

Interview by David Perilli, Global Cement Magazine

Atollogy: Visualising plant logistics

Silicon Valley start-up Atollogy has developed a range of image recognition algorithms that offer cement plants advantages in terms of customer experience, health and safety and optimisation. David Perilli spoke to Atollogy to find out more...

Global Cement (GC): Please introduce Atollogy.

Damian Murphy (Member of Industry Advisor Board) (DM): Atollogy was founded in March 2017. The name is taken from Atolls in the Pacific, the idea being that we connect islands of information by digitising operations. The company has undergone rapid growth in a short space of time and markets around 800 devices in the field of logistics and automation. It has around 25-30 sites across a range of manufacturing industries, including cement.

As a new digitisation company, Atollogy wanted to help some more 'traditional' industries to digitise their operations, particularly with regard to customer experience. Many Internet-of-Things (IoT) solutions are fairly intrusive and can take months to implement. By contrast Atollogy's solutions are quick to install and can be deployed in many areas of the plant.

GC: Why is Atollogy's solution different?

Joseph Farhat (Head of Innovation and Customer Success) (JF): Atollogy's solution analyses visual data, using cameras, typically 5-25 of them on any given site. You can extract so much data out of digital images via a range of different algorithms. They may seem low tech in the modern world of

GPS, Bluetooth and Radio Frequency Identification (RFID) sensors, but camera-based systems are much more adaptable. The cameras themselves are nothing unusual. It's the algorithms behind the cameras and neural network that do the hard work.

GC: But the other technologies provide data that cameras don't. Can you comment on that?

JF: It's true that these systems have some capabilities that visual systems don't, for example off-site tracking by GPS. However, RFID, as the main direct competing technology for Atollogy's systems, has a major drawback: Its capture rate. The sensor has to be right under the gateway with a straight line of sight. For a cement plant the investment cost of RFID roll-out is also fairly high and the adaptability is limited. As well as putting chips in all of its own vehicles, RFID chips have to be installed in all customers' and suppliers' vehicles too, at fairly significant cost. Even in the best-case scenarios the capture rate is only 30%.

GC: How does camera performance vary in darkness, rain or snow?

JF: We have not seen any problems with rain, snow or indeed hot weather. We have an installation in Dubai that baked in >40°C heat all summer and another in Canada that endured -30°C blizzards. Both performed strongly in terms of camera performance and the system as a whole was totally robust. The only camera lost so far was when someone drove into it! With respect to darkness, we have infrared capabilities. However, in the vast majority of cases, our cameras are installed in places where people are in close proximity to vehicles. Most already have lights for night-time operations to meet safety requirements. Our cameras can see in those light levels as easily as if it were day.

GC: What facilities does the user need to provide?

JF: Atollogy brings its own tried-and-tested network infrastructure to the site, so the client only needs

Below: Atollogy uses a cameras and visual analysis algorithms to optimise cement logistics and health and safety.



to supply power. Sometimes that's from the existing network and sometimes, for remote locations, we use solar panels. Data is stored in the Cloud with AWS.

GC: What do cement producers use the technology to do?

DM: Cement sector margins are fairly low and competition is fierce, so customer service is becoming an increasingly important differentiator. What Atology does is enable cement producers to extend the 'Uber experience' to their customers.

Our solutions also have benefits in terms of health and safety for everyone on site. For example, a new contractor that is only on site for a month can be recognised by the system without the need (and cost) to install RFID chips in every vehicle that the contractor needs to use on site.

Cameras, and the algorithms behind them, can also be adapted to different targets. For six months, a cement producer might prioritise customer wait times at a particular site. Then, the emphasis may shift to improving health and safety. Another few months pass and there has been a change in the upstream process. Now the management wants to know whether or not it should invest US\$5m in a new silo for cement loadout. Atology's solutions can inform that decision-making process.

GC: How do the algorithms do all of this?

JF: The algorithms can detect truck license plates, can tell the difference between people, tractors, trailers and cars and identify different colours. For every vehicle on site, the system generates a digital twin so it can keep track of its movements. Every time the vehicle is detected by the system it updates its records. Think of it like a 'facebook profile' for the vehicle. Every time the vehicle does something, there is a 'status update' in its 'news feed'.



Above: In a crowded market, cement companies are increasingly focused on customer experience. Nobody wants to wait for product.

