



# ZÁKLADY BEZDRÔTOVÝCH SIETÍ

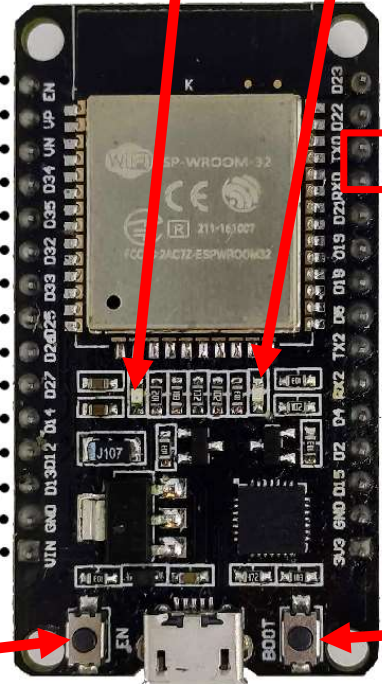
KOMUNIKAČNÉ TECHNOLOGIE PRE SYSTÉMY IOT (3/4)

ING. LUKÁŠ FORMANEK, PHD.

Vytvorené v rámci projektu KEGA 026TUKE-4/2021

# ESP32 DEVELOPMENT BOARD

## ESP32 DEV KIT V1 PINOUT



The diagram shows the ESP32 Dev Kit V1 with various components and their pin connections. Red arrows point to the PWR LED, USER LED (GPIO2), RST button, and BOOT button. A red box highlights the UART pins (GPIO1, GPIO3, TXD0, RXD0, CLK3, CLK2).

Pin	Function	Function	Function	Function
EN				
5	GPIO36	ADC1_0	SensVP	RTC GPIO0
8	GPIO39	ADC1_3	SensVN	RTC GPIO3
10	GPIO34	ADC1_6		RTC GPIO4
11	GPIO35	ADC1_7		RTC GPIO5
12	GPIO32	ADC1_4	Touch9	Xtal32P
13	GPIO33	ADC1_5	Touch8	Xtal32N
14	GPIO25	ADC2_8		RTC GPIO6
15	GPIO26	ADC2_9		RTC GPIO7
16	GPIO27	ADC2_7	Touch7	RTC GPIO17
17	GPIO14	ADC2_6	Touch6	HSPI_CLK
18	GPIO12	ADC2_5	Touch5	HSPI_Q
20	GPIO13	ADC2_4	Touch4	HSPI_ID
36	GPIO23	V_SPI_D		MOSI
39	GPIO22	V_SPI_WP		SCL
41	GPIO1	TXD 0		CLK3
40	GPIO3	RXD 0		CLK2
42	GPIO21	VSPI_HD		SDA
38	GPIO19	V_SPI_Q		MISO
35	GPIO18	V_SPI_CLK		SCK
34	GPIO5	V_SPI_CS0		SS
27	GPIO17	TXD 2		
25	GPIO16	RXD 2		
24	GPIO4	ADC2_0	Touch0	HSPI_HD
22	GPIO2	ADC2_2	Touch2	HSPI_WP0
21	GPIO15	ADC2_3	Touch3	HSPI_CS0
GND				
3.3v				
				RTC GPIO10
				RTC GPIO12
				RTC GPIO13

