Arduino Solution with IBM Bluemix for Smart House

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Abstract

The article describes the characteristics of the IBM Internet of Things (IoT) Foundation solution and the IoT development capabilities provided in IBM® Bluemix ™.

The smart home is automated residential building designed for comfortable family living, with wide integration of high-tech devices. ArduinoMini is a board of microcontroller. Mini can process data coming from sensors, read identification card, number from the RFID reader, display the measured value on LCD modules, in addition to control the voice module to remind the user with a RF tag ID of the record the value of the sensors in the database. Data can be transferred from ArduinoMini to RaspberryPi or used ArduinoEtherNet.

Keywords: ArduinoMini, RaspberryPi, IBM Bluemix, sketch, Smart House,sensor

Introduction

The system of "digital home" for residential premises means that the object will be filled by some "electronic gadgets". And it is not only and not so much lighting, televisions and various media equipment, but mainly security systems, ventilation, air conditioning and heating, and very important in this whole system

is the unit ensuring uninterrupted supply. In 2005 a platform was developed for rapid creation of electronic devices, which later received the name Arduino. To Arduino you can connect different types of sensors, motors, lights, and other devices. Moreover, the control operates on easy to develop code that is based on Wiring, however, most programs are written in C++ and compiled using avr-gcc (WinAVR).

Material and methods

Drawing of the general scheme of the project

ArduinoMini is a board of microcontroller. Mini can process data coming from sensors, read identification card, number from the RFID reader, display the measured value on LCD modules, in addition to control the voice module to remind the user with a RF tag ID of the record the value of the sensors in the database. Data can be transferred from ArduinoMini to RaspberryPi or used ArduinoEtherNet. It should be noted that the Architecture of system Raspberry is based on RaspberryPiModel B Rev. 2. This is a single-Board computer containing an Ethernet network port, two USB 3.0 ports and the SD card. The SoC contains an ARM1176JZFS, which works with floating point at a frequency of 700 MHz.

IBM Bluemix is an open cloud platform to build, run and manage applications. Using IBM Bluemix, you can quickly create, manage and run web and mobile applications. IBM offers as database services, Bluemix, based on computing environment of the cloud, users can access computing resources on demand via the Internet [3].

Cheapest and easiest way of light sensor is a photoresistor that can be used as a sensor. Arduino can't directly measure the resistance (although it is possible, for example, voltage), because of this, the photoresistor should be included in the scheme of the voltage divider [6]. For the experiment, it is best to measure the relative level of illumination. Small values will correspond to the dark, large values will correspond to the bright light.

Experiments were carried out with the sensors of light and heat according to guide open-source for Arduino [8].

For installation, use: card tasks CIRC-09 - 1pc, 10 kOhm resistor brown-black-orange-2pcs, 2× connector – 4pcs, Resistor 560 Ohm green-blue-brown -1 Photoresistor-1 PCs, Green led -1pcs.

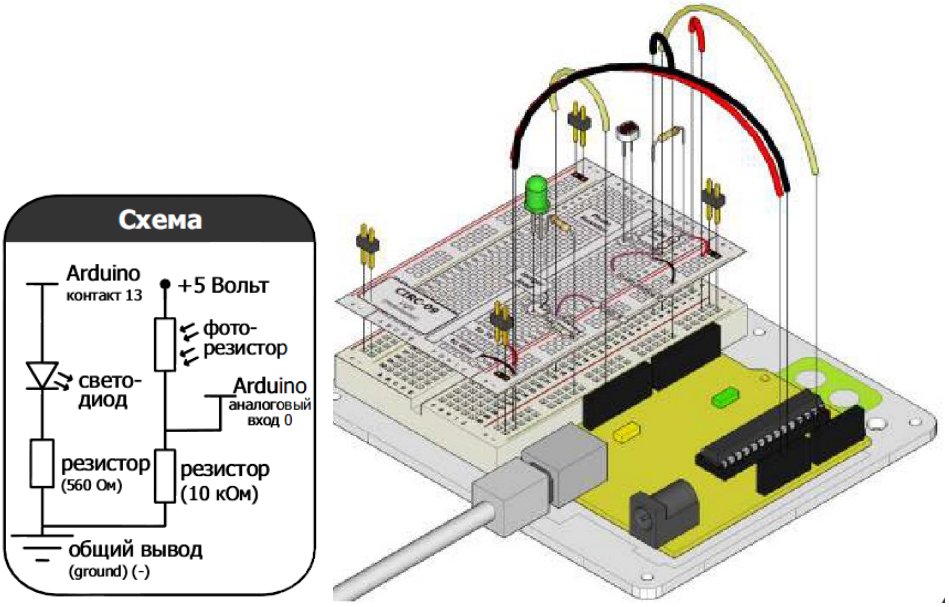


Figure 1. Scheme Arduino with photoresistor

An excerpt of the sketch for module light (full text link http://ardx.org/src/circ/CIRC09-code.txt)

