

Interview: English

Before the interview we would like to ask for your consent to record the interview as we would need it for transcribing in the analysis, for over project.

Yes sure no problem

We are four university students and the topic that we are studying right now is about automates vehicles and there potential effect on the society and the industry, and we would like to discuss how your monitoring technology will change the field, and the potential future of automates vehicles. Oure research up till now has concluded that automates vehicles or self-driven cares are a technology that is fare into being fully developed. We also talked to another... one of over other interview yesterday and they said that even though it seems like it can be soon that we can have autonomous vehicles it seems like it could be fare into the future especially concerning security issues when it comes to automated vehicles. The concept of cares and car driving without a driver has already been implanted in a few places for testing purposes, we already experienced it here in Denmark, we have seen it as well in America. We have also researched that the technology of autonomous cars and monitoring technologies are affiliated with one another, and sins one of the risks with driverless cars is car theft and the risk of hacking which is like also a topic that your monitoring technology is trying to prevent, so we would then like to ask you about *Visage Technologies* and how it influents society and safety while using automated driving.

I am just curios on what kind of discipline you are approaching? This topic like societal or sociology or individual psychological approach?

We are focusing on society and security at once but not any topic outside of thoughts tow

No further questions, I mean you got a very interesting topic, that's sorter happening right now, and quite complexed and big so it must be a challenge for you too in a way narrow it down

It is but it's also very interesting to hear other different kind of inputs concerning it and seeing the positive and negative impacts it can have on society and also the potential risks that can come with having automatic vehicles but that is some of the questions we are going to ask you and see if you can answer that.

We would like to ask what your role in the company is? What is it that you stand for?

So I am the director of sales which means I am in charge of the sales team so Visage Technologies we develop our own products and the sales team tries to find clients that would use those products, that's quite high tech products we call SDK's which is software development kits, which means we basically have software libraries and we sell those to software developers that create applications out of them, and driver monitoring is an example of application that can be built on over software development kit. You maybe compare it to, if we would manufacture a motor then you have a car company that builds a car around it and sales it, it not an end solution but a core component. Wide variety of applications, and driver monitoring is one of our focus areas, we also serve a wide range of other industries at the same time.

Are there other focus areas of Visage Technologies or is it the driver monitoring that you specify in?

We currently focus on driver monitoring and virtual makeup try-on for an e-commerce. But besides that we have clients in robotics, in remotes, health monitoring, facial recognition in terms of surveillance systems and many others. Many other applications fields.

The third question will be, how long has the company worked with facial tracking and facial recognition and why did you decide to focus on that with autonomous driving

Visage exists for 20 years for this entire 20 years we have been focused on the face and face tracking as a technology. In the beginning years we were using it for facial animation, later on for face filters because there were a lot of business there, so the Instagram filters, Facebook filters. Five years ago this business was booming and now we have all kinds of free solutions so there is, it is more challenging to make money in that area. So about two years ago we identified, we call it focus niches, so niches in the market that we want to spend more efforts on and so two years ago we decided to go for driver monitoring as part of the autonomous vehicles. This was partly driven because we already had one big client that used our technology for this, so we had some experience with leverage that...

That inspired you in some kind of way, and further continue with it and work

Yeah exactly

But we still serve a lot of markets, so there are companies out there that completely went for driving monitoring and dropped all other applications, we still have a horizontal product in that we still cater to health care, robotics and all the other niches as well but we put over focus on driver monitoring and virtual try-ons.

Do you have a specific target group or what is your typical clients, and what range is the industry?

No its like we are a small company so we don't sell to customers but to other companies and I will leave it myself to driving monitoring scenario to simplify it, but the automotive industry is quite.. there is a lot of layers, I don't know you have a OIM, ford, you have tear 1 provides like continental is a famous one, and then you have tear 2, that deliver technology too the tear 1 that delivers the OIM that builds the care, and we generally target the tear 2 and tear one providers we also have some clients like the OIMs but it's really difficult to get real business there. Generally, we are a bit lower in the value chain because it's easier for us to meet there requirements.

