Software Requirements Specification

for

Road Repair And Tracking System(RRTS)

Version 1.0 approved

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CS29006 Software Engineering Lab, Spring-2021

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1. Introduction

1.1 Purpose

The purpose of the software is to manage the various bookkeeping activities for the road repairing task of the Public Works Department of the Corporation of a large city. The system is to be used for scheduling and keeping track of the maintenance works going on, those to be done and the current availability of various resources. The document describes the entire system.

1.2 Document Conventions

The conventions adopted are as follows: The document consists of six sections. The section headings are given in Times New Roman, bold 18. The subsection headings are given in Times New Roman, bold 13.9.

The abbreviations used in the document are:

RRTS	Road Repair and Tracking System, refers to the goal software
PWD	Public Works Department, the civil body responsible for maintenance, repair, etc. of public property (here roads)
Admin	Refers to the City Corporation Administrator
Resources	Represents the material (sand, cement, water), manpower, and machines collectively, which are required for repairing roads
Jobs/Repairs/ Repair works	Indicate the work that needs to be done to address a complaint
UI	Refers to the User Interface of the software to be designed
GUI	Graphical User Interface

1.3 Intended Audience and Reading Suggestions

The document is intended for developers, project managers, users and testers. The rest of the document contains a detailed description of the product, starting with an overall description, followed by the description of various user interfaces, system features and other non-functional requirements. The developers should go through the overview sections followed by the system features, user classes, interfaces and other requirements. The users may focus more on the user interfaces and the features provided by the product.

1.4 Product Scope

The software is an effective tool in managing the various activities of the road repairing task of the PWD. It helps the various employees to keep a record of all the complaints raised and the repair works currently in progress. It schedules the repair works according to their priority and the available resources. The software can also be used to generate road repair statistics. It always ensures the maximum and effective use of the resources available, thus increasing the prospects for smooth and timely completion of repair works. The objective of the software is to automate certain processes in order to decrease human labour and increase productivity.

1.5 References

The references used for preparing this document are:

The format specified in the document in the link has been followed:

https://drive.google.com/file/d/13brFaDL-cLLtQ5w4vY0EHEEhQrJpD7d6/view?usp=sharing

2. Overall Description

2.1 Product Perspective

The software is for automating the tasks of tracking and scheduling road repairs in the PWD of the corporation of a city. A City is modelled as a collection of Areas, and each Area consists of a disjoint set of Roads.

The aim of the product is to automate the above mentioned tasks for road repairs in the PWD, which would otherwise be done manually. Doing such jobs for a large city requires a lot of effort and makes the system prone to inconsistencies, thus leading to even more delay in repair works. Automating such jobs would save time, effort and monetary costs. The processes would become more organised and smooth. Moreover, scheduling of repairs by the software is done in such a manner that the maximum of available manpower and other material resources are put to use at any point of time. This would ensure timely completion of jobs, and hence benefit the residents of the city. The amount of available resources can also be updated by the city corporation. Hence, the software can play an important role in the overall development of the city.

