Group Project Deliverable 2

"Requirements Determination & Specification Documentation"

Group Project Topic:

Construction Management Information System

Group Name: Tech Phantoms

Team 2

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OVERALL PHASE STATUS		
SECTION	**ASSIGNEE**	**STATUS**
1) Overview Statement	**Kyle Rumde**	**Completed**
2) Determine Customers/Users	**Artur Komissarov**	**Completed**
3) Goal of Information System	**Artur Komissarov**	**Completed**
4) Requirements Identification & Classification	**Artur Komissarov**	**Completed**
9) Conceptual Model	**Krushnam Badami & Varnika Srivastava**	**Completed**

Task 5 - Modeling Function Requirements(Activity diagram using IBM Rational Software Architect**)**		
Use Case Name	**ASSIGNEE**	**STATUS**
i) Confirm BluePrint	**Faith -Valentine Uzoka**	**Completed**
ii) Process Purchasing Order	**Khaliq Minsariya**	**Completed**
iii) Schedule Project	**Srinath Bhaskaran**	**Completed**
iv) Produce Progress Report	**Kyle Rumde**	**Completed**
v) Manage Budget	**Krushnam Badami**	**Completed**
vi) Tracking Equipment	**Varnika Srivastava**	**Completed**

SECTION	ASSIGNEE	STATUS		
Use Case Names:		**Task 6 - Events**	**Task 7 - Use Case Specification**	**Task 8 - Use Case Diagrams**
i) Register Client	**Faith - Valentine Uzoka**	**Completed**	**Completed**	**Completed**
ii) Confirm BluePrint	**Faith -Valentine Uzoka**	**Completed**	**Completed**	**Completed**
iii) Estimate Required Materials	**Khaliq Minsariya**	**Completed**	**Completed**	**Completed**
iv) Determine Completion Time	**Khaliq Minsariya**	**Completed**	**Completed**	**Completed**
v) Process Purchasing Order	**Khaliq Minsariya**	**Completed**	**Completed**	**Completed**
vi)Manage Inventory	**Krushnam Badami**	**Completed**	**Completed**	**Completed**
vii) Determine Workers List	**Faith -Valentine Uzoka**	**Completed**	**Completed**	**Completed**
viii) Schedule Project	**Srinath Bhaskaran**	**Completed**	**Completed**	**Completed**
ix) Produce Progress Report	**Kyle Rumde**	**Completed**	**Completed**	**Completed**
x) Update Tasks	**Kyle Rumde**	**Completed**	**Completed**	**Completed**
xi) Construct Employee Assessment	**Varnika Srivastava**	**Completed**	**Completed**	**Completed**
xii) Manage Budget	**Krushnam Badami**	**Completed**	**Completed**	**Completed**
xiii) Record Meeting Minutes	**Kyle Rumde**	**Completed**	**Completed**	**Completed**
xiv) Tracking Equipment	**Varnika Srivastava**	**Completed**	**Completed**	**Completed**
xv) Infer and Analyse Data	**Srinath Bhaskaran**	**Completed**	**Completed**	**Completed**
xvi) Report Incidents	**Srinath Bhaskaran**	**Completed**	**Completed**	**Completed**

Task 1 - Overview statement - the purpose of the project

The purpose of our project is to develop an information system for construction management that covers all stages of a construction project, with a website that can:

- Integrates communications into an interface which is capable of:
    - Coordinating construction workers by determining a list of workers responsible for the project, generating their schedule, assessing their performance, and staying updated on the status of their tasks.
    - Aiding in planning between architects, managers, and construction professionals through the use of documented meetings, and streamlining the processing of blueprints.
- Automating tasks, analytics, and reporting to:
    - Reduce the chances of errors when estimating the amount of materials required, processing purchase orders, assigning workers, and their schedules.
    - Automatically generate reports and charts/visualizations of spending, incidents, tasks, and recommendations for improvements in the next project.
- Saves time with:
    - Resource acquisition by calculating the amount of required materials for a given project.
    - Scheduling when determining the time needed to complete different projects and tasks, assigning workers, and assigning a time frame in which they need to complete all their work.
    - Monitoring by keeping track of who can log into the system, the status of tasks, the check in and out times of workers, and equipment.
- Aids management in:
    - Project sites by determining who is supposed to do what and where it needs to be done, generating reports on the status of tasks on the project site, and keeping track of equipment.
    - Inventory by keeping track of what materials arrive and leave and when, and what is contained within the inventory including equipment.
    - Finances by processing the purchase orders, fitting workers based on the assigned budget, keeping track of and reporting on spending, and on equipment that needs to be ordered.
    - Safety by documenting concerns posed by the safety manager and logging incident reports.
- Reducing cost by analyzing all the reports at the end of a project and checking to see where improvements can be made.

Task 2 - Determine Customers/Users:

Determining stakeholders of the CMIS involves a great variety of users which play a role in the construction project endeavour which we wish to manage with our CMIS. In alignment with ITEC 4040, these stakeholders are divided into subcategories, as well as whether they are the primary stakeholder of that subcategories or not.

PRIMARY USERS -- MANAGERS

There are multiple managers involved in the CMIS which will have direct access to software to initiate, maintain, and complete a construction project endeavour. They are the main users of the software who have full access to CRUD operations (Create, Read, Update, and Delete) according to which department they reside in. Only the Project Manager can override these departments with full CRUD control on the CMIS. The finance manager will also have full read control over the entire software due to the nature of this manager as we will cover later on.

1. Project Manager

   The project managers are overseers of the entire construction project endeavour and play a critical role in keeping the project on track. They will be responsible for the flow of work in each phase of the construction project and will communicate to other departments that have a role in the CMIS for project success. They can address issues which are flagged in the CMIS and monitor progress to assure that the project is on track at all times.

2. Resource Manager

   This manager is responsible for the procurement of resources such as slabs, stones, wood, and any other materials of interest which are required in the construction project endeavour. They are also capable of determining the number of workers needed for the construction project. The resource manager would most likely work along with the inventory manager such that errors do not occur in the construction project endeavour (Errors where information is desynchronous, missing numbers, miracles or black holes in information involving resources and labour, etc).

3. Inventory Manager

   The inventory manager would be the ones responsible for obtaining and distributing the resources needed throughout the construction project endeavour. Tasks such as providing equipment status, maintaining storage of equipment, and managing the incoming process orders to be stored would be the job of the inventory manager. They also work along with resource managers so that errors have not occurred or been passed along from other tasks and to ensure that everything is proceeding according to the plan.

4. Field Manager

   These are one or many managers who partake in managing ongoing activities and operations that occur at construction site(s). They provide daily reports into the CMIS that are of main interest to other managers involved in the project endeavour (What has been completed or not) , as well as a construction site "Diary" for activities of interest or concern that occurred during the day (e.g → person X dropped and broke the 20x20 granite slab -- we need another one). They also provide employee-based field reports to see employee performance, keeping track of their shift attendance and activity schedule compliance and any relevant information to the CMIS. They also construct work order schedules in which they are free to edit shifts or provide information to construction workers. Schedules for the next week are made available 3 business days prior to the beginning of that week. Field managers are the ones who report incidents to a safety manager.

5. Safety manager

   Tight governance of safety applied to the workplace environment and the safety regulations being met with blueprints is crucial. This is a role the safety manager secures in the projecte endeavour, where they are concerned with the overall soundness of a blueprint, as well as safety protocol are in effect at a construction site. They also get involved in incidents that have not been resolved by the field manager and address the situation. Safety Managers ensure routine checks to make sure that the safety of the

construction project and the workers has been maintained up to mark or not. They are also involved in analysing some data to improve overall safety in the workplace.

These managers often work along with existing external entities such as the Occupational Safety and Health Administration (OSHA) to ensure regulations are met during the constructing phase of the project endeavour.

6. Finance manager

   The finance manager are responsible for the spendings according to a project budget provided to them. This budget is realized and decided feasible together with the client in certain activities. The finance manager also approves purchasing orders as long as it's reasonably within budget. They maintain records of receipts from these orders, as well as having the final saying in a proposed workers list according to the budget.The finance manager will communicate with the project manager in case the expenses for the project increases and more funds needs to be allocated in order to complete project within the stipulated time.Furthermore, the finance manager will be managing the budget throughout the course of the construction project endeavour with the aid of the CMIS and its rich information stored within there.

SECONDARY USERS -- TEAM MEMBERS

There also exist other users who do not declare themselves as managers in the construction project endeavour, yet they have specific CRUD operations (except delete) with the software we intend to develop. They are generally denoted as Construction Workers who still have importance to the CMIS and bear relevant information managers would likely use.

1. Architects

   The architect is among one of the Construction Workers who directly interacts with the client to declare design specifications to the CMIS. The architect is able to obtain blueprints based on client specifications, update or create one blueprint outside of the CMIS and import it into the system.

2. Construction workers

These are users in a way where they report activities which were done at a construction site. They report whether they are ON STANDBY, IN PROGRESS, CONFLICT,or COMPLETED.

This status is reported to a field manager, who further updates the information in the CMIS that helps to understand where the project stands with progress reports.

3. Construction professionals

This is a specific group of engineers who would have relative interest and concern with the project blueprint and materials in use for the project. These engineers can vary, let it be an electrical engineer, utility engineer, and so on, but most of these engineers in this project endeavour will play a role such that they will request information and the CMIS will deliver the finalized blueprint as well as the materials requirement so that they can execute their work in the construction site. They are also capable of determining the time needed to complete the construction project out of experience in this field.

CUSTOMERS -- STAKEHOLDERS

Customers are important to the CMIS such that business flows smoothly and that expectations are being met by internal and external actors. These are prioritized stakeholders and therefore do not need designation on whether they are primary or secondary customers.

1. Supplier

The suppliers are external organizations who will be involved in the CMIS to procure the needed materials or equipment.

2. Clients

The kind of clients which are declared here are those who have a saying in what they expect out of the construction project endeavour, as well as what requirements they **need** (not always want!) out of the project. They voice what kind of buildings they would like, the materials that they wish to use on each blueprint, as well as key factors that should not be overlooked throughout the project endeavour. They directly work with architects to determine such specifications and may also be interested in requesting reports to see

where the project is going. They will always have the final say in an agreed budget between the client and the managers involved in the project endeavour.

Task 3 - Goals of the information system

The construction management information system would like to achieve the following goals:

Automation of managerial tasks:

Our greatest concern would be the time consuming processes and chances of errors in certain tasks. Miscommunication in a construction project endeavour has potential to delay projects, cause huge financial losses or jeopardize the entire project initiative in itself. Eliminating human error completely is a goal rarely achieved, but we could automate the simple tasks with the information system in which it can perform these tasks far quicker than a manual task.

Integrate communications, all visible in one centralized interface:

Our software intends to behave as a dashboard and have all tasks relevant to the construction project endeavour to be displayed in modules. It would be chaotic to handle every unique process under different software and translate this to managers. Even if the translations were pitch perfect, as well as that this translation did not carry over any errors, this in itself would be a task that takes up precious time a project manager may not have in the first place. Instead, they could access this centralized interface and have everything they need with one simple software. This, in turn, will further reduce errors and the time or effort that could be allocated elsewhere in the construction project endeavour.

Task 4 - Requirements identification and classification

#	Requirement	Actor(s)	Use Case
1	Client needs to register to become a part of our construction management information system, creates a profile with important details like contact information and personal details, builds a unique username and password that would be used for future signing in our information System	Client	Register Client
2	Client talks with the architect and expresses his/her requirements in person. The Architect needs to pull out a blueprint based on client requirements from the database. The Architect will adjust the blueprint based on clients requirements if needed [that is if the blueprint pulled out is not completely matching the clients requirements] A safety manager is going to review the blueprint [if it is updated]for all building codes and safety requirements, once the architect finalizes the project on his end. Architect is required to meet with the client in person when he has finalized the blueprint on his end & safety manager has approved it as well, takes the client's confirmation to proceed with the blueprint and confirms the amount the client is ready to invest in this project. The finance manager is involved in this "in person meeting" as well to confirm if the budget that client is ready to invest is enough to carry out this project according to the designed blueprint or not. Once the client, finance manager, settles on the amount to be invested in this project,the project endeavour actually begins. At the end of the meeting the architect must fill out the meeting minutes document in order to record all details of the meeting in the CMIS for future reference.	Architect, Safety Manager, Finance manager, Client,	Confirm Blueprint

3	A user requests the amount of materials needed for the project and the system automatically calculates, estimates based on the finalized blueprint specifications. The total budget of the materials is calculated according to the estimated amount to be used. Due to the budget constraints it needs to be deemed feasible by the finance manager.	CMIS, Construction Professionals, Finance Manager	Estimate required material
4	Once all the above documents have been finalised, the time taken to complete the construction project would be estimated by the construction professionals and stored in the information system, thereby seeking project manager's approval for signing off design phase.	Project Manager, Construction Professionals, CMIS	Determine Completion time
5	All the orders are processed in this use case - regarding materials needed or equipment for construction. Green light from the finance manager is needed before the Resource Manager processes the order. All approved purchasing order receipts should be submitted to the finance manager for maintaining records.	CMIS, Resource Manager, Finance Manager, Supplier	Process Purchasing order
6	The inventory manager is required to update the list of building materials and equipment required for the project which will be ordered by the Resource manager for the project, equipment would be kept on standby for welding. On placing the necessary "Purchasing Orders" the Resource manager would be able to fetch the status of the process orders and notify the inventory manager accordingly to when the materials would arrive. If the order has been delayed due to unknown reasons the resource manager would get in touch with the Suppliers. If the order arrives on time, it would be stored in the inventory, monitored by the inventory manager.	Project Manager, inventory manager, resource manager, Supplier	Manage Inventory

