

<u>D</u>evelopment of <u>E</u>mbedded <u>System</u> Courses with implementation of <u>I</u>nnovative Virtual approaches for integration of <u>R</u>esearch, Education and Production in UA, GE, AM





Presentation of P04 Zaporizhzhya National Technical University (ZNTU) Zaporizhzhya, Ukraine

### Work in Embedded Systems Laboratory. Best students practices.

### Anzhelika Parkhomenko

PhD, Associate professor

Tbilisi 29 October, 2015



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		<ul> <li>Вбудовані операційні с</li> </ul>		<ul> <li>Моя домашня</li> <li>Сторінки сайту</li> <li>Мій профіль</li> <li>Мої курси</li> </ul>		Пошук курсів:	Застосувати
		<ul> <li>Людино-машинна взаєй</li> <li>Приклад 15.10</li> <li>Викладях: Varchenko Liliya</li> </ul>	модія	<ul> <li>Кросі</li> <li>Пілотне нарчання за планом Мікнародного проекту ТЕ</li> <li>САОІСАМІСАЕ для вбудованих систем</li> <li>САОІСАМІСАЕ ВО</li> <li>Віддалені лабораторії та віргулизація</li> </ul>		C A ar	IX CUCTEM Binshight Avkentiva Паркоменко CADICAM/CAE for Embedded Systems Am of the course: study of modern information technologies in the field of design and manufacture of Embedded Systems Hardware, as well as getting practical skills of using modern MCAD and ECAD systems
http://moodle.zntu.			edu.ua/	<ul> <li>р. / ложие нераційні системи</li> <li>Родико-нацинна взахнодій</li> <li>Родико-нацинна взахнодій</li> <li>Родико-нацинна взахнодій</li> <li>Пілотие наязникі за плаком мікнародкого проекту ТЕ</li> <li>Факультет комплотерних наух і технологой</li> <li>Факультет соклотерних наух і технологой</li> <li>Факультет соклотерних наух і технологийни даухнатет</li> <li>Факультет радовсякувания та телекомунаций</li> </ul>		C C M n tr tr tr tr tr tr	на от вала у полоти послед от ракена. Очите Лацираде Тевдій Ulanania ADICAMICAE для вбудованих систем. ета курсу: вивнення сучасних інформаційних технопол'й в галузі осогдовання практичних нареко використання сучасних MCAD та ECAD стим. Іова курсу: українська/англійська





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## FPV auto project





Zaporizhzhya, October 15, 2015







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### Moving objects control systems

Basic software requirement: •minimum response time for input parameters;

Basic hardware requirements: •compactness;

•energy consumption minimization.

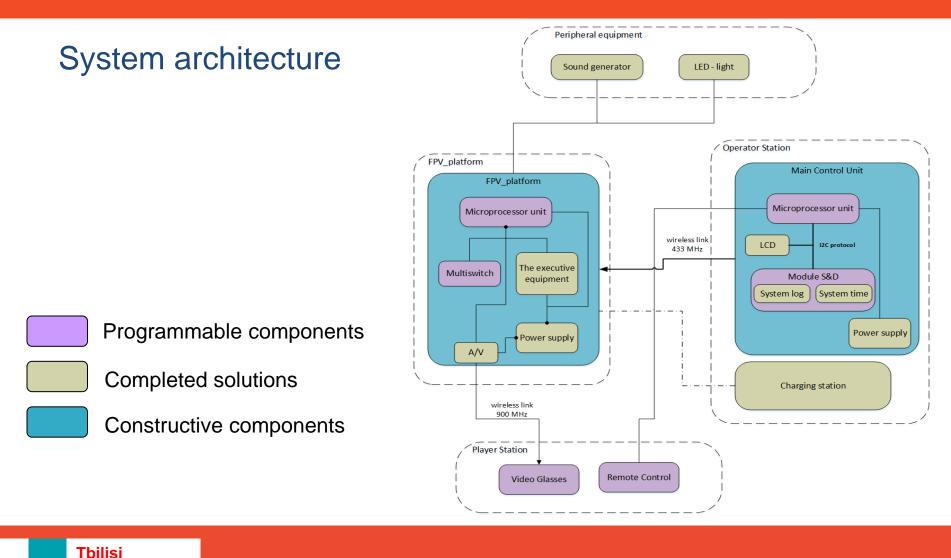
Basic system requirements •expected behavior of the system; •reliability; •durability.



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#### Zaporizhzhya National Technical University

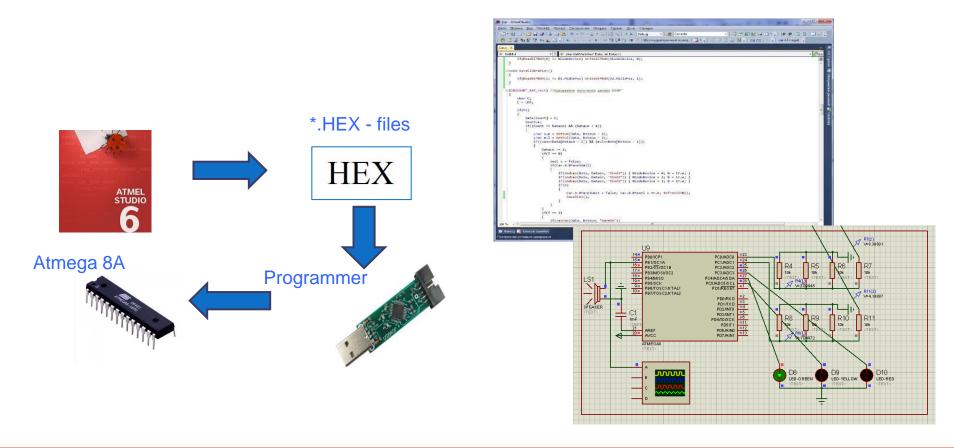
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29 October, 2015



