HUSARION & ag-gps

COOPERATION PROJECT

The world`s first

AUTONOMOUS GOLF GREENS MOWER

Retrofit solution

Introduction

About	AG-GPS (Accurate Golf – GPS) retrofit system, transforming golf mowers to autonomous mowers
Mission	Reduce labor cost, and improve quality at golf courses
Vision	To be the preferred retrofit solution for converting mowers to autonomous operation

Introduction

HUSARION

Mobile Robots for the Most Demanding Applications

We provide mobile robotic platforms, software and connectivity solutions which allow you to build your own autonomous systems based on ROS & ROS 2 easily and efficiently.

Learn more about Panther robot:
https://husarion.com/#robots

For outdoor applications
Panther is designed with outdoor and industrial environments in mind.
Equipped with high profile wheels and IP54/66 chassis it will rise to even the toughest challenges.

Autonomous Mower

Autonomous Jacobsen Eclipse® E322 Electric are like nothing ever seen before; electric, simple in operation, guaranteeing cutting excellence, and best in-class safety

Almost perfect, yet still needs a human operator to control steering, acceleration and speed

Eclipse® E322 mowers have **CAN bus with Steer & Drive By Wire** already installed, and **HUSARION** will make the mower ready for **driverless operation**

Autonomous Eclipse® E322 will be the most technologically-advanced mower, a real game changer in golf, gardening and landscaping

With telematics solutions, the health of the vehicle can be monitored in real time

The mowers are well suited for moving airports areas, football pitches and public parks

Video of the prototype mower (2019) **on**: YouTube

Proof of Concept

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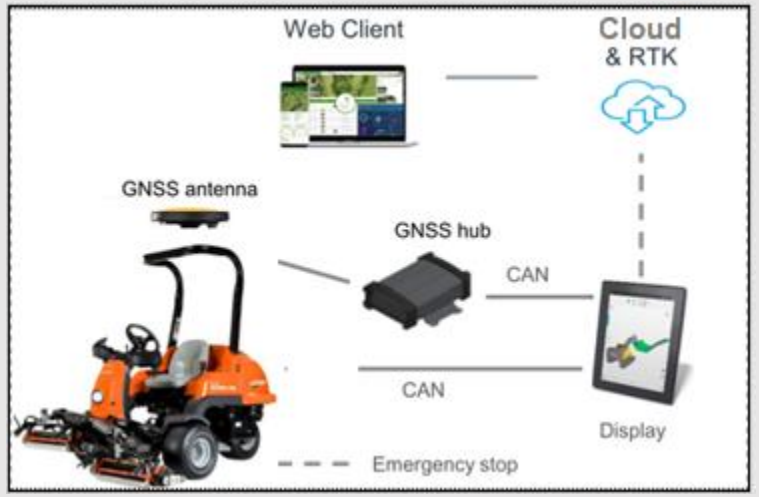
Autonomous Green Mowing

- Navigation for autonomous golf mowers, Fix Position
- LIDAR Ouster OS1-32 -- assures best in class safety
- Route is recorded in advance including events to control the activating of the cutting reels
- The route is stored in a cloud environment and can be modified through a web client
- A route is pushed to the vehicle via a web client and then activated in the intelligent display



Cutting procedure:

1. Start by administrator
2. Driverless operation to first golf green
3. Driverless operation of cutting patterns across the golf greens
4. Cutting outer edge of the golf greens
5. Driverless operation to the next green

Fairway mowing concept

Fairway mowing:

