# Der Robot

## Operation Sequence

The sequence if decided into the following positions:

### Starting Position

Each Robot starts on one side of the field, the distance to the Lego-dispenser is chosen randomly. The positioning sideways can be chosen by the teams. Each team has an additional 3 Lego stones available, for example as assistance for orientation.

As soon as the starting signal is sent, both robots drive forward to get the first stone.

### Front Position - "Getting-Position"

With the aid of a distance sensor, Klaus is able to determine, if he reached the front dispenser. As soon as he got the stone with his magnet grabber, he drives backwards to the position of the tower.

### Back Position - "Wait-Position"

While driving back, an additional distance sensor checks for the freely placed stone and he stops. He waits until the partner robot confirmed, that they placed their stone, then turns.

### Back Position - "Setting-Position"

After a quarter turn, Klaus locks the stone into position. Then, he raises his arm again, turns back and sends the confirmation to the other robot.

This sequence will be repeated until out robot placed the ninth stone. While the other robot gets the lighthouse apex, Klaus sends the final message to the lighthouse, confirming that his part is achieved.

## Mechanical System

The mechanics is divided into three parts. The Base is the chassis, responsible for the movement. The four wheels of the robot run between the Lego knobs on the ground, guiding him like rails.

The main part is located on top of the chassis. These parts are connected by a turning support pole, on top of which is a cog wheel, allowing it to turn. The complete electronics is situated on top of this. On the main parts side, there are two rails guiding a grappler, the height of which can be changed by a toothed rack. To be able to reach the towers position without having to move in more than one direction, the grappling arm has to be extendable, realized by the rails. This only has to happen at the start, as there is a size maximum.

The most important part of the robot is the grappling arm. It is connected to the teethed rack with a motor, allowing it to move up and down. At the front of the arm, the grappler is attached, as well as the servo, enabling it to tilt. It is constructed to fit the Lego exactly. To keep the Lego in position, a magnet is integrated in the center of the grappler.

## Elektronik

Klaus has to fulfill different tasks, that can be achieved by a correct control with a print board. It was decided to use two different boards for the following reasons:

-Both plates are physically separated

-The error detections if easier

-Each of the two can design and bring into service their own board

The disadvantage of this system is, that a connection cable is needed for the connection between both boards, also increasing the space occupied.

The lower part contains:

Power supply, 12V

Transformation, 12V to 5V

Transformation, 12V to 3.3V

Three motor drivers for a total maximum of six motors, one of which is planned as a reserve if one does not function properly.

**Picture**

The top board contains the following components:

IR distance sensors

Switches for start and reserve

Connection fort he vibration motor

Wifi module

Connections for the encoders

LED, used for displaying statuses

Connection to the MPC 555

Switch for reset

Both boards have the same measurements, 130mmx110mm, so that they can be stacked easier.

**Picture**

## Informatics

The software is programmed with the language «Java». To achieve a clear program, and to be able to test singular parts more efficient, the program is divided into several subprograms, each executing only few tasks.

To be able to drive and turn, as well as moving the arm, Klaus utilizes multiple motors. They are able to drive to a set position and keep that position as well.

The communication is done by WLAN. In the beginning, a signal is sent to the other robot and will be confirmed by them, to check if the communication is working. Other signal used are a starting signal, a signal to confirm, that a stone is set, and a signal to the lighthouse to sign, that the task is done.

The robot’s orientation is done by IR-distance-sensors. The last few values are averaged, and if one value drops out of line, Klaus knows, that he hit an obstacle.

To visualize problems during the run, LEDs show some statuses. The one system, most likely to cause problems, is the communication, so the most important status is, if the connection is working.

To coordinate those subprograms, a main class is needed. This class manages the sequence and delegates the tasks to the other classes.