



Beehive AI monitoring and robotic automation



Artjom Kurapov
Founding engineer

Bee colony health observability

- Need regular (weekly) inspections
- Treat against varroa mite infestations
- Predict swarming, track queen presence
- Track colony growth/efficiency, prevent starvation



Human worker efficiency

- Hard physical labour
- Not scalable with amount of beehives
- Driving to remote locations takes time



Precise pollination

- Pollination boosts crop yields (+10-30%)
- Farmers lack sufficient amount of pollinators
- Beekeepers providing services to farmers earn 9x more money compared to their honey income
- Demand of pollination grows 2x faster than growth of honeybee colonies



Vision



Data analytics SaaS app for beekeepers

- AI detections of a frame photo
 - Bee counts
 - Queen and queen cups
 - Varroa mites
 - Frame cells
- Manage apiaries, hives, frames, photos
- AI advisor
- Mobile app
- Manual inspections, inspection timeline

- Re-train on user data
- Analytics (graphs) to find correlations/anomalies
- Alerts



Vision



Hive entrance video monitoring / IoT device

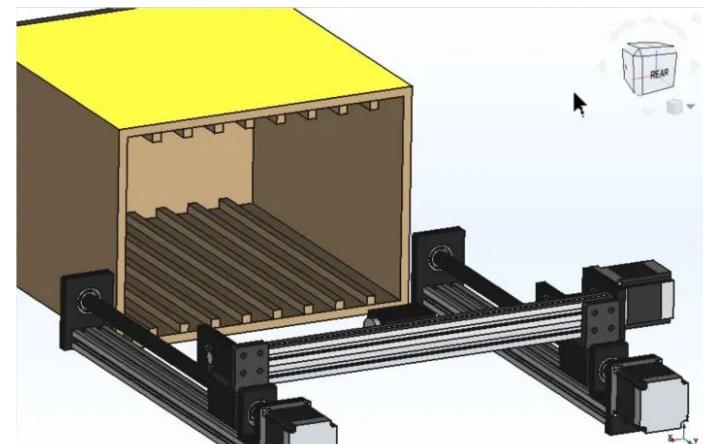
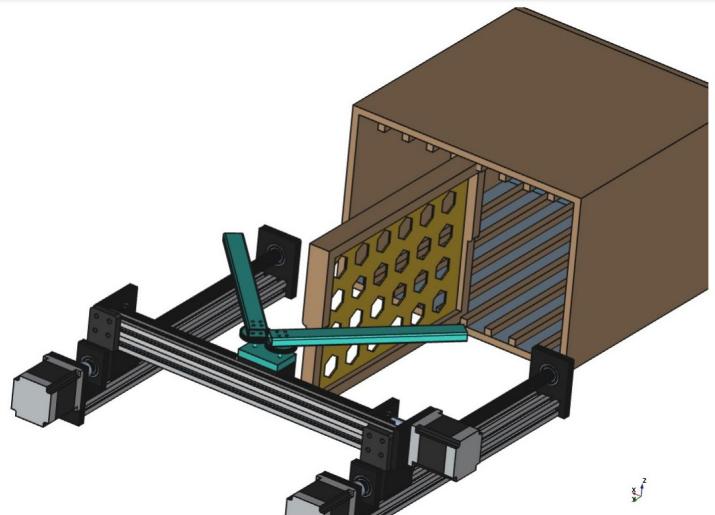
- Video streaming & playback
- Incoming/Outgoing bee counter
- Varroa mite detection
- Pesticide exposure seizures
- Pollen foraging activity
- Ant infestation
- Queen mating flight
- Stealing state alert
- Hornet alerts



Vision



- Frame extraction mechanism
 - 2 cameras to take photos of the frame to upload to web-app
 - Frame extraction for honey harvesting
- Frame movement across hives
- Initially, single colony robot
- Next, cost-effective multi-hive robot. Moves on rails
- Temperature, humidity, weight, audio monitoring
- Ventilation, Automatic feeding
- Anti-varroa mite treatment





Team



Artjom Kurapov

Founding engineer / beekeeper
(ex-Pipedrive, Clarifai)



