

## Project «Smart City Parking».

Hello, ladies and gentlemen! We are Rustechno team, Volya Maksim, Devyatov Leonid and Rynin Dmitriy want to show you project «Smart City Parking».

Maxim: Our task is developing smart parking with charging stations for electric vehicles to make using electric cars easier and more comfortable by that increase demand for them, reduce the number of cars with gasoline engines and, therefore, carbon emissions into the atmosphere.

Lenya: More and more people are using electric cars, but they deal with one big problem, it's charging. Nowadays we haven't enough stations for charging. Sometimes people even sell their electric cars and buy vehicles with gasoline engine.

Dima: During working, we made these goals:

- Find information about charging stations and electric cars
- Make a model of charging complex
- Develop a 'refueller' robot
- Develop a parking robot
- Absorb work with database
- Absorb layout and programming website, make http server for processing 'get' requests
- Debug connection between Raspberry and Arduino

Maxim: So, we decided to develop smart parking with charging station, it consists of parking zone and some zones for charging. This parking station serve server and two robots: refueller and parking robot.

Dima: The work of 'Smart City Parking' starts with website. Here user log in his account (for example we have 3 accounts, each of which is linked to one of the cars standing on the stand. We offer to choose 2 cars and two parking places, which will be used during showing the project). After that user gets on the page for processing of order, here customer enter number of parking place, where is his car and choose charging speed. After user press button 'Pay', data is sent from page to server, where they getting in database. All data about orders there are in database (for example information about users, data about car models, status for user, technical status and etc. For this we use some 'tables', between which we made connection). After recording data in database, special logic defines that, system should start charging, pick up optimal charging place, send message to parking robot with necessary parameters for its work

Lenya: It's parking robot, it has to transportation car from parking place to charging zone, after end of charging returns car back. For this robot we made

special electronic circuit board. Robot is compact and it can come under car. Undercarriage consist of 4 omni-wheels and Trick motors, that is all provides it with more maneuverability. For robot navigation using line sensors and gyroscope. Lifting platform for cars works from servos. Robot is controlled by Arduino and program, which was made in Arduino IDE.

Maxim: It's robot 'refueller'. It can serve some charging places. Robot gets message about delivering car on charging place. Next 'refueller' come to car, find refueling hatch and carefully open it, using first manipulator with vacuum suction cup. After robot defines type of jack in car and using second manipulator needful plug for charging, after that, using camera robot paste exactly plug in jack, after charging starts.

Lenya: 'Refueller' was made on base our special electronic circuit board< it consists of 2 manipulators, vacuum suction cup, motors for pumping out air, usb camera, raspberry pi 3 for defining type of jack in car demonstration screen. Programs for robot was written in Arduino IDE, we printed corpus using 3D printer, modeling the details was in Fusion 360 software.

Dima: We put in robot camera. Robot check type of jack using video of vision, which was written on Python and Open CV library.

Maxim: When charging finishes, robot takes of plug from car and send message to server with information of finish of charging, so that parking robot return back car to parking. Car owner gets notice of that car is charged and ready to using.

Lenya: Also, worth it consider our cars, which was made for showing robot working. We made them by 3 mm plywood, they have Arduino Nano, which control the headlights and the battery charge indicator. All electric vehicles have charging hatch in different places, also they have jacks for charging. The drawings for the clipping were made in Fusion 360, and externally, the cars are covered with color film.

Conclusion:

Maxim: We showed developed by us stand of smart parking with system of car charging.

Dima: These stations can be in different city structures.

Lenya: Let people have less problem with using electric vehicles.