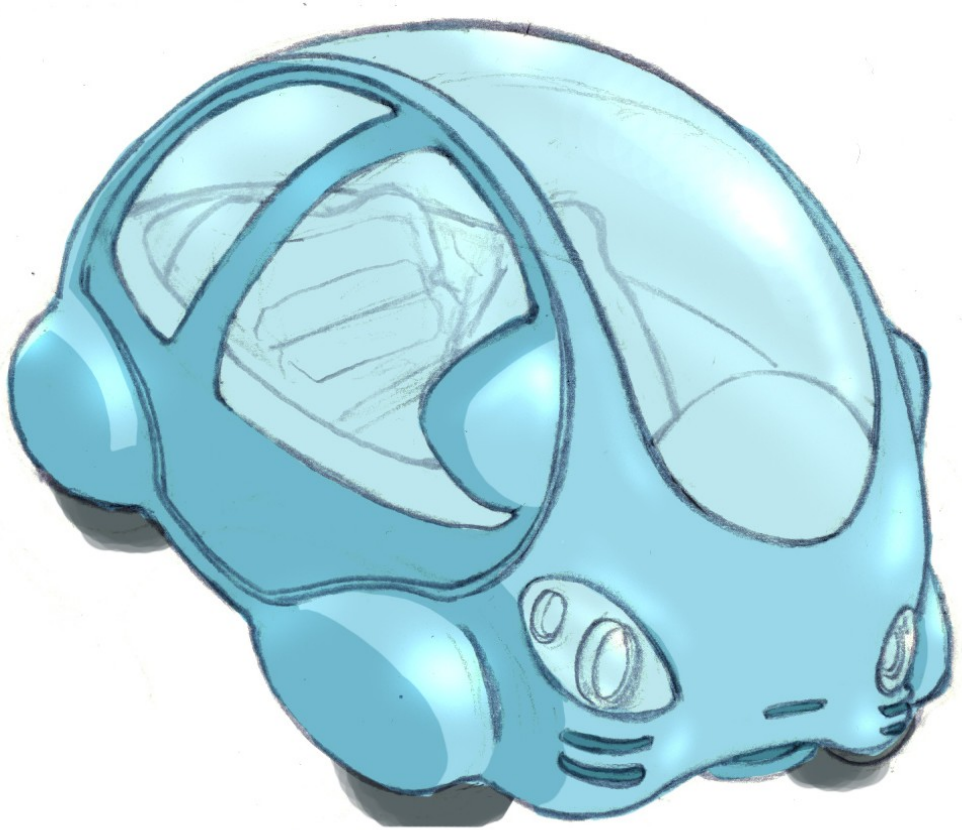
NECOCAR

International CATIA Project

2008

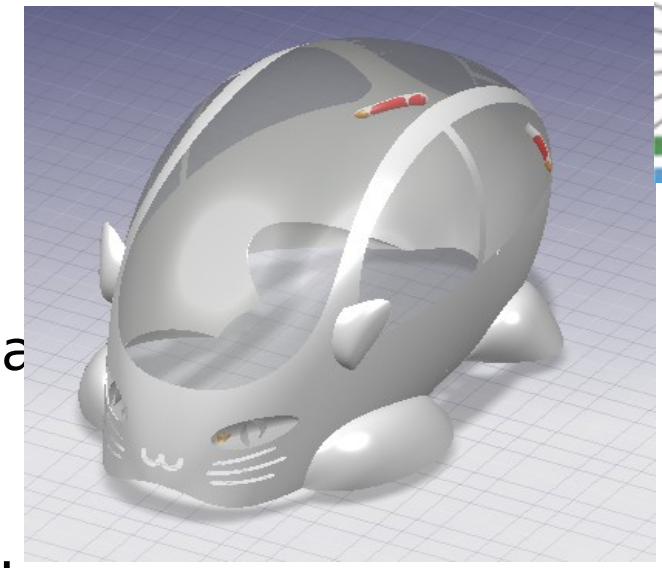
GOAL

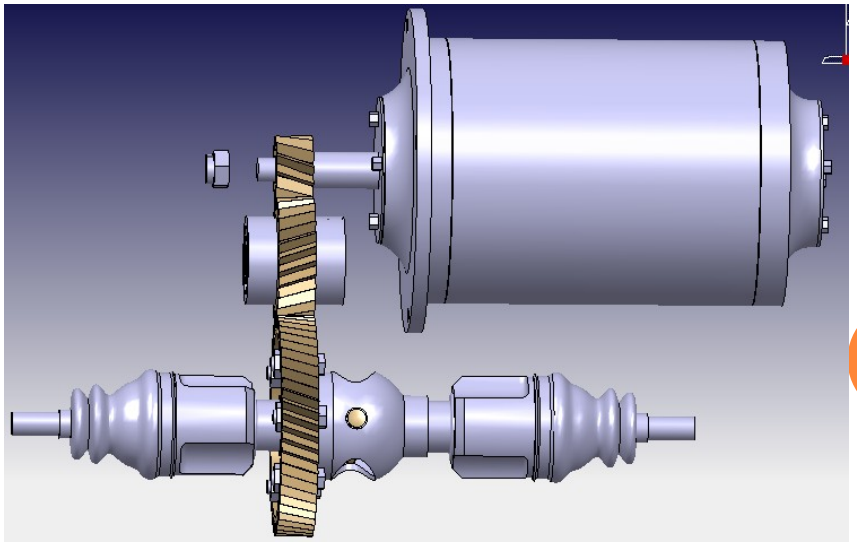
- The goal of this project is to design an electrocar for the Japanese public.
- Cute
- Comfortable
- Modern
- Ecological



ORGANIZATION

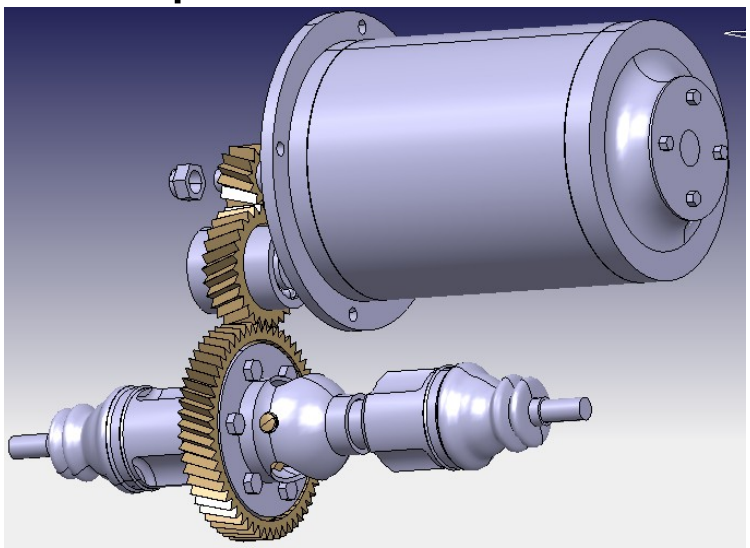
- Russe-Français
- CATIA V5 R18
- Sharing of work:
  - External part – França
    - concept and
    - design
  - Internal part – Russe:
    - electrical engine and
    - transmission chain



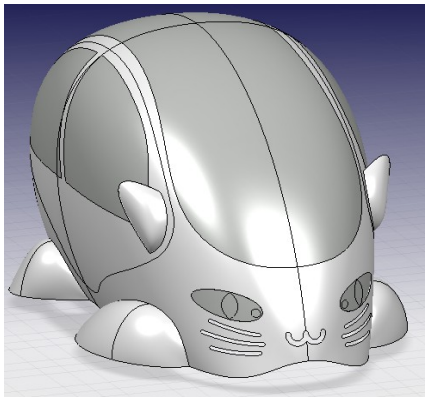


PROPERTIES

- Maximal speed – 115 kilometers per hour
- Rear wheel drive
- Sequential gearbox
- Rear motor arrangement



- Size: (length/width/height), meters – 3/1,7/1,6
- Electrical engine
- Minimal weight

