

embedded world 2021 DIGITAL

Bosch Sensortec GmbH
Visitor:
Gerhard-Kindler-Straße 9
72770 Reutlingen
Tel 07121 3535-900
www.bosch-sensortec.com

09 March 2021

Bosch Sensortec Q&A sessions @ embedded world 2021 DIGITAL

Date:	March 1, 2021 – 4:50-5:20 pm CET
Title:	<i>Bosch Sensortec</i> unveils the new robust barometric pressure sensor BMP384 and the first gas sensor with Artificial Intelligence BME688
Speaker:	Dr. Thomas Block, Product Manager for Environmental Sensors, Bosch Sensortec Dr. Richard Fix, Product Portfolio Manager, Bosch Sensortec
Part 1: “Making a splash: Bosch launches a robust barometric pressure sensor”	
1. What is the typical current consumption of this device?	
BMP384 has a typical current consumption of 3.4 μ A @ 1 Hz for pressure and temperature.	
2. What is the max. overpressure and damage range of the BMP384?	
The piezo resistive membrane withstands an overpressure of up to several bar (burst pressure). This value is for the single membrane inside the package only, so more a theoretical value, because this maximum value until the sensor will be damaged is much higher than the water pressure you will use e.g. 5 bar.	
3. Can you tell us, what is the waterproof level, which you can achieve with the BMP384?	
The possible waterproof level depends on the final 2nd integration concept, but IP67, IP68 or 5 bar is realistic.	



4. Where can I actually buy the BMP384?

BMP384 is available at all our distribution partners. You can find a list on our website at www.bosch-sensortec.de.

Part 2: “BME688 – Environmental sensing with Artificial Intelligence”

1. Where is the BME development kit X8 (BME688) available?

Both BME688 and the development kit with 8 sensors will be available at all our distribution partners as of April 2021. We are going to link to all suppliers on our [BME688 product website](#).

2. As soon as the algorithm is trained with data from several sensors in order to recognize one component, can we export the parameters and use only one sensor to detect it?

Yes, the BME AI-Studio software can export the trained algorithm as a config string, which can be loaded into the BSEC 2.0 software on any device having one BME688. With that, the device can directly output the trained scan results of the BME688.

3. Do you have a code and examples showing the integration and use with your BSEC library?

Both is becoming available on our website <https://www.bosch-sensortec.com/software-tools/software/BME688-software/> for download until end of March.

4. Is it possible to detect the gases produced by burning of network cables and electronics?

We expect that this can be an interesting application for using the BME688.

Let's give some background: If there are unusual states in electric circuits or cabinets, there are typically two reasons:

- 1) Materials (e.g. isolator) get hot due to high currents / shorts,
- 2) High voltages or shorts lead to flashovers / sparks.

In case 1, hot or even melting materials occur increased outgassing, typically many unburned hydrocarbons, which can be well detected by the BME688 (as well as people smell it). In case 2, flashovers generate ozone, which is well detected by a BME688 and has a completely different signature than other gases.

5. Does BME688 detects combustible gases like CH₄ & C₃H₈ and poisonous gases like CO?

Yes, nearly all hydrocarbons (C_xH_y) are being detected by the BME688 gas sensor as well as many other gases like for example CO. Combustible gases are typically classified into NMOG (“Non-Methane Organic Gases”) and

methane. Methane (CH₄) is an exception, since its decomposition requires special catalysts, so we do not expect high signals even for high concentrations of methane. However, in many applications, methane does not appear as a single gas but together with other gases (e.g. sulfur compounds), which are well detected by BME688. Therefore, it makes sense to test with the BME688 in your application.

6. Why do we need 8 sensors on the evaluation board?

The BME688 development kit can be configured with the BME AI-Studio software. This allows to optimize performance, ODR and power consumption on specific application needs. By featuring eight BME688 sensors, the board allows you to test and gather data with more than one configuration at the same time. This significantly increases statistics and reduces development time as well.

7. Can we use current PCB using the BME680 print and upgrade it with BME688 without changes?

Yes, the BME688 is fully backward compatible and can be placed on every PCB, which has been designed for the BME680. You just have to update the API to the [new version](#), which automatically detects the BME688 and does the right value calculation (necessary due to the extended ASIC range of the BME688).

Date: March 2, 2021 – 3:00-3:45 pm CET
Title: Rutronik Tech-Talk 'Self-learning AI Sensor BHI260AP for Fitness Tracking'
Speaker: Kaustubh Gandhi, Senior Product Manager Software, Bosch Sensortec

1. Is it going to be a black box for the devs or will it be an open software development kit?

We will provide software development kit for programming the BHI260AP and make it as open as possible for developers.