7	Resource Manager will determine the approximate number of workers needed for the construction project, inform the finance manager about it in a document. Finance manager will, according to the fixed budget determine the job costing, determine the list of workers that fit in the job costing budget, signal to proceed ahead if deemed feasible, if not, the necessary changes would be made in the number of workers or cost allocation.	Finance manager, Resource manager	Determine Workers list
8	Project Manager will assign the number of days needed to be spent on the number of activities to complete the project within the stipulated time. Activity Names - Marking of Layout, Excavation, Foundation Work - i) Compacting the ground ii) Plain Cement Concrete iii) Footing Reinforcement iv) Shuttering, v) Footing Concrete , Column Casting, Construction of Walls, Lintel, Roofing, Plastering Work, Fixing of Doors & Windows, Fixing of Electrical and Plumbing Works, Tiles Laying, Painting, [Terrace waterproofing, landscaping works, False Ceiling, Installation of Furniture - according to client needs. Thereafter the field manager will design the work schedule for the workers accordingly, specifying shift time, days, task allocated in detail. Work Order Documents are required to be issued by the field manager to the workers on a weekly basis. Any changes to be made in the work schedule would be done by the field manager as well.	Field manager, Project manager, Construction worker	Schedule project
9	The system should be capable of producing project progress reports weekly or on request made by a client. Contents of this progress report will summarize which tasks have been completed, in progress, in conflict, or on standby (which is fed into the CMIS by the field manager). The same report can also be requested by the project manager to know the status. It should also show the time used and time remaining for the construction endeavour to be completed.	Project Manager, Client, Field manager	Produce Project report
10	It is required that the construction workers inform	Field Manager,	Update tasks

	the field manager and the field manager should update tasks which were COMPLETED, IN PROGRESS, ON STANDBY or INCOMPLETE at the end of each day. This will allow other use cases to make good use of the new information and as well as staying on track with the project endeavour according to the CMIS.	Construction Worker	
11	The field manager will concern themselves with whether workers are adhering to project milestones or have met attendance on their shifts[log in the accurate number of hours]. This is necessary so that the field manager may adjust the schedule to get tasks done on time. [Daily basis task]	Field Manager, Construction Worker	Construct Employee assessment
12	It is recommended that the construction project endeavour operates under budget it has been provided. This requirement aims to investigate the actual spending on project endeavour with the project budget assigned. A finance manager will assess this and report the findings to the project manager if the budget is about to exceed the budget assigned, with aid of existing information stored in the CMIS, that includes getting the detailed information about the labor cost, material cost and other expenses to further analyze the current expenses incurred.	Finance Manager, Project manager,	Manage Budget
13	The System allows all kinds of Users to schedule a meeting online to address or discuss construction project related concerns or progress. At the end of each meeting a document named "Meeting Minutes" should be filled out highlighting the points discussed. This will help maintain a log of meetings and changes made in the project, any of the managers can refer to it if needed.	All users	Record Meeting Minutes
14	All the equipment needed for the construction are	Inventory	Tracking

	stored in the inventory. The inventory manager is required to keep track of the equipment being used for the project and will update the status of the equipment being used. The inventory manager would say "Not Available" in two scenarios : 1. If the equipment is not available in the inventory 2. If the equipment in the inventory is all used by the workers at that point of time. Inventory manager will also make sure that all the equipment used for the development of the project is returned at the end of the day. If a particular equipment is not available in the inventory a request is issued to "Process Purchasing Orders"that has to be approved by the finance manager.	`Manager, Finance manager`	Equipment
15	The data collected [blueprints, safety documents, budget, materials, all reports] in the project endeavour would be analysed and assessed at the end of the project endeavour, inferences from the data would be made in ways to improve services for future construction projects. Things to be considered, recommended.	`Architect, Safety Manager`	Infer and Analyse data
16	Any hazardous incidents that take place at the construction site should be reported by the field manager in a document, the way the incident occured and had been handled should also be mentioned. Any incident that occurs and hasn't been resolved needs to be notified to the safety manager as well [to resolve the concern] - note of this should also be made in a document for future reference purposes The safety manager will do routine checks to make sure that the safety of the construction project and the workers has been maintained up to mark or not. This needs to be documented as well.	`Safety Manager, Field Manager`	Report Incident

Elicitation Techniques

The elicitation technique proposed to discover these requirements are in the best interest of engaging with the project stakeholders at a respectable amount of time and to avoid tacit knowledge. Tacit knowledge can be basically described as something that the client understands or interprets trivially, meaning that they wouldn't mention it during the elicitation process, whereas the requirements engineer is unaware of such realizations.

The best example to this would be cookies, as it's a useful way to personalize information while roaming the internet -- those who are unaware of such realizations may interpret it as snack. This misunderstanding could become costly later on in the project and it is therefore important to avoid tacit knowledge when eliciting with stakeholders to develop the CMIS.

There are three elicitation techniques suggested for this project endeavour to be followed in order:

1. Reading/Document Analysis

   This is the best way to acquire knowledge of the stakeholder's working environment without wasting the stakeholder's time! It allows the requirements engineer to develop a foundation of knowledge for the project endeavour such that it can identify use cases, critical pillars of IS as well as those who are involved in the construction project endeavour, and gaining domain knowledge. This will gear the requirements engineer to dig deep with stakeholders with the information found.

2. Brainstorming sessions

   This is where the stakeholders are finally met with the requirements engineer as well as other clients relevant to the project endeavour to initiate some brainstorming. The requirements engineering by now should already have some knowledge on what the domain is like, but with the use of a brainstorming session, it can further elaborate on the problem domain and hear suggestions or ideas that may be put to use in the product to be made (Our CMIS). It can also confirm the requirements engineer's findings and avoid tunnel vision on the wrong set of requirements.

   Those ideas can then be narrowed and may become requirements that the system needs to develop the product according to the stakeholder's needs. It also invites an

opportunity to clarify on subjects that may seem to be tacit knowledge to the requirements engineer and get a better understanding of the domain.

3. Observation

The final step in the eliciting process. This will demonstrate to the requirements engineer the construction project endeavour to make connections with the information they've found with the elicitation process, problem domains which were discussed in the brainstorming session, and the ideas suggested to develop the right set of requirements for the product. This is the requirements engineer's final opportunity to catch tacit knowledge in the field and proceed to finalizing the set of requirements. The observation should be executed in a generally passive manner, unless a particular event within observation prompts the requirements engineer for some explanation in a particular event.

Requirements Document

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4. Project Matter

1.1 - Purpose and Scope of the Project

The main intent of this project is to develop an Information System capable of managing a construction project endeavour which accesses all relevant and important information in one website. The purpose of this project is to apply automation to manual tasks in efforts to reduce errors and the time used in each process. It also aims to Integrate all tasks for project managers to oversee the progress and status of the project with relative ease. Main users of this project will involve various managers, as well as unique users with different CRUD capabilities such as the architect, construction worker, and construction professionals (better known as the engineers). The CMIS will be involved with initializing, deploying, and completing a construction project.

1.2 - Business Context

Construction projects have seen a notable amount of time-consuming activities and errors within communication, let it be by person or by software, that impedes the overall time used to

complete the construction project endeavour. With these constraints in mind, they've also noted an increased growth in the corporation's operations, thus making allocation for fundings, resources, and time troublesome. Stakeholders who are involved in such construction project endeavours desire that a project is completed in budget and on time. This desire is contested with the AS-IS processes as well as the need of fixing errors before continuing the project endeavour. This is an outcome the corporation does not take upon lightly, thus seeking a solution to the issue at hand.

1.3 - Stakeholders

The stakeholders who are considered for the project are listed below:

- Project Manager
- Field Manager
- Finance Manager
- Resource Manager
- Inventory Manager
- Safety Manager
- Architects
- Construction professionals
- Construction worker

1.4 Ideas for Solutions

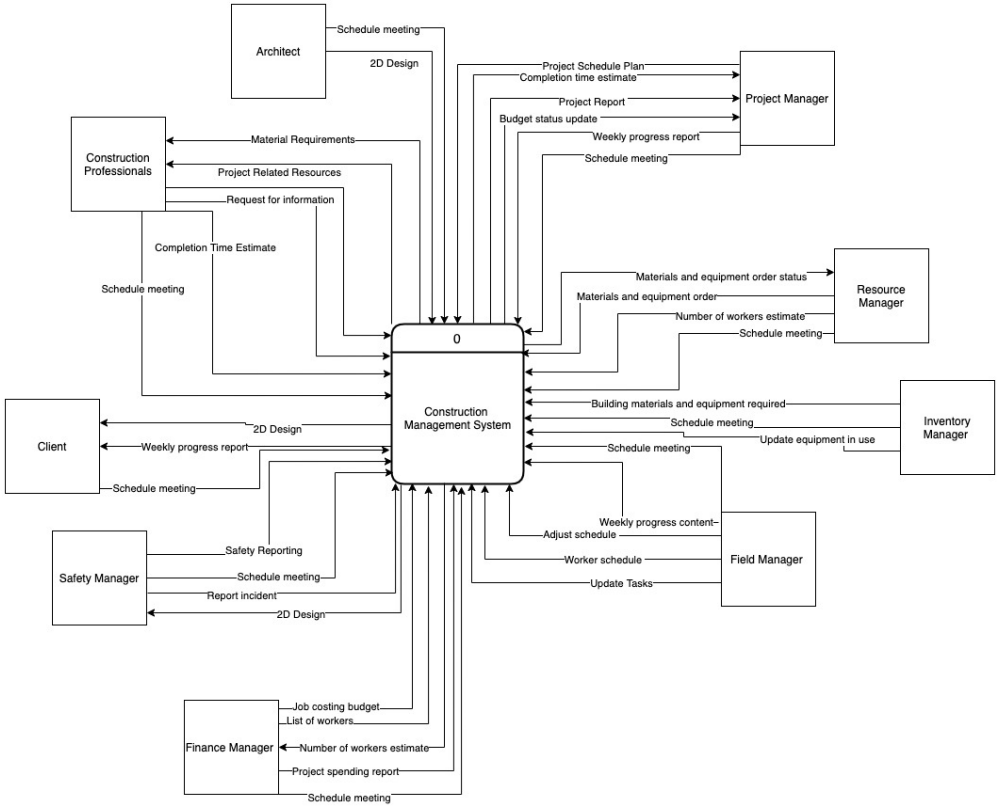
The product intends to use a website such that it can use HTTP to access databases at the backend. The website will be designed as an interface, where the main page will provide a

dashboard of all tasks or activities in the construction project endeavour sorted in columns. Each column is a phase of the construction project endeavour (initialization, deployment, construction) which will house multiple boxes. These boxes are the tasks of relevance that have been posted into the dashboard with the use of commands at the bottom right of the website. For the sake of functionality, all users who have access to this website are capable of all CRUD controls, although the finished product aims to give specific stakeholders specific controls, as well as managers only able to add their side of tasks to the dashboard. Each of these boxes will lead to new pages that specify on that task with full detail, as well as progress and status of those tasks wherever appropriate in that page. Tasks which are done would be checkmarked at the top left of the box.

1.5 Document Overview

The rest of the document will cover the following functional requirements: Confirm Blueprint, Process Purchasing Order. Schedule Project, Produce Progress Report, Manage Budget and Tracking Equipment. The following non-functional requirement will also be covered in the document along with a few functional requirements: reusability, traceability, efficiency, and configurability. A short review of schedule and budget, as well as a few open issues will be identified in this document.

2.1 - Scope of the System



2.2 - Functional Requirements

Commented [1]: green = initialization
yellow = deployment
orange = construction

1 - The user would need to register an account and/or log in to the CMIS to access the dashboard

2 - The user (project manager) initiates a new project

- 2.1 - A blueprint would need to be published in order for the project endeavour to proceed
  - 2.1.1 - A blueprint may be found in the system's database based on the customer's requirements
  - 2.1.2 - If the client's requirements do not match an existing blueprint, changes could be made to the existing blueprint. Alternatively, a new blueprint could be created by the architect and imported into the system.
  - 2.1.3 - The blueprint will need to be confirmed.
    - 2.1.3.1 - Informally, through a meeting, the architect as well as the client and safety manager will approve a blueprint which is then uploaded into the CMIS.
  - 2.1.4 - The material estimation will be computed depending on the parameters set in the blueprint (how many floors, how wide, how long, in what depth, etc) and a value will be calculated by the system. The client will meet with the finance manager to determine budget feasibility. If it does not, task 2 could be repeated or the project endeavour ends.

3. - With a project initiated, the construction professionals with the aid of the CMIS will need to determine the time for completing the construction project endeavour

4. - With an existing project beginning, all assets relevant to completing the construction of the blueprint will need to be purchased by processing the orders.

5. - Over the course of the construction phase of the project, the following management will be performed

- 5.1 - Inventory will need to be managed over the course of the construction phase by the Inventory Manager.
- 5.2 - The project schedule will need to be managed over the course of the construction phase by the Field Manager
- 5.3 - The salary of workers in the construction phase will need to be determined and managed by the Finance Manager.
- 5.4 - The Finance Manager will also manage the budget of the construction project endeavour
- 5.5 - Equipment tracking in terms of what equipment is available or not to be used by the construction worker on the field site.
- 5.6 - Meetings and collaboration, which will be recorded into the system
- 5.7 - Safety managers will perform routine checks to assure safety of the construction workplace in determining if they are meeting safety standards or not.

6. The following reports will need to be constructed out of request or at a weekly basis

6.1 - A project progress report will be produced

6.2 - An employee-based assessment report will be conducted and produced on a daily basis

6.3 - Data inferences and analysis performed to improve services on future construction projects would take place at the end of the project.

7. Whenever any task relevant to the project endeavour is completed, the task will need to be updated in the dashboard by the Field Manager.

8. In the event of accidents or incidents at the workplace, a safety and incident report will be performed by the Field Manager.

3.1 - Non-Functional Requirements

For 2.1: The blueprint should enable **configurability** for the project endeavour. **Reusability should also be enforced** for future projects for when clients wish to use an existing, saved blueprint on the database.

For FR 4: **Efficiency** is encouraged for optimal speed of obtaining and processing purchasing orders. **Performance** is also required such that the approval or disapprovals made by the finance manager should take no longer than 8 hours from which the request of approval was received.

