Recording System for Data Driven Research and Development in RoboCup

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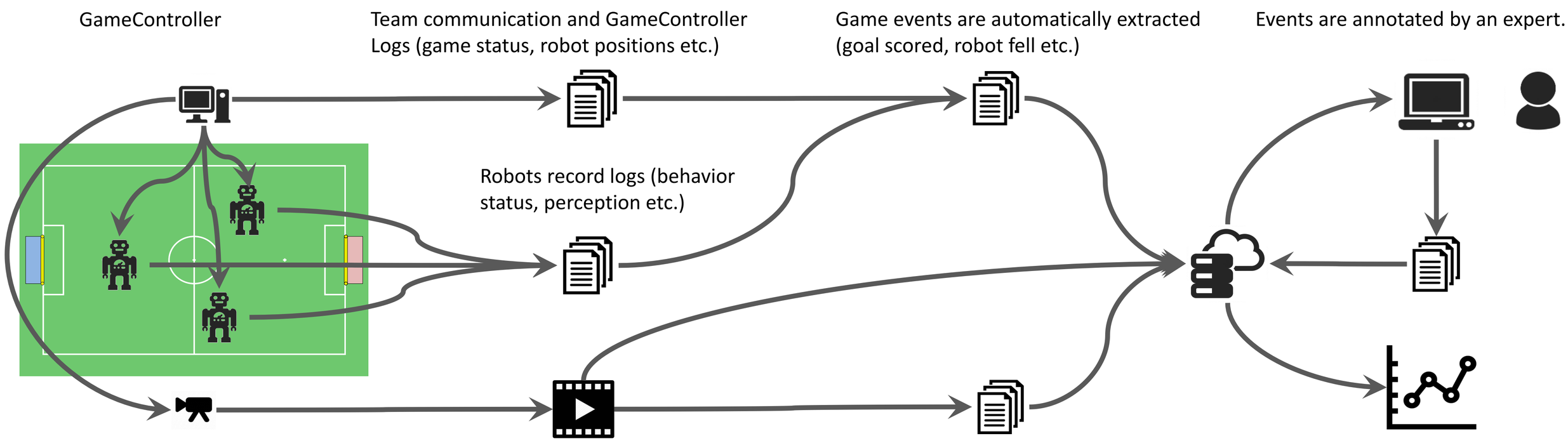
Systematic Data Collection during RoboCup Games

RoboCup provides a unique common test scenario for robotics involving hundreds of games and robots. To realize the full scientific potential of this largescale experiment we require a set of empirical **methods** and **practices** for **evaluation** and **comparison** of proposed models and solutions.

`robocup.tools` - is a workflow and a collection of tools to support **collection, organization and analysis** of large amounts of RoboCup specific data and promote data driven research and development in RoboCup. A core component is the recording system for **automatic recording** of RoboCup videos **synchronized** with other log data collected from the robots, like team communication, and log data from the individual robots. In this project the system was upgraded with new cameras and more stable software. We also report on main features of the overall project and the collected data.

`robocup.tools` ecosystem



Video recording synchronized with the game.

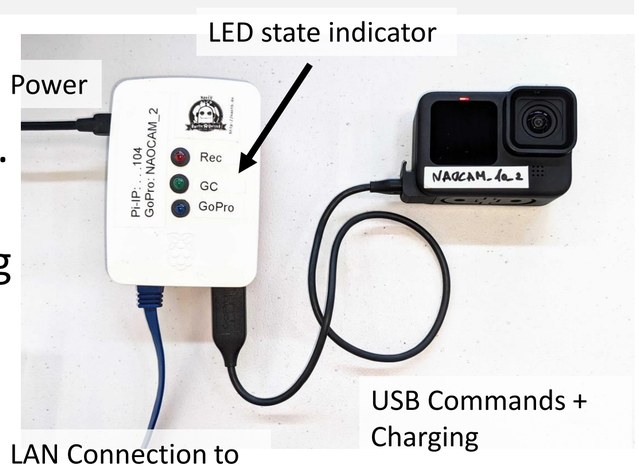
Video of the game

Additional information is extracted from the video, like positions of robots, ball etc.

Annotated data is used to improve algorithms or validate predictions.

Hardware

New Cameras: GoPro 10
Provides high quality recordings. API for controlling the camera over a USB making the recording more reliable (as compared to WiFi connection in the previous version). Recording IMU data (can be used for alignment of the camera). HDMI port (with an extension) can be used for streaming.



Recording Server
Customized Recording Computer based on RaspberryPi with light indicators. Powered USB-Hubs to ensure the cameras are changed through the entire tournament.

Key Features and Highlights

Online annotation tool based on CVAT with automated pre-labeling using Yolov5.
CVAT: https://github.com/opencv/cvat

- Systematic and Automatic Recording
- Synchronization with other log data from the robots
- **Open Source** - All tools developed within this project and the collected data are made publicly available.
- Extensible – code and data are publicly available

Milestones

The project *robocop.tools* has a successful history within the RoboCup community. These milestones illustrates the project's development and impact.

- Grants: RCF 2017, 2018, (2020*), 2023, Media Commission / HU 2018
- Collected Data: In the past years we collected significant amounts of data from RoboCup events. RoboCup 2019, 2022, 2023*, GermanOpen 2019, GORE 2023
- 2017 first experimental deployment
- 2022 SPL technical challenge based on the recorded data - teams developed tools extending the toolbox;
- 2023 Video Recording is Part of the Rules in the SPL

http://robocup.tools