RTK GPS system

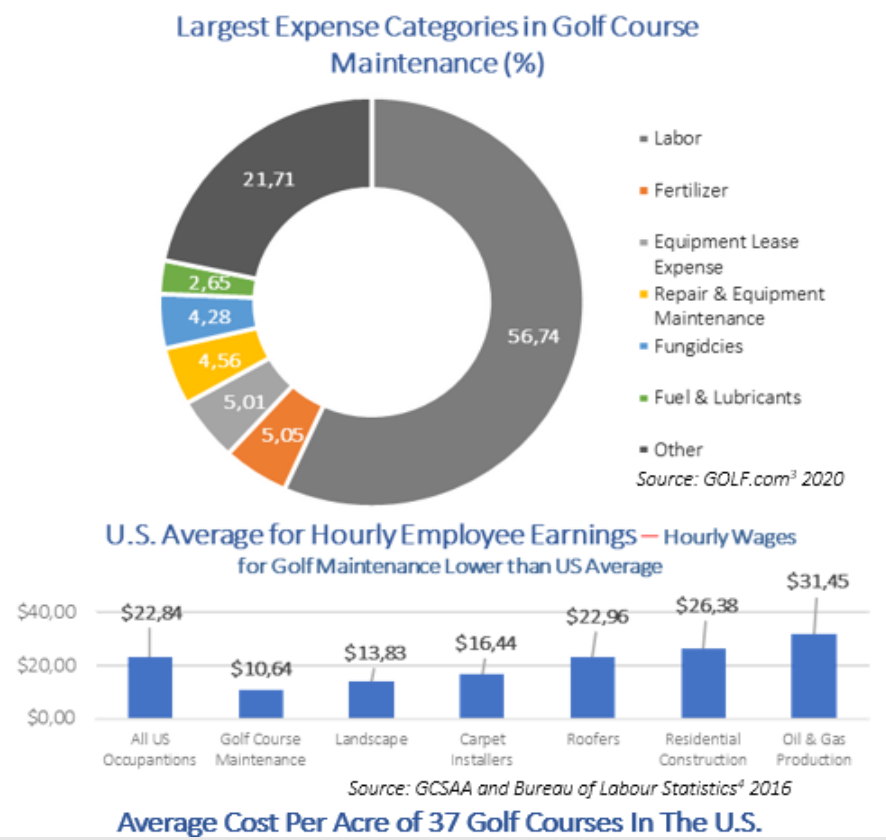
Operator drives mower ① are responsible for safety issues on the mowers

Mower ② follows mower ① In exact relativ posistion

On large fairways, three – or more - mowers in colomns

Robotic Mowing – Golf Courses

Highlights - expences



Robotic and autonomous movers that are capable of mowing fairways and rough will lead to substantial savings given these areas account for a much larger percentage of a golf course property

1. ROBO-GOLF: Robotic mowers for better turf quality on golf courses
2. Golf Course Maintenance Cost in 2023
3. What does it cost to maintain a golf course?
4. R17 - Costs of Golf Course Maintenance Past Present and Future

Average Cost Per Acre of 37 Golf Courses In The U.S.

Putting Greens	Trees	Fairways	Bunkers	Rough
€58,824	€7,210	€7,850	€36,960	€1,607

Source: USGA[4] 2018

Robotic Mowing – Golf Courses

Highlights - expences

- **Cost Saving** Typically, golf courses will spend around €730,000 every year on maintenance. Predominantly labor costs (50 - 60%), along with fertilizer, equipment, & fuel expenses
- **Labour shortage** due to low hourly wages at golf facilities lead to clubs requiring an assistant pro, head pro or club manager to drive the range-picker, instead of them dealing with more important jobs such as divot-fixing, irrigation, tee maintenance etc.
- **Technological advancements** such as battery-powered robotic & autonomous mowers, will allow facilities to reduce labour budget and energy expenses without sacrificing playing conditions
- **Research** conducted by an Italian group on a semi-rough seeded with tall fescue and on a fairway seeded with mani-lagrass showed that plots mowed with robotic mowers had better turfgrass quality, higher tiller density, and finer turf-grass leaves than control plots maintained with a manual rotary mower in semi roughs with manual triplex cylinder mowers on fairway and football pitches
- **Preliminary results** from field trials in 2020 and 2021 at the NIBIO Turfgrass Research Center Landvik, Norway, and demonstration trials on one golf course in each of the five Nordic countries, showed that turfgrass quality with robotic mowing was similar to manual mowing A survey of players' attitudes to robotic mowers conducted on the five golf courses showed that about 90% of the players were positive or neutral to the new technology

Source: USGA[4] 2018

SWOT

Strength

- Patented system, tailored for golf courses
  The world`s first autonomous golf greens mower
  ENABLING PRECISE GLOBAL POSITIONING EVERYWHERE ™
- Received very good feedback during the presentation of concept to 50 Norwegian Greenkeepers
- In-demand service for greenkeepers with >5 000 existing Jacobsen Eclipse® 322 ready for retrofitting
- All golf greens worldwide are mowed manually by a greenkeeper, no driverless solution are available

Opportunity

- Potential for expansion by catering to other commercials lawns as well as airports/ private/ residential clients
- Autonomous movers that are capable of mowing fairways and rough will lead to substantial cost savings given these areas account for a much larger percentage of a golf course property
- A fully automated solution that can enhance productivity and increase saving compared to proximity automation (proof of concept)

Weakness

- Lack of capital to complete the minimum viable product. Company is actively seeking investors to fund this project
- Ability to provide some of our services is dependent on a sole third-party technology provider. Company is looking out for other vendors as well in this space to reduce dependency
- Potential client; existing owners and importers of Jacobsen Eclipse® 322 mowers, and later other brands of mowers

Threat

- Existing competitors include major international companies that have superior expertise in R&D and marketing and may commercialize products more rapidly and effectively than we are able to do, thus affecting competitive position
- Information technology and telecommunication infrastructure may be vulnerable to security breaches despite security measures