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### Development of programs for the microcontroller

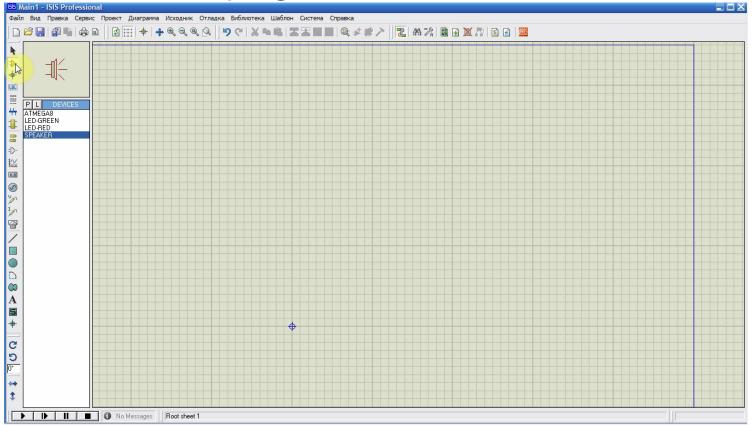


### Tbilisi29 October, 2015



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### Simulation of programs for the microcontroller



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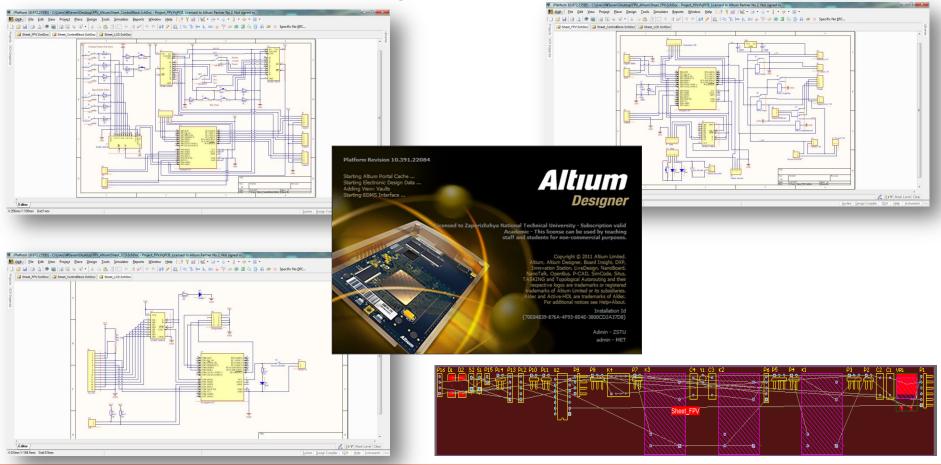
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### Creation and investigation system virtual prototype



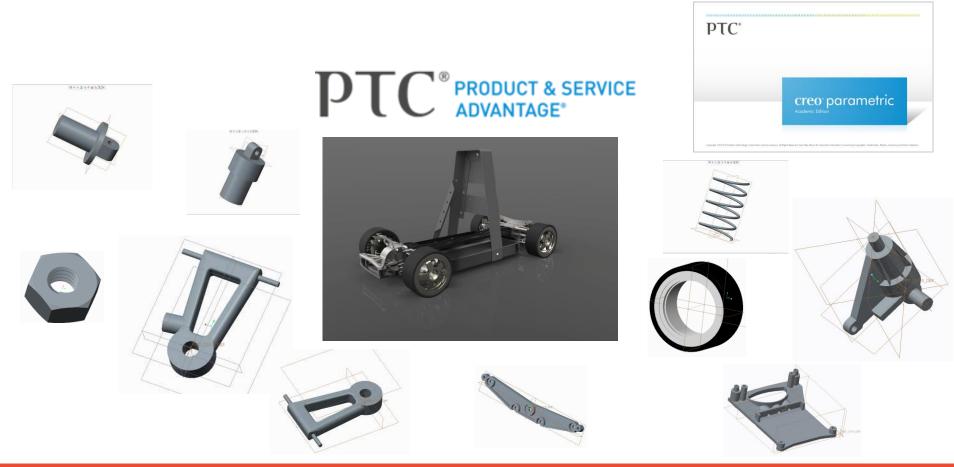
Tbilisi 29 October, 2015

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Creation and investigation system virtual prototype







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### Modern hardware and software platforms



Arduino



Altera Cyclone



Zaporizhzhya National Technical University

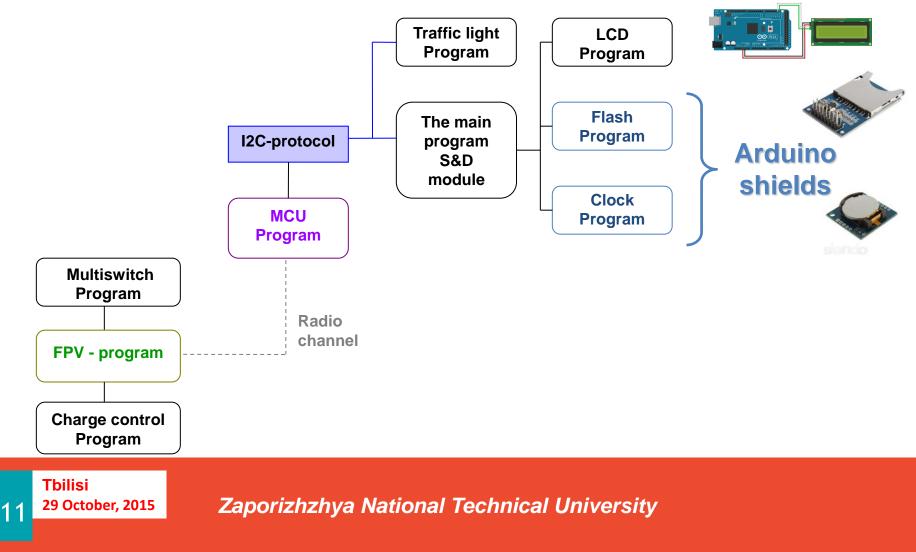


**Raspberry Pi** 



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### Bachelor work in progress based on Arduino





