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SMART SHIPPING HACKATHON

On November 26 and 27, De Vlaamse Waterweg nv organized the very first Smart Shipping Hackathon in collaboration with Antwerp Management School and EY. The goal was to support innovative thinking and acting in the inland shipping sector and to stimulate cooperation with all stakeholders involved. In this way, De Vlaamse Waterweg nv wants to continue to respond to creative methods that should help inland shipping forward. The hackathon focused on ideas and solutions for the many challenges facing inland shipping today in the field of Smart Shipping.

A successful Hackathon

215 participants from all over the world, divided into 17 teams and supported by coaches with sector-specific knowledge in the field of Smart Shipping, searched for tangible solutions to four concrete challenges in 36 hours.

1. How is an automated barge able to safely pass through a lock when no persons are present on the barge?

2. Which communication protocols should be implemented to enable safe navigation with automated and conventional barges?

3. How to enable corridor planning for both automated and conventional barges?

4. How should the government incorporate new technologies and organise their operations towards optimal traffic management?

For each challenge, a winning team was chosen and in addition, also an overall winner was elected. The international jury, consisting out of 7 members, looked at 5 criteria to select the most innovative, creative and useful solutions:

1. How innovative is the idea?
2. How big is the value creation?
3. How mature is the solution?
4. How feasible is the solution? Can this easily be put into production?
5. How much progress has been made during the hackathon?

Let's have a look at the winning teams.

Challenge 1: Crewless Lock Passage - Smart Ropes

Crossing an unmanned lock with an unmanned ship: a challenge which the team of the TU Delft tackled during the 'Smart Shipping Hackathon'. They came up with the system 'Smart Ropes' that uses vertical ropes in the lock and winches on the ship to secure the vessel during the transit.

As a team from the Netherlands, they have a few sailors among them who are frequently crossing canals throughout the country. This gave them a good practical background of the ins and outs in the locks.

The team exists of Ferdinand, Kalea, Anna-Louise and Carmen. Carmen is currently doing the research for her PHD in autonomous shipping, she is as well supervising the master-thesis in the same field of Anna-Louise who is occupied with an autonomous dredging vessel. Kalea and Ferdinand are currently finishing their bachelor on the topic of waterborne transport in Amsterdam. Together they formed a diverse team for the hackathon, all adding different interests and strengths.

When they started the research into the task, they quickly identified one certain aspect as a bottleneck in the automation of maritime traffic in locks: the mooring.

Because locks are big, expensive and complex structures, making big changes to the lock itself is not desirable: the cost of the project would be high and the locks would be out of service for a long time.

The team assessed the least difficult solution at first. In this scenario, two people are on duty 24/7 on all locks to do the mooring operations for unmanned ships. Even if only the minimum wage is paid, this adds up to several million euros per year for a total of 130 locks in Flanders.

Considering the factors of the complex lock-structures and the costs of personnel the main goal of the developed solution was an easy and viable implementation.

The solution which was developed is an automated mooring system, which is very comparable to the present ways of mooring.

In this design the ship uses a system of hooks and off-the shelf available tensioning winches.

Inside the lock, vertical ropes or cables are spanned at each line of bollards. This means that with a distance of 20 to 25 meters between those, an average of 8 ropes in every lock, have to be installed.

The ship itself is equipped with a set of 4 winches, 2 on each side, and an installation to unfold and retraceable hooks that grasp on in the vertical lines spanned at the quay wall. By making use of the hooks and the self-tensioning winches, the vessel can position itself.

As the hooks can slide along the vertical lines, no refastening during locking is required. After locking, the arm which is used to extend and retract the hooks is used once more to prevent the mooring lines from falling into the water. This is important to prevent damage to the ship and the propellers of other vessels.

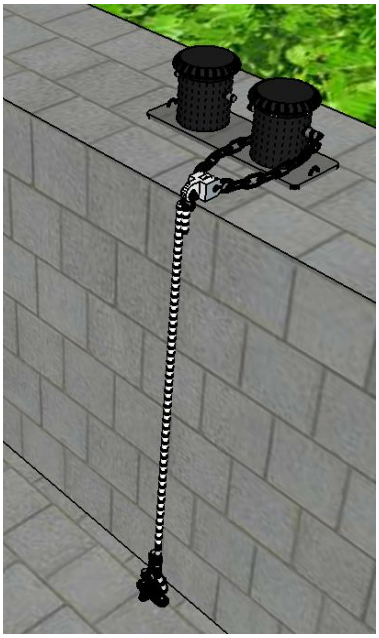
The implementation costs of the system are low. An estimated investment of 110 to 140 thousand euros for the locks in Flanders is needed. The price is dependent on the used materials for the vertical lines in the lock chamber. Classical ropes are the least expensive, however they have a higher wear and tear and need replacement more often than the more expensive option of steel cables. This choice is as well dependent on the lock itself, for a frequently used lock steel wires might be more convenient and ropes for a less frequently used lock.