We would now continue on to the topic of safety:

How do you think the implementation of driver state monitoring and face tracking in automotive vehicles will affect traffic safety?

There are many factors to it, some people are using their phone while driving and causes them to be distracted, and it leads to accidents, and I mean there is research that gives you numbers, but the amounts of like casualties is in the hundreds and thousands for example cell phone users or drowsiness, people falling asleep, and I do believe driver monitoring will have a positive impact in those areas. When we can identify when somebody is getting into a dangerous state that we can adapt the way the care is driving. So I expect a positive impact, but how exactly will also depend on how the technology will develop, because currently it's not set in stone, how driving monitoring will look like in five years, there is quit... there is some concerns. We sort of know okay when someone is falling asleep, we can identify that, or when somebody's eyes are closed for a long time that's not good, but will we give an alert, will we adapt in a way that the car is driving by itself? These are still questions we are still figuring out, but I think all of them will have an impact on safety and I think the main or one of the main things is how to balance the user experience with the safety components, because we can... if you close your eyes for half a second it can make

vary annoying beeping sounds, and if you are driving then this is not good and car makers don't want to annoy their customers.

So, its to improve the attention span of the driver?

Yeah so, we are quite sure about that we can identify when someone is falling asleep also when somebody is distracted, but you have obvious distractions and you have very subtle distractions, because I can for example we can track where somebody is looking, the direction, but I can look straight in the camera but at the same time my mind is somewhere else, I can stare I cannot pay attention, where my eye direction shows a different, and for this challenging ways of being distracted or not engaged with driving... well the technology becomes less accurate and the certainty of someone actually being drowsy becomes lower.

Are there any other challenges or is that the main challenge you are facing?

I mean there are many... this is one of them, the other is the interaction with the car, so what do we do with the information we generate, okay somebody is drowsy what do we do then? Is the car going to stand still slowly or if you are on the highway and your car goes into a standstill then that's not good, that's not safe at all. So, this link is a challenge of accuracy and which type of distraction can we identify with a high degree of certainty. And also which behaviour... so this drowsiness is one, cell phone usage can be one, smoking can be one, but then again maybe we want to allow people to smoke while in the car... why not isn't it apart of your freedom, so there is also these ethical questions. What do we want to track, and on the technological level there is many challenges but I will say more the abstract and societal level is the main ones.

That is really interesting to learn about because the way facial recognition can overcome all of these things

Yeah because it seems like you have to actually... when you say that you are not focused on something when it comes to the mind you have to kind of connect the brain to the technology before it can kind of like work with each other. And that's also like not where we are at right now and that's maybe further in the future when we can figure out anything like a chip or something like that, you never know.

There are companies that collect data from an ICG they monitor the heart and sometimes also blood flow connected to the signals from the camera and it is also possible to see for example how far the pupil is dilated, so pupil dilation can also be a signal for drowsiness, next to the direction where somebody is looking, you also have blink rate... do you blink often or not or are there irregularities in blinking, so when somebody is drowsing it often happens that you blink a lot and then you don't blink for some time and then you blink a lot again, where is people who are rested and who are in a calm good state they have more of a regular blinking rate so these are all signals that you can use and try to combine them and as I said before, for what companies are doing to use other instruments as well for making these connections between blinking and drowsiness.

We would like to move on to the next topic, and the next topic will be about society where we have one question which is What are the possible benefits and disadvantages of your products?

So I will talk about driver monitoring as an end product, we don't sort of sell this end product but a component of it... like the benefits is its safety and personalization I think these are the two important parts... in terms of safety for example the whole Volvo brand they build around safety, so people buy a Volvo car because it is a safe car and has, I don't know, big bumpers, firm frame and all these things so people they want to buy safety, they want to feel safe, and when they know driver monitoring is in there then it is a plus for them, there is also the personalization part which has to do with facial recognition so we say facial recognition is.. ah there is a face camera and the computer behind it can say this is Tom or this is Chelsea based on what it sees. If you installed it in a car then you go and sit behind the steering wheel, and it sees for example that it is Chelsea and the system already knows what Chelsea is like so, she likes jazz or she likes the temperature to be on 90 degrees, so all this sort of comfort features can be set automatically when the car can recognize who is behind the steering wheel. So this is another part and there is another company called Xpery that focuses strongly on that so they are like we want to enable the experience of the future car your car should be like your second home, where you feel great and can do whatever you want and use the face recognition and other technologies to enable that. So for the end use these two safety and personalization .