For FR 5.1: **Traceability** should be enforced such that all equipment in inventory have valid status and accurate detail as to who is using the equipment, as well as the condition of said equipment. **Traceability** should also be enforced in new equipment orders to synchronize the inventory with the resource database.

4.1 - Open Issues

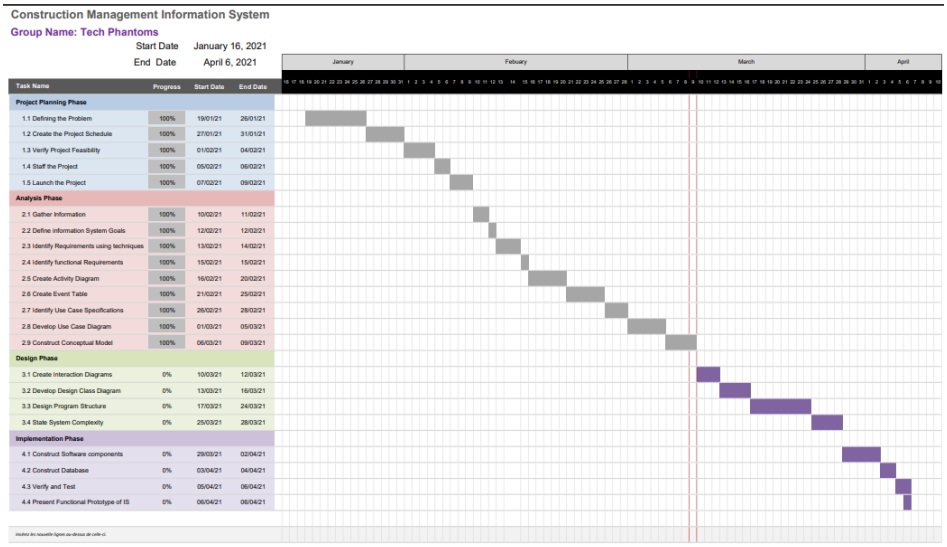
Future requirements:

- **NFR traceability & security on users who have CRUD control on the interface**
- **NFR traceability on construction site tasks to ensure completeness**

Potential problems once the system deploys:

- Database may need to be expanded to accommodate high volume of projects

4.2 - Preliminary Schedule



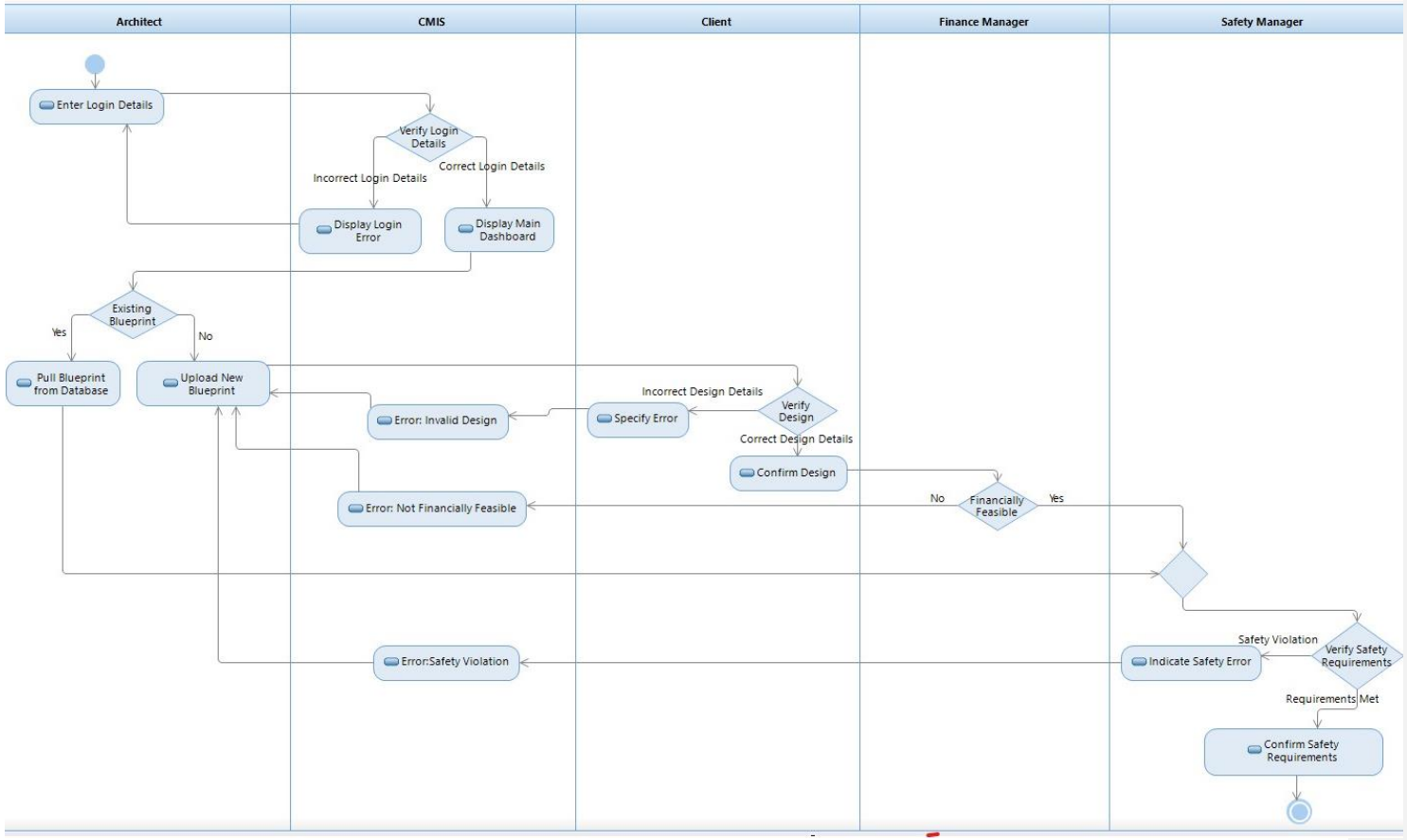
4.3 - Preliminary budget

Cost/Benefit	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Value of Benefits		4,71,600	5,89,500	7,54,560	9,80,928	13,73,299	
Discount Factor (10%)	1	0.9091	0.8264	0.7513	0.6830	0.6209	
Present Value of Benefits		4,28,732	4,87,163	5,66,901	6,69,974	8,52,681	30,05,451
Development Costs	-3,10,951						-3,10,951
Ongoing Costs		-2,32,000	-2,32,000	-2,32,000	-2,32,000	-2,32,000	
Discount Factor	1	0.9091	0.8264	0.7513	0.6830	0.6209	
Present Value of Costs		-2,10,911	-1,91,725	-1,74,302	-1,58,456	-1,44,049	-8,79,442
'V of Net of Benefits & Costs	-3,10,951	2,17,820	2,95,438	3,92,599	5,11,518	7,08,633	
Cummulative NPV	-3,10,951	-93,131	2,02,307	5,94,906	11,06,424	18,15,057	
Payback Period	1 year +93131/ (93131+202307) = 1 + 0.315 or 1 year 31 days						
5 Year ROI	152.48%						

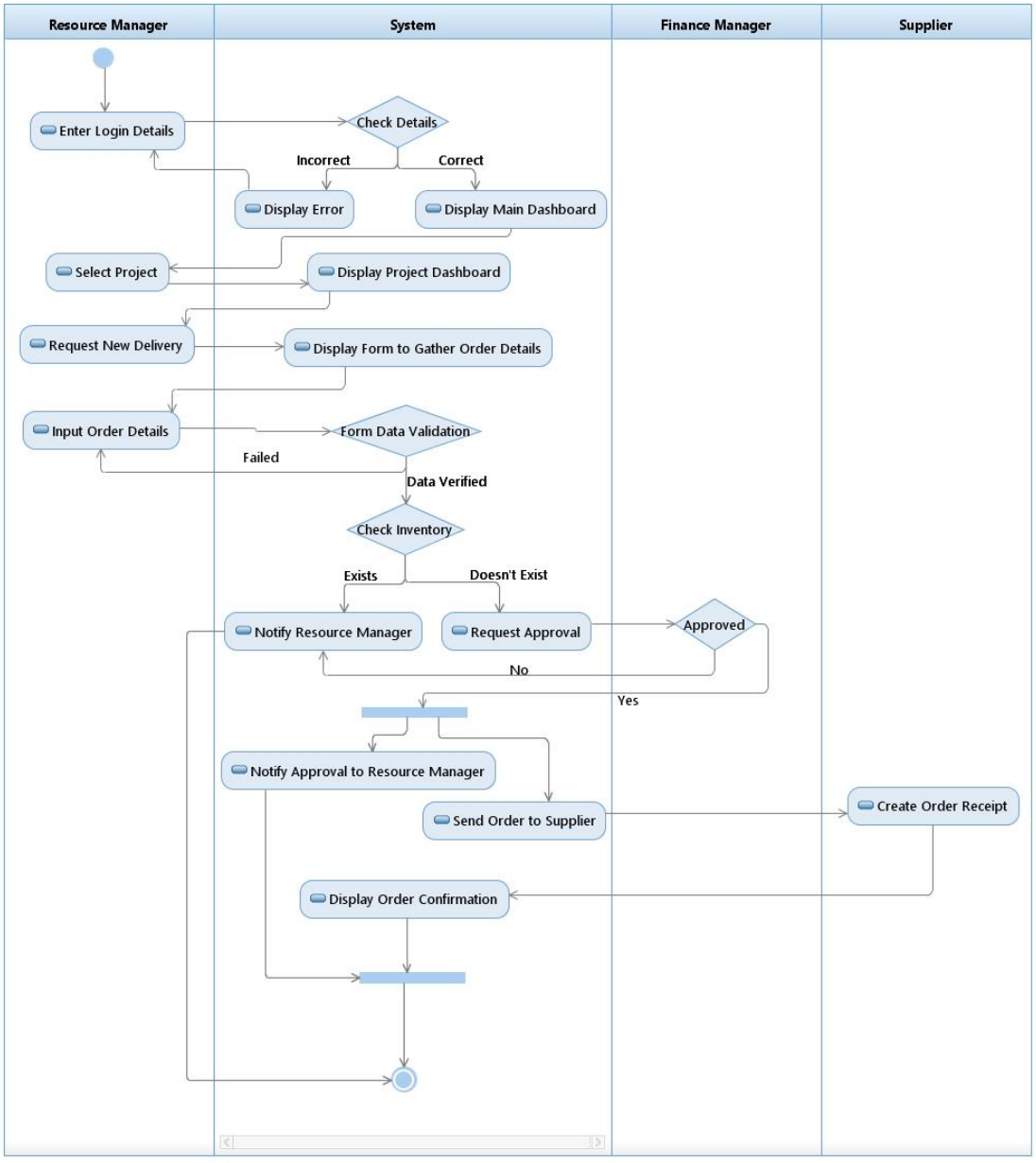
- Costs are shown to be paid back in 1 year, 31 days.
- Net benefits and costs show to grow linearly, no great concern in cost of project.
- ROI at a robust 152.48%