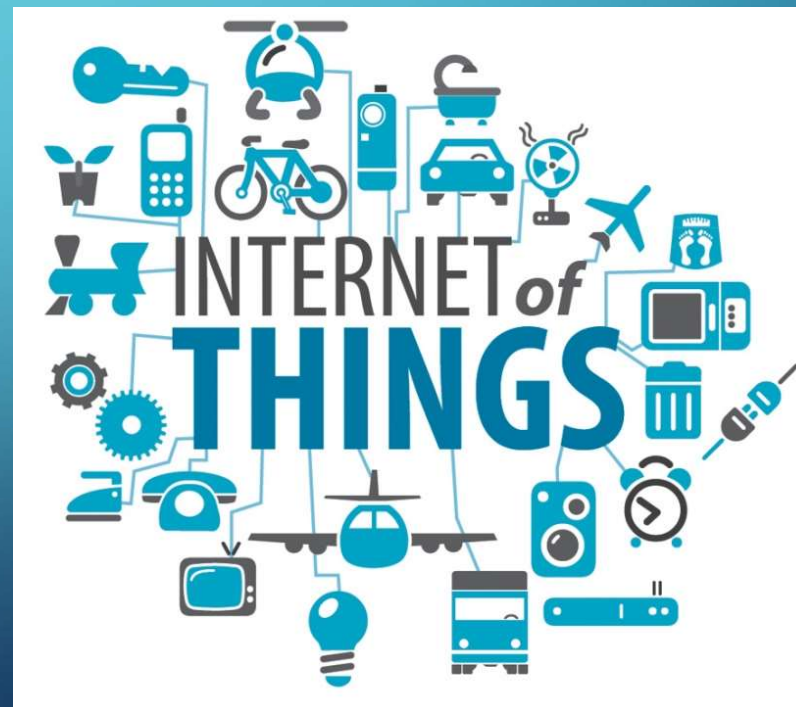
**Additional Labels:**

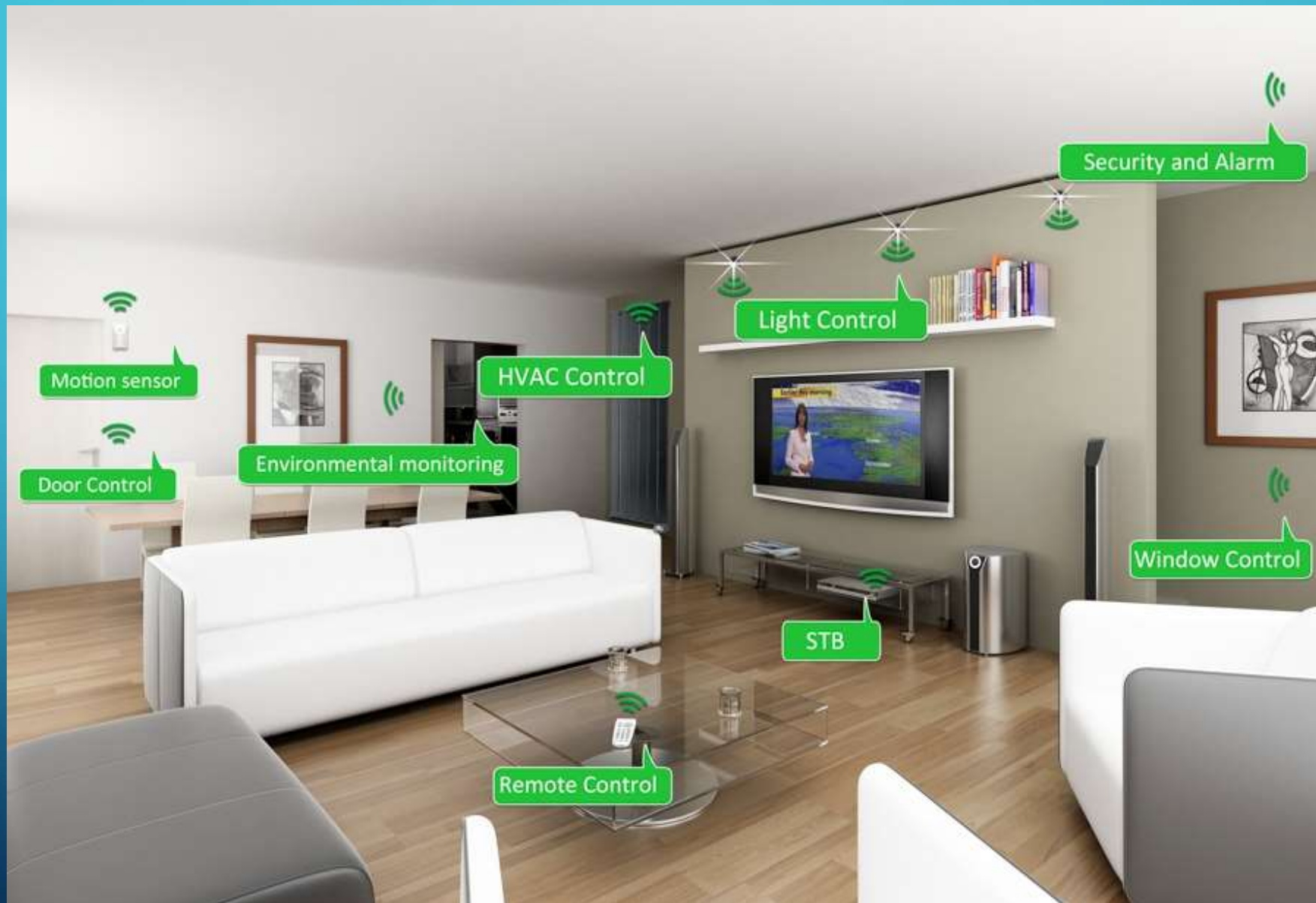
- PWR LED**: Points to the power status LED.
- USER LED (GPIO2)**: Points to the user status LED.
- UART**: Red box around TXD0, RXD0, CLK3, and CLK2 pins.
- RST**: Points to the reset button.
- BOOT (GPIO0)**: Points to the boot button.

