

CPP TEAM BUILDER – A PLATFORM FOR STARTUPS

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SIGNATURE PAGE

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ABSTRACT

Nowadays, looking at the current trends in IT businesses and ventures it is easy to assume that we are in the era of startup nation. Digital tools became more available to the mass due to the development of new technologies and plummeting costs. Investors tend to put in more efforts even to early-stage funding. Looking at the statistics the number of companies that was funded doubled between 2007 and 2012 in Silicon Valley.

On the other hand, launching startup is high-risk high-reward venture. Statistics shows, that a vast amount of ventures lack funds, barely survive or just stop functioning. Also, looking from the perspective of job-seekers startup may look like an amazing chance to grow with a company and become big in future and play an important role in company growth. But at the same time, it may look also too risky, because the future of the company may seem unknown, whether it will have enough funding to continue functioning or will the product become successful etc. In short, startups do not have the same level of stability and reliability as bigger companies.

Nevertheless, even considering the above-mentioned problems startups remain a good source of jobs, they can provide many workplaces and satisfy people's ambitions, whether you are an entrepreneur or someone who is looking for a job. The application developed in this project called Team Builder, provides an opportunity for both, entrepreneurs and job-seekers to find people to join a team or find a team to join correspondingly. Companies list projects and positions they have and their requirements, while candidates can choose and apply for a position and contact an employer. This application should serve a reliable platform which supports such a promising venture as a startup.

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INTRODUCTION

Startups are newly emerged businesses the goal of which is to find its niche on a marketplace, build a successful business model which brings profit. Nowadays, there are tons of startup companies and every day these number changes because the tendency is so, that they have high rates of failure, but the minority which become successful usually tends to be large and influential in the future. Nevertheless, a lot of new startups show up on the market all the time, despite the gloomy statistics. It has reasonable explanations, as a lot of people want to work on themselves and believe in their own ideas, which they want to implement.

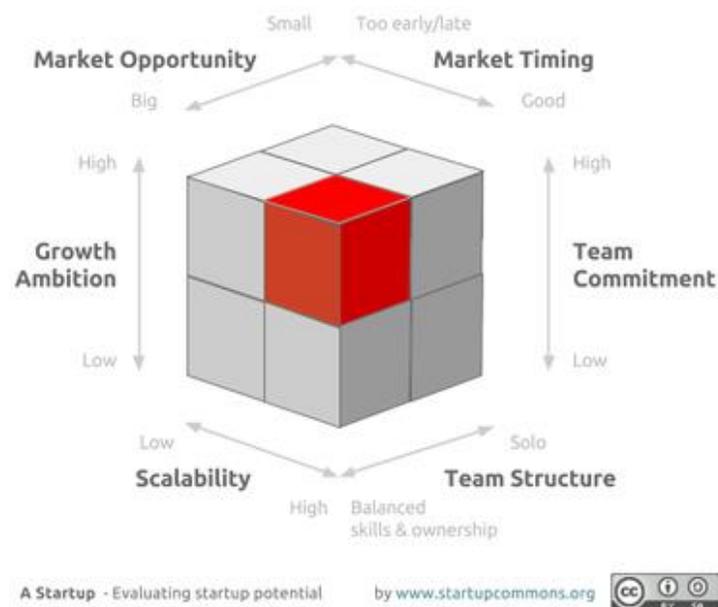


Figure 1. Key success factors of a startup venture

Figure 1 visualizes the key factors of success for a startup. We can observe that in order for a venture to succeed many factors should be taken into consideration. Market should be big enough and have a lot of opportunities, as well as timing of the project should be

considered as well due to possible competitors in the same niche, etc. Team structure is crucial step as well, finding right people for the job, with passion and goals which meet the goals of the startup is imperative.

Nowadays, we have thousands of jobs available in information technology field and even more applicants. It is common situation when an applicant hired is not the best fit for the job or vice versa, the job is not what an applicant has a passion for. This is especially prevalent in startups because goals, methods which company is using and the company's culture might not be yet clear for both, the company and the applicant. There are dozens of job-board websites which help people to find jobs and get hired, but the solution (the system) proposed in this paper is focused on exactly startups. It helps not only applicants to find a startup company, but also companies to find employees they need. It is centralized system where people can apply for a project, and for a specific opened position in this project.

