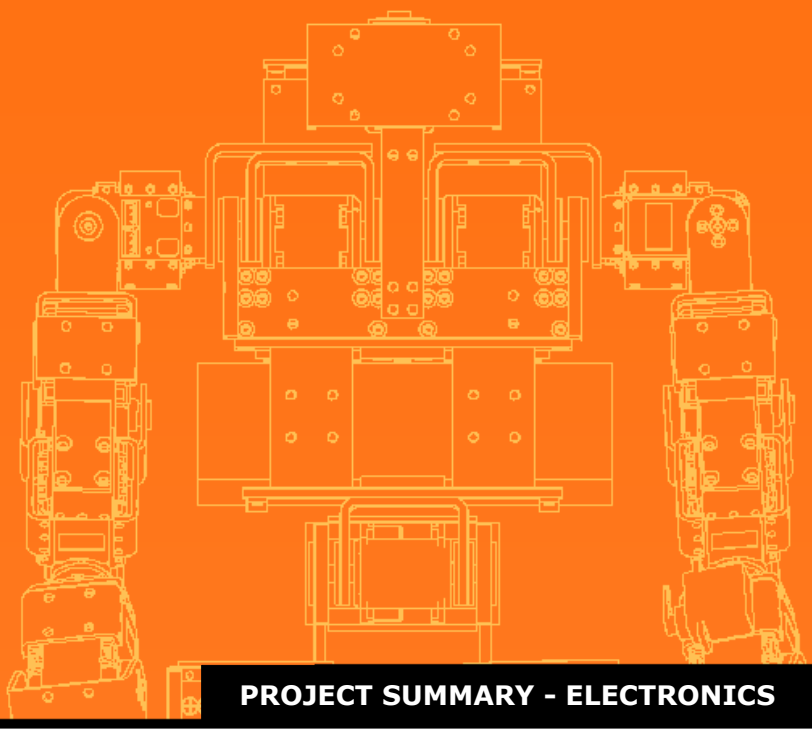
# ABASTROBOT

## THE HUMANOID PROJECT



## PROJECT SUMMARY - ELECTRONICS

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The ABASTROBOT project assumes creation of a robot which can communicate with people. For this purpose we need to create platform powerful enough to process sounds and images. The first step was a creation of a prototype, which would be able to provide mobility to robot.

We made decision to use Mini2440 development board at the fist stage, just to check the possibilities and start programming.

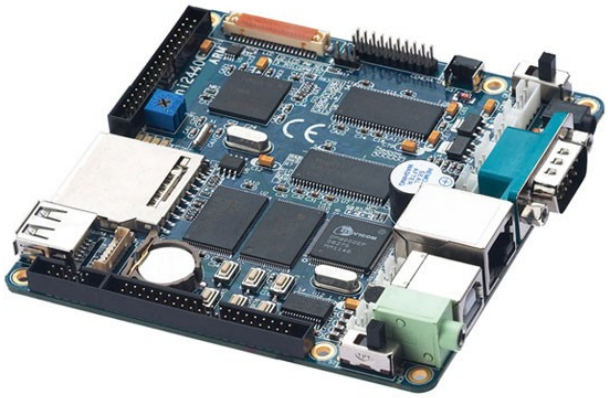
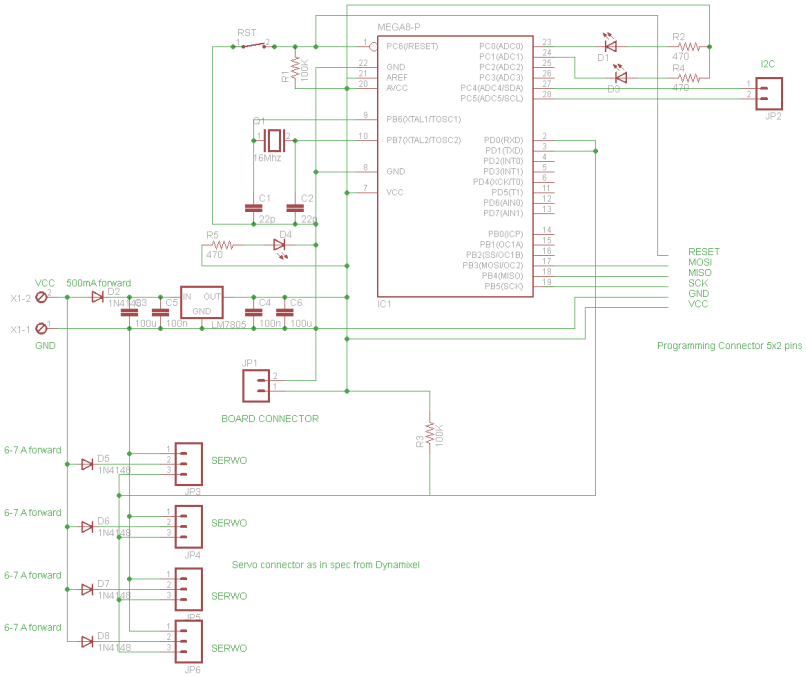


Illustration 1: Mini 2440 board

Unfortunately, the servomotors we bought were not compatible with the Mini's communication speed. That is the reason, why an additional board had to be designed.