[www.mischianti.org](http://www.mischianti.org)

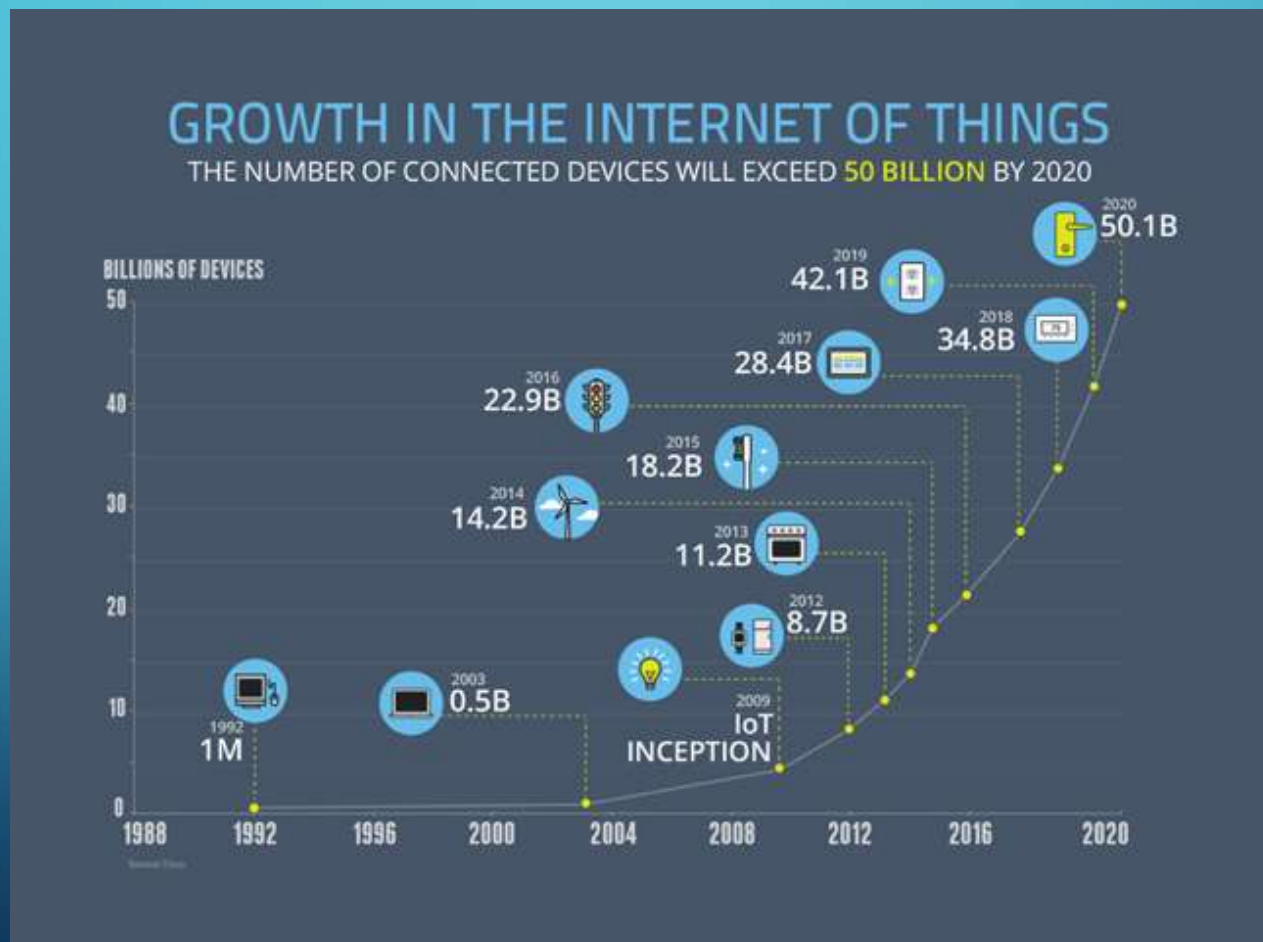
# INTERNET VECÍ

- Prepojenie zariadení s internetovou konektivitou.
- Najmä bezdrôtové.
- Možnosti interakcie s používateľom.
- Možnosti interakcie medzi systémami.
- Sledovanie, ovládanie, zabezpečenie.





# POČET ZARIADENÍ PRIPOJENÝCH K INTERNETU (2020)



# CLOUDOVÉ SLUŽBY PRE IOT

- Uchovanie a spracovanie nameraných dát.
- Vizualizácia nameraných veličín.
- Analýza.
- Interakcia.



# THINGSPEAK

- Cloudová služba pre IoT.
- Umožňuje uchovávať, vizualizovať, analyzovať a spracovávať dátové toky priamo v cloude v reálnom čase.
- Možnosť spracovania údajov s využitím MATLAB podpory priamo v cloude.
- Jednoduchá konfigurácia.
- Vizualizácia.
- <https://thingspeak.com/>



# VYTVORENIE ÚČTU

ThingSpeak™

Channels

Apps

Community

Support ▾

How to Buy

Log In

Sign Up

## Sign up for ThingSpeak

In order to sign up for ThingSpeak, you must create a new MathWorks Account or log in to your MathWorks Account. The ThingSpeak service is operated by The MathWorks, Inc.

### Create MathWorks Account

iot.fri.uniza@gmail.com ✓

FRIIoT ?

•••••••• ✓

Slovakia ▾

IOT ✓

FRI ✓

By clicking continue, you agree to our [privacy policy](#)

Cancel

Continue



# VYTVORENIE ÚČTU

[Channels](#)[Apps](#)[Community](#)[Support](#)[How to Buy](#)[Log In](#)[Sign Up](#)

## Sign up for ThingSpeak

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### Verify Your MathWorks Account

To finish creating your account, complete the following steps:

1. Go to your inbox for **iot.fri.uniza@gmail.com**.
2. Click the link in the email we sent you.

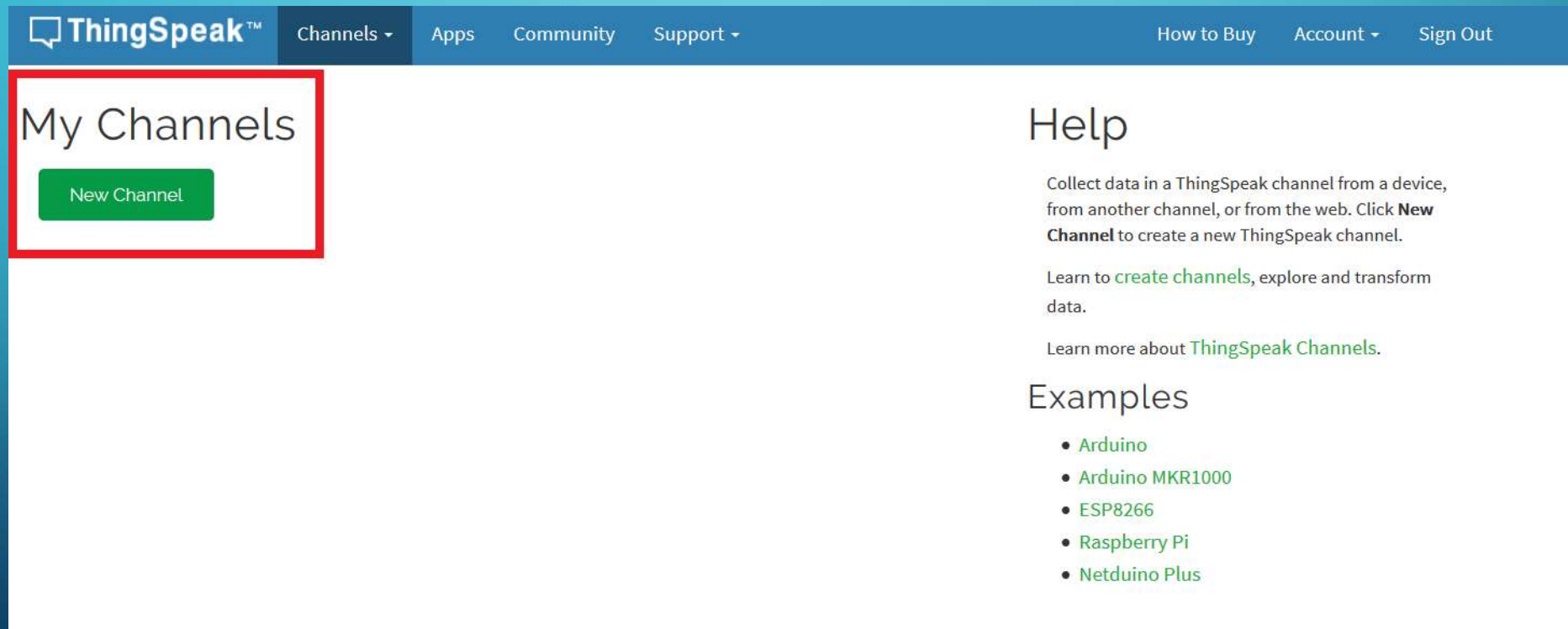
Once you've done this, click Continue.

### Didn't get the email?

1. Check your spam folder.
2. [Send me the email again](#).
3. Contact [Customer Support](#) if you still do not have the email

[Cancel](#)[Continue](#)

# VYTVORENIE KANÁLA



The screenshot shows the ThingSpeak website interface. At the top, there is a navigation bar with the ThingSpeak logo and links for Channels, Apps, Community, and Support. On the right side of the navigation bar, there are links for How to Buy, Account, and Sign Out. The main content area is divided into two columns. The left column is titled 'My Channels' and contains a green 'New Channel' button, which is highlighted by a red rectangular box. The right column is titled 'Help' and contains text explaining how to create a new channel, a link to learn more about creating channels, and a section titled 'Examples' with a list of device types: Arduino, Arduino MKR1000, ESP8266, Raspberry Pi, and Netduino Plus.

ThingSpeak™ Channels ▾ Apps Community Support ▾ How to Buy Account ▾ Sign Out

## My Channels

New Channel

## Help

Collect data in a ThingSpeak channel from a device, from another channel, or from the web. Click **New Channel** to create a new ThingSpeak channel.

Learn to [create channels](#), explore and transform data.

Learn more about [ThingSpeak Channels](#).

## Examples

- [Arduino](#)
- [Arduino MKR1000](#)
- [ESP8266](#)
- [Raspberry Pi](#)
- [Netduino Plus](#)

# VYTVORENIE KANÁLA

## New Channel

Name

IoT

Description

Svetelný senzor

Field 1

Svetelný senzor



Field 2



Field 3



Field 4



Field 5



Field 6



Field 7



Field 8



## Help

Channels store all the data that a ThingSpeak application collects. Each channel includes eight fields that can hold any type of data, plus three fields for location data and one for status data. Once you collect data in a channel, you can use ThingSpeak apps to analyze and visualize it.

### Channel Settings

- **Channel Name:** Enter a unique name for the ThingSpeak channel.
- **Description:** Enter a description of the ThingSpeak channel.
- **Field#:** Check the box to enable the field, and enter a field name. Each ThingSpeak channel can have up to 8 fields.
- **Metadata:** Enter information about channel data, including JSON, XML, or CSV data.
- **Tags:** Enter keywords that identify the channel. Separate tags with commas.
- **Latitude:** Specify the position of the sensor or thing that collects data in decimal degrees. For example, the latitude of the city of London is 51.5072.
- **Longitude:** Specify the position of the sensor or thing that collects data in decimal degrees. For example, the longitude of the city of London is -0.1275.
- **Elevation:** Specify the position of the sensor or thing that collects data in meters. For example, the elevation of the city of London is 35.052.
- **Make Public:** If you want to make the channel publicly available, check this box.
- **URL:** If you have a website that contains information about your ThingSpeak channel, specify the URL.

# API KEYS

ThingSpeak™ Channels Apps Community Support How to Buy Account Sign Out

## IoT

Channel ID: 233715 Svetelný senzor  
Author: friiot  
Access: Public

Private View Public View Channel Settings **API Keys** Data Import / Export

+ Add Visualizations Data Export MATLAB Analysis MATLAB Visualization

### Channel Stats

Created: [about a minute ago](#)  
Updated: [about a minute ago](#)  
Entries: 0

Field 1 Chart

IoT

Svetelný senzor

Date

ThingSpeak.com

# API KEYS

ThingSpeak™ Channels Apps Community Support How to Buy Account Sign Out

## Write API Key

Key

Generate New Write API Key

## Read API Keys

Key

Note

Save Note Delete API Key

Generate New Read API Key

## Help

API keys enable you to write data to a channel or read data from a private channel. API keys are auto-generated when you create a new channel.

### API Keys Settings

- **Write API Key:** Use this key to write data to a channel. If you feel your key has been compromised, click **Generate New Write API Key**.
- **Read API Keys:** Use this key to allow other people to view your private channel feeds and charts. Click **Generate New Read API Key** to generate an additional read key for the channel.
- **Note:** Use this field to enter information about channel read keys. For example, add notes to keep track of users with access to your channel.

### Create a Channel

```
POST https://api.thingspeak.com/channels.json
api_key=7WCLB048AAAYE0LE4
name=My New Channel
```

### Update a Channel

```
PUT https://api.thingspeak.com/channels/233715
api_key=7WCLB048AAAYE0LE4
name=Updated Channel
```

### Clear a Channel

```
DELETE https://api.thingspeak.com/channels/233715/feeds.json
api_key=7WCLB048AAAYE0LE4
```

### Delete a Channel

```
DELETE https://api.thingspeak.com/channels/233715
api_key=7WCLB048AAAYE0LE4
```

[Learn More](#)

# DATA IMPORT/EXPORT

ThingSpeak™ Channels Apps Community Support How to Buy Account Sign Out

Private View Public View Channel Settings API Keys **Data Import / Export**

## Import

Upload a CSV file to import data into this channel

Prehľadávať... Nie je zvolený súbor.

Time Zone (GMT+00:00) UTC

Upload

## Export

Download all of this Channel's feeds in CSV format.

Download

## Help

Select a CSV file on your hard drive and import all of its data directly into this channel. Your CSV file should contain a date field in the first column. If your data doesn't contain timezone info, select one appropriately.