Task 5 - Modeling functional requirements: Activity diagrams

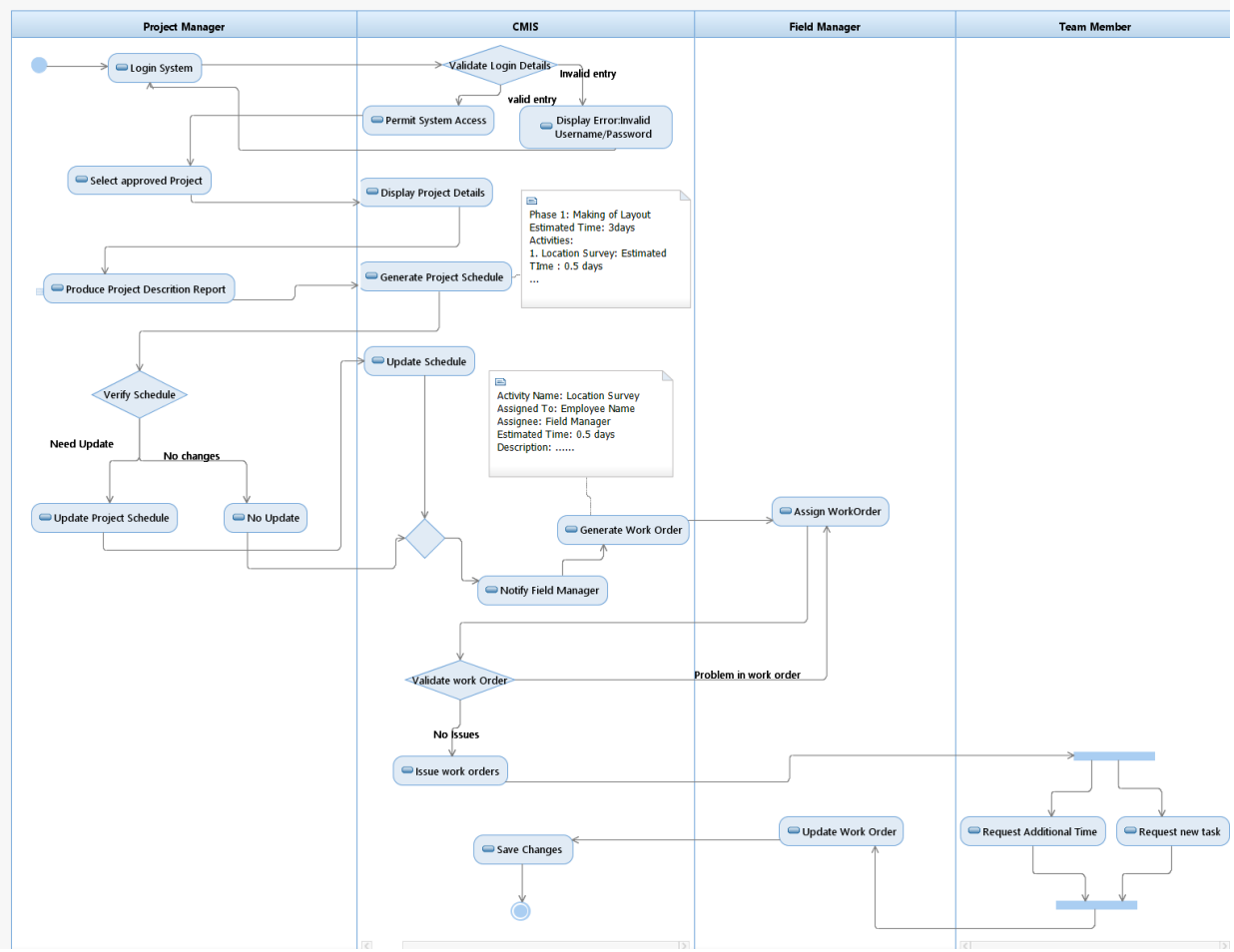
Use Case #2: Confirm Blueprint



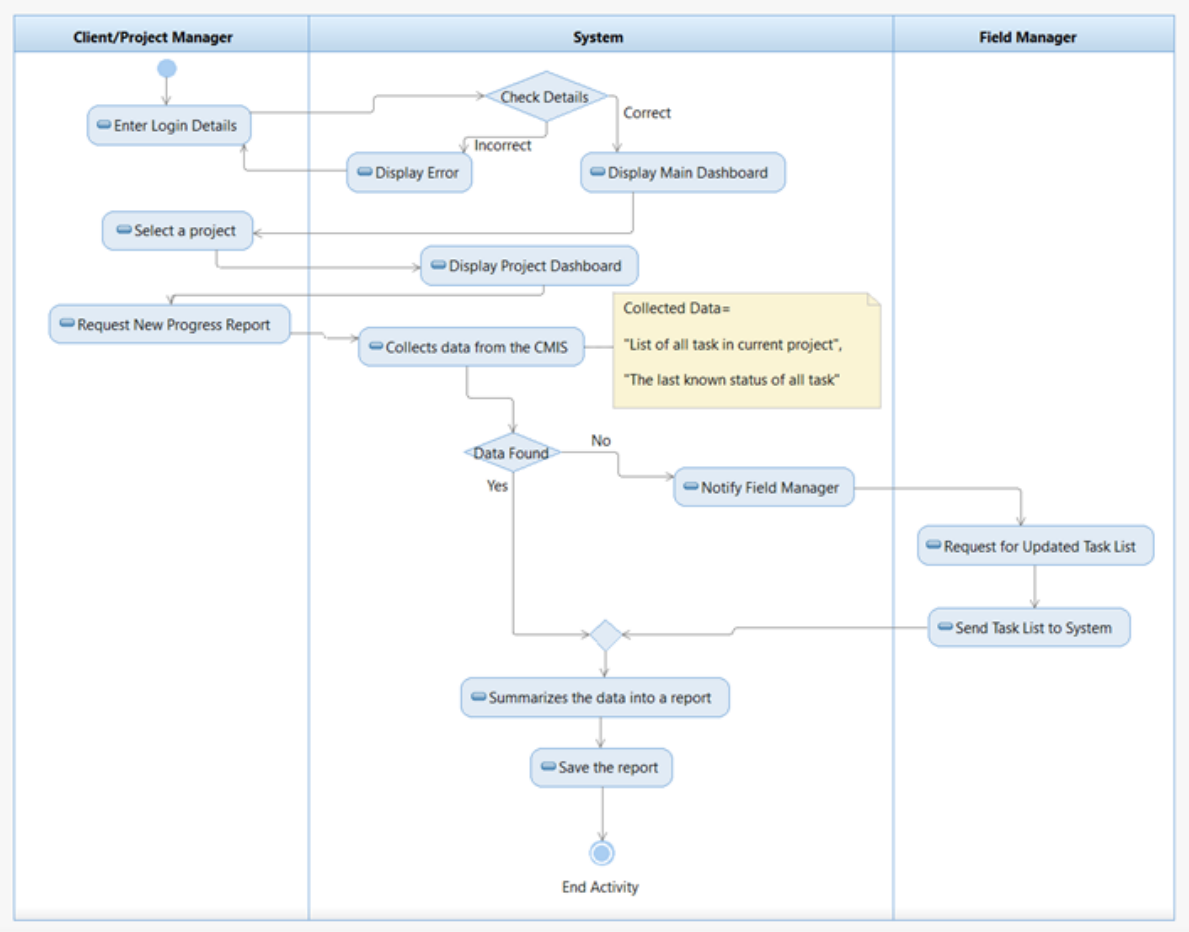
Use Case #5: Process Purchasing Order



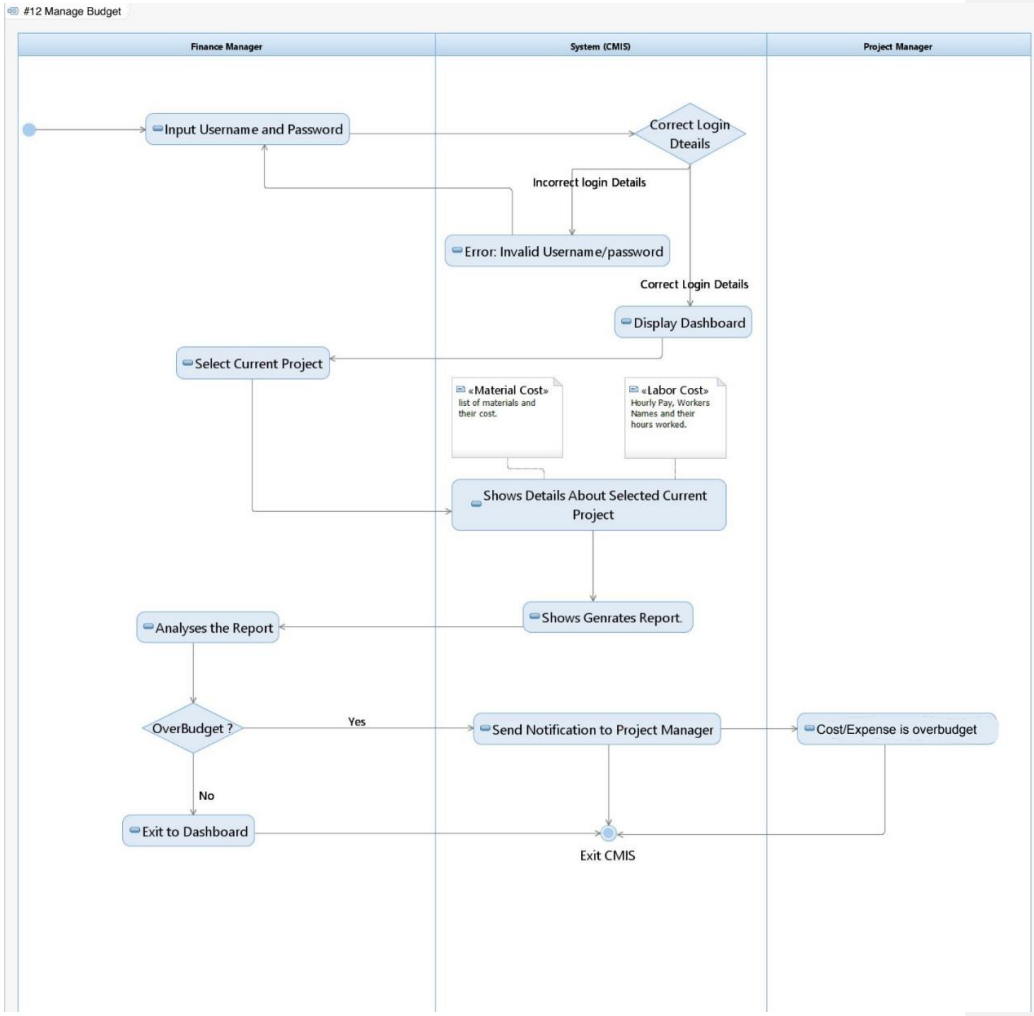
Use case #8 Schedule Project



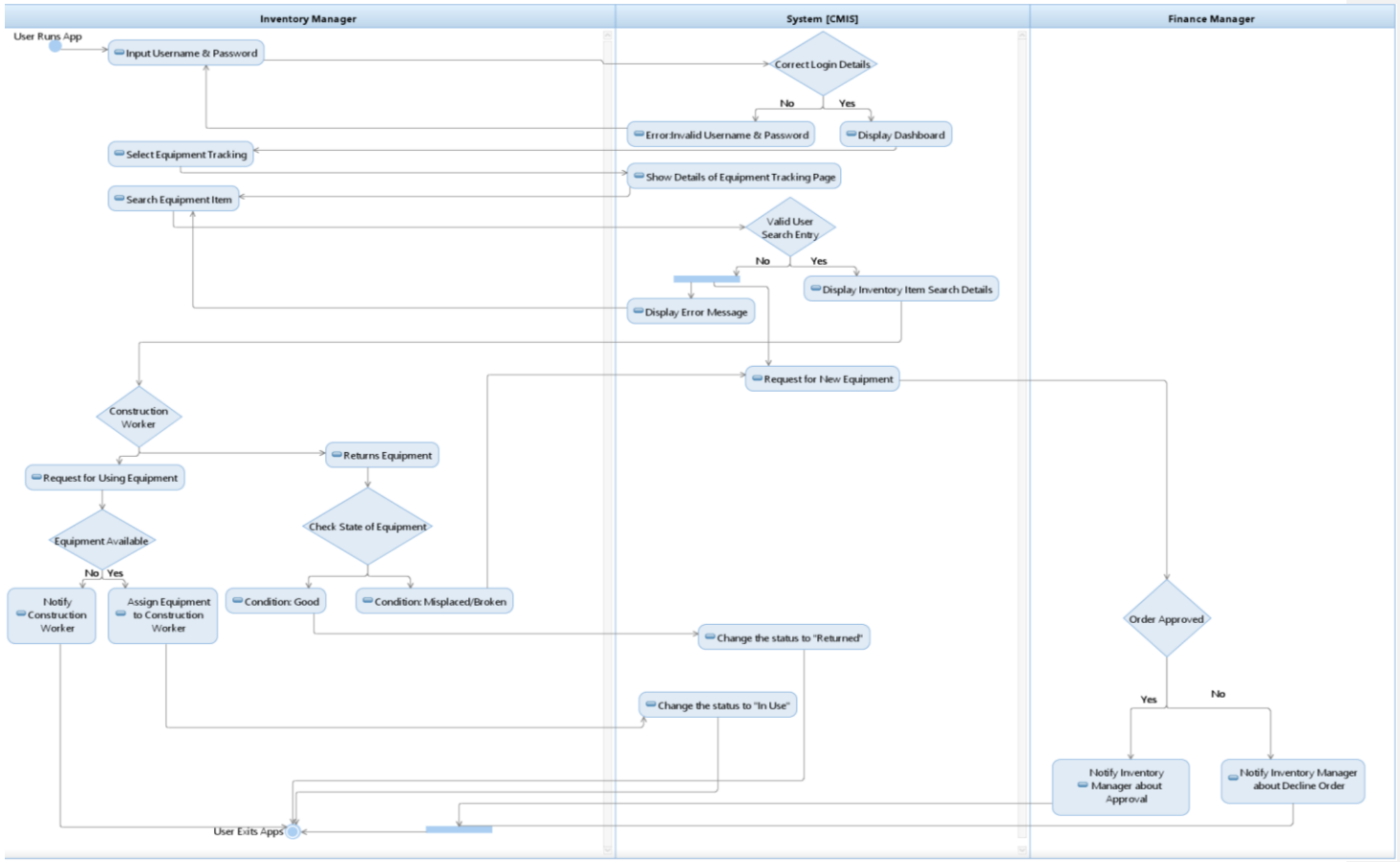
Use Case #9: Produce Progress Report



Use Case #12 : Manage Budget



Use Case #14 : Equipment Tracking



Task 6 - Events Table

Construction Management Information System Event Table[1]					
Event	**Trigger**	**Source**	**Use Case**	**Response**	**Destination**
1) Client registers with the CMIS by providing personal information	Client decides to begin using the CMIS	Client	Register Client	Client account created with password and unique username	Client
2) Client and Safety manager confirm blueprint that is provided by the architect	Blueprint is submitted	Architect	Confirm Blueprint	Blueprint is confirmed based on requirements of the client and safety regulations	Architect, Client
3) Constructor worker wants to find out the amount of materials needed for the selected blueprint	Request for amount of materials needed	Construction Professional	Estimate Required Materials	Details of required materials: quantity & cost	Construction Professional

[1] All the events listed in the table are external events, the ones that are not external events are listed in ()

4) Project manager wants to know how long the project will take to finish	Project completion time inquiry	Project Manager	Determine Completion Time	Number of months required for the completion of the project	Project Manager, Construction Professionals
5) Resource manager has to place an order of the required materials for the current project	New order of materials	Resource Manager	Process Purchasing Order	Order receipt, Order confirmation, Estimated date of delivery	Resource Manager, Finance Manager, Inventory Manager
6) Resources Manager checks the inventory for the status of the ordered materials.	Material delivery inquiry	Resources Manager	Manage Inventory	Look up the delivery dates , and show the status of order.	Resources Manager, Inventory Manager
7) Labour cost is determined based on a list of workers.	Labour cost requirement requested	Resource Manager	Determine Workers List	List of workers and hourly rate produced with labour cost as an output	Finance Manager

8) Create Work Order Documents and send it to the Construction Worker	Project Manager gives the project schedule document.	Project Manager	Schedule Project	Construction Worker's order documents are made according to project schedule document	Construction Worker
9) Time to produce Project Progress Report (Temporal Event)	End of Week or manual request		Produce Progress Report	Generate progress report with details of task list summary and time remaining for project completion	Project Manager and Client
10) Field Manager updates the status of a task completed by the Construction Worker	Manual task update on the field site.	Field Manager	Update Task	Update status of a task assigned to the construction workers	Field Manager or Construction Worker

