**Onetech Asia Project Management Tools Cross-platform Mobile Application**

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**Contextual Report**

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**Abstract**

This project is a research about how to create a project management tools applications which can be deploy to web and both mobile platform of IOS and Android, under the point of view of a quality control engineer as known as a tester, with limited coding skill but understood the problems when operating the quickly scalable projects. The outcomes should be a detail research report about mentioned topic and a prototype application that enough to represent the research result.

**Acknowledgement**

Sincerely thank to my family and my parents for creating the motivation and conditions for me to complete this project. I also would like to express my gratitude to the teachers and University of Greenwich Vietnam for creating the best conditions and helping me in times of need, having dedicated to teaching and transmitting knowledge and experience to my academic and mature.

Although there are many efforts in the learning process, as well as in the process of making the graduation project, it is inevitable shortcomings.

I am looking forward to the valuable suggestions of all reviewers; we let my results be more complete.

Once again, I sincerely thank!

Tran Truong Minh Toan

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# Introduction

## Background

After 6 months of working as a QC (Quality Control) engineer at Onetech Asia, I have realized that there are lots of deficiency issues in our current usage project management tools and task management functions are limited. It is required a high cost and long-term subscription in order to activate all the necessary features and reach the highest performance. Moreover, the back-end service for those tools and application are often setup in another country such as Singapore, Malaysia, Philippines, etc. that make the internet connection become one of the problems that affect our projects business performance. It also put our security at risk of unexpected data leaking, mining or scrapping. For all of those reason, I decide to process my own research to figure out how to create an effective and high-performance project management application that my company can fully control the features and host the back-end server and database on our own with using any third-party tools or applications.



## Aims and objectives

For this topic, I am about to research about how to create a project management system in both technical and business aspect. To be more clearly, the aims and objectives of this research should be separated into 4 main ideas:

**First, study about project management,** what users need from a management tool or application, what should be required and what are the improvements?

**Second, research about infrastructure design,** what are an enterprise level system needs? Which technologies should be used? Which design pattern should be applied? And, how to combine all of those selections.

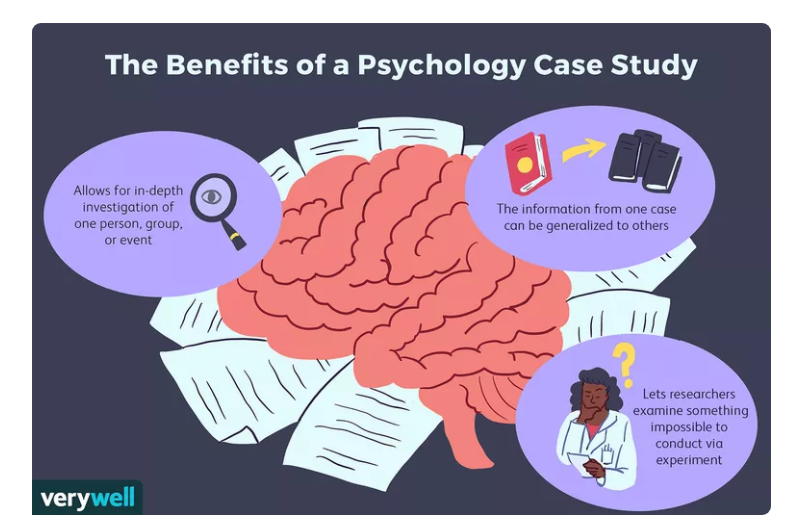
**Third, research about what is a cross-platform application?** What framework and technologies should be used? And create a project management application that can satisfy the business requirement at the First idea.

**Fourth, apply the knowledges from the Second research** in order to create a back-end server system for the applications.

Thus, the four idea should the objective for this research, I will specifically follow them to avoid losing my way in this journey!

## Approach

For more clearly, as mentioned before, I have been working as a QC engineer and my career path is more management orientation than architect orientation, so, my approach for this project shall a little bit lean to the side of research and compare the management system to figure out the good, the bad and the improvement that should be apply. However, this is a project of Computing programme, so technology is also a very important aspect that should be considered to described carefully and especially detail. Moreover, despite that I have a reasonable time to experience the project operating process and environment, but an undergraduate student as I am still lack of the knowledge about project management, so study from specific cases should increase my speed of researching really much. For all of those reason, the Case Studies Research Method would be my dominant research methodology of this project.



# Literature Review

## Approach to literature searching

Before finally decide to choose this topic about develop a project management application, beside my current experience in project operation environment, I have briefly done some research two main question: what are the business requirements for this application and how to create a cross-platform application include server and client side. So far, those researches led me to divide the two common questions in four details problems that suitable with the defined above objectives.

Therefore, in this section of literature review, I will continuously go through that four problems to find out what researches or investigations should be done in order to build the application system that satisfy our objectives.

## Identifying the problem

As mentioned above, this report topic is separated in four main problems that help keeping me align with the beginning and do not become lost too far from the main road. So, I will briefly introduce about those problems as following:

One, the very first question, the root core of my topic, what is project management? What are the aspects that should be considered to study about in the field of project management? And, finally, when a project management process started to require a tools or application?

Two, what are the project management tools or application definition? What make a good project management application?

Three, this management system infrastructure design. How to design the overall system? How to create a good back-end data API server?

Four, cross-platform application development? What technologies and frameworks to used? How to consist the UI/UX and guarantee the performance?

## Project management - The common definitions and aspects

### Project definition

Before go straight into the concept of project management, I will quickly summary about the project definition. Project is a temporary effort that taken to create a specific product, service or any other types of result. A project is definitely unique in which does not include not just a routine operation, but unique collection of operations created to achieve a singular goal. So, a team of project usually includes member that seldom working with each other ever before, sometimes they might from different company, organizations or across country borders and separated by geographies. Some easily found example for project such as development of software, a business process improvement, a building construction, a charity programme or a marketing campaign are all project and all must be especially managed to delivery on time, within given budget of cost and resource of the organizations.

Project management, then, can be quickly defined as the application of skills, tools, experiences, knowledges and specify techniques to the project operation that lead it to the point of requirement meet.

### Project management definition

Project management can be defined as the discipline of applying specific processes and principles to initiate, plan, execute, and manage the way new initiatives or changes are implemented within an organization. Project management is different from managing business activity as usual, which is an ongoing process, as it requires the creation of new work packages to achieve agreed ends or objectives.

The four key components of project management are:

**Time** - the expected duration of work

**Cost** - The budget allocated to the work

**Scope** - What innovations or changes will be brought about by the project

**Quality** - the standard of the result of the project.

For example, reducing the **time** allocated to complete the project will also reduce the amount of work that can be done **(scope)**, which can then affect the **quality** and **cost** of the project.

Project management is recognized as a separate business function within an organization and project managers have specific roles and responsibilities in achieving the goals of their projects. The project manager will define and lead the project, lead the project team and decide how to approach the work based on such factors as the type of project, the needs of the company and the expertise of the collaborators working about the project.

Despite there are different methodologies and approaches to project management, most projects follow the five stages process that would be introduce at the following section.

