AP2DX

Awesomizing the P2DX

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UvA

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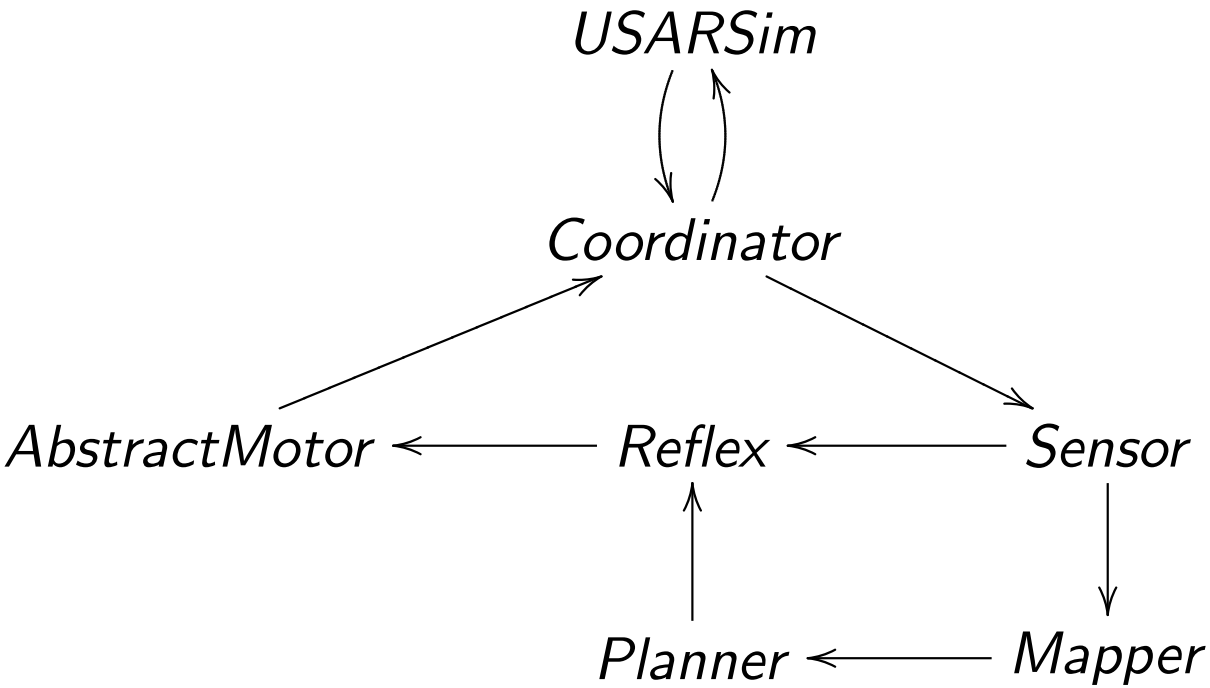
Introduction

