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|-----------------------------------|--|
| Project Name | Robot Visual Perception |
| Online team meeting | https://fau.zoom-x.de/j/62836031488 |
| Production system (if any) | Service Provided (later in the Project) |
| Test system (if any) | Local Webcam |
| GitHub repository | https://github.com/amosproj/amos2025ws04-robot-visual-perception |
| GitHub feature board | https://github.com/orgs/amosproj/projects/92 |
| GitHub imp-squared backlog | https://github.com/orgs/amosproj/projects/95 |
| Team T-shirt (white) | https://www.shirtinator.de/s/E_elf-EIT4iidRVnqM8J5w |
| Team T-shirt (black) | https://www.shirtinator.de/s/R0CANDdWTRCOvCohq_encA |
| Additional materials | https://discord.gg/VDqD2Zfb |
| Team mailing list | oss-amos-proj4@lists.fau.de |
| | https://happy-amos.appspot.com/ |
| | Please use our mailing list for written communication. Only CC teachers (university) and coaches on specific topics, as the mailing lists are very long. |

| Last Name | First Name | GitHub User Name | Email Address |
|-------------|------------|-------------------|---|
| Hilgers | Felix | fhilgers | felix.hilgers@fau.de |
| Samdani | Sarib | saribx | saribstudent@gmail.com |
| Chinbat | Anuun | anuunchin | anuun.ch @gmail.com |
| Goldschmidt | Georgina | bu31punu | dzsini.lost@gmail.com |
| Zinn | Benedikt | BenediktZinn | benedikt.wh.zinn@gmail.com |
| Badura | Emil | Tenebrae311 | badura@tu-berlin.de |
| Assenbaum | Paul | Paul2607 | paul.assenbaum@fau.de |
| Mantsch | Christoph | Christoph-Mantsch | christoph.cm.mantsch@fau.de |
| Asadi | Zohreh | zohrehasadi00 | z.asadi@campus.tu-berlin.de |
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| # | Meeting Day | Product Owner | | Software Developer | Release Manager | Scrum Master | Comment |
|---|-------------|---------------|---------------|--------------------|-------------------|----------------------|---|
| | | Review | Planning | | | | |
| 1 | 2025-10-22 | Felix Hilgers | Benedikt Zinn | Everyone else | Paul Assenbaum | Georgina Goldschmidt | (Tuesday 21. Discord for Release process example) |
| 2 | 2025-10-29 | Benedikt Zinn | Felix Hilgers | Everyone else | Anuun Chinbat | Georgina Goldschmidt | |
| 3 | 2025-11-05 | Benedikt Zinn | Felix Hilgers | Everyone else | Sarib Samdani | Georgina Goldschmidt | |