Why do you think that it is important for cars to have a driver monitoring system?

so it depends a bit on the perspective there is the perspective of the user there is the perspective of the car maker so for example... you are researching autonomous driving, the cars that can drive by themselves so in a scenario that you know my car can drive by itself and 80% of the cases need a driving monitoring system to see if the driver is still engaged during those moments the car can't take care of itself, so it's a different perspective but if you have this, say it's limited autonomous driving which all cars have currently and I believe that it will stay like this for at least 10 more years, that this fully autonomous driving is not possible and then you need the driver monitoring to ensure safety from the OEM from the car maker point of view, because in the USA you now see that Tesla claims that their cars can drive autonomously to a very big degree like in many situations, but car crashes happen and now Tesla is being sued for the conservensness of that, because they claim that our cars can drive by themselves, but then how does it happen that you run in to a cyclist or pedestrian. So for this sort of liability of a car maker it's good that you can assess whether the driver will be held accountable for situations like that.

You (the company) claim that you don't use or store any private data or pictures to ensure the highest level of privacy. How does the system know that the user is the right owner of the vehicle without storing any personal data?

So what facial recognition can do, you give it a face and then the computer algorithm generates the scripture which is basically a very big number. It's a mathematical representation of the face - but the algorithm makes the translation between the picture and the numbers, so without the algorithm, this number doesn't make sense at all and you can also not do it the other way around or you cannot give the algorithm another number to reconstruct the face because you don't use the information from the entire face but only certain features. - For example, here is the nose; these are the mouth points; these are the eyes and eyebrows, so even if he was sort of reverse engineering you wouldn't get a very sort of just the set of.. we call it feature points... not really a face with colour or texture or all of these things you would get a rough shape so that is the way the way in which we ensure privacy that we don't do anything with this image we just... there's an image you give it to our algorithm you get a lot a big number and this number you can store wherever you want you can store it in the car you can store it in the cloud you can store it somewhere on the Internet... doesn't really matter we advise for example the car if you have a car will probably be used by only a few people maybe then you are like car sharing 20 and then it's

possible to store this 20 numbers in the car so that the car can recognise the person behind the steering wheel.

We in role people in the gallery so they can be recognised, and again how you do this enrolment... you can do it in the car, somebody need to sit in the steering wheel and get an approval in some way that this person is allowed to drive the car. Maybe you have an application and that's connected to the garage which you can do this, or maybe when the car recognises.... recognised a new person, like it's not in the gallery, that you on your phone get some survey image... like this person sitting in your car is this person allowed to drive and you could say yes and then... so how you create this system exactly there are many possibilities for it but there is this idea of enrolling somebody the gallery. **For facial recognition there is an Important distinction between what we call identification and verification. So identification for example if somebody walks on the streets we captured the person on the camera and we need to know who it is but it can be anybody so we have a database of million photos and we need to find the best match that's very complicated to do but verification is much easier where you have one or a few persons people and you just need to see is this person I don't know Chelsea or one of her family members so much easier question**

Interesting, so this is more concerning hacking. Is hacking which is a very big topic concerning autonomous vehicles and security is the possibilities of hacking a concern for the monitoring system and how do you avoid it?

For us it's not so much because we our customers create their system and on this system level you need to have security measures for example against hacking so we don't deal with it ourselves instead this comes down to where the points of entry, and if somebody is inside what can he or she do but I we don't deal with it so

OK so that's not your focus area, you just like make the product if you can say it like that and then give it on and then it's their job to kind of ensure the highest form of security, and you know that less risk over of hacking okay.