MOTIVATING EXAMPLE

The idea of being successful is inherent in most people. While developing this project the inspiration to develop some system that will be used by many users and brings a lot of benefit and use to those who use it was taken from such platforms and application like AngelList. This is a bright example of a startup which grew into a huge network of people who share connection between each other, jobs and a place where thousands of people find their places, their jobs. It has been a recruiting portal since 2012. The number of startup jobs listed on AngelList encountered 75000, number of accredited investors reached 50000 by March 2018. The amount of money that flows through AngelList annually reached \$200 million. Furthermore, on average, there are about 1000-2000 hires monthly, over \$160 million raised by over 565 startups and over 10000 matches per week between job seekers and companies.

Those numbers sound more than inspiring and is one of the greatest examples how startup becomes a world size unit bringing millions of profit.

CHALLENGES

During development of any project facing various challenges is a common process.

Creating modern software is a complex process involving not only writing the code but also engineering the solution, provisioning what modules should it has, whether some of them are required or not, will be successful or not and prioritize tasks considering the terms, the goals and requirements. While engineering Team Builder, many challenges were faced and addressed. Below listed are the main challenges which had to be solved.

3.1 The variety of tools and development platforms

“Team Builder”, being a web application, can be implemented with different programming languages and technologies, using different development platforms. One of the options is to use HTML for a web page markup, CSS for styling pages and JavaScript for making it all functional. But JavaScript itself has a lot of frameworks like AngularJS, React.js, Node.js, Express.js etc. It can also be implemented using Java and some development tool for visualizing the pages, for example JSP or JSF. The list of possible options is probably too long to recap in this paper. Of course, it is also crucial to choose technologies with which developers are already familiar or have some experience with not to delay the process.

Another point worth mentioning is choosing the development platform, which also might be not only desktop, but mobile. Developing for Android requires Java, but developing for iOS requires Swift or Objective-C, we cannot simply develop one code base and use it

for all the platforms. The target audience for the application should be determined to make the first choice.

Last, but not the least, we should define what database is going to be used. Nowadays, we have dozens of different databases and they may serve to some purposes better or worse depending on our goals. The database must be robust, secure, meet all the needs and be scalable. For instance, Oracle or MySQL are the options, or some NoSQL solutions like MongoDB or Firebase, which operate with JSON format.

So, choosing the correct option considering the development environment and different circumstances is an imperative solution which can influence the project development speed, performance, user interface, user experience and success overall.

3.2 Choosing security controls

Data security is one of the most important parts in application development nowadays. Companies spend millions of dollars on security and making user's data private is one of the top priorities. "Team Builder" is not an exception too, since in this application users are going to interact with other users (e.g. applicants with companies and vice versa), and user's data is going to be stored as well, the application must be secured by using modern security protocols. So, the requirement of encrypting all the data which is being sent over the Internet, especially when it relates with some private information, is crucial.

Moreover, authentication also plays an important role in the system to be able to restrict access to user data.

Providing proper security level is not trivial task, it is generally a complex process and a separate broad branch of study. It requires knowledge of various factors such as

performance and scalability. Ensuring that the right security level is maintained is very important and cannot be simply added without proper knowledge of the consequences, as it may result in a system with potential security risks and may also affect performance of the entire system. So, during the development process it should be decided whether the application needs separate measures of security including but not limited to hashing, encryption mechanisms, firewalls, password rules, data backups. For example, simply setting a firewall for any application may not make sense because simple firewall restriction may prevent users to perform legitimate operations or it can also diminish performance as they use processor power and RAM memory to perform their functions. It may also require additional costs depending on the type of firewall. Thus, a lot of factors should be considered to choose the perfect balance between security and costs/necessity in applying it.

3.3 Difficulties in maintainability and scalability

Software systems usually evolve over time due to adding new features, increasing the number of users in the system, providing new technologies and other kinds of updates. For instance, adding more features is essential part of any application development process and it may involve updating the data format or changing the amount of data transferred to and from server. For adding even a small feature, it may require to change code in different modules, files and developer needs to incorporate these changes carefully. Hence, organizing the development process and managing code in an efficient way, making the addition of new features easy and eliminating the risks of breaking the existing code is essential.

Scalability also plays an important role in evolution of an application as a user base will more likely to grow and initial amounts of database space, its format or even initial server used may not be enough to support all needs of growing platform. Choosing scalable solutions also protects initial investments, and businesses can continue using same software for a longer period of time if designed properly.