| 4 | 2025-11-12 | Felix Hilgers | Benedikt Zinn | Everyone else | Sarib Samdani | Georgina Goldschmidt | |
| 5 | 2025-11-19 | Felix Hilgers | Benedikt Zinn | Everyone else | Anuun Chinbat | Georgina Goldschmidt | |
| 6 | 2025-11-26 | Benedikt Zinn | Felix Hilgers | Everyone else | Emil Badura | Georgina Goldschmidt | |
| 7 | 2025-12-03 | Felix Hilgers | Benedikt Zinn | Everyone else | Emil Badura | Georgina Goldschmidt | |
| 8 | 2025-12-10 | Benedikt Zinn | Felix Hilgers | Everyone else | Paul Assenbaum | Georgina Goldschmidt | |
| 9 | 2025-12-17 | Felix Hilgers | Benedikt Zinn | Everyone else | Christoph Mantsch | Georgina Goldschmidt | |
| 10 | 2026-01-07 | Benedikt Zinn | Felix Hilgers | Everyone else | Christoph Mantsch | Georgina Goldschmidt | |
| 11 | 2026-01-14 | Felix Hilgers | Benedikt Zinn | Everyone else | Zohreh Asadi | Georgina Goldschmidt | |
| 12 | 2026-01-21 | Benedikt Zinn | Felix Hilgers | Everyone else | Zohreh Asadi | Georgina Goldschmidt | |
| 13 | 2026-01-28 | Felix Hilgers | Benedikt Zinn | Everyone else | | Georgina Goldschmidt | |
| 14 | 2026-02-04 | Benedikt Zinn | Felix Hilgers | Everyone else | | Georgina Goldschmidt | Demo day! |
| 15 | 2026-02-11 | Felix Hilgers | Benedikt Zinn | Everyone else | Anuun Chinbat | Georgina Goldschmidt | Retrospective |
| | | | | | | | |
| Product owners, software developers, and Scrum Master are set and ideally don't change over time; the critical part is the Release Manager role you need to define here | | | | | | | |
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| Goals | Development of a visual perception system for robots with an accuracy of $\geq 90\%$ |
| Meeting norms | <p>Zoom-Meetings in the meeting room of the university. Joining the meeting is mandatory, with exceptions (like sickness, etc.). As an exception, showing up to 10 minutes late is fine if the team is informed via discord. Happiness Index: has to be completed at the end of the meeting (amos happy). Stand-up-mails: containing -> things done, problems encountered, things up next. -> For SDs: min 2x per week -> For POs: min 1x per week</p> |
| Working norms | <p>Issues on Github in the "Feature board" project of the repository. Definition of Done: If specified in the issue that the feature has to be tested, tests have to be written for that feature, documented (in code or later in the wiki) Git-branches: The latest commit on the main-branch has to be tagged. Only 2 "in progress" tickets per person at one time.</p> |