Awards & Recognitions

AG-GPS AS; Our ref. 2019/113344 04/09/2019 MARKET CLEARANCE SUBSIDIES
Grant amount Innovation Norway grants AG-GPS AS a grant of up to NOK 100,000

SkatteFUNN: Tax refund award from Norges forskningsråd, a Norwegian government agency / payback of Added Value Tax (20%) 3 years period. The Research Council's aim is to promote a society where research is created, used and shared, and thus contributes to restructuring and enhanced sustainability: SkatteFUNN

Customer Survey

AG-GPS has presented its concept to 50 Norwegian greenkeepers and has received very good feedback.

"When can we run test at our golf course"

Ian Ross Head Greenkeeper

Tyrifjord Golf Course Norway

"I will inform my union about this, it`s very interesting"

Svein Drange Olsnes

European Golf Course Architects Union

"We would like to write about this in our magazine"

Agne StrømManager,

Norwegian Greenkeeper Organization

"I will certainly visit you to see the mower when ready"

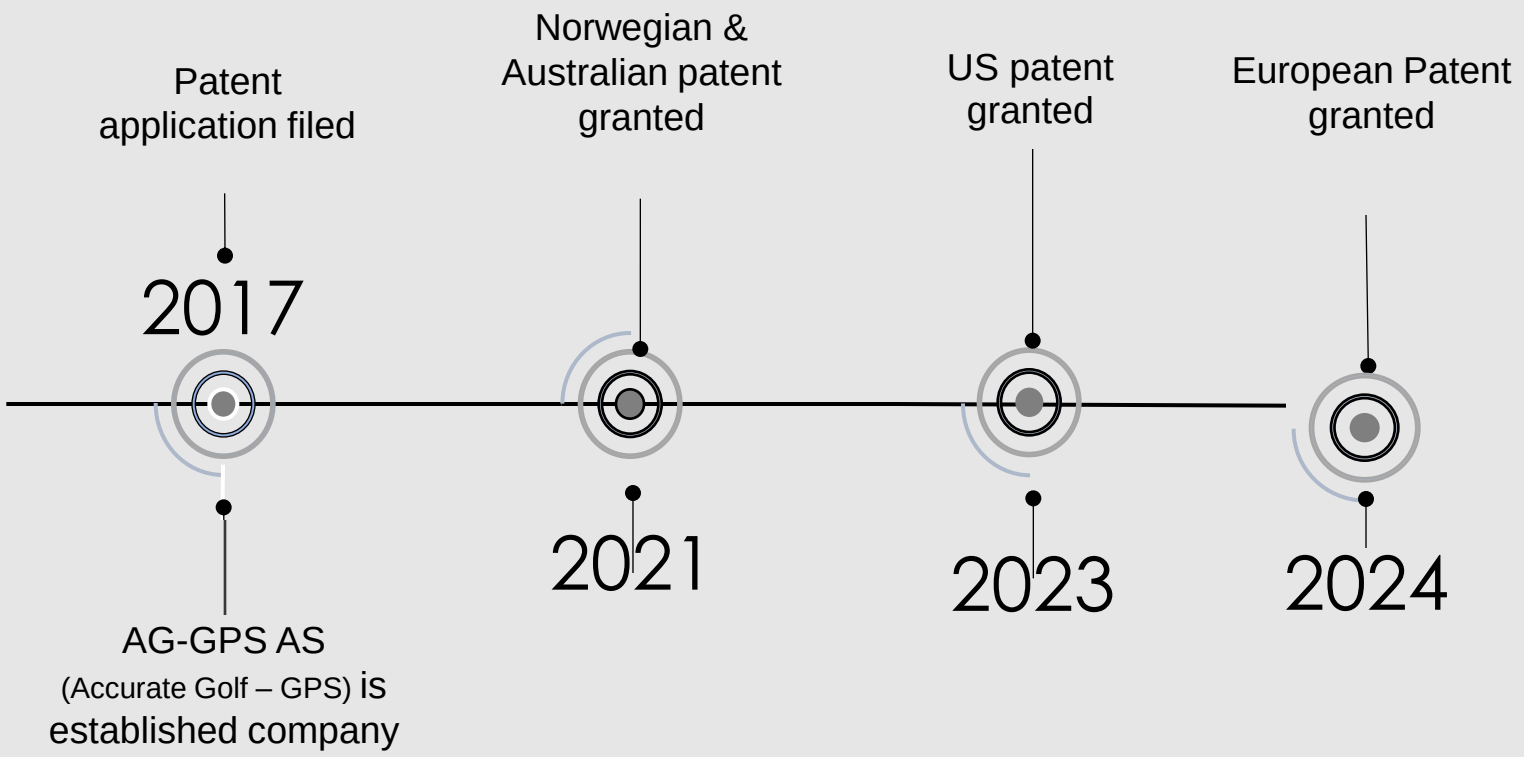
Director at manufacturing plant in UK

"This is exactly what we are looking for"