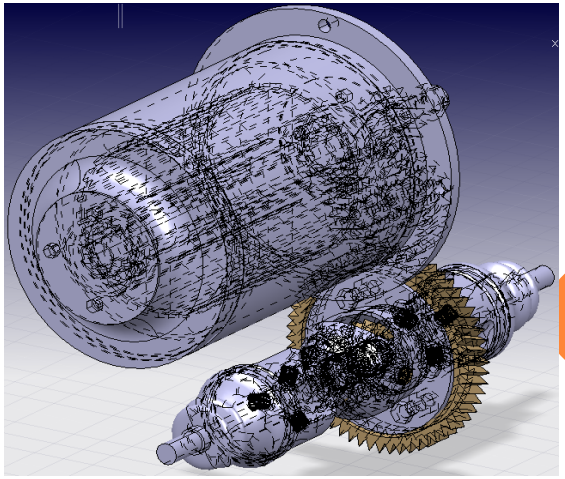


INTERNAL PART BY RUSSIAN STUDENTS)

- Independent rear suspension and size of tyres is equal 135/80R12’’
- Constant-circuit drive with DC converter-fed motor
- Motor’s power drive is supplied by DC-accumulators
- Electromechanical converter – electrical fed-motor with feedback sensor of position
- Digital system of motor controlling

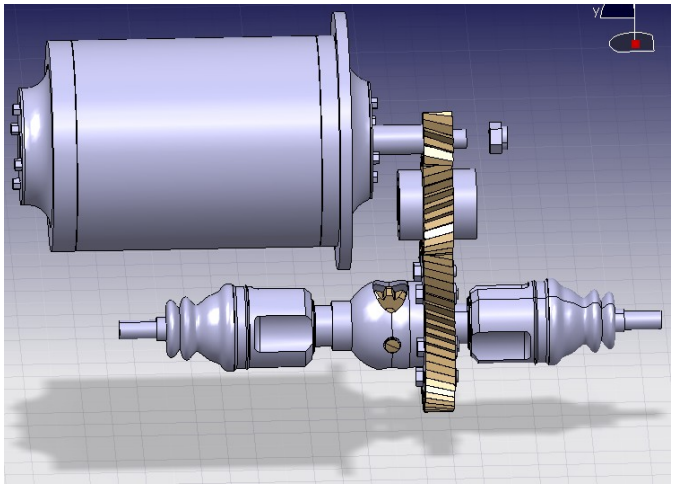
THE CONVERTER-FED MOTOR

- DC-converter-fed motor
- Synchronous electromagnetic engine with high-coercitive magnets.
- The rated voltage is 120V.
- The maximal motor’s power is 14,6 kW.
- The maximal rotating frequency is 5000 revolutions per minute.
- 3 anchor’s winding.
- 8 pole terminals.
- $Nd_2Fe_{14}B$ DC-magnet.



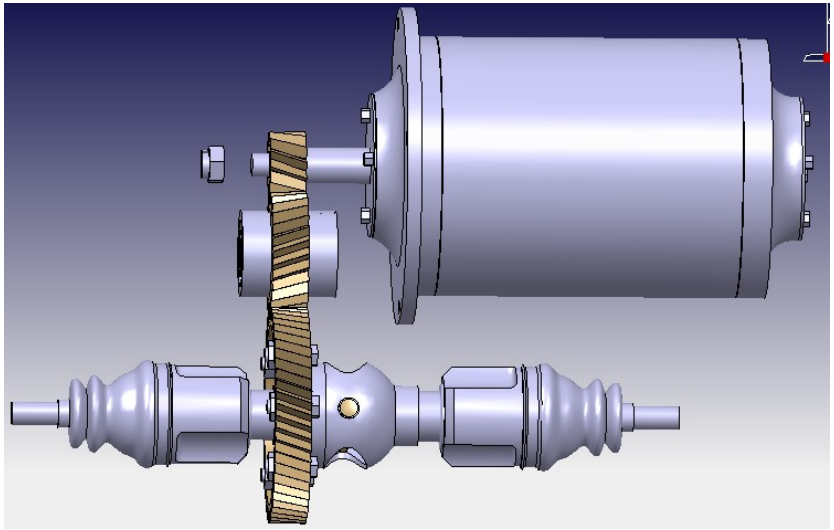
ROTOR (INDUCTOR)

