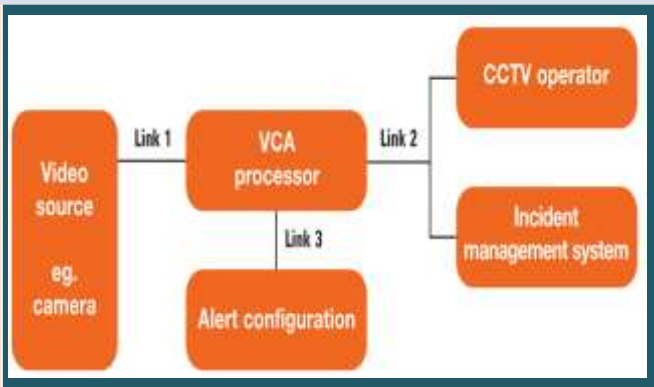
2015

Camera & Video Analytics-based Advanced Driver Assistance Systems (ADAS) Technologies



Homeland Security Research Corp.

Camera & Video Analytics-based Advanced Driver Assistance Systems (ADAS) Technologies – 2015

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1. Present and Pipeline Video Analytics (VA) & Video Content Analytics (VCA) Technologies

1.1. Camera & Video Analytics-based Advanced Driver Assistance Systems (ADAS) Technology and Market

1.1.1. Camera & VA-based Advanced Driver Assistance Systems Market

Road traffic accidents and injuries remain a major unresolved problem worldwide. The World Health Organization (WHO) estimates that there were 1.24 million deaths on the world's roads in 2010. The WHO also estimates that road traffic accidents can adversely affect 1-3% of a country's gross domestic product. In 2011, AAA estimated that auto accidents cost the United States $300 billion annually. As a result, reducing traffic injuries has been a critical priority for governments, safety organizations and the automotive industry. Making vehicles safer has been critical to reducing road traffic injuries.

The U.S. Insurance Institute for Highway Safety (IIHS) cites studies finding that more than 90% of vehicular accidents are due to human factors. IIHS has estimated that if all vehicles were equipped with forward collision warning, lane departure warning, side-view assist, and adaptive headlights, as many as 1.9 million crashes involving passenger vehicles could be prevented or mitigated each year, including about one of every three fatal crashes and one of every five serious or moderate injury crashes. The ADAS market is a new and growing market. Mobileye forecasts that major regulatory changes, together with increased customer awareness of the benefits of active safety technology, will drive ADAS adoption to the point where the vast majority of new cars produced will be equipped with one or more ADAS capabilities.

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Figure 1 - Mobileye Detects: Lane Departure, Forward Collision Monitoring, Headway Monitoring, Speed Indication, Intelligent High Beam and Pedestrian Collision Monitoring

Automobile safety is driven both by regulation and by the availability to consumers of independent assessments of the safety performance of different car models, which have encouraged OEMs to produce cars that are safer than those required by law. In many countries, new car assessment programs (NCAPs), particularly the European NCAP, and the U.S. NCAP administered by the U.S. National Highway Traffic Safety Administration (NHTSA), have created a market for safety. Car manufacturers seek to demonstrate that their new and revamped car models satisfy the NCAP's highest rating, typically five stars, or can tick the box on the new car sticker. National NCAPs will continue to add specific ADAS applications to their evaluation items over the next several years, led by the European NCAP.

Mobileye forecasts that this global roll out will lead to harmonized requirements across key geographic areas. For example, in 2014, the European NCAP increased its active safety weighting to 20% from 10%, meaning that a 5-star rating will require one or more active safety systems on each vehicle model; by 2017 active safety functions will be required to achieve a 4-star rating. Similarly, the U.S. NCAP continues to add ADAS features to its evaluation items, including forward collision warning and lane departure warnings, begun in 2011, and rearview video systems beginning in 2014. In addition, the IIHS has added collision avoidance technology such as FCW to its criteria for awarding a Top Safety Pick+ rating.

