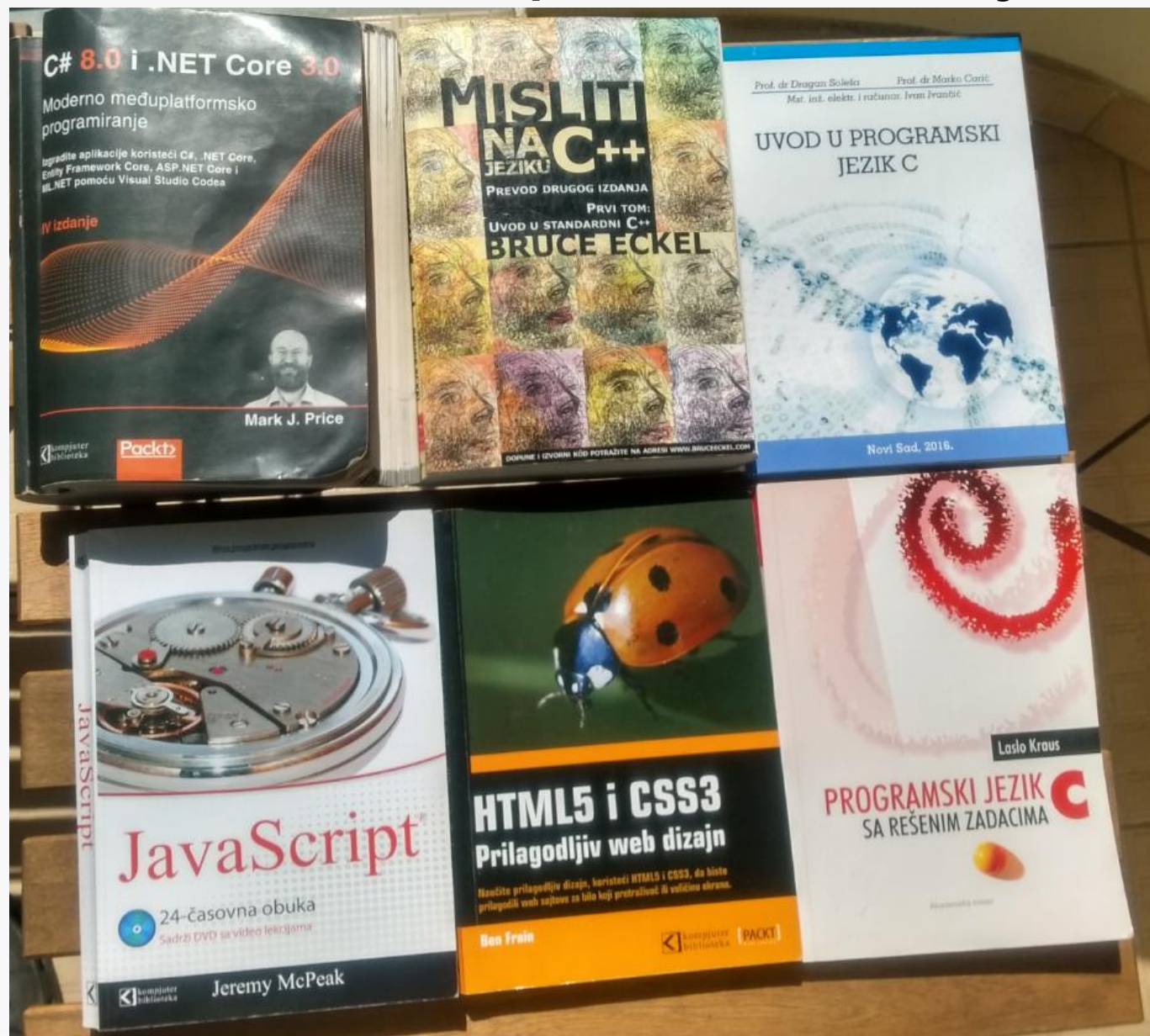
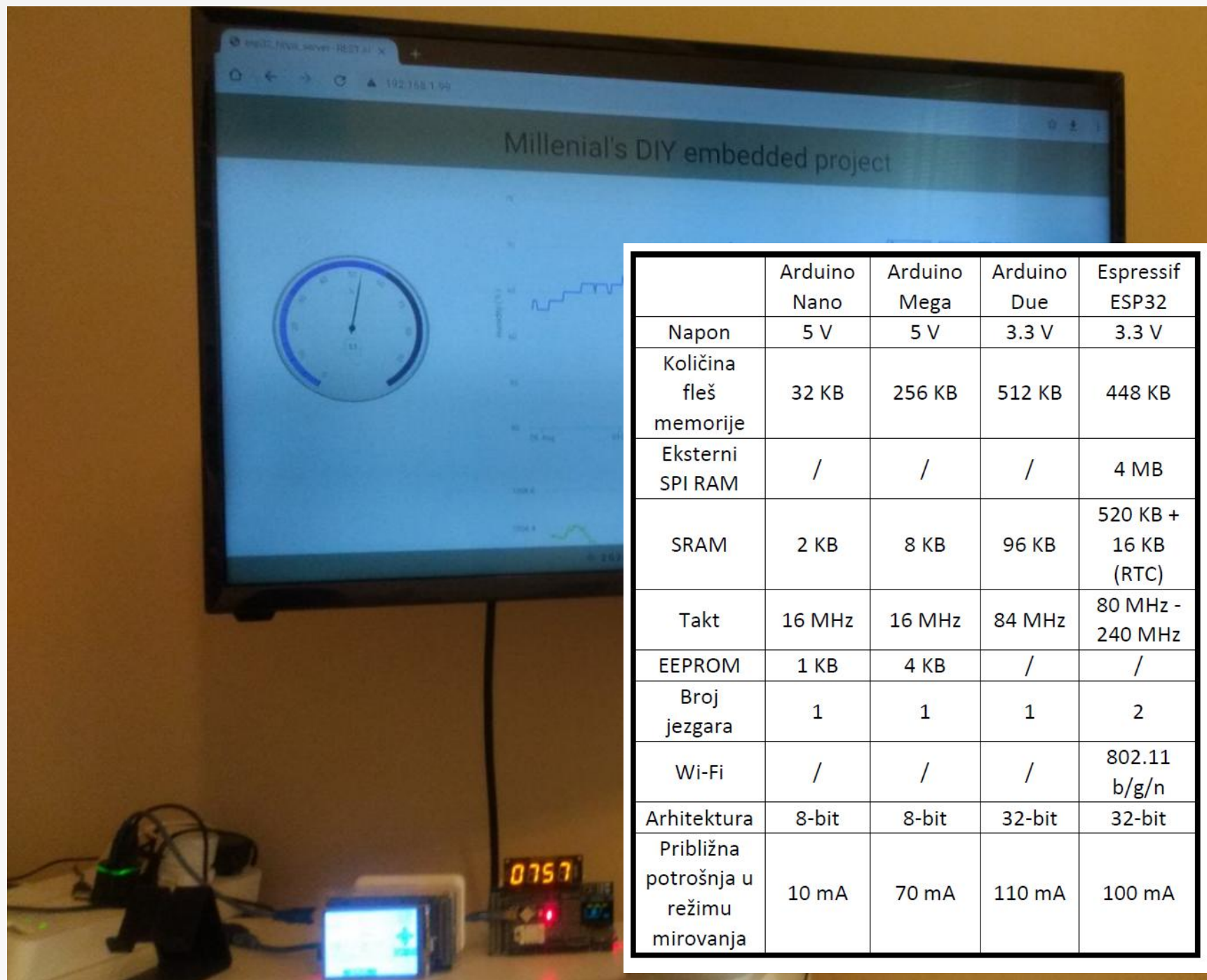