- External diameter is 120 mm
- Size of DC-magnet (length/height/width) is 150/30/18 mm^2
- Shafting ‘s size (in the rotor’s centre) is 35 mm
- Radial size of rotor’s bandage is 2 mm



STATOR

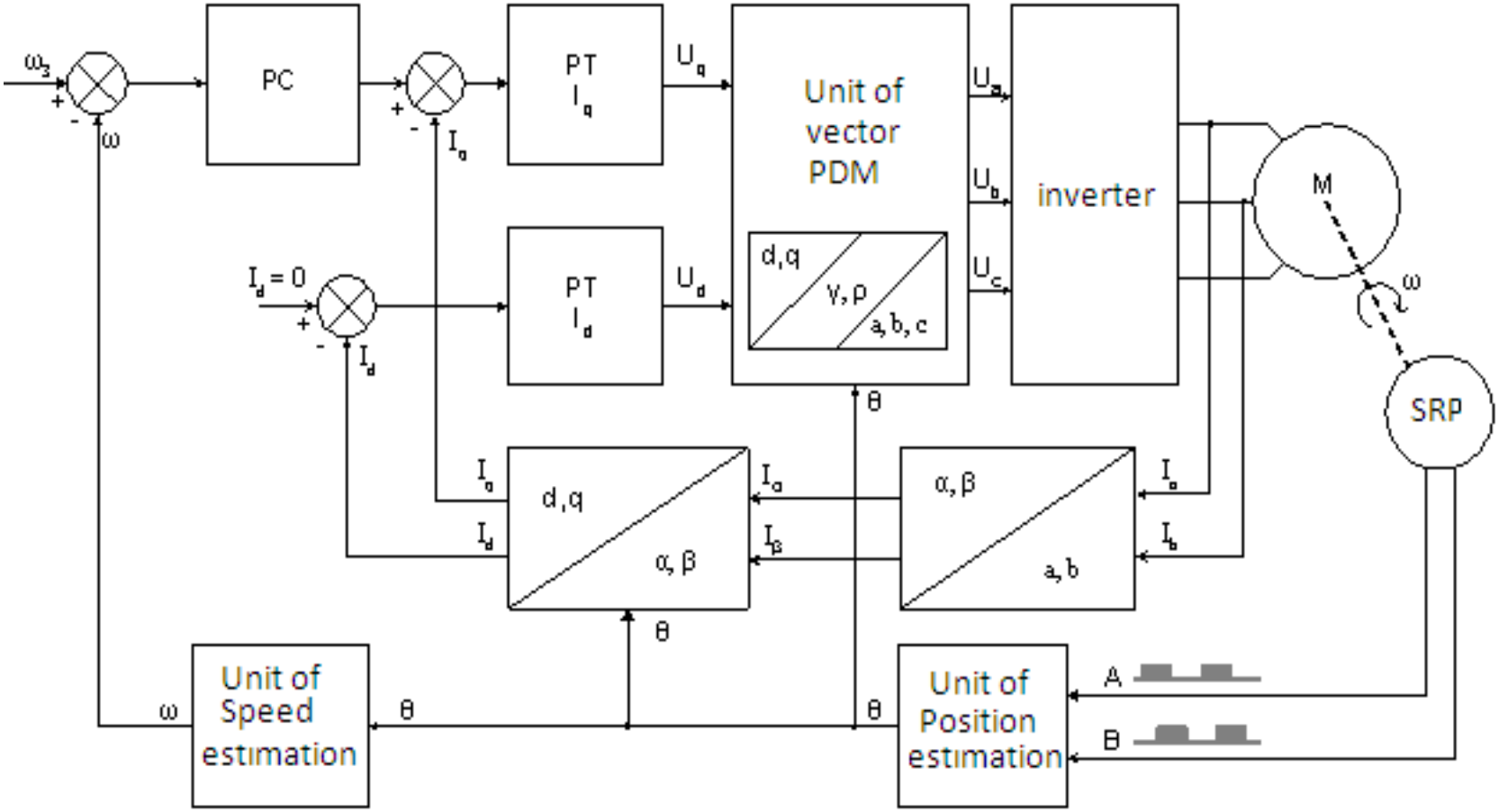
- External diameter is 165 mm
- Internal diameter is 124 mm
- Packet’s length is 150 mm
- 24 slots of stator’s winding



FRAME

- External diameter is 180 mm
- Bearing’s panels are aluminum with steel parts for bearings
- Electrical motor’s frame casing to general transmission is flange mounting
- Ball bearing with 2 gaskets type 180605
- General length of frame with bearing’s panels is 290 mm
- Size of other parts will be detailed during the process of next design of car’s general transmission.