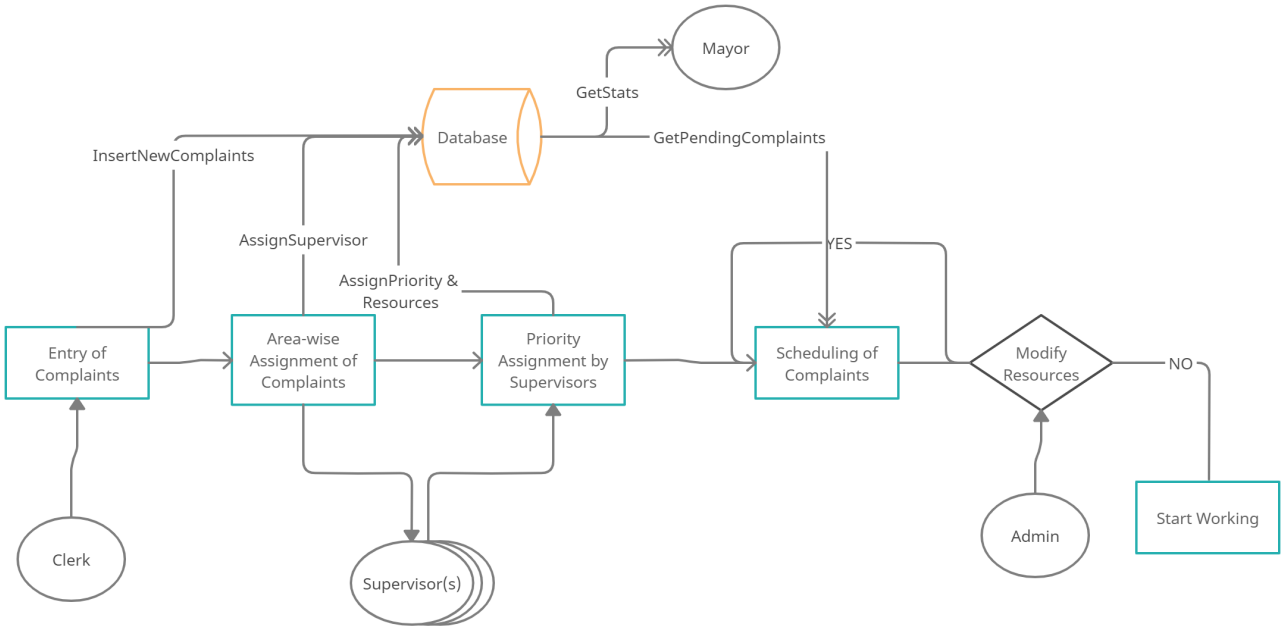

Figure showing the major functionalities of the system in the approximate chronological order

2.2 Product Functions

The major functions supported by the product are:

- Entering queries (repair requests) into the system by the clerk
- Getting an area wise list of queries for the supervisors
- Entering priorities for the various repair works to be done by the supervisors
- Scheduling and allocating resources to all the newly arrived and pending repair requests
- Keeping a track of all the currently available resources, and allowing for record updation by the city corporation administrator
- In case of resource updates, rescheduling the repair works
- Getting the road repair and resource utilisation statistics over a period of time for the mayor of the city
- Managing various logins and their functionalities like change user password
- Adding new supervisor employees
- Changing area allocation of supervisors

2.3 User Classes and Characteristics

The various user classes are:

- Employees of the Public Works Department of the city Corporation:
    - Clerk -- A clerk is the entry point of complaints in the system. All complaints that are filed in the office are expected to be filtered and the legitimate ones entered

into the system.

- Supervisors -- A supervisor is in charge of a few areas. He/she has a two-way interaction with the system. He/she has to survey the locations (under his jurisdiction) needing repair and assign priorities to all the repair works, as well as estimate the resources and time he may require to repair the damages. Secondly, after the priority and resources data has been received for all the complaints, the system generates a schedule with the complaints that can be addressed on that day under constraints of resources and priorities set by the supervisors. This final schedule has to be displayed on the UI and a print utility should be provided that can print the schedule.

- City Corporation Administrator (Admin) -- The Admin is responsible for keeping track of the resources currently being used, and the total resources available. He/she can, in event of some malfunction or new equipment purchase, change the resources available. The Admin can also add new Supervisors and change the areas allocated to existing Supervisors.
- Mayor of the city -- The mayor has a functionality to get the statistics of the complaints addressed, resources used by PWD, types of repair works conducted, pending complaints, etc.

2.4 Operating Environment

The software should be able to operate on any Windows, Linux or MacOS platform. It should be a robust software.

2.5 Design and Implementation Constraints

The system design is to be done using C++ and object oriented design principles. The application will feature an interactive GUI as the user interface. It will also use databases for various record keeping activities and storing all the areas and roads in the city.

2.6 User Documentation

A user manual will be delivered along with the product. It will contain a detailed description of all the features provided by the software and a step-by-step guide for using the software.

2.7 Assumptions and Dependencies

It is assumed that all the required data regarding the areas and roads in the city, and the resources are provided. Also, the administrator is responsible for updating the resources databases, as and when required. It is assumed that the clerk serves as a base scanner of requests and filters out redundant requests for the same road.

It is also assumed that the Roads, Areas, etc in the City are fixed always.