Razvoj merne stanice sa web interfejsom, upotrebom otvorenog hardvera u konceptu Industrije 4.0

**Ivan Gutai, Prof. dr Platon Sovilj, Marina Subotin, dr Nemanja Gazivoda,
dr Bojan Vujičić i Đorđe Novaković**

HTML5, CSS3 i JavaScript i IoT uređaji...





Korišćeni hardver u trećoj iteraciji (budžet ~ 10 €)

- Espressif ESP32 verzija DevkitC (32-bit)
- Senzor BMP280 (temperatura i pritisak),
- Senzor DHT11 (vlažnost vazduha)
- Senzor MQ9 (ugljen monoksid)
- Dvokanalni relej

Tehničke karakteristike uređaja

- C++ bazirani REST (Representational State Transfer) server.
- Povezivanje na kućnu Wi-Fi mrežu (praktičnije za testiranje) ili kreiranje Access point-a.
- Pristup web interfejsu sa uređaja koji ima web browser i Wi-Fi (testirano na telefonu, tabletu, računaru i Android TV box-u).
- Prikaz vrednosti sa senzora na analognim skalama i na graficima, koji mogu da pokažu do 480 tačaka, a zatim se dinamički pomeraju.

Tehničke karakteristike uređaja (nastavak)

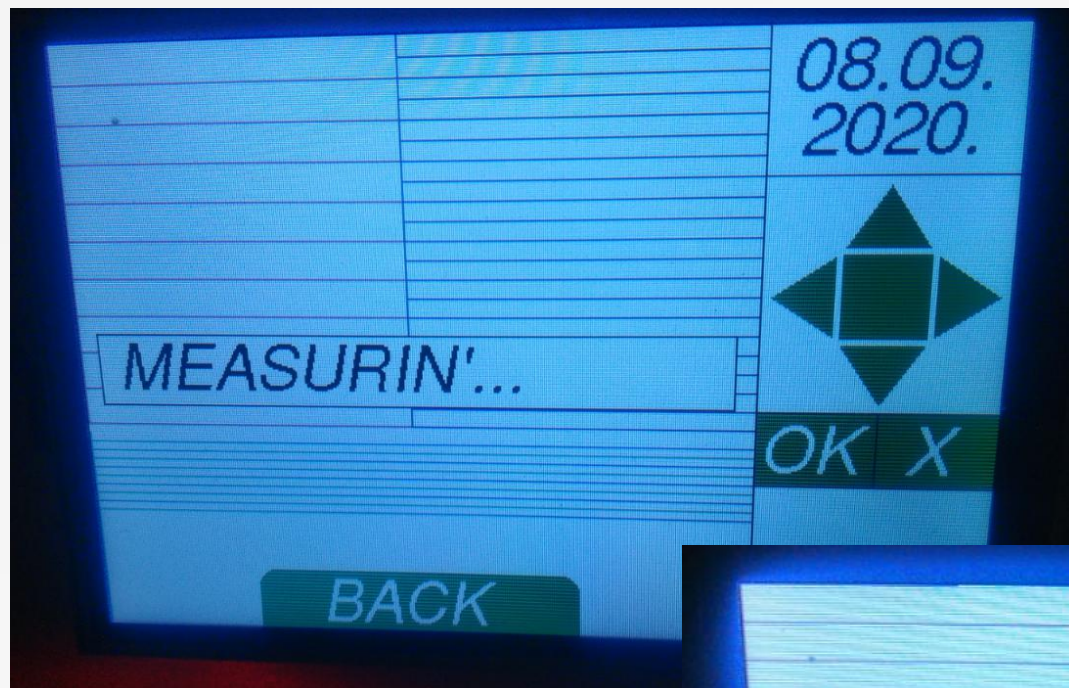
- Responsive (prilagodljivi) korisnički interfejs.
- Fiksni heder i futer u interfejsu predstavljaju idealno mesto za najbitnije informacije sistema, kao što je npr. upTime.
- Mogućnost aktiviranja releja iz web interfejsa.
- Fiksna IP adresa.
- SPIFFS (Serial Peripheral Interface Flash File System), reklamirano 32 Mb = 4 MB, a zapravo ~ 1 MB za deploy koda na fajl sistem.

Tehničke karakteristike uređaja (nastavak)

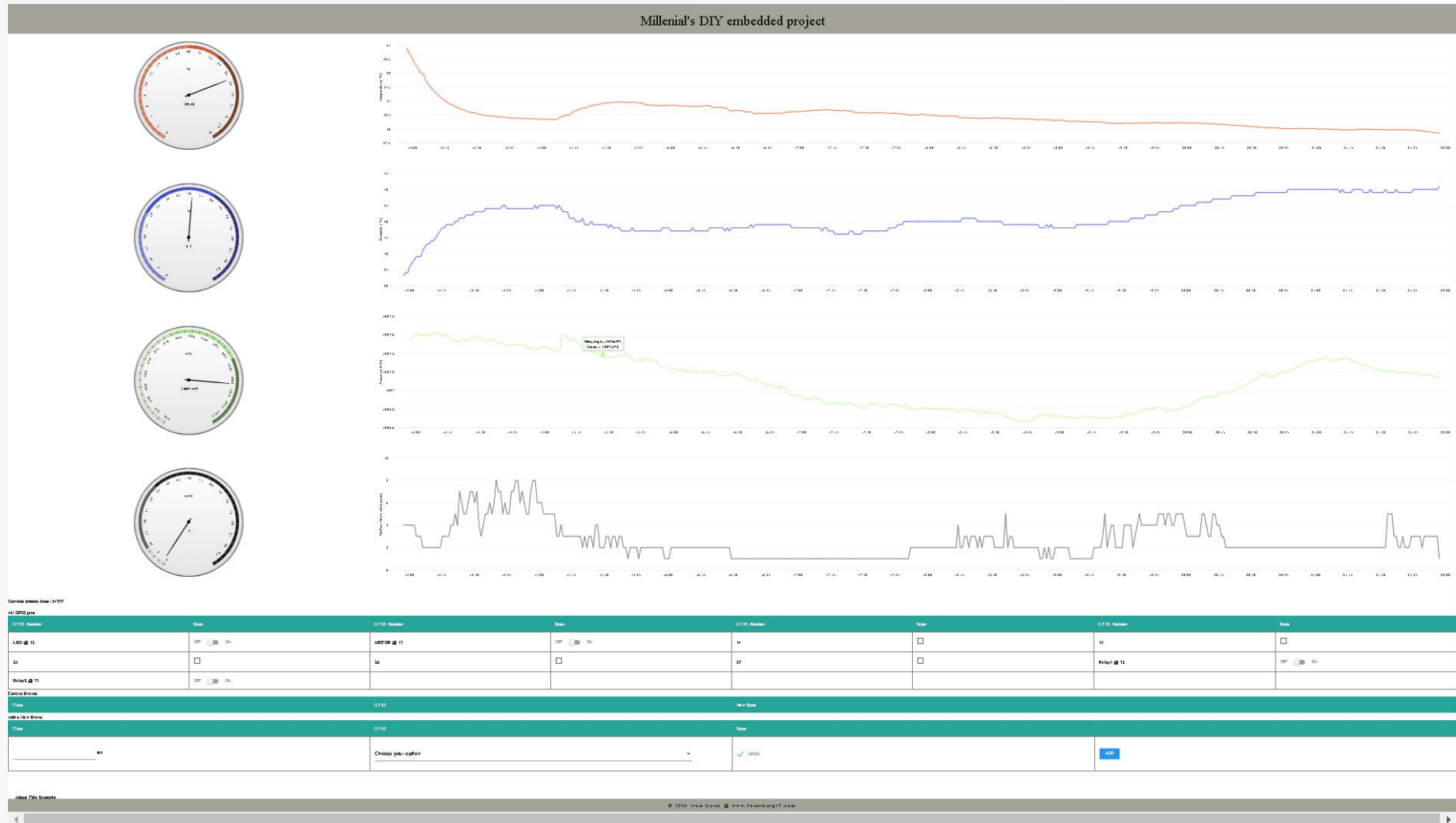
- Korišćenje elemenata RTOS-a, sa ciljem da Core0 služi za sve procese koje se tiču merenja, a Core1 odgovara na HTTP zahteve.
- Upotreba HTTPS-a, sa samostalno generisanim sertifikatom (bira se domen i važenje sertifikata)