Kurban Ramazanov

UX engineer volunteer



Muhammad Zain Shakeel

Mechanical engineer volunteer



Maxim Golubev

UX engineer volunteer



Aleksei Zaitsev

Fullstack engineer volunteer



Ahmed Daoudi

Fullstack engineer volunteer

Research advisors, Czech Republic



Šimon Bilík

Researcher, PHD
System engineer / Beekeeper



Adam Ligocki

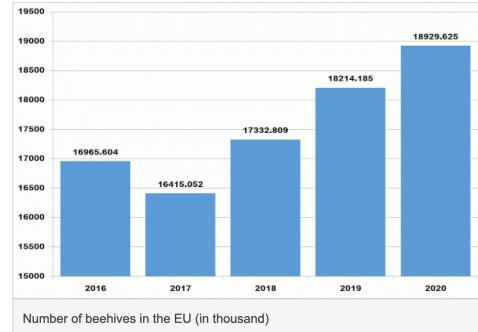
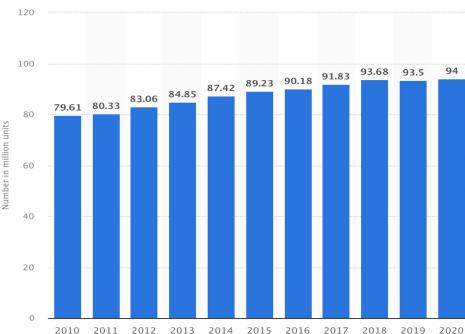
ML engineer, PHD



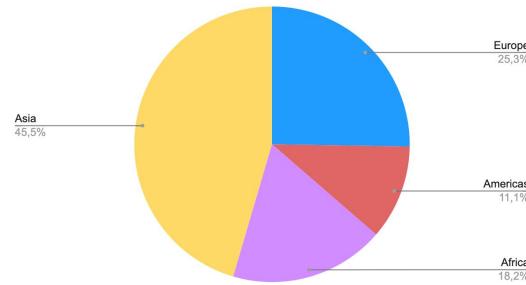


Market

- Target customers - **industrial beekeepers** (B2B, robot)
- Secondary - backyard beekeepers (B2C, web-app, manual inspections)
- Addressable market
 - Estonia - 6425 **apiaries** (PRIA sources). ~ 60% beekeepers have > 25 bee colonies
 - Europe - 620k **beekeepers**, **19-25M** colonies
 - World wide - 94M **colonies** in 2020 → 101.6 M **colonies** in 2021



Bee colonies world wide ~100M in 2021





Market

- 10% market share * 1M industrial beekeepers * 2 robots * 150 EUR/mo = 360M EUR YoY
- 5% market share * 2M beekeepers * 15 EUR/mo for web-app = 18M EUR YoY

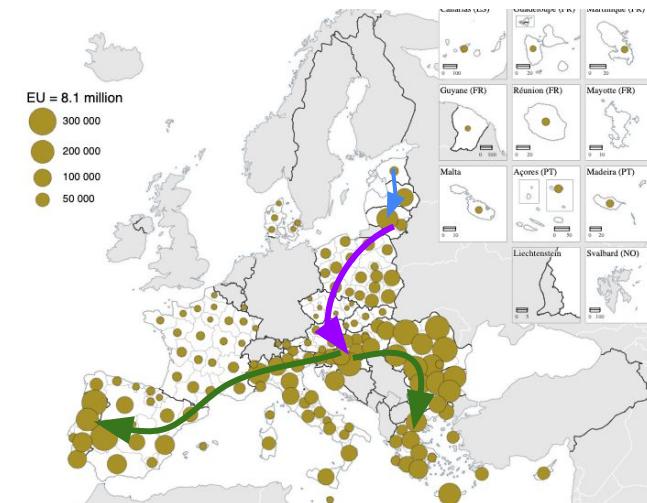
Go to market strategy by Product development

- Web-app
- Entrance observer
- Robotic beehive + apiary

Go to market strategy by region

- Estonia, Baltics (Seed / R&D phase)
- Europe - Poland, Hungary, Croatia, Italy, Bulgaria (Series A)
- US, Middle East, Portugal (Series B)

Number of beehives on farms, 2020



Pricing model

Community

free

5 hives max

Essential

15 EUR / month

2 weeks trial, annual billing

- More AI detection features
- Timeline
- Sharing
- Alerting
- Telemetry API

Professional

5 EUR per beehive per month
+ **10 EUR per user per month**

(All of Essential plan, plus)

- Analytics + Demographic breakdown
- Multiple users
- Inventory management
- Video streaming playback

	 Entrance Observer	 Robotic Beehive	 Robotic Apiary
Purchase retail price (estimated)	600 EUR - 1 hive 1200 EUR - 4 hives	~ 3000 EUR	~ 10 beehives (arranged in a line) ~ 7000 EUR
Rent (annual billing)	+ 100 EUR / month	+ 150 EUR / month	+ 250 EUR / month