| Coordination norms | <p>Developers can create issues but not put them onto the "Feature board". If blocked by a different task, discuss it as soon as possible. Communication should happen via Discord & mail. Criticism should be constructive. Language should be respectful at all times, both verbal and written communication.</p> |
| Communication norms | <p>Developers can create issues but not put them onto the "Feature board". If blocked by a different task, discuss it as soon as possible. Communication should happen via Discord & mail. Criticism should be constructive. Language should be respectful at all times, both verbal and written communication.</p> |
| Consideration norms | |
| Cont. improvement norms | |
| Rewards | Online coffee or lunch meet at some point. |
| Sanctions | Document absence. Repeated absence is addressed with the missing person directly but will later be escalated to professors. |
| Signatures | |
| Scrum Master | Georgina Goldschmidt |
| Product owner | Felix Hilgers |

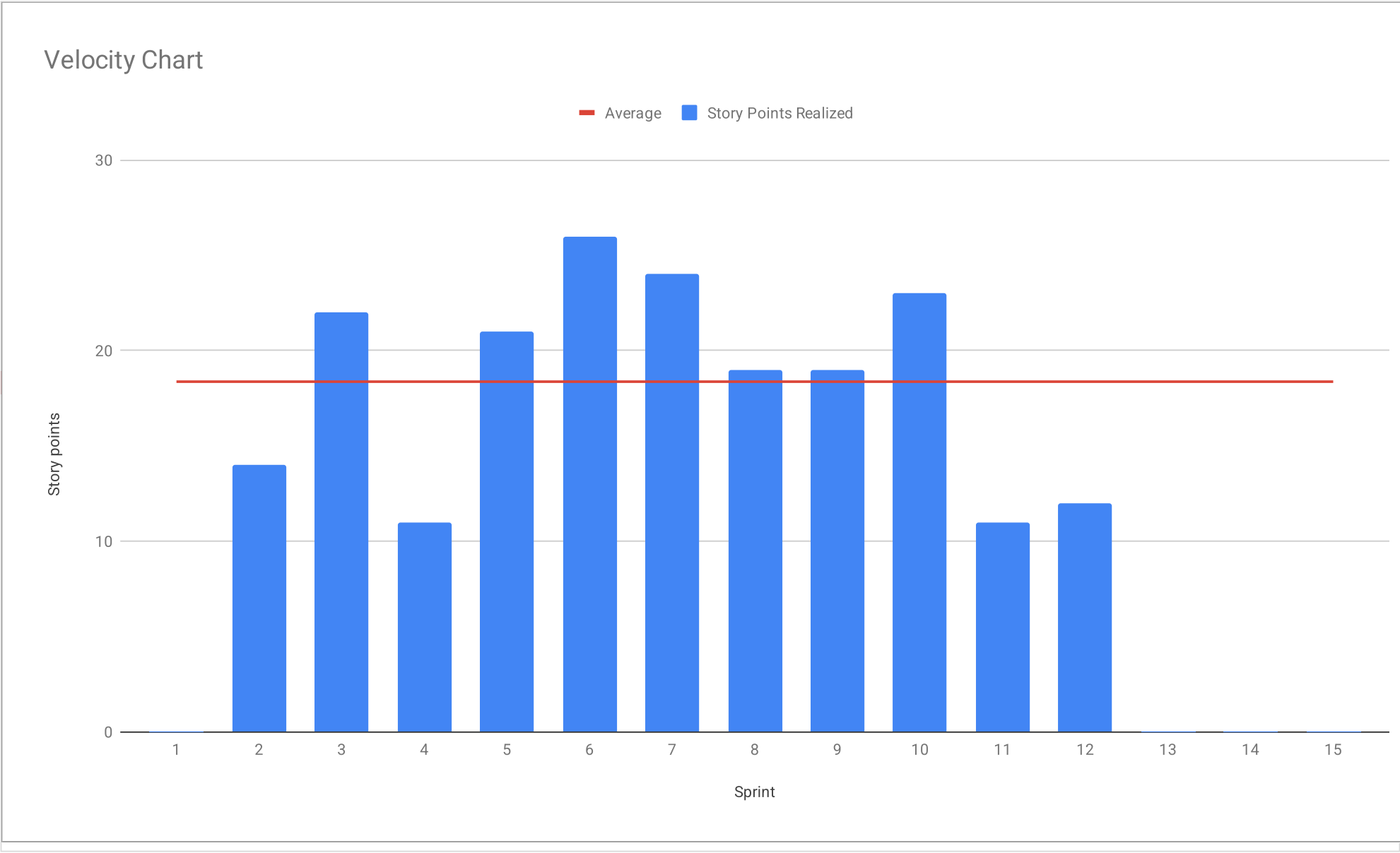
| | |
|--------------------|-------------------|
| Product owner | Benedikt Zinn |
| Software developer | Sarib Samdani |
| Software developer | Emil Badura |
| Software developer | Anuun Chinbat |
| Software developer | Paul Assenbaum |
| Software developer | Christoph Mantsch |
| Software developer | Zohreh Asadi |

| Product Vision | Project Mission |
|---|---|
| <p>Optibot helps people when operating robots equipped with a single camera. It gives real-time distance estimates for known objects inside the field of view of said camera without relying on other sensors. The software stack is easy to integrate with already existing WebRTC based systems, making it easy to enhance existing robot networks.</p> | <p>The mission of this project is to create a containerized system that processes a WebRTC stream as an input and outputs a stream of metadata. This metadata will contain the objects detected in a certain frame of the video stream, their bounding boxes in the image & the estimated distance. This information can be overlayed over the existing video stream in a React component. All components of the project have well defined interfaces and can easily be integrated into existing architectures.</p> |