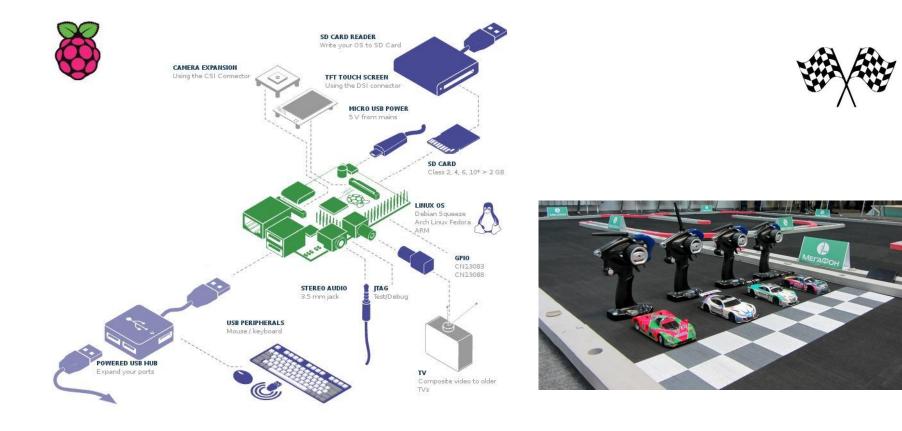
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### Bachelor work in progress based on Raspberry Pi





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### Real prototype

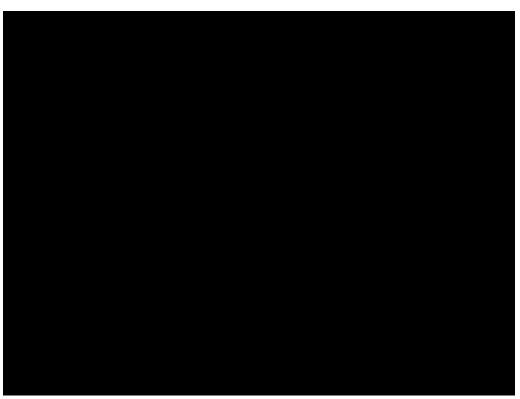






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### Video demonstration









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Education and Production in UA, GE, AM

### Development and Application of Remote Laboratory for Design of Embedded Systems (RELDES)



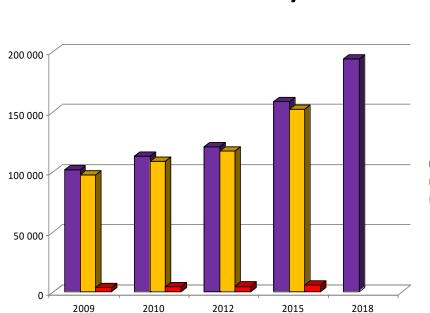




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ES today



Embedded System
 Embedded hardware
 Embedded software

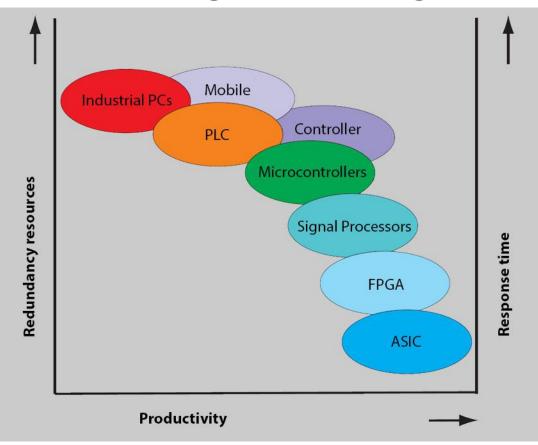






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### ESs design technologies



Platunov A.E, 2012





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### Hardware/software platforms for ES design



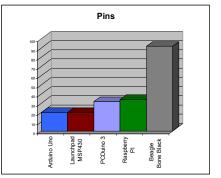
Launchpad MSP430

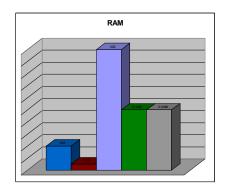


Freeduino



**Raspberry Pi** 







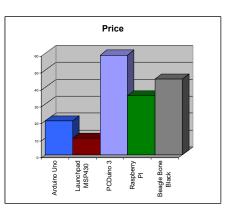
**Beagle Bone Black** 

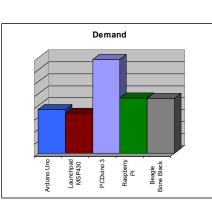


Arduino



Altera Cyclone



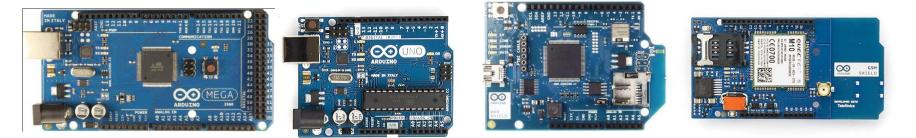


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### Hardware/software platform Arduino



#### Arduino boards and shilds



#### Arduino simulator





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### Applications of remote laboratories

- Electronics
- Robotics
- Physics
- Chemistry

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- Biology
- Earth Science
- 90 80 70 60 50 40 30 20 10