But there is a question, for example, do you want your car to be connected to the Internet there's a trend that the car makers want to do that because you

can update your car over the air and 5G and everything is great but the downside is that you expose the car to hackers as well I think that there is also the possibility to have a car that's not connected to the Internet so everything is it's a local system but then well to update the car you need to plug it in somewhere so that like your laptop like if you don't have Wi-Fi you need to have an internet cable to get access to the internet, then it is exactly the same with a car.

so the last question is are you interested and excited for it to come out to society in the future?

Like for me there is many layers so I think that increasing the level of autonomy is great and it's a good technology example it's a good technological progress because computers can be better than humans at performing tasks they don't grow tired and they're not biased they don't have concepts like anger that will affect their driving ability for example.

- **To conclude the interview, we wanted to ask a biased question that was directed to our interviewee and was concerning the future of autonomous vehicles.**

So in that way I am positive about this development but I think we should be cautious and in the way also honest about what is possible and what not and we should be careful in introducing these technologies to the general society.

- *On the other side, Gemeren has some concerns about the implementation of autonomous vehicles in the general public. Honesty and transparency is important in keeping a healthy and trustworthy relationship with the general society, and can help in gaining the people's trust towards new technology.*

So as an example you have a autonomous vehicles in for example the mining industry is quite established, and why because the environment is very predictable. You have a construction site we know there is the mine and we need to drive for A to B and its full autonomy and ther is not really the option of a cyclists coming all of the sudden because it's a contained environment so in such a scenario is already great but I don't think that

cars now are ready for like for this full autonomy so this means that in terms of implementation we can have cars that will and it's already there

Using autonomous vehicles in the industry business, such as the mining or construction industry, is easier to implement since their environment is predictable and as it is in a closed environment with no sudden, unwanted interactions. As a car is in an open environment with other vehicles, objects, pedestrians and cyclists, it's a lot more difficult to implement it in today's society without This makes it easier for the autonomous vehicles to roam around, *if you cross if you go towards the line that the car automatically will correct itself so that you keep driving straight on the highway, this is completely fine, it's just that there is not much space for error but to give the sort of agency of driving to the car itself like fully like I just say I want to go home I'm gonna sit back and relax in the car will do everything for me, I don't think that we're ready for that and we should be very careful in allowing the progress like we should we should first be sure that that really works before we allow such cars to drive like that.*

It's interesting to see in terms of regulations countries take different approaches, so for example in Israel currently you have quite some opportunities to test the autonomous vehicles on the road whereas in Europe not so much. In the USA in California there are somethings already possible but in other states not yet. If I would... I would rather live in the states that's more restrictive to autonomous driving than one that allows these autonomous vehicles, because I don't know if they will stop for me if I will go... what's the name of the zebra crossing, I feel more safe knowing that where I live there not really autonomous cars yet so much.

yeah that's a big question you know the trolley question you know if you have an autonomous vehicle when you're in it and your you have two directions you can go, and as you know one area that's with three people and the other one is one person like who do you want to risk, do you want to save yourself or kill one person or kill yourself or kill three people there's loads of ethical questions that you can you have to ask and answer before you can really put it out to the society, because it could be that society is not really ready for it yet you know

yes

so does Visage Technologies have any plans for the future concerning autonomous vehicles... now you're doing driver monitoring and face tracking and that stuff, have any other like thoughts about what you think about what you want to do in the future

what I think will become trends in autonomous... automotive industry and driver monitoring, is health monitoring will become bigger and bigger like the smartwatches that we have now that the car can also have such functionality that will be able to analyse your heart beats blood flow another vital signs. That it will go beyond just seeing if somebody is engaged with driving or not but also this idea of health I think it will continue to grow and also enter into the to the cockpit of the car. And so for us our primary focus is not necessarily autonomous driving but driver monitoring which can even be part of not so much of autonomous driving

you know everyday cars yeah... so just to ensure so basically it's just to ensure the maximum form or like security depending on if it's an automatic vehicle or if it's you know generated vehicle somebody that use it yeah for themselves

yes.