- The same assignment
- Who we are
- What is special in our case

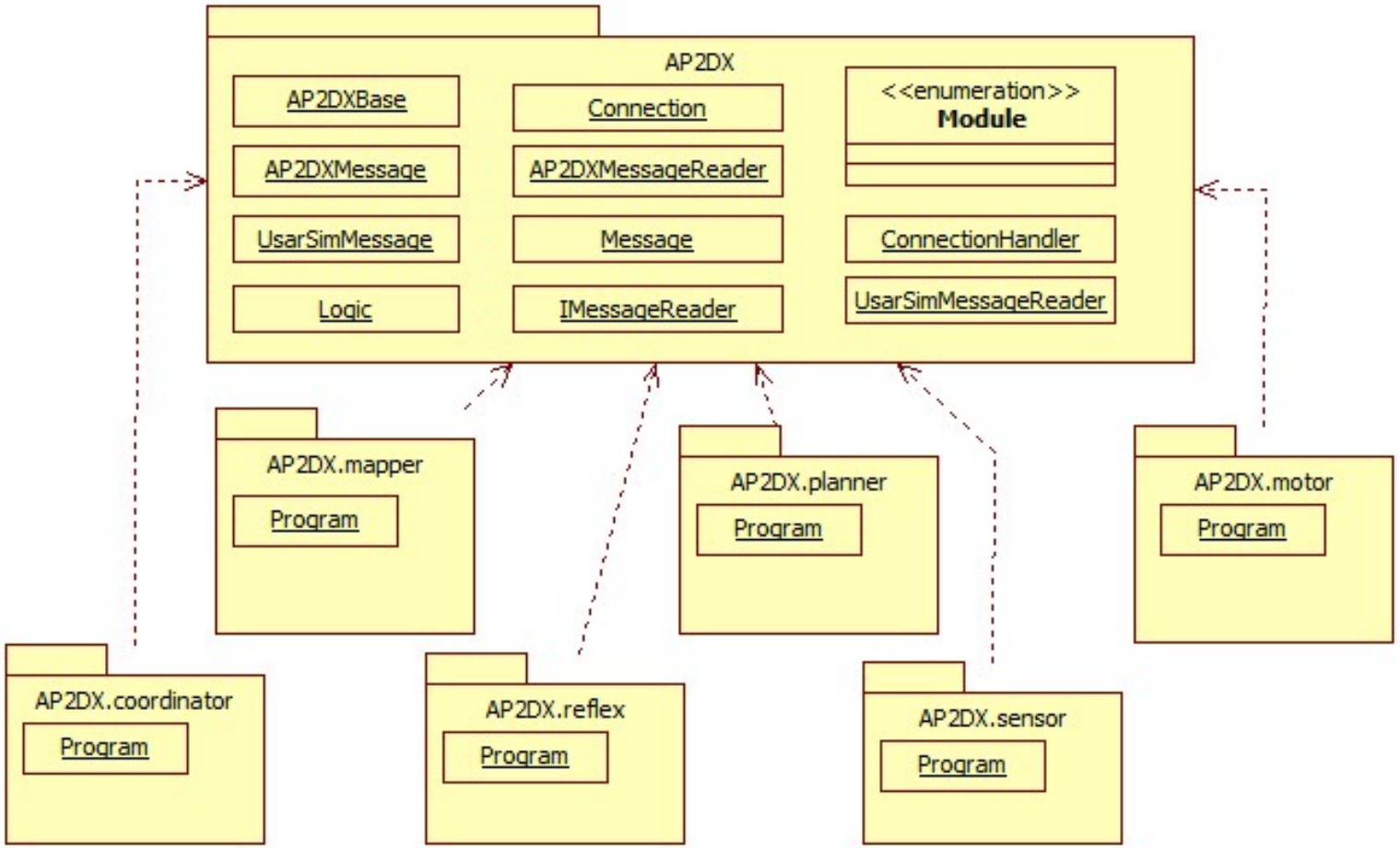
Goals

- Loosely coupled modules based on network communication
- Robot should be safe, i.e. stop for obstacles
- Robot should be able to drive autonomously through the environment
- Robot should be able to create a map of the environment
- No user input will be required

Architecture - the basics



Architecture - into the depths



Abstract base class

We decided to use an abstract class, to base all our classes on.

Advantages

- Very easy to work with
- Only have to make the connection protocol once
- Strict contracts with team mates

Disadvantages

- Stuck with one language
- Hard debugging
- Hard to make big changes, or add things we had not thought of

Movement - how we do it

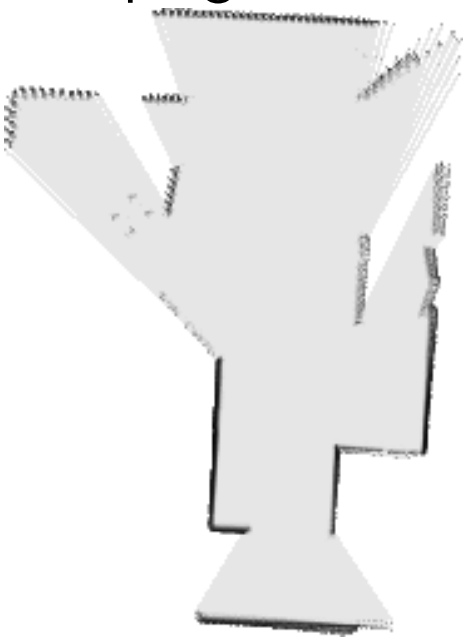
- Based on Sonar sensor data
- Not using the outer two sonars (-90° and 90°)
  - Only use them for detecting "gaps in the wall", places we may want to go
  - "hey, this time the wall is $>$ 1 meter further away in one tick, maybe there is a hole!"
  - Turn to the hole, scan the width, and decide to drive through or not.