Technology Stack

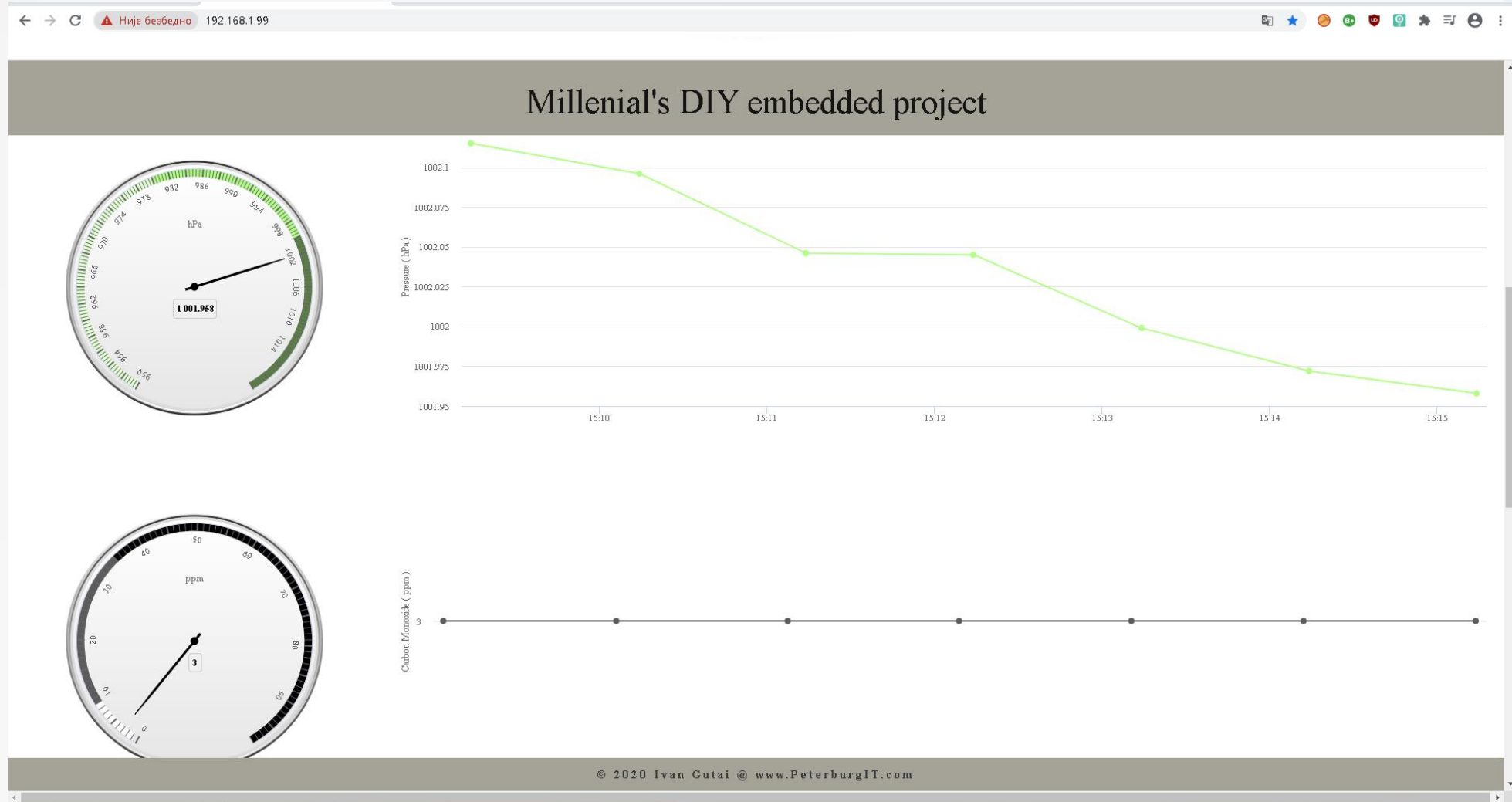
- Čist HTML, CSS i JavaScript
- Upotreba biblioteka Materialize CSS, Highcharts.js i jQuery
 - Materialize CSS za prikaz interaktivnih “prekidača” (zapravo checkbox-a)
 - Highcharts.js ima niz primera i preglednu dokumentaciju
 - jQuery za dinamičko dodavanje elemenata na stranicu
- Preuzimanje JSON-a sa “back end”-a upotrebom XHR zahteva.
- Manipulacija GPIO od 12 do 33 upotrebom AJAX-a.