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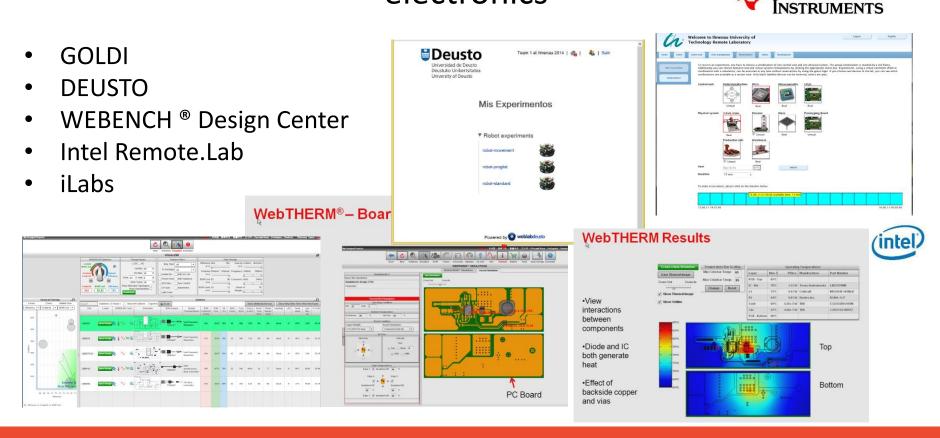
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TEXAS

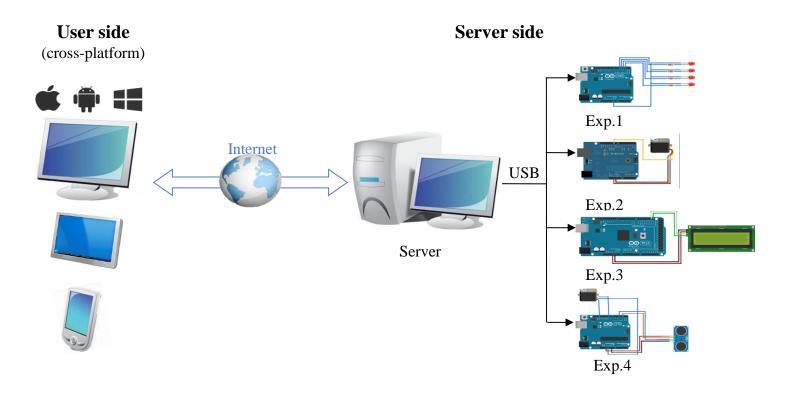
# Remote laboratories in the fields of electronics





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### **RELDES Hardware architecture**







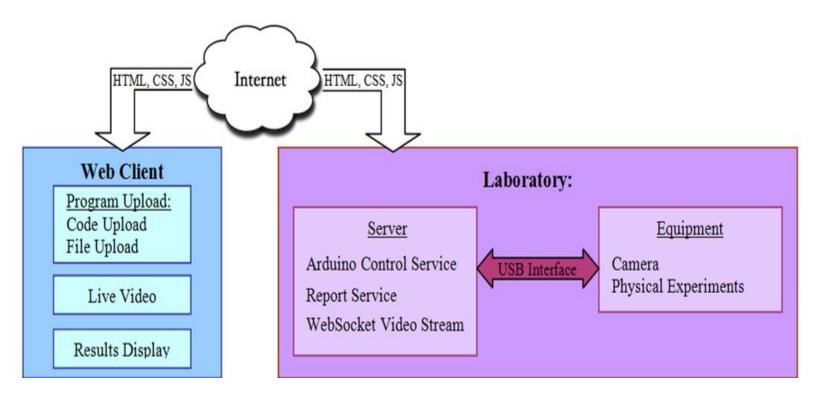
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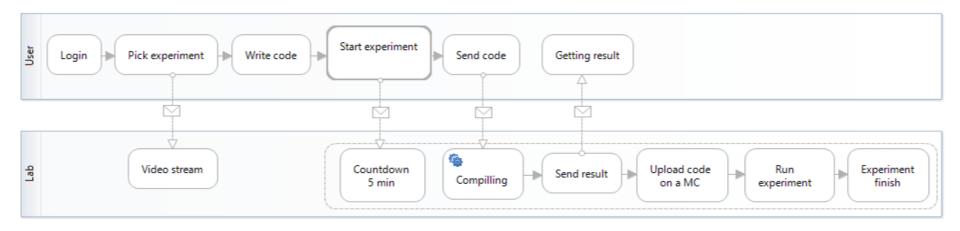
### **RELDES Software architecture**





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### Laboratory process diagram







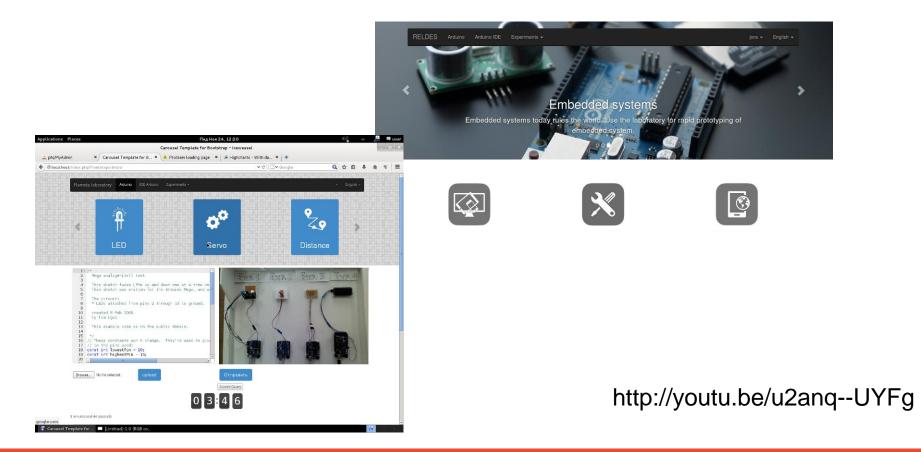
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### **RELDES** interface