3.4 User interface responsiveness

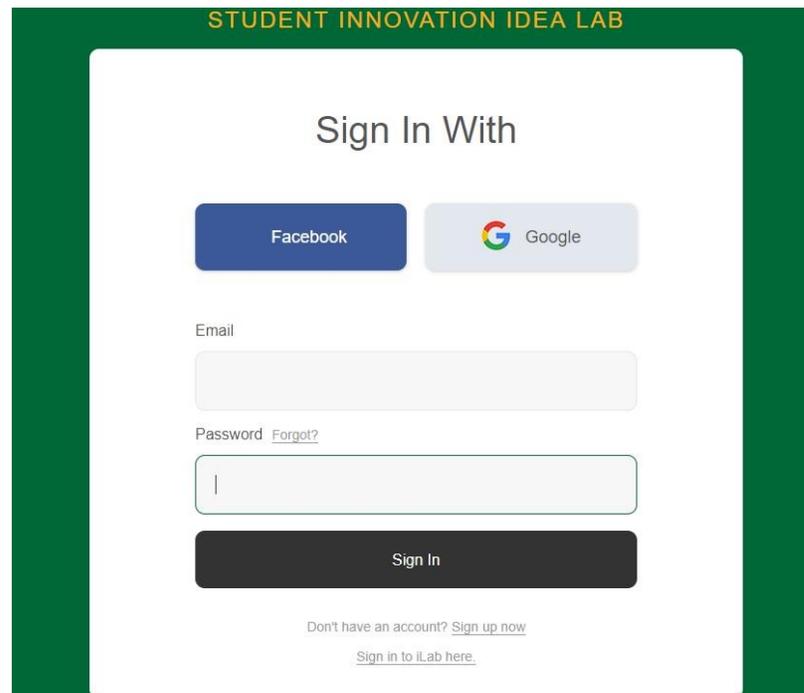
Nowadays, when building web application or any website we cannot imagine developing it only for desktop computers, as mobile devices and have seen rapid growth on market and a lot of people prefer to browse internet using them. By the end of 2016 mobile usage had overtaken desktop. So, when implementing the application, we must keep in mind that GUI should be adapted to both, desktop and mobile versions, and other screen sizes, whether it is iPad, iPhone or Samsung phone etc. It is crucial to invest in responsive web design and make sure that an application works well on smartphones or other screens.

SOLUTION

CPP Team Builder is a web-based application, it provides graphic user interface in the form of html pages in the browser.

4.1 Implementation

First page a user can see is a login form which allows to login for existing users or create new account for new users.



The image shows a login form titled "Sign In With" for "STUDENT INNOVATION IDEA LAB". The form is centered on a white background with a dark green border. It features two social media login buttons: a blue "Facebook" button and a light blue "Google" button with the Google logo. Below these are two input fields: "Email" and "Password". The "Password" field has a "Forgot?" link next to it. A dark grey "Sign In" button is positioned below the password field. At the bottom, there are two links: "Don't have an account? [Sign up now](#)" and "[Sign in to iLab here.](#)".

Figure 2. Web based interactive UI (login form)

On a login page user must input two parameters which are email address and user password.

BRONCO INNOVATION LAB

Register

First Name

Last Name

CPP Email

Password ?

Password (Again)

Cancel Register

Figure 3. Web based interactive UI (register form)

In order to register user must provide his/her first name, last name, email address, password. There is a set of rules which password must follow to provide solid security level to a user account. For instance, the length must be 8-15 symbols, it also must have at least 1 digit, 1 uppercase letter and 1 lower case letter and 1 special character.

If a user has an Innovation Idea Lab account he/she may log in using it. To do this, there is a link on a login page “Sign in to iLab here” which redirects to Idea Lab account login. User should fill following fields: name, email, class year (possible options are freshman, sophomore, junior, senior, graduate or other). Corresponding picture can be observed on figure 4.

The image shows a web-based login form for 'iLab'. The form is set against a dark green background with the text 'STUDENT INNOVATION IDEA LAB' at the top. The main heading is 'Sign In to iLab'. Below the heading are four input fields: 'Name', 'Email', 'Class Year' (a dropdown menu), and 'Purpose of Visit'. At the bottom of the form are two buttons: 'Cancel' and 'Submit'.

