

## **IOT lecture course oriented on Arduino controllers**

The initiative of Internet Society pronouncing Internet of Things (IoT) as the main idea of the Chapterthon 2018 responded to the needs of the world Internet community. The advent of IoT in all spheres of human life made the training of young people in IoT a matter of urgent necessity.

Because of that the ISOC Armenia Chapter came forward with a project "IOT lecture course oriented on Arduino controllers". The lecture course was aimed to train several specialists and at the same time develop a well tested lecture course that will be used for mass training. The project will benefit the community by development of a lecture course oriented on the widely known Arduino controllers that will be used for training a big number of IoT specialists. We suppose that the project will give a start to more ambitious project of training a big number of IoT technicians ready to make their inclusion to the development of a digital economy in Armenia. We expect a sponsorship of the future project from the Armenian Internet Registry. The future IoT training courses will be advertized on a specially created Facebook page.

The community attention to the IoT was also attracted on the 4th national IGF that took place in October 10, 2018, by the presentation of Avetik Yessayan "Urban Ecology Monitoring System using IoT". The admittance to the course was advertized by ISOC Armenia Chapter and ISOC AM NGO networks and the following participants were recruited:

Armen Avetyan, Armen Mkhoyan, Armine Martirosyan, Ashot Mkhoyan, David Misakyan, Hakob Krpoyan, Harutyun Vanyan, Hasmik Artemyan, Hegine Shahinyan, Hovsep Minasyan, Hripsime Stepanyan, Lilia Totolyan, Lilit Gevorgyan, Naira Hovhannisyan, Narek Boshyan, Narine Mesropyan, Suren Gevorgyan, Suren Manukyan, Tehmine Grigoryan, Tigran Nikoghosyan, Tigran Unanyan, Vardanush Hovhannisian.

ISOC Armenia Chapter has quite a strong cohort of IoT specialists among its members, including:

- Vahan Misakyan having a good experience in the field developing IoT solutions of several technology applications;
- Karen Yerznkanyan, President of the "Smart City" NGO, fulfilling an IoT project for the Yerevan city municipality;
- Avetik Yessayan, lecturer at the Yerevan State University, reading the IoT course there. He is also heading the Shirak Technologies company, making IoT projects by contracts with house managers from France.

It was decided to organize the lecture course with three levels each enlightening different aspects of IoT applications: Beginners, Intermediate and Advanced. Descriptions of levels are shown below.

The series of lectures were opened by the President of ISOC Armenia Chapter, Igor Mkrtumyan. He presented the mission of the Internet Society and main idea of Chapterthons, the Internet Society is organizing each year, and explained why this year Chapterthon is devoted to the Internet of Things.



### **1-st level: Beginners**

1-st level lectures was conducted by Vahan Misakyan. His lectures included the following topics:

1. Basics of Arduino controllers' programming in Windows platform
2. Types of Arduino controllers, their specifics and differences
3. Digital input-output
4. Analog input-output
5. Arduino controllers memory
6. Using Arduino controllers' interruption system
7. Direct control of outputs with the help of microcontroller registers
8. Ready for use code libraries, their development and utilization
9. Sensors, their structure and utilization by Arduino controllers

The lab works with Arduino controllers using sensors are listed below:

Passive buzzer module  
2 color LED module  
Vibration switch module  
Photoresistor module  
Key Module  
Tilt switch module  
Infrared sensor module  
Active Buzzer Module  
Temperature sensor module  
Auto flashing LED light Colorful LED module  
Mini Magnetic Reed Modules  
Magnetic Hall Sensor Module  
Infrared sensor receiver module  
Class Bihor magnetic sensor  
Detectable heartbeat module  
Reed module  
Obstacle prevention sensor module

Microphone Sound Sensor Module  
Laser sensor module  
Relay module 5 V  
Temperature sensor module  
Flame sensor module  
Sensitive microphone sensor module  
Temperature and humidity sensor module  
XY-axis joystick module  
Metal sensor module

The first part of the course was organized at the Internet availability center for blind and visually impaired people created by the earlier ISOC grant thus solving the problem of renting the space and computers. It also demonstrates the continuity of the ISOC projects.



## 2nd level: Intermediate

2nd level lectures was conducted by Karen Yerznkanyan. His lectures included the following topics:

1. IOT solutions in everyday life, industry, agriculture, logistics, environmental protection.
2. Technical implementation of IOT. The choice of communication technology for IOT solutions. MQTT protocol. Devices and sensors for IOT.
3. Open Source and cloud IOT solutions. Thingsboard, Bluemix IBM, Microsoft Azure.
4. Securing IOT solutions

Lab works

1. Arduino board, Arduino IDE development environment. Connection of sensors and actuators to Arduino. 4 hrs.
2. Modules ESP8266 and Lora. Connection of the ESP8266 module to a WiFi network. Installation of MQTT server. Electronic lock working on MQTT. Control of electricity via the Internet.
3. Building a LoraWAN network. Energy-saving IOT solutions.
4. Connection to Thingsboard and Bluemix servers. Monitoring of air pollution. Monitoring the fullness of garbage containers.





### **3rd level: Advanced**

3rd level lectures was conducted by Avetik Yessayan. His lectures included the following topics:

#### 1. IOT for Building Management

- IOT introduction
- IOT system elements and development spheres
- Building Automation needs
- Facility Management with IOT system
- Improve the comfort and quality

#### 2. IOT components for development

- IOT Reference Model
- IOT data driven development
- Sensor technology and standardizations
- Communication technology and standardization
- Cloud Solution

#### 3. Data flow and data control

- IOT Data flow
- IOT data control
- DB as key source for data manipulation
- Time closure and synchronization
- Data correlation
- Data analytics

#### 4. IPv6, IOT security and data privacy

- IPv6 for IOT
- IOT game changer and information security in IOT cluster
- Data ownership
- Privacy
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A special lecture devoted to the IoT security and privacy awareness was included in the lecture course.

The lab works included:

Development of a model of trash control and removal, defining sensors necessary for that and collecting a prototype of a model.