### Five stages of project management

Developed by the Project Management Institute (PMI), the five phases of project management include project design and initiation, planning, execution, performance / monitoring, and project closure. PMI, which began in 1969, is the world's largest non-profit membership association for the project management profession. It has set the standards for project, program and portfolio management and offers training and certifications. The gold standard of the association's certification is Project Management Professional (PMP) certification. There are seven other certifications available for different types of project management.

According to PMI,

*“project management is the application of knowledge, skills, tools, and techniques to a broad range of activities in order to meet the requirements of a particular project…”*

There are five phases of project management and while the lifecycle provides an overview of the project, the phases are the roadmap to accomplishing it.



**PHASE 1: INITIATION**

This is the start of the project, and the purpose of this phase is to define the project at a broad level. This phase usually begins with a business case. This is when we will investigate whether the project is feasible and whether it should be undertaken. If feasibility tests are to be carried out, it is at this stage of the project that it will be completed.

**PHASE 2: PLANNING**

This phase is the key to successful project management and focuses on a roadmap that everyone will follow. This phase begins the setting of goals. Two of the most popular methods of setting goals are S.M.A.R.T. and CLEAR.

* **SMART Goals** - Method ensures that the objectives have been verified. It also provides a clear understanding of the implications of the goal setting process.



**- S**pecific – To set specific goals, answer the following questions: who, what, where, when, who and why.

**M**easurable – Create criteria that we can use to measure the success of a goal.

**A**ttainable – Identify the most important goals and what it will take to achieve them.

**R**ealistic – Able to work toward a particular goal.

**T**imely – Create a timeframe budget to approach the goal.

* **CLEAR. Goals** - A new method for setting goals that takes into account today's fast paced business environment.

**C**ollaborative - The goal should encourage employees to work together.

**L**imited - They should be limited in scope and time to keep them manageable.

**E**motional - Goals should tap into the passion of the employees and be something they can bond emotionally.

**A**ppreciable - Divide larger goals into tasks and smaller ones that can be accomplished quickly.

**R**efinable - As new situations arise, be flexible and refine goals as needed.

**PHASE 3: EXECUTION**

This is the phase where deliverables are developed and completed. It often feels like the meat of the project, as a lot of things happen during this time, like status reports and meetings, development updates, and performance reports. A "kick-off" meeting usually marks the start of the execution phase of the project where the teams involved are made aware of their responsibilities. Tasks performed during the execution phase include: Develop the team, resource attribute, execute project management plans, purchasing management if necessary, PM directs and manages project execution, set up monitoring systems, task assignments are carried out, Status meetings, update the project schedule, edit project plans as needed.

Although the follow-up phase of the project has a different set of requirements, these two phases often occur simultaneously.

**PHASE 4: MONITORING**

It's about measuring the progress and performance of the project and making sure that everything that happens is in line with the project management plan. Project managers use key performance indicators (KPIs) to determine if the project is on track. A PM will typically choose two to five of these KPIs to measure project performance:



* **Project Objectives:** Measuring whether a project is on schedule and on budget is an indication of whether the project will meet party goals.
* **Quality Deliverables:** This determines whether specific task deliverables are achieved.
* **Effort and Cost Tracking:** The PM will report on the effort and cost of resources to see if the budget is on track. This type of tracking informs whether a project will reach its completion date based on current performance.
* **Project Performance:** This monitors changes in the project. It takes into consideration the amount and types of problems that arise and how quickly they are resolved. These can be the result of unforeseen obstacles and changes in scope.

**PHASE 5: CLOSURE**

This phase represents the completed project. Contractors hired to work specifically on the project are terminated at this time. Valuable team members are mentioned. Some PMs even organize small work events for people who have participated in the project to thank them for their efforts.

Once a project is completed, a PM will often hold a meeting - sometimes called a “post mortem” - to assess what went well in a project and identify project failures. This is particularly useful for understanding lessons learned so that improvements can be made to future projects. Once the project is complete, PMs still have a few tasks to complete. They should create a list of tasks that were not completed during the project and work with team members to complete them. Make a final project budget and prepare a final project report. Finally, they should collect all project documents and deliverables and store them in one place.

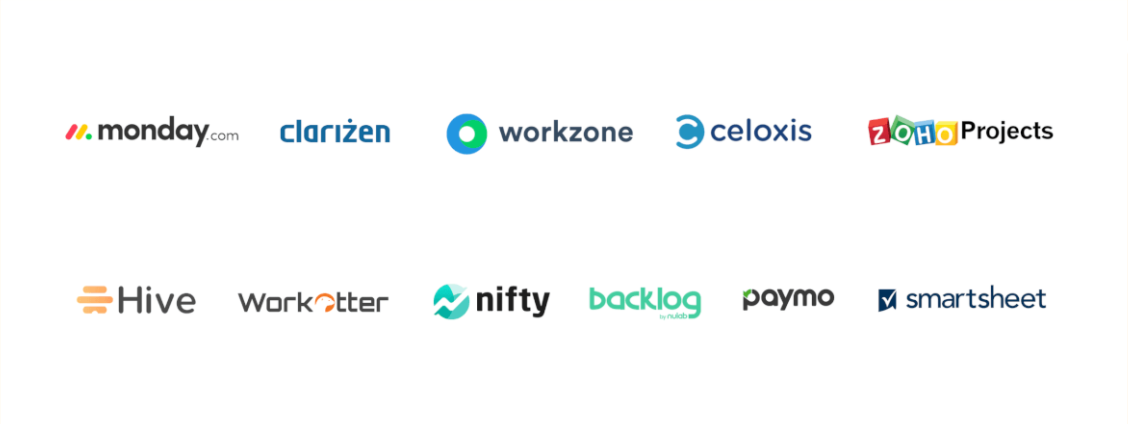
## What make a good project management tool application?

### Project management tool application

Project management software helps project managers, or PMs, manage projects. PM software can be installed on site, but many new tools are offered online as SaaS. They offer functionality to create charts and reports, share documents, track budgets, allocate resources, manage tasks, plan projects, and communicate with teams. Often, project management software includes portfolio management tools or additional program management tools in addition to project management features.

### A good project management tool requirement

In defining a good digital project management tool, we are focused on tools that make it easier to "do" a project. It means bringing people together to create something amazing for a digital world. So, what does it take to deliver a digital project? We have identified five key aspects of functionality that we believe make it easier to complete digital projects. We can use them to get rid of our post-it notes, spreadsheets, and emails, and to get our project done more efficiently.



**Task lists** – Projects are made up of sub-tasks, and sub-sub-tasks, checklists and TODO. Being able to outline what needs to be done, by when, by who, is critical to delivering a project well.

**Schedules** – Timelines, calendars and Gantt charts help we know where tasks fit within the broader scheme of a project. This is key to being able to deliver a project on time.

**File sharing** – No one likes having to waste timing trying to dig around for random files. The ability to organize and share key project files and assets is important to deliver a project efficiently.