Figure 4. Web based interactive UI (iLab login form)

On figure 5 the code which registers new user is shown. As Node.js is used as a main backend development language it makes it easy to make a database connection and operating on data. It connects to the Firebase database, checks if current user is not registered and logged in, if not – then database entry with the given input is created. Before it happens the code also checks for any errors occurred during the registration. To avoid any data discrepancy, it checks if all the required fields are filled and meet the requirements. Once user is registered he/she can log into the application and is redirected to the home page.

```

router.post('/', function (req, res) {
  // check if user is already logged in
  var user = firebase.auth().currentUser;

  if (user) {
    // User is signed in.
    // redirect them
    res.redirect('/');
  } else {
    // No user is signed in.
  }

  // check for any form errors
  var fname_errors = checker.name_check(req.body.first_name);
  var lname_errors = checker.name_check(req.body.last_name);
  var email_errors = checker.email_check(req.body.email);
  var password_errors = checker.password_check(req.body.password, req.body.password_conf);
  var general_errors = {};
  var fire_base_errors = [];
  var errors = false;

  // if no errors occur, continue checking before register email/password
  if (!(fname_errors.length > 0 || lname_errors.length > 0 || password_errors.length > 0 || email_errors.length > 0)) {
    // call firebase to create account
    firebase.auth().createUserWithEmailAndPassword(req.body.email, req.body.password).then(function () {
      // if registration was successful
      firebase.database().ref('user_profiles/' + firebase.auth().currentUser.uid).set({
        fname: req.body.first_name,
        lname: req.body.last_name,
        email: req.body.email,
        // info below will be added later
        major: "",
        year: "",
        atcpp: "",
        availability: "",
        bio: "",
        interest: "",
        skills: "",
        pic_url: "/images/default-profile-pic.png",
        first_login: true,
        applied: "",
        notifications: ""
      });
    });
  }
});

```

Figure 5. Code responsible for registration

Once user is logged in home page is opened. From the home page all main functions of the application are available. Which are: view available projects and open positions and an ability to apply for them, view current leaders of the projects, manage your profile.

