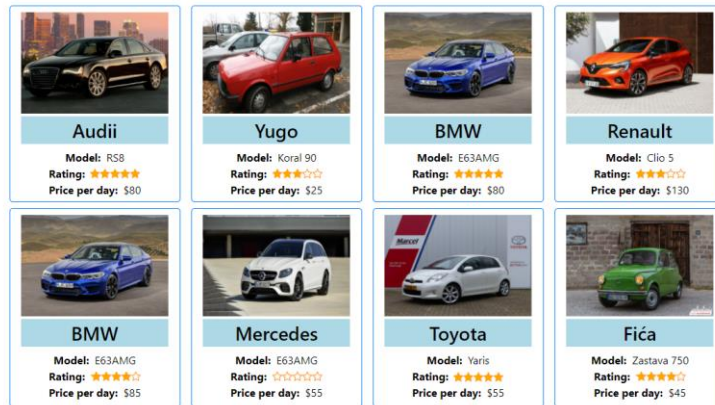
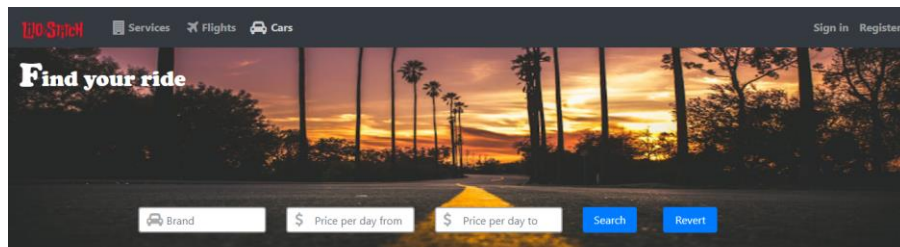
- **Baza podataka** - Amazon RDS baza podataka kojoj pristupa serverska strana
  - Kreiranje RDS instance (MySQL *engine*) - *db.t2.micro*
    - *Security* grupa - omogućava dolazne saobraćaje (MySQL/Aurora)
  - Konektovanje na neki od vizuelnih alata (*endpoint*, port, *Matser User*)
  - Izvršavanje migracija za kreiranje i inicijalizaciju baze



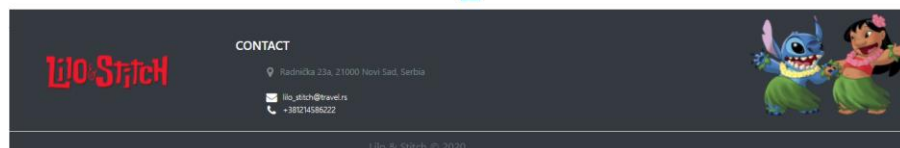


# Prikaz implementiranog rešenja

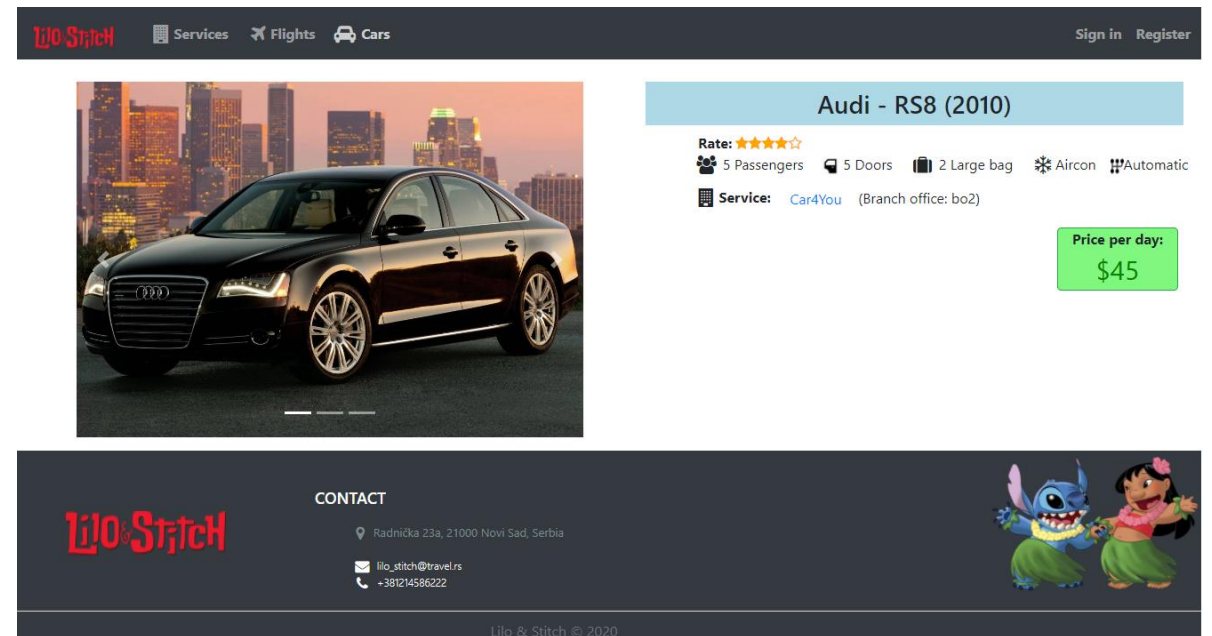
- Stranica za prikaz liste automobila



« Previous 1 2 Next »