2. Is the sensor able to indicate that the workout is done correctly?

For providing guidance to the user for appropriate training, you can make use of combination of the recognition and orientation tracking included inside BHI260AP.

3. The ability to indicate if a workout is done correctly would open up the field to physiotherapy applications, right?

Yes, correct.



4. How is the software reacting to highly varying movements like “burpees directly followed by heavy deadlifts” etc.? Is it picking up those constantly changing movements properly performed in a row when learned individually?

Yes, the sensor is picking up the changing movements automatically, without any explicit information from user.

5. How configurable is the BHI260AP for different activities? For example, a swimming expert with biomechanics background may have some different focus than the built in swimming analysis. Will developers be able to configure that?

Yes, the developers would be able to create and load customized patterns for the activities of their interest. Please get in touch with us via the [Bosch Sensortec Community](#) if you need further support for this topic.

6. Is there any data analytics previewed in real time (smart data profiling) or that are used for diagnostic predictions for instance?

Yes, data analytics can be previewed in real time with the development desktop.

7. Can the self-learning AI Software be used for other activities than fitness, like for e.g. fishing?

Yes, please get in touch with us via the [Bosch Sensortec Community](#) for further discussion on how to achieve this.

Date: March 4, 2021 – 11:30 am - 12:00 pm CET
Title: Bosch Sensortec presents “ ‘AI-catching’: Environmental sensing and fitness tracking with Artificial Intelligence”
Speaker: Dr. Richard Fix, Product Portfolio Manager, Bosch Sensortec
 Kaustubh Gandhi, Senior Product Manager Software, Bosch Sensortec

Part 1: “BME688 – Environmental sensing with Artificial Intelligence”

1. Do you use the sensor to train its AI model?

Yes, the sensor data is being used for the AI model. The standard gas scan mode for VSC detection is being developed based on sensor data from a huge number of sensors and lab tests with different gases. And for other applications, BME AI-Studio enables everyone to develop own use-cases based on BME688 sensor data, for instance by using the dev-kit with eight BME688.



One of the major benefits of the BME688 is that you can directly use sensor data measured in real-life applications. So far, the typical procedure for enabling new gas sensor-based applications is the following:

1. Identify single lead gases as well as potential interfering gases with sophisticated gas analyzers.
2. Find or develop suitable gas sensors for these gases.
3. Do lab tests with lead gases against interference gases (usually in synthetic air, which cannot represent real life conditions).
4. Test reproducibility and performance in the real-life application.

This procedure still makes sense in case of known target gases like for e.g. sulfur compounds as a marker for bad breath. However, it comes to its limits for other smells or more complex gas mixtures.

With BME688 and the BME AI-Studio software you can directly develop, test and optimize in your application. For sure, this can still be accompanied by lab tests and might be even mandatory in some applications. However, using real-life data for gas sensing algorithms can significantly improve the performance and even enable new use-cases.

2. Do you need to force air into the BME688 when taking samples?

No, this just happens “by itself” due to the laws of nature, in particular due to diffusion. As soon as the gas composition around the BME688 changes, there is a concentration gradient, which leads to diffusion of gases into and out of the BME housing. In addition, thanks to the tiny dimensions (the lid hole is less than 1 mm away from the gas sensor chip inside), this happens within few seconds.

3. As the data is stored on the sensor, how many measurements are possible?

The BME688 stores the scan profile as well a few data points in its buffer. The measured data has to be continuously read by the microcontroller (MCU) of the device to which the BME688 is connected anyway. In that configuration, the only limit for measurement data is the device storage. By running the [BME688 library](#) (called “BSEC”) on the MCU, the sensor data can directly be evaluated, so that you do not have to store raw data but only the required output values.

4. Next to gasses, what else can be measured with the sensor?

The BME688 has temperature, barometric pressure, air humidity and gas sensor elements inside. All sensor information can be used either as single values or combined in the AI software to recognize certain



conditions or states. In BME AI-Studio, you can decide whether you just want to use the gas sensor data for your application or take as well pressure, temperature and humidity sensor data into account.

5. Are profiles of pre-trained models of some gases available for implementation?

The standard profile is developed to detect VSCs. There are several other gas scan profiles available in BME AI-Studio and you can even configure your own profile. For sure, they have to be trained on an application.

6. Are you planning to offer more pre-trained models than currently available?

Bosch Sensortec, as well as first customers are already developing models for other applications.

7. Does the BME688 have Flash or EEPROM?

No.

8. Which neural network topology is used in AI? Or is it just statistical analysis for pattern recognition?

The current version of BME AI-Studio uses a pre-defined Neural Net Architecture combined with one configurable optimizer for training (ADAM optimizer). Depending on market requirements, we plan to have the possibility of choosing other architectures in a future release.