The costs for outfitting the ship are estimated between 60 and 85 thousand euros. This price includes the acquirement of the winches and the installation.

As a conclusion, the advantages of this system are an easy implementation and low costs as well as the practicality of the absence of the need of re-mooring during locking.
With this system, which the team named 'Smart Ropes', the maritime sector is ready to hook on to the future!

The TU Delft team won €1000, sponsored by Watertruck+ and a visit to the company Shipping Technology including an autonomous test run on ms Factofour, an inland waterway vessel that has been used as a test case for smart shipping for more than 2 years.

AUTOSHIP winner



The AUTOSHIP project[1], funded under the European Union's Horizon 2020 research and innovation program, has been looking for the team with the most mature solution for a remote controlled vessel, passing a lock and having correct and secure communication protocols with the infrastructure and found this with team Smooth Lock Transit. The project will be discussed with the consortium to see whether it can be used during the AUTOSHIP trial and PNO will give funding advice.

The winning team was Smooth Lock Transit and their project focussed on possible mooring methodes inside a lock by making use of existing standard bollards or floating bollards.

To reduce investment costs, the project proposed to install steelwire or a chain as a vertical guide from the bolder downward along the quay wall. The ship can attach itself to the vertical guide and move up and down along with the water level whilst keeping the same position in the lock. This way, the ship does not have to use the thrusters to keep the position and it is fastened to the infrastructure according to current law.

The project also proposed a similar solution that is suited for floating bollards and came up with a design for a newbuild lock.

[1] Grant Agreement N°815012

Challenge 2: Communication - Flumen Platform

Flumensys Technologies is a Dutch startup on a mission of creating the necessary digital infrastructure for smart waterways. The company believes that unmanned and autonomous technologies will unlock great economic potential of waterways world-wide. They also believe that current ways on how we use our waterways, whether they may be of commercial or leisure nature, shouldn't be affected because of it. That is why Flumensys is developing technology which enables sharing of the waterways between humans and unmanned vehicles in a safe, transparent and sustainable way.

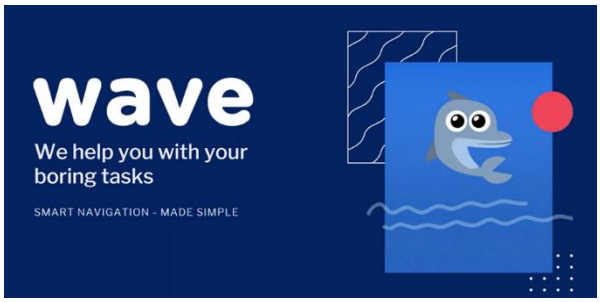
The Flumen platform is an evolutionary step that augments and integrates with currently used technologies and procedures on the waterways while providing a new set of essential services to authorities, unmanned vehicles and their remote operators, traditional commercial shippers and leisure crafters.

With their patent pending technology they can provide a high level of scalability, reliability and security that is required to keep the waterways safe and clean.

During this hackathon the team has researched, with help from amazing event mentors, more in the direction of leisure crafters and how they fit in the overall vision of waterways of the future. Their solution is a mobile application that integrates leisure crafters with De Vlaamse Waterweg lock passing services and the Flumen platform. It creates a non-verbal communication channel and a reward-based system which benefits all parties.

The Flumensys hackaton team consisted of partners and experts in the fields of maritime rules and regulations, maritime education and certification, business, survey and spatial modelling, intellectual property rights, artificial intelligence, computer science, autonomous robotics, mission critical systems, industrial automation and system integration.
The team won €1000, sponsored by BDO and a coaching trajectory with the experts of dotOcean.

Challenge 3: Corridor Management – Wave



Project Wave - ‚smart navigation, made simple, was the winner. This project also won the overall prize. All together they won a feasibility study from DVW, a 10 day consulting trajectory at EY, Google Cloud platform vouchers (€3000) and €1000 sponsored by Alsic.

Meet Wave, the smart navigation assistant. Wave helps barge operators automate planning tasks by monitoring all relevant dependencies during ships' voyages in real-time. This means that users will always be up to date on changes.

Wave gives barge operators and shippers the optimal route based on traffic and incidents, matches arrival times with slots and arrivals or departures of seagoing vessels and any other dependencies that we identify along the way or that are added by an operator. The goal is to allow barge operators to get their cargo at its destination at the right moment, every time, without losing valuable time. The shipping sector is very dynamic. Nothing ever goes according to plan. If anything changes along the way – say you're sailing too fast or too slow towards a lock, or the departure time of a vessel changes – Wave will send out a notification, and with the click of a button Wave creates a brand new sailing schedule.