11) Time to produce Employee -Based Field Reports (Temporal Event)	End of Day		Construct Employee Assessment Report	Evaluation of construction Worker's progress at the field site on a daily basis	Field Manager, Construction Workers
12) The finance manager will assess the report's analyze the current expenses incurred.	Analyze cost.	Finance Manager	Budget Management	If the project is over budget or under budget.	Finance Manager and Project Manager.
13) Any User involved in the current project schedules a meeting	New meeting request	Any User involved in the current project	Record Meeting Minutes	Time slot for meeting is scheduled Meeting takes place Meeting minutes document is saved.	Project Manager

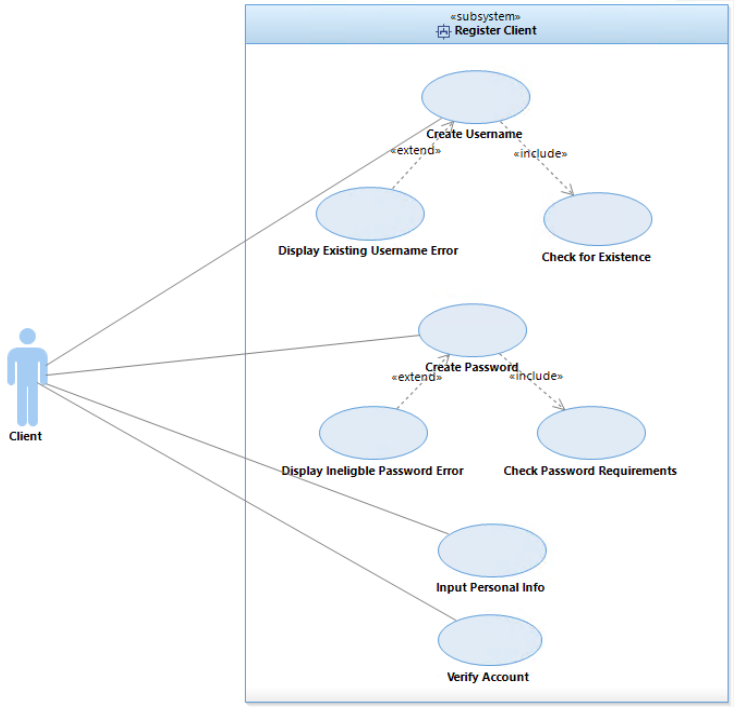
14) Inventory Manager checks the equipment status to identify equipment available.	Equipment Tracking	Construction Workers	Tracking Equipment	Gets the equipment available for construction workers to use.	Inventory Manager
15) Inventory Manager checks the equipment status to identify if equipment is returned or not.	Equipment Tracking	Inventory Manager	Tracking Equipment	Checks if equipment are returned at the end of construction workers shift.	Construction Workers, Inventory Manager
16) Analyze Reports and Documents to improve the business process	Project completion	Documents covered by the user in the current project	Infer & Analyse Data	Find opportunities to improve business process	Company Stakeholders
17) Safety manager analyse the incidence related to construction workers safety and take corrective actions	Safety incidence	Field manager	Report Incidents	Updated company policies and training manuals	Construction workers

Task 7 :Use Case specification & Task 8: Use Case Diagrams[2]

Use Case #1: Register Client

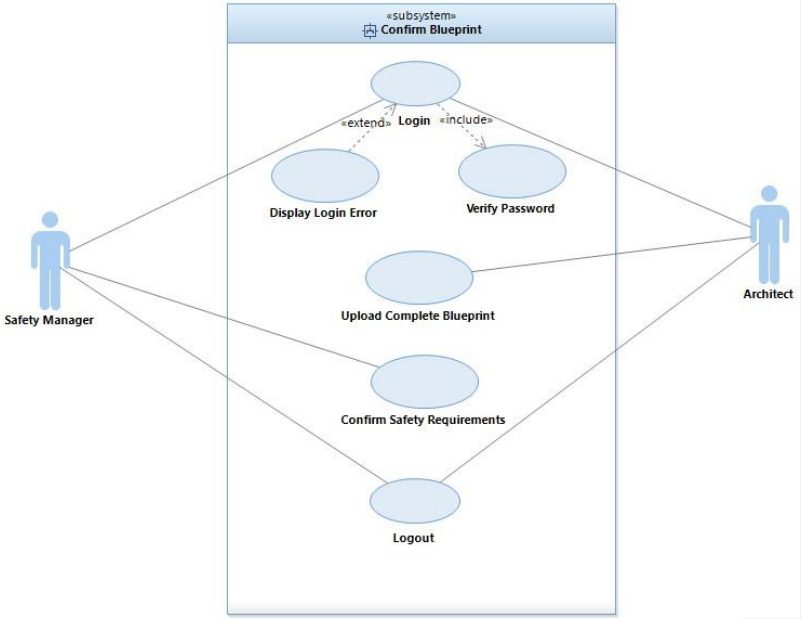
[2] More & clear information details on Task 7 & 8 can be found in "CMIS Use Cases Explanation"

Use Case Name:	Register Client	
Scenario:	Client Creates an account with the CMIS	
Triggering Event:	Client decides to begin using the CMIS	
Brief Description:	Client registers by making a profile to become a part of the construction management information system.	
Actors:	Client	
Related Use Cases:	-	
Stakeholders:	Client: To use the CMIS to manage activities related to the construction projects	
Preconditions:	Client must provide their legal personal information and a unique username	
Postconditions	For using the CMIS every time	
Flow of Activities	**Actor**	**System**
	1. Client navigates to the client registration page. 2. Client inputs contact and personal information like name, address, and phone number. 3. Client creates a username. 4. Client creates a password. 5. Account is verified by the client either through email or text	1. Client registration page opens. 2. Contact and personal information is logged into the system. 3. Username is logged into the system. 4. Password is logged into the system. 5. Account verification is sent out by email or text message
Exception Condition	3. Username already exists. 4. Password does not meet requirements. 5. Email or phone number does not exist or is not in use	



Use Case #2: Confirm Blueprint

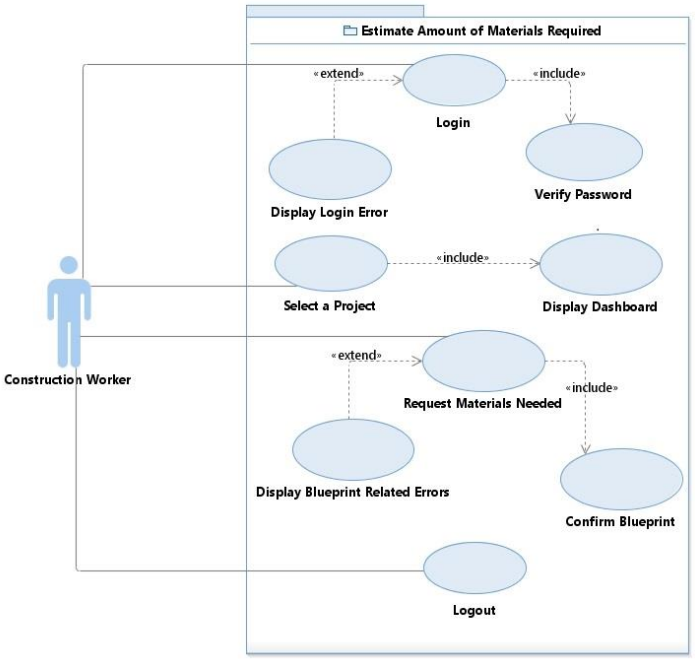
Use Case Name:	Confirm Blueprint	
Scenario:	The architect looks to confirm the designed blueprint with the client based on the given requirements through the CMIS	
Triggering Event:	Developing the construction project blueprint according to client's requirements	
Brief Description:	The architect who works on the design of the construction project receives specifications from the client and designs a blueprint which is reviewed by the safety manager and confirmed by the finance manager.	
Actors:	Architect, Safety manager	
Related Use Cases:	Determine Completion Time, Estimate Required Material	
Stakeholders:	Architect: Pulls blueprint out according to the client's requirement Safety Manager: Check if the standards of safety regulations are met or not, approved if met	
Preconditions:	Clear design instructions should be given to the architect before blueprint is created and confirmed	
Postconditions	Once the blueprint is confirmed by all those involved, then the project can begin.	
Flow of Activities	**Actor**	**System**
	1.Architect Logs into the CMIS using their password and ID. 2. Architect navigates to "Upload Blueprint" page 3. Architect uploads completed blueprint. 4. Architect logs out of the system. 5. Safety manager logs into the CMIS using their password and ID. 6. Safety manager navigates to "Confirm Blueprint" page. 7. Safety manager checks and confirms that the blueprint meets safety regulations. 8. Safety manager logs out of the system.	1. Prompts the architect to input password and id. 1. Authenticate architect ID and password. 2. Upload Blueprint page opens. 3. Stores blueprint upload for later access 4. Exit of Architect recorded 5. Prompts the Safety manager to input password and id. 1. Authenticate Safety manager ID and password. 6. Confirm Blueprint page opens. 7. Safety requirements confirmation is logged into the system. 8. Exit of safety manager recorded
Exception Conditions	1.1 Incorrect login credentials. 3. Blueprint does not meet the standard for predetermined requirements. 5.1 Incorrect login credentials. 7. Blueprint does not meet standards for safety requirements.	



Use Case #3: Estimate Required Material

Use Case Name:	Estimate Required Materials
Scenario:	Amount of materials needed inquiry initiated.
Triggering Event:	Constructor Professionals wants to find out the amount of materials needed for the selected blueprint.
Brief Description:	This use case allows the construction professionals to determine the amount of materials required when planning for the project by using the confirmed blueprints as the input.
Actors:	Construction professionals, finance manager.
Related Use Cases:	Confirm blueprint.
Stakeholders:	Construction professionals: they report the information to the resource manager. Project manager: uses this information in planning the triple constraint of the project. Resource manager: uses this information to choose the best supplier. Finance manager: checks the feasibility of the cost.
Preconditions:	The blueprints of the construction work to be done must exist as calculations are based on this.
Postconditions:	A detailed list of the materials required and the quantity of each must be displayed to the worker.
Flow of Activities:	See table below
Exception Conditions:	1. Poor internet connection may result in the application not loading. 2. Account may not exist. 4.1 Blueprint may not exist

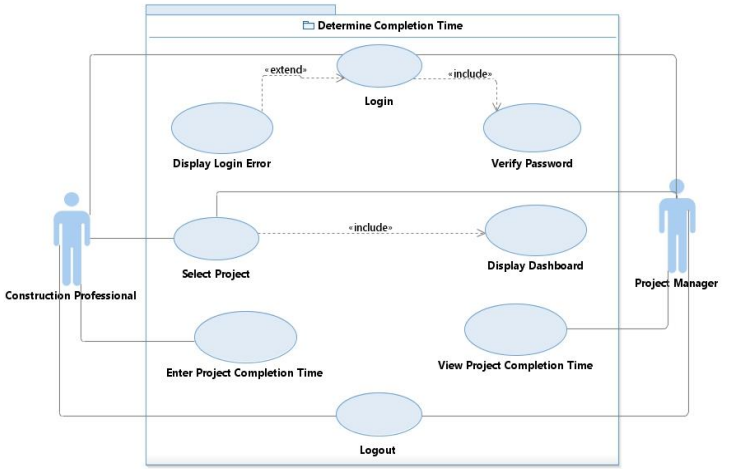
Actor	System
1. Construction professional navigates to the login page. 2. Construction professional inputs login credentials. 3. Construction professional selects the appropriate project from the home page. 4. Construction professional triggers the number of materials needed for inquiry. 5. Construction professional logs out.	1.1 Display login page 2.1 If credentials are incorrect, display error and prompt to re-enter credentials. 2.2 If credentials are correct, redirect to the home page. 3.1 Display selected project's details. 4.1 Verify blueprint exists. 4.2 Calculate materials needed based on the verified blueprint. 5.1 Clear session and redirect to home page.



Use Case #4: Determine Completion Time

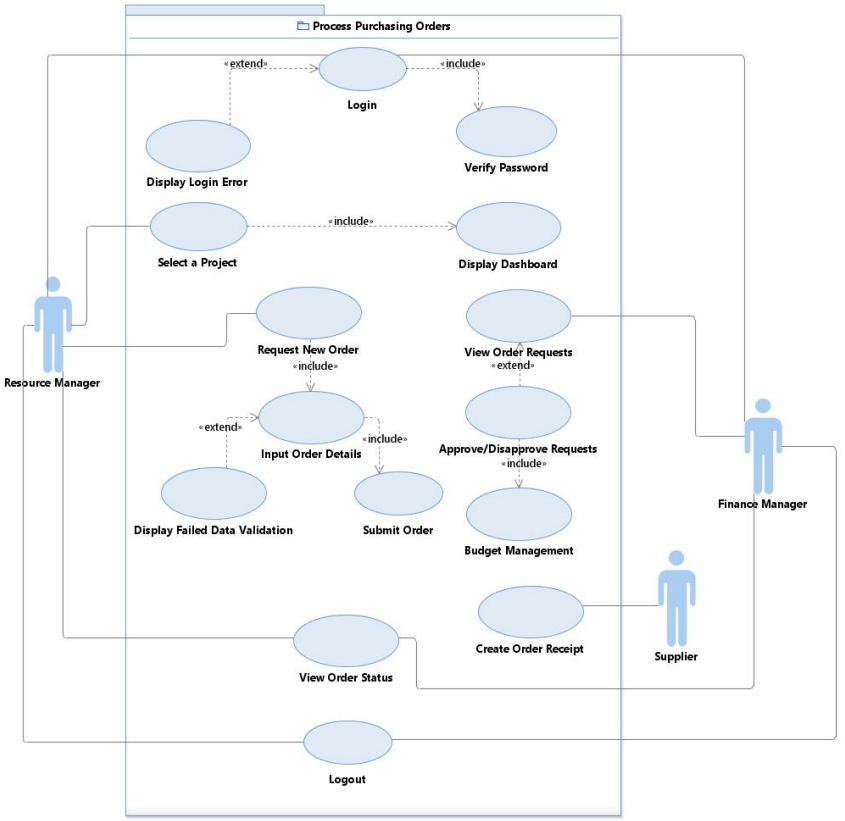
Use Case Name:	Determine completion time
Scenario:	Project completion time inquiry initiated.
Triggering Event:	Project manager wants to know how long the project will take to finish.
Brief Description:	This use case allows construction professionals to input the time required, in months, to complete the construction project which project managers can later view in their accounts.
Actors:	Project managers, construction professionals.
Related Use Cases:	-
Stakeholders:	Project managers: uses this information in constructing the project schedule. Constructional Professionals: enter an estimation of project length using their expertise and knowledge.
Preconditions:	Construction professional's account must exist, and he/she must be logged in.
Postconditions:	The total length of the project should be displayed to the project manager.
Flow of Activities:	See table below
Exception Conditions:	1. Application does not respond due to network connection. 2. Incorrect credentials or the account does not exist. 6. Construction professional may not have entered the competition time yet, thus project manager may not see the completion time.