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### Work in progress

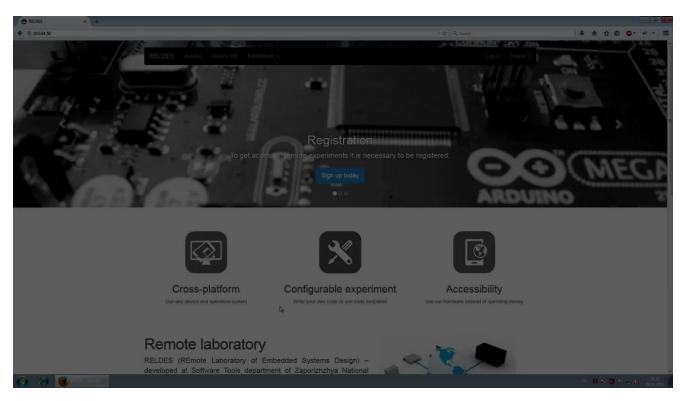
Future work will be focused on :

- expanding the range of provided hardware-software platforms;
- adding the set of experiments for solution of different tasks of embedded systems of mobile objects control design;
- development of special mechanism of lab reservation;
- creation of statistical data processing module for control of laboratory using.



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## Video demonstration







<u>D</u>evelopment of <u>E</u>mbedded <u>System</u> Courses with implementation of <u>I</u>nnovative Virtual approaches for integration of <u>R</u>esearch, Education and Production in UA, GE, AM

## **CNC** machine









Presentation of project Zaporizhzhya, October 15, 2015

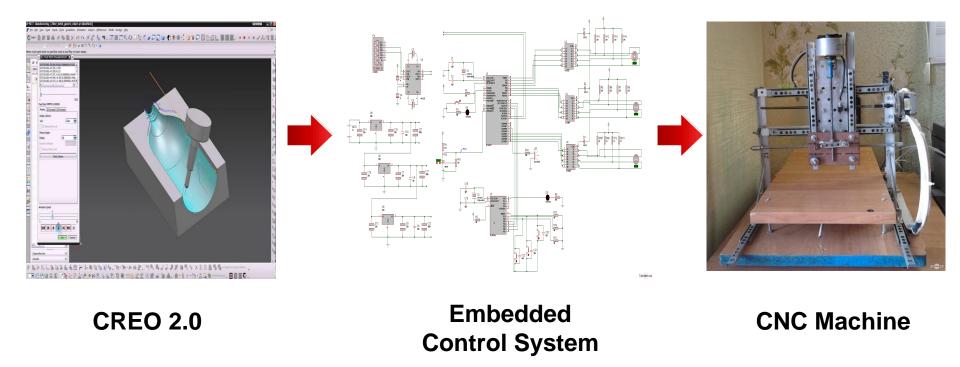






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#### **Project Overview**

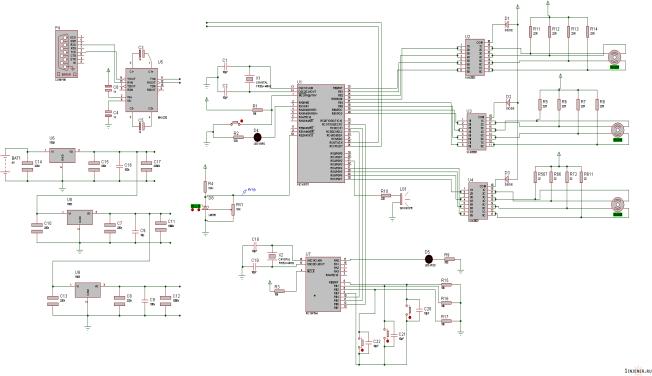






**Development of Embedded System Courses with implementation** of Innovative Virtual approaches for integration of Research, Education and Production in UA, GE, AM

### **CNC Machine Control Unit**



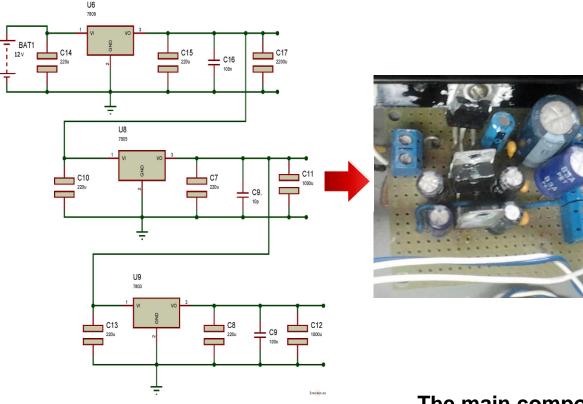
- Power supply module 1.
- 2. Commands transformation module
- Motor control driver 3.
- 4. Sensor control module

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<u>D</u>evelopment of <u>E</u>mbedded <u>System</u> Courses with implementation of <u>I</u>nnovative Virtual approaches for integration of <u>R</u>esearch, Education and Production in UA, GE, AM

#### **CNC Machine Control Unit**



- 1. <u>Power supply module</u>
- 2. Commands transformation module
- 3. Motor control driver
- 4. Sensor control module