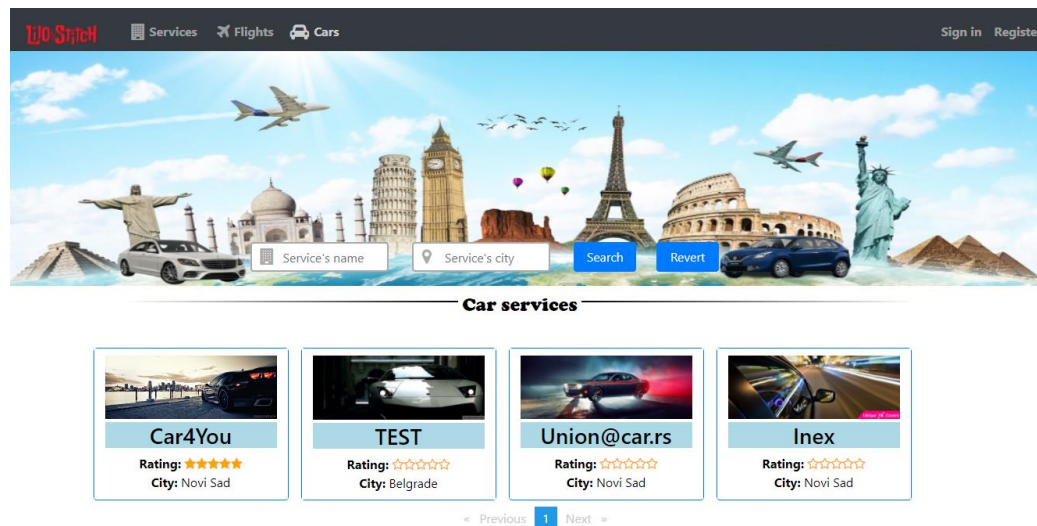


- Stranica za prikaz informacija automobila

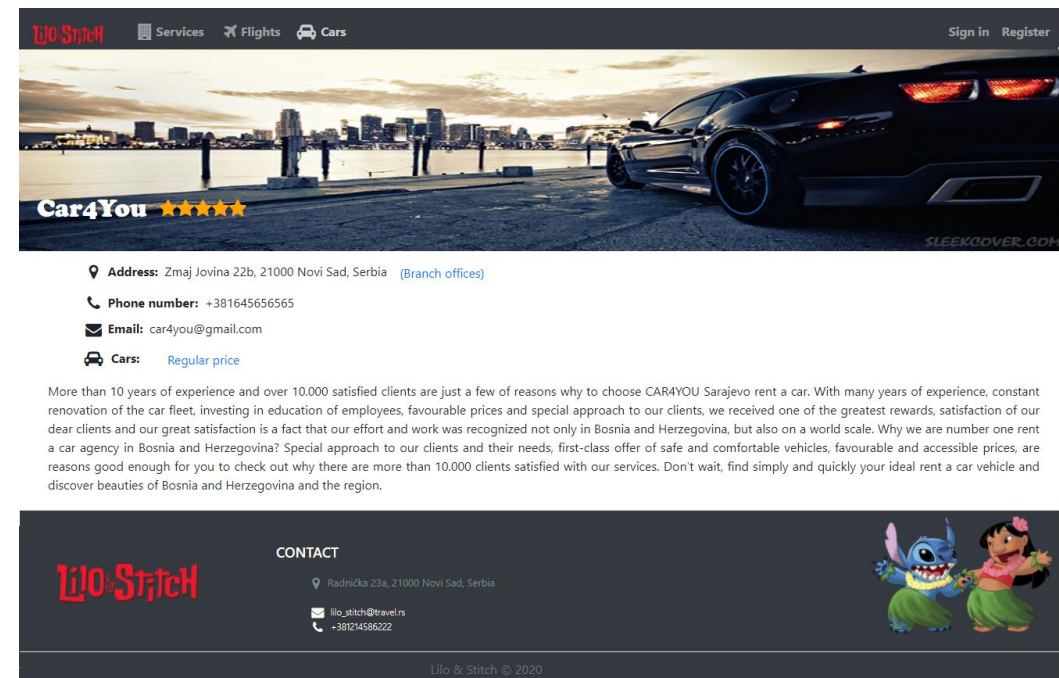


# Prikaz implementiranog rešenja

- Stranica za prikaz liste *Rent a car* servisa

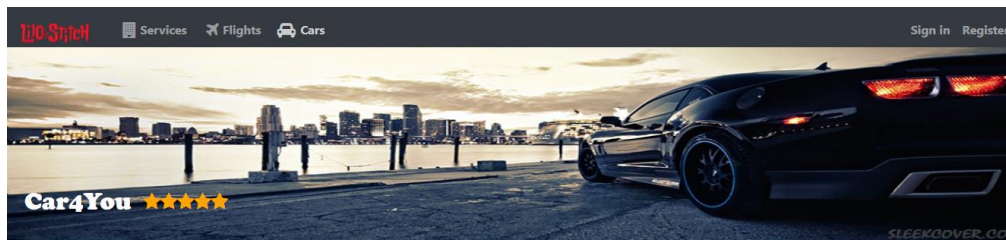


- Stranica za prikaz profila *Rent a car* servisa



# Prikaz implementiranog rešenja

- Stranica za prikaz liste filijala *Rent a car* servisa
- Stranica za prikaz liste automobila sa redovnom cenom *Rent a car* servisa



**Car4You ★★★★★**

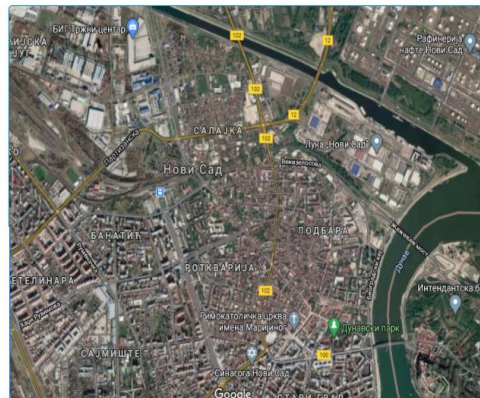
📍 **Address:** Zmaj Jovina 22b, 21000 Novi Sad, Serbia  
📞 **Phone number:** +381645656565  
✉ **Email:** car4you@gmail.com

**bo1 ★★★★★**

📍 **Address:** Bulevar Oslobođenja 155, 21000 Novi Sad, Serbia  
📞 **Phone number:** +38144557878  
✉ **Email:** bo1@gmail.com

**bo2 ☆☆☆☆☆**

📍 **Address:** Bulevar Evrope 265, 11000 Belgrade, Serbia  
📞 **Phone number:** +381455656  
✉ **Email:** bo2@gmail.com










**Lilo & Stitch** CONTACT

📍 Radnička 23a, 21000 Novi Sad, Serbia  
✉ lilo\_stitch@travels.rs  
☎ +381214586222

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## Cars - regular prices

 <b>Audii</b> Model: RS8 Rating: ★★★★★ Price per day: \$80	 <b>Yugo</b> Model: Koral 90 Rating: ★★★★★ Price per day: \$25	 <b>BMW</b> Model: E63AMG Rating: ★★★★★ Price per day: \$80	 <b>Renault</b> Model: Clio 5 Rating: ★★★★★ Price per day: \$130
 <b>Mercedes</b> Model: E63AMG Rating: ★★★★★ Price per day: \$55	 <b>Fića</b> Model: Zastava 750 Rating: ★★★★★ Price per day: \$45	 <b>Batmobile</b> Model: Cadillac Series 75 Rating: ★★★★★ Price per day: \$210	

« Previous 1 Next »

**Lilo & Stitch** CONTACT

📍 Radnička 23a, 21000 Novi Sad, Serbia  
✉ lilo\_stitch@travels.rs  
☎ +381214586222

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# Prikaz implementiranog rešenja

- Forma za prijavu na sajt

Please sign in

Sign in

Don't have an account yet? [Register now](#)

Sign in with:



- Forma za registraciju na sajt

Create your account

Register

Sign in with:





# Prikaz implementiranog rešenja

- Stranica profila prijavljenog korisnika

**My profile**

Choose profile image

Change password

lilo\_stitch@travel.rs

Slavko

Radnička

21000

Serbia

lilo\_stitch

Stamenković

23a

Novi Sad

+381214586222

Save

**CONTACT**

Radnička 23a, 21000 Novi Sad, Serbia

lilo\_stitch@travel.rs

+381214586222

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- Stranica za definisanje popusta

**Add discounts**

% Discount percent\*

%

WITH\_FRIENDS

FULL\_WITH\_FRIENDS

Add

**Edit discounts**

FULL = 5 %

% Discount percent\*

%

FULL

Save

**CONTACT**

Radnička 23a, 21000 Novi Sad, Serbia

lilo\_stitch@travel.rs


+381214586222

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# Prikaz implementiranog rešenja

- Forma za kreiranje novog administratora

Register a new admin



Choose profile image

Role\* ▼

E-mail\* Username\*

Password\* Password repeat\*

First name\* Last name\*

Street name Number


Postal code City

Country Phone number

Register

- Forma za kreiranje novog *Rent a car* servisa

Register a new car service



Choose profile image

Select admin\* ▼

Name\* Country\*

Street name\* Number\*

Postal code\* City\*

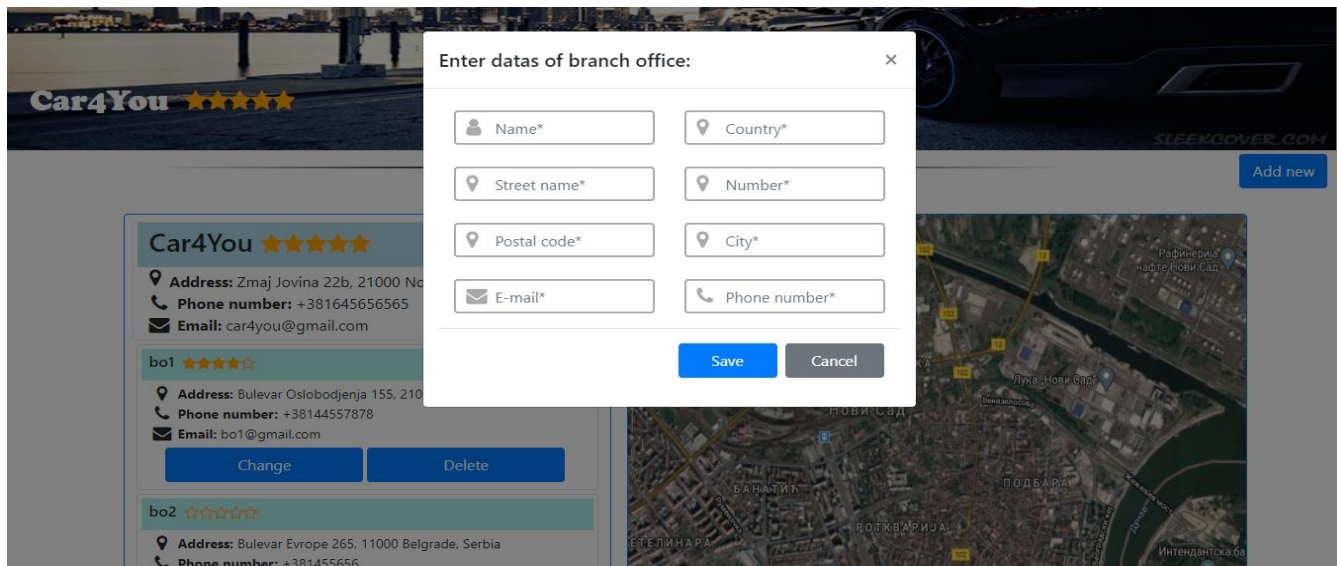
E-mail\* Phone number\*

Description\*

Add

# Prikaz implementiranog rešenja

- Modalan dijalog za kreiranje nove filijale

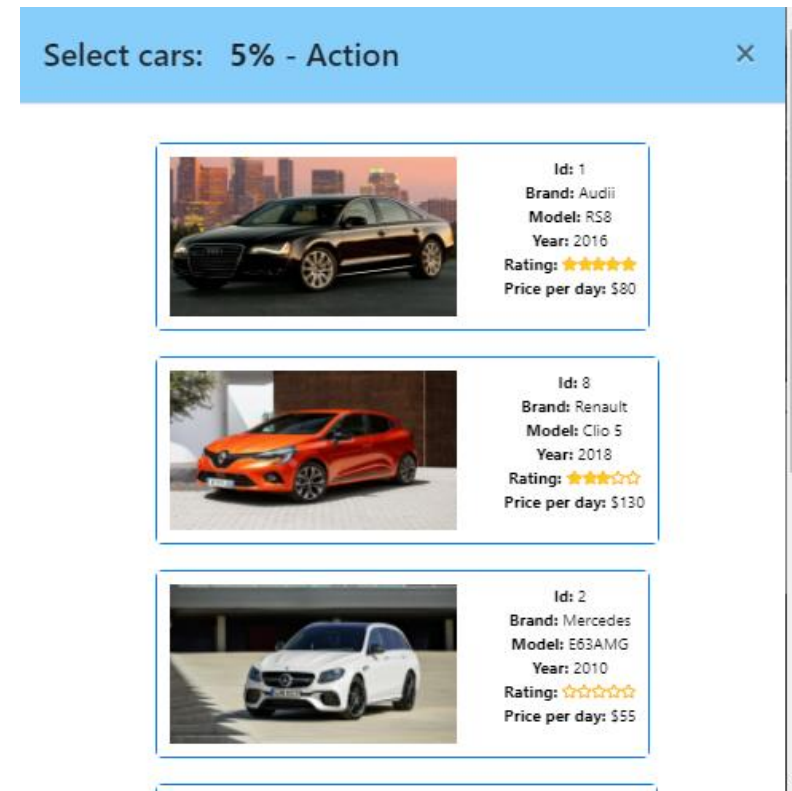
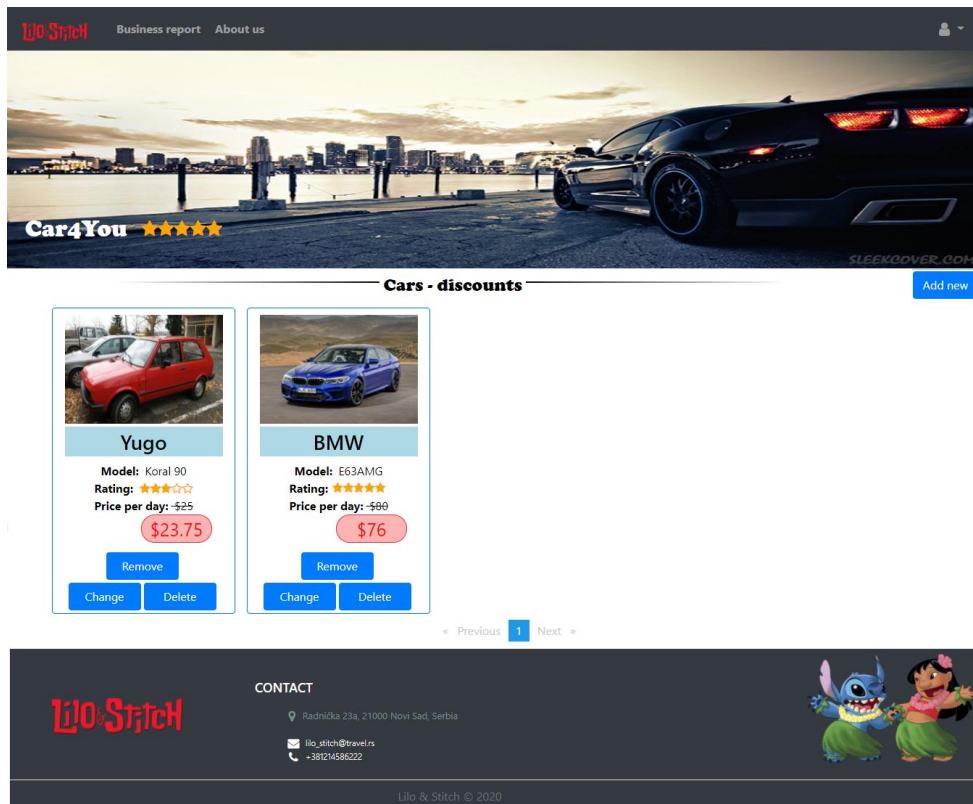


- Modalan dijalog za dodavanje novog automobila

The screenshot shows a modal dialog titled "Enter datas of car:" with a close button (X) in the top right corner. The dialog contains several input fields and options: "Select branch office\*" (dropdown), "Select passenger number\*" (dropdown), "Brand\*" (text), "Select number of doors\*" (dropdown), "Model\*" (text), "Large bag number\*" (text), "Year\*" (text), "Air-condition\*" (radio buttons for True/False), "Price per day\*" (text), and "Automatic\*" (radio buttons for True/False). Below these fields is a section labeled "rs:" with a large circular icon containing a person silhouette. Below the icon is a "Choose main image" button. At the bottom of the dialog are "Save" and "Cancel" buttons.

# Prikaz implementiranog rešenja

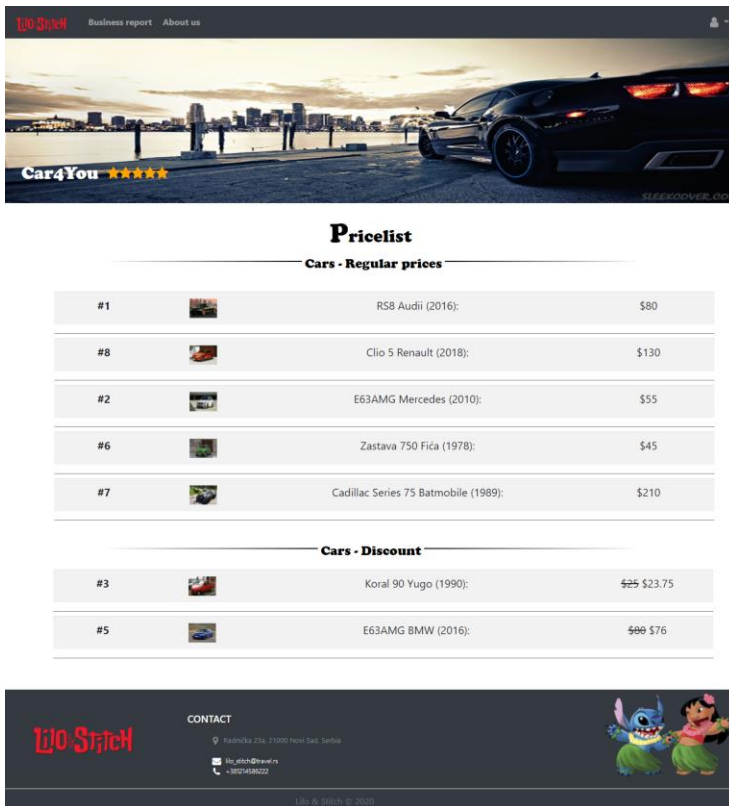
- Stranica za prikaz liste automobila *Rent a car* servisa koji su na popustu
- Modalan dijalog za odabir automobila kojima će se dodati popust





# Prikaz implementiranog rešenja

- Prikaz stranice na kojoj se nalazi cenovnik *Rent a car* servisa



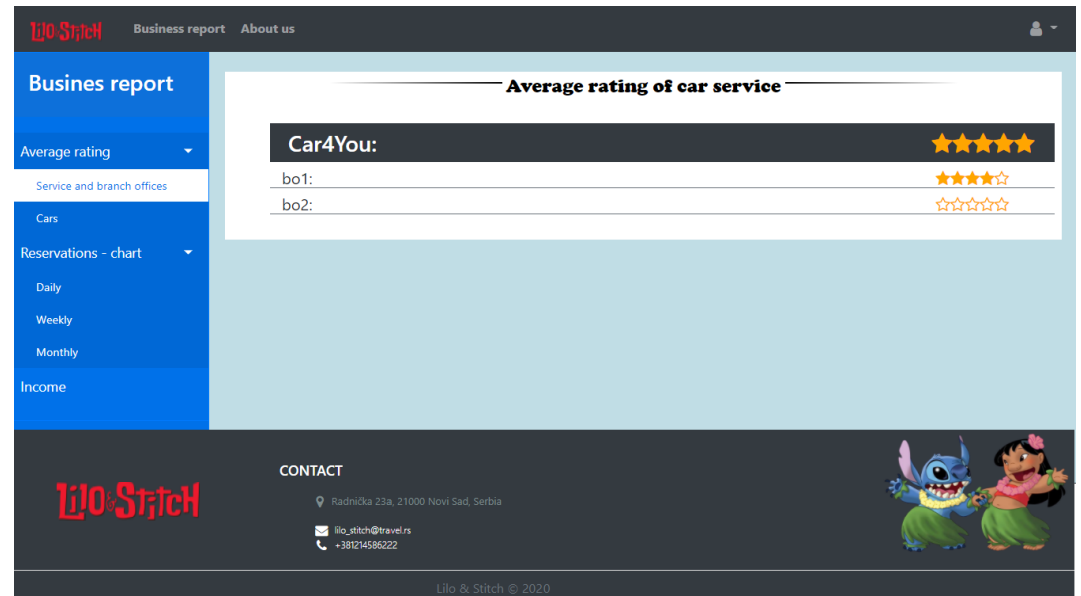
The screenshot shows the Car4You website. At the top, there's a navigation bar with 'Lilo & Stitch', 'Business report', and 'About us'. Below the navigation bar is a banner image of a car at a harbor with the text 'Car4You ★★★★★'. The main content area is titled 'Pricelist' and 'Cars - Regular prices'. It contains a table with 7 rows of car rental options. Below this, there's a section for 'Cars - Discount' with 2 rows. At the bottom, there's a 'CONTACT' section with the company name, address, email, phone number, and a cartoon illustration of Lilo and Stitch.

#	Car	Price
#1	RS8 Audi (2016):	\$80
#8	Clio 5 Renault (2018):	\$130
#2	E63AMG Mercedes (2010):	\$55
#6	Zastava 750 Fića (1978):	\$45
#7	Cadillac Series 75 Batmobile (1989):	\$210

#	Car	Price
#3	Koral 90 Yugo (1990):	\$25 \$23.75
#5	E63AMG BMW (2016):	\$60 \$76

- Prikaz izveštaja srednjih ocena *Rent a car* servisa i njegovih filijala

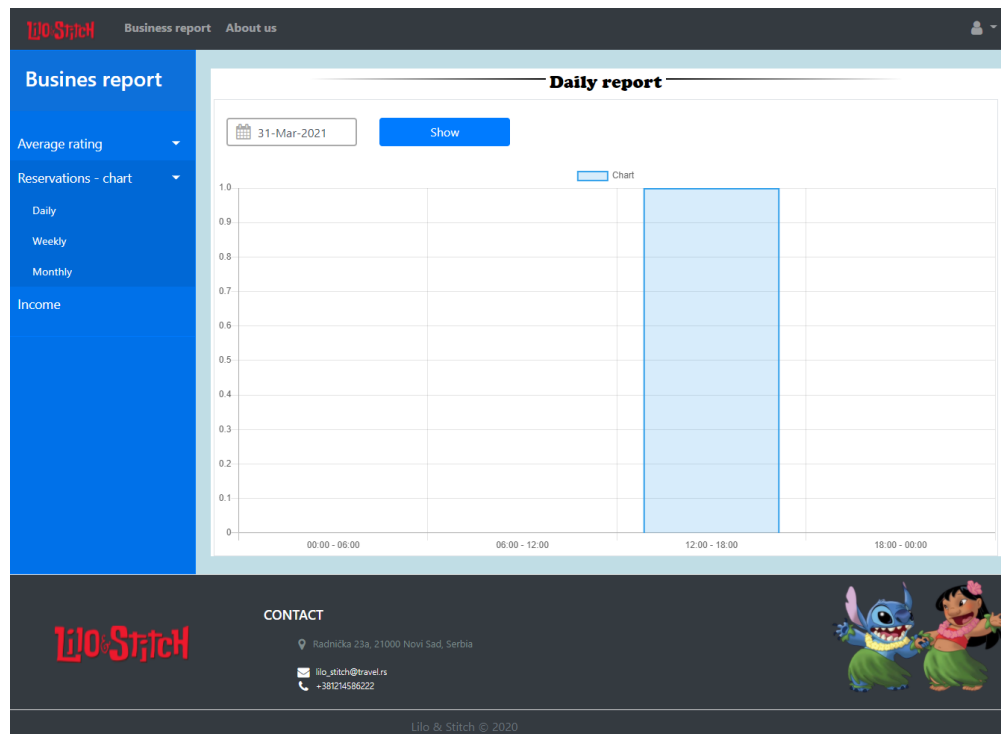


The screenshot shows the Car4You website. At the top, there's a navigation bar with 'Lilo & Stitch', 'Business report', and 'About us'. Below the navigation bar is a banner image of a car at a harbor with the text 'Car4You ★★★★★'. The main content area is titled 'Average rating of car service'. It contains a table with 2 rows of car rental options. Below this, there's a section for 'Cars - Discount' with 2 rows. At the bottom, there's a 'CONTACT' section with the company name, address, email, phone number, and a cartoon illustration of Lilo and Stitch.

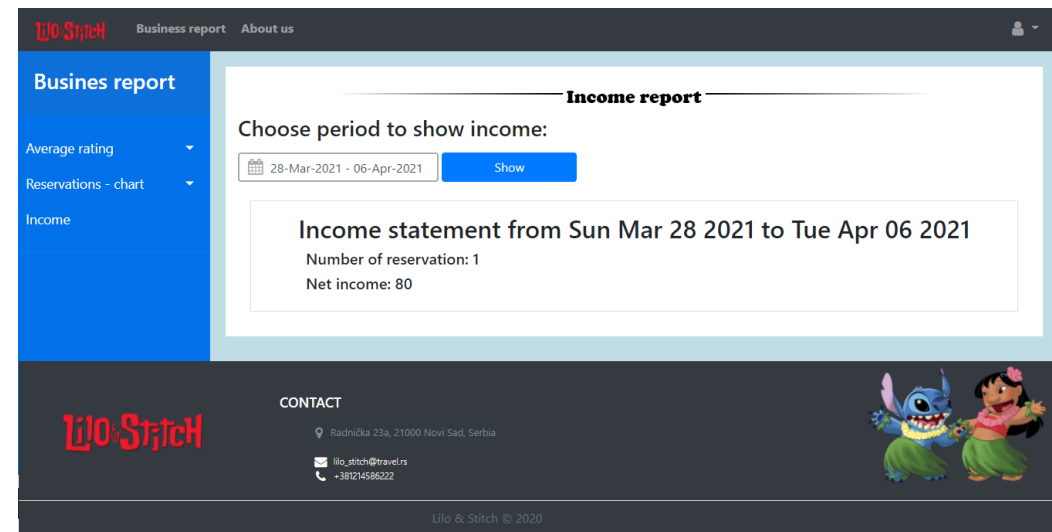
Car	Rating
Car4You:	★★★★★
bo1:	★★★★☆
bo2:	★★★★☆

# Prikaz implementiranog rešenja

- Prikaz grafičkog izveštaja ostvarenih rezervacija *Rent a car* servisa na dnevnom nivou



- Prikaz izveštaja prihoda *Rent a car* servisa na osnovu ostvarenih rezervacija u određenom periodu



# Prikaz implementiranog rešenja

- Stranica istorije rezervacija prijavljenog korisnika

**History of reservations**

**Cars**

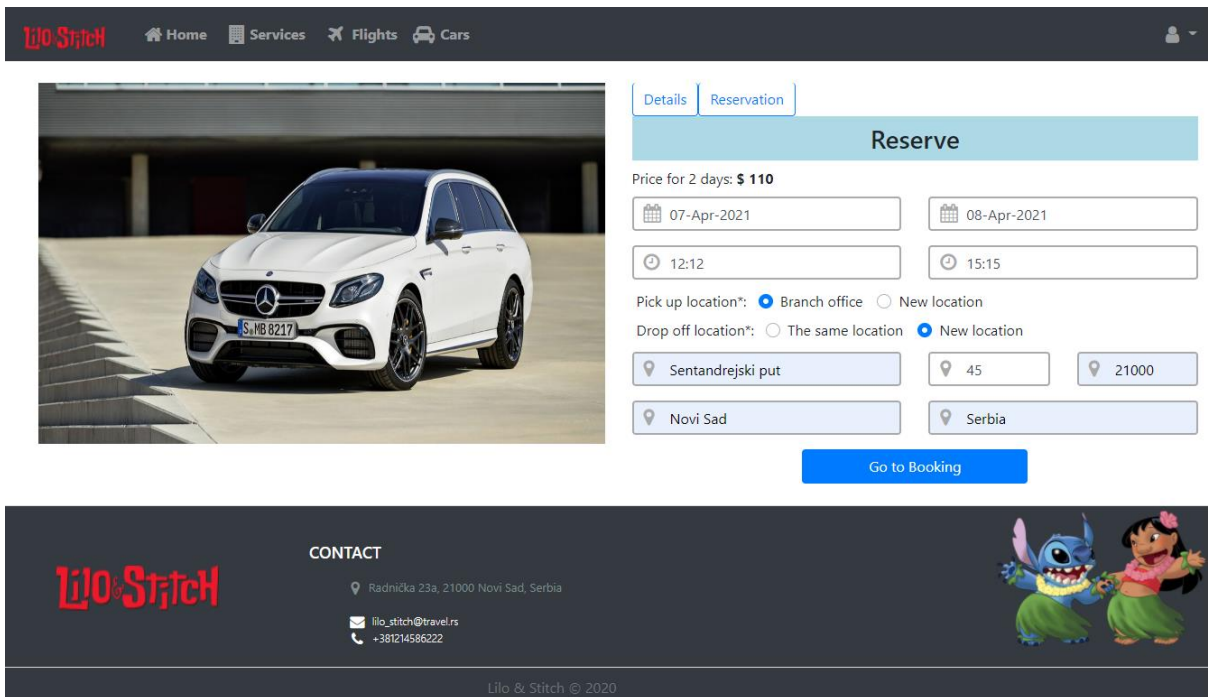
<b>Service:</b> Car4You	Rated with: 5	<b>Branch office:</b> bo1	Rated with: 4
<b>From</b> 2021-03-31 17:38:00 <b>To</b> 2021-03-31 17:40:00	<b>From</b> Bulevar Oslobođenja 155, 21000 Novi Sad Serbia <b>To</b> Bulevar Oslobođenja 155, 21000 Novi Sad Serbia	Audi RS8 (2016)	★ Rating* <a href="#">Save</a>