Drawing 1: Additional servomotors controller

Actuators we have chosen use UART communication protocol at the speed of 1 Mbs. Mismatching bound rate was the only problem. That is why we used AMTEGA-16 micro-controller which gives us the ability to obtain such values.

A prototype model has been created on a universal board to be tested before.

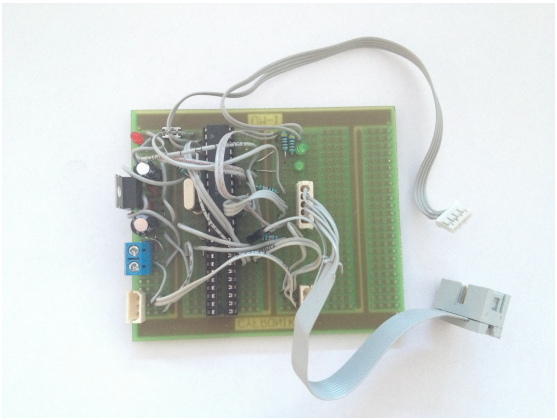


Illustration 2: Servomotors specialized controller prototype

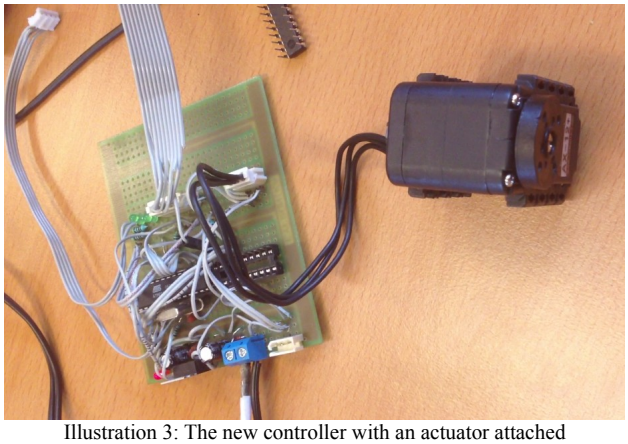
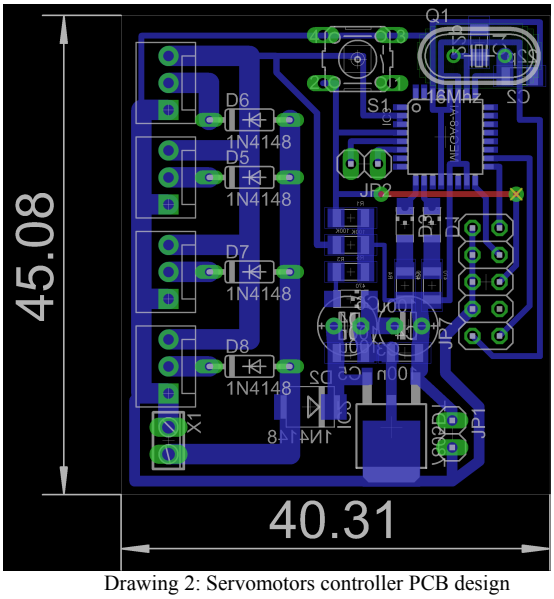


Illustration 3: The new controller with an actuator attached

We use a Dynamixel series actuators and as they need 1 Mbs connection speed and special frame that has to be send in order to execute a command on a desired servomotor, the communication protocol had to be adjusted.

The actuators can be connected in parallel. Special identification number is assigned to every single one of them. The main advantage of this kind of solution is a reduced number of connectors to the main board and a reduced number of cables, which decreases the mass and complexity of whole circuit.

Given set: Mini 2240 + specialized control board, was successfully tested and the board was miniaturized. We used SMD modules and the final effect is a board of 45x40 mm dimensions.




Drawing 2: Servomotors controller PCB design

I2C communication protocol has been chosen to provide communication between Mini 2240 and it's modules, in regarding the possibilities of parallel connection of many modules and sensors to one board connector.

Because of actuator's high power consumption we had to use routs of a great width. Under maximal load servomotor's current consumption can reach even 16 A and this is a great reason to divide the whole system into subsystems, which will consist of  a set of servomotors, that will be an equivalent to each limb. After applying such solution current load should not exceed 4 A for each connector.

Another challenge is to find proper battery for our robot. As the strongest actuators, under maximal load, can take current an equal to 4A, the whole current load of ABASTROBOT can reach 45A in peak values. Unfortunately, there is no battery available on market, that can work under such conditions for more than 15min minutes.

For a typical usage - half of the servomotors in rest state and the other working at the half capacity, 13 Ah battery should be enough for about 30 min of work. Mechanical construction allows placing a battery that meets the above conditions. Precise data will be obtained from after tests carried out on a built prototype. After that final battery will be chosen.

Next step is to add digital image processing module. Mini 2240 is the main control unit and it's task will be to balance the robot and make decisions of how to react under certain stimulus.

To decrease Min 2240 from doing hard calculations of image processing additional module will be added. The module will be communicating with 'brain' using I2C protocol, sending data about obstacles and distance from objects, and per-analyzing process.

The last step of the constitution process is a unification of all modules as specialized single board controller, which will make all the tasks above. This will miniaturize whole processing unit.