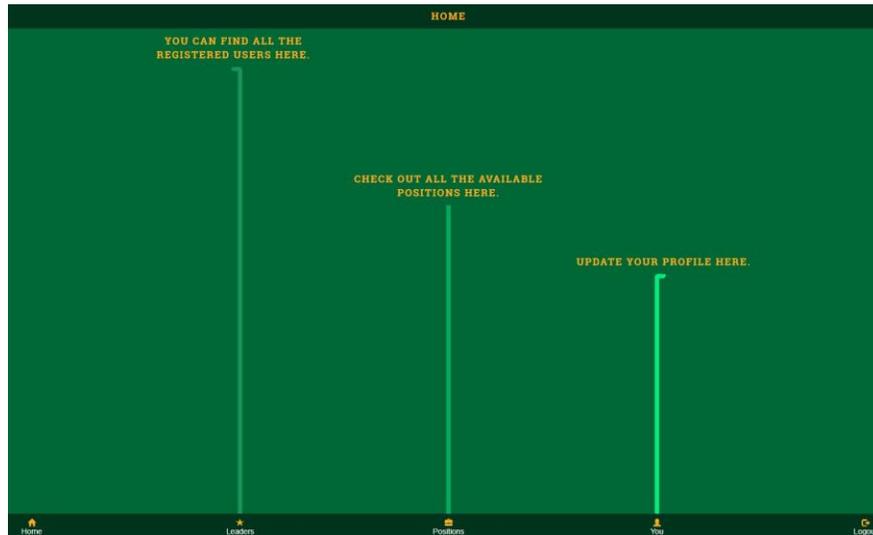


Figure 6. Application home page

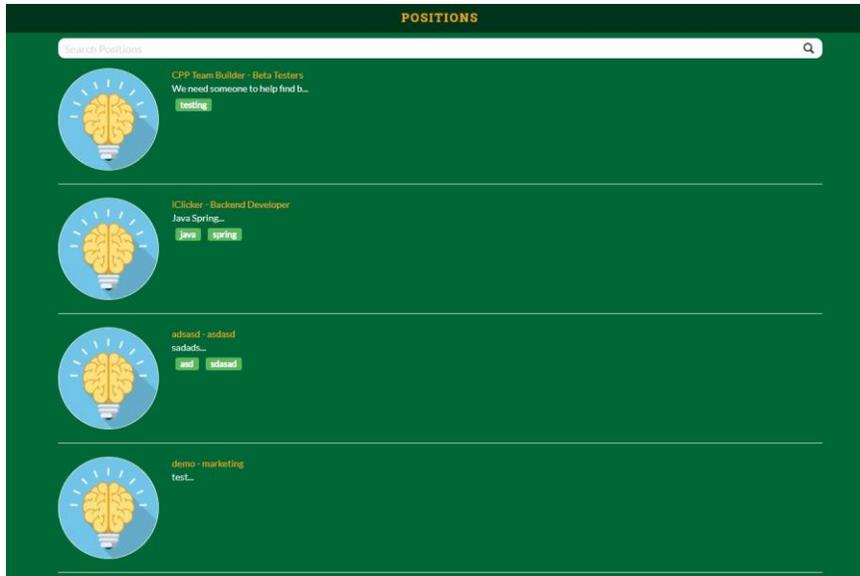


Figure 7. Positions screen

On figure 7 the positions screen is shown, user can look through the list of available positions and projects or search one using the search field. Once it is found user can select it by clicking on the project picture and view the details and apply for position. The owner of the project will be notified by email in this case.

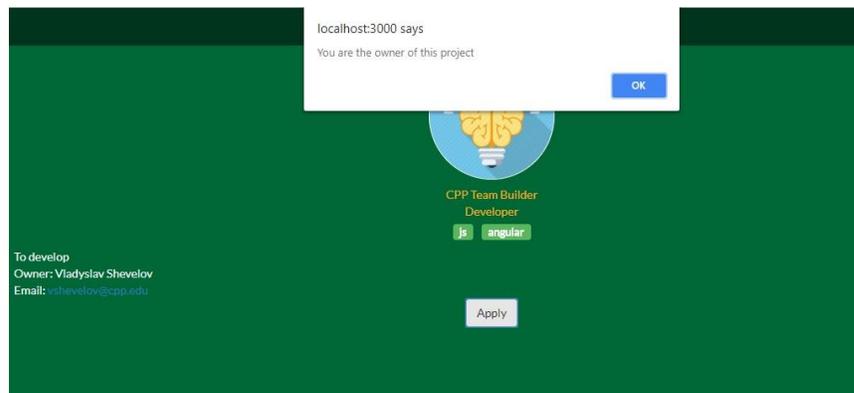


Figure 8. Apply for selected position

By going to the Leaders screen user can observe current project leads and check some of their available information and their availability hours.



Figure 9. Leaders screen

Users can also manage their profiles, they can see their information, edit it, manage the projects they are participating in, as well as add new project. To edit profile information user should click on the pencil icon and change or enter corresponding fields:

- 1) Year – a dropdown list specifying student’s current year at the school. Possible options are: freshman, sophomore, junior, senior, graduate.
- 2) Major – simple text field specifying student’s major.
- 3) School start date – field which specifies starting year at school.
- 4) Bio – text field used for some optional description of a person.
- 5) Skills – field consisting of tags of applicable skills.
- 6) Interests – a field listing hobbies or interests.
- 7) Availability – a field specifying if a person if open for new projects.

Clicking on Cancel button will return a page to view mode and clicking save button will save changes and return the page to a view mode. Figures 10 and 11 show profile view and edit modes.