Each working day is divided into two slots - morning (9 a.m. - 1p.m.) and evening (2 p.m. - 6 p.m.). It is assumed that resource allocation to each job is done in such a manner that it gets completed within

one or at the maximum two slots. The supervisor is also responsible for estimating the number of slots required to complete the task. The resources allocated to every slot for a particular job is the same. Once a job is finished, the manpower and machinery involved in it are freed up and allocated to some other job. Tasks pending for sometime are given priority over recent ones. Also, tie-breaking between tasks having the same priority is done by taking into consideration the type of area.

New supervisor addition and changing of area allocation must be done, if necessary, before area-wise allocation of repair requests is done.

No dependencies are present.

3. External Interface Requirements

3.1 User Interfaces

A loginID and password utility should be set up. Every employee has his/her employeeId as loginID and gets a preliminary password from the Admin at first login, which can be changed later. The gtkmm GUI framework is suggested to be used for the interface.

1. Clerk – Should have an entry form for submitting the complaints.
2. Supervisor – Before all complaint priorities are entered, a window to enter the priorities and after all priorities are assigned the final schedule generated. He should be able to print the schedule.
3. Admin – The admin should have a tally of the resources assigned, used and available. There should be an appropriate mechanism to change the resources which should trigger a rescheduling in the schedule of the complaints. The Admin also has the feature to add new Supervisors and change the areas allocated to existing Supervisors.
4. Mayor – There should be a display of the stats of complaints and resources but the mayor cannot edit them. He can print them.

Areas and roads in the city, Complaints, resolved, pending, etc and resources tally all should be well placed in the database. Optionally, SQL databasing can be used.

3.2 Hardware Interfaces

The supervisors have the liberty to print the final schedule if required after it has been generated. This has to be dealt with the connection of a printer hardware and in case not detected then it can give appropriate error messages.

3.3 Software Interfaces

Software databases for the City plan, its Areas and member Roads, should be required before hand. The current employees database is also required before the execution. These data are to be provided

from the PWD of the City corporation itself.

gtkmm framework (v4) by GTK+ is the proposed GUI for the project. An appropriate SQL, XML, JSON etc file scripting is suggested for all kinds of data storage on files. These can include,

a) currentComplaints (updated daily by the Clerk, when he enters the complaints received that day)
b) completedComplaints (all closed complaints should be pushed here along with resources consumed for the task associated)
c) pendingComplaints (those jobs that don't get completed over a single day)
d) resourcesTrack (stores the resources available at any moment)

4. System Features

The various functionality requirements and descriptions are given below.

4.1 Login for various users

4.1.1 Description and Priority

The login for various users should be supported including the related user interface. This has medium-high priority naturally, otherwise it will be difficult to regulate which user does what. A facility to change the password should be provided to users.

4.1.2 Stimulus/Response Sequences

When any user launches the app, he is asked for a loginID and Password. If correct credentials are entered, then the related function frame is loaded. If not, an appropriate message is displayed.

Upon a change password request, the user should give the confirmation either through date of birth or old password, and the password should be changed accordingly.

4.1.3 Functional Requirements

- UI for entering login credentials
- Proper message to be displayed on invalid login
- Upon, successful verification, the appropriate window should be displayed for each kind of user (clerk, supervisor, admin, mayor)

4.2 Complaint Input Filing for User Clerk

4.2.1 Description and Priority

This feature is very important and is basically the input to the system. The clerk user avails this function and inputs the details of complaints. This has a very high priority.

4.2.2 Stimulus/Response Sequences

Upon successful login of a clerk user, the function to enter the road concerned with the complaint, and the complaint content is added to the system, one by one. The credentials entered and the add button pressed pushes the complaint in the data file. After all complaints have been added, an end process button should disable entry of new complaints for that day and move on to the next stage (4.3).

4.2.3 Functional Requirements

- UI for entering the details of the complaints
- Proper message to be displayed on successful addition to the data file
- Invalid Road input should be flagged with a message and should not be added to the data
- Once complete the Admin is notified that complaints have been filed.

4.3 Area-wise Assignment of the Complaints to the Supervisors

4.3.1 Description and Priority

After all complaints have been filed, they are read from the data file and depending upon the Area in which the Road is situated, they are assigned to the corresponding supervisors. This has a very high priority.

4.3.2 Stimulus/Response Sequences

This assignment should be done immediately after the clerk user ‘ends’ the process of entering complaints. The assignments having been done the complaints of each of the supervisors should be displayed to their corresponding interface for entering priorities.