| Term | Definition |
|----------------------------|---|
| ONNX | Open Neural Network Exchange (A runtime to run machine learning models on a variety of hardware) |
| Monocular Depth Estimation | Estimating the Depth in a Scene with only one eye (or camera in our case) |
| YOLO | You Only Look Once, family of state of the art object detection models (and more) |
| MiDaS | A ML model for Monocular Depth Estimation |
| ML | Machine Learning |
| ORT | ONNX Runtime |
| CUDA | NVIDIA GPU runtime for machine learning and more |
| ROCm | AMD GPU runtime for machine learning and more |
| IoU | Intersection over Union |
| NMS | Non Maximum Suppression |
| FPS | Frames per Second |
| COCO | Common Objects in Context, a commonly used dataset for training and testing Object detection models |
| WebRTC | Web Real-Time Communication, video streaming between the different services |
| SBOM | Software Bill of Materials |
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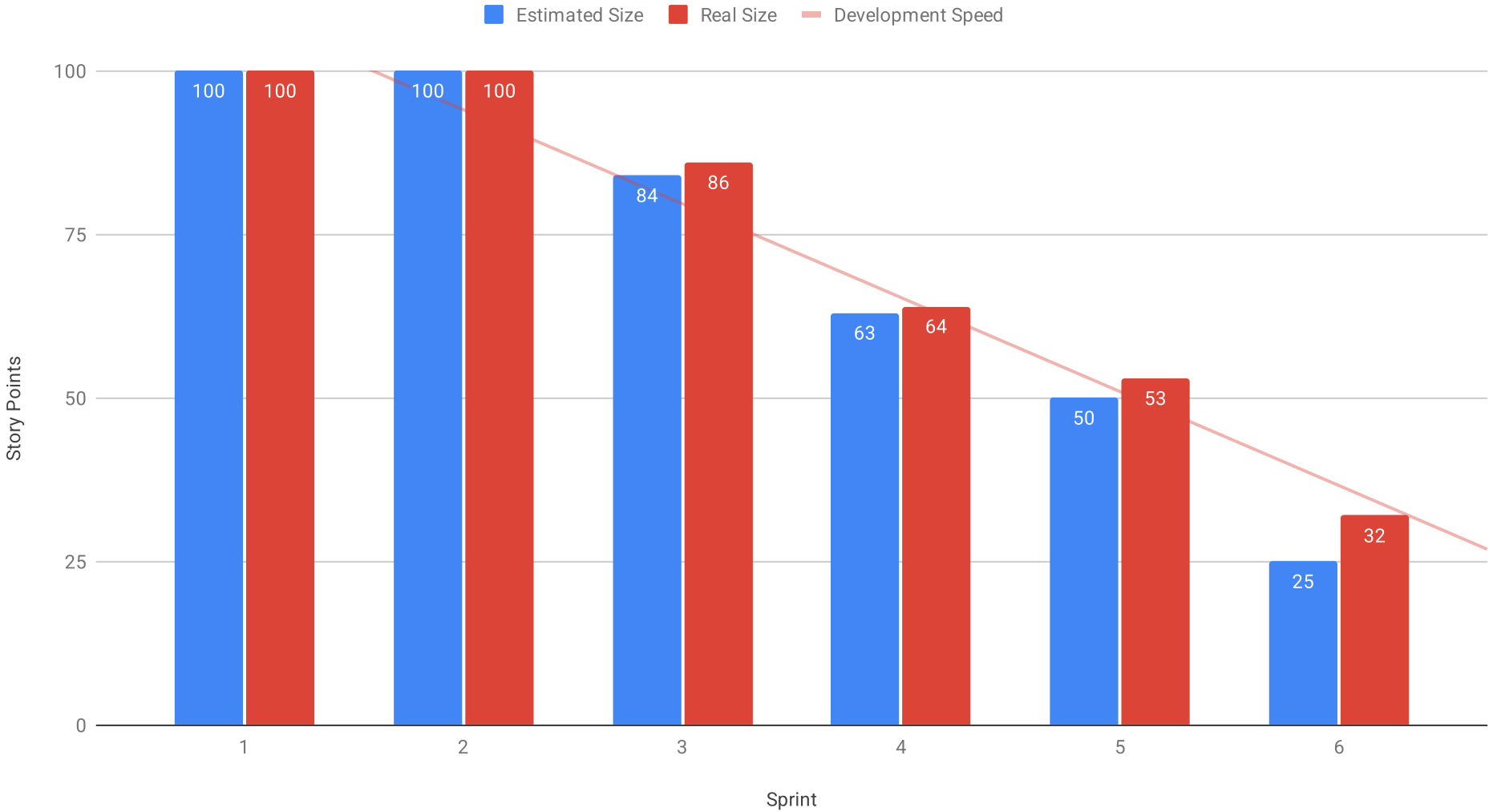
| Sprint # | Sprint goal |
|----------|--|
| 1 | Meeting with industry partner and getting things started (and the T-shirt of course) |
| 2 | Start work on individual components and research unclear topics |
| 3 | Combining components into a first working prototype |
| 4 | Refining prototype and splitting out components |
| 5 | Finishing the Implementation of the Initial Architecture |
| 6 | Refine component parts |
| 7 | Improve Extensibility and Documentation |
| 8 | Refining the overall look and feel |
| 9 | Project integration with real SFU |
| 10 | Technical Improvements and Experiments |
| 11 | Refactoring and Testing |
| 12 | Refining the Frontend |
| 13 | Performance Improvements |
| 14 | Finalizing the Documentation and Preparing for Demo Day |
| 15 | Reflecting on the Project |
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| Sprint # | Story Points Realized |
|----------|-----------------------|
| 1 | 0 |
| 2 | 14 |
| 3 | 22 |
| 4 | 11 |
| 5 | 21 |
| 6 | 26 |
| 7 | 24 |
| 8 | 19 |
| 9 | 19 |
| 10 | 23 |
| 11 | 11 |
| 12 | 12 |
| 13 | 0 |
| 14 | 0 |
| 15 | 0 |
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| Sprint | Goal | Feature Name | Est. size | Est. remaining | Real size | Real remaining |
|----------|--|---|-----------|----------------|-----------|----------------|
| Release | | | | | | |