**Communication** – Contextual project-specific communication to hash things out quickly and chat with our team and client is vital to keep tasks on track.

**Reporting** – As project managers, it’s our job to know whether or not our project is on track and to use this information in communication. Therefore, it’s essential to know how a project’s tasks are progressing—will it be delivered on time, or not?

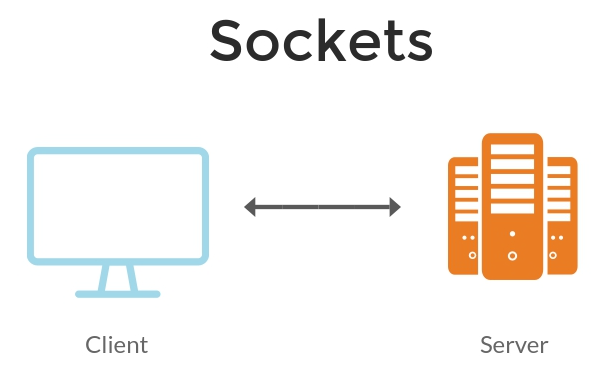
### Which requirement should we have for the prototype:

Obviously that is should be all five mentioned above requirement would be implement in this project. However, only the two first requirement of **Task lists** and **Schedulers** could be guaranteed to be done because they are mostly relief on the business and requirement the basic development skill that I have learn in my current programme such as database design, API development, application development and model relational. Those are requirement also the at least to have for every project management application, so apply them would be the most important technical requirement in order to finish this project.

About the three others, it is required many others technologies to implement and take time to research to figure out the solution and measure the necessary time to apply them.

Firstly, about the **File sharing** requirement, I need to research more about the file transfer technologies, moreover, the storage and download would be another problem to consider. On the other hand, despite the technologies and solution is found, find a suitable framework or library that support them in my infrastructure design shall be a huge time taken in this project. The similar issues are happened to the **Communication** requirement when technologies solution become the hardest task to be done.

For example, a communication channel like chat box could not only fetching and posting message, but also keep the data real-time by some kind of socket server and manage the message data, where and how to store them? How to secure, encrypt the message? And many others problems.



Continuously, the **Report** function, furthermore, require me to deep in investigate about the business aspect of project management, what report that a project need? What are the formular? What data that need to be visualize? And that will consume a huge amount of time.

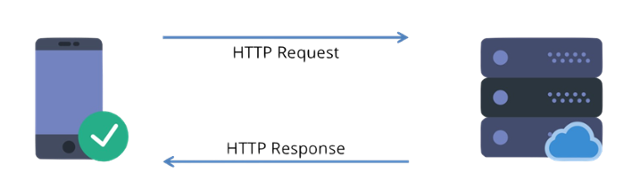
In conclusion, for this project, I will focus on implement the most stable prototype for the least requirement of a project management application. The others requirement should be considered, but maybe not all of them would be apply in order to balance the time budget, which is so interesting that one of the key components of project management!

## REST data API and overall system infrastructure

Develop mobile application in general and cross-platform application in particular is obviously impossible to apply the familiar MVC design pattern or any others server-side-rendering system architecture. Because the client -side application can only process the user local data, and others complicated data need to be display should be process at server and fetch the result by a data request, which is usually a HTTP request. So, what is a HTTP request?

### HTTP request

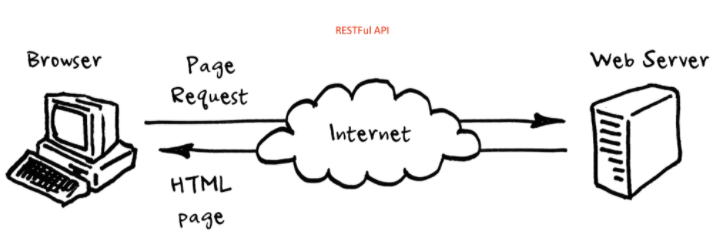
HTTP are an important part of our “uniform interface” constraint and provide us with the noun-based resource action counterpart. The main or most commonly used HTTP verbs (or methods, as they are correctly called) are POST, GET, PUT, PATCH, and DELETE. These correspond respectively to the creation, reading, updating and deletion (or CRUD) operations. There are also a number of other verbs, but they are less frequently used. Of these less frequent methods, OPTIONS and HEAD are used more often than others. The most commonly used to architectural style to build a server with HTTP methods is RESTful services.



### What is REST or RESTful?

REST is stand for **RE**presentational State **T**ransfer, which is architectural style for distributed hypermedia systems and that first presented by Roy Fielding ’s famous dissertation, in 2000.

Like any other architectural style, REST also has its own 6 guiding constraints that must be satisfied if an interface is to be called RESTful that would be described in detail at following section.



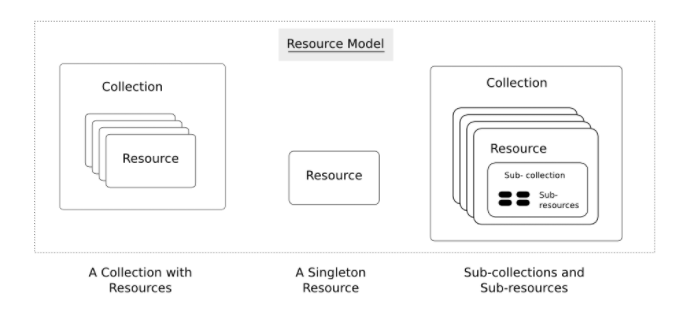
### Principles guiding of REST

|  |  |
| --- | --- |
| **GUIDING CONSTRAINTS** | **DESCRIPTION** |
| **Client–server** | By separating user interface concerns from data storage concerns, we improve user interface portability across multiple platforms and improve scalability by simplifying server components. |
| **Stateless** | Each request from the client to the server must contain all the information necessary to understand the request and cannot take advantage of any context stored on the server. The session state is therefore entirely preserved on the client. |
| **Cacheable** | Cache constraints require that the data in a response to a request be implicitly or explicitly label as cacheable or not. If a response can be cached, a client cache has the right to reuse that response data for subsequent equivalent requests. |
| **Uniform interface** | By applying the principle of generality of software engineering to the interface of components, the overall architecture of the system is simplified and the visibility of interactions is improved. In order to obtain a uniform interface, several architectural constraints are necessary to guide the state of the components. REST is defined by four interface constraints: identification of resources; manipulation of resources by representations; self-describing messages; and, hypermedia as the engine of application state. |
| **Layered system** | The layered system style allows an architecture to be composed of hierarchical layers by constraining the state of components such that each component cannot "see" beyond the immediate layer with which they interact. |
| **Code on demand** | REST allows us to extend client functionality by downloading and executing code in the form of applets or scripts. This simplifies customers by reducing the number of features to pre-implement. |

### Resource

The key abstraction of information in REST is a **resource**. Any information that can be named can be a resource: a document or an image, a time service, a collection of other resources, a non-virtual object. REST uses a **resource identifier** to identify the particular resource involved in an interaction between components.