In recent years, there has been increasing emphasis on autonomous, automated or self-driving vehicles. Self-driving vehicles are those in which operation of the vehicle occurs without direct driver input to control the steering, acceleration and braking, and are designed so that the driver is not expected to monitor the roadway constantly while operating in self-driving mode. Self-driving vehicles range from single applications with the driver required to continuously monitor traffic to semi-autonomous or fully autonomous driving where the driver increasingly relinquishes control. Semi-

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autonomous driving under certain conditions, such as highway driving, means the driver does not have to monitor traffic continuously but must be ready to control the vehicle. Fully autonomous driving under all situations will not require any driver input. The move to the autonomous vehicle is expected to introduce significant potential economic savings as well as further reduce traffic accidents. While fully autonomous driving is not expected in the near future, Mobileye forecasts that there will be ongoing introductions of semi-autonomous driving capabilities. Mobileye forecasts that these capabilities will start with hands-free highway driving that will gradually extend to other types of roadways such as country and city driving. ADAS applications that warn but do not perform a control function are not for this purpose considered automated driving, but they are necessary for effective performance of the control functions. The key factors in the growth of autonomous driving will be increased safety, consumer demand and economic and social benefits, which Mobileye expects will subsequently be reflected in automobile regulations and rating systems. Controlling the costs of the systems is also critical as many studies have shown that consumers are interested in safety but are also very sensitive to costs.

The ADAS industry is highly competitive. Competition is based primarily on technology, innovation, quality, delivery and price. Future success will depend on the ability to develop superior advanced technology and to maintain a leading competitive position with respect to technological advances over existing and any new competitors. Vendors face potential competition from Tier 1 companies and other technology companies, some of which have significantly greater resources. Google Inc.'s autonomous car program has received significant public attention. It is not known how close Google Inc. is to commercializing its product or whether any OEM has agreed to manufacture an automobile with Google Inc.'s technology. It is possible that a competitor or potential competitor, including Google Inc., could create a competitive ADAS technology that gains significant market share, although Mobileye believes that they would experience a five-to-seven year development timeline with an OEM.

1.1.2. Camera & VA -based Advanced Driver Assistance Systems Technology

Sophisticated video analytics software algorithms and a system on a chip (SoC) combine high performance, low power consumption and low cost, with automotive-grade standards to provide drivers with interpretations of a scene in real-time and an immediate evaluation based on the analysis. The technology uses monocular camera processing that works accurately alone or together with radar for redundancy. Products with multi-focal cameras for automated driving applications with the same high performance, low energy consumption and low cost will start working in 2016.

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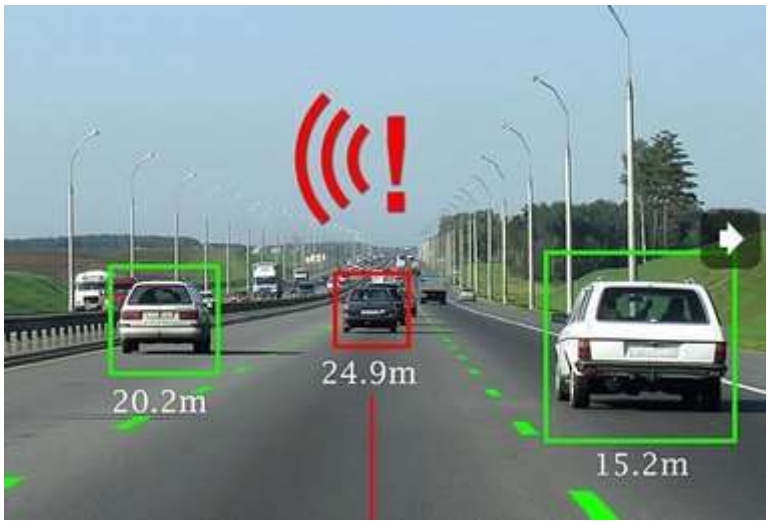
Figure 2 - "Lane Keeping" Mode



The CCTV & video analytics based ADAS market growth is based on the following:

1] All applications in a single camera

The developers of the technology understood that it was essential to develop the entire spectrum of camera functionalities in order to position the camera as the primary sensor due to its cost and packaging convenience. It provides all applications in a single system and camera. Mobileye forecasts that this makes the solution compelling to OEMs. Further, many of the pipeline additional applications require a simple update to the software rather than costly and time-consuming changes to the hardware itself. Mobileye forecasts that as internet access becomes more available in cars, software updates may even be made wirelessly.

2] Large validation datasets train and optimize complex algorithms

The leading technology commercialization company Mobileye has the largest number of serial production models in the industry and experience with most global OEMs have yielded millions of miles of road experience data covering more than 40 countries at all times of the day and in multiple scenarios - highway, country, or city - across hundreds of vehicle models. Mobileye's large datasets, unbiased as to any OEM, give them the unequalled ability to train and optimize their proprietary algorithms.