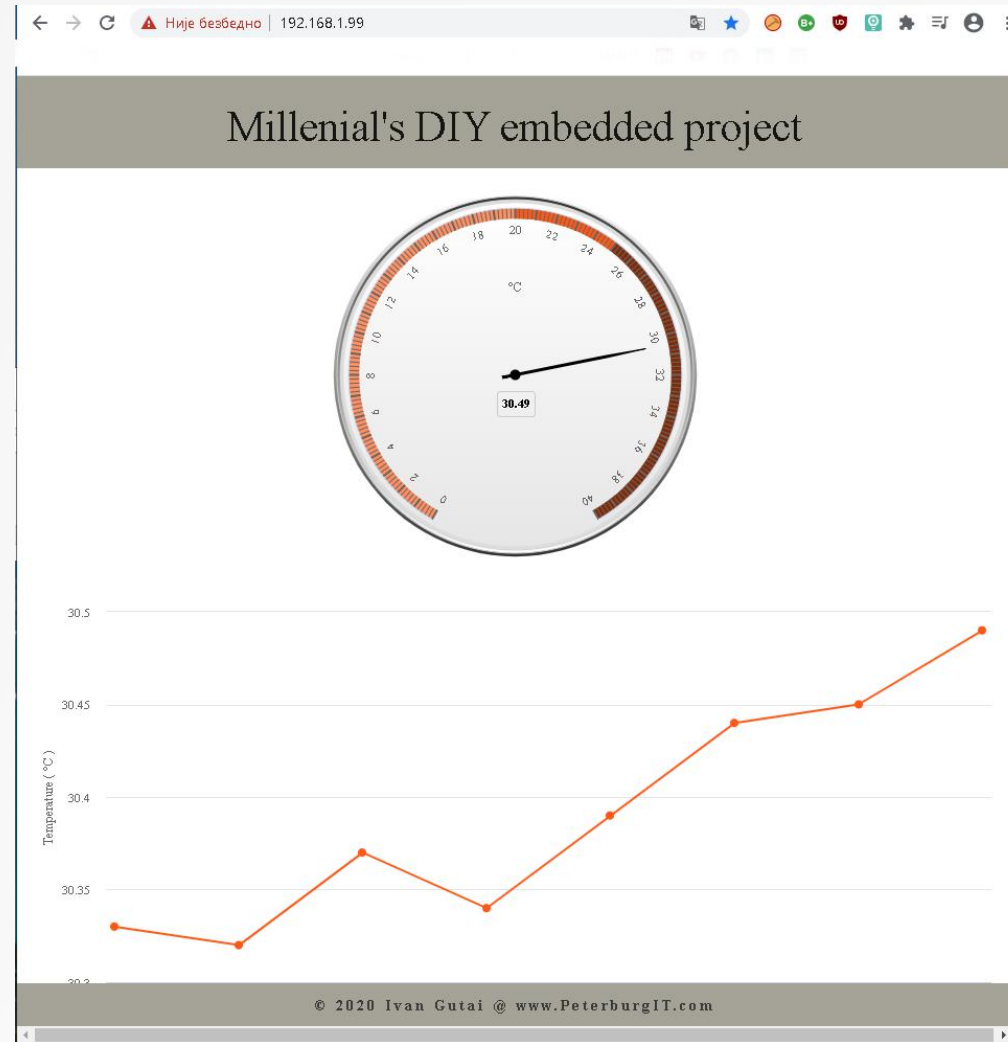
Web interfejs - maksimalni zoom out



Web interfejs - prikaz vrednosti pritiska i ugljen monoksida




Web interfejs - test na drugom uređaju ili zoom in



Web interfejs - kontrolni GPIO deo

← → ↻ ⚠ Није безбедно 192.168.1.99

Millenial's DIY embedded project



15:10 15:11 15:12 15:13 15:14 15:15 15:16

Current system time: 570

All GPIO pins

GPIO Number	State	GPIO Number	State	GPIO Number	State	GPIO Number	State
LED @ 12	Off <input type="checkbox"/> On <input type="checkbox"/>	MOTOR @ 13	Off <input type="checkbox"/> On <input type="checkbox"/>	14	<input type="checkbox"/>	15	<input type="checkbox"/>