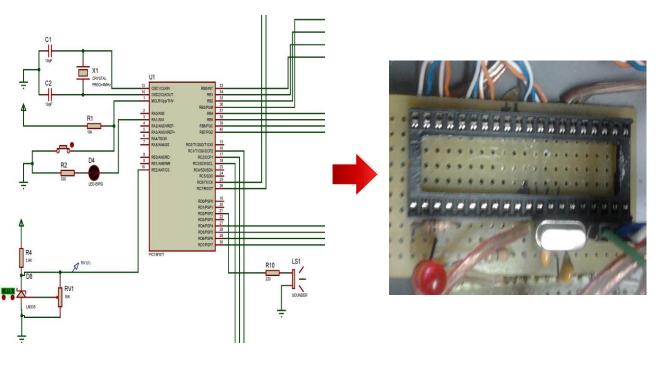
#### The main components: LM7805, LM7809, LM78033





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### **CNC Machine Control Unit**



- 1. Power supply module
- 2. <u>Commands</u> <u>transformation module</u>
- 3. Motor control driver
- 4. Sensor control module

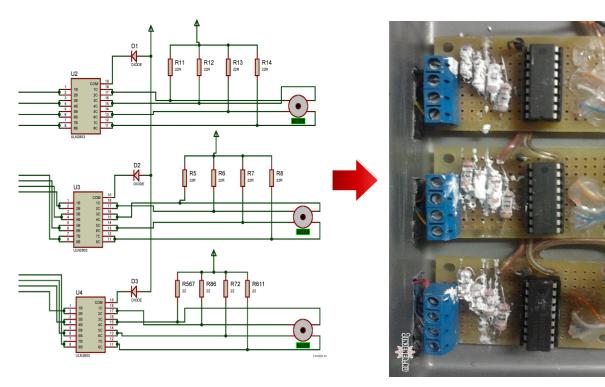
#### The main components : PIC16f877a





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### **CNC Machine Control Unit**



- 1. Power supply module
- 2. Commands transformation module
- 3. Motor control driver
- 4. Sensor control module

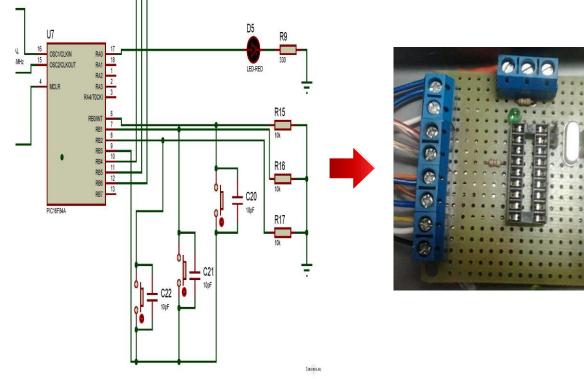
The main components : ULN2804a





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#### **CNC Machine Control Unit**



- 1. Power supply module
- 2. Commands transformation module
- 3. Motor control driver
- 4. <u>Sensor control module</u>

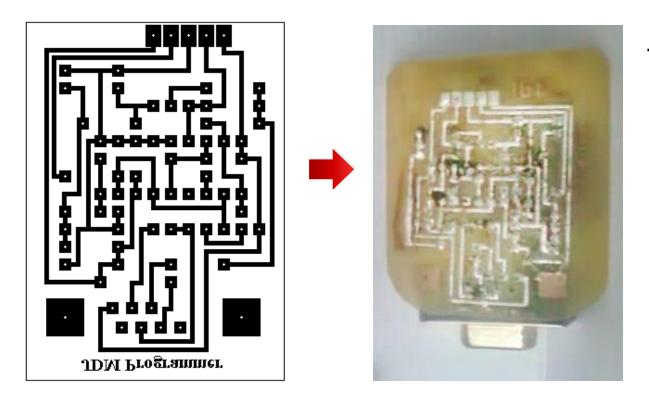
#### The main components : PIC16F84a





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#### **CNC Machine Control Unit**



#### **Programing of**

PIC12C509A, PIC16F84, PIC16F84A, PIC16F628A PIC16F877A

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#### **CNC Machine hardware design**





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#### **The Test Program**

ЧПУ КНТ - COM WINAPI		
Настройки порта Номер порта СОМ1 С DTR Скорость передачи 9600 С RTS 000 Сткрыть порт	Ручное управление Сохранить в файл Имя файла: test.txt W A S D R F	Автоматизация Загрузить файл
Ручная передача команд Введите данные для передачи Принятые данные:	Состояние	
	<ul> <li>Очистка поля</li> </ul>	
		Старт