Atle Hansen Head Greenkeeper

Bærheim Golf Course Norway

Timeline


Patent application filed
2017
AG-GPS AS (Accurate Golf – GPS) is established company
Norwegian & Australian patent granted
2021
US patent granted
2023
European Patent granted
2024

Patents

EINHEITSPATENT | UNITARY PATENT
BREVET UNITAIRE

Hiermit wird bescheinigt, dass die einheitliche Wirkung für das nachstehende europäische Patent im Register für den einheitlichen Patentschutz eingetragen wurde.

It is hereby certified that unitary effect has been registered in the Register for unitary patent protection for the European patent indicated below.

Il est certifié que l'effet unitaire a été inscrit au Registre de la protection unitaire conférée par un brevet pour le brevet européen ci-dessous.

EP3610293

07.11.2024

AT BE BG DE DK EE FI FR IT LT LU LV MT NL PT RO SE SI

02.10.2024

Patentinhaber | Proprietor(s) of the patent | Titulaire(s) du brevet

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4260 Torvastad
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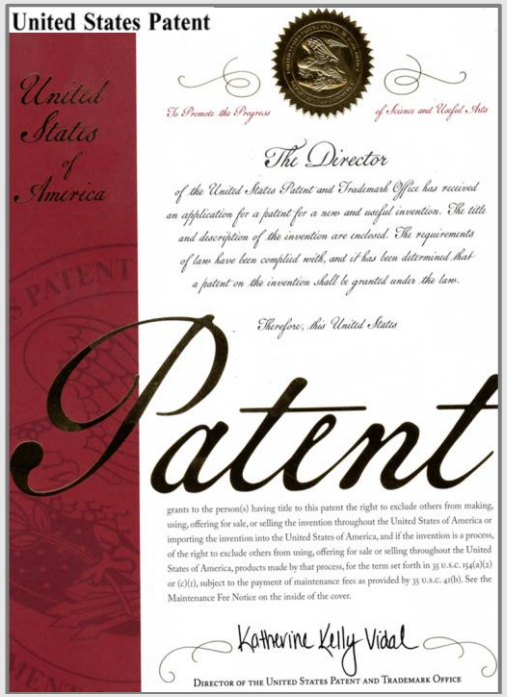
António Campinos

URKUNDE | CERTIFICATE | CERTIFICAT



United States Patent

United States of America

To Promote the Progress of Science and Useful Arts

The Director

of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this United States

Patent

grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Katherine Kelly Vidal

Director of the United States Patent and Trademark Office

Australian Government
IP Australia

CERTIFICATE OF GRANT
STANDARD PATENT

Patent number: 2018252931

The Commissioner of Patents has granted the above patent on 18 March 2021, and certifies that the below particulars have been registered in the Register of Patents.

Name and address of patentee(s):
Bjørn Roness of Hålandsvegen 19 4260 Torvastad Norway

Title of invention:
System for determining a position on a golf course

Name of inventor(s):
Roness, Bjørn

Term of Patent:
Twenty years from 6 April 2018

Priority details:

Number	Date	Filed with
20170623	12 April 2017	NO

Dated this 18th day of March 2021

Commissioner of Patents

PATENTS ACT 1990

Region/	Patent Status	Patent Number
United States	**Granted**	US 11,555,929 B2
Norway	**Granted**	345335
Australia	**Granted**	20170623
European Union	**Granted**	EP3610293

Investment Rationale

- The total market value for professional lawn care is estimated at €10 billion, where most of the cost today is for labour operating the mowers. There is a large untapped potential in converting professional lawn mowing from a manual task to fully automized
- Favourable macro factors, widespread shortage of labour, and substantial savings for golf courses will drive future organic growth
- Well positioned to capture market share with a provision of a retrofitted solution for existing equipment owners and gain competitive advantage by leveraging autonomous technology solutions
- Autonomous Eclipse® 322 will be the world`s first and most technologically-advanced mower, a real game changer in golf and landscaping, allowing the operators to reduce operational costs, increase reliability, and complete all jobs on time
- AG-GPS seeks financing of EUR 400,000 for the production of a prototype and then present the product to potential customers and go on with the last phase (proof of concept).

Investment Amount: € 400,000 for 45% stake Transaction Preference: Partial Stake Sale

Investors welcome

More information available
for partner discussions.

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