The state of the resource at a particular timestamp is called a **resource representation**. A representation consists of data, metadata describing the data, and hypermedia links that can help clients move to the next desired state.



The data format of a representation is called a media type. The **media type** identifies a specification that defines how a representation is to be handled. **A truly RESTful API looks like hypertext**. Each addressable information unit has an address, either explicitly or implicitly.

According to Roy Fielding:

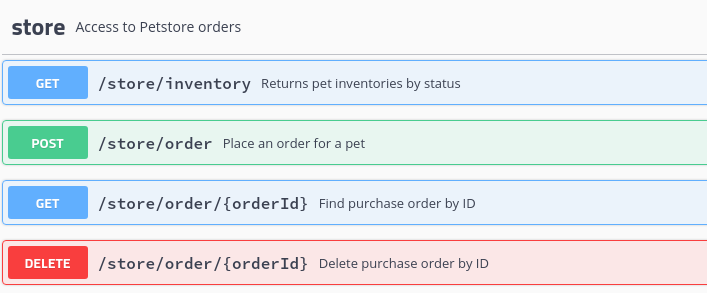
*“Hypertext (or hypermedia) means the simultaneous presentation of information and controls such that the information becomes the affordance through which the user (or automaton) obtains choices and selects actions. Remember that hypertext does not need to be HTML (or XML or JSON) on a browser. Machines can follow links when they understand the data format and relationship types…”*

Additionally, resource representations must be self-descriptive: the customer does not need to know whether a resource is an employee or a device. It must act on the basis of the type of media associated with the resource. So, in practice, we will end up creating many types of custom media, normally one media type associated with a resource.

*“…Each media type defines a default processing model. For example, HTML defines a rendering process for hypertext and browser state around each element. It has nothing to do with* ***the GET / PUT / POST / DELETE*** *resource methods other than the fact that some media type elements will define a process template that goes like "Anchor elements with an HREF attribute create a hyperlink that when selected invokes a fetch request GET on the URI corresponding to the CDATA encoded HREF attribute."*

### Resource methods

Another important thing associated with REST is the **resource methods** to be used to make the desired transition. Many people mistakenly associate resource methods with HTTP **GET / PUT / POST / DELETE** methods.



Roy Fielding never mentioned any recommendation as to which method to use under which condition. All he insists is that it should be a uniform interface. If we decide that HTTP POST will be used to update a resource - rather than most people recommend HTTP PUT, all is well and the app interface will be RESTful.

Ideally, whatever is needed to change the state of the resource should be part of the API response for that resource, including the methods and the state in which they will leave the representation.

A REST API should be entered without any prior knowledge beyond the initial URI (bookmark) and set of standardized media types appropriate for the intended audience (i.e. intended to be understood by any customer likely to use the API). From this point on, all application state transitions should be governed by the client's selection of the choices provided by the server that are present in the representations received or implied by the manipulation of those representations by the user. Transitions can be determined (or limited by) the client's knowledge of media types and resource communication mechanisms, both of which can be enhanced on the fly (such as, code on demand).

### Does REST and HTTP are the same?

Many people prefer to compare HTTP with REST. **REST and HTTP are not the same**.

However, since REST also intends to make the Web (Internet) more streamlined and standard, it advocates more strictly using REST principles. And that's where people try to compare REST with the web (HTTP). Roy Fielding, in his thesis, nowhere mentioned any implementation guidelines - including any protocol and HTTP preferences. So far we follow the 6 REST guiding principles, we can call our RESTful interface.

Simply put, in the REST architectural style, data and functionality are considered resources and are accessed using Uniform Resource Identifiers (URIs). Resources are exploited using a set of simple and well-defined operations. Clients and servers exchange representations of resources using a standardized interface and protocol - typically HTTP.

Resources are decoupled from their representation so that their content is accessible in a variety of formats, such as HTML, XML, plain text, PDF, JPEG, JSON, etc. Metadata about the resource is available and used, for example, to control caching, detect transmission errors, negotiate the appropriate representation format, and perform authentication or access control. Most importantly, every interaction with a resource is stateless.

All of these principles help RESTful applications to be simple, light and fast.