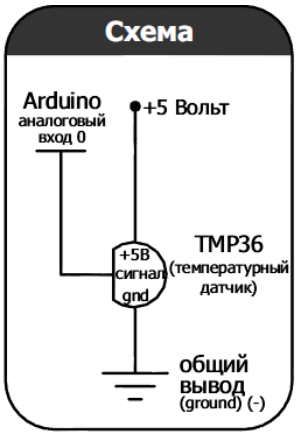
```
void loop()
{
intlightLevel = analogRead(lightPin); //Read the lightlevel
lightLevel = map(lightLevel, 0, 900, 0, 255);
        //adjust the value 0 to 900 tospan 0 to 255
lightLevel = constrain(lightLevel, 0, 255);//make sure the /value is between 0 and 255
analogWrite(ledPin, 255 - lightLevel);//write the value
}
```

Problems during the experiment with the module light Table 1.

Problem	Decision

1. The led does not turn on	The problem with the wrong polarity led. To change the pole.
2. No response to change of illumination	To check the contact area of the connectors of the devices
3. It is still not working	The room is too dark or light. To turn on and off electricity or to light gently light source sensor.

For installation, use: card tasks CIRC-09 - 1, 2× connector – 4pcs, TMP36 temperature sensor-1pcs, wire.



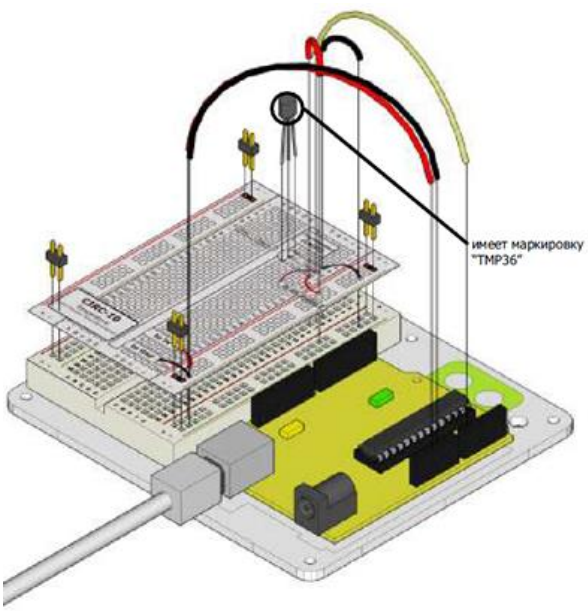


Figure 2. Scheme Arduino with temperature sensor

An excerpt of the sketch for module temperature (full text link http://ardx.org/src/circ/CIRC10-code.txt)

```
void setup() {
Serial.begin(115200);  /*Start the serial connection with the copmuter to view the result open the serial monitor }
void loop()    {
```

```
float temperature = getVoltage(temperaturePin);   //getting the voltage reading from the temperature sensor
temperature = (temperature - .5) * 100;  //convert from 10 mv per 500 mV offset
Serial.println(temperature);                    //printing the result
delay(1000);                                //waiting a second
}
// getVoltage() - returns the voltage on the analog input defined by pin
floatgetVoltage(int pin){
return (analogRead(pin) * .004882814); //converting from a 0 to 1023 digital range
                                    // to 0 to 5 volts (each 1 reading equals ~ 5 millivolts
}
```

Problems during the experiment module temperature Table 2.

Problem	**Decision**
1. There is no data.	This program does not use indication.
2. Incorrect data is displayed in an unusual range of characters	Perhaps when the monitor is connected via the serial port receives data in the wrong speed. In our case reduced from 115200 to 9600 baud.
3. The temperature hung	To try with the help of ventilation or breathing to release the indicator.