A picture then builds up and it can start to diagnose and highlight problems to a human decision maker. It can tell the operator at that exact moment how many trucks are in the yard and what they are due to receive or unload. Is the wait time acceptable? If not, trucks can be redirected to different silos, the load order can be changed or other actions can be taken to maximise customer experience.

Beyond this, we can look at patterns over longer timeframes. Is a bottleneck a daily event or only on a certain day? Does it only happen when a particular company or driver arrives? Recently, one of our client's customers complained that one of its drivers took two hours to load up. Historically there has been no single source of objective truth that answers: *Why did the driver take two hours?*

Data can answer that. Maybe it was down to sheer weight of traffic on a unusually busy Monday. The driver may have been delayed by over-enthusiastic security staff or was even having a nap in the cab. Maybe they were stuck behind a driver that took three hours.

With the proper diagnosis from the data, action can be taken. If the root cause was high traffic levels,

Below: Atology's Yard View enables operators to see an overview of each point of interest in their camera network.





Above: The technology is not thrown when reading licence plates in the dark.

the plant could advise customers to avoid certain times. If on-site staff are unwittingly causing delays, there can be optimisation at the cement plant. Maybe there should be a 'gentle nudge' to the driver for sleeping on the job. Maybe the event was a complete one-off and no action need be taken.

GC: What other capabilities are there?

JF: Several of our cameras focus on silos. They can tell not only how long a truck is stationary but see if the driver gets out of the cab. It will be able to see whether the driver is wearing personal protection equipment and whether they put chocks under the wheels or not.

Another case we're seeing with alarming regularity is drivers getting out of the cab when they are unloading raw materials. If the camera detects a person within a stipulated radius of an unloading vehicle, it triggers an alarm. We saw this happening at a site where a person had died because they did not follow this rule. The data supplied is exceedingly valuable in the quest for greater health and safety.

The cameras can also be trained to watch load-out scales. This allows users to properly capture and avoid over- and under-loaded trucks either going out or having to go around the yard again to meet the correct weight. Recently we saw a truck visit a small aggregates plant with a 26 minute turnaround time. The following day the same truck took just 4 minutes. The difference? On the first day 22 minutes were spent on three re-weighs! On one of those, the driver unloaded when the truck was already under-weight. The root cause was a language barrier. How much does this kind of problem affect the cement industry? Nobody knows! Now with visual capture and algorithms, Atollogy's clients can identify the amount of time, money and material wasted. Steps can then be taken to avoid it.

GC: How do cement plants handle the vast streams of data generated by Atollogy's algorithms?

JF: The data delivery aspect is via a real-time dash-

board that can be monitored by site staff. Another version operates above that for group-wide activities. This allows senior staff to see which plants are performing well against their baselines and highlight areas for improvement. It allows analysis across the group, to provide synergies and identify opportunities for improvement.

All of the information used by Atollogy's dashboard is also available as a raw database so that the customer can integrate the data into their own existing systems.

GC: Does the system provide advice to operators?

JF: At the moment the algorithms provide data to be acted upon by human operators. Of course, we're working towards prescriptive analysis in the field of cement logistics, where the system will be able to both diagnose issues and act on them. This is already being developed by Atollogy for other applications.

GC: Are there any concerns about algorithms replacing humans?

DM: Not at all. The system adds to human abilities at a time when it's getting harder and harder to find good staff. 'Keeping watch' over an individual silo is not a job at a cement plant. There aren't the people and the job itself would be mind-numbingly dull. What you have with our cameras is a watchman that never sleeps. It keeps a constant eye on safety and only flags dangerous activities to the operator when they occur.

90% of accidents in these kinds of sites are directly down to decisions taken by the individual involved. This system can act as a gentle 'tap on the shoulder' to nudge them away from the danger. There are two ways that this can inform the person in charge. One is a flashing box on the dashboard. Another, which is still being refined, is an email or text. You click on the link and it brings an image of the incident.

GC: Do you have facial recognition capabilities?

DM: This is a frequent question and the answer is 'No.' Atollogy is only interested in the *presence* of an individual, a truck / trailer / car and tracking license plates. As explained above, this is an incredibly powerful combination. There has also been a significant backlash to facial recognition software in use in several countries. We have no intention to be that intrusive to our clients. For some clients we even deliberately obscure the image of individuals, rendering them unrecognisable to even their co-workers.