25	<input type="checkbox"/>	26	<input type="checkbox"/>	27	<input type="checkbox"/>	Relay1 @ 32	Off <input type="checkbox"/> On <input type="checkbox"/>
Relay2 @ 33	Off <input type="checkbox"/> On <input type="checkbox"/>						

Current Events

Time	GPIO	New State	
700	GPIO13	HIGH	<button>DELETE</button>

Add a New Event

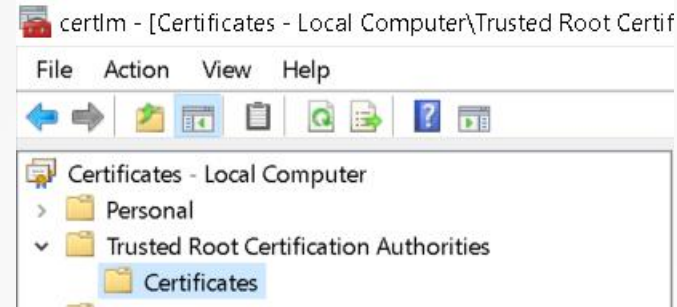
Time	GPIO	State	
<input type="text"/> sec	GPIO13	✓ HIGH	<button>ADD</button>

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SSL workaround

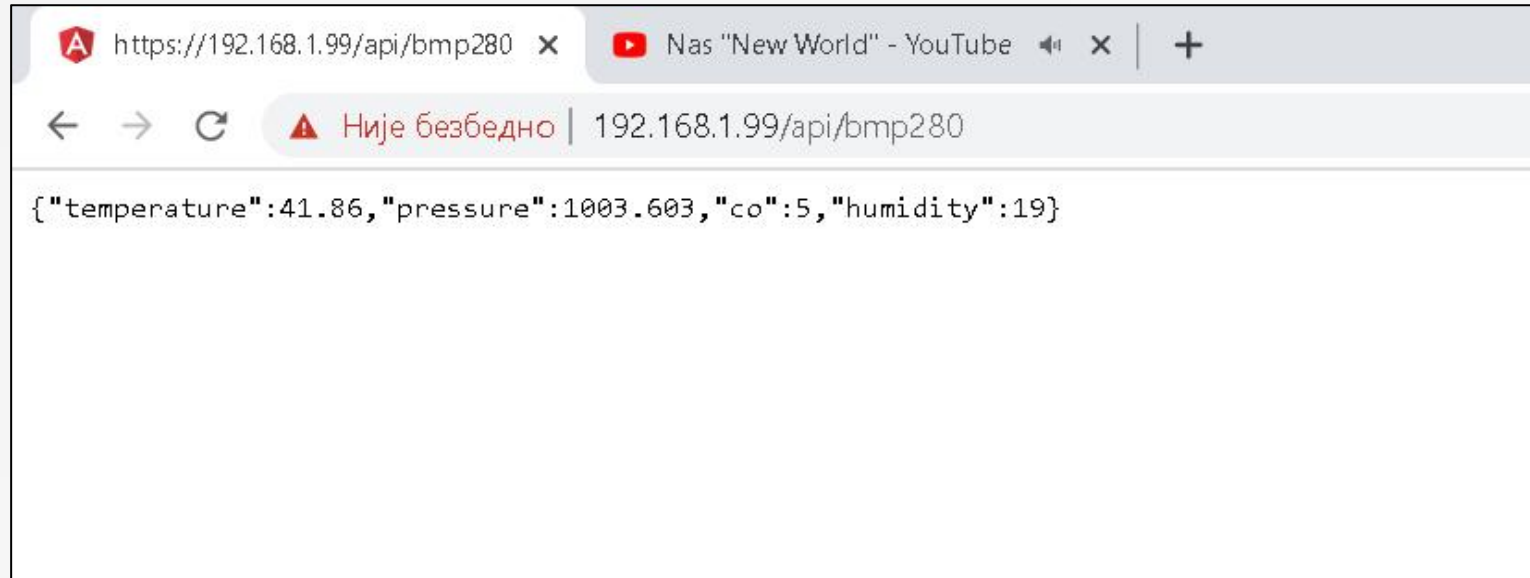
- C:\Windows\System32\drivers\etc\hosts

```
# localhost name resolution is handled within DNS itself.  
#       127.0.0.1       localhost  
#       ::1             localhost  
192.168.1.99          ivan.gutai.local  
|
```