IoT is defined, as a rule, digitize technology to connect all computing and network. Billions of physical assets are already generating volumes of data two times faster than traditional computers, and social networks. Very diverse and noisy streaming data with a short life time make it difficult to implement - were projects of IOP in a reasonable team. Therefore, most of the IOP data are not used for analytical optimize and to control, but for one detection event. In order to reduce the complexity and to unlock the potential of analytical data and intellectual

services, the information industry must implement a robust cloud and cognitive com - Puting. The speed of development, is expected to grow significantly, which requires co-organized the efforts of all parties involved. Resource the Main work was done to increase speed drastically reducing the time of prototype of the product, while maintaining its core analytical functionality. Fortunately, new cloud platforms, develop - ERS with a rich set of features built-in fade now you can implement a prototype in just a few hours, applying a new approach, which will be given in a later analysis.

Results

As the cloud has become a major platform for IOP services, developers need to integrate resources in a cloud architecture. Demonstrated key technologies for implementing solutions, neat in agriculture and found a template, which is based on ZigBee networks. This approach can be extended analytical services and cloud infrastructure as well. [An attempt was made to classify services provided by the IoT in order to help application developers to rely on essential services. They identified four main categories of services and IoT provided primeneniya some examples: Identity Services related to (I); Info AggregationServices (II); Joint-Aware service (III); Ubiquitous Services (IV). On the basis of this study we define here the "starter kit" in conjunction with the decision of network services. To involve rapid prototyping, and provide the solution with the template IoT the agent thodical service.

In order to be implemented in multiple instances, the solution concept of infrastructure has resulted in an educational project with a set of useful and inexpensive environment :

- LEDs and buzzers were used simple actuators.
- More than hundreds of sensors were prepared for development projects, but only analog sensors and temperature sensors digital was actually used in the tutorial project. We preferably use a simplified interface Grove to avoid short-circuit.

- ArduinoUno with microcomputers Groveexten Board Sion is used to receive data from the sensors.
- Wireless radio frequency RF modules 433MHz is used for the switch with the hub.
- Raspberry Pi microcomputer is used as a computing hub, and control actuators. Thanks to radio and Ethernet, it can be connected to the host and the cloud side.
- IBM Bluemix Implemented data storage, analytical processing and data visualization services.

The architecture of the prototype project is shown in figure 4. The project works in the following way. Arduino was TERS analog and digital data from sensors and transmit them via radio. Such a connection allows transmit data from multiple hosts to one or more compute nodes (raspberry Pi). The hub forms the MQTT packets and transmits them to Bluemix in the cloud for storage and processing. Back to the hub, Bluemix passes control commands to the actuators.

The IBM Internet of Things (IoT) Foundation solution and the IoT development capabilities provided in IBM® Bluemix ™, the overall concept of the project began to emerge. Figure 3 shows the general scheme of the project.

Figure 3. Drawing of the general scheme of the project

Sketch 1 for temp.sensor

In this project, the Arduino board connected to the temperature sensor sends information about the temperature (in degrees Fahrenheit and Celsius) and humidity according to the schedule in the IoT Foundation using the MQTT protocol. Based on this information, a graph is constructed using the capabilities provided in Bluemix. IoT Foundation allows you to display this data on the graph in real time.

Figure 4. Scheme of the “SH” project

Sketch 2 for connect IBM Bluemix

If you've made these changes, save the sketch and include it to Arduino. Then return to this browser, push the Go button on the MAC-address of the page, and wait .

Conclusion

We introduced a rapid method for create "Smart House" the Internet of things projects to make them competitive enough to be purchased by the business. The template shows an Arduino solution based on inexpensive components and IBM Bluemix cloud platform.

Currently, the problem of experience: This question is addressed to disseminate recent experiences and best practices within the IBM Blumix system. When new assets or services appear on the market, they should be tested and implemented, it is the best way to use and implement improved provements.

A more detailed framework for the complete solution industry must also be developed and it can be a good area for further research.

The sizzling pace of innovation in recent years, particularly the proliferation of embedded sensor technology, wearables, and apps, has already caused incredible change in just a few short years. But what will the world of logistics look like when not 1 percent of things, nor 3 percent of things, but 30 percent of things are connected? As we reflect on these developments in the context of the Internet of Everything, it is clear that we are just beginning to connect the unconnected.

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