Real-Time Bridge Monitoring
Final Project Report

Version 1.0

Revision History

Date	Version	Description	Author
2014-01-06	1.0	Initial version Chapter 1, 2, 3 and 4	Andrea Bottoli

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1. Introduction

1.1 Purpose of this document

The purpose of this document is to provide an overview of the Real-Time Bridge Monitoring project results and team member performance during the Distributed Software Development (DSD) course of 2013/2014.

This course is a joint course between Politecnico di Milano (PoliMi) in Italy, University of Zagreb (FER) in Croatia and Mälardalen University (MDH) in Sweden.

The Real-Time Bridge Monitoring members are from PoliMi and MDH.

This document is defined at the final phase of the project work.

1.2 Intended Audience

This document is intended to all the stakeholders in the Real-Time Bridge Monitoring project including:

- Project group members
- Project Supervisors (Raffaela Mirandola and Elisabetta Di Nitto)
- Project Customers (Francesco Ballio and Gianluca Crotti)
- DSD course staff

1.3 Scope

This document covers the results of the Real-Time Bridge Monitoring project via metrics, tables and snapshots from other documents; it will also cover some of the differences between the initially planned and finally delivered metrics and milestones.

1.4 Definitions and acronyms

1.4.1 Definitions

Keyword	Definitions
Real-Time Bridge Monitoring	The project name

1.4.2 Acronyms and abbreviations

Acronym or abbreviation	Definitions
POLIMI	Politecnico di Milano
MDH	Mälardalen University
FER	University of Zagreb
DSD	Distributed Software Development

1.5 References

Project homepage: http://www.fer.unizg.hr/rasip/dsd/projects/real-time_bridge_monitoring

Project application: http://161.53.67.134/BridgeMonitoring/

Project documents: http://www.fer.unizg.hr/rasip/dsd/projects/real-time_bridge_monitoring/documents

2.   Background and Objectives

2.1   Project Goal

The Goal of this project is to develop a system that can help the monitoring process of bridges and to improve the speed of reaction at dangerous events. The system has to indicate the level of alarm in which the bridge is, so eventual security measures can be performed by the users; also make these information available on the web.

2.2   Project Requirements

2.2.1   Data sources

The system gathers data from various sensors that are:

- Anemometer
- Hydrometer
- Echo sonar
- Cameras

2.2.2   Data calculations

The system has to calculate the various characteristics of the bridge:

- The bridge stresses
- The forces acting on the bridge
- The wind speed
- The impact of the amount of traffic and its direction

2.2.3   User interface

The system has a user interface on which all the information will be displayed; it will also be displayed a temporal graph showing the temporal trend of values in the current day. The interface let to the users the possibilities to change some bounds or other variables.

There will be also the possibility to display historical data of the bridge on graph to allow the users to make comparison from the current state and the historical one; the users have to insert the period of time that they will want to see.

2.2.4   Web Application

The system can be reached on web to allow the uses to see all the information on their own devices.

2.3   Project Milestone

The main milestones are:

- Project Vision
- Project Plan
- Requirements definitions
- Design description
- Alpha prototype
- Beta prototype
- Acceptance test
- Final product

2.4   Project Deliverables

The deliverable are:

- Project Plan & Vision (with presentation)
- Project Plan Document
- Project Requirements and Architecture (with presentation)
- Design Description
- Alpha Prototype (with presentation)
- Beta Prototype (with presentation)
- Testing Report
- Final Project (with presentation)

2.5   Project testing

The testing phase expect to test the system reaction at some unexpected situations as the loss of network connection, loss of data, incorrect data, data missing and some other cases.

2.6   Project delivery

The final project/product will be delivered at 13-01-2014 on the web page with all the source codes.

3. Organization

3.1 Project group

The project group consists of seven members all together.

There are three members from the Italian side, that are coming from the Politecnico di Milano University: Andrea Bottoli, Lorenzo Pagliari and Marko Brčić.

The other four members are from the Mälardalens University: Dzana Kujan, Miraldi Fifo, Jörn Tillmanns and Nikola Radisavljevic.