Movement - reflexes

- If reflex stops the robot, because of an object in the way, turn to the direction with the furthest view angle
- If all four middle sonar sensors detect $>$ 0.5m, we can drive forward.
  - The bot's width is 38cm, angle between outer-middle 2 sonars (sensor 3 and 6) = 60 degrees, lets say the hole needs to be 45cm wide to drive through it, those two sensors need both to see at least 45cm. (cosine rule)

Mapper

We did not make our own mapper. We used DP Slam[1][2].
The program works in C, and creates a map like this one:



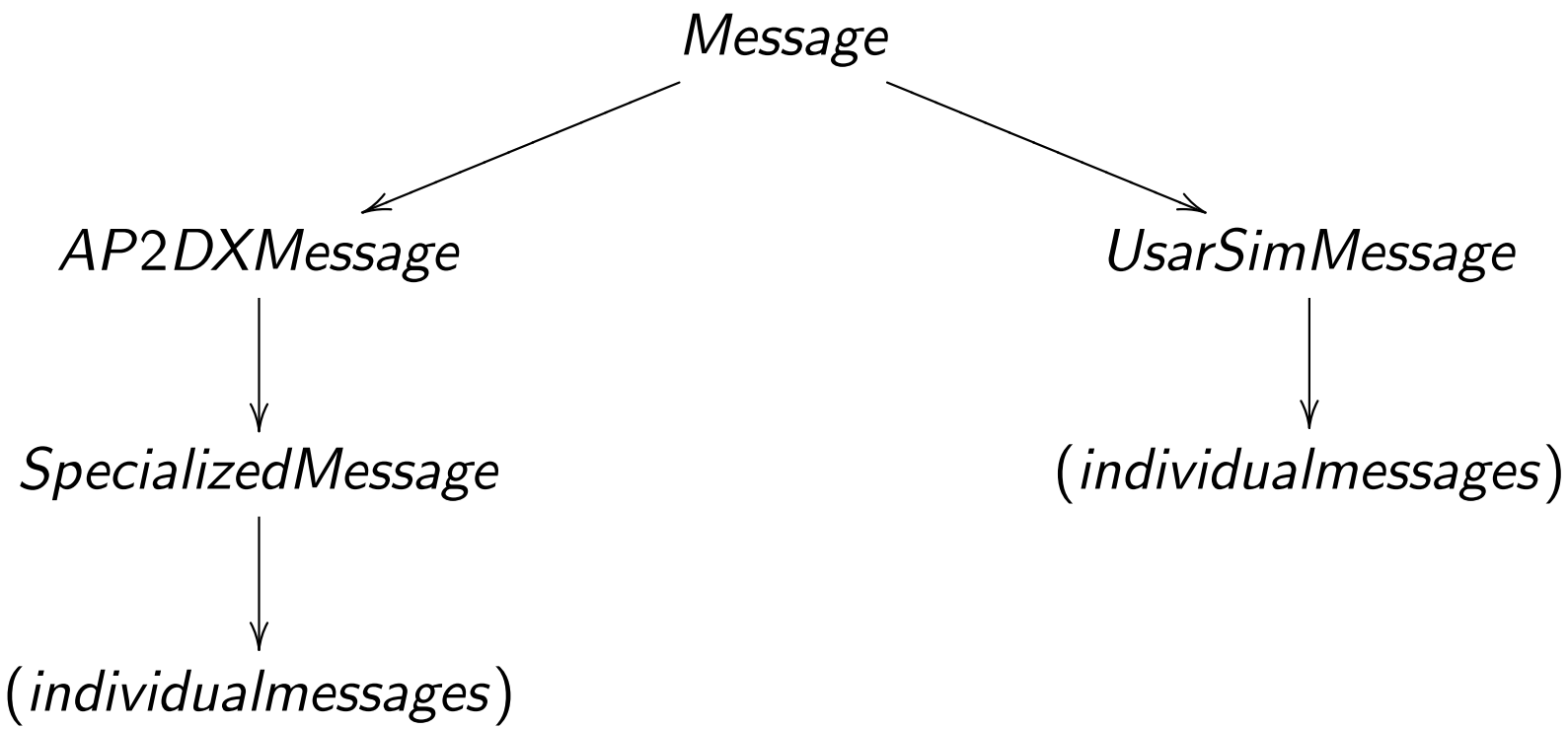
[1] http://www.cs.duke.edu/ parr/dpslam/

[2] Algorithm from: Austin Eliazar, Ronald Parr: DP-SLAM: Fast, Robust Simultainous Localization and Mapping Without Predetermined Landmarks