Actor	System
1. Construction professional navigates to the login page.	1.1 Display login page
2. Construction professional enters login credentials.	2.1 If credentials are incorrect, display error and redirect to the login page.
3. Construction professional selects the project from the home page.	2.2 If credentials are correct, display the home page.
	3.1 Display selected project's details.
4. Construction manager requests to enter project completion time.	4.1 Display form to input project completion time, in months.
5. Construction professional enters the number of months required to complete the construction project.	5.1 Save that value to be displayed when requested by the project manager.
6. Project manager requests to see project completion time.	6.1 Display total project length.
7. Construction professional and project manager log out.	7.1 Clear session and redirect to home page.



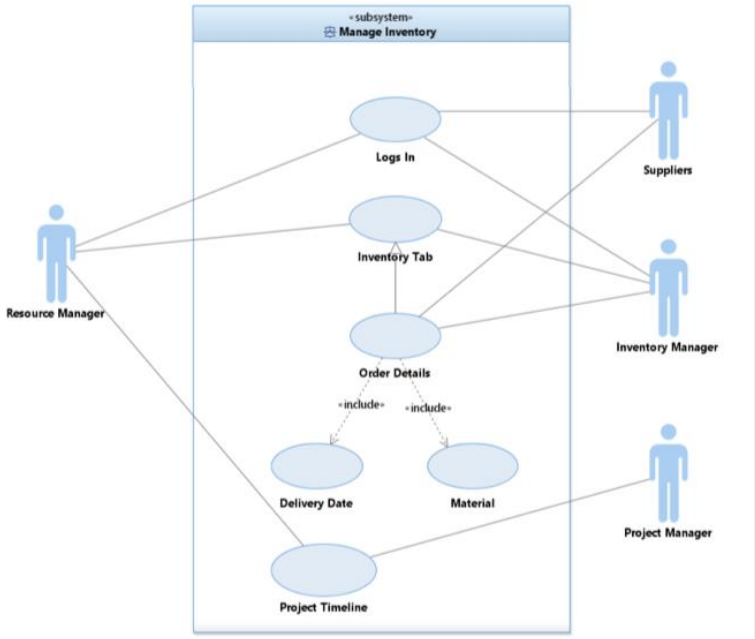
Use Case #5: Process Purchasing Order

Use Case Name:	Process purchasing order.
Scenario:	New order of materials or equipment required.
Triggering Event:	Resource manager must place an order of the required materials for the upcoming project.
Brief Description:	This use case allows the actor to place an order of the materials needed for a specific construction project as well as request new equipment which workers may misplace or break during its initial use.
Actors:	Resource manager, inventory manager, finance manager
Related Use Cases:	Track equipment, manage budget, manage inventory.
Stakeholders:	Finance manager: approves the cost of the purchasing order. Inventory manager: updates stock levels in inventory due to the new purchase. May also request new equipment if misplaced or broken by workers. Project manager: project cost and time is impacted by this new purchase which the manager analyses.
Preconditions:	Inventory manager must confirm the order is necessary and the warehouse has space. Finance department must show enough funds are available to proceed with the purchase.
Postconditions:	The supplier sends confirmation of receiving the order. An order receipt is generated. An estimated date of delivery is displayed. Inventory is updated.
Flow of Activities:	**Actor** / **System** 1. Resource manager navigates to the login page. 2. Resource manager inputs login credentials. 3. Resource manager selects the project to work on from the home page. 4. Resource manager initiates new purchase order. 5. Resource manager inputs materials quantity, chooses supplier and submits form. 6. Finance manager checks the budget and approves the order. 1.1 Display login page. 2.1 If credentials are incorrect, display error and prompt to re-enter details. 2.2 If credentials are correct, redirect to the home page. 3.1 Display selected project's details. 4.1 Display form to input order details. 5.1 Save form details and send it to the finance manager for approval. 5.2 Confirm ordered materials are not present in inventory. 6.1 Send approval notification to resource manager. 6.2 Send order to supplier.
Exception Conditions:	1. Application may not load due to poor internet connection. 2. Incorrect credentials or the account may not exist. 5.1 Form may contain invalid data and not send approval notice to the finance manager. 5.2 Inventory may have enough materials which means new order is not necessary. 6. Cost of order may be outside budget and will not be approved.



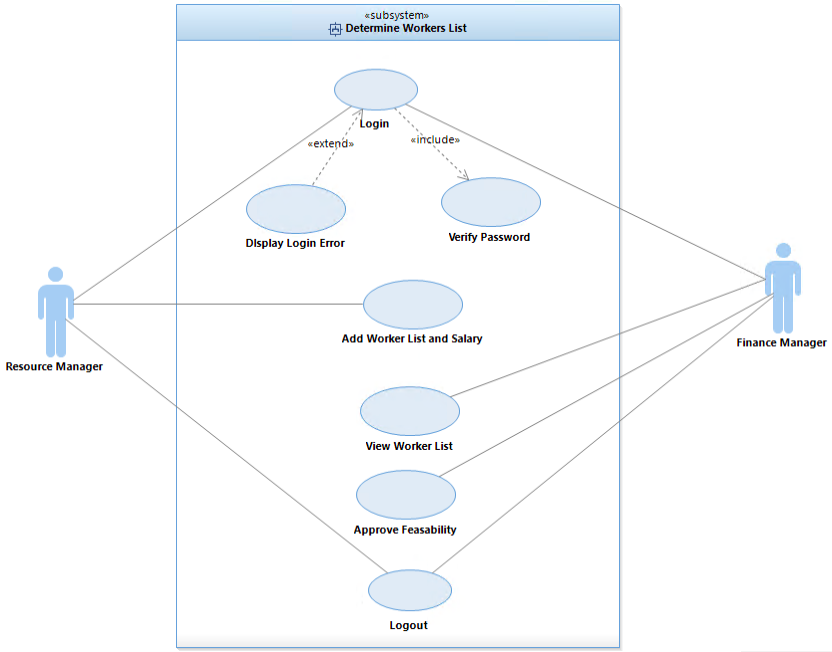
Use Case #6:Manage Inventory

Use Case Name:	Manage Inventory	
Scenario:	Check order status or inventory.	
Triggering Event:	Resources Manager checks the inventory for the status of the ordered materials.	
Brief Description:	When a Resources Manager needs to know the status of the ordered materials for project timeline purposes. Like if all the materials are arriving in time with the project's projected timeline. If there is any kind of delay in delivering the Resources Manager will contact the Suppliers and get in touch with Project Manage and Inventory Manager and update the project timeline if necessary.	
Actor:	Resource Manager, Suppliers	
Related Use Cases:	Process Purchasing Order, Update project timeline.	
Stakeholders:	Inventory Manager: to receive the arriving order. Project Manager: to modify project timeline. Suppliers: to provide UpToDate order status.	
Preconditions:	Order must be placed and delivered status must be provided by the Suppliers.	
Postconditions:	Project timeline must be updated if any materials are arriving late.	
Flow of Activities:	**Actor:**	**System:**
	1. Resource Manager logs into his/her account in the system. 2. Resource Manager clicks on the inventory tab on the system. 3. Resource Manager selects the specific order to see detail view. 4. Resource Manager clicks on the project timeline tab on the system. 5. Resource Manager updates material arrival dates in the system.	1.1 Login successful. 1.2 Shows Dashboard and components accessible to the Resource Manager. 2.1 Shows the list of all the building material related to the project. 3.1 Shows the detailed purchase order with order date, quantity, and delivery date. 4.1 Show project timeline. 5.1 Updates project timeline.
Exceptions Conditions:	3.1 If the materials are not ordered, the system would show a blank page. 4.1 If the materials are arriving late Resource Manager needs to update the project timeline as it would be affected. 5.1 If new dates are conflicting or are over delayed then Resource Manager need to communicate with project manager and inform inventory manager.	



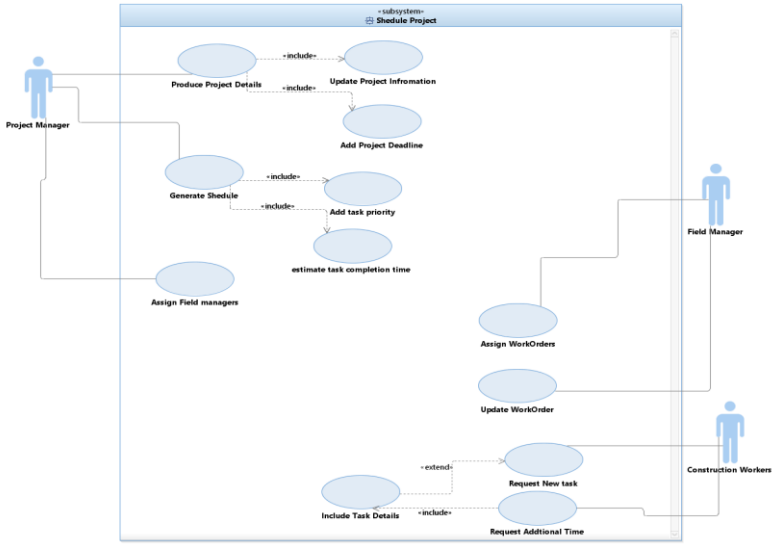
Use Case #7:Determine Workers List

Use Case Name:	Determine Workers List	
Scenario:	A list of workers is needed to calculate the costs that are incurred for that aspect of the project.	
Triggering Event:	Project requirements requested	
Brief Description:	Resource Manager determines the approximate number of workers needed for the construction project and informs the finance manager through a document.	
Actors:	Finance Manager, Resource Manager.	
Related Use Cases:	Budget Management	
Stakeholders:	Resource Manager: To track those involved in the project labour. Finance Manager: To record all cost incurred in the project	
Preconditions:	A budget for labour needs to be created	
Postconditions	List of workers and cost must be verified to make sure the cost is within the budget	
Flow of Activities	**Actor**	**System**
	1. Resource manager logs into the CMIS using their password and ID. 2. Resource manager navigates to "Add workers" page. 3. Resource Manager adds the number of workers required and their salaries. 4. Resource manager logs out of the system. 5. Finance manager logs into CMIS using their password and ID. 6. Finance manager navigates to "View list of workers" page and makes note of labour cost. 7. Finance Manager determines feasibility of the labour cost. 8. Finance manager logs out	1. Prompts resource manager to log in with ID and password. 1. Authenticate resource manager ID and password. 2. Add workers page is open. 3. Logs the number of workers and calculates the total cost based on their salary. 4. Exit of resource manager is confirmed. 5. Prompts finance manager to log in with ID and password. 1. Authenticate finance manager ID and password. 6. View list of workers page is open. 7. System makes record of feasibility decision. 8. Exit of finance manager is confirmed
Exception Condition	1.1 Incorrect login details 3. The salary and/or number of workers is not acceptable by the system. 6.1 Incorrect login details 7. The cost of labour does not fit within the budget	



Use Case #8: Schedule Project

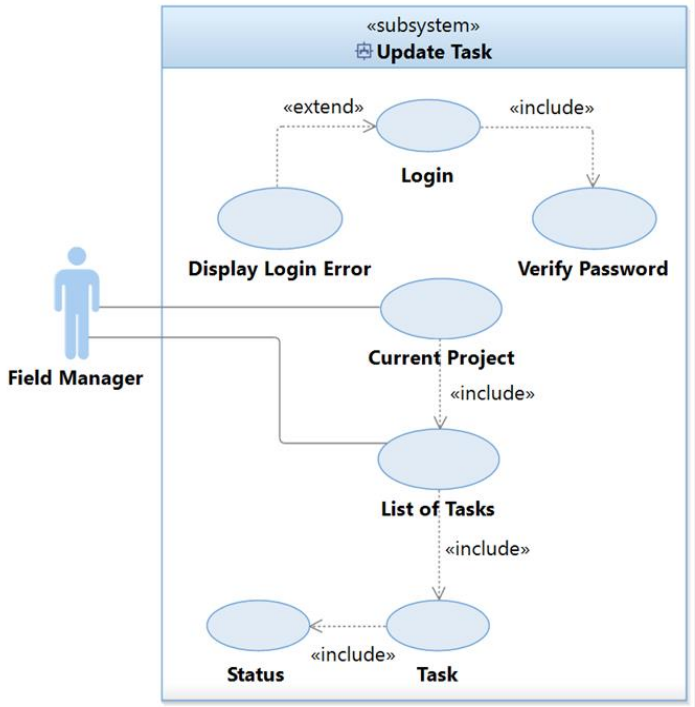
Use Case #9: Produce Progress Report



Use Case Name:	Produce Progress Report	
Scenario:	Generate a progress report	
Triggering Event:	Automatic weekly request Manual request to generate a report	
Brief Description:	Generates a report that will summarize the status of current tasks in a project like completed, in progress, in conflict, or on standby. It will also show the time used and time remaining for the construction endeavour to be completed.	
Actors:	Project Manager, Field Manager, Client	
Related Use Case:	Update Task	
Stakeholders:	Client: To confirm the current project's status Project Manager: To confirm the current project's status	
Preconditions:	User must log in to the CMIS	
Postconditions	The report is generated and saved	
Flow of Activities:	Actor	System
	1. A Client or Project Manager logs into the CMIS using their password and ID 2. The Client or Project Manager navigates to Projects 3. The Client or Project Manager selects a project from the list. 4. A Client or Project Manager requests for a progress report.	1.1 Prompts the Client or Project Manager to log in with their ID and password 1.2 Authenticates Client or Project Managers ID and password 1.3 Displays the main dashboard 2.1 Displays a list of projects to choose from (The client is only able to view their own projects). 3.1 Displays the project dashboard 4.1 Collects information on the status of all tasks from the selected project. 4.2 Summarizes all the information into a report and saves it.
Exception Conditions:	1.2 If authentication fails then prompt for their ID and password again. 4.1 If the information doesn't exist, then request for information from the field manager.	