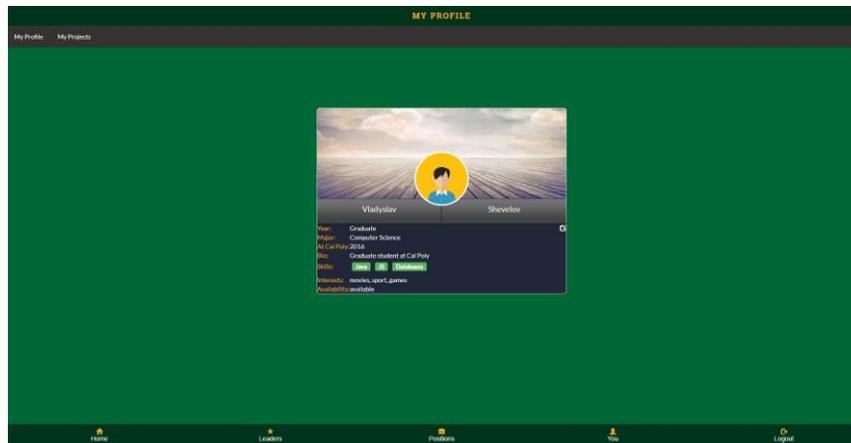


Figure 10. User profile page view

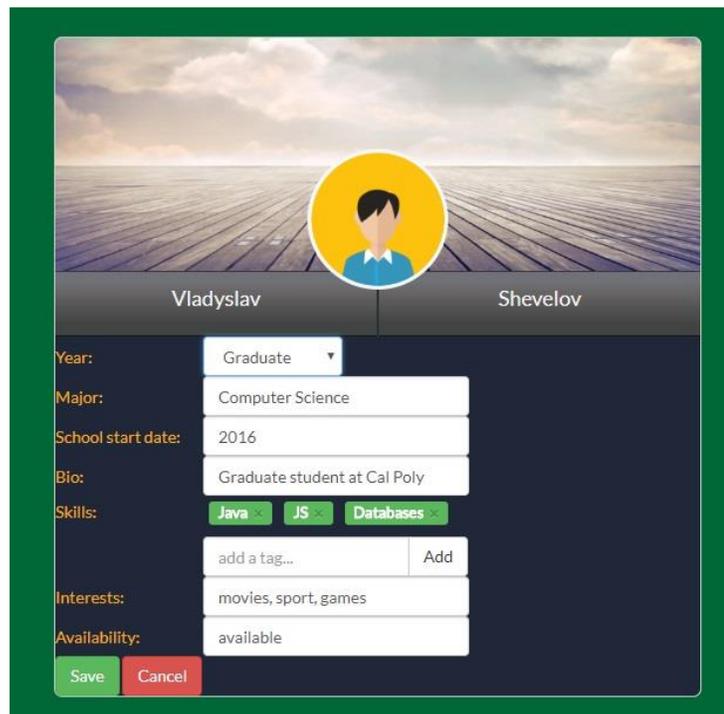


Figure 11. User profile page edit

To view list of projects, edit them or add a new one user should choose “My projects” option in the navigation bar menu on the top of the page, which switches the view to the project view. The view for this is shown on the figure 12. User also has an option to view

current notifications which are shown on his account when someone applies for an opened position. They are located in the notifications tab below project list. The projects table has three columns: name – which is the name of the project, description – short description of the project and action – having two buttons for deleting the project and editing the project.

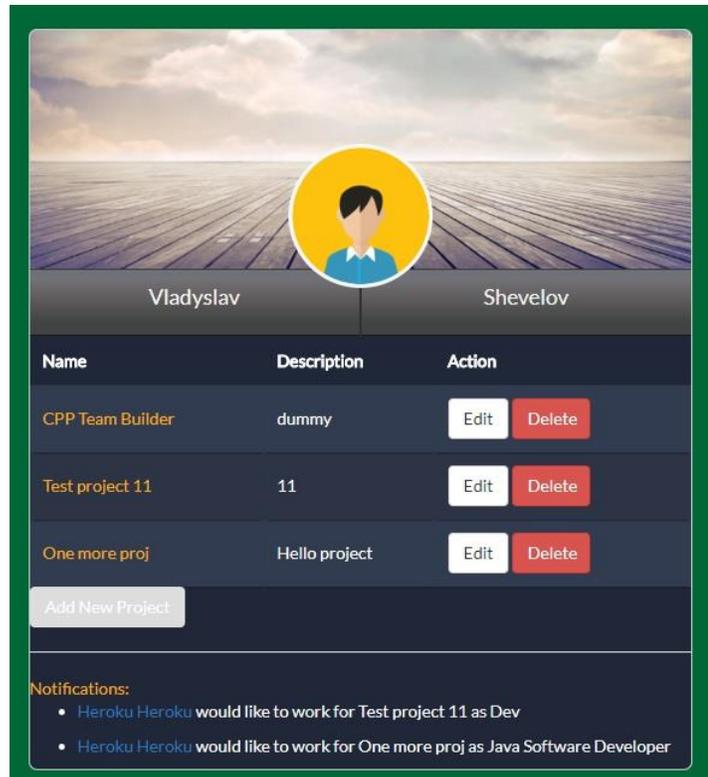
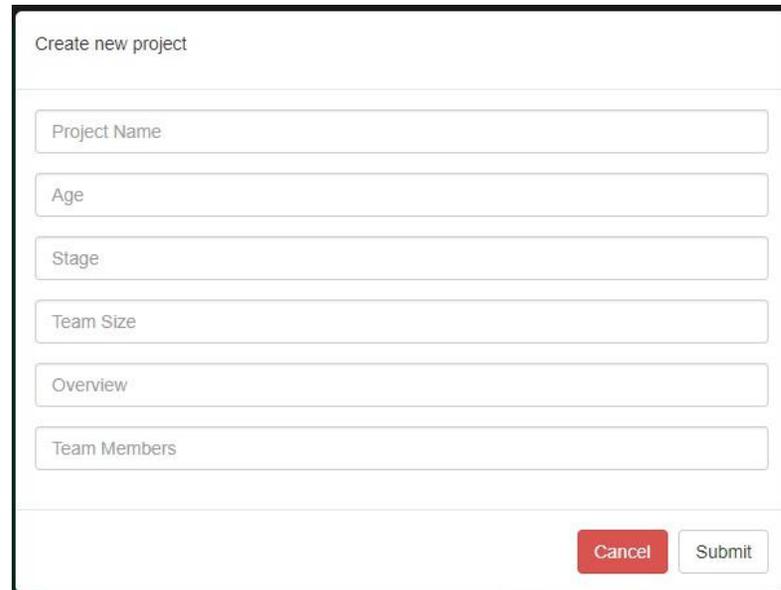