Mapper - What makes it special

- Two ways to use a mapper:
  - While driving
  - After driving (with saved sensordata)
- We make a map, while driving
- Mapper uses Odometry and Laser range scanner data
- Currently only works on linux

Messages


Message
AP2DXMessage
UsarSimMessage
SpecializedMessage
(individualmessages)
(individualmessages)

Messages - explained

There are a couple of advantages and disadvantages:

Advantages

- Very easy to work with
- Easy to add a new kind of message
- Strict restrictions to how a message should look (and thus uniformity)

Disadvantages

- Very hard to debug
- Hard to add a type of message that doesn't fit in

Developing process - 1

Test driven programming

- Unit test in front
  - Smallest testable part of code
  - Every dependency is mocked
- A lot of overhead for small project

File management

We used Git, to easily synchronize our code. There are some advantages:

- Distributed, so it is not like subversion
- It has change tracking
- It automatically merges
- It is installed on the UvA computers.

Developing process - 2

Automatic building

Ant was used to build everything. This includes compiling, testing, publishing test reports, javaDoc, creating jar files.

Continuous integration server

Jenkins was used as integration server. It uses:

- Git checkout
- Ant build
- Clarifying coverage reports

Together this makes a nice way to discover every detail about our project. Screenshots will follow.

Gmail - Alle berichten - jjwtimmer@gmai... | 12.1 Robots - Usarsim | AP2DX [Jenkins]

Jenkins search Jasper | log out

Jenkins » AP2DX DISABLE AUTO REFRESH

- Back to Dashboard
- Status
- Changes
- Workspace
- Build Now
- Delete Project
- Configure
- GitHub
- Coverage Report

Build History (trend)

#236	Jun 29, 2011 7:01:17 PM
#235	Jun 29, 2011 6:01:17 PM
#234	Jun 29, 2011 5:01:17 PM
#233	Jun 29, 2011 4:01:17 PM
#232	Jun 29, 2011 3:01:17 PM
#231	Jun 28, 2011 7:00:30 PM
#230	Jun 28, 2011 6:00:30 PM
#229	Jun 28, 2011 5:00:30 PM
#228	Jun 28, 2011 4:00:30 PM
#227	Jun 28, 2011 3:00:30 PM
#52	Jun 9, 2011 10:00:33 AM

RSS for all RSS for failures

Project AP2DX

Super Awesome! It's P2DX! :D Nice!!!!

edit description

Disable Project

Project managers never ask Chuck Norris for estimations... ever.

Coverage Report

Workspace

Recent Changes

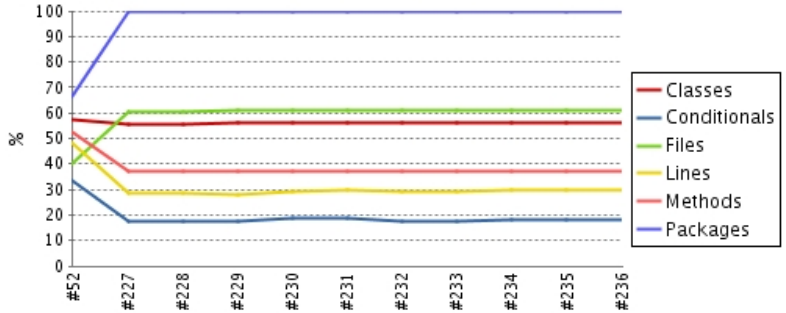
Latest Test Result (10 failures / ±0)

Permalinks

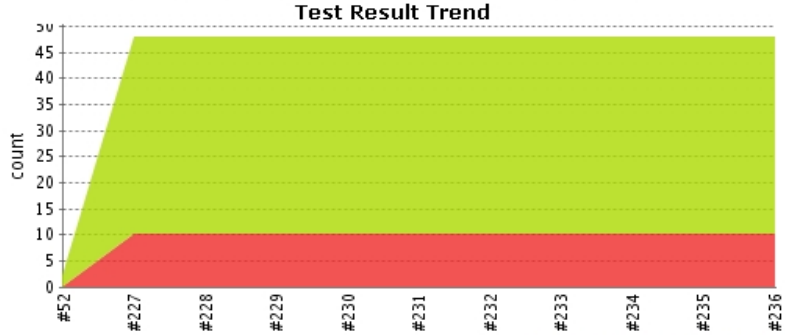
- Last build (#236), 4 hr 25 min ago
- Last stable build (#52), 20 days ago
- Last successful build (#236), 4 hr 25 min ago
- Last unstable build (#236), 4 hr 25 min ago
- Last unsuccessful build (#236), 4 hr 25 min ago