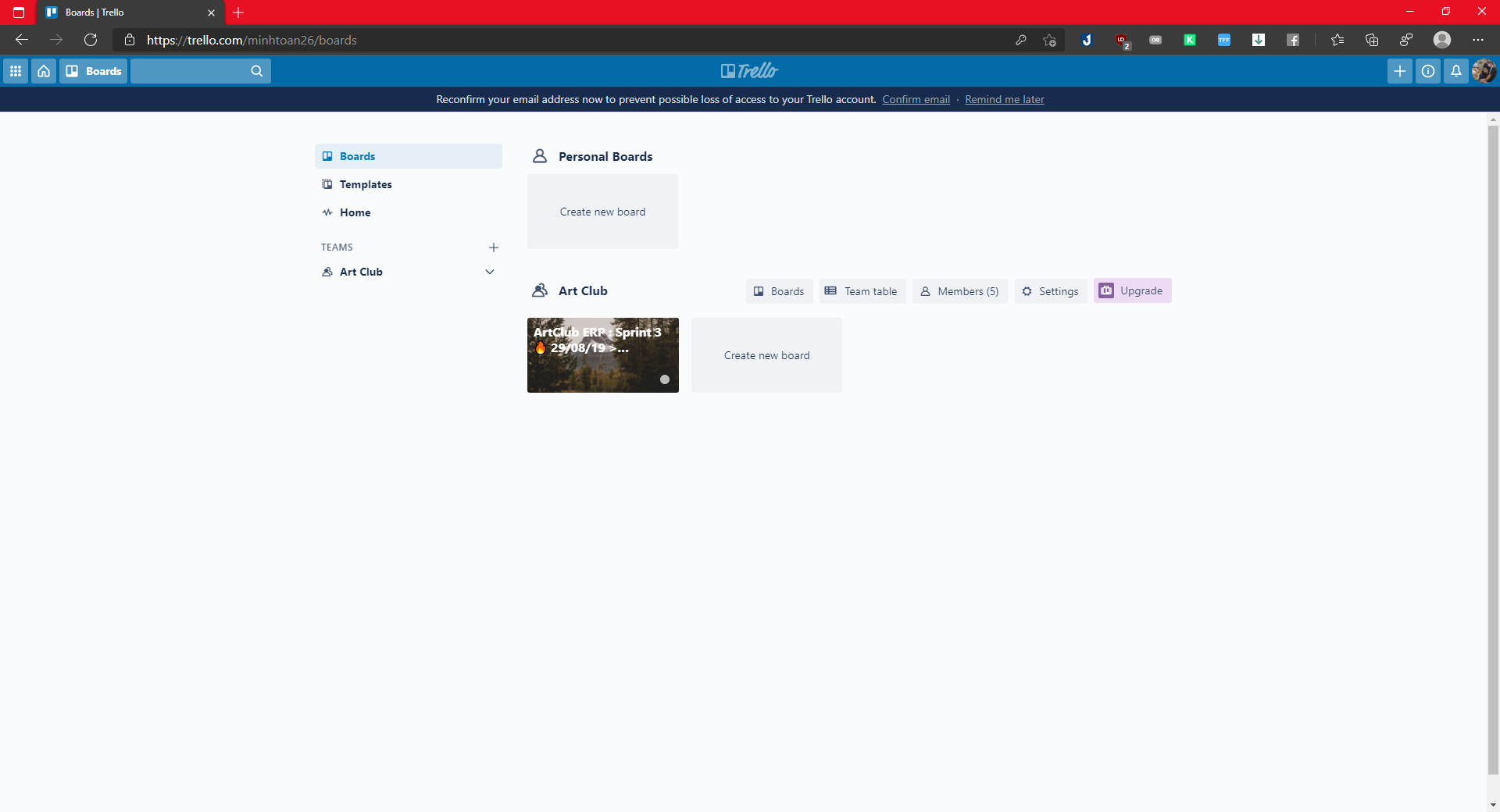
## Conclusions

So, for all above research, I have identified the scope for this project, getting in shape what need to be done and define the protype requirement, both the core features and the optional features in order to make our outcomes product become the most complete. In the next section, I will look through the current well-known products about project management and compare them with a set of criteria based on the requirement above.

# Product Research

## Trello

Trello is one effective management tools for one team, for main purpose is: make one member can clearly understand what they have done and what they have to do, also other team member task. Trello use KANBAN, which is make all the task to one table, set task status (To do, Doing or Done), to limit “Woking on process” task, and help team member focus on which task they have to do.



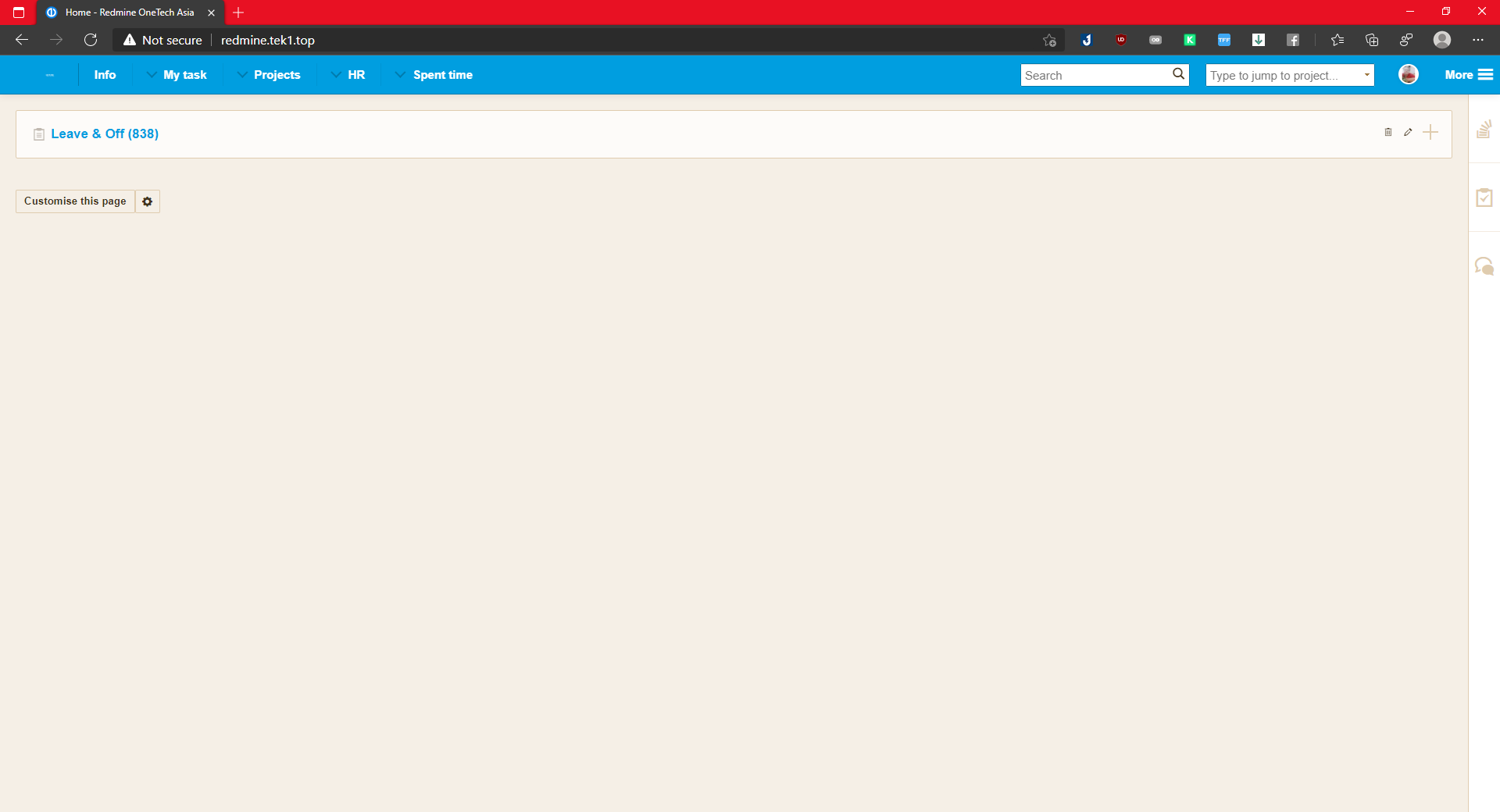
What is Trello advantage? Trello displayed as information board, so team member can easily follow team task when they looking into general board. Trello also is one effectively tools for teamwork. As Usual, project manager or team leader will create task and assign task for other team member, and team member can also change/update some information for that task. By that way, project manager or team leader can follow all other member task, and support if they needed.

But Trello also have disadvantage. As you can see, Trello focuses on small task, like daily task or some small task in one project, it is difficult to follow up entire project as PM or TL. And because Trello using KANBAN, it can work well with small group (3 to 10 member), small project, but if team member upscale by the time, or project is upscale by the time, it will harder and harder to control entire project. In this case, Trello will not effective as it was.

## Redmine

Redmine is one open-source application, one tool for project management on the web, written in Ruby on Rails. Redmine allow user to manage multiple projects and create subject for them.

What is advantage of Redmine? It is open-source, so you can customize to fit with your requirement, you can add some plugin to make this tool serve you as much as you want. Redmine is also one Role-based access control, you can define some role for project, like tester, developer, officer, …And Redmine can divided project into sub-project, easier to manage and tracking process, by that way, PM or TL can also manage project easier, tracking project progress.



But Redmine is also have disadvantage. Because open-source and can develop more function, new users need to train before using this project management tools, it can take a lot of time if your Redmine are customize too much. It also not has mobile platform, not have some function like export report or hard to develop it, so in the long term, Redmine will not meet some requirement, or need more effort to make it meet requirement. Redmine also have little outdated UI, it looks like ten year ago UI.