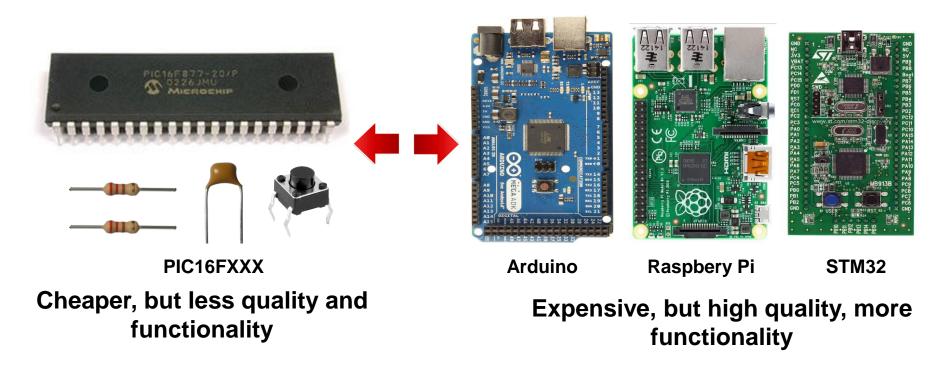
Настройки порта	Ручное управление	Автоматизация
Номер порта	🔲 Сохранить в файл	Загрузить файл
COM1 T DTR	Имя файла: test.txt	
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Скорость передачи 🔔 👝 то	S D	9400041
9600		5100061 4150061
	R	9300041
൙ Открыть порт		3150061
	Состояние	1300041
	Состояние	_ 6100061 3450061
Ручная передача команд—		5100061
Вредиле дриные для передрии	4	4150061
Введите данные для передачи		9300041
Введите данные для передачи	Передать	9300041 3150061
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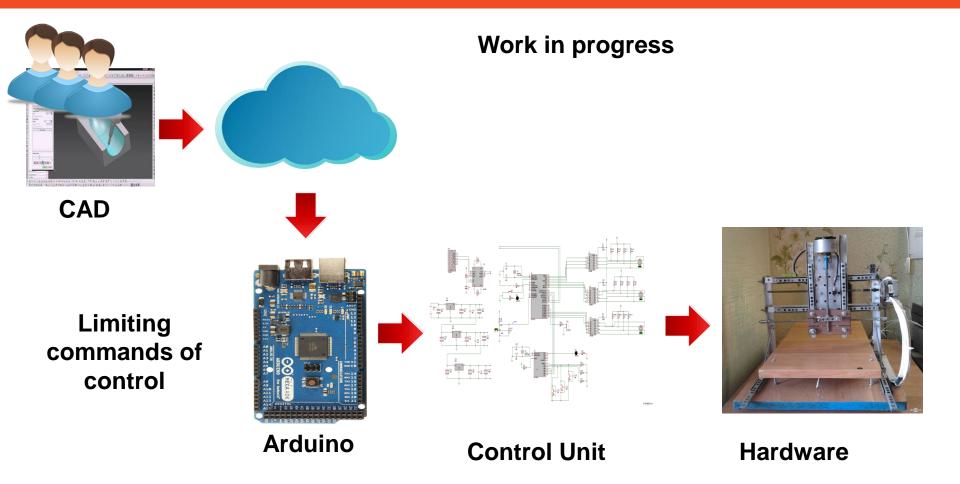
<u>D</u>evelopment of <u>E</u>mbedded <u>System</u> Courses with implementation of <u>I</u>nnovative Virtual approaches for integration of <u>R</u>esearch, Education and Production in UA, GE, AM

#### Work in progress





<u>D</u>evelopment of <u>E</u>mbedded <u>System</u> Courses with implementation of <u>I</u>nnovative Virtual approaches for integration of <u>R</u>esearch, <u>E</u>ducation and Production in UA, GE, AM



Tbilisi29 October, 2015



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## Video demonstration



https://youtu.be/aDHGX-FLe\_o





<u>Development of Embedded System Courses with implementation</u> of Innovative Virtual approaches for integration of <u>R</u>esearch,

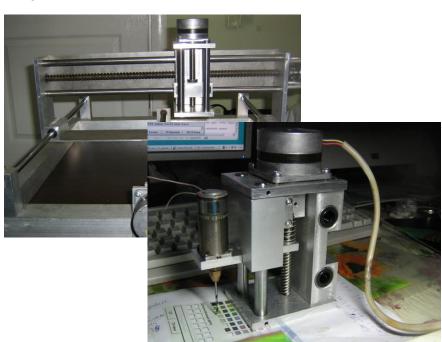
Education and Production in UA, GE, AM



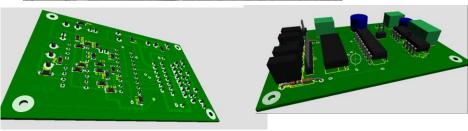
## **CNC** machine

Donbass State Engineering Academy (DSEA) Kramatorsk, Ukraine









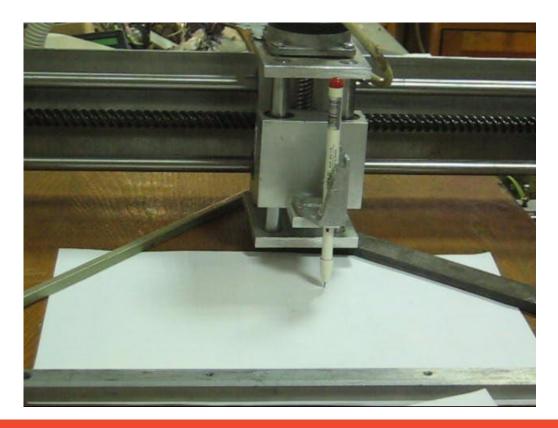




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### Video demonstration









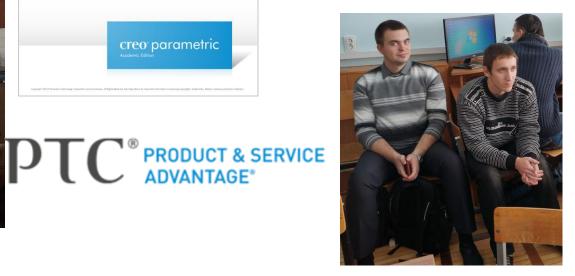
**Development of Embedded System Courses with implementation** of Innovative Virtual approaches for integration of Research, Education and Production in UA, GE, AM

# Modern tools for design and prototyping

PTC<sup>®</sup>



#### 3D scanner Gotcha



3D printer Leapfrog Creatr HS



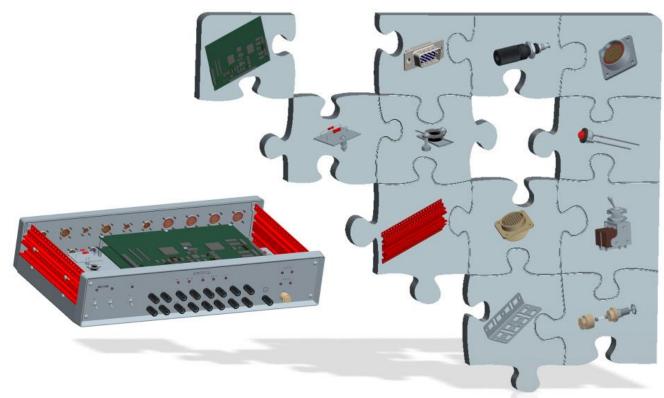
Zaporizhzhya National Technical University

creo parametric



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### Student integrated project in Creo Elements/Pro 5.0