A screenshot of a web browser window. The address bar shows "https://ivan.gutai.local" with a yellow warning icon. A "Site Information" popup is displayed, showing "Connection not secure" and "Permissions" (You have not granted this site any special permissions.). The background shows a webpage titled "Millenial's DIY embedded project" with a table of GPIO pins.

All GPIO pins				All GPIO pins	
GPIO Number	State			GPIO Number	State
LED @ 12	Off <input type="checkbox"/> On <input type="checkbox"/>			MOTOR @ 13	Off <input type="checkbox"/> On <input type="checkbox"/>
				14	<input type="checkbox"/>

Primer sistema koji nije praktičan za proširivanje



```
{} data.json X
C: > Users > Ivan Gutai > Desktop > {} data.json > ...
1  {
2    "temperature": 41.86,
3    "pressure": 1003.603,
4    "co": 5,
5    "humidity": 19
6  }
```

Upotreba baza podataka, neograničene mogućnosti

The screenshot displays the SQL Server Enterprise Manager interface. On the left, the 'Object Explorer' pane shows the database structure for 'Expo2020Sensors'. The 'dbo.MeasurementsFromBME280' table is selected, showing its columns and constraints. The right pane shows the results of a SQL query. The query is a SELECT statement that joins 'dbo.MeasurementsFromBME280' with 'dbo.Locations' on 'LocationOfSensor' and 'LocationId'. The results table shows 5 rows of data, including MeasurementFromBME280Id, UnixTimestamp, LocationName, Temperature, Humidity, and Pressure.

Object Explorer - Expo2020Sensors

- Database Diagrams
- Tables
 - System Tables
 - FileTables
 - External Tables
 - Graph Tables
 - dbo._EFMigrationsHistory
 - dbo.Locations
 - Columns
 - LocationId (PK, bigint, not null)
 - LocationName (nvarchar(128), not null)
 - Keys
 - Constraints
 - Triggers
 - Indexes
 - Statistics
 - dbo.MeasurementsFromBME280
 - Columns
 - MeasurementFromBME280Id (PK, bigint, not null)
 - LocationOfSensor (FK, bigint, not null)
 - UnixTimestamp (bigint, not null)
 - Temperature (money, null)
 - Humidity (money, null)
 - Pressure (money, null)
 - Keys
 - PK_MeasurementsFromBME280
 - FK_MeasurementsFromBME280_Locations_LocationOfSensor
 - Constraints
 - Triggers
 - Indexes
 - Statistics
 - dbo.MeasurementsFromMQ135

HP4IG\EXPO2020...ementsFromBME280

	MeasurementFromBME280Id	LocationOfSensor	UnixTime...	Temperature	Humidity	Pressure
1	1	1	1598427912	37,2700	31,0000	1007,0910
2	2	1	1598427917	37,7800	32,0000	1007,7200
3	3	2	1598427922	32,0000	40,0000	1007,0000
5	5	2	1598427927	33,0000	39,0000	1007,5000
▶▶	NULL	NULL	NULL	NULL	NULL	NULL

5 of 5

HP4IG\EXPO2020.Ex...rs - dbo.Locations

	LocationId	LocationName
1	1	LivingRoom
2	2	Balcony
▶▶	NULL	NULL

3 of 3

SQLQuery1.sql - HP4...IG\Ivan Gutai (52)

