



Beehive AI monitoring and robotic automation



Artjom Kurapov
Founding engineer

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



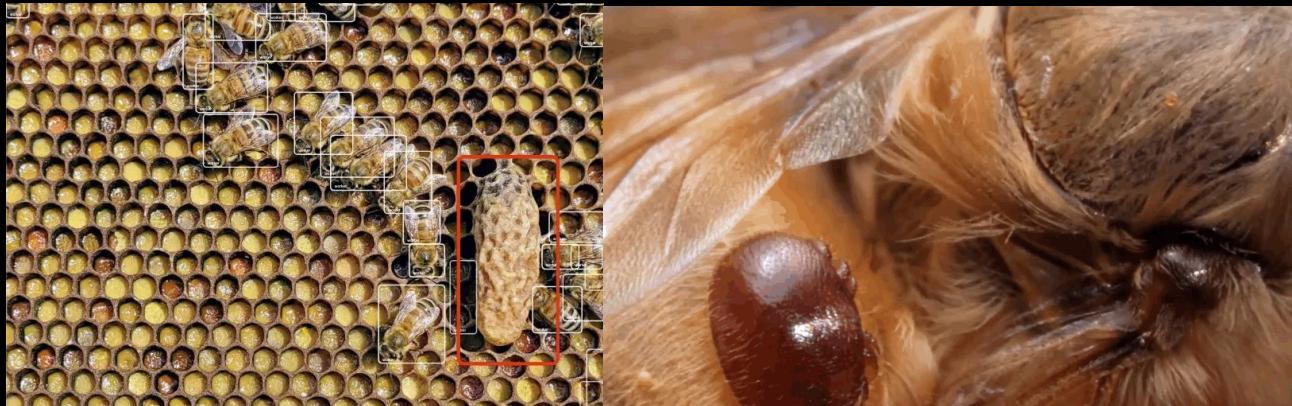
Human worker efficiency

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



Bee colony health observability

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



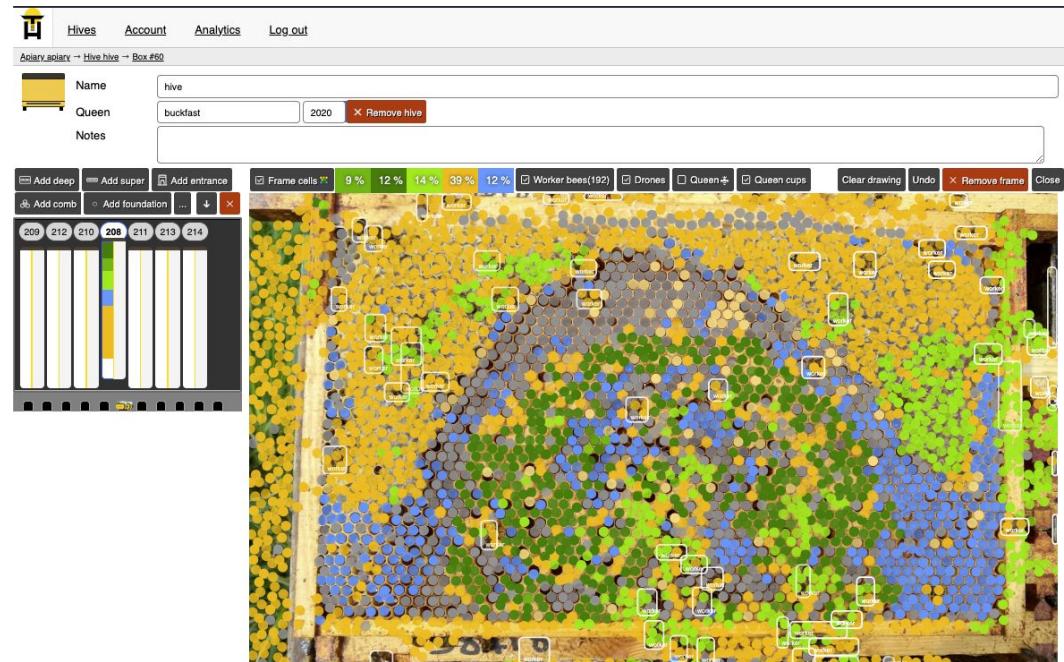
Vision



Software as a service for beekeepers to organize and monitor their apiary

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

- 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
- Foraging analysis
- Stealing state
- