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## Edenz logo_for monitor(RGB)_Large

**Diploma in Software Development**

DSE 760 Cloud and Web Software Development

Assessment: Project Report  
Total marks: 100  
Course Weighting: 100%

Due Date: Friday, 9th November at 5:00 p.m., 2018

**Student Name(s):……Michael Braverman……………………………………**

# EXECUTIVE SUMMARY

I created a tool to support foreign language learners. It will help people to save new foreign words together at one place with translations, and learn them through a simple game.

I decided to write this software because it may be useful for people. I have been learning English for about 2 years and have not found yet a simple application that can save new words and help to learn them. There are a lot in the internet, but they are too complicated or not good enough. I took as a model Android App “My Vocabulary” that does not exist in Google Play with some improvements.

I used Microsoft technologies for development such as ASP and MS SQL Server because they are extremely popular in New Zealand.

The application is supporting tool for a person who takes learning language serious. This is private dictionary for learning words and nothing more than that. You can add new words you learnt with translation and learn it afterwards by memorization game: you will have the word and 3 options to choose. You can change direction: from native to foreign and vice versa. You can make a mistake for two times only, after the third mistake – game will be over. You will win if you guess all words in the list. Instead of creation of huge bunch of words (the game will be for hours), there is the option to create as much lists as you want.

# Introduction

## Background

*Describe why you chose this application and what you were planning to achieve.*

My decision of choosing of dev technologies is based on job market’s demand.

I started to look for a job directly after arrival and found out that Microsoft Technologies prevail in the market. During job interviews with representatives of different HR companies such as [Enterprise](https://www.enterprise.co.nz/) and [Potentia](http://potentia.co.nz/), I was informed that MS ASP is the most popular skill in the job market. When I looked for a job through <https://www.seek.co.nz/> I also figured out that in New Zealand between 60 and 80% of the all jobs are .NET jobs. Most of these jobs require knowledge in ASP.NET. Most in-demand DB technology (about 80%) is MS SQL Server. I did not make exact calculation and this is my subjection perception of the situation. Together with information from HR agencies, I believe that choosing these technologies it is a right decision.

I created my application with following technologies:

1. ASP.NET core Razor Page
   1. 60-80% of all jobs in New Zealand are in ASP.NET MVC
   2. Even though companies still use ASP Web Forms, ASP MVC or even ASP classic, ASP.NET core is the most perspective technology for Web.
2. MS SQL Server as a data storage
   1. Although I dealt last years with Mongo Db, I decided to work with MS Server to polish up my SQL skills.
   2. Entity Framework Core I used as object-relational mapper (O/RM)

My goal was to learn newest cutting-edge Microsoft web development technology to prepare myself better to NZ local job market.

## Scope

*Give a short overview of what you have included and what extensions are possible later.*

Application is available to the registered users only. The application is a dynamic dictionary with option to play memory game. You can create unlimited number of independent dictionaries. Every dictionary is the *List*. The List keeps Records, where every record is a foreign word with translation. User can create some lists with a number of records. For comfortable and not too long Memory Game, a list should keep not more than 100 records, but it is up to the user. The Memory Game initiates for every List. User should select the list with more than five Records in the List. The goal is to train the memory of user by showing him a foreign word with three option of translations, where one is correct and two are wrong. User will win if he guesses right all records in the selected list. User can make not more than two mistakes. With a third wrong selection the game will be over. Application will show how many records are left, what is your record in all games you did, what is your current score and how many lives you have.

Through your configuration, you can choose the game direction: from foreign language or from your native language. If you choose from foreign language – you will see the foreign word and three options for translations. If you select from native language – you will see translation and three options for foreign word.

# Project Planning and Execution

## Project Plan and Gantt Chart

1. Understanding what do I want to do
2. Creation of User Stories
3. Creation of Use Cases
4. Learning ASP Razor Page technology from [Microsoft Docs](https://docs.microsoft.com/en-us/aspnet/core/tutorials/razor-pages/?view=aspnetcore-2.1) together with building my project structure
   1. Building of Models: how my DB structure will look like
   2. Generation of Data Base by Entity Framework Core
   3. Creation of appropriate Razor Pages
   4. Implementation of Authentication and Registration with default MS authentication model
   5. Implementation of Email validation
   6. Making web pages available only by authenticated user
   7. Implementation of the game
   8. Configuration development
5. Bugs fixing
6. UI improvements
7. Code refactoring
8. Code cleaning up
9. Report creation

## Risk Management

1. Even though I consider myself as a experienced developer, I started my project very early with plenty of time in advance to be able to finish it slowly, quietly without rush.
2. I planned to fully finish my development 2 weeks before deadline to have more time for report
3. One student spoil his water close to my PC and I thought it is a good idea to keep your code somewhere in a cloud to have it saved in the case of disaster. For instance, hardware breakdown. To prevent loosing of all code, I used [GitHub](https://github.com/) source control. The [code and documentation](https://github.com/mickeybrave/MemoryGame) is available online.
4. Another risk is to be able implement all possible technologies. For instance, I wanted to implement all code with server-side C#. However, when my development was almost done, I faced some fatal error: “HTTP Error 502.3 - Bad Gateway”. After a day of hitting head against a brick wall, I decided to change technology. Solution from internet did not work. Consequently, I rewrote all business logic in JavaScript and removed redundant C# code.

I learnt that it is robust idea to start development ASAP, make balance between quality and speed and leave a “dead-end” to consider another solution for a stubborn problem.

# Requirements Management

I based on Agile approach to collect my requirements.

Agile is a set of principles and values that are set up by a team to create better software. (Shead, n.d.)

The best way to treat *User Story* as a conversation with a customer when the UX engineer gathers the information about a new System or a feature from the customer. (Scott, n.d.)

As a part of Agile methodology, *User Story* technic follows Agile Principles (Beck, Beedle, & Arie van Bennekum, n.d.) and implies flexibility, responding to change and interactions. Consequently, in some organization, these requirements are written on sticky notes, adhered on walls to provide and encourage discussions, design and planning. As a result, these discussions are more important that requirement statements. (mountaingoatsoftware, n.d.)

I thought about this software for quite a lot time, because I used a couple of similar application and learnt about their benefits and flaws. For instance, if you do not separate your words to lists, your memory game will be too long. From my experience more than 15 minutes it is too long, consequently, words should be separated to independent lists about 100 records length. Moreover, I keep records in database instead of local file in client’s device. That is beneficial in the case the device, lost, broken of local file is corrupted.

|  |  |  |
| --- | --- | --- |
| Actor | Wants | Reason |
| user | Play memorization game | To learn foreign words |
| user | Create list of words and translations | In order I can memorize foreign words |
| user | View the list of words and translations | To see how many words in the list |
| user | Add and remove words and translations to and from the list | To allow the game |
| User | Navigate between created list | To see all lists, add words to different lists, initiate the game with particular list |
| user | See the number of words in the top of list | To help me keep the list short |
| user | Change game direction settings (from Russian to English or from English to Russian) | From native to foreign will improve my speaking, from foreign to native improves my reading. |
| user | See a word along with 3 translation and to choose the correct one | To test my knowledge and memory |
| User | See label “correct” | To have indication that user is right |
| User | See label “wrong” | To have indication that user is wrong |
| User | See label with indication how many words are left | To see approximately how long he needs to play to finish the game |
| User | See the best score/record | To aspire for improvements |

I used two approaches to gather requirements:

1. User story (Vatoz Atozdevelopment, n.d.)
2. Use case (created by MS Visio)

A Use Case is an approach in System Engineering to recognize, clarify and structure system requirements. (Rouse, n.d.). As a final product, it is a written or graphical description of user’s actions while working with a software. Every use case represents a sequence of a single step that starts with user’s goal and ends with the goal’s achievement. (usability, n.d.).









# User Experience Design (UX)

## Definition

UX (User Experience) is the process of improvement user satisfaction of usage of a software product by boosting of usability, accessibility and enjoyment that provides the interaction with the product. (Wikipedia, n.d.) As a result, eventually facilitates to increase the number of customers of a software product.

## Why UX is so important?

### High competition

In XXI age of technology advance every business offers some service online, the most convenient, useful and attractive software product will take all customers – others will not survive! Today we have 2 kinds of businesses: with high-quality website or bankrupted one. As an example: think will you spend your money in online shop that is definitely worse than another one?

### Spoiled customers

In the eon of prosperity of the internet, customers are captious and spoiled. If your software is not the best one – you will lose customers, money and as a result your business. As an example: as yourself, will you waste your time for a not intuitive, nor attractive nor user-friendly product?

### The lack of time

Nowadays people are extremely busy and will not spend their time for complex and incomprehensible web site. You need to create a software where a user can achieve that maximal result with minimum clicks. As an example: will you complete your purchase in a web store if you need to make more than a couple of click to finish your shopping?

### Software as a habit

People are reluctant to leave their zone of comfort. If they found your software as a good one and got used to it, they will hardly change it to another one. Even though you have higher prices. As an example: will you change the online store you use for years and you are satisfied? Most of the people will not.

### Attracting non-technical customers

Usage of a software is not for everyone. Even in our age, you can meet many people who consider themselves as the “old school guys”, “computer is not for me”, “it is too difficult to understand” and “I like to buy in physical shops”. If you can show them that your software is simple, effective and chipper than in local store, you can earn money even from this “difficult” category of customers. As an example: I showed to my mom once a web store and proved that is more convenient than others and chipper than physical store and she uses it by now.

### Innovativeness

Even effective, user-friendly and attractive application may lose their customers if they don’t keep up with the times! A software should be implemented by cutting-edge technology, with implementation of innovative technic and patterns; otherwise, it will look obsolete. Users may think: this looks old, its owners do not care for the product and it is not as useful as a product of their competitors. As an example: I feel esthetical satisfaction from usage of new bells and whistles sometimes even out of curiosity.

### My implementation

Features I implemented to improve User Experience:

1. I used [bootstrap](https://getbootstrap.com/) for better look and feel
2. I show different indications while memory game:
   1. The best personal record to stimulate adding new words and making a new record
   2. Current score to indicate how many words are currently guessed
   3. How many records are left to win
   4. How many lives are left (how many time user can make a wrong guess before the game is over)
   5. Indication that the user’s selection was correct
   6. Indication of a wrong selection
3. Waiting 3 seconds after every selection to show to the user his guess
4. All data is saved in remote data base and user will never lose his data
5. Search in records to comfort location of required record (update/remove)
6. Convenient navigation between pages
7. Inputs validations

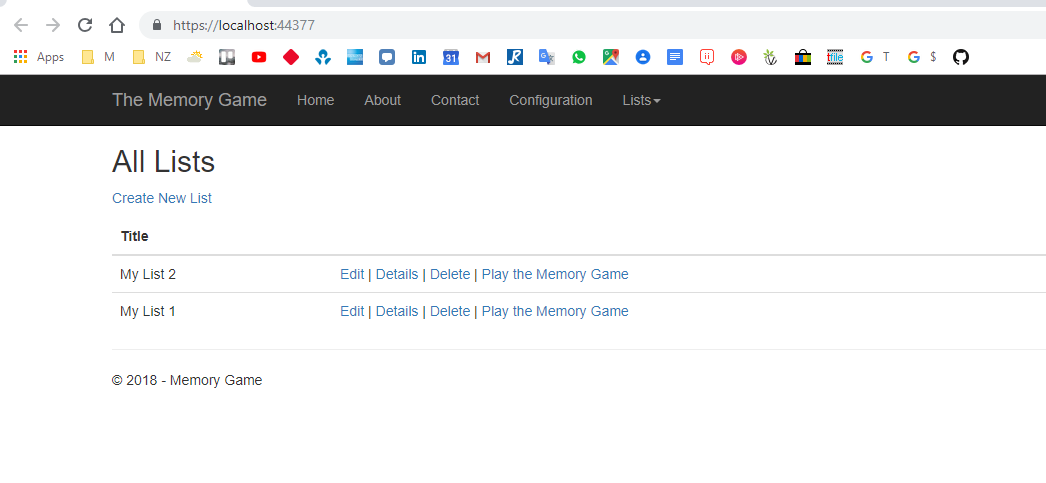
# Architecture and Design

## Content structure

The textual, visual, or aural content is treated as part of the user experience on websites and called *Web Content*. It can be other things: text, images, sound, video and animation. (Wikipedia, n.d.)

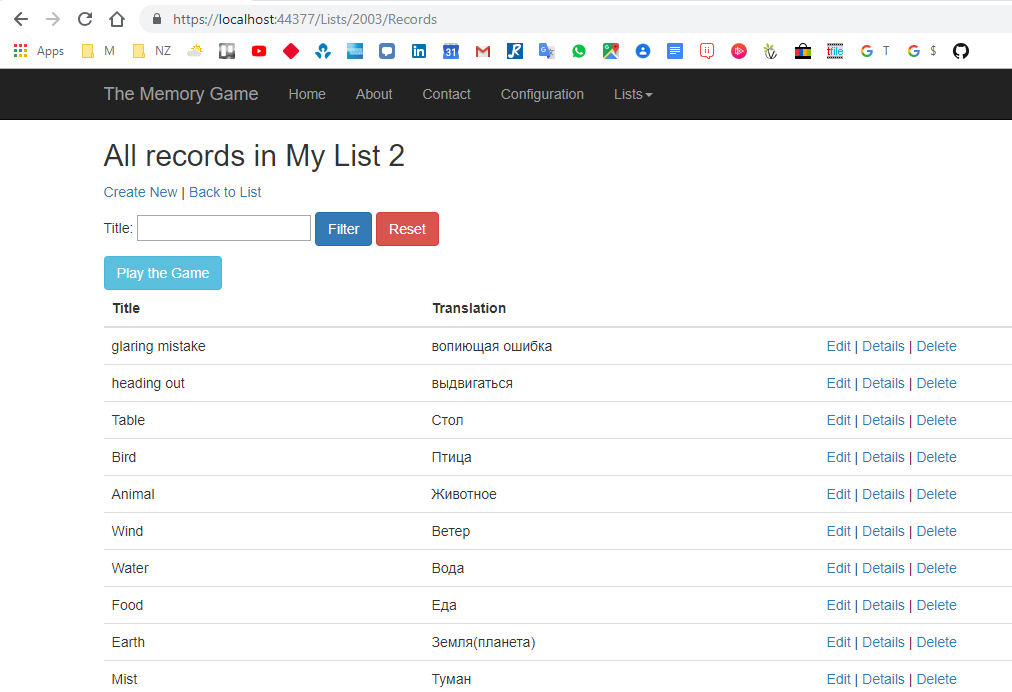
My software does not include too much in addition to texts, because my software is an advanced dictionary for saving and learning words.

This is my main page. Here I listed my *Lists* with following options:

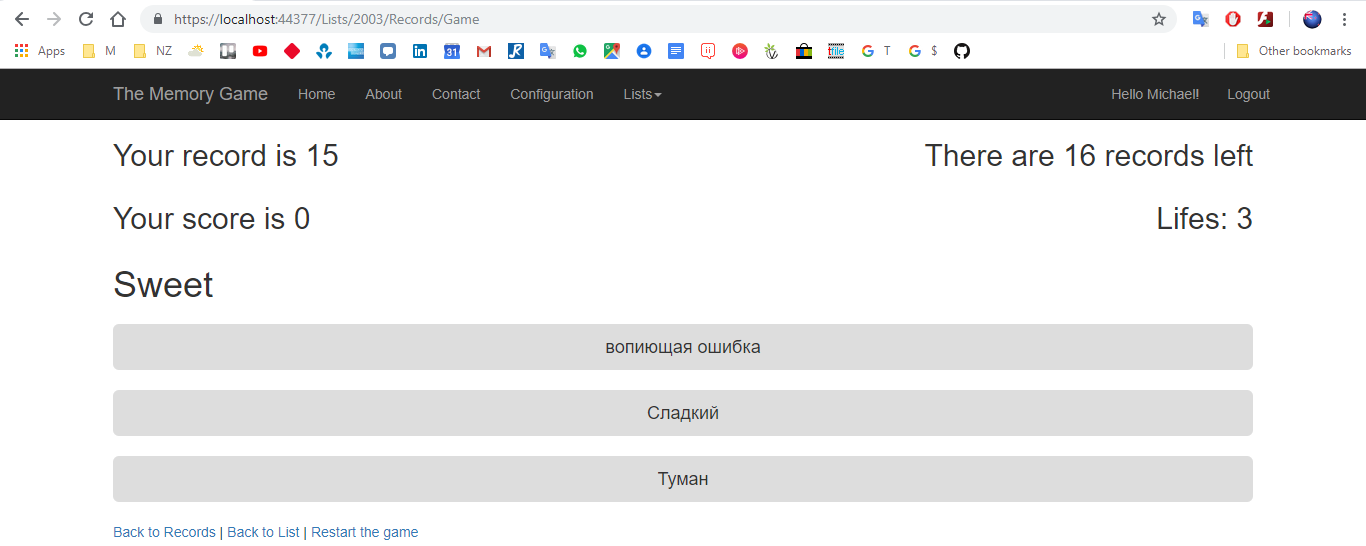


Every option is simple and does not require explanation. Besides *Details* and *Play the Memory Game*:

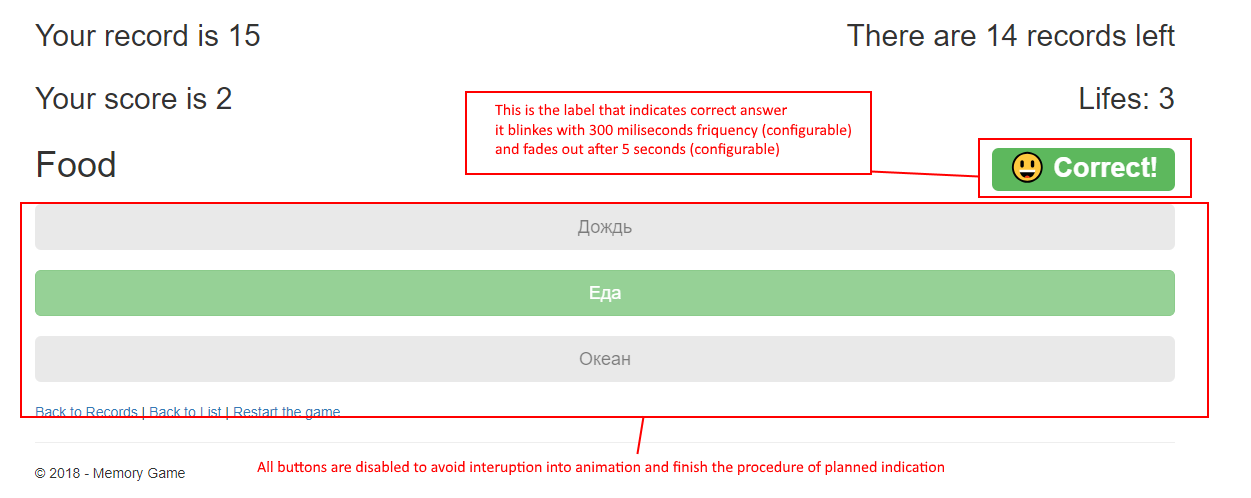
1. Details – shows the List of records inside of selected List

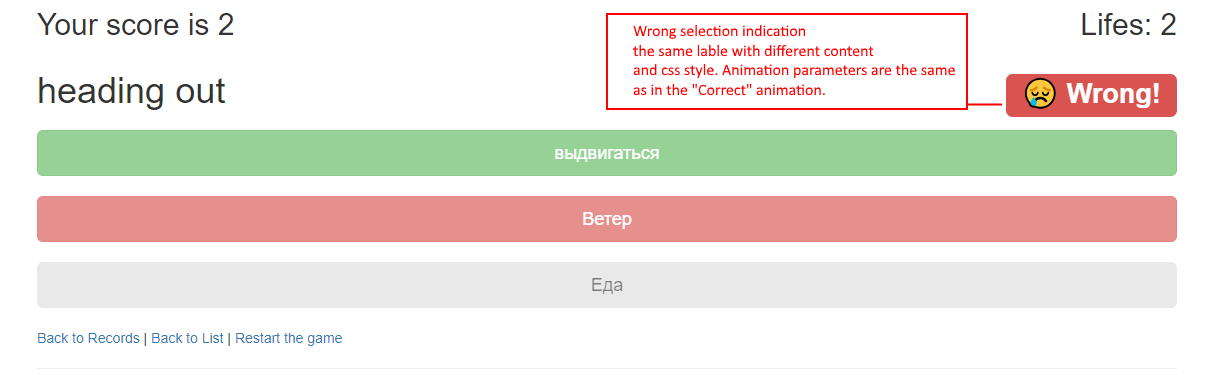


1. Play the Memory Game – initiate the memory game for the selected List



Nevertheless, I included animation in Memory Game to highlight valid and invalid selection to encourage the user to go on. Animation is built from blinking and fading out of the label that indicates whether user was correct or wrong.





The Game screen also incudes different labels that show the score, record, how many left and how many time it is allowed to make a wrong guess before the game is over.

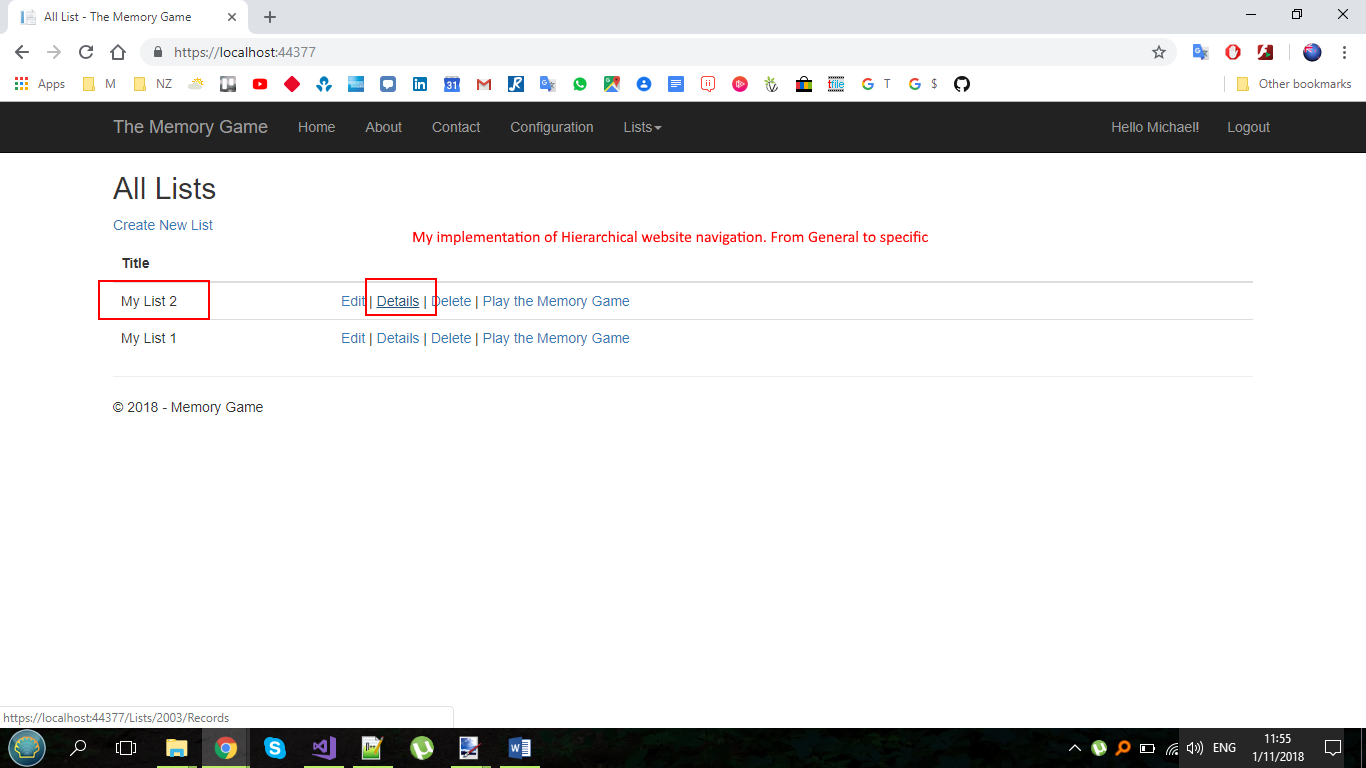
## Navigation

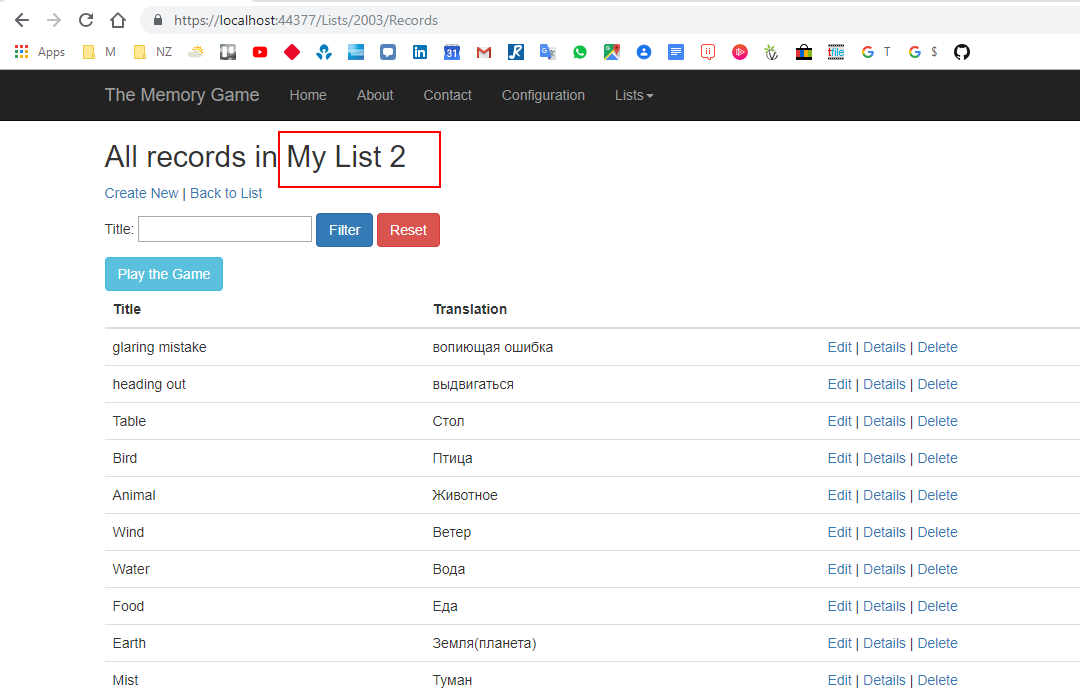
Web Navigation is process of movement from one Web page to another Web page through the internet by usage of web browser. (O'Rourke, n.d.) (Wikipedia, n.d.)

I used two kinds of navigations:

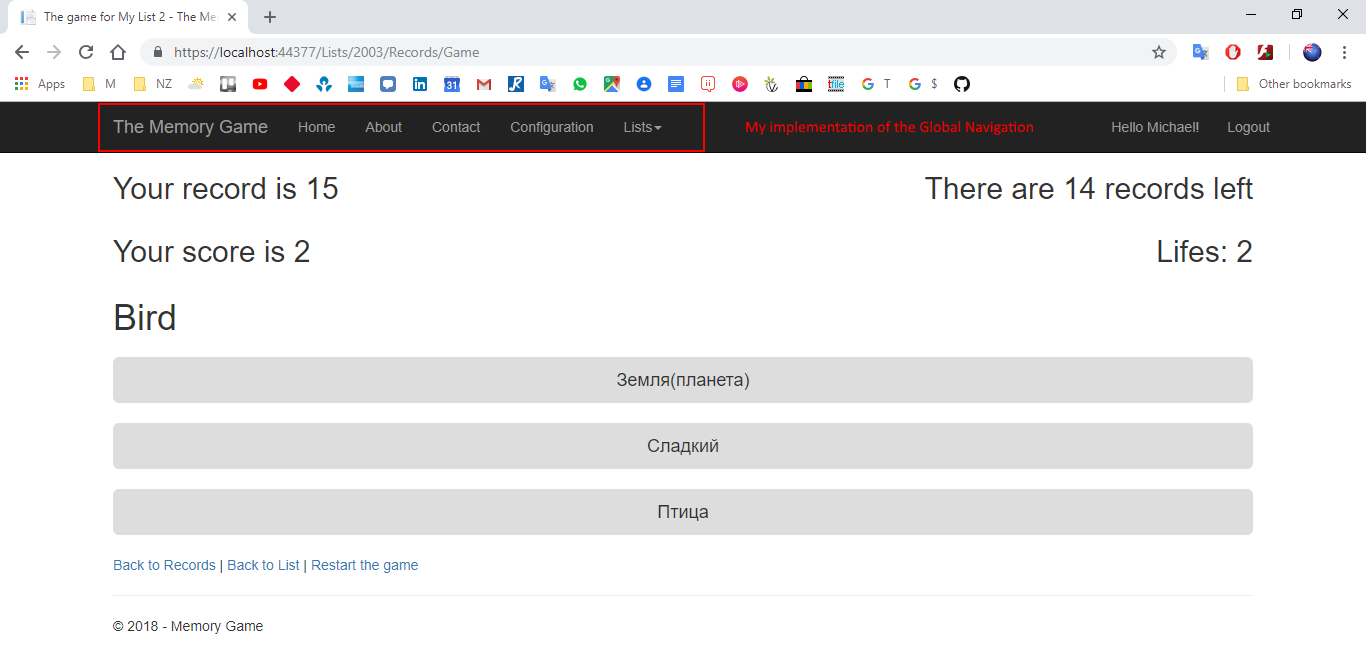
1. Hierarchical website navigation – This is when you navigate from general to specific. That gives simple way to all pages from anywhere of the site. (Wikipedia, n.d.)

Here is navigation from general list of Lists to its content:

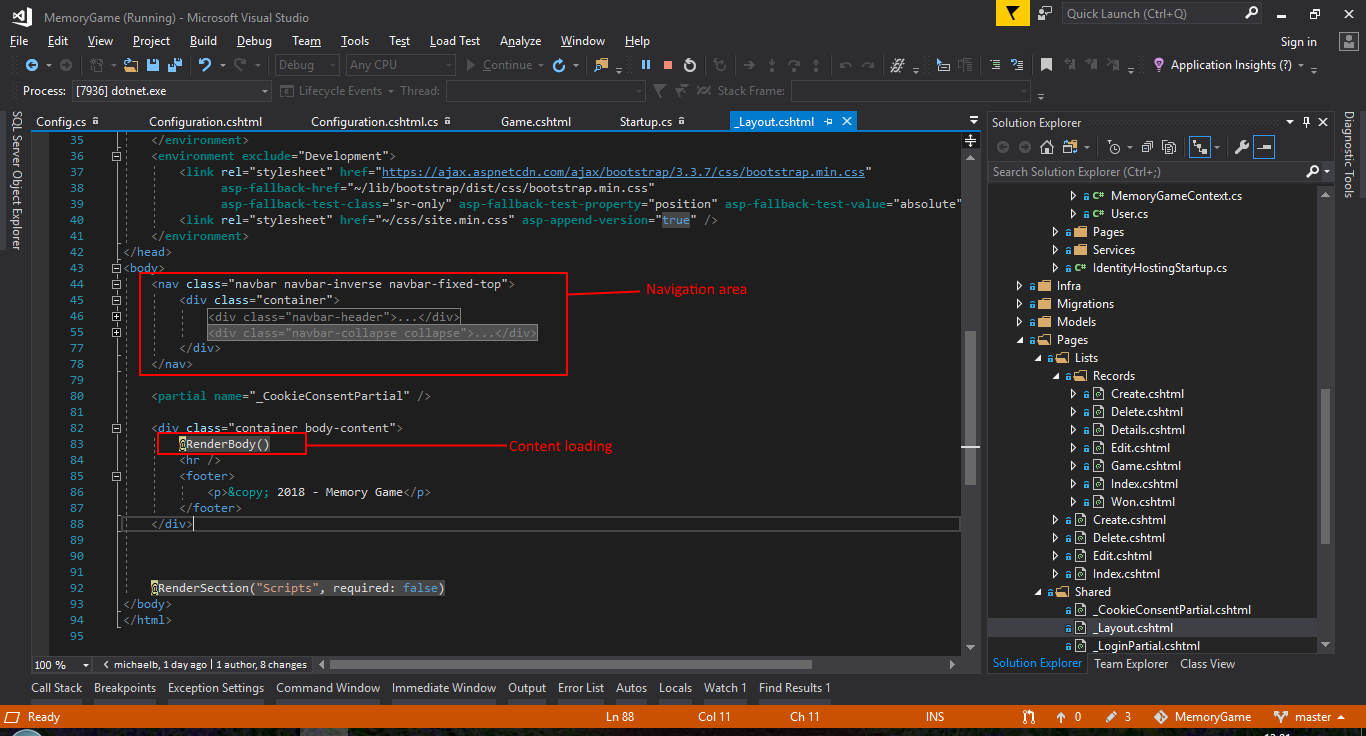


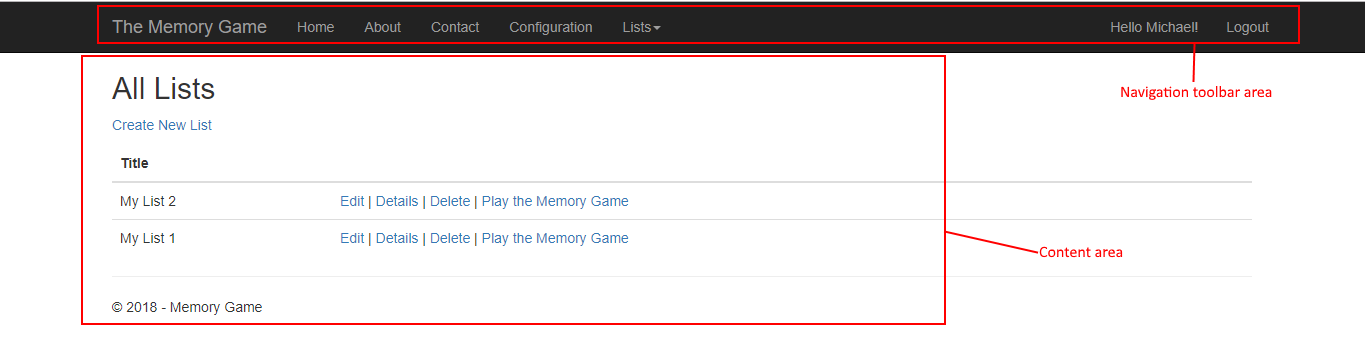


1. Global website navigation – “Global website navigation shows the top level sections/pages of the website. It is available on each page and lists the main content sections/pages of the website.” (webpagemistakes, n.d.) In other words using a constant section of every page as a toolbar with links or buttons that allows navigation anywhere.



I separated navigation area from content to use the same tool bar and reload only content.

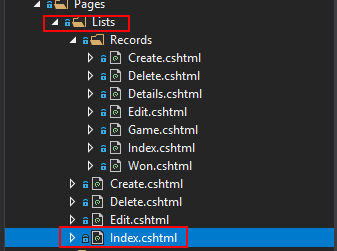




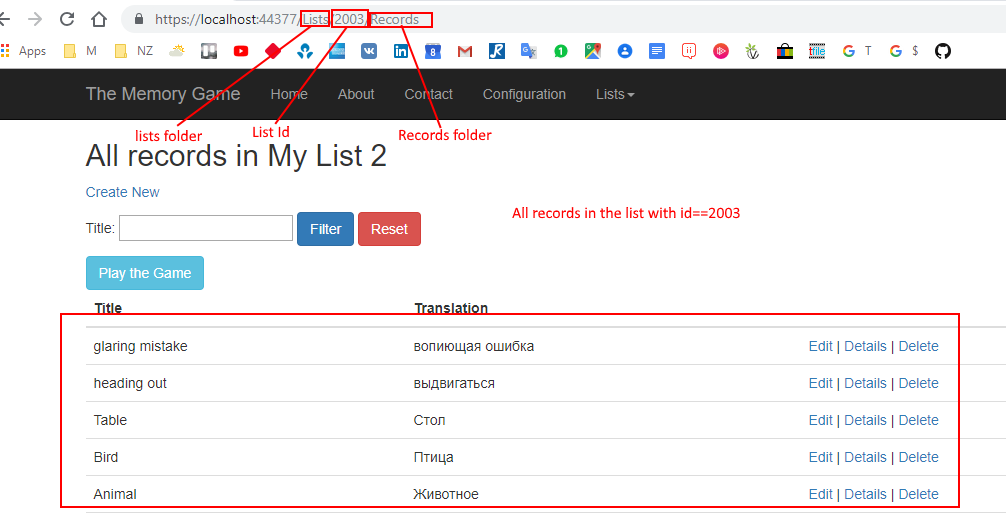
That reduces amount of code and support principle “don’t repeat yourself” (DRY).

Here I found serious limitation of Razor Pages technology. Even though it is a part of .NET Core it is newer than MVC and has less support from the community. There is not enough information how to implement different requirements in Razor Pages. Moreover, when I asked Google how to implement required URL and folder structure, I found examples in MVC because it “old brother” technology. However, the implementation in MVC is so different that will not help to implement the same in Razor Pages. I even created the similar solution with MVC instead of Razor Pages; however, I found solution afterwards.

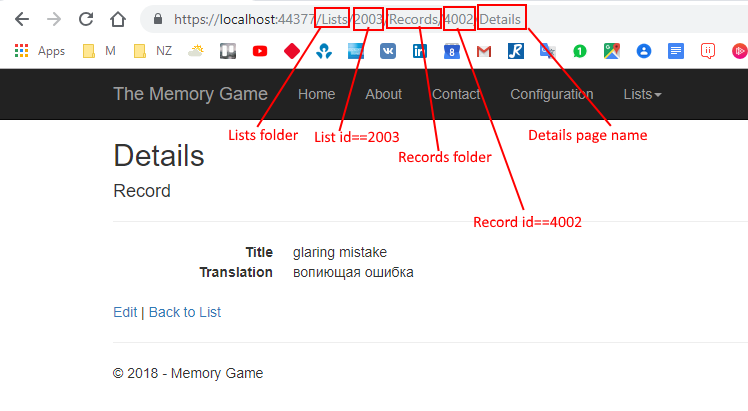
I wanted to implement appropriate REST URL according to hierarchy of my classes: list has many records. MS .NET Core builds automatically URLs according to folder’s and page’s names:



Nevertheless, I did not know how can I change URL and insert there required list and record ids. However, that was not straight forward to implement. I wanted to see the URL like this:



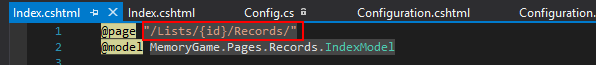
In the case of records, I wanted to see the URL this way:



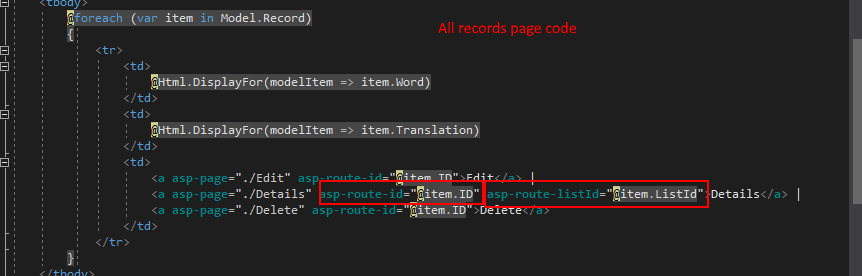
After tries and errors, I decided to place questions in the biggest and most popular developer’s community in the world: <https://stackoverflow.com/>. It is not such simple as it sounds: ask a question, and experienced developers compete between them who will give you the best and fastest answer. The community rejects most of the questions. Moreover, if you want to keep your reputation in this portal as I do, you’d better to ask only a clever question, well-structured and logical. Otherwise, every “dislike” on your question will reduce your reputation and I do not want to do that. I asked two different questions:

1. [Razor Page Routing in the same way as in Web API](https://stackoverflow.com/questions/52863354/razor-page-routing-in-the-same-way-as-in-web-api)
2. [Razor Pages: passing more than one parameter to while navigation OnGetAsync](https://stackoverflow.com/questions/52900647/razor-pages-passing-more-than-one-parameter-to-while-navigation-ongetasync)

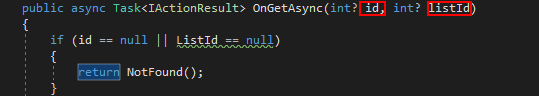
and received the answers that did not helped me to resolve my issue but gave me the right direction.

I posted my final solution to the same questions, because it may be useful for other developers. To show all records in a list I built this URL:  
where the number is List Id. I implemented that by recreation of my URL in Razor Page code: 

Navigation from list to concreate record is built in this way:

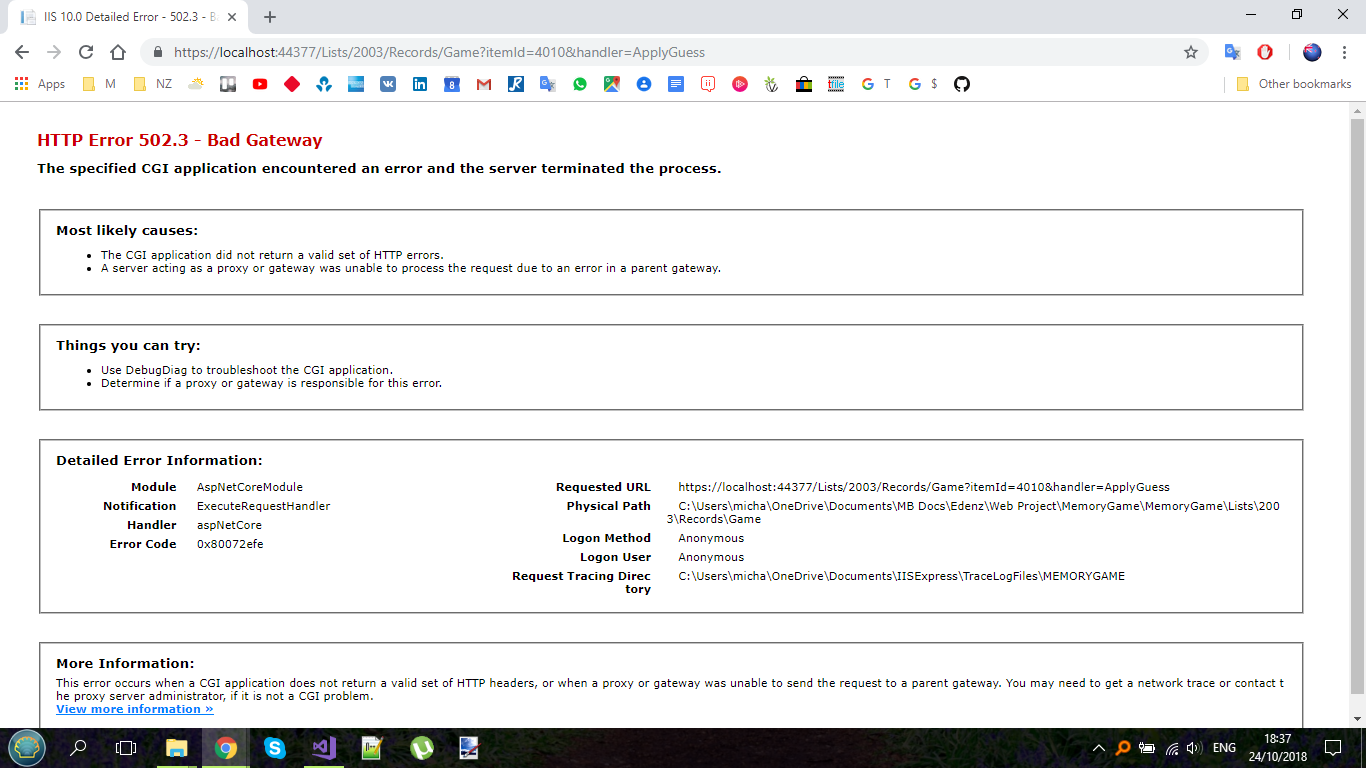


And OnGetAsync method in receiving page:



## Functionality

As was mentioned previously, I faced fatal error: “HTTP Error 502.3 - Bad Gateway” when I implemented my BL in server side. I tried to call method POST every time when user selected his choice. IIS crashed after 6-7 POST methods. Consequently, I was forced to write all BL in client through JavaScript. The result was serious improvement in performance: game interaction happened immediately! Application takes care for all database communication in server side through EF objects that deals successfully with big set of requests, but all computation of BL happens in client side.



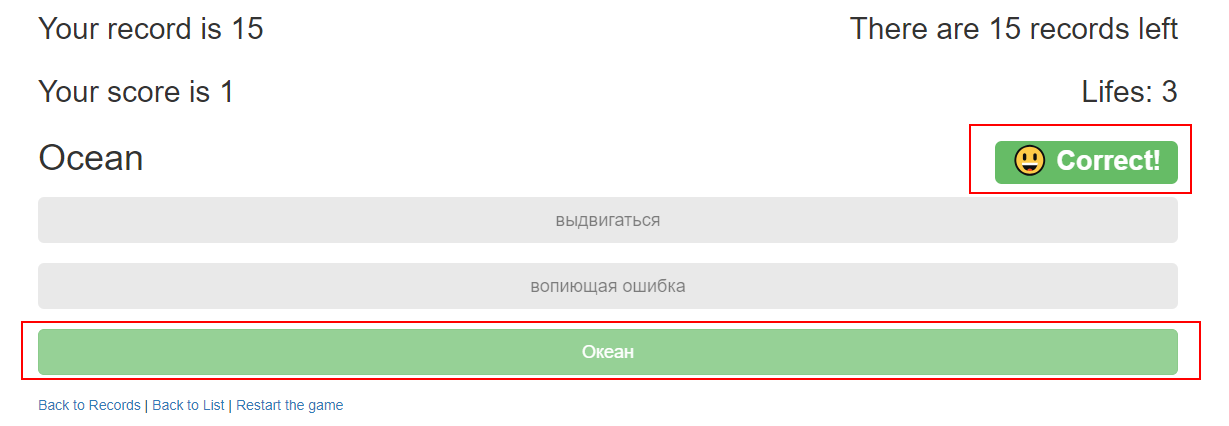
## Styling

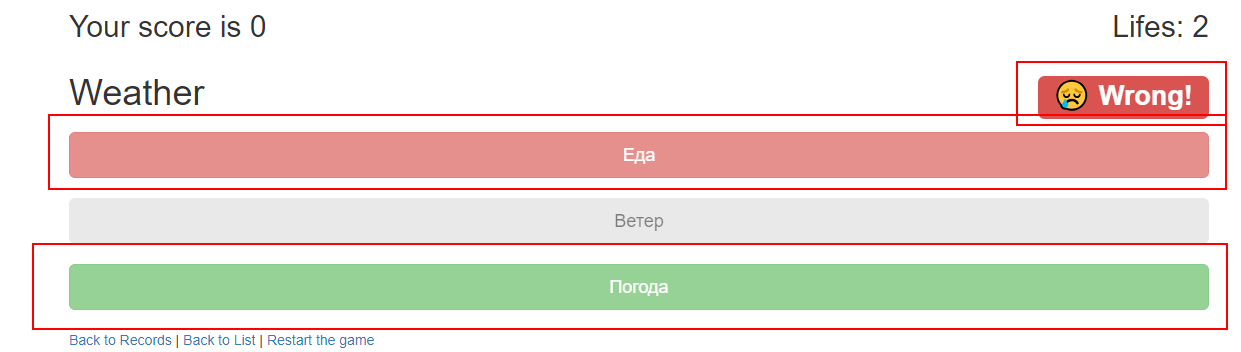
I did not want to implement any css at the beginning, because I wanted to focus on learning Razor Page technology, however, usage of [bootstrap](https://getbootstrap.com/) is very easy. I just needed to add some css and JavaScript files to my solution and use it. All styles I applied by using [bootstrap](https://getbootstrap.com/). I also added a couple of mine css styles to implement special behaviour. For instance, I used css to create table layout with div element. All my styles are located in file local.css.

## Accessibility

“Accessibility is the design of products, devices, services, or environments for people with disabilities. The concept of accessible design and practice of accessible development ensures both "direct access" (i.e. unassisted) and "indirect access" meaning compatibility with a person's assistive technology (for example, computer screen readers).” – Wikipedia. (Wikipedia, n.d.).

It is impossible to play this game or use the application for blind people for example. However, colours-blind people can play the memory game without problems, because colours do not matter while playing:

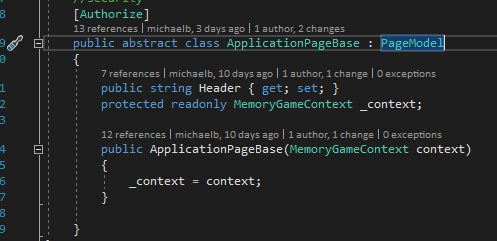




Even though green and red colours indicate correct and wrong answers respectively, you can see “correct” and “wrong” labels with happy or unhappy emojis.

## Security

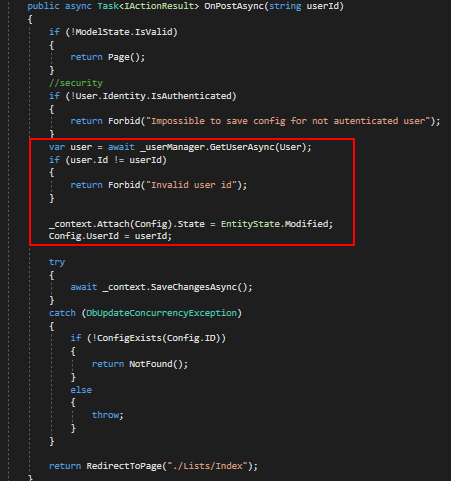
The main security in my application to make lists private. Means, only the current authenticated user can see his lists. First of all, I used attribute [Authorize] for all pages related to Lists, Records, Configuration and Game etc.



All my pages that required authentication inherits from ApplicationPageBase, prevents navigation to these pages without authentication and redirect to login page if someone tries to navigate to these pages manually.

I used email confirmation while registration to avoid fake logins.

I also checked user id when it is sent through URL to make sure it is the authenticated user. For example, in POST method in Configuration page:



It is possible to pass another user id to the URL and without this checking – wrong user will be updated.

## Reflection

I learned how to develop with completely new technology in very short time. I am new in web in general and in ASP in particular, consequently, that was challenging to implement all features I needed: authentication, validation, navigation, database communication etc.

# Implementation

## Discussion of technologies used

I considered usage of Angular + Mongo or ASP + SQL Server or ASP + Mongo. New JavaScript framework such as Angular or React are popular and very interesting for personal research. However, as I mentioned previously, I wanted to focus on better preparation to the local market’s demands. According to my research, the best choice is ASP and SQL Server, because more jobs are available in local market with requirements of knowledge of these technologies. Decision to use MS SQL Server was easy, because it is more popular than other databases in NZ and works perfect with all version of ASP. Nevertheless, it was difficult to decide what version of ASP to use? ASP classic and Web Forms are robust, solid and working technologies, but I wanted to learn something trendy and modern. Consequently, I needed to choose between ASP Core Razor Pages and ASP Core MVC. Based on result from reliable sources:

[Why is Razor Pages the recommended approach to create a Web UI in Asp.net Core 2.0?](https://stackoverflow.com/questions/46777404/why-is-razor-pages-the-recommended-approach-to-create-a-web-ui-in-asp-net-core-2)

[ASP.NET Core 2.0 Razor pages vs Full MVC Core](https://stackoverflow.com/questions/48121928/asp-net-core-2-0-razor-pages-vs-full-mvc-core)

I decided to work with Razor Pages. However, if I had done it today, I would have used ASP Web API to use the same Web API for Mobile and desktop development.

My starting point was in [Introduction to Razor Pages in ASP.NET Core](https://docs.microsoft.com/en-us/aspnet/core/razor-pages/?view=aspnetcore-2.1&tabs=visual-studio). While seeing these examples I implemented my ideas and made the application running.

*Discuss the technologies used in your application along with alternatives considered and your reasons for final choices.*

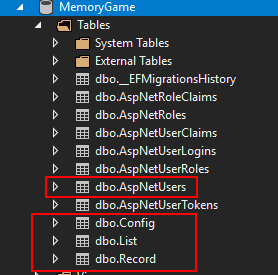
Limitation: Razor Page is tight coupled to other MS technology as Entity Framework (EF) and SQL Server. I can change easily DB schema by migration scripts, because I used EF Code First. That means, I created C# Model classes and EF generated DB for me. I also run update DB scripts when I changed my Model. However, it will be very difficult to work together with another database. MySql for instance. Means, if you change the database for Mongo for instance it will be less convenient and will take much more time to develop. Moreover, there is no enough support because this technology is relatively new and the community does not have enough experience.

## Database schema

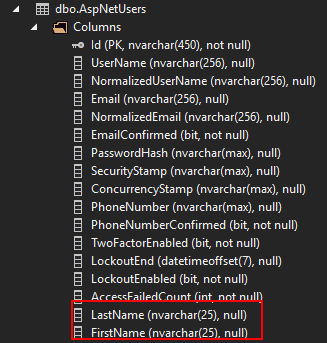
When you use built-in ASP authentication, Visual Studio generates for you database with required data tables. Most of the tables was generated for me. I added only 3 tables:

1. List
2. Record
3. Config

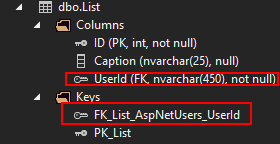
In addition, modified AspNetUsers.

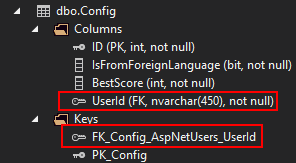


In Users table I added 2 fields:

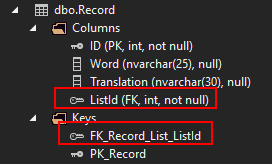


Lists and Config tables have a Foreign Key to Users table:

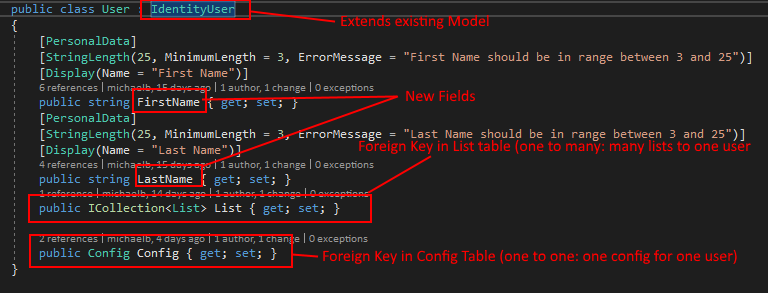


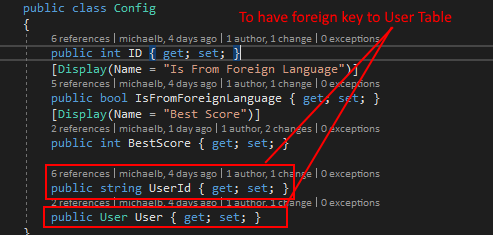


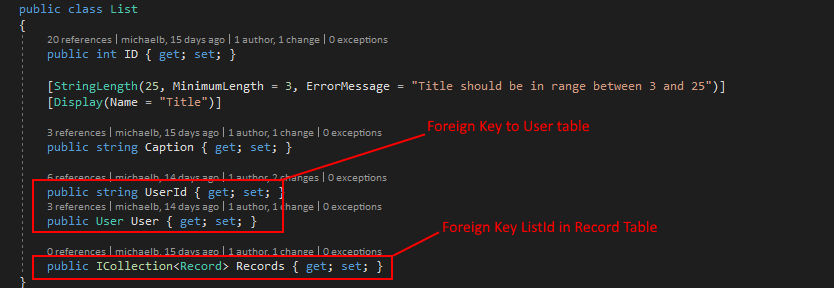
Records has foreign key to List table:

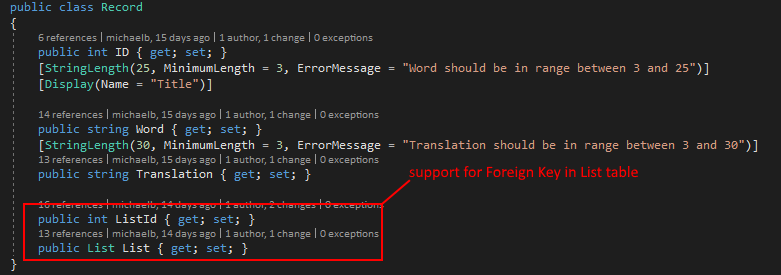


I added these tables and modified existed by EF migration scripts while used technic Code-First. I created. Following Models:





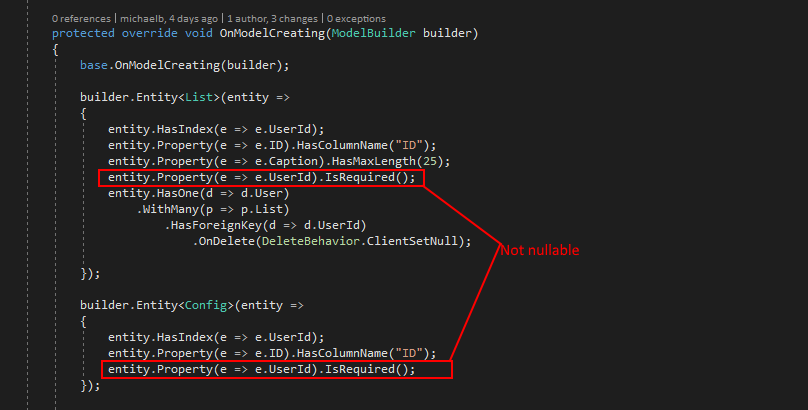




After all models where created, I generated the database with EF core scripts:

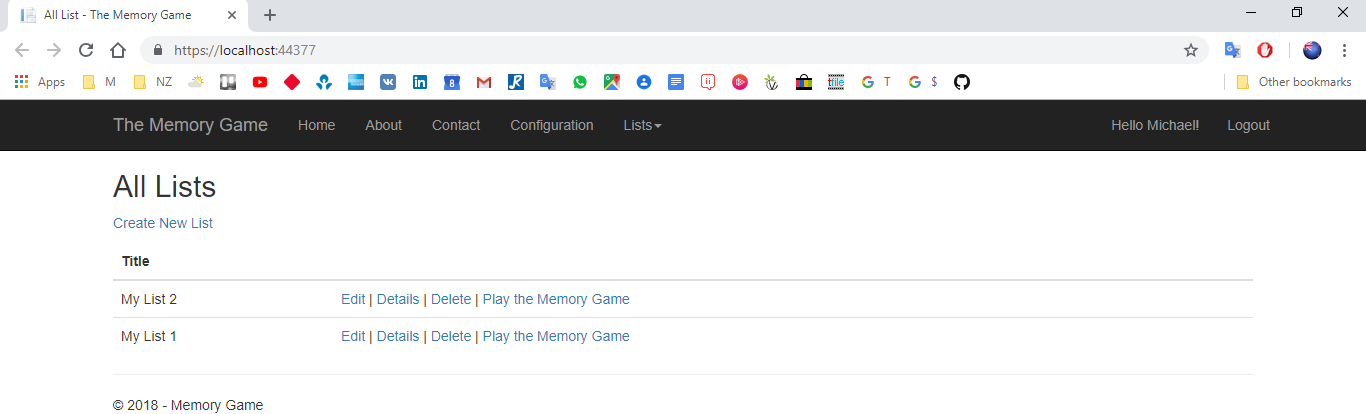
Add-Migration **Initial -** Generate Migration code that creates database in the second command.  
Update-Database - Create database file with required schema

I spent a couple of days to build required db scheme, because of some issue. *Users* table has Primary Key of type *nvarchar*, and Foreign Key in tables *Config* and *List* were generated as Nullable and that was wrong. List and Configuration instances do not make sense without connection to the user. I did not find information how to fix this issue and consequently I made [reverse engineering](https://en.wikipedia.org/wiki/Reverse_engineering). I changed the database manually and generated Model and Migration code. Based on generated code I modified my MemoryGameContext:

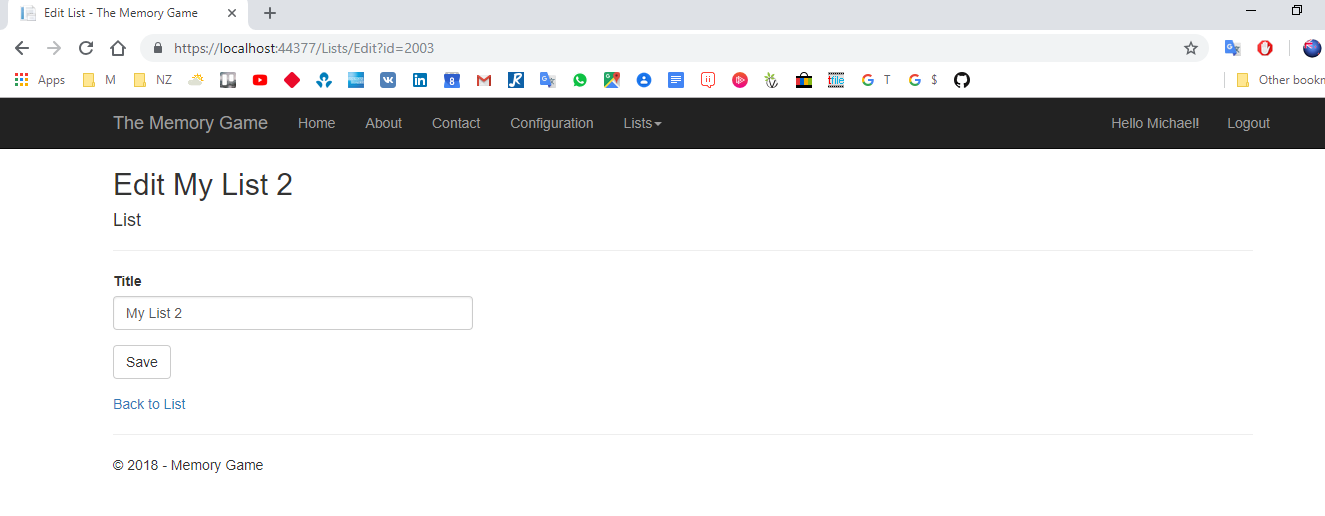


## Screen shots

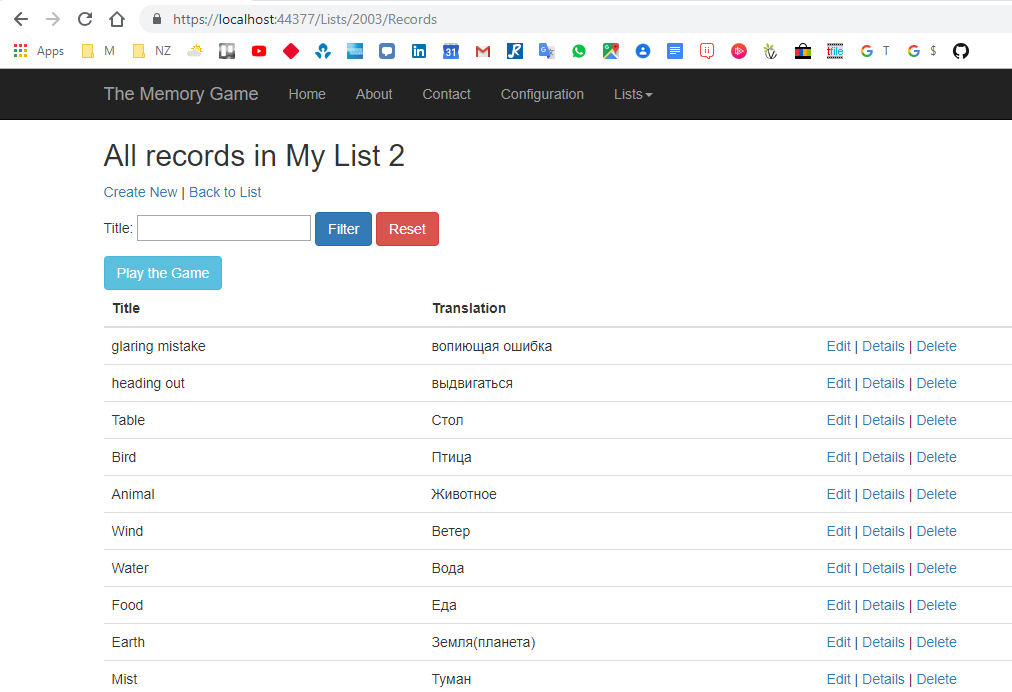
### Main Page



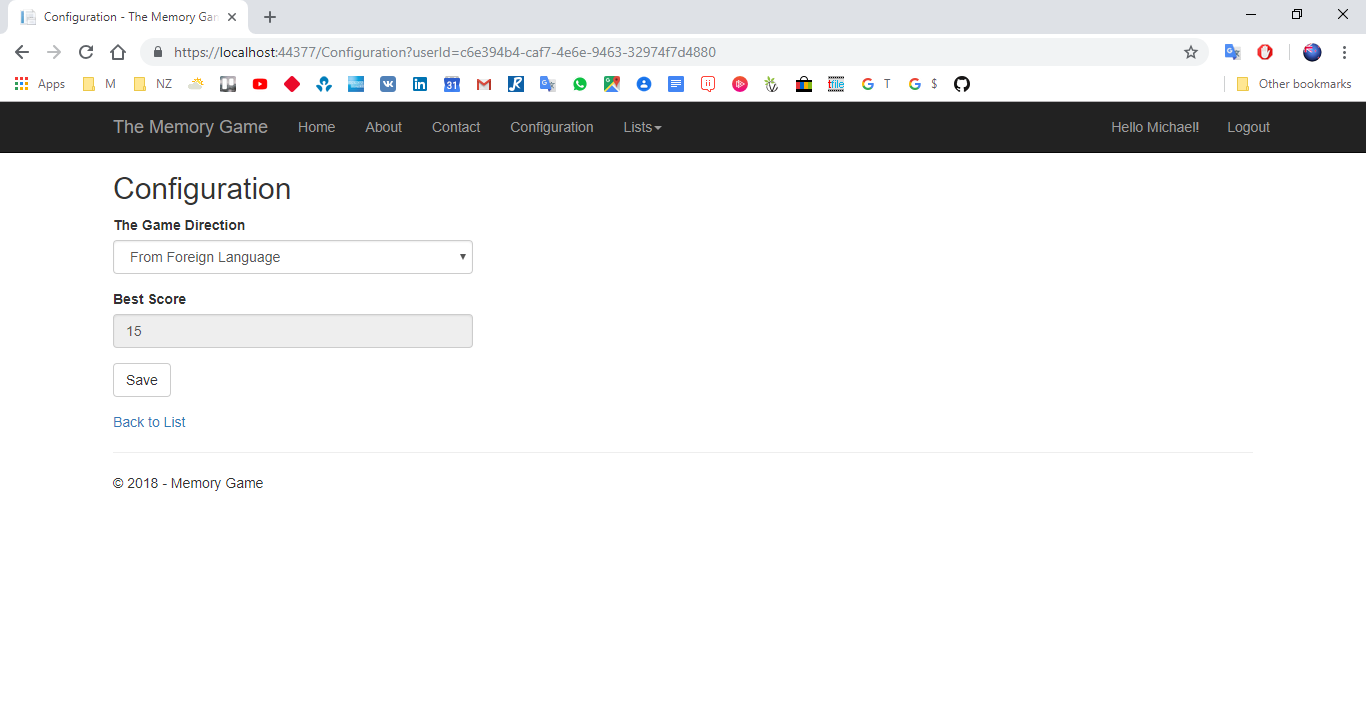
### Edit List



### All records for a List

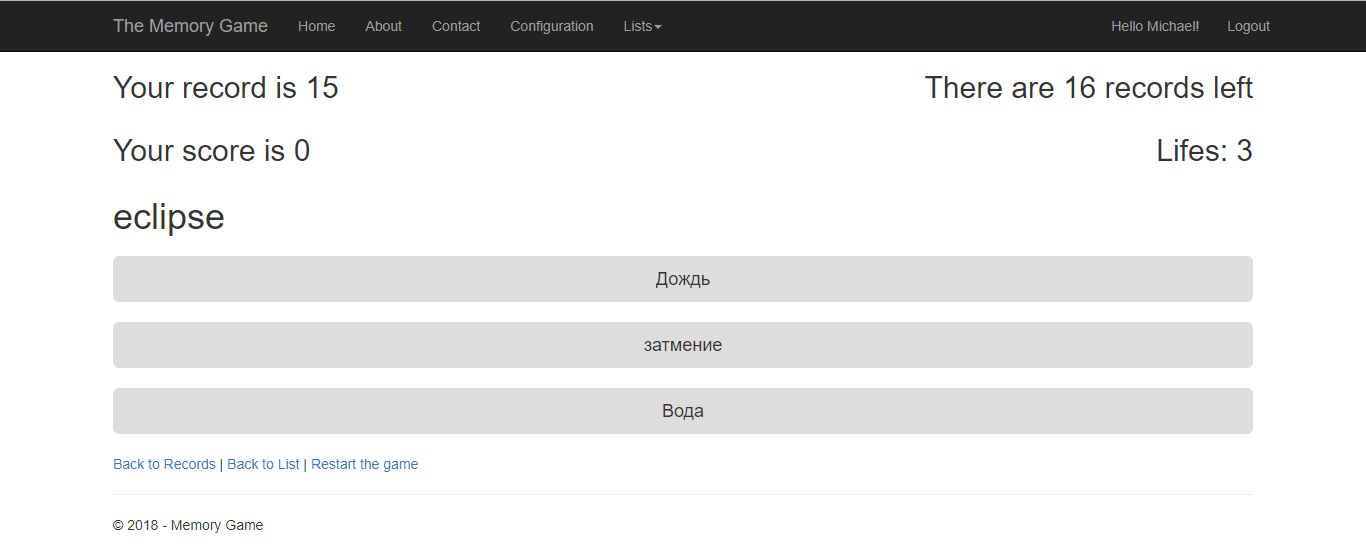


### Configuration Page

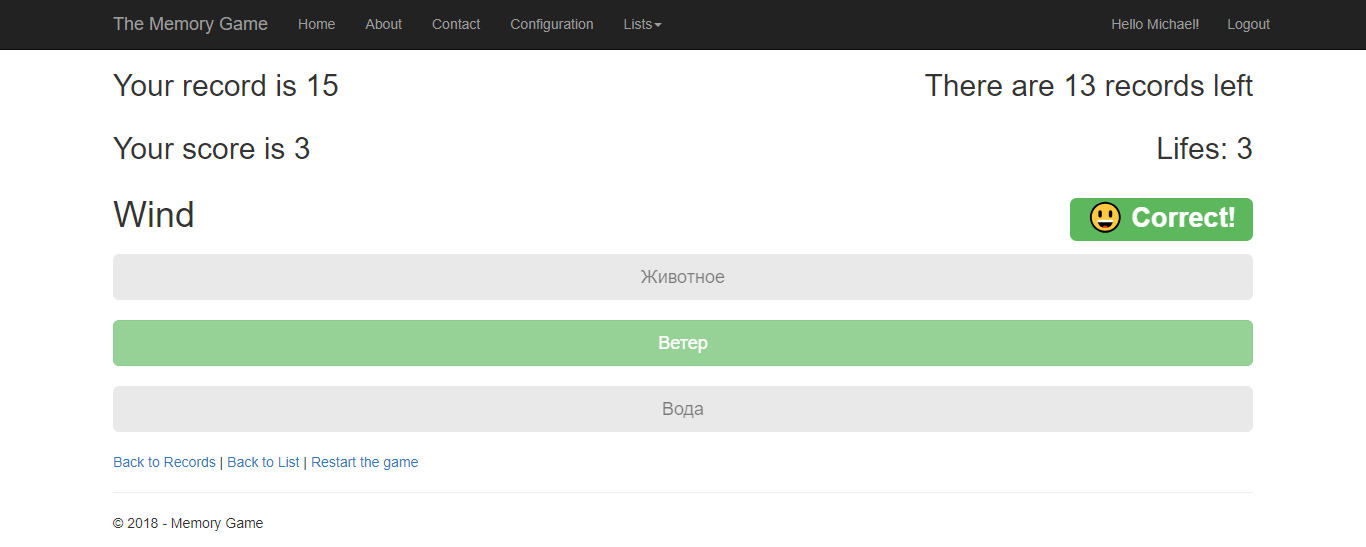


### Memory Game

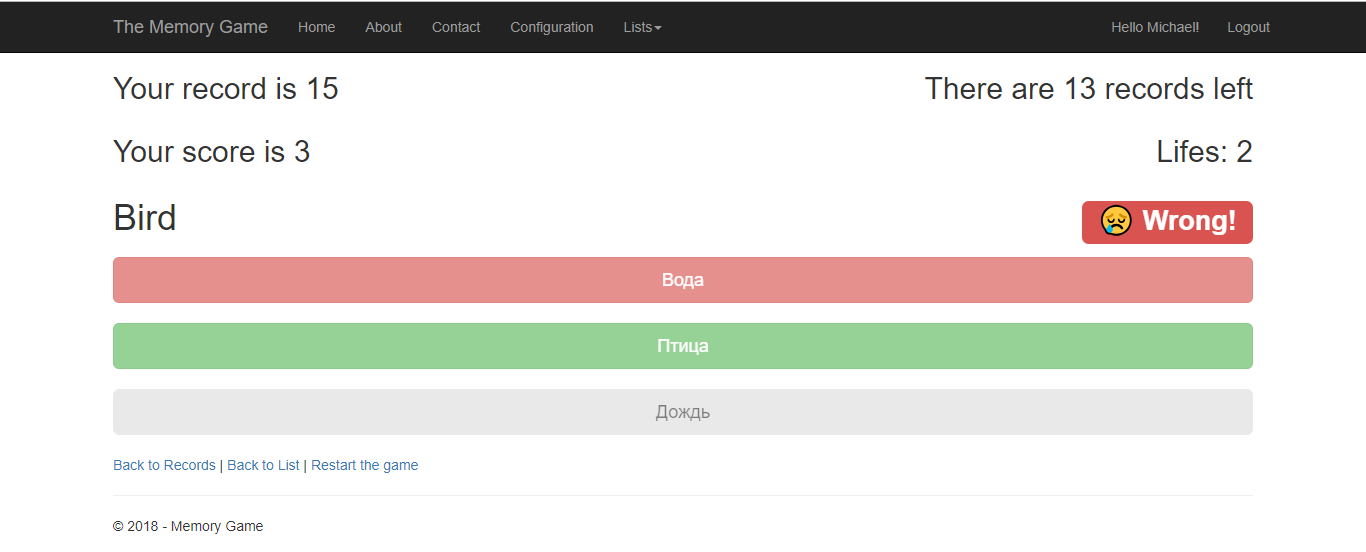
#### Starting



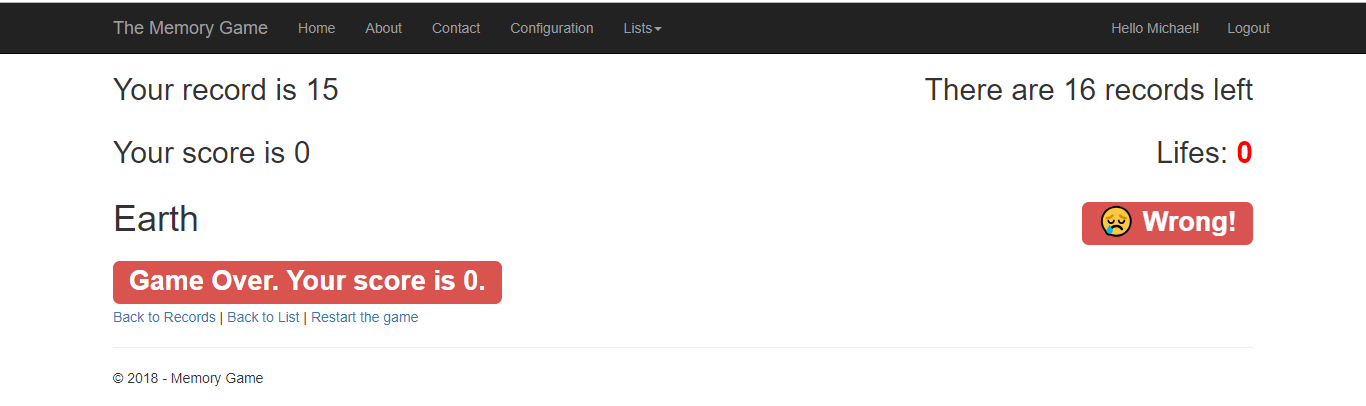
#### Right Selection



#### Wrong Selection



#### Game Over



## Reflection

I learnt how to work with ASP .NET Core either MVC and Razor Page. I polished up my SQL Server knowledge, EF skills and created my first web application. I also wrote JavaScript code for the first time and was very important because all my business logic is in JavaScript. Moreover, I learn how to work with GitHub as a source control. I have never used GitHub before.

*Right here about the cloud*

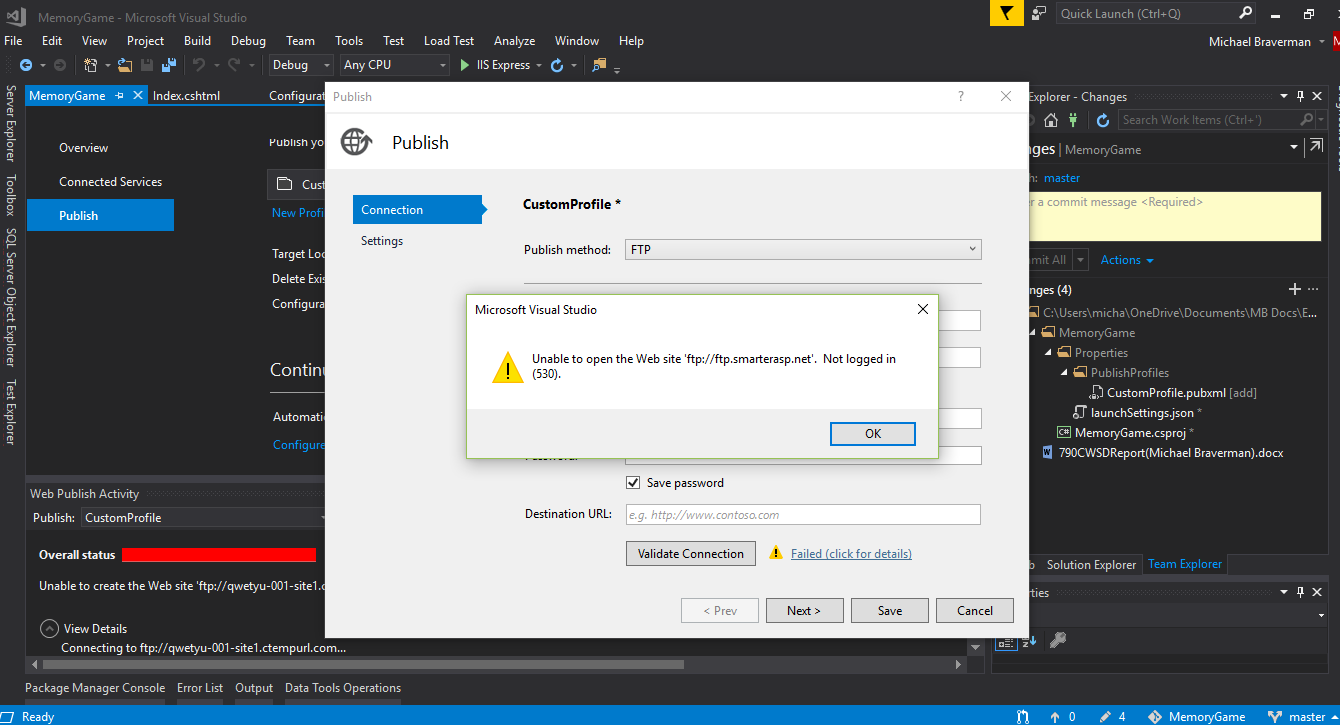
# Cloud Deployment

“Cloud computing is shared pools of configurable computer system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet. Cloud computing relies on sharing of resources to achieve coherence and economies of scale, similar to a public utility.” (Wikipedia, n.d.)

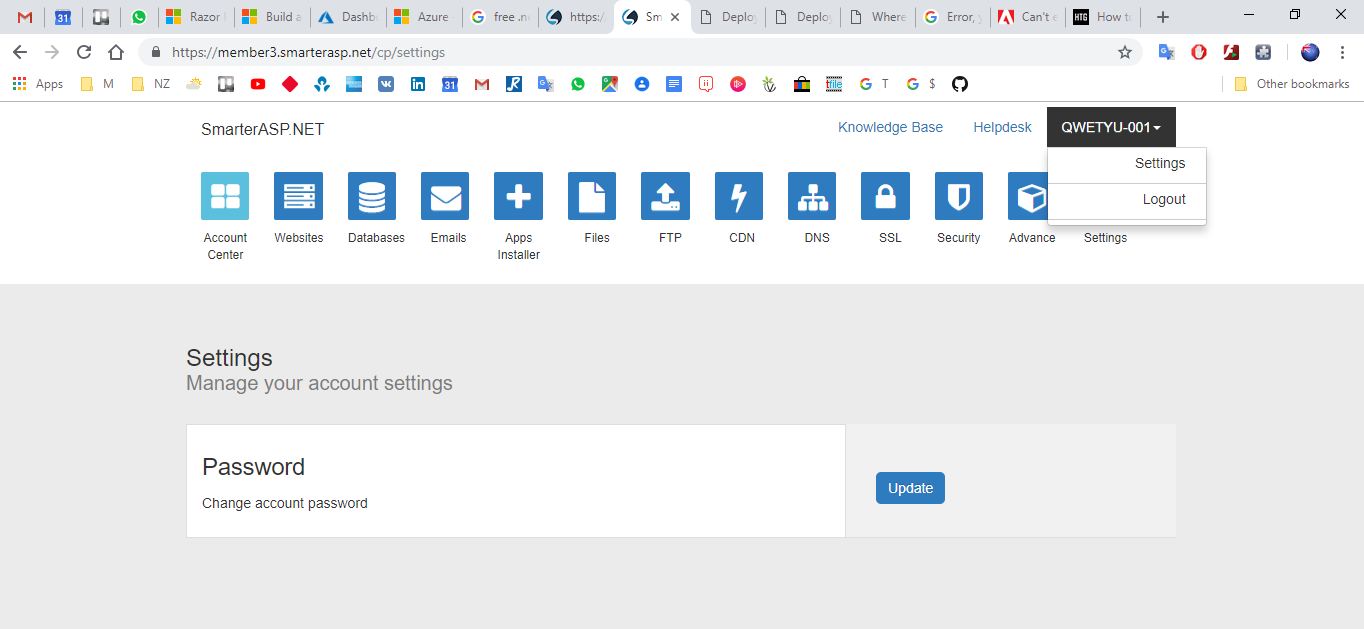
In my case I was needed to find some free cloud infrastructure as a service that provides hosting for ASP .NET Core web site together with MS SQL Database. Most of MS products are not free in comparison to Apache, MySql and Linux for instance. That is why I found only a few free services that do not work for me due to different issues.

## Discussion of cloud technologies

This is very difficult to find free and working ASP .NET Core hosting. I spent all day by trying to upload my web site to [smarterasp](https://www.smarterasp.net/), but it was all to no avail. I tried to do that through Visual Studio (VS) wizard but got different errors like “invalid url” or “invalid credentials”



Even though I am currently logged in to it through browser:



I also tried MS Azure, but it wanted my credit card “just for confirmation, we do not charge you”. I declined this idea directly.

1. [mLab](https://mlab.com/) – Mongo Db as a Service – totally free

I love to work with this cloud. It allows hosting of your Mongo DB in cloud and access it by special connection string. Very simple and convenient. Disadvantage: extremely horrible Interface. I would say there is no interface. You need to create database manually, create your own way to add documents to it and CRUD it through your application. Additional problem was when I sent my solution to the third party: he could not access to the cloud from his work PC due to some firewall issue and consequently I moved my DB to [gearhost](file:///C:\Users\micha\OneDrive\Documents\MB%20Docs\Edenz\Web%20Project\MemoryGame\gearhost.com).

1. [smarterasp](https://www.smarterasp.net/) – Infrastructure as a service – 60 days free
2. [gearhost](gearhost.com) – database as a service
3. MS Azure – Infrastructure as a server – free, but they want credit card

*Describe and compare architectures and infrastructures for three cloud platforms.*

## Deployment

*Discuss the process of deploying an application to the cloud and your experiences with this process.*

# Testing

## Test planning

|  |  |  |
| --- | --- | --- |
| Number | Test Case | Result |
|  | Navigation to the main page redirects to Lists\Index page | works |
|  | All links works and navigate to appropriate pages | works |
|  | Adding a new list, adds a list to the database | works |
|  | Edition of an existing list reflects the change | Works |
|  | Deletion deletes the list | Works |
|  | Search in All Records page | Works |
|  | Reset in All Records page removes filter | Works |
|  | Records in All Records page belong to appropriate List Id | Works |
|  | Button “Play the game” initiates the memory game | works |
|  | Registration sends confirmation email | Works |
|  | Pressing on confirmation link navigates to “email confirmed” page. Field “EmailConfirmed” in the database changed to “true” | Works |
|  | Login/Logout | works |
|  | User cannot login before email confirmation | Works |
|  | Confirmation email contains appropriate message | Works |
|  | Cannot access to List, Configuration and records pages without authentication | Works |
|  | Toolbar items Lists, configuration are hidden without authentication | Works |
|  | Authentication with different users shows different data | works |
|  | Authentication with different users shows valid data (only the records that were added by this user) | works |
|  | User does not login directly after registration | Works |
|  | User can CRUD record | Works |
|  | Login shows User’s first name (not email or second name) | Works |
|  | Play game from button initiates the memory game | Works |
|  | Play the Memory Game link from “All Lists” page initiates the memory game | Works |
|  | Game initiates for proper list (for records that belong to selected List) | Works |
|  | In Game Page the best result (record) score appears | Works |
|  | In Game Page current score label appears | Works |
|  | In Game Page appears label with counter of how many records left to win | Works |
|  | Configuration page shows the best result score for current user | Works |
|  | Game Direction is saved in configuration page (when you save and come back to the page you can see your change is applied) | Works |
|  | Save configuration redirects to All Lists page | Works |
|  | When your Game Direction is “From Foreign Language”, you see the word to guess in foreign language and 3 buttons with translation to your Native language | Works |
|  | When your Game Direction is “From Native Language”, you see the translation to Native language and 3 buttons with translation in foreign language | Works |
|  | When you initiate the Game for list with less than 5 records – you see message that game is impossible | Works |
|  | When you select correct option – you see “Correct!” green label | Works |
|  | When you select incorrect option – you see “Wrong!” red label | Works |
|  | In Right/wrong selection – label disappears gradually after 3 seconds | Works |
|  | In Right/wrong selection – label blinks for 3 seconds | Works |
|  | Valid selection changes its colour to green | Works |
|  | Invalid selection changes its colour to red | Works |
|  | Invalid selection shows valid word/translation by making the button green | Works |
|  | All 3 buttons are disabled during the animation – impossible to make any selection | Works |
|  | Score increases with valid selection | Works |
|  | Records left decreases with valid selection | works |
|  | Score and records left labels do not change with invalid selection | Works |
|  | After valid/invalid selection – new random options are shown |  |
|  | All words/translation in 3 buttons are different | works |
|  | Only one option is valid | works |
|  | Selection of valid record always indicates as correct | works |
|  | Selection as invalid option always indicates as wrong | Works |
|  | Life label decreases its value with invalid selection | Works |
|  | Last life remains with red colour and bold font | Works |
|  | After 3 invalid selection- the game is over and user sees the appropriate notification | works |
|  | After user selects all valid options in the list – the game is over with notification “you won + user name” with redirection to Won page | works |
|  | If user overcame his record – he sees “congratulation” message and record is update in configuration table | Works |
|  | Next game new record is seen in appropriate label | Works |
|  | URL of the game page shows id to valid list: https://localhost:44377/Lists/**2003**/Records/Game | Works |
|  | URL of all records for the list shows valid list id: https://localhost:44377/Lists/**2003**/Records | Works |
|  | URL of selected record shows id of list and for the record: https://localhost:44377/Lists/**2003**/Records/**4002**/Details | Works |

## Test results

As I mentioned previously, I started to wright the code in C# and made unit test for a lot of cases, however, after facing of fatal “voodoo” bug in IIS, I rewrote all BL in JavaScript. Even though JavaScript is C-family language and I do familiar with it, learning of new JavaScript Unit Testing framework was out of scope and was not in my scheduler. Moreover, most of the frameworks are Node.js based and did not plan to spend time for Node.js installation and configuration. Consequently, I do not have unit tests in my application. Besides the Game Page, the logic in my application is very straight forward and unit tests are redundant. I agree that I did not use enough abstraction, inversion of control and other SOLID principles. I did it deliberately because I wanted to focus on Web, .NET Core and Razor Pages (I am absolutely new in these technology), and distraction could lead to delay in my time scheduler. I decided to do that safe without risks.

During development I had problem with generation of random words/translation and options to select. I used recursion to generate random members and that took a time to fix bugs. I also spent some time generate valid URLs (last tree tests).

I do not know any bugs remain in my application. All planned functionality works.

## Reflection

1. Improved my JavaScript development skills. I hate JavaScript because it is too dynamic with not enough compilation errors, bad intellisense, weird types treating and not logical (from my opinion) mechanism. However, during this project I rewrote all BL and fixed bugs during about 20 hours. Devil is not so black as he is painted.
2. Enhanced my JavaScript debugging skills through Chrome Dev Tools.
3. I developed a business angular application in my previous company and in comparison to Angular – ASP Core is a child play. Razor Page/ASP is well structured, organized platform. It is pleasure to develop with this technology. It is also easy to troubleshoot, because usually ASP shows your problem very precisely with exact line of code – and this is really cool, whereas working with Angular and React was real nightmare: a lot of times it did not work without error message and I did not know what is a problem and what to do! I proofed to myself again that MS technologies are most convenient in the marked!

# Conclusion

## Reflection

*Explain what you learned during this project. You should aim to identify all problems and how these affected your project. What would you do differently next time?*

## Summary

*Provide a summary of your project. This should tie up with the Executive Summary at the beginning of the report.*

# References

*You must use the APA referencing system*