Their roles in the group are defined and represented in the table below.

| Name	Initials	Responsibility (roles)
Andrea Bottoli	**AB**	**Project Manager**
Dzana Kujan	*DK*	*Team Leader*
Marko Brcic	MB	Documentation manager
Lorenzo Pagliari	LP	Design manager
Miraldi Fifo	MF	Testing manager
Jorn Tillmanns	JT	Database manager
Nikola Radisavljevic	NR	Integration manager

3.2 Customer

There are two customers in this project: they are Ballio Francesco and Crotti Gianluca.

3.3 Supervisor

There are two supervisors in this project: they are Mirandola Raffaela and Di Nitto Elisabetta.

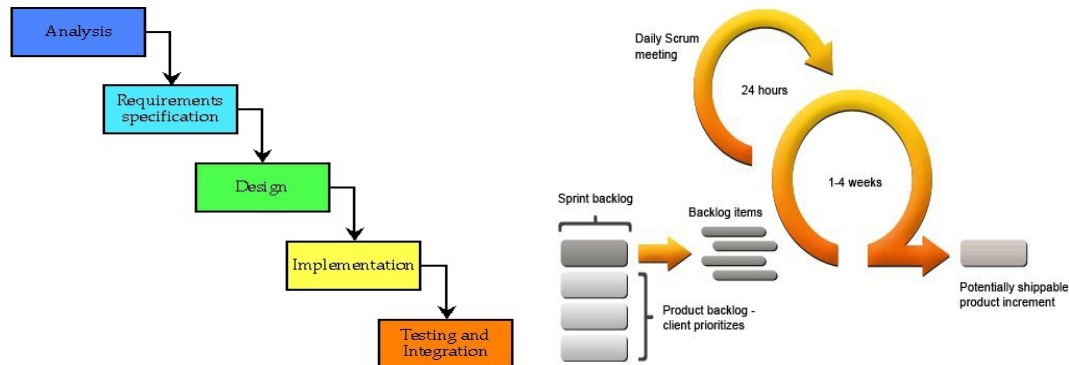This organization structure is better depicted in the following picture.
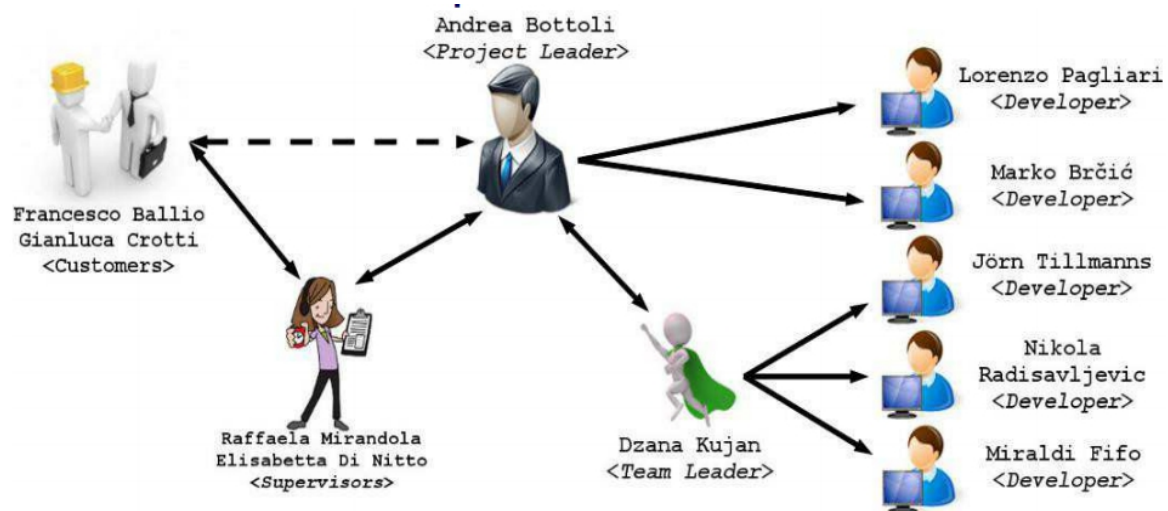
4.   Development process

4.1   Introduction

On the overall project the team follow a Waterfall model, but in the Requirements phase, Design phase and Implementation phase the team will follow a SCRUM model.

