Electrical design 2019

Main Architecture

With the experiences of the previous generations we decide to focus the redesign of the electronics for the new platform on safety and reliability.

This results in

- Modules based on their primary functionality
- Wiring minimised and more reliable connectors resulting in
    - IO modules connected via ethernet,
    - minimizing the use of USB connectors
- Start of status monitoring of the various sub systems

For safe testing of the robots an additional module will be added to each robot. Together with a safety button at the side-line all the robots can be stopped immediately via an independent communication channel. However during a match these additions will be not available.

IO Architecture

Table 1 shows various electronic modules of the robot. Main submodules (2-5) are controlled directly by the central processor.

	Main modules	Sub modules	Control line(s)
1	Central processor		LAN / USB
2	Motor control		LAN
3	Camera		LAN
4	Compass		USB
5	IO controller		LAN
5a		Safety block	dig io
5b		HV generator	dig io
5c		Kicker HV switch	dig io
5d		Battery control	dig io

Off the shelf modules *Motor control* (2) and *Camera (3)* have already build-in LAN connectors.

Today the Compass module (4) is still connected to the Central Processor via an USB link. It is foreseen for 2020 that this module will be adapted with a ethernet connection as well.

All IO with a moderate or low refresh-rate are connected to IO-controller (5). Data from and to IO-sub-modules (5a to 5d) is controlled by this IO-controller.

IO-Controller (5)

This Arduino based controller handles

- Life-sign signal from the Central processor (1)
- Various sensors of the robot like battery temperature and charge levels and more,
- Human/operator interface like buttons and status displays
- Other more specific designed sub-modules (5a to 5d)

Safety block (5a)

A sperate system checks a.o. the life-sign signal generated by the Central processor and transferred by the IO-controller. If this life-sign signal is missed or any other warning signal is entered , all the powerful IO will be shut-down:

- The driving motors will be freed,
- Kicking signal will be blocked,
- HV generator will be switched of,
- HV capacitors will be discharged

A separate display will show the status of this so called ‘safety-block’.

HV Generator (5b)

This generator transforms power voltage of 48V to 400V needed to load the kicker capacitor bank. A new design is capable to load the capacitors faster than our previous solutions.

Start signal coming from the IO-controller, filtered by the safety-block, will start the conversion process. A direct serial link to the IO-processor presents the status of the conversion: voltage level, board temperatures, etc..

Kicker HV switch (5c)

A fully galvanic isolated switch connects the kicker coil to the HV capacitor bank. It is mounted close to the capacitors and so minimizing the overshoots (stress !) at the switching transistors.

Battery control (5d)

A set of special sensors records the status of the two battery banks (24V and 48V nominal). Temperature (specific at charging) and charge level will be indicated to the IO-controller by specific IO lines. Other long term status signals will be send to the IO-controller via a dedicated serial line.