## Conclusion

Advantage and disadvantage of Redmine and Trello, I think it will not meet some requirement of my company. Trello have good UI design, friendly with user, but it not has enough feature for customize and upscale project, it only fit with some small team. Redmine very strong, can customize more function, can upscale for my company, but UI is not trendy nowadays, and it also take more effort to develop some function. Because advantage and disadvantage of Trello-Redmine, I have some experience for my project management tools. I will try my best to avoid problem of these 2 tools

# Requirements

## Analysis of requirements

In this project there are of two must have requirement and three more optional requirement which are defined at the literature review section. For this section, I will go to further describe about these requirements.

### Tasks list (required)

For this requirement, we are focusing the most important component of project management: **Task**. Firstly, the tasks list should have basic features of a list component which are CRUD: Create, Read, Update, and Delete. The data fields for a task often includes the values such as: name, description, as usual, and two specify data for task management are assignee and status.

Moreover, another key feature for a management application is the roles decentralization. Apply to defined features, a project could have multiple of roles played by multiple of users, so each of roles should be limited in a number of task data manipulation features. Such as, a business analysist should be able to create task and assign to developer, but only a developer can change the status of that task or maybe only the role of project owner can approve to delete tasks. So, there are a lot of complicated relation between there object: user, role and task that should be carefully organized in this project.

### Schedulers (required)

A project is all about and schedule, arrange and assign the task to member in order to reach the final goal by time and cost. So, scheduler is the next important features for our application. For this reuqirement, task shoud be able to be arraged and set time in somekind of calendar in order to manage and make sure it will be delivered on time.

### File sharing (optional)

For this requirement, the system should allow user to upload, store and provide the accessibility to specific user in order to keep the security rules.

### Communication (optional)

Communication includes the ability to messaging or further calling and video calling between user in system.

### Report (optional)

Report function allow user to visualize and export the project overall progress data in charts, tables, etc...

## Introducing to project requirement (functional, non-functional and the difference)

### Introduction

Like many professions, the world of engineering and project management has its own “terms of the art” which can be confusing to both experts and novices. As we go through our requirements document, we may be wondering what the difference is between a functional requirement and a non-functional requirement. Is this difference still important? We will detail why the difference matters below, and how to generate and write these requirements using best practices.

### Why is the difference between functional and non-functional requirements important?

Ultimately, we want to deliver the product the customer requests. Functional requirements are the primary means by which the client communicates their needs to the team. They allow all members of the project team to move in the same direction. Without an agreed functional requirements document to clearly define the scope, the end product risks missing the target.

At first, providing the wrong scope is clearly a problem, but it also creates other problems. To fix the perimeter, the schedule is extended and the cost increases. The customer may not have the time and money to correct errors, so they accept them and consider our product to have quality defects.

However, not all of the reach is equally important. Typically, the customer has both wants and wants. After seeing the cost estimate, they can ask to reduce the scope. Often, range reduction exercises focus on non-functional requirements. Excessive non-functional requirements can quickly increase costs, while insufficient non-functional requirements lead to poor user experiences.

### How are functional and non-functional requirements brought together?

One of the best ways to bring requirements together is to bring all stakeholders together for a guided brainstorming session. Remember that in many cases, the top-level stakeholders are not the users. Include user representatives on the team, who are one of the best sources for non-functional needs.

## Functional requirements

### What is a functional requirement?

The functional requirements define the basic behaviour of the system. Essentially, they are what the system does or should not do, and can be viewed in terms of how the system responds to inputs. Functional requirements typically define if / then behaviour and include calculations, data entry, and business processes.



Functional requirements are characteristics that allow the system to perform as intended. In other words, if the functional requirements are not met, the system will not work. Functional requirements are the characteristics of the product and focus on user requirements.

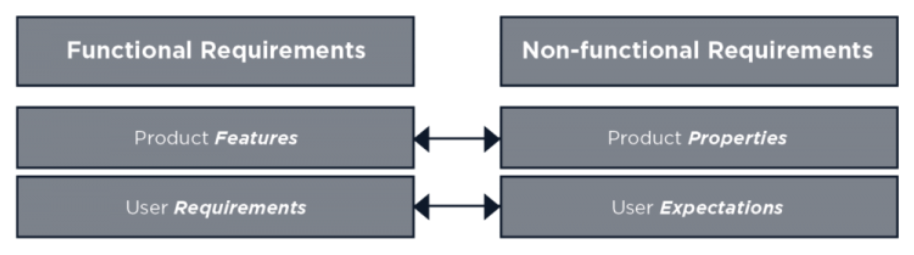
### Functional requirement for this project

* Role management for user.
* Create and schelue task.
* Task progress and status management.
* Project member management.
* Task assignment.

## Non-functional requirements

### What is a non-functional requirement?

While functional requirements define what the system does or should not do, non-functional requirements specify how the system should do it. Non-functional requirements do not affect the basic functionality of the system (hence the name, non-functional requirements). Even if the non-functional requirements are not met, the system will still fully fill its basic purpose.



If a system will always operate without meeting non-functional requirements, why are they important? The answer is usability. Non-functional requirements define system behaviour, functionality, and general characteristics that affect the user experience. The quality of the definition and execution of the non-functional requirements determines the usability of the system and is used to judge the performance of the system. Non-functional requirements are properties of the product and focus on user expectations.

There are more examples below, but for now, think about a functional requirement that the system loads a web page after someone clicks a button. There should be an associated non-functional requirement specifying the loading speed of the web page. Without it, the user experience and the perception of quality are threatened if they are forced to wait too long, even if the functional requirement is fully met.