4.2   Project Phases

4.2.1   Analysis

In this phase the team analyzed the project, thinking at high level at the possible users, at the possible scenarios in which the system will work. Also works to build a shared vision of the project, on which each members of the team is agree.

4.2.2   Requirements Specification

In this phase the team set up with the customers the requirements of the project, focusing on the behavior of the final product and also on the type and structure of data in input at the system.

During the Design phase and Implementation phase the team can make some changes at the requirements, adding or removing some features depending on the issues that will rise.

4.2.3   Design

In this phase the team works on the design of the architecture of the system and on the behavior of the user interface to make it as user friendly, expressive and comprehensible as possible for the user.

4.2.4   Implementation

In this phase the team focus on the development of the various parts of the system.

4.2.5   Testing & Integration

In this phase the team will test the system's features in all the possible scenarios, to verify the correctness of the behavior of the system.

4.3 Roles

In the overall development process all the members of the team are developers. Adding this, threre are also other roles:

- Project leader
- Team leader
- Document manager
- Design manager
- Test manager
- Integration manager
- Database manager

4.4 Quality Assurance

During all the iterations of the Design phase and Implementation phase the Test manager will check that the system's features meet the customers desires.

Sometimes, the customers involvement guarantees that the product fits their needs.

5.   Milestones

COPY FROM THE LAST VERSION OF PROJECT PLAN DOCUMENT!

6.   Project Results

6.1   Requirements

6.1.1   Requirement Compliance Matrix

List all the requirements from the requirements table in the Requirements Specification document; mark them (completed column) with one of the keywords defined below the table. If any remark is necessary, enter them in the Remarks table below.

Id	Requirement Description	completed	Rem
ADM-1			
ADM-1.1			

Completed: Yes (completely implemented)
No (not implemented at all)
Partially (partially implemented, more description under Remarks subsection)
Unknown (completion status not known)
Dropped (requirement was dropped during the course of the project)

6.1.2   Requirements Compliance Summary

Summarize the requirements compliance data.

Total number of requirements	
Number of requirements implemented	
Requirements partially fulfilled	
Requirements not fulfilled	
Requirements dropped	

6.1.3   Remarks

Remark Id	Description

6.2   Deliverables

COPY FROM THE LAST VERSION OF PROJECT PLAN DOCUMENT!

7.   Risks

Look at the risk table from the Project Plan document and list and comment:

- *risks that have appeared but their impact was low because of preventive actions*
- *risks that appeared and had a significant impact on project work*
- *risks that appeared but were not foreseen and listed in the table (describe them and their impact on project work)*

8. Project Experiences

8.1 Positive Experiences

Write down what went well during the project work, be very specific – what, how, why!

8.2 Improvement Possibilities

Write down what did not go well during the project work, be very specific – what, how, why, how to improve in the future!

9. Metrics

9.1 Work per Member

List all project team members, all weeks the project was going on, hours invested per week, total hours a person invested during the project.

Member	Wxy	Wxz	W..	Total
X Y	6	2	0	
	5	1	0	
	2	3	0	
	2	3	0	
	2,5	1,5	0	
	2	2,5	2	
	2	3	0	
	2	3	0	
	0	2	0	
Total	**23,5**	**21**	**2**	**1425**

Comment the results, compare them with the forecasted amount of hours needed to finish the project, compare possible differences between project members (average number of hours invested, standard deviation, why there are persons – name them - with significantly less or more hours invested compared to average).

9.2 Milestone Metrics

From Milestone section of this document compile the summary data for milestones, enter the number of milestones completed on time or earlier, total number of milestones defined in the project and calculate the percentage of milestones on time or earlier and enter it in the Timeliness cell.

Completed as planned or earlier	Total	Timeliness

9.3 Effort Metrics

List all the activities in the project (project phases like requirement definition, design, implementation of certain artifacts, testing etc.), enter the actual number of days (total number of days invested by the project team) for each effort, planned number of days for that activity (see project plan document), and calculate deviation from the plan (+- percentage).

ID	Activity	Actual Effort	Planned Effort	Deviation (%)

Explain reasons behind significant deviations (if any)!

Effort estimation accuracy (%) *(100*(1 - abs(Actual – Planned)/Actual))*	84%