9. Is the BME688 certified as a medical sensor?

No, usually this is done on device level, not on sensor component level. Bosch Sensortec qualifies products according to the standard requirements for consumer electronics (e.g. JEDEC). Generally, our customers are the experts for their specific application field and mission profile in which they use our sensor components. End devices anyway have to be certified, the advantage of certified components is usually low.

10. Is it possible to detect drugs and explosions with your BME688?

We do not have experience in this field. However, you can test it with the BME688 development kit.

11. Are over-the-air updates possible to detect more gasses and substances in future?

You can do that even today: The configuration of the BME688 is completely defined by software, not hard-coded in the ASIC. For instance, if you have developed a new application with BME AI-Studio, the result is a new config-string in combination with a scan profile. Both can be easily transferred to



each of your devices in the field over the air, since it is just a few kb of size. As soon as the BSEC software on your device is loaded with the new configuration, the sensor works with the new characteristic.

09 March 2021

Page 7 of 9

Part 2: "BHI260AP – Fitness tracking with Artificial Intelligence"

1. What is the prediction accuracy rate for your trained algorithms?

The typical prediction accuracy is >90% for personalized pre-trained activities.

2. Which neural network topology is used in AI? Or is it just statistical analysis for pattern recognition?

This is a proprietary patented Bosch technology designed especially for learning on the edge (which enables personalization) and still keeps computational and power requirements low.

3. Can the raw data from the BHI260AP be accessed in real-time and does the sensor include a multi-axis accelerometer?

Yes, the raw sensor data can be accessed in real-time. The sensor includes a 3-Axis accelerometer and 3-Axis Gyroscope.

4. Is the AI firmware updateable?

Yes, the AI firmware is updatable.

5. Is BHI260AP compatible with MCUs?

Yes, the BHI260AP can be used together with other MCUs.

6. Do you have development boards, like for e.g. a pulse band?

Yes, we have application and shuttle boards. Shuttle boards for BHI260AP are not yet available with our distributors. We plan to make them available in Q2 2021.

7. Do you provide a design kit and a free graphical user interface (GUI) with real-time raw data display at Windows OS?

Yes, we provide software development kit for programming the BHI260AP and the PC based development desktop tool for visualization of real-time data.

8. Does the BHI260AP need any real-time cloud AI support or is it an edge AI sensor?

BHI260AP is a complete edge sensor. Cloud support is not needed.



Date:	March 5, 2021 – 2:30-3:00 pm CET
Title:	<i>Bosch Sensortec</i> introduces the self-learning AI sensor BHI260AP and the new robust barometric pressure sensor BMP384
Speaker:	Kaustubh Gandhi, Senior Product Manager Software, Bosch Sensortec Dr. Thomas Block, Product Manager for Environmental Sensors, Bosch Sensortec

Part 1: “BHI260AP – Fitness tracking with Artificial Intelligence”

1. What is the classification based on, is there a NN used?

Classification (learning and recognition) is based on time-series accel and gyro data using a proprietary patented Bosch technology designed especially for learning on the edge (which enables personalization) and still keeps computational and power requirements low.

2. Some of the heavy compound exercises might be dangerous if they are not done correctly. Is there a measure to prevent incorrect training due to the incompetence of the users?

For providing guidance to the user for appropriate training, you can make use of combination of the recognition and orientation tracking included inside BHI260AP.

3. What is the typical mean power consumption when the sensor is steadily in use (e.g. when someone is doing a workout)?

It depends on the number of sensors activated inside the sensor (accel or gyro) and the variety of activities simultaneously being tracked. For an exact number, please get in touch with Bosch Sensortec.

4. Is there an IDE available to use the API and customize it?

Yes we provide software development kit for programming the BHI260 and sensor API for customizing the sensor

5. Is there a MCU inside the sensor?

Yes, there is a MCU inside.

Part 2: “Making a splash: Bosch launches a robust barometric pressure sensor”

1. Is there any application note showing how to place/use the BMP384 in a final application?

We are working on an application, which we will release on our website soon.

09 March 2021

Page 9 of 9

2. Could you elaborate on the mechanical integration concept for a watertight solution?

There is no generic integration concept. It depends on the customer experience and requirements. However, the customer has to take care that only the gel area gets in contact with the water. This is possible with an O-ring sealing, under fill or adhesive gel.

3. What is the maximum pressure the BMP384 can withstand?

Maximum pressure the BMP384 can withstand is 10 bar.

4. What is the absolute accuracy of the BMP384?

The absolute accuracy is ± 0.5 hPa between 900 . . 1100 hPa from 25 . . . 40 °C.

5. How much difference in response time of the BMP384 could be expected compared to the non-gel version?

There is no difference in response time due to the gel.

6. Do you have an evaluation board to test the BMP384?

Yes, an evaluation board is available via our distribution partners.