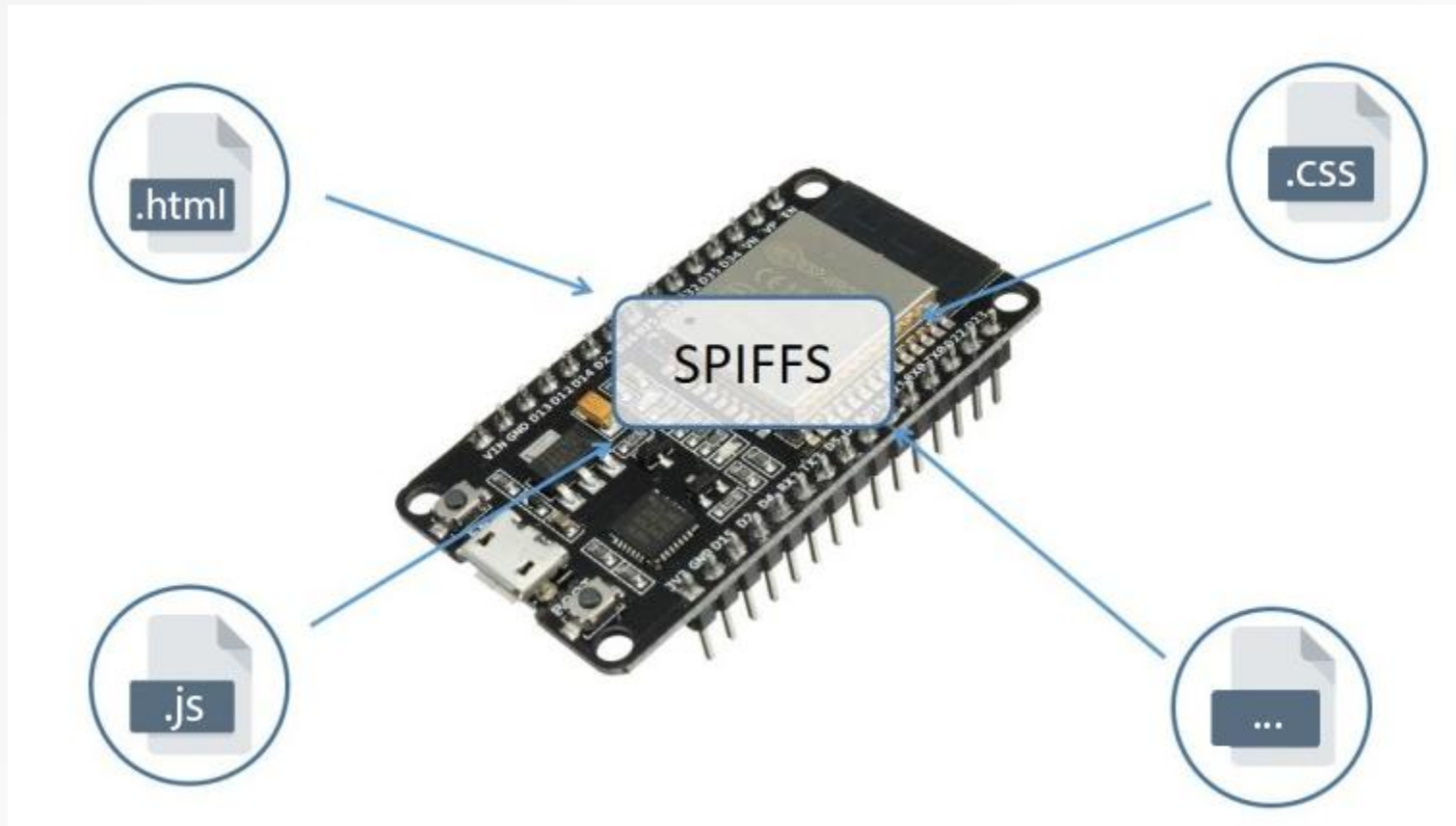
```
SELECT MeasurementFromBME280Id, UnixTimestamp, LocationName, Temperature, Humidity, Pressure FROM dbo.MeasurementsFromBME280 m LEFT JOIN dbo.Locations l ON m.LocationOfSensor = l.LocationId
```

100 %

Results

	MeasurementFromBME280Id	UnixTimestamp	LocationName	Temperature	Humidity	Pressure
1	1	1598427912	LivingRoom	37,27	31,00	1007,091
2	2	1598427917	LivingRoom	37,78	32,00	1007,72
3	3	1598427922	Balcony	32,00	40,00	1007,00
4	5	1598427927	Balcony	33,00	39,00	1007,50

Visok odnos uloženog i dobijenog za open hardware rešenje, kućni web server.



Q&A sekcija [linkedin.com/in/ivangutai](https://www.linkedin.com/in/ivangutai)



Ivan Gutai

Electrical engineer M.Sc. | Software Engineer (C#, JavaScript) | Technical Support Specialist | IoT devices maker (C++, JavaScript, HTML5, CSS3) | Self-taught Node.js Developer | World Cultures Enthusiast
2mo

You can get inspiration everywhere at any time.

Rock-solid firmware from my Nokia 8210 (made in 2000, yes 20 years ago) inspired me to create a menu based user interface on Millenial's DIY embedded project.

Nokia's marketing slogan: "Nokia connecting people", also inspired me to write this post, and let's do it.

Stay safe and tag someone creative who is a geek, a big fan of technology, or a creative individual. :)

Which was/is your favorite feature phone?

P.S. Every time you purchase a Nokia product, you can be aware that this device is built to last.

It would be amazing if they continue to build similar or the same feature phones as they did 20 years ago.

[#nokiamobile](#) [#hmdglobal](#) [#arduino](#) [#openhardware](#)