| Total | | | 100 | 100 | | |
| Sprints | | | | | | |
| 1 | Meeting with industry partner and getting things started (and the T-shirt of course) | | 0 | 100 | 0 | 100 |
| 2 | Start work on individual components and research unclear topics | | 16 | 100 | 14 | 100 |
| 3 | Combining components into a first working prototype | | 21 | 84 | 22 | 86 |
| 4 | Refining prototype and splitting out components | | 13 | 63 | 11 | 64 |
| 5 | Finishing the Implementation of the Initial Architecture | | 25 | 50 | 21 | 53 |
| 6 | Refine component parts | | 25 | 25 | 26 | 32 |
| Features | | | | | | |
| 1 | Meeting with industry partner and getting things started (and the T-shirt of course) | | | | | |
| 2 | Start work on individual components and research unclear topics | | | | | |
| | | Setup Architecture | 5 | | 5 | |
| | | Serve Webcam as WebRTC stream | 5 | | 5 | |
| | | Setup Initial CI Pipeline | 3 | | 3 | |
| | | Discuss Team Distribution Preferences | 3 | | 1 | |
| 3 | Combining components into a first working prototype | | | | | |
| | | Keep BOM up to date | 2 | | 2 | |
| | | Setup REUSE licensing | 2 | | 3 | |
| | | Update Architecture document | 2 | | 2 | |
| | | Create Object Detection Example | 3 | | 3 | |
| | | Prepare Build Process Review | 2 | | 2 | |
| | | Prepare Depth Estimation | 5 | | 5 | |
| | | Research Object and Depth Estimation | 5 | | 5 | |
| 4 | Refining prototype and splitting out components | | | | | |
| | | Metadata Transport | 5 | | 3 | |
| | | Split Backend Responsibilities | 3 | | 3 | |
| | | Improve Code Quality | 5 | | 5 | |
| 5 | Finishing the Implementation of the Initial Architecture | | | | | |
| | | Remove Redundant Calculations | 3 | | 3 | |
| | | Utilize Library for detecting Object dimensions | 5 | | 5 | |
| | | Create a React Video Component | 3 | | 3 | |
| | | Investigate and Fix startup Time | 5 | | 3 | |
| | | Fix Windows Development setup | 3 | | 3 | |
| | | Create a React Video Overlay | 3 | | 3 | |
| | | Build Process Video | 1 | | 1 | |
| | | Update Container Images | 2 | | 0 | |
| 6 | Refine component parts | | | | | |
| | | Initialize Build/Deployment Documentation | 3 | | 1 | |
| | | Initialize Technical Documentation | 3 | | 2 | |
| | | Initialize User Facing Documentation | 3 | | 3 | |
| | | Setup and Test analyzing with Cuda and Rocr | 3 | | 3 | |
| | | Properly use CSS | 2 | | 2 | |
| | | Reduce Initial Connection Time | 2 | | 2 | |
| | | Automate SBOM Generation | 3 | | 5 | |
| | | Setup Docker Compose | 3 | | 3 | |
| | | Separate Model Downloading from Running | 3 | | 5 | |

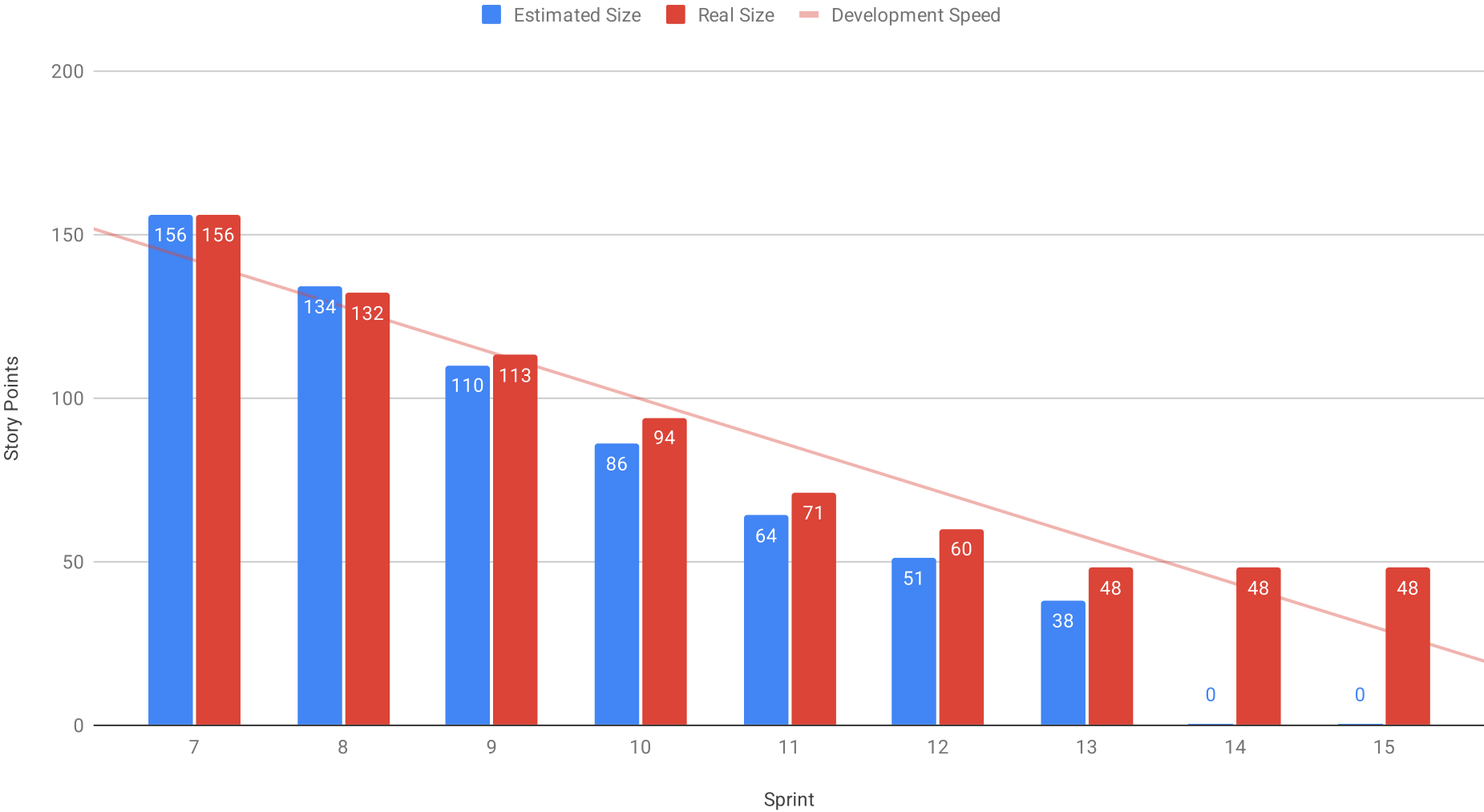
Burndown Chart



| Sprint | Goal | Feature Name | Est. size | Est. remaining | Real size | Real remaining |
|----------|---|---|-----------|----------------|-----------|----------------|
| Release | | | | | | |
| Total | | | 156 | 156 | | |
| Sprints | | | | | | |
| 7 | Improve Extensibility and Documentation | | 22 | 156 | 24 | 156 |
| 8 | Refining the overall look and feel | | 24 | 134 | 19 | 132 |
| 9 | Project integration with real SFU | | 24 | 110 | 19 | 113 |
| 10 | Technical Improvements and Experiments | | 22 | 86 | 23 | 94 |
| 11 | Refactoring and Testing | | 13 | 64 | 11 | 71 |
| 12 | Refining the Frontend | | 13 | 51 | 12 | 60 |
| 13 | Performance Improvements | | 38 | 38 | 0 | 48 |
| 14 | Finalizing the Documentation and Preparing for Demo Day | | 0 | 0 | 0 | 48 |
| 15 | Reflecting on the Project | | 0 | 0 | 0 | 48 |
| Features | | | | | | |
| 7 | Improve Extensibility and Documentation | | | | | |
| | | Extensible Object Analysis | 3 | | 2 | |
| | | Send Object Location (x, y, z) relative to Camera | 3 | | 5 | |
| | | Move to pyproject.toml | 3 | | 2 | |
| | | Reduce Container Size | 3 | | 1 | |
| | | React Metadata Widget | 2 | | 3 | |
| | | Reduce Inference Time | 3 | | 3 | |
| | | Transported Metadata Usage | 5 | | 8 | |
| 8 | Refining the overall look and feel | | | | | |
| | | Ability to Hide Overlay | 1 | | 0 | |
| | | Debounce Detections in Metadata Widget | 3 | | 3 | |
| | | Add Support for Yolo11 | 2 | | 1 | |
| | | Create Make Targets for ONNX Export | 1 | | 1 | |
| | | Run MiDaS via ONNX | 2 | | 2 | |
| | | Overlay Flickering When Zoomed-in / -out | 3 | | 2 | |
| | | Clearing Overlay Unreliable | 2 | | 2 | |
| | | Overlay Drawn Out-of-bounds | 2 | | 1 | |
| | | Disconnecting Unreliable | 3 | | 3 | |
| | | Document Analyzer API Endpoints | 2 | | 1 | |
| | | Create Object Filter | 3 | | 3 | |
| 9 | Project integration with real SFU | | | | | |
| | | Smoother Overlays | 5 | | 5 | |
| | | Add Support for Depth Anything V2 | 3 | | 2 | |
| | | Standalone Model Downloading | 2 | | 2 | |
| | | Run on real Hardware | 2 | | 2 | |
| | | Video Stream from File | 3 | | 3 | |
| | | Backend Logging | 3 | | 2 | |