4.3.3 Functional Requirements

- Area-wise separation of complaints received and assigning them to each of the supervisors
- After the separation the UI for supervisor user should show his/her allotted complaints

4.4 Priority & Resources Assignment for the Complaints of the individual Supervisors

4.4.1 Description and Priority

After all complaints have been filed and assorted to individual supervisors, each supervisor is required to enter the priorities according to his discretion. He/she is also required to allot the resources(cement bags, litres of water, sand bags, labourers, machines) and the slots (one or two) that he may require the resources for completing the task. This has a very high priority.

4.4.2 Stimulus/Response Sequences

The module is crucial to the next step of scheduling and hence unless and until all supervisors do not fill in the priorities, the schedule is not made and neither are the resources allocated. Once the resources are allocated, the next (schedule) module is expected to return a list of jobs that have been allocated in each slot (morning and evening).

4.4.3 Functional Requirements

- If the user supervisor has not yet entered the required fields, then he is prompted to do so.
- If the current supervisor has completed his task of assigning and estimating, but there is at least one supervisor who has not done, then a “Please Wait” is shown.
- When all priorities for all supervisors have been received the schedule module is run.
- OPTIONAL : Moreover, if some supervisor fails to allot the priorities within some time limit, then he/she is reported to Admin.
- OPTIONAL : The Admin should have a record of how many supervisors have done and how many are left.

4.5 Scheduling and Resource Allocation to the Newly Arrived Tasks and the Pending Requests

4.5.1 Description and Priority

After the supervisors have assigned priorities to all the repair works under their jurisdiction, the system schedules the tasks and allocates the resources estimated by the supervisor to each of them. Here scheduling means arranging the tasks in a particular order, and allocating the task to the first time slot available (available in terms of available resources) during the day. If some job requires two time slots, then it is allocated both to the morning and evening slots. If such a task cannot be allocated to the morning slot, then it is not taken up that day. All the pending tasks which could not be done due to lack of resources are queued up. The scheduling is done every day morning, after priority assignment.

The system schedules the tasks in order of: priority assigned by the supervisor in charge of it > type of area in which the road is located (like commercial and busier areas are given higher priority) > task is a pending one or a recent one (pending tasks given higher priority) > resources required (tasks requiring lesser resources are given higher priority so that more jobs can be done at the same time.

This has a very high priority. This is one of the main objectives of the software.

4.5.2 Stimulus/Response Sequences

The module gives a list of all the tasks to be done in the morning and evening slots, along with the resources allocated for each of them. This is required for properly executing the repair works.

4.5.3 Functional Requirements

- The schedule function is executed using all the required data consisting of the priorities and resources assigned to all the repair works, and the types of areas. This needs all the databases
- It gives a list of all the works scheduled on that day for both the slots. This list is displayed on the UI, and stored.
- All the pending requests are queued up and stored for future reference.

4.6 Resources updation due to some machine malfunctioning or unavailability of resources

4.6.1 Description and Priority

The city corporation Administrator (Admin) is in charge of maintaining all the records pertaining to the available manpower and other material resources. In the event of some machine failure, or unavailability of any of the resources, or purchase of new materials or machinery, the Admin should update the records. This has a very high priority.

4.6.2 Stimulus/Response Sequences

This will require rescheduling of the tasks (4.7). So, the schedule is prepared taking into account the current resources. The new schedule is displayed on the UI, and stored in place of the old schedule.

4.6.3 Functional Requirements

- The Admin is totally responsible for updating the records. He/she has an option for editing the records. This feature is accessible only to the Admin, and not to anyone else in the system.

4.7 Rescheduling Repair works in the event of Resource Updation

4.7.1 Description and Priority

The tasks are rescheduled if any changes are made to the available resources as mentioned in 4.6. The schedule function is called along with the new records, to reschedule the tasks. This also has a high priority.

4.7.2 Stimulus/Response Sequences

The updated schedule is put up on the UI, and stored in place of the old schedule.

4.7.3 Functional Requirements

- Same as those given in section 4.5.3.

4.8 Obtaining Road Repair Statistics

4.8.1 Description and Priority

The Mayor of the city can avail this feature. He/she can request for various road repair statistics:

- Number and type of repairs carried out over a period of time
- The repair work pending at any point of time
- Utilisation statistics of manpower and resources over a period of time

This functionality is also given high priority.