Figure 12. Project list

By clicking on a button “Add New Project” modal windows opens and user must fill in the following fields:

- 1) Project Name – name of the project.
- 2) Age – how many years have the project been under development.
- 3) Stage – what is the current stage of the project.
- 4) Team size – number of team member (if applicable).

- 5) Overview – short description.
- 6) Team members – specify who is working on the project (if applicable).



The image shows a web form titled "Create new project". It contains six text input fields stacked vertically: "Project Name", "Age", "Stage", "Team Size", "Overview", and "Team Members". At the bottom right of the form, there are two buttons: a red "Cancel" button and a white "Submit" button with a grey border.

Figure 13. Add new project

When project is created user can check its details and edit the information as well as open or close some positions for it. The screen for editing project information is shown on figure 14.

To edit project information user enters or modifies the above-mentioned fields and saves.

To open new positions for the project users clicks on “Add New Position”, modal window opens and following 3 fields should be specified:

- 1) Position title – the title of new position.
- 2) Position description – short overview of duties.
- 3) Tags – create tags for new position.



Figure 14. Edit project screen

4.2 Addressing challenges

In this section the challenges which were described in paragraph 3 are discussed and how Team Builder addresses them.

1) The variety of tools and development platforms

Team Builder is implemented using HTML, CSS and JavaScript. Node.js is used for backend purposes and for user interface Angular.js and Express.js are used. The choice was made considering the modern trends in web development and speed of development process.

As for mobile versions mentioned in the challenges section, the development was prioritized on web application as it can also be accessed in the mobile browser, even when we do not have standalone mobile version.

The database chosen is Firebase. There are some reasons behind that. First, it satisfies all current development needs, it is real-time – meaning that all users connected to it receive

live updates on every change. Authentication mechanism are well developed and simple, anonymous, password or different social authentications can be used. As well as application can be deployed over secured connection to Firebase servers. One of the most important factors is also its simplicity, it is very user friendly as it does not require any complicated configurations, it has simple control dashboard and moreover it does not require knowledge of SQL as it uses simple JSON format for storing data. Of course, there are some limitations on Firebase free plan which is 50 connections and 100Mb of storage which is enough for initial phases of development and usages and can be upgraded in the future.

2) Choosing security controls

While working with sensitive data, like users' private information it is important to secure all kind of communications to prevent any loss of information. Team Builder has authentication mechanism which allows only registered users to see available information on the system. Moreover, the application is secured with SSL certificate, so all the connections are going under HTTPS protocol. This is achieved by using Heroku web server which provides reliable HTTPS protocol to deployed applications. One of the challenging moments were to decide on the application server which is going to be used. First, a manual SSL certificate was created with generated encryption key, which was successfully used on the website. But the drawback of such approach is that it is appeared to be unsecured to users, though it is only visually, by looking at the icon in the browser search bar, because the encryption mechanism still works. The second approach tried was using Amazon Web Services, which is popular and reliable platform but it did not have any free plans for deployment, whereas one the main requirements were to have HTTPS

working. Finally, it was decided to use Heroku application server which comes free and has HTTPS connection. It is also very simple in use as it does not require any complex configurations, it is simply deployed from GIT sources, and updated server whenever sources are updated.

3) Difficulties in maintainability and scalability

As software systems evolve over time based on user feedback and developing new features, it is very common to receive new updates to a system, especially when the system is used by users who can also request new features. Team Builder provides source code to the developers which gives them complete control over the system, and makes it easy to add new modifications or features at any given time. The code is organized in the way that it keeps maintainability by using several programming paradigms and functions are built in that way that each and every of them is separately responsible for some application functionality and they are well organized on separate files. This makes it easier to provide future changes as it is not spread all over the project but kept in separate file.

