



**MIDDLE EAST TECHNICAL UNIVERSITY**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**EE-494 SENIOR DESIGN COURSE**

**CONVOY PROJECT**  
**STANDARDS REPORT**

**09 March 2018**

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### I. INTRODUCTION

A set of rules are required for the projects involving multiple groups working together, so that the groups can coordinate and cooperate to their fullest to achieve a goal. This purpose is fulfilled by the standards committee, which aims to define this set of rules called standards.

This document is the final report highlighting the standards set for the “Platoon (convoy)” project. It contains the details of the standards set under the supervision of the coordinator and with the mutual agreement of the teams participating in the project. This report also describes the structure and operation of the standards committee for the project.

### II. PROJECT DESCRIPTION

This project requires each group to design an autonomous robot. The robot is a part of a convoy, which is led by a leading robot (mock up robot). The whole convoy moves according to the movement of the leading robot. When commanded externally, the autonomous robot is required to leave the convoy and re-join the convoy as the last robot. The autonomous robot should signal when leaving the convoy (leaving flag) and recognize the signal of the last robot in the convoy and take its place. This robot is then signalling being the last in the convoy.

### III. THE STANDARDS COMMITTEE AND ITS OPERATIONS

#### The Structure of the Standards Committee

- **Coordinator Faculty Member:** Prof. Dr. Aydan Erkmen
- **Chairperson:** Abdullah Aslam
- **Scribe:** Tugce Numanoglu
- **Number of Participants:** 5

#### The Operations of the Standards Committee

The standard committee held 4 meetings, one each week. Each week, new standards were set, and few were revised. The breakdown of set and revised standards is as follows:

- Week 1,
  - Standard issues are specified
    - Markers and Flags
    - Physical Standards

- Leaving protocol
  - Visibility markers options are discussed
- Week 2,
  - Agreed on visibility markers
  - Mock-up Movement limitations are set
  - Suggestions for last one signal and leaving signal are given
  - Physical Standards are discussed
- Week 3,
  - Mock-up Movement limitations and physical standards are revised
  - Last one signal and leaving signal are discussed
- Week 4,
  - Synchrony between “Leave-the- line” and “Last-in- line” signals is established.
  - Restriction (distance/time) for leaving-the- line is decided on.
  - Last one signal and leaving signal are agreed on

#### IV. PROJECT STANDARDS

Standards are listed with clear description.

##### Mock-Up Robot Movement

- 1) Maximum speed of the Mock-up robot: 12 cm/s
- 2) Radius of curvature of the Mock-up robot: 100 cm
- 3) When “Leave-the-line” command is given, mock-up has to keep the path it was following before the command was given.

##### Robot Specifications

- a) Nominal distance between robots: 20 cm
- b) There should be a flat surface from 8 cm to 12 cm (from the ground) on the left and right sides of the robot and from 4 cm to 8 cm at the back of the robot. (that surface can contain sensors)
- c) Time limitation for leaving the line: 15 s
- d) Distance requirement for leaving the line: 10 cm (distance between the sides of the robots)

##### Visibility Markers

- a) Rectangle

- Location: At the back of the robot, in the middle of the horizontal edges of the robot
- Centre of rectangle height: 16 cm from the ground

- 57 mm 7 segment display's boundaries colored with green layer of 2.5cm width (Previously undefined)

**b) Continuously Illuminating High Power IR LED** (Previously it was two regular IR LEDs)

-Location: Placed at a height of 10 cm from the ground at the horizontal center of the robot. (Previously at the sides of the robot)

The led shall have the following characteristics.

1) Power led with consumption of 1 watt.

2) integrated lens with a radiation angle of 140 degrees.

-Signal: Continuously illuminating

### **“Leaving-the-Line” Flags**

**a) Blinking IR LED**

- Use the same IR LED used as visibility markers

- Carrier Frequency: 38 +-20% kHz (no carrier frequency was used previously)

- Signal: Off-Time: 100 +-30% ms; On-Time: Between 100ms and 500ms (Previously a 5Hz signal)

**b) Number eight**

-8 is shown on the seven-segment display

### **“Last-in-Line” Flags**

**a) Blinking IR LED**

- Use the same IR LED used as visibility markers

- Carrier Frequency: 38 +-20% kHz (no carrier frequency was used previously)

- Signal: Off-Time: 200 +-30% ms; On-Time: Between 100ms and 500ms (Previously a 2 kHz signal)

**b) Laser Beam**

- Height of the laser beam: 10 cm from ground

- Location: Placed at the left and right sides of the robot at the far back edges

### **Synchrony between “Leave-the-Line” and “Last-in-Line” signals**

**a) “Leaving-the-line” signal must be turned on when the “Leave-the-line” command is given by the group.**

**b) “Leaving-the-line” signal must be turned off when the robot re-joins the convoy as a last robot keeping the specified distance (20 cm) from the robot in front.**

c) "Last-in-line" signal must be given by the re-joined robot when it turns off the "Leaving-the-line" signal.

d) "Last-in-line" signal must be turned off by the previous last robot when it detects a robot at specified distance (20 cm) behind.

LELZ Industries:

Member Name:

Signature:

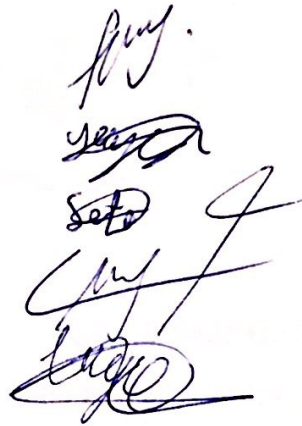
Fiona Pollosika

Yazın Ören

Sefer Burak Okcu

Gağınur Tekereköglü

Tuğçe Numanoglu



OJO:

Member Name:

Signature:

Umut Can Serçe

Anar Abdullayev

Syed Saad Saif

Abdullah Aslan

Bulut Ulukapi