| | | Frontend Logging | 3 | | 1 | |
| | | Low Confidence Filter | 3 | | 2 | |
| 10 | Technical Improvements and Experiments | | | | | |
| | | Prometheus for Backend | 3 | | 3 | |
| | | Keep Metadata In Sync | 5 | | 8 | |
| | | Calibration Guide | 2 | | 1 | |
| | | Add Detection Threshold | 3 | | 3 | |
| | | Evaluate Apple Depth Pro | 2 | | 2 | |
| | | Label Mapping in Backend | 3 | | 2 | |
| | | Support multiple languages | 2 | | 2 | |
| | | Dark Light mode | 2 | | 2 | |

[illegible]

Burndown Chart



| Type | Link / reference |
|------|------------------|
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| # | Context | Name | Version | License |
|----|--------------------------|---|----------|--|
| 1 | Frontend (React UI) | npm:react | 18.3.1 | MIT |
| 2 | Frontend (React UI) | npm:react-dom | 18.3.1 | MIT |
| 3 | Backend (FastAPI API) | pypi:aioice | 0.10.1 | BSD-3-Clause |
| 4 | Backend (FastAPI API) | pypi:aiortc | 1.14.0 | BSD-3-Clause |
| 5 | Backend (FastAPI API) | pypi:av | 16.0.1 | BSD-3-Clause |
| 6 | Backend (FastAPI API) | pypi:fastapi | 0.115.10 | MIT |
| 7 | Backend (FastAPI API) | pypi:httpx | 0.27.2 | BSD License |
| 8 | Backend (FastAPI API) | pypi:numpy | 1.26.4 | BSD-3-Clause |
| 9 | Backend (FastAPI API) | pypi:onnxruntime | 1.20.1 | MIT License |
| 10 | Backend (FastAPI API) | pypi:onnxruntime | 1.20.1 | MIT License |
| 11 | Backend (FastAPI API) | pypi:onnxruntime-gpu | 1.23.2 | MIT License |
| 12 | Backend (FastAPI API) | pypi:opencv-python | 4.9.0.80 | Apache 2.0 |
| 13 | Backend (FastAPI API) | pypi:opentelemetry-exporter-otlp | 1.27.0 | Apache-2.0 |
| 14 | Backend (FastAPI API) | pypi:opentelemetry-sdk | 1.27.0 | Apache-2.0 |
| 15 | Backend (FastAPI API) | pypi:opentelemetry-semantic-conventions | 0.48 | Apache-2.0 |
| 16 | Backend (FastAPI API) | pypi:prometheus-client | 0.21.0 | Apache Software License 2.0 |
| 17 | Backend (FastAPI API) | pypi:pydantic | 2.12.3 | MIT License |
| 18 | Backend (FastAPI API) | pypi:timmm | 1.0.22 | Apache-2.0 |
| 19 | Backend (FastAPI API) | pypi:transformers | 4.49.0 | Apache 2.0 License |
| 20 | Backend (FastAPI API) | pypi:ultralytics | 8.3.58 | AGPL-3.0 |
| 21 | Backend (FastAPI API) | pypi:uvicorn | 0.38.0 | BSD-3-Clause |
| 22 | Backend (FastAPI API) | pypi:websockets | 15.0.1 | BSD-3-Clause |
| 23 | Frontend (React UI) | npm:@types/react | 18.3.12 | MIT |