CAR'S CONTROL SYSTEM



- SPR - Sensor of Rotor's Position
- M – motor
- PDM – Pulse-Duration Modulation
- PC - speed control of drive
- PT – circuit controller

CAR'S CONTROL SYSTEM

- Transmission is provided by rotational moment from electrical motor to wheels using the reduction gear's transfer constant is 4,3. The transmission is the integrated with the electrical motor. Car's speed control is provided by controlling of motor's rotary axis speed.

- Motor rate of rotation is ω. Signal ω_3 is speed selector formed by control pedal of car.

- SPR (Sensor of Rotor's Position) sends the signals to controller and it computes them using the units of estimation of rotor's position and velocity rate.

- According to information about phases' circuits I_a and I_b the value of phase C circuit I_c is defined and provided the transformation of these circuits to stationary coordinate system linked with stator. The transformation from stationary system of coordinates to movable, linked with current vector of stator's position allows to calculate parts of stator's circuit vector axis direct (d) as well as quadrature (q).

CAR'S CONTROL SYSTEM

- The moment of synchronous motor with dc-magnet drive is directly proportional to component of stator's vector in quadrature axis. Also for minimization of joint amount of electricity the recommended value of quadrature axis circuit is 0. The end of speed control of drive (PC) is connected to the circuit controller's input with direct axis (PT I_q) a proportional and the absence of circuit is provided to the circuit controller with direct axis (PT I_d).

- The output signals of circuit controller are proportional to result stator's voltage vector of quadrature and direct axises. The unit of vector PDM (Pulse-Duration Modulation) transforms voltage vector to polar coordinate system (g,r) linked with current rotor's position q, defines the working sector, intersected angle and then calculates the parts of basics vectors in absolute axis (coordinate system) linked to stator. Also there are forming of voltages to driver's windings U_a, U_b, U_c.

- All transformations of axises (Parck and Klarck) are real-time provided. The construction of controlling scheme is developed with typical controllers and units for different types of motors controlling. Also control scheme should include the mode of recuperation (recovery) at the case of motor braking.

TRANSMISSION CHAIN

- Transmission consists of reduction gear, idler pinion and traditional constructive differential gear.
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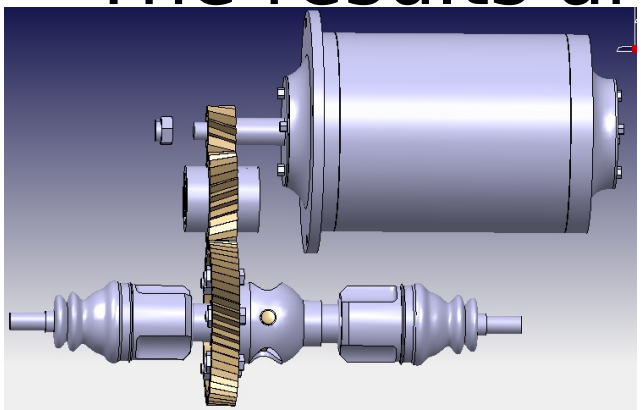
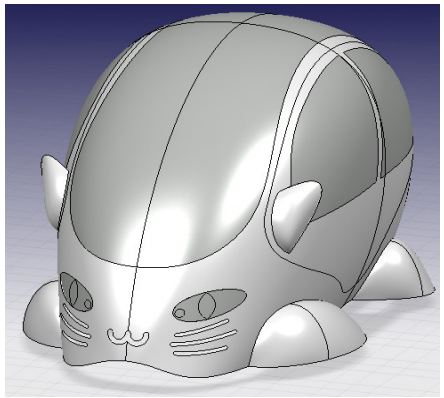
- The reduction gear is designed with the spur helical gears and the transfer constant is equal 4,3 according to data about maximum car’s speed, size of drive wheels and maximal motor’s rotation velocity.
- The idler pinion is necessary for providing optimal arrangement of motor, reduction and differential gear.