[Learn More](#)

## API Requests

**Update Channel Feed - GET**

```
GET https://api.thingspeak.com/update?api_key=Q5BQSRMAAK97DBBG&field1=73
```

**Update Channel Feed - POST**

```
POST https://api.thingspeak.com/update.json
api_key=Q5BQSRMAAK97DBBG
field1=73
```

**Get a Channel Feed**

```
GET https://api.thingspeak.com/channels/233715/feeds.json?results=2
```

**Get a Channel Field Feed**

```
GET https://api.thingspeak.com/channels/233715/fields/1.json?results=2
```

**Get Status Updates**

```
GET https://api.thingspeak.com/channels/233715/status.json
```

# NASTAVENIE ZOBRAZENIA GRAFU

The image shows the 'Field 1 Chart Options' dialog box in the ThingSpeak interface. The dialog is used to configure the appearance and behavior of a chart for a specific field. The background shows a channel page for 'Svetelný senzor' with 'Channel Stats' and 'Add Visualizations' buttons.

**Field 1 Chart Options**

Title:	IoT	Timescale:	
X-Axis:	Čas	Average:	
Y-Axis:	Hodnota	Median:	
Color:	red	Sum:	
Background:	black	Rounding:	
Type:	spline	Data Min:	
Dynamic?:	true	Data Max:	
Days:		Y-Axis Min:	
Results:	100	Y-Axis Max:	

Buttons: Save, Cancel

# NASTAVENIE ZDIEĽANIA KANÁLA

ThingSpeak™ Channels Apps Devices Support Commercial Use How to Buy LF

## ESP32

Channel ID: 1721203  
Author: lukasff1  
Access: Private

Private View Public View Channel Settings **Sharing** API Keys Data Import / Export

### Channel Sharing Settings

- Keep channel view private
- Share channel view with everyone
- Share channel view only with the following users:

Email Address

### Help

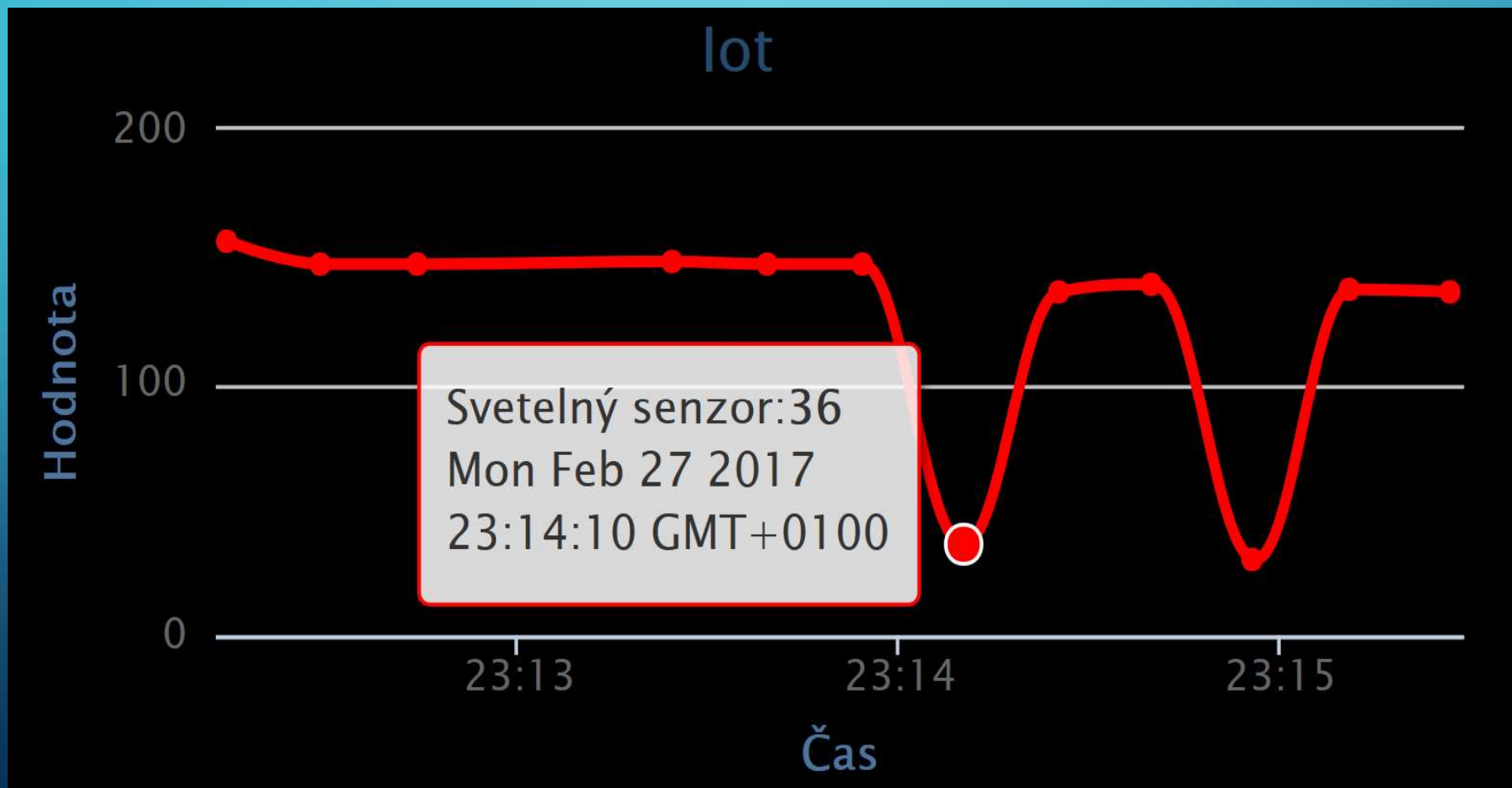
ThingSpeak allows you to control who can view the data in your channel. Irrespective of the settings on this tab, reading data from or writing data to the fields of a channel requires the appropriate API key for the channel.