4.8.2 Stimulus/Response Sequences

This has no particular effect on the functioning of the system. It can serve as a useful insight as to whether the current amount of resources is enough for carrying out repair works timely, or is it required to increase the resources. It also serves as a check on whether the whole system is functioning properly or not.

4.8.3 Functional Requirements

- This feature requires all the databases of repair works carried out, resources used and record of all the pending requests.

4.9 Adding new Supervisors by Admin

4.9.1 Description and Priority

The Admin has the ability to add new Supervisor employees to the System. This should be done before the area-wise assignment of complaints(4.2) is done so as to avoid conflicts.

This functionality has a low priority.

4.9.2 Stimulus/Response Sequences

Before the complaint assignments are done, the Admin may add new employees to the system. Using (4.10), the new user added can be assigned areas from

4.9.3 Functional Requirements

- The module should have access to the database required.
- In case of invalid details, a proper message should be given.

4.10 Changing Area Allocation of Supervisors by Admin

4.10.1 Description and Priority

The Admin has the ability to change the area allocated to Supervisor. This should also be done before the area-wise assignment of complaints(4.2) is done so as to avoid conflicts.

This functionality has a low priority.

4.10.2 Stimulus/Response Sequences

Areas assigned can be redistributed amongst the supervisor. However after such reassignment is done, all areas should have one supervisor and one supervisor only.

4.10.3 Functional Requirements

- The module should have access to the database required.
- In case of invalid details, a proper message should be given.
- In case of invalid allotment, the process should not change the database.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

The system has an interactive interface. Depending on the user, the information displayed and the functionalities are different. The system has minimal delay with every action-response functionality. The only delay in displaying the schedule can happen if all the supervisors have not filled in their priority list and the system cannot process the entire data and make a complete schedule. Every supervisor gets the scheduled project list made by the system. Rescheduling will lead to a message showing “Rescheduled” with the rescheduled list. The delay for all these actions should be < 10 sec. The complaints that are not scheduled on a particular day are stored to be scheduled on the next day.

The number of supervisors change depending on the data of the city provided. There is no limit to the number of complaints made on a certain day as well.

5.2 Safety Requirements

As Information entered by a supervisor or administrator is used for building schedules and wrong information or unwanted changes by a third party may lead to wrong schedules each of the users i.e clerk,supervisor,administrator and the mayor have their own login accounts which cannot be accessed by others.

5.3 Security Requirements

When citizens report a complaint, he is assured of anonymity as the clerk only fills in the road, area and the complaint of the road. All 4 categories of users of the system have their own id and password for login which is secure in the system and shouldn't be leaked.

5.4 Software Quality Attributes

Supervisor is able to see the entire schedule made by the system. Administrator is able to change the amount of material,manpower or machine available which leads to rescheduling of the projects. As it's an office software system there are no customers, just a set of users able to access and utilize the functionalities of the system. New supervisors can be added to the system.Number of roads in the system are fixed. Schedule changes everyday.Complaints not scheduled in a day due to lack of material or manpower is stored in a pending projects vector/list and scheduled in the coming days. The Mayor receives the statistics of the repairs done. The report is made by the system.

5.5 Business Rules

Clerk: Clerk is able to fill in the data about the complaint. He fills in the road name, and the details about the complaint.
Supervisor: He sees the complaints coming from localities under him. After analysing the roads he makes a priority list depending on the area and severity of the damage. He also makes an estimate of the material which could be required for repair of each road and fills it into the system.
Administrator: Able to change the availability of materials,manpower,machines which leads to rescheduling of the projects.
Mayor:Can request for a statistical report of the repairing projects completed,under work from the system.

6. Other Requirements

City, Mayor and Clerk are singleton classes. No other unspecified requirements required.

Appendix A: Glossary

The definitions of some standard terms used in the document are as follows:

1. RRTS – Road Repair Tracking System, refers to the goal software
2. Admin – Refers to the Public Works Office Admin, who also plays the role of system admin
3. PWD – Public Works Department, the civil body responsible for maintenance, repair, etc of public property
4. Resources – Represents the material (sand, cement, water), manpower, and machines collectively, which are required for repairing roads
5. Jobs/repairs/repair requests – Indicate the work that needs to be done to address the complaint