RESULTS

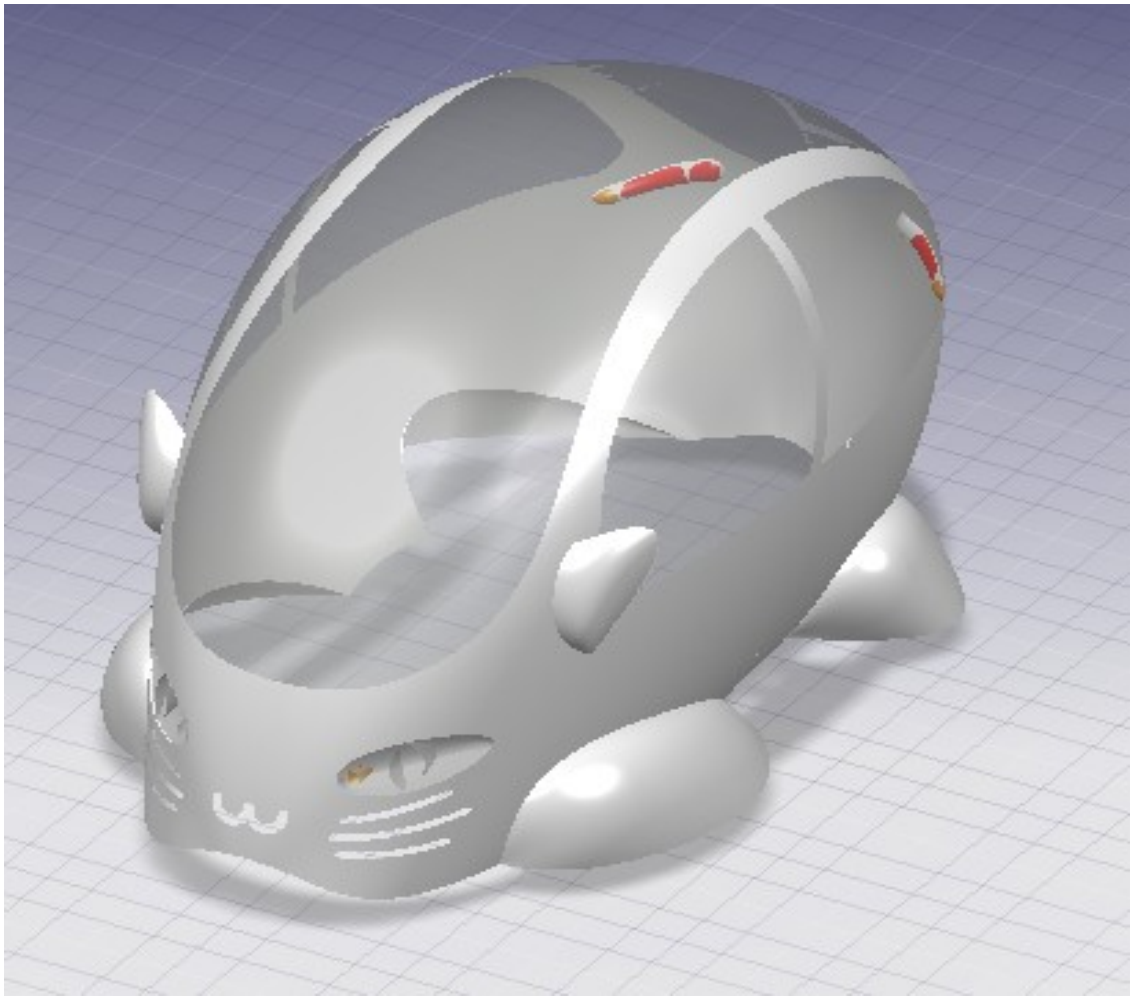
Now the students of department of Automatics and Computer Systems (TPU) taking part in this project, study the CATIA V5 software and develop the predesign sketching and solving the tasks.

The results are presented in the files.





EXTERNAL PART (FRENCH)



INTERNAL PART (RUSSIAN)