### Channel Sharing Settings

- **Keep channel view private:** Selecting this option keeps your channel private. Only you will be able to see the channel view.
- **Share channel view with everyone:** Selecting this option makes the public view of your channel viewable by anyone browsing the ThingSpeak website.
- **Share channel view only with the following users:** Selecting this option shares the private view of your channel only with specific ThingSpeak users.



# UKÁŽKA ZOBRAZENIA GRAFU



# MICROPYTHON

```
33
34 import urequests
35 import esp32
36
37 HTTP_HEADERS = {'Content-Type': 'application/json'}
38 THINGSPEAK_WRITE_API_KEY = 'YOUR_API_KEY'
39
40 measured_values = {'field1':(esp32.raw_temperature()-32)*0.5556, 'field2':esp32.hall_sensor()}
41 request = urequests.post('http://api.thingspeak.com/update?api_key=' + THINGSPEAK_WRITE_API_KEY,
42 json = measured_values, headers = HTTP_HEADERS )
43 request.close()
44
45 print("Upload values:", end=" ")
46 print(measured_values)
```

Shell x

```
Upload values: {'field1': 51.6708, 'field2': 55}
```

```
>>>
```

# POSTUP

1. Pripojenie ESP32 k AP s konektivitou na internet (použite napr. [ssid/pswd]: wifri/- alebo KIS-Guest/hatatitla).
2. Nastavenie Write\_Api\_Key.
3. Nahratie (upload) nameraných hodnôt. (free account: interval  $\geq 15$  s.).

# ÚLOHY

- Vytvorte si vlastný účet a kanál na [thingspeak.com](https://thingspeak.com).
- V pravidelných intervaloch nahrajte do vášho kanála nasledovné hodnoty:
  - Interná teplota MCU v °C.
  - Interná hodnota z Hallovhho senzora.
- Vytvorte dvojice. Stlačením tlačidla (boot-GPIO0) na jednej vývojovej doske budete meniť stav (on/off) LED diódy(GPIO2) na druhej vývojovej doske a naopak. Na synchronizáciu využite Firebase Realtime databázu.

ĎAKUJEM ZA POZORNOST



Vytvorené v rámci projektu KEGA 026TUKE-4/2021