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CREO virtual model of car body

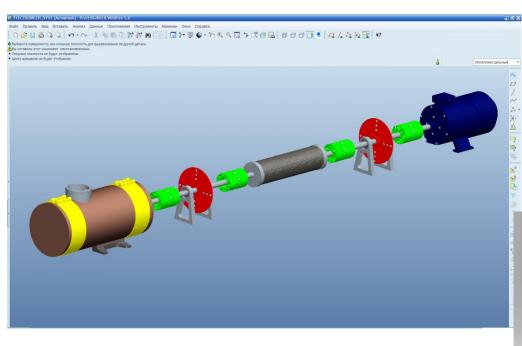






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> CREO virtual model of electromechanical system









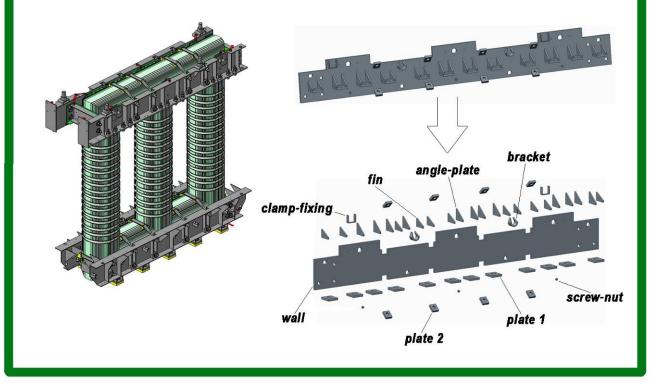
Tbilisi

47

29 October, 2015

Co-funded by the Tempus Programme of the European Union <u>D</u>evelopment of <u>E</u>mbedded <u>System</u> Courses with implementation of <u>I</u>nnovative Virtual approaches for integration of <u>R</u>esearch, Education and Production in UA, GE, AM

### Design of 3D model of transformer beam in Creo 2.0

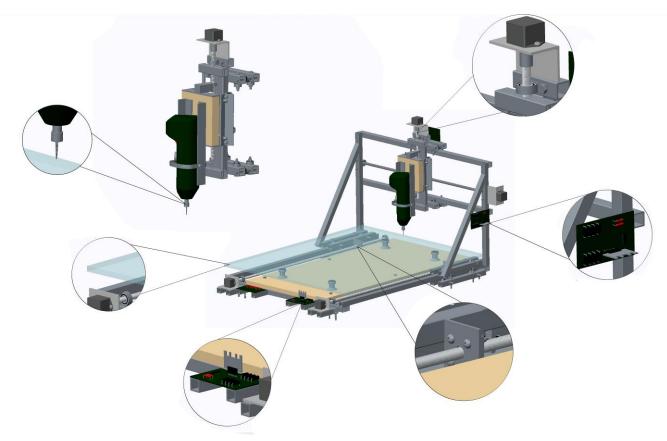






Development of Embedd & Bystemptomses times in pleitheatation of Innovative Virtual approaches for integration of Research, I Esturation entropy of Brasherienrines & Esturation

CREO virtual model of CNC machine







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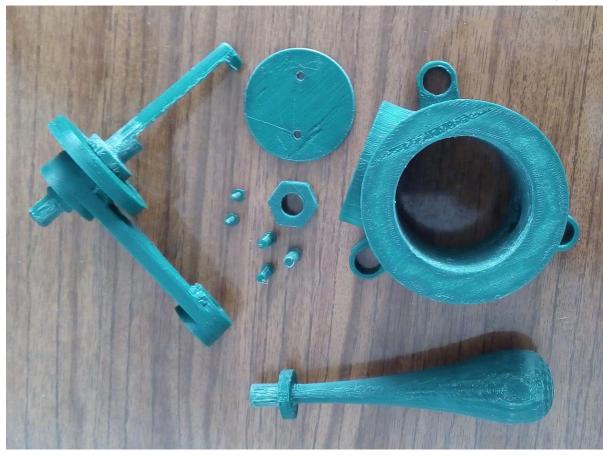






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Printed real valve prototype









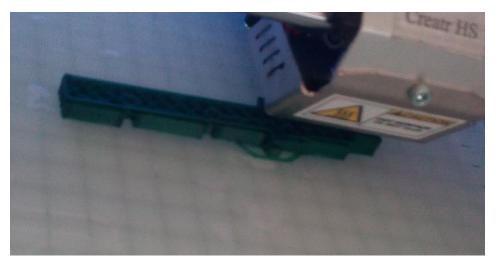
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#### 3D printing







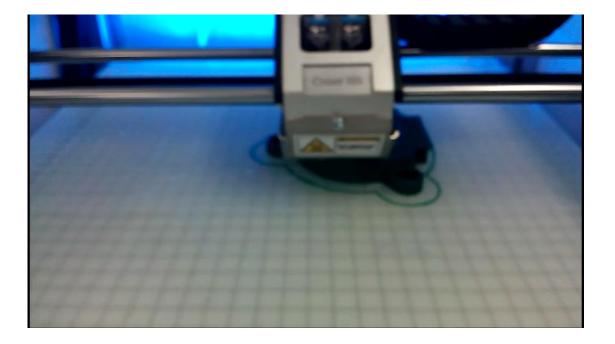




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# Video demonstration





52 Tbilisi



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#### We are open for new projects



#### https://community.aldebaran.com/en/developerprogram



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# THANK YOU FOR YOUR ATTENTION!





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URL: <u>http://zntu.edu.ua/</u>