Code Coverage

Classes 56% **Conditionals** 18% **Files** 61% **Lines** 30% **Methods** 37%
Packages 100%



Test Result Trend



(just show failures) enlarge

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Jenkins

search | Jasper | log out

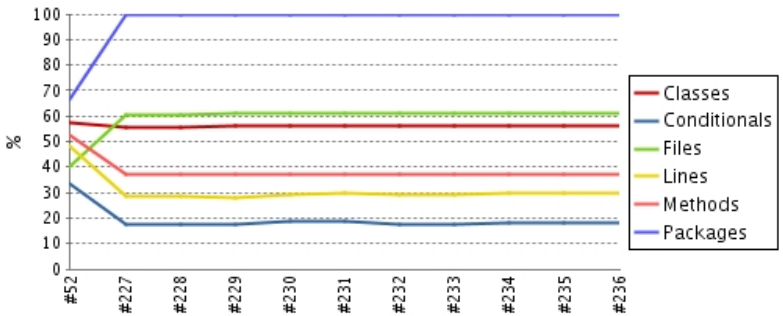
Jenkins » AP2DX » #236

- Back to Project
- Status
- Changes
- Console Output
- Edit Build Information
- Git Build Data
- **Coverage Report**
- Test Result
- Previous Build

Code Coverage

Cobertura Coverage Report

Trend



Project Coverage summary

Name	Classes	Conditionals	Files	Lines	Methods	Packages
Cobertura Coverage Report	56% 36/64	18% 54/295	61% 30/49	30% 535/1810	37% 145/389	100% 10/10

Coverage Breakdown by Package

Name	Classes	Conditionals	Files	Lines	Methods
AP2DX.specializedMessages	31% 5/16	5% 1/20	27% 4/15	23% 66/287	24% 20/85
AP2DX.usarsim	100% 2/2	69% 11/16	100% 2/2	69% 34/49	78% 7/9
AP2DX.coordinator	40% 2/5	14% 2/14	33% 1/3	27% 29/106	50% 5/10
AP2DX.reflex	100% 2/2	7% 2/27	100% 1/1	23% 14/62	38% 5/13
AP2DX.sensor	67% 2/3	4% 1/23	50% 1/2	13% 19/149	27% 6/22
AP2DX.mapper	60% 3/5	0% 0/15	100% 3/3	28% 34/121	26% 7/27
AP2DX	64% 9/14	14% 10/69	100% 8/8	35% 168/478	51% 41/81
AP2DX.planner	33% 1/3	0% 0/27	50% 1/2	8% 9/112	14% 3/21
AP2DX.usarsim.specialized	67% 8/12	37% 26/70	67% 8/12	38% 147/387	40% 46/115
AP2DX.motor	100% 2/2	7% 1/14	100% 1/1	25% 15/59	83% 5/6

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```
24          * make a new UsarSimMessage
25          *
26          * @param in
27          */
28         public UsarSimMessage(String in) {
29  7              super(in, Module.UNDEFINED);
30  7      }
31
32         /**
33          * make a new UsarSimMessage
34          */
35         public UsarSimMessage(MessageType type) {
36  4              super(type);
37  4      }
38
39         @Override
40         public Message.MessageType getMsgType() {
41  6              if (this.type == MessageType.UNKNOWN || this.type == null) {
42  2                      String startPatternStr = "^[A-Z]+";
43  2                      Pattern startPattern = Pattern.compile(startPatternStr);
44  2                      Matcher startMatcher = startPattern
45                                      .matcher(this.getMessageString());
46
47  2                      if (startMatcher.find()) {
48  2                              this.type = UsarSimMessage.MessageType
49                                              .getEnumByString(startMatcher.group(0));
50                      } else {
51  0                              this.type = null;
52                      }
53              }
54
55  6              return this.type;
56      }
57
58         @Override
59         protected void parseMessage() throws Exception {
60  0              throw new Exception(
61                              "Not possible on this class, try casting to a specialized message type.");
62      }
63
64         /**
65          * This method uses annotated fields to build the output of the message.
66          * field.toString() is the value of the field like so: {name value}.
67          * @throws IllegalAccessException
```

Discussion

- Framework is handy and dynamic, but the connections are hardcoded. This makes it harder to add an entirely new module to the set.
- Framework took a lot of time to set up and debug
- Messages took a lot of time to debug, because we were using JSon