On a related point, something we learned early on with this kind of system was never to punish anyone using the system. If you do that, the system will be sabotaged and trust will be eroded.

GC: Can we delve a bit more into the algorithms? How are they developed?

JF: We use a lot of deep learning via TensorFlow to teach the algorithms all the abilities we've already discussed. While you can get many algorithms off-the-shelf these days, it's hard for these to deal with the most difficult cases, for example reading a license plate through a truck window. Atollogy's algorithms can get around such difficulties. We do this by training using the most difficult cases. The algorithm is then very good at handling the unexpected.

GC: How long does installation take on site?

DM: We recently launched a system at one of the largest cement terminals run by a major US cement player. The installation, which looked at seven points of interest, with just one in-house electrician took 11 hours. This case was especially remarkable given that two of the 11 points were supplied with power by dedicated solar units.

Data was gathered within 1 hour of installation after a short adjustment period. Two hours later the algorithms were starting to 'paint a picture' of the site. Within a week there were already six full days of useable results. The client was astonished!

GC: What kind of savings or return on investment are we talking about?

JF: I know it will sound like a 'cop out,' but the value comes from taking decisions based on the data generated. We find that as little as 1-2 months of data is sufficient for operators to take what would previously have been thought of as quite drastic decisions.

The example of the under/overfilled aggregate truck provided very quick savings for that client.

Turnaround times have reduced by 10%. Its sales personnel are also being more proactive. They have been able to improve the customer experience, for example by highlighting quieter times. When delays occur, the sales staff know why and can reassure concerned clients that it won't happen again.

Another client spent US\$3m on a new silo and then measured the improvement in its turnaround time. It reduced 'poor' turnaround times as defined by the plant's formula, by 70%.

GC: Are your longest-standing clients still gaining improvement years later?

JF: Our longest-standing users are in the aggregates sector. Some of them have recently experienced customer complaints due to contaminants, for example large boulders. They have responded to these complaints by attaching images of the truck as it leaves the plant to the job electronically so that there can be no debate as to the condition of the load when it left the site. New ideas like these keep coming up.

GC: What happens to the data if the connection between Atollogy's local network and the cloud is disrupted?

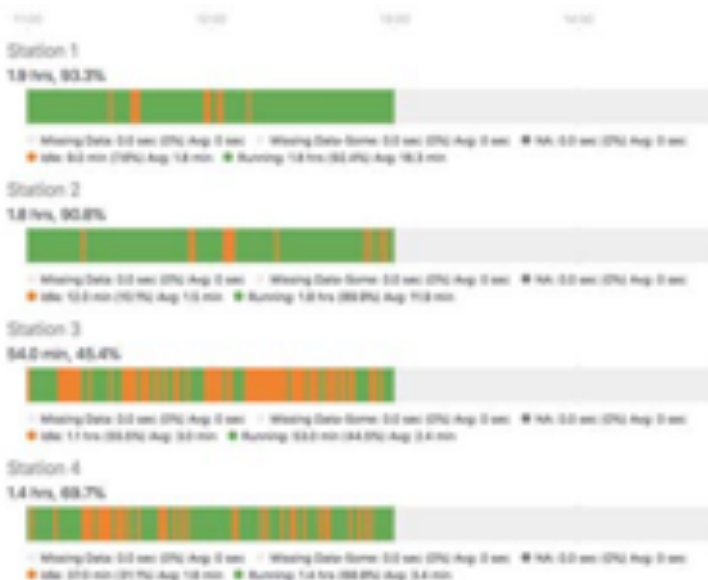
JF: There is a backlog capability in the network for up to seven days. We never expect a week-long outage, but the capability is there should it ever be needed. Once any disruption is over, the backlogged data will flow back to the Cloud.

GC: What is Atollogy working on right now?

JF: There are developments in prescriptive analysis that we are pursuing and we also want to 'load up' each cameras so it can do more in any given position. We also want to look at more 'hotspots' like the raw material example I provided. Another thing is to optimise and possibly automate security. What happens when a site is shut to customers? Are security staff really necessary all the time? Can we use the existing technology to identify intruders and alert staff? These are really exciting possibilities and we're only just beginning to understand where else the algorithms could take us.

GC: Thank you for your time today.

DM/JF: You are very welcome.



Left: The Warehouse View enables easy visualisation of the time that a silo spends loading and idle.