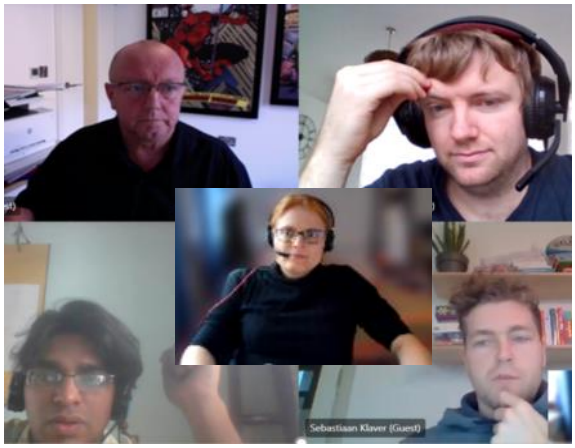
Wave also automates communication with authorities such as lock planners and port authorities, sparing even more time. Sailing schedules can be shared automatically through SWINg.

The goal of Wave is to get the barge operator in the green. Their smart route calculator optimizes fuel consumption by making barge operators sail at a constant speed. This results in a better profit margin, but at the same time reduces emissions and helps us save the planet. Their useful parameters monitor fuel consumption, emissions and speed for a specific vessel or a whole fleet. This means that useful insights are available at the blink of an eye.

Wave picks the optimal route based on the priorities of the barge operator. The operator tells where to go and Wave takes care of it.

Wave is created by Port+ and Numble. By joining forces, they brought together a mix of young graduates with technological knowledge and operational knowledge of the shipping sector. They have been working together on digital solutions for a few years already. With their participation in the hackathon they wanted to work on ideas that they gathered over time and wanted to show to the authorities such as De Vlaamse Waterweg nv and the Port Authorities what the potential of sharing existing data is. The creators are looking very much forward to the next steps in the interesting concept that Wave has become and so does De Vlaamse Waterweg nv!

Challenge 4: Operations for the Future – Remote Terminal for Vessel Train Application



The Team "Touch Nothing Call a Vessel Train" was working on the "Operations of the future" challenge. The five team members, Bart Van Landeghem, Sebastiaan Klaver, Bernard Twomey, Anmol Jadav and Alina Colling, all had different backgrounds and experience. The aim of the team was to gain a better understanding of the regulatory barriers that vessels with higher levels of automation face and provide suggestions to deal with them. The team used the Vessel Train (VT) concept as a case study application.

A VT consists of a lead vessel that takes over navigational responsibility for the follower vessel, to allow the follower vessels to sail for longer period of time with smaller crews and hence reduce operating cost. In essence the VT provides an autonomous sub-system (navigation) in a non-autonomous system on the follower vessels. The IMO regulations do not accommodate for such autonomous sub-systems, hence part of the solution involved suggestions on an amendment of the wording that define the degrees of autonomy of a vessel.

The VT also causes the bridges of the follower vessels to be unmanned and the vessels to be remote controlled from the lead vessel. Such conditions are not addressed in neither the IMO nor the ES-TRIN regulations. In order to prove an inherent safe design of the concept, it needs to allow for timely detection and action to be taken in any arising situation. To adhere to this part of the regulation, the team came up with a remote terminal. The handheld terminal/watch keeps the crew, that may either be resting or perform other tasks on board, informed of all necessary information. In case of emergency it suggests reaction options provided by the lead vessel operator, and allows immediate reactions to be taken before the crew is back on the bridge. This means by the time the crew is back on the bridge they are either already aware of what needs to be done or action has already been initiated. The terminal is a way to ensure safe application of autonomous sub-system on the path to full autonomy of vessels.
The team won €1000 sponsored by DEME and access to the Remote Control Center of the Port of Antwerp to work further on their project.

Future outlook

Due to the Covid19 situation, the hackathon was a virtual event. Still, it connected people from all over the world and participants felt like they were working side by side.
Thanks to all partners involved in the Smart Shipping Hackathon, the winners can further develop and test their solutions. “Together with Minister Lydia Peeters, Flemish Minister for Mobility and Public Works, I am eagerly looking forward to the implementation of the solutions in a few months or years,” said Chris Danckaerts, managing director of De Vlaamse Waterweg nv. “Thanks also to all participants for helping us find answers to the challenges in inland navigation in order to better exploit the potential of water transport. We call on all hackathonians to continue the innovation work!”