

The roadmap to the fully autonomous vehicle

 By Jessica Tennant

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As part of Start JLM 2018, Nimrod Dor, director APAC & Africa: Mobileye Aftermarket Division, provided an overview about Mobileye and its roadmap towards the autonomous vehicle.

With a series of videos, Dor demonstrated the impressive progress Mobileye has made to date, throughout the research and development (R&D) stage, of its autonomous vehicle and safety technology solutions.



Mobileye started out in an effort to solve some very unfortunate figures. There are approximately 1.25 million road deaths globally annually, and about 20-50 million cars damaged. Most of these accidents (about 90%) are a result of human error.

“Most accidents occur because of human inattention. People are using their mobile when they're driving, drinking coffee, looking at their baby in the mirror for three seconds, looking at the side of the road... all those scenarios, those 2 to 3 seconds, when we lose our attention on the road, are causing the accidents,” said Dor.

So, Mobileye started trying to find technology solutions to decrease these statistics and ultimately save lives. It thought to take a forward-facing camera with AI visual computing technology to understand what was happening, in order to provide drivers with alerts in real-time to rectify a potentially dangerous collision.

Other features, such as automatic braking, are based on Mobileye's technology and they are currently working on developing a fully autonomous vehicle to take the driver out of the driving wheel. Dor believes that in doing that, they can reduce road accidents by about 90%. "We believe we can reduce the level of accidents by 90% on the road when the autonomous vehicle is ready to use commercially."

“ The goal is to make sure that the autonomous vehicle will never initiate an accident. ”

Mobileye was founded in 1999 by Hebrew University professor Amnon Shashua. Together with Ziv Aviram, the company's R&D headquarters were set up in Jerusalem, where they spent eight years working on the R&D without a single user. The company has since scaled exponentially and most recently, in 2017, it was acquired by Intel for \$15.3bn. This is the biggest acquisition in the history of Israel, and that year it also announced its partnership with BMW and their shared commitment to placing their first fully autonomous vehicle on the road by 2020.

"With this, we are planning on having the first autonomous vehicle on the road in Japan, starting from next year, only on highways."



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Further to this, it was announced last month that Mobileye is also partnering with the Volkswagen Group and Champion Motors to deploy Israel's first self-driving ride-hailing service, effective 2019.

Dor believes Jerusalem is the ideal base for Mobileye and testing its technology.

“ We believe that Jerusalem is like a sweet point between very aggressive culture driving like in India and South East Asia, to driving in Europe or the US. It's similar to Italy or France, so we believe it's the perfect location to test and ensure that our R&D car is able to match itself to a different location. ”

He also mentioned that driving is also a cultural thing, and believes that Jerusalem's diverse population lends itself well to this.

Three pillars of autonomous driving

1. Sensing

Mobileye predominantly uses camera sensors. Human beings drive with their eyes, understanding not only the dynamics of the road but also semantics. “The only sensor that has that level of capabilities is the camera and so we believe that the main sensor will remain the camera for the autonomous vehicle.”

2. Mapping

“In order to have an autonomous vehicle on the road, we also need to be able to build an HD map that will enable us to locate an autonomous vehicle with accuracy.” They need to be able to tell where it is located in a specific lane, before a specific stopping line and so forth.

For this to happen, Mobileye has developed a unique methodology of crowdsourcing. “We’re using all the units that are there on the road, equipped with our technology to crowdsource all the data from the road and build a map.”



"Build, move fast and break things" - Waze co-founder Uri Levine

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3. Driving policy

They also need to be able to teach the autonomous vehicle to have intuition and other relevant human-like behaviours. “Driving is a multiagent game,” he explains. We emerge into traffic, we sometimes even look the other driver in the eye to indicate our intention and so the autonomous vehicle needs to understand this behaviour to an extent.

To achieve this, Mobileye has employed a sophisticated team dedicated to learning its AI computing mechanism. “There are thousands and thousands of different scenarios and simulations on the road and we’re teaching the computer how to react to each and every scenario.”

The elephant in the room

“ *Everybody talks about AB, but no one knows how to address it. There are two main approaches in the industry today – one is a safety model based on mileage where you drive a certain amount of mileage and based on that if you have an accident you can prove a level of safety. We believe this is a risky approach because you can only drive on highways without sophisticated scenarios. The other approach is that we are developing a safe technology where you have to rely on us that we are safe enough because we say so.* ”

Only a combination of the above pillars will make autonomous driving a reality, but that’s still not enough to have an autonomous vehicle. They also need to address the elephant in the room, and that is the safety issue, which is linked to the third pillar in the sense that Mobileye has built a Responsibility-Sensitive Safety (RSS). This is basically a mathematical model incorporating numerous scenarios to ensure a common-sense, intuitive response to every scenario on the road. So, Mobileye is taking all those scenarios and trying to cover them with the RSS. “Because computers cannot keep anything open to interpretation. They must follow exact mathematical rules,” explained Dor.

In order to achieve this, he said they’re formalising the current sense of safe driving, then define what is a dangerous situation and what is the proper response for that situation, putting these into the equation and thereby making sure to avoid those dangerous situations.

To ensure they cover all their bases, they're inviting industry players and regulators to engage in this process and are allowing every other player in the market for the autonomous vehicle to use the RSS and challenge it.

"We believe that the more policymakers, the more players in the market that engage in the system, the more accurate it will get and the better we will have a common sense of what is the safety necessary for the autonomous vehicle", says Dor.

As there's going to be a long period of transition before all the cars on the road will be autonomous, in the interim Mobileye has solutions that can be retrofitted to any vehicle to provide alerts.

"We are developing the autonomous vehicle that eventually will take the driver out of the driving wheel, but at the same time, we're using the same technology – the same chip that we're using to do that – in order to provide alerts to drivers who don't want to buy a new car but want to have the same level of safety with their existing car."

Today, more than 25 global automakers rely on Mobileye technology to make their vehicles safer, more than 25 million vehicles worldwide are equipped with Mobileye technology and 13 automakers are working with Mobileye to enable autonomous driving.

While there's still some time before we'll see autonomous vehicles dominating the market, Mobileye is certainly making significant progress and leading the way to our autonomous driving future.

More will be published on [Start JLM](#) over the course of the next couple of weeks, so follow #StartJLM to get a taste of the so-called 'secret sauce' of Israeli innovation. For more info on Mobileye specifically, go to [Mobileye.com](#).

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