3] Cost-effective chip Set

Mobileye has designed its own microprocessor chip that has the computing power to run LDW, FCW, AEB (for vehicles and pedestrians), TSR, AHC, ACC, Free-Space Analysis, debris detection, and more at a frame rate of above 20 fps. This kind of computational load is unusually high on a portable device. Mobileye's EyeQ SoC is capable of achieving a very high throughput

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at a very low power consumption and very low cost. Each new generation of the EyeQ SoC is many times faster than its predecessor, allowing for more and better image analysis. EyeQ2 was approximately six times faster than the original EyeQ; EyeQ3 launched in vehicles in 2015, is approximately eight times faster than EyeQ2; and Mobileye is currently designing EyeQ4, which is expected to be launched in 2018.

4] Scalable technology

Mobileye business model results in strong operating margins, and in 2013, Mobileye generated operating income and net income for the first time. Mobileye believes that its business can grow significantly without corresponding increases in fixed and capital expenditures because Mobileye has strong existing relationships with nearly all OEMs and Tier 1 companies, and is not reliant on traditional sales and marketing processes to develop the OEMs business.

5] Leading the development of ADAS specifically for automated driving

Mobileye believes that it will be the first to supply the underlying technology to launch commercially viable semi-autonomous driving at highway speed. The move towards hands-free driving necessitates additional capabilities such as traffic-light detection, detection of obstacles outside the driving path and significant growth of scene understanding in order to support automatic lateral control of the vehicle. Mobileye believes that the camera is the sensor best suited to address the functionalities necessary for automated driving. Effective automated driving will require the coordination of multiple cameras around the vehicle to provide both a wide field of vision and protective redundancy. Mobileye has been designing new multiple cameras configurations to support the higher safety standards required for hands-free driving and has been further developing existing AEB functions to meet even higher reliability standards. As Mobileye continues to gain experience in this area, it expects to be a leader in additional ADAS for automated driving.

6] Creating additional and enhanced applications

Mobileye expects to launch full-braking, camera-only AEB with multiple OEMs in early 2015 as well as additional and enhanced applications in 2014 and 2015 including “no entry” sign detection, new traffic signs, animal detection, general object detection, free space or construction zone assist, traffic light detection, pothole detection and debris detection. As Mobileye continues to expand the suite of ADAS Mobileye offers, it believes that technological advantages over competitors will continue to grow.

7] Developing surround-view capabilities

Mobileye is working on rear-view camera ADAS and surround-view ADAS, both of which are also critical to effective automated driving and the emerging market for automated parking functionality. The rear-view camera will also be critical to winning new serial production because in March 2014, the NHTSA

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issued a final rule requiring rear visibility technology in all new vehicles under 10,000 pounds by May 2018 to prevent back over accidents. Currently, OEMs offer surround-view cameras that display a bird's-eye-view of the area around the car to assist the driver in manual parking. Mobileye is working with one OEM to launch the next generation of surround-view functionality, not merely for display but also for processing visual information to aid the function of automated parking.

8] Winning additional serial productions with existing and new OEMs

Mobileye intends to leverage strong relationships with existing OEM customers to win additional serial production contracts in order to create a fundamental component of its OEMs' global platforms. Mobileye also believes that its superior product and demonstrated ability to work with OEMs and Tier 1 companies will enable Mobileye to win serial production contracts from additional global and smaller OEMs for automobiles, as well as buses, trucks and other vehicles, which may require specialized customization.

9] Expanding aftermarket sales

The aftermarket products can be fitted for both automotive and truck uses. Mobileye believes there is significant opportunity for growth in sales to fleet owners, fleet telematics providers, insurance companies, vehicle importers, public transportation providers, taxi operators and OEMs that may seek to offer aftermarket product for vehicles that do not contain ADAS technology as a standard feature. Mobileye believes that it can leverage the growing public acceptance and awareness of driver safety technologies, and the rising influence of "five-star" quality ratings in new car models to market its ADAS aftermarket products as well. Mobileye also seeks to promote regulation that will mandate or encourage aftermarket installation of ADAS technology for certain usages such as fleets or certain drivers such as young drivers.

More information can be found at:
Global Video Analytics, ISR & Intelligent Video Surveillance Market – 2015-2020

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