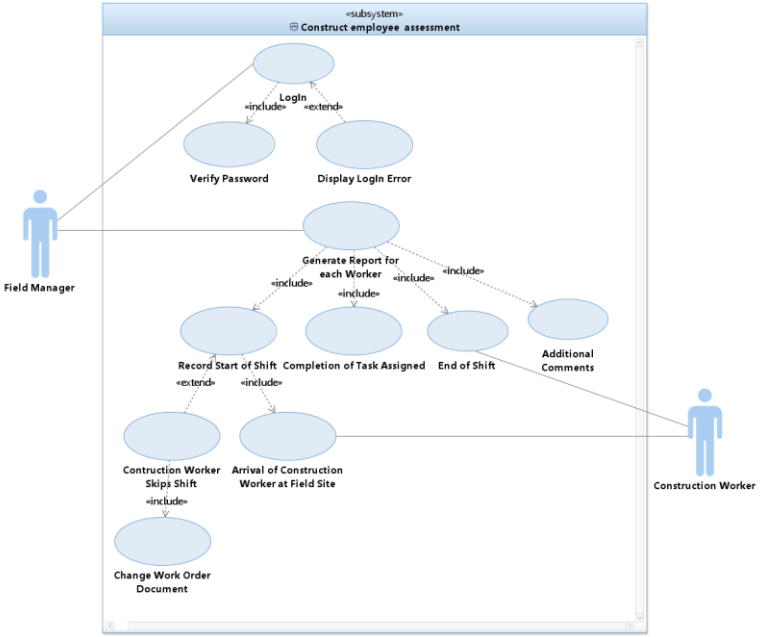
Use Case #10: Update Tasks

Use Case Name:	Update Tasks	
Scenario:	Update an existing task	
Triggering Event:	The end of the day	
Brief Description:	A Field Manager enters an update on the status of a task into the CMIS	
Actors:	Field Manager	
Related Use Case:	Produce Progress Report	
Stakeholders:	Project Manager: To confirm the projects status Field Manager: To check and update the status of the task based on information provided a construction workers or professional Construction Worker/Professional: To complete the task assigned and inform the status of the task to the Field manager	
Preconditions:	User must log in to the CMIS	
Postconditions	Status of the tasks is changed to match the update	
Flow of Activities:	Actor	System
	1. A Field Manager logs into the CMIS using their password and ID 2. The Field Manager navigates to the Task list 3. The Field Manager requests to update the status of a task at the end of the day. 4. The Field Manager selects one of the four possible options from the list.	1.1 Prompts the Field Manager to log in with their ID and password 1.2 Authenticates the Field Managers ID and password 1.3 Displays the main dashboard 2.1 Displays a list of tasks along with their status'. 3.1 Displays a list for possible changes that can be made to the task either, "COMPLETED, IN PROGRESS, IN CONFLICT, or ON STANDBY. 4.1 Saves changes to the status of the task.
Exception Conditions:	1.2 If authentication fails then prompt for their ID and password again. 4.1 If there is no difference between the option chosen by the user and the current status of the task, then make no changes.	



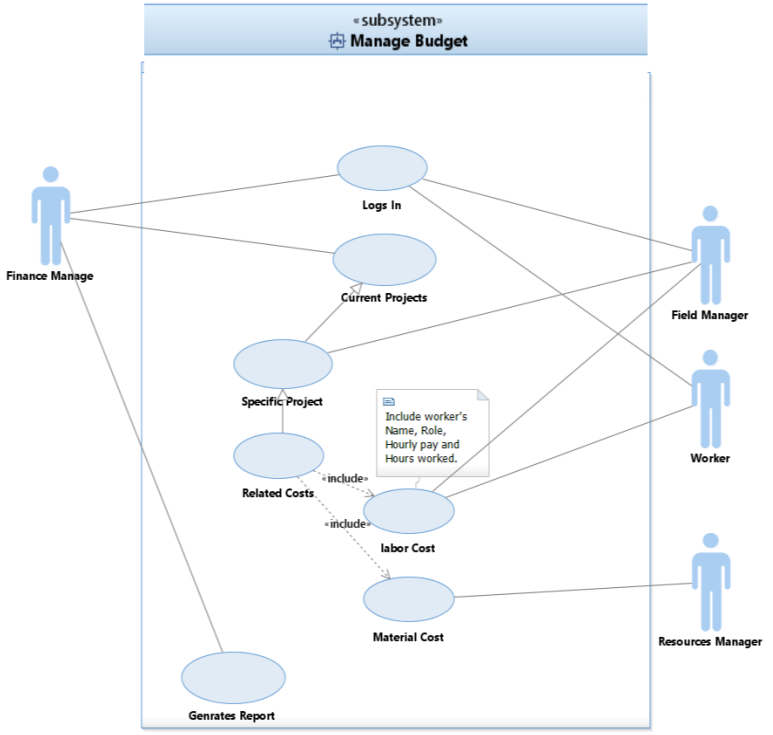
Use Case #11:Construct Employee Assessment

Use Case Name:	Construct Employee Assessment	
Scenario:	The Field Manager needs to keep track of the Construction Employee's work progress on the field site in the CMIS.	
Triggering Event:	After assigning the work order document, the construction workers show up on the construction field site to complete their tasks.	
Brief Description:	Employee-Based Reporting is needed daily to record the attendance of the workers, login their number of hours, fulfilment of the assigned task. Field Manager is authorised to make changes to the "Work Order Document", if a particular task is not completed by a worker due to unforeseen situations.	
Actors:	Field Manager, Construction Workers	
Related Use Cases:	Construct Project Schedule, Update Tasks	
Stakeholders:	Field Manager: Should generate employee – based assessment Reports on a daily basis Construction Workers: Should give their attendance to the field manager	
Preconditions:	Construction Workers should come to the field site according to their shifts mentioned in the "Work Order Document"	
Postconditions:	Construction Worker has successfully completed his/her shift, task assigned. If the worker has not completed his/her shift, the task assigned then the field manager would take necessary actions. The information of the number of hours logged in by a Construction worker is taken into consideration by finance manager for calculating the labour cost.	
Flow of Activities:	**Actor** 1. Field Manager enters his/her user ID and password to enter the CMIS. 2. Field Manager navigates to the "Employee Based Reporting" Page 3. Field Manager logs in the entry of construction workers at the field site. 4. When the construction worker fulfils his/her shift the field manager will log in the exit of the worker. 5. The Field Manager will fill in data about whether the construction worker has met his/her shift hours, task completion for the day or not.	**System** 1. Prompts the Inventory Manager to input password and ID. 1.1 Authenticate User ID and password with the registered Users. 2. Employee Based Reporting Page opens. 3. Entry is recorded in the CMIS. 4. Exit of the construction worker is recorded. 5. Data inputted by the Field Manager is recorded.
Exception Conditions:	1.1. Field Manager forgets his Login ID credentials 3.Construction Worker arrives late at the field site. 5. Construction Worker does not fulfil his/her shift for the day or does not complete the task assigned to him/her. In this case the Field Manager will have to make changes to the "Work Order Document" 5. Construction Worker works for less time/ over time than the allocated time in the shift, field manager would have to make the necessary changes.	



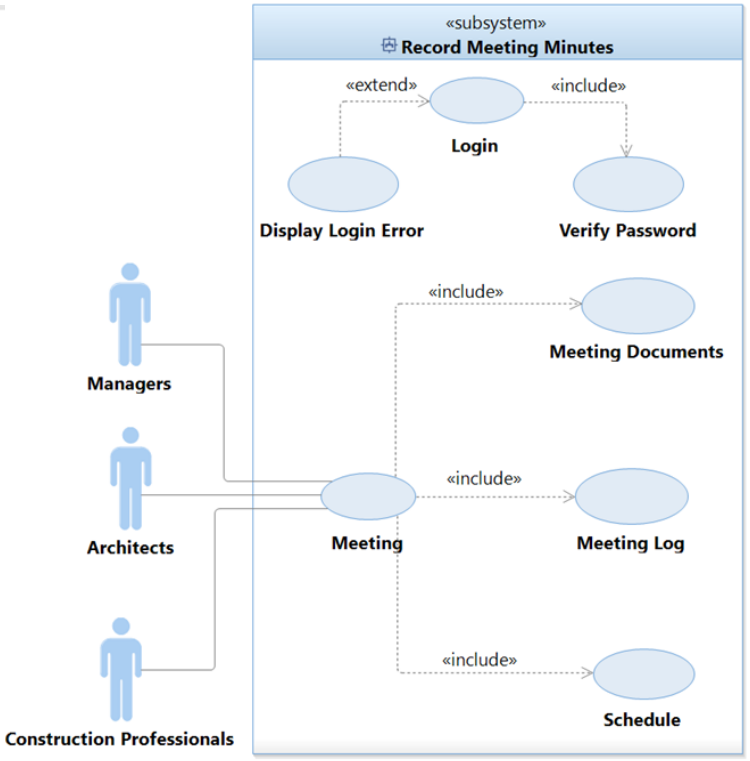
Use Case #12:Manage Budget

Use Case Name:	Manage Budget	
Scenario:	Get Total cost.	
Triggering Event:	The Finance Manager will get the number of hours the construction workers have worked and other related costs of the project.	
Brief Description:	The Finance Manager wants to look at the labour cost and material cost, spent on the current project to make sure that the project is not running over the total budget allocated for the construction endeavour and the costs are under the budget assigned by accessing the number of hours the construction workers have been working on the project and material cost.	
Actor:	Finance Manager.	
Related Use Cases:		
Stakeholders:	Project Manager: to act if the project is over budget. Finance Manager: to track past and ongoing expenses in the current project.	
Preconditions:	Assuming the Field Manager and workers have correctly logged in the number of hours worked. The Resource Manager has added all the material purchase receipts.	
Postconditions:	If the ongoing cost is high, figure out the issue with the Field Manager, Resource and Project Manager, to make sure the project is not running over budget and ways to control the cost.	
Flow of Activities:	Actor:	System:
	1. The Finance Manager logs into his/her account in the system.	1.1 Login successful. 1.2 Shows Dashboard and components accessible to the Finance Manager.
	2. The Finance Manager clicks on the current project tab on the system.	2.1 Shows the list of all the current projects.
	3. The Finance Manager selects the specific project to see a detailed view.	3.1 Shows the project details: Description, Timeline, level of completion, list of workers, related costs.
	4. The Finance Manager clicks on the generated report.	4.1 Show the Generated report in detail (with costs and other key cost matrix)
	5. The Finance Manager analysed the report and decided if the project is over budget or not.	5.1 If Over Budget send notification to Project Manager
Exceptions Conditions:	4.1 If the Field Manager and workers have not correctly logged the number of hours worked the list may not be accurate. And if not, all purchase receipts are added by the Resource Manager. 5.1 Finance Manager will analyse the report generated by the system to find if the costs are within reasonable limits it exits the system.	



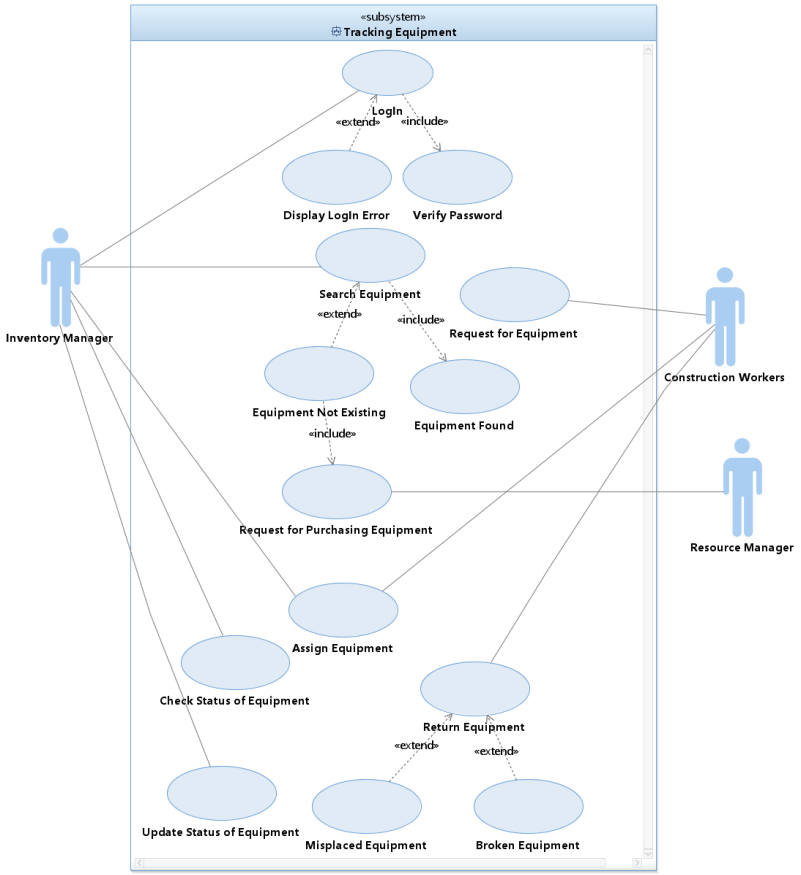
Use Case #13: Record Meeting Minutes

Use Case Name:	Record Meeting Minutes	
Scenario:	A meeting takes place between two or more users	
Triggering Event:	A user of the system requests for a meeting	
Brief Description:	When a user requests for a meeting; a meeting is scheduled, the meeting takes place, a document from the meeting called Meeting Minutes is saved.	
Actors:	Any User	
Related Use Case:	None	
Stakeholders:	Managers: To confirm changes needed to be made to the project, where Meeting Minutes is filled in after every meeting.	
Preconditions:	User must log in to the CMIS. Scheduled time slot is valid. There are at least two participants in the meeting. All users taking part in the meeting are notified	
Postconditions	Meeting is completed. Document Meeting Minutes is saved into the system	
Flow of Activities:	**Actor**	**System**
	1. A User logs into the CMIS using their password and ID. 2. The User navigates too the Meetings page 3. User Schedules a meeting. 4. Users accepts and opens the meeting. 5. Users fills the document and end the meeting	1.1 Prompts the user to log in with their ID and password. 1.2 Authenticates the user ID and password. 1.3 Displays the main dashboard. 2.1 Displays the page for meetings. Schedule a time slot for a meeting. Generate a blank document to be filled after the meeting. Opens the meeting and invites all users. 4.1 Sends a shared document to all users. 5.1 Closes the meeting. 5.2 Saves the document into the meeting log.
Exception Conditions:	1.2 If authentication fails then prompt for their ID and password again. 3.1 If the time slot is booked or not valid, then prompt for a new time slot. 5.2 If no changes are made to the document, then don't save the document.	