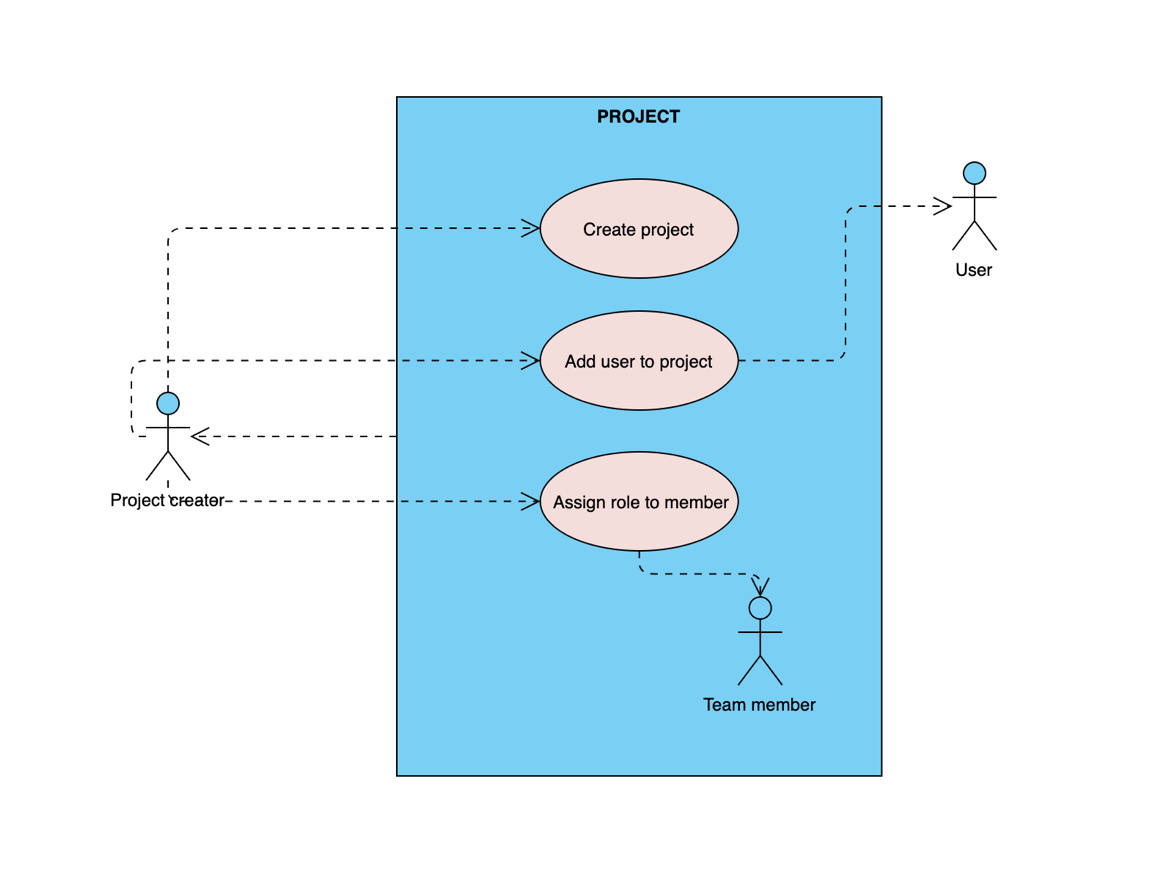
### Non-functional requirement for this project

* User account security.
* Application UX guarantee.
* Server performance.
* Clean UI.
* Good code convention for maintainance

# Design

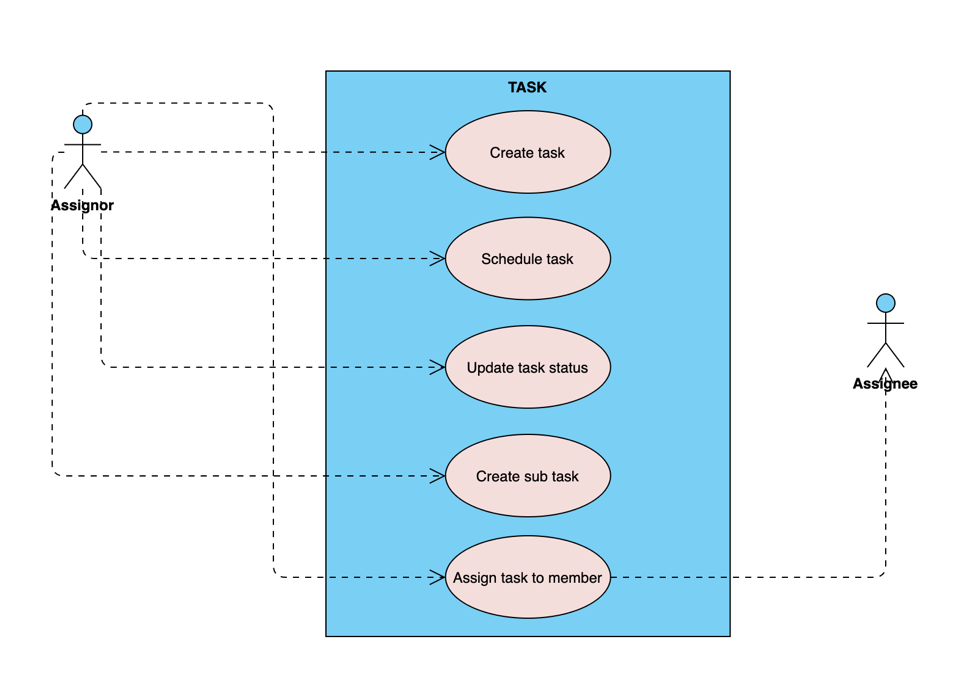
## Use cases diagrams

### Project creator



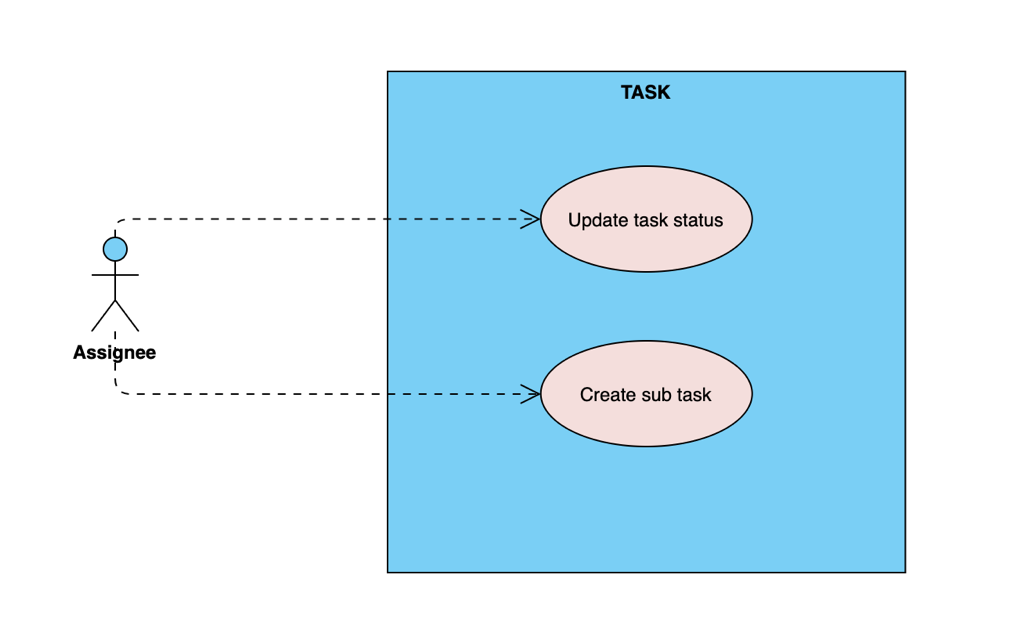
Role of **project creator** is able to: create **project**, add **user** from outside the project into project, assign role for **user** inside project.