- Pretraga automobila za registrovanog korisnika

<input type="text" value="Pick-up date"/>	<input type="text" value="Drop-off date"/>	<input type="text" value="Pick-up time"/>	<input type="text" value="Drop-off time"/>	<input type="text" value="Pick-up location"/>	<input type="text" value="Drop-off location"/>
<input type="text" value="Price from"/>	<input type="text" value="Price to"/>	<input type="text" value="Passengers"/>	<input type="text" value="Brand"/>	<input type="text" value="Service's name"/>	<input type="button" value="Search"/> <input type="button" value="Revert"/>

# Prikaz implementiranog rešenja

- Stranica sa formom za rezervaciju automobila
- Forma za plaćanje rezervacije



The screenshot displays the Lilo & Stitch website's car reservation interface. The header includes the logo and navigation links: Home, Services, Flights, and Cars. The main content area features a large image of a white Mercedes-Benz SUV on the left. To its right is a 'Reserve' form with tabs for 'Details' and 'Reservation'. The form includes fields for dates (07-Apr-2021 to 08-Apr-2021), times (12:12 to 15:15), and location selection (Pick up location: Branch office, New location; Drop off location: The same location, New location). A 'Go to Booking' button is at the bottom of the form. The footer contains contact information and a copyright notice: Lilo & Stitch © 2020.

**Lilo & Stitch** Home Services Flights Cars

**Reserve**

Price for 2 days: \$ 110

07-Apr-2021 08-Apr-2021

12:12 15:15

Pick up location\*: ☒ Branch office ☐ New location

Drop off location\*: ☐ The same location ☒ New location

Sentandrejski put 45 21000

Novi Sad Serbia

[Go to Booking](#)

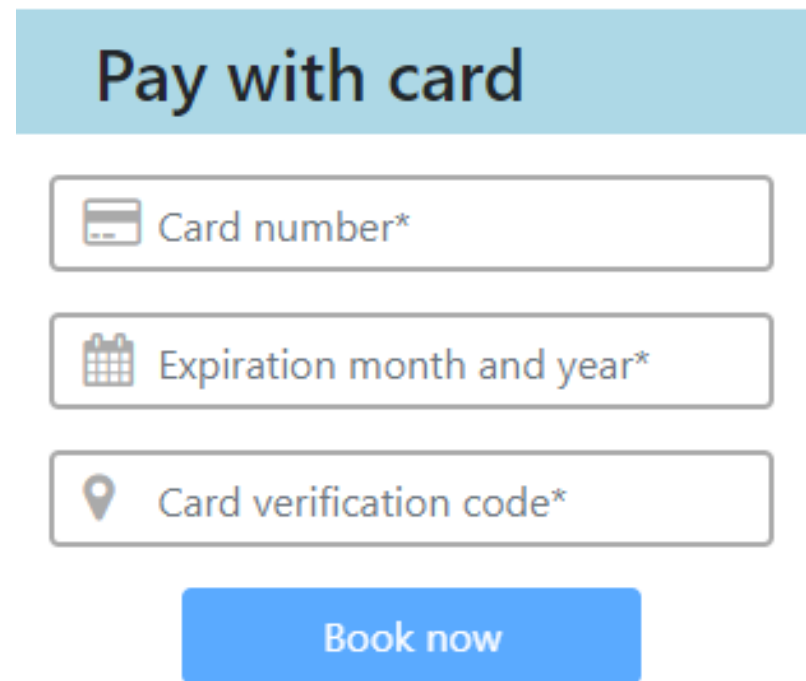
**CONTACT**

Radnička 23a, 21000 Novi Sad, Serbia

[lilo\\_stitch@travel.rs](mailto:lilo_stitch@travel.rs)

+381214586222

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The screenshot shows a 'Pay with card' form with three input fields: 'Card number\*', 'Expiration month and year\*', and 'Card verification code\*'. A blue 'Book now' button is located at the bottom of the form.

**Pay with card**

Card number\*

Expiration month and year\*

Card verification code\*

[Book now](#)

# Zaključak

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- U ovom radu opisan je razvoj dela sistema za rezervisanje avio-karata i automobila koji predstavlja aplikaciju *Rent a car* servis i zajednički delovi sa aplikacijom Avio-kompanija servisom
- Realizovanjem ove aplikacije, prijavljenim registrovanim korisnicima je omogućeno da pronađu i rezervišu željeni automobil za željeni period i destinaciju uz *online* plaćanje. Ocenjivanjem rezervacija, prikupljene su povratne informacije od korisnika kako su oni zadovoljni uslugama koje su im pružene. Na taj način, svi korisnici mogu da vide kvalitet usluga koje pružaju servisi prilikom iznajmljivanja vozila.
- **Mogućnost proširivanja:**
  - Da se klijentska strana postavi na *AWS cloud*
  - Doda funkcionalnost koja omogućava prijavljenim registrovanim korisnicima da postavljaju komentare za automobile. Na taj način, korisnici bi mogli detaljnije da ocene pružene usluge što bi olakšalo drugim korisnicima prilikom odabira automobila.



Kraj

