

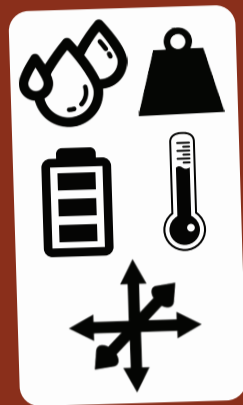
# Bee-hives monitoring using Internet of Things



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## Motivation

- bee-hives monitoring
- simplification of beekeeper's duties
- early notification of the beekeeper about important changes
- influencing the quality and quantity of the honey production
- hive control



## End user services

- online monitoring of bees even in far nature
- utilization of low power Internet of Things technology SIGFOX
- Android and web application for easy access to outer and inner temperature and humidity, hive weight and hive fall
- data displayed in graphs and numbers

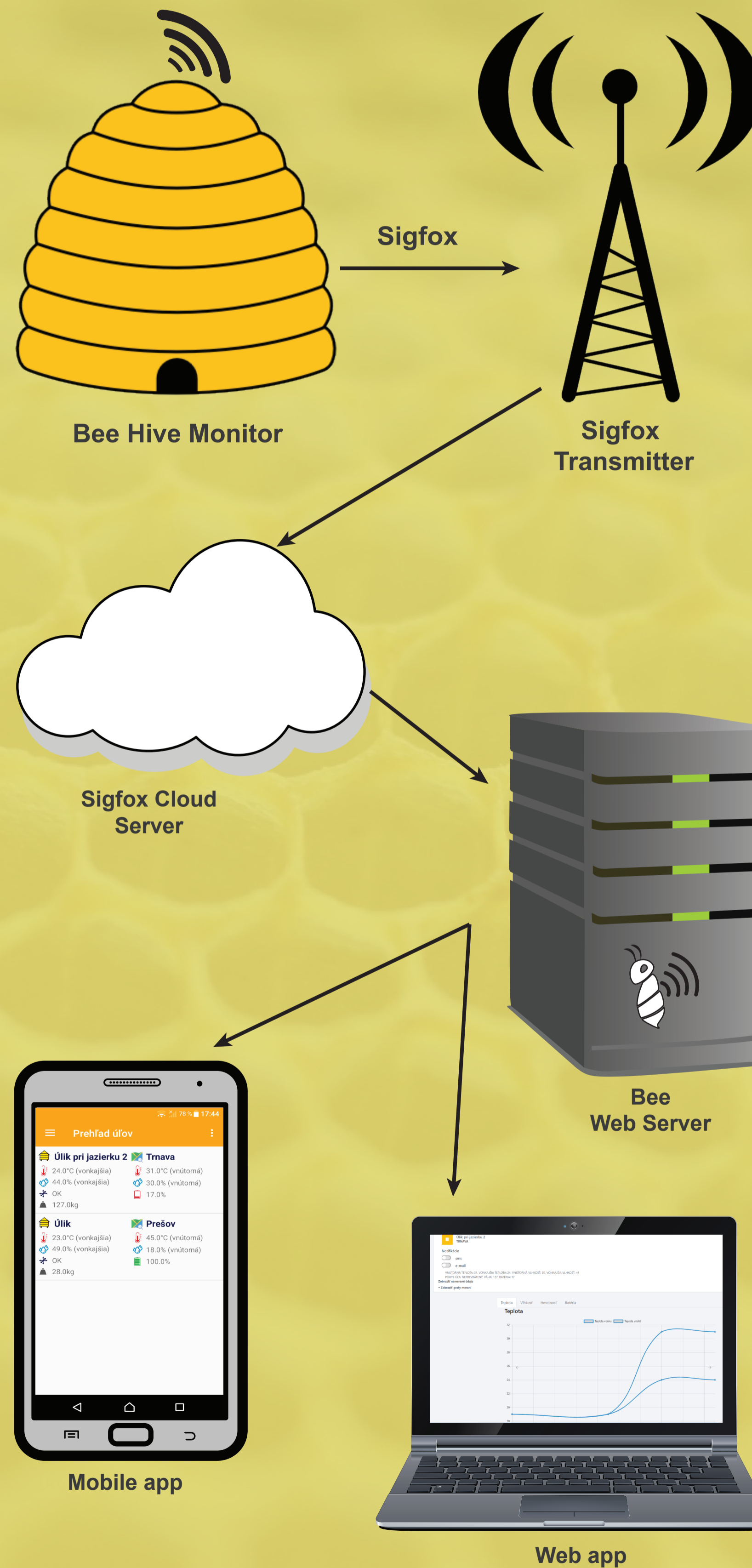
### Prehľad úľov

Úľik pri jazierku 2	Trnava
24.0°C (vonkajšia)	31.0°C (vnútorná)
44.0% (vonkajšia)	30.0% (vnútorná)
OK	17.0%
127.0kg	
Úľik	Prešov
23.0°C (vonkajšia)	45.0°C (vnútorná)
49.0% (vonkajšia)	18.0% (vnútorná)
OK	100.0%
28.0kg	

- setting notification limits values for each hive monitor
- display current notifications and their history
- system for separate roles – admin or user (beekeeper)
- possibility of ordering the whole product
- contact to developer team

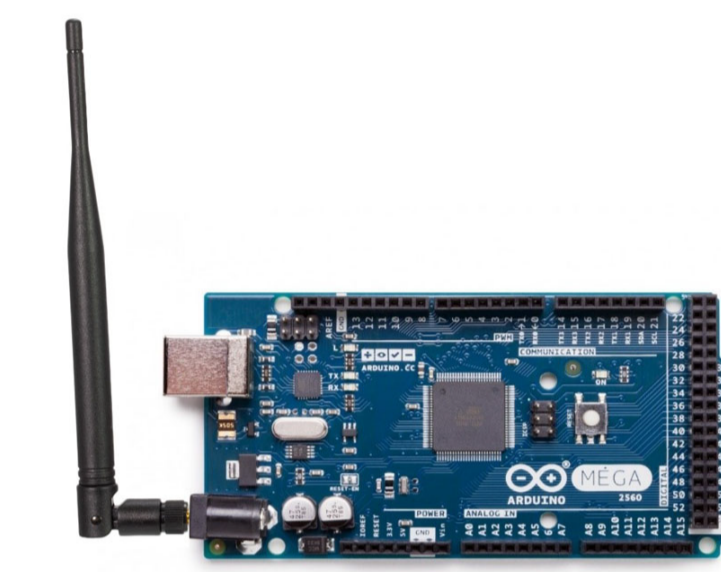


## System architecture



## Arduino and sensors

- microcontroller - Arduino Mega 2560 with Sigfox antenna and sensors
- DHT22 is accurate digital temperature and humidity sensor
- accelerometer based on a chip MPU-6050 includes a 3-axis gyroscope along with a 3-axis accelerometer
- TMOEC 200kg electronic load weight sensor for weight measurement



## Sigfox network

- inexpensive and low power consumption – ideal for IoT
- maximum length of message is 12 bytes
- each Sigfox end device sends up to 140 messages a day
- Slovak mobile operator – SimpleCell Networks Slovakia



## Future work

- audio and video analysis for better prediction of the bee's colony needs
- sending SMS message notifications
- solar panel to extend battery life