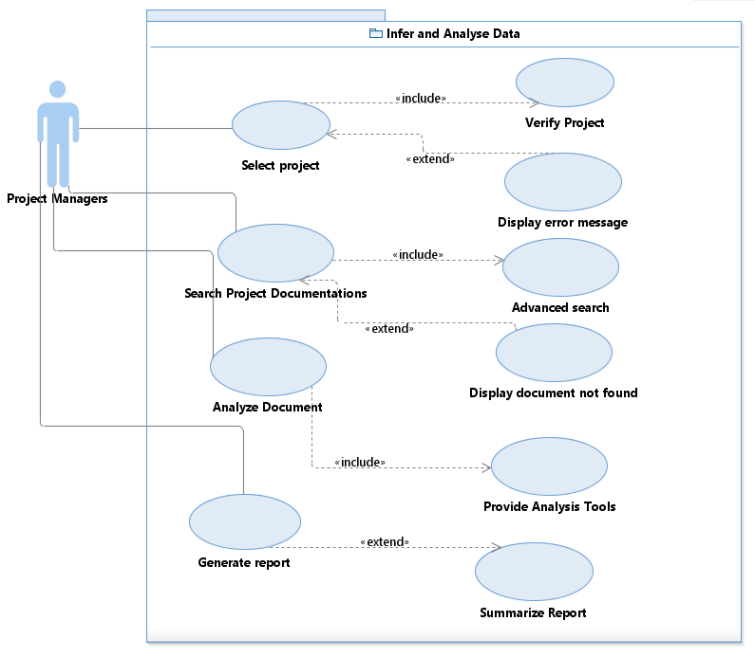
Use Case #14: Tracking Equipment

Use Case Name:	Tracking Equipment	
Scenario:	Inventory Manager keeps track of the equipment's being used by the workers for the construction project daily in the CMIS.	
Triggering Event:	Requirement of Equipment's for building the project at the construction site	
Brief Description:	Equipment Tracking is needed daily at the construction site to make sure the equipment's are not misplaced by the workers. A request needs to be made to the "Process Purchasing Orders" in case the equipment asked for is not available in the inventory	
Actors:	Inventory Manager	
Related Use Cases:	Inventory Management, Process Purchasing Orders	
Stakeholders:	Inventory Manager should keep all the required Equipment's for construction on Standby.	
Preconditions:	All Equipment's to be used must exist in the Inventory System	
Postconditions:	Exact Number of Equipment's used that day would be returned in the Inventory System	
Flow of Activities:	**Actor**	**System**
	1. Inventory Manager enters his/her user ID and password to enter the CMIS. 2. Inventory Manager navigates to the "Equipment Tracking" Page 3. Inventory Manager selects "Used" when the construction worker asks for an equipment. 4. Inventory Manager selects "Returned" when the construction worker returns the equipment at the end of his shift.	1. Prompts the Inventory Manager to input password and ID. 1.1.Authenticate User ID and password with the registered Users. 2. Equipment Tracking Page opens. 3. Updates the status of the equipment to "Used". 4. Updates the status of the equipment to "Returned"
Exception Conditions:	1.1 Inventory Manager forgets his Login ID credentials 3. The equipment requested by the construction worker is not available in the inventory as all are used by other construction workers. 3. The equipment requested by the construction worker does not exist in the inventory, in this case a request to "Process Purchasing Order" needs to be made. 4. The equipment is misplaced or broken by the construction worker at the construction work site.	



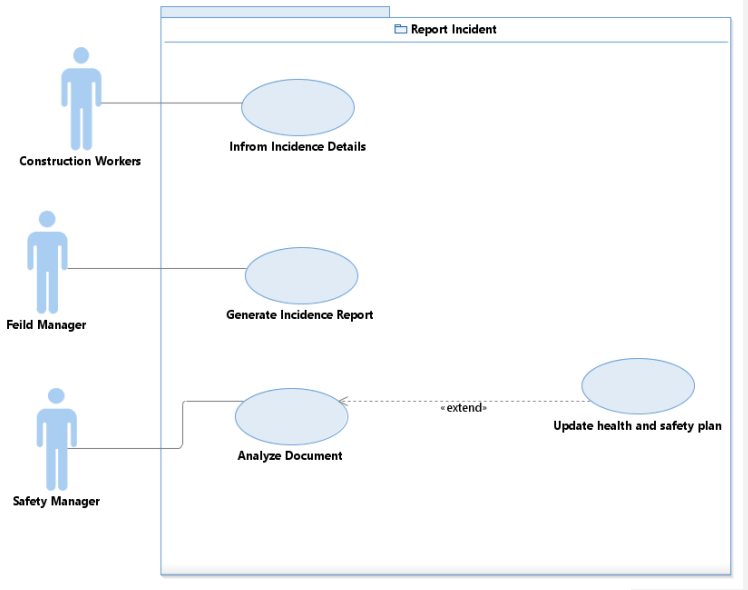
Use Case #15:Infer and Analyse Data

Use Case Name:	Infer and Analyse Data	
Scenario:	The project managers will analyse all the reports generated during the project execution to make sure if any changes should be made to improve the business process.	
Triggering Event:	Completion of the project	
Brief Description:	The data Inferences and Analysis require data from all the other reports generated during the project execution. This report will be analysed by the project managers to find patterns which could help to improve the current business process and find new opportunities.	
Actors:	Project managers	
Related Use Cases:	Produce Progress Report, Manage Budget, Report Incidence	
Stakeholders:	Project managers: Examine the document to find new opportunities	
Preconditions:	The project is completed	
Postconditions	The report should be saved for further analysis	
Flow of Activities	**Actor**	**System**
	1. The project managers will search different reports generated during the project execution. 2. The manager will analyse the data to find ways to improve the current business process. 3. Shares the findings with the company's stakeholders to improve the business process or to address new opportunities	1.Provides Search and advanced search functionality. 2.Provides analysis tools to conduct analysis. 3. Summarize the data for presentation if requested.
Exception Condition	1. Only project manager can access the documents.	

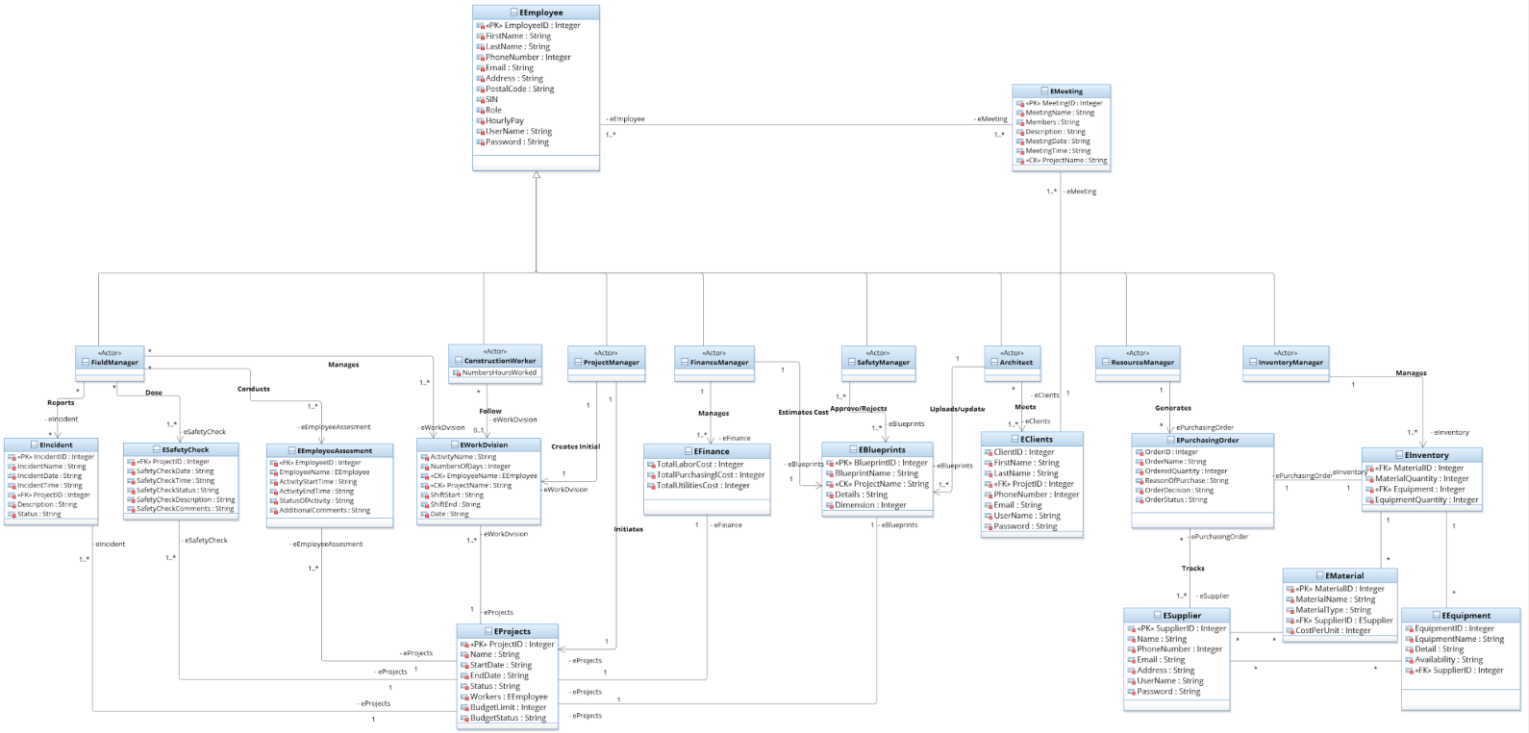


Use Case #16: Report Incident

Use Case Name:	Report Incident	
Scenario:	The Field manager documents any incidents regarding safety of the workers to the safety manager	
Triggering Event:	When an incidence related to safety arise	
Brief Description:	During execution of the project, the construction workers will report any incidents regarding the safety of the employees to the field manager. The field manager will document the incidence and will send it to the safety manager to make corrective actions. The safety manager will analyse the incidence and take corrective actions based on the company's policies or update it.	
Actors:	Safety manager, Field Manager, Construction Worker	
Related Use Cases:	-	
Stakeholders:	Construction Workers: Will report their injuries to the field manager. Field managers: Generates the safety incident report. Safety managers: Will analyse the report to make a decision.	
Preconditions:	The project is in development stage	
Postconditions	The safety incidence documents should be saved in the system	
Flow of Activities	**Actor**	**System**
	1. Team lead informs field manager about the safety incidence on the field. 2. Field manager gathers information from team lead about the incidence and will report it to the safety manager. 3. Safety manager will analyse the document and take corrective actions if required. 4. Safety managers will add the report for future references for best practices.	1. Notifies the field managers about an incidence in the field. 2. Provides field manager with the company's safety report template and pass it on to the safety managers. 3. Notifies the team lead and the affected member about the corrective actions. 4. Saves the reports in a secured database.
Exception Condition	1. The report will not be saved if the incidence does not comply with the company policies	



Task 9 : Draw Conceptual Model



Class Discovery Techniques

We used a mixed approach to discover our classes in the conceptual model, this included the use of Common Class Patterns, Use Case Driven, Class Responsibility Collaborators (CRC) approach.

- **Common Class Patterns -**
    - Through the identified functional requirements we were able to come up with the common notion of "Construction Management".
    - The users involved in this information system were identified as the: Field Manager, Construction Worker, Project Manager, Finance Manager, Safety Manager, Architect, Resource Manager, Inventory Manager and Client.
    - Our group identified the keywords in the functional requirements and used these simplistic words to name our entity tables.
- **Use Case Driven -**
    - After carefully analyzing the activity & use case diagrams we figured out what kind of interactions exist between the users involved in our CMIS. This helped us identify the associations between the entities and their respective cardinalities as well.
    - We were further able to pick out the primary and candidate keys involved in each identified entity class.
    - It was also recognized that the users had certain common attributes and their role specific attributes. Therefore we decided to use the inheritance feature to inherit all our common attributes into the child actors/users.
- **Class Responsibility Collaborators (CRC) -**
    - With the information gathered from using above techniques, our group performed a brainstorming session to further discover and validate classes.

Participation Marks

1. **Artur Komissarov-** 10
2. **Faith-Valentine Uzoka** 10
3. **Khaliq Minsariya -** 10
4. **Krushnam Badami -** 10
5. **Kyle Rumde -** 10
6. **Srinath Bhaskaran -** 10
7. **Varnika Srivastava -** 10