4) User interface responsiveness

One of the main requirements were to make a responsive user interface, especially considering the fact, that the application is built only on web version (no mobile application so far), so any user who uses different kinds of devices can easily and comfortably use Team Builder and can have positive user experience.

One of the most challenging moments was to create such a responsive UI which can satisfy different platforms, whereas it is iPhone (and its variations like iPhone Plus,

iPhone SE as they all have different screen sizes), iPad or any other device. Developing user interface for usual screen size is different as it does not require developer to think about forms flexibility, font sizes, image sizes, elements placement and so on. But when testing the same code in a different scale it may not look good or it may be broken at all. Team builder is developed that way, that all UI elements are responsive to any kind of device screen sizes and is easily usable.

TARGET AUDIENCE

Team Builder can be used by any user whether it is an individual or some legal entity. As this application is developed to help people find jobs and help companies (especially startups) hire suitable candidates it is assumed that it is mostly should be used by those who seek for new opportunities or those who want to increase their team size and add new members.

There are two participating sides (entities) in this application: 1) Job seekers – are the users who build their profile, specify their skills and what they are looking for, 2) Companies – any legal entity whether it is a big company, school, startup etc. that are looking for employees to hire who match their requirements.

Job seekers will be creating their profile filling their personal information, portfolio photograph, their relevant skills and project they are participating or they want to participate or find. Companies will list their open roles and projects along with the requirements and description.

RELATED WORK

There are many websites and applications which focus on job search. Whereas some have a broad spectrum of specialties and employment forms, some others make an emphasize on more detailed and narrow search.

One of the closest related works is an AngelList which is a website for startups, job-seekers or investors looking to work at startups. As mentioned before, startups have a lot of challenges, especially in earlier stages of their development, and AngelList democratizing the investment processes and helps startups in challenges with fundraising and talent search. It has a powerful system specialized for a job search where potential employee can find thousands of startups and can run search configuring many parameters like location, role (e.g. software engineer, sales manager, hardware engineer etc.), job type (candidates can look for full-time, part-time, internships or even can run search on companies who sponsor visas), compensation range and different keywords which can help to customize the search to find more suitable positions and so forth. Companies list not only their available positions but the product they are working on, describe why investors or candidates should choose them and provide detailed job description with salary range and technology stack required. Moreover, the website can act also like a kind of social network, because it has a mechanism which allows people to connect to each other and find potential employers or other valuable connections, furthermore they have also a very useful module for finding people you may know, like those you have worked with or studied with etc. Besides above-mentioned functionality users can post a job, check statistics for salary for different jobs and roles and customize their profile.

LinkedIn is another job-search/social-network platform, and is probably the most famous one. Generally, it is a business and employment-oriented service that operates via websites and mobile applications. It is mainly used for professional networking where also employers post jobs and job seekers post information about themselves, their resumes, experience etc. LinkedIn had 500 million registered users. Besides being a professional social network, they launched LinkedIn jobs which focuses on job search for both, companies and candidates, which became a very popular job seeking platform as it is very convenient to search for a job having your connection who can post them and refer you directly to a company. Users can also search jobs by companies, locations, positions etc. Companies have their pages for job positions where they list available jobs and list requirements and company descriptions. LinkedIn also has a very useful option called Easy Apply which allows job seekers just to provide their resume and name to apply for chosen position.

Team Builder does not currently focuses or has many of the mentioned above features under development, like messaging, connection (to act as a social network) etc. But it makes more emphasize on strict job applications or job postings.

CONCLUSION AND FUTURE WORK

In this project, an application for building startup teams was developed. It is a platform, where people can find potential employers and employers can find someone who they need to hire. Companies provide projects which they have and positions they are hiring for, while users in their turn specify what type of job they are looking for and their current/past project. In this application such aspects like security, flexibility, performance and scalability are addressed to make the best user experience for the customers. This project has a huge future scope due to all possible improvements, features and modifications which can be implemented.

Currently only a few major functions were implemented, which are creating projects and positions, applying for projects and positions, viewing the list of projects and leaders and other minor features. Current user interface is made responsive to support all user platforms and devices but it can further be improved when implementing new features. Moreover, for future works, such important functions like more advanced profile tuning and job search including search by different parameters like location and job types, compensation and other should be included, possibility to upload resume with additional feature of parsing its contents to fill in the profile for the user etc.

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