### Assignor



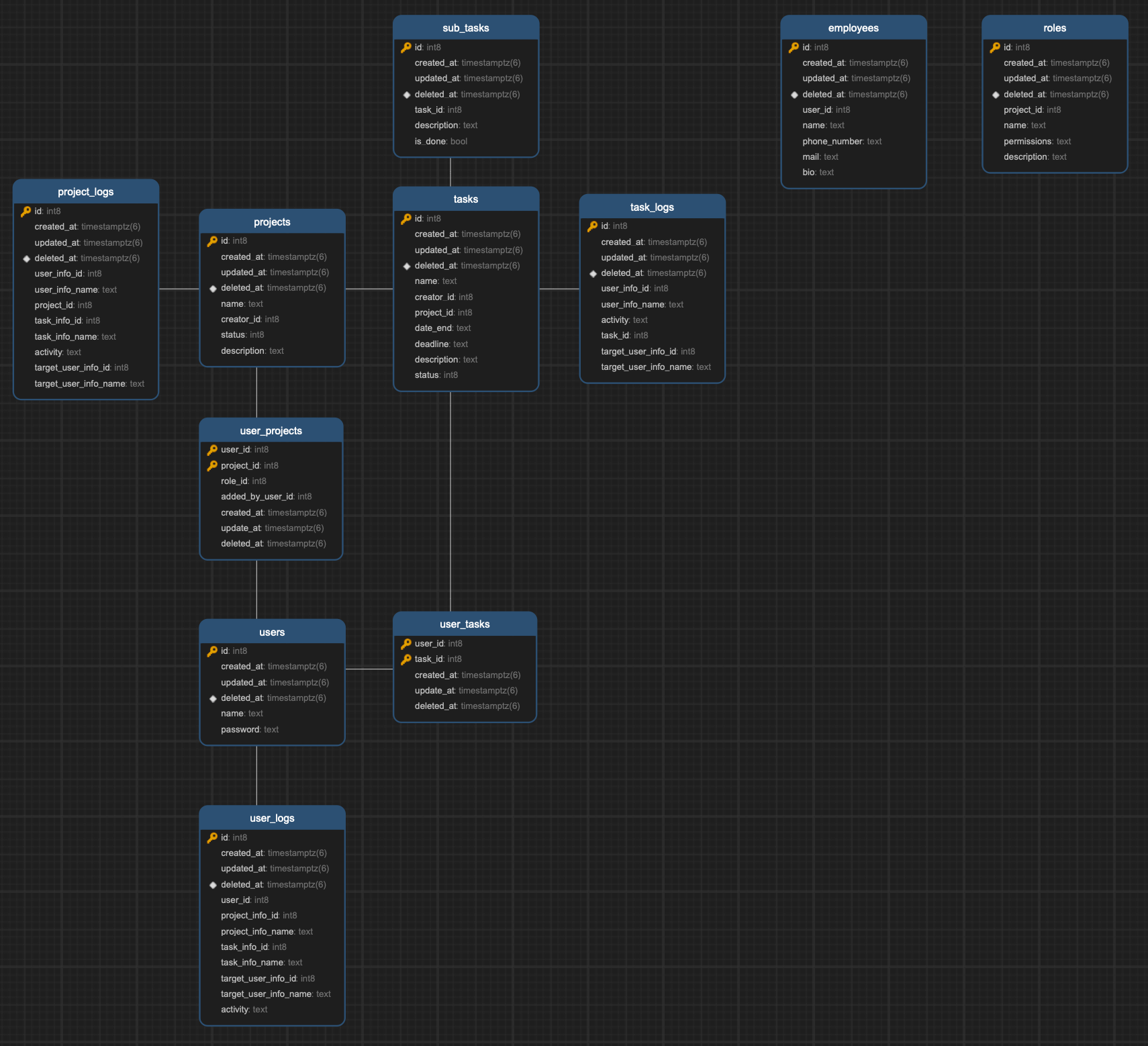
Role of **assignor** is able to: create, schedule **task** and **sub-task**, update task status (progress) and asign task to **user**.

### Assignee



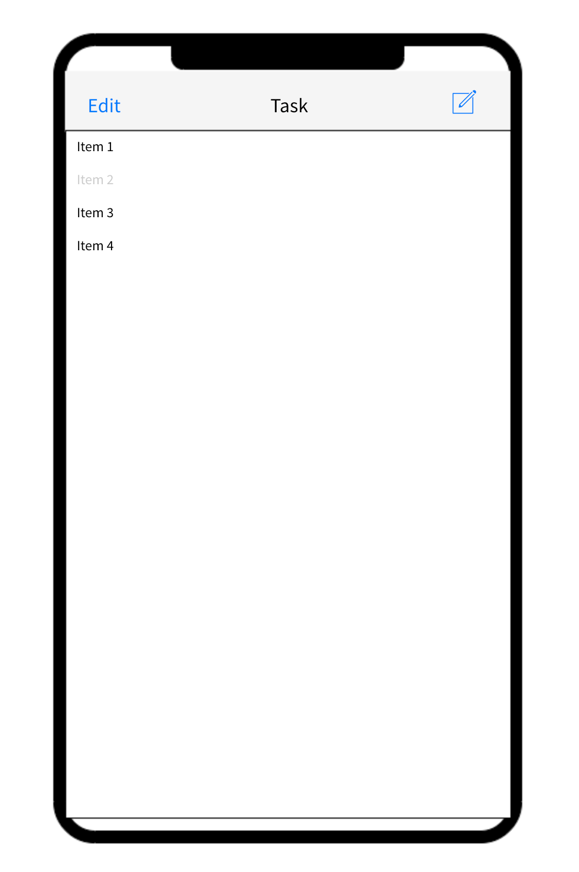
A role of task as **assignee** is only able to: do the **task**, obivously, update the task status (or progress) and create **sub-task**.

## Database model design



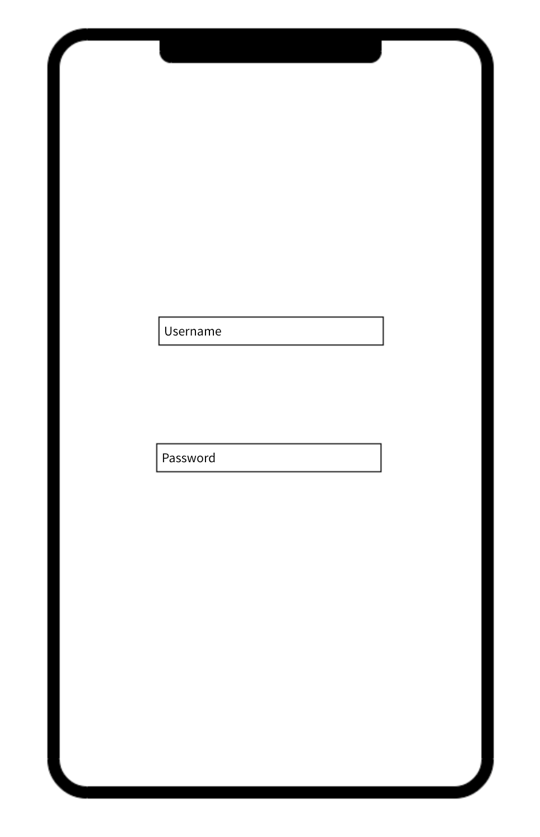
## User interfaces

### List



The most common UI in this application should be the list item for task, user, project, etc. List often contain a header for buttons of action and a list of item to display and manipulate data.

### Sign in and form



The sign in page should include the text input for username and password. The input password shoud be hidden.

# Reflection

# References