| 24 | Frontend (React UI) | npm:@types/react-dom | 18.3.1 | MIT |
| 25 | Frontend (React UI) | npm:@typescript-eslint/eslint-plugin | 8.16.0 | MIT |
| 26 | Frontend (React UI) | npm:@typescript-eslint/parser | 8.16.0 | BSD-2-Clause |
| 27 | Frontend (React UI) | npm:@vitejs/plugin-react | 4.3.4 | MIT |
| 28 | Frontend (React UI) | npm:autoprefixer | 10.4.22 | MIT |
| 29 | Frontend (React UI) | npm:eslint | 9.17.0 | MIT |
| 30 | Backend Dev Dependencies | pypi:mypy | 1.13.0 | MIT |
| 31 | Backend Dev Dependencies | pypi:onnx | 1.19.1 | Apache License v2.0 |
| 32 | Backend Dev Dependencies | pypi:onnxsript | 0.5.6 | MIT |
| 33 | Backend Dev Dependencies | pypi:onnxsrim | 0.1.75 | MIT |
| 34 | Frontend (React UI) | npm:postcss | 8.5.6 | MIT |
| 35 | Frontend (React UI) | npm:prettier | 3.4.2 | MIT |
| 36 | Backend Dev Dependencies | pypi:pytest | 8.3.3 | MIT |
| 37 | Backend Dev Dependencies | pypi:pytest-asyncio | 1.2.0 | Apache License v2.0 |
| 38 | Backend Dev Dependencies | pypi:reuse | 4.0.3 | Apache-2.0 AND CC0-1.0 AND CC-BY-SA-4.0 AND GPL-3.0-or-later |
| 39 | Backend Dev Dependencies | pypi:ruff | 0.7.0 | MIT |
| 40 | Frontend (React UI) | npm:tailwindcss | 3.4.16 | MIT |

| # | Context | Name | Version | License |
|----|---------------------|----------------|---------|------------|
| 41 | Frontend (React UI) | npm:typescript | 5.6.3 | Apache-2.0 |
| 42 | Frontend (React UI) | npm:vite | 6.0.3 | MIT |
| 43 | Frontend (React UI) | npm:vitest | 2.1.5 | MIT |

| Last Name | First Name | Value | | | | | |
|--|------------|-------|--|------|------------------|--|--|
| Samdani | Sarib | 3 | | 3.00 | OK | | |
| Chinbat | Anuun | 3 | | | | | |
| Badura | Emil | 3 | | | | | |
| Assenbaum | Paul | | | 0 | No size | | |
| Mantsch | Christoph | | | 1 | Trivial size | | |
| Asadi | Zohreh | 3 | | 2 | Small size | | |
| | | | | 3 | Medium size | | |
| Hilgers | Felix | | | 5 | Large size | | |
| Goldschmidt | Georgina | | | 8 | Very large size | | |
| Zinn | Benedikt | | | 13 | Too large (size) | | |
| | | | | | | | |
| How to play planning poker | | | | | | | |
| | | | | | | | |
| 1. Everyone type their number into their value field, don't hit return yet | | | | | | | |
| 2. Someone, perhaps a product owner, count down 3.. 2.. 1.. | | | | | | | |
| 3. Then, everyone hit return to submit their value | | | | | | | |
| | | | | | | | |