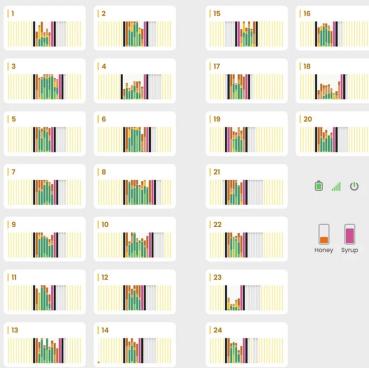
- Raising 35k angel investments
 - Hardware development (Entrance observer)
 - Field testing with local beekeepers
 - GPU hosting cluster + cloud video storage
- Raising 1M pre-seed round for runway: 24 months
 - **Team of 4** + external contractors & beekeepers
 - AI models improvements
 - Robot R&D

pilot@gratheon.com



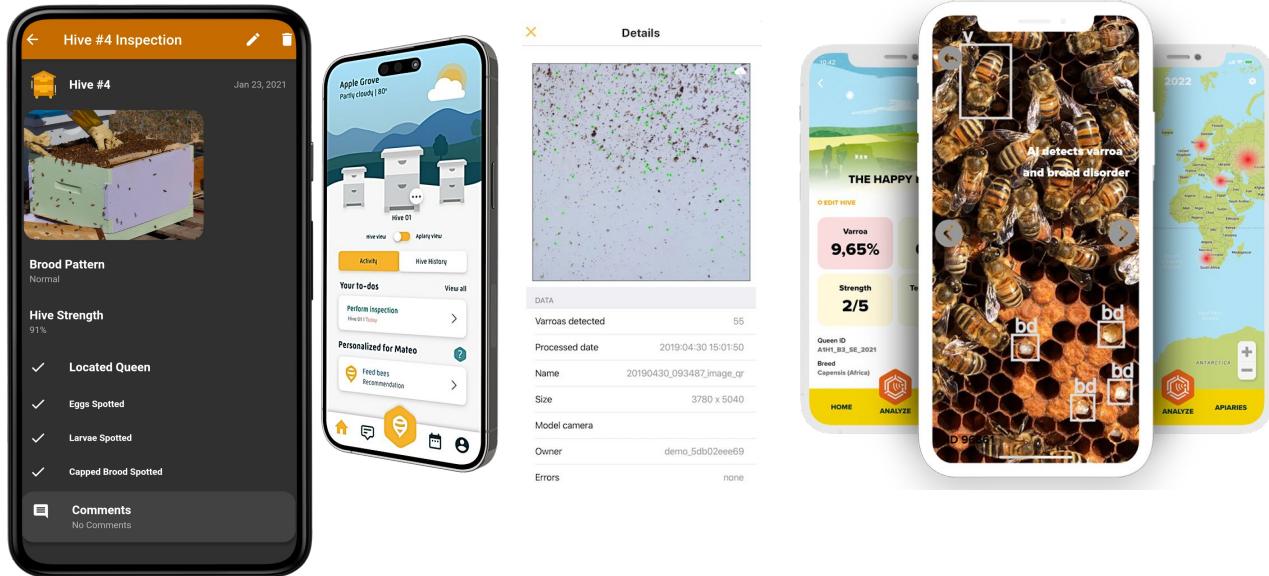
Competition - Vision AI and hardware

- beewise.ag - robotic multi-colony container hive
- beehero.io - IoT
- beemate.buzz - counts bees
- apic.ai
- bestbees.com



Competition - Data organizer apps

- nectar.buzz
- BeeScanning
- ApiZoom
- HiveTracks
- HiveBloom
- BeeQueenDetector
- apimanager
- apiary book



IoT - analog data (audio, humidity, temperature)

- beehero.io
- beep.nl - opensource
- broodminder.com
- beelab.se
- intelligenthives.eu
- beehivemonitoring.com
- solutionbee.com
- beehivemonitoringusa.com
- osbeehives.com
- beesage.co

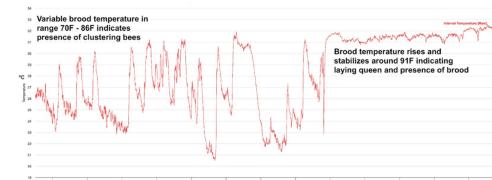


Fig. 2: Using Brood temperature to detect onset of laying queen in late winter/early spring

