

# KN2C 2016 Team Description

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**Abstract.** This paper is a summary of the latest works done by the KN2C SSL team. In this paper we will highlight the main improvements in hardware and software systems. Over the previous years, slight improvements were made in the software system and the hardware system have not changed much. Major changes in the robot's hardware system are being done which will be explained briefly.

## 1 Introduction

“KN2C” small size soccer team, founded in 2009, is part of the Advanced Robotics and Automated Systems (ARAS) Lab. This team has participated in six Iran Open Small Size League competitions.

In this paper we introduce the latest changes in hardware and software systems.



Fig. 1. Our Robots

## 2 Electronics

Each robot consists of a main board, four driver boards and a kick board, each of them will be introduced in the following.

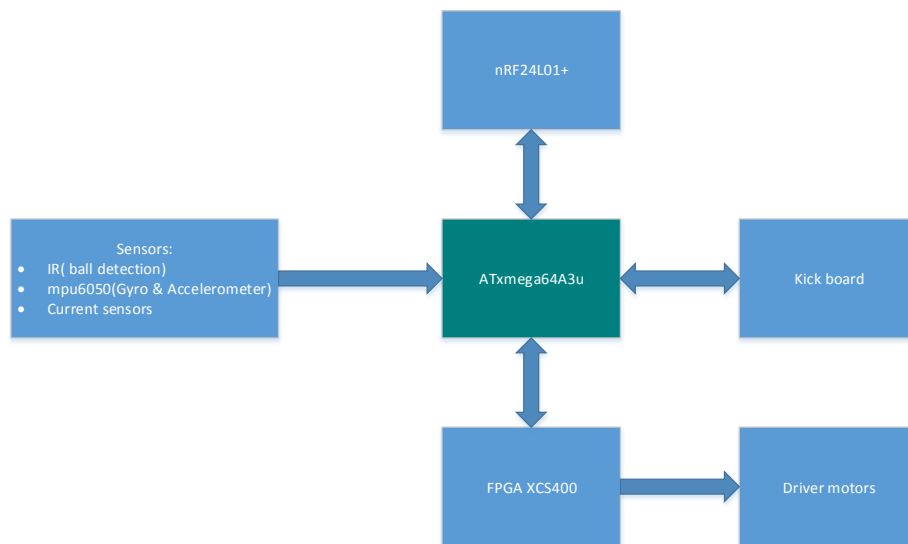
### 2.1 Main Board

There are two processors in each board, an ATxmega64A3U and a FPGA XCS400. ATxmega64A3U is the main processor which does the following:

- motion control calculation
- wireless communication
- motors' current protection
- chip and kick ordering

FPGA processor, due to its ability of parallel processing, is suitable for driving motors. It receives the OCR of each motor from Microcontroller.

We are working on replacing AVR Microcontroller with ARM Microcontroller in the main board.



**Fig. 2.** Block diagram of the electrical system.

## 2.2 Motor Drivers

BLDC Motors (Maxon EC45 Flat Motor) 30W are driven by 4 inverter boards using hall sensors.

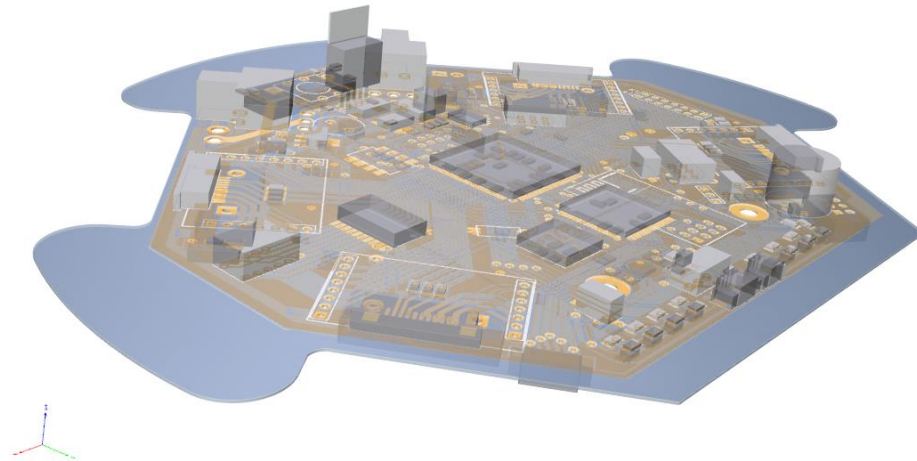
## 2.3 Wireless communication

nRF24L01+ modules are used for wireless communication between computer and robots. Operation frequency of this module is 2.4GHz. In this communication, robots speed setpoints, vision data (speed), kick speed and robot ID are sent from computer to robots. Battery voltage is sent from robots to computer.

## 2.4 Kick Circuit

In kick circuit in order to achieve the proper speed, two parallel capacitors (200V, 2200uF) are charged to the desired voltage level using a Boost circuit. Then the microcontroller from the main board produces PWM wave to give the order of straight or chip kick.

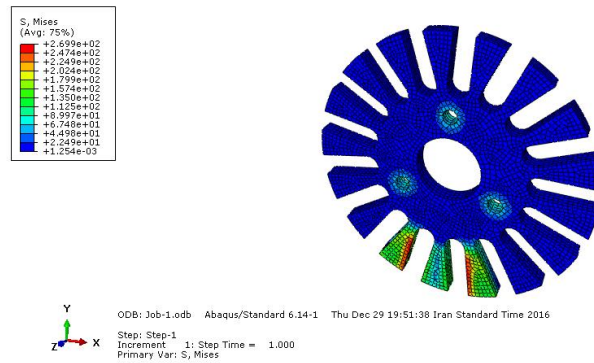
This circuit has some problems like breaking down MOSFETs. We are working on solving problems and designing a new circuit.



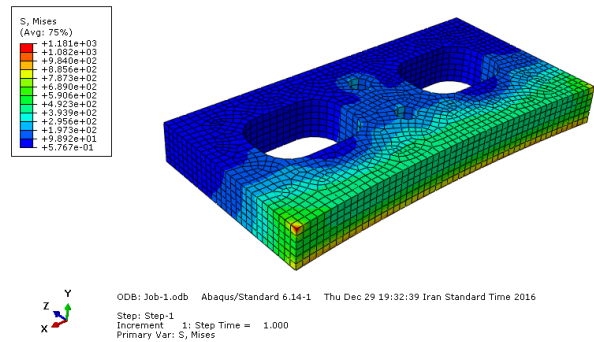
**Fig. 3.** Main Board

### 3 Mechanics

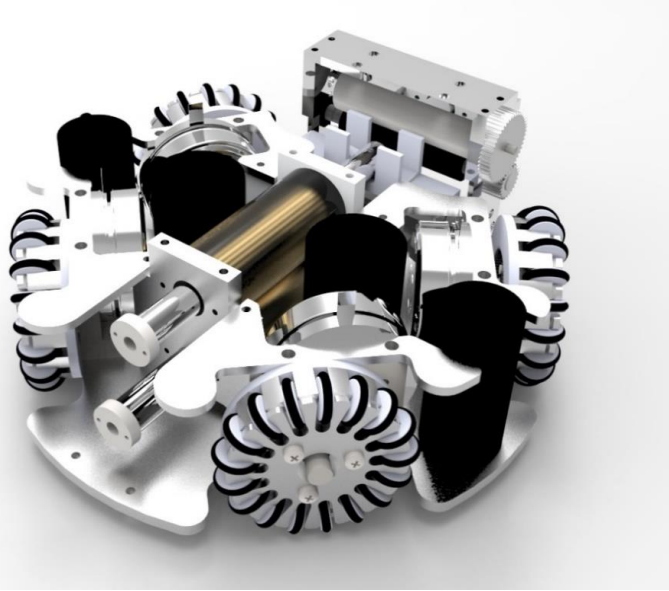
This year nearly no changes have been made in mechanics [1]. We redesigned our robot in order to use the spin back system, improve the chip's function, decrease the robot's weight and increase the robot's stability. In order to be sure of our design and materials' strength against some probable stresses during competitions, we used Abaqus CAE [2] to simulate the probable conditions.



**Fig. 4.** The wheel's hubcap after considering the forces between hubcap, pitch, and screws.



**Fig. 5.** Stresses that forced the kicker at the moment of kicking



**Fig. 6.** Robot's shape

## **4 Software**

Our system is the same as what was mentioned in the last TDP [1]. This year we are just concentrated on fixing bugs in our system. [This year we concentrated more on debugging our system.]

### **4.1 Log Player**

For debugging purposes, we need to know what exactly happens during the game. So, we are developing a log system to record the events. Unfortunately, the system is still in its developing phase and no more data is available now.

## **References**

1. Mohammad Reza Karimi Dastjerdi, Vida Zolghadr, Mohammad Amin Kashi, Mohsen Raoufi. "KN2C 2015 Team Description." In: Proceedings of Robocup 2015.
2. <http://www.3ds.com/products-services/simulia/products/abaqus/>