

Assignment 4 - Architectural evaluations using AADL

Blunderjack System

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1 Introduction

The purpose of this assignment is to provide hands-on experience of using Architecture analysis and design Language (AADL) for documenting and evaluating an architecture. A simplified high-level architecture of the timber harvesting machine control system “Blunderjack” will be used for this task.

2 Description

In Figure 1 an overview of the architecture for the Blunderjack system is shown.

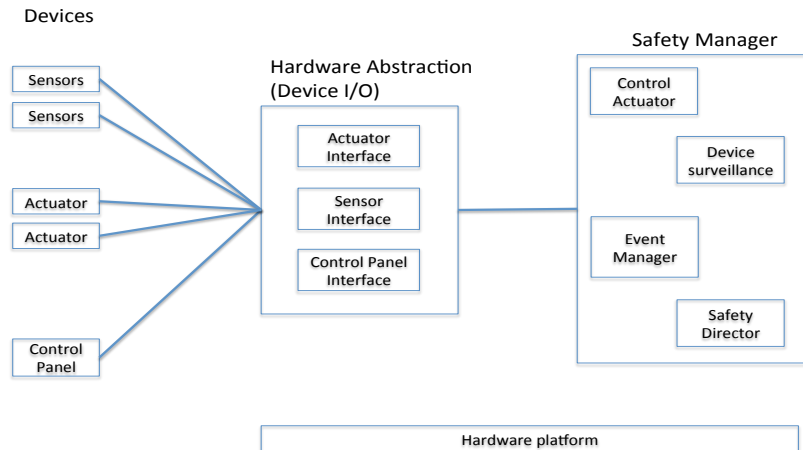


Figure 1: System overall structure

Table 1: AADL description of Blunderjack architecture

File / Package Name	Description
HardwareParts	Defines the hardware components used in the system.
HardwarePlatform	Provides different configurations of hardware platforms for the system.
BJSubsystems	Defines the building blocks of the Blunderjack system architecture.
BJSystem	Defines the overall system and subsystems as depicted in Figure 1.
SystemConfigurations	Defines the implementation of the Blunderjack system and resource allocation.

Table 2: Resource budgets for Blunderjack architecture

Package.ProcessName	Processing speed (in MIPS)	Memory (RAM in KB)
BJSubsystems.ActuatorInterface	200	512
BJSubsystems.ControlPanelInterface	200	256
BJSubsystems.SensorInterface	300	256
BJSubsystems.EventManager	500	768
BJSubsystems.ControlActuators	900	256
BJSubsystems.DeviceSurveillance	300	256
BJSubsystems.BJSafetyDirector	300	768

3 AADL package

A skeleton of the architecture in Figure 1 is documented in AADL in OSATE package Blunderjack.zip. The contents of this package are described in Table 1.

4 Analysis

4.1 Resource allocation analysis:

Given the hardware platforms and the budgets for system components find an appropriate configuration for the system. In the report explain why you picked a certain configuration over others. To do resource allocation analysis, the following details should be added to the AADL specification:

- For “Resource allocation analysis” estimates of memory and processing speed requirements for various sub-components are provided in Table 2. You will need to specify these in the AADL description of the system to perform the budget analysis.
- Furthermore the mapping of processes to processing units in the hardware configurations is currently incomplete. Processes “ActuatorInterface” and “ControlActuators” have frequent communication between them so they must be run on the same processor. Also, the

processes running on a certain processor can only use the memory banks associated with that processor.

4.2 Latency Analysis:

Evaluate the end-to-end latency in the following scenarios:

- **Scenario 1:** The weight sensor measures and propagates the weight of the object in Blunderjack's arm to the system. The system assesses that the weight of the object is more than the allowed limit so it sends a warning message to the Blunderjack display. The required end-to-end latency for this scenario is maximum 350 ms.
- **Scenario 2:** The operator initiates the action to remove branches from the log, the sensor detects the angle at which log is currently held in the arm and propagates the information to the system. The system determines that the direction of the log is dangerous as it is pointing towards the operator-cabin. The system must stop the movement immediately and provide feedback to the operator. The required end-to-end latency for this scenario is maximum 400 ms.

Most of the flows are already implemented but for "Latency Analysis" you will need to add missing flows in the model depending on the scenario you are evaluating.

5 Deliverables

5.1 Report

Title page Course title and number, name of the system, assignment number, name and social id of group members. A table where you describe the contribution to ideas and documentation of each team member (in percent).

Introduction An introduction, presenting the assignment and a short discussion on whether the AADL specification covers the requirements given in the system description.

Evaluation result A description of:

1. the changes made to the model in order to perform the evaluation
2. the result of the evaluations and your conclusions

Challenges A discussion (max. 1 page) of the challenges you have encountered in:

1. understanding
2. extending

the AADL model. Describe also how you addressed a specific challenge and whether you perceive that you have succeeded or not.

Reflection A discussion (max. 1 page) on the benefits and liabilities of using a formal architecture specification and evaluation compared to the evaluation you performed in Assignment 3.

5.2 AADL model

The AADL model with the changes you have implemented. The model must compile and both the resource allocation and latency analysis shall provide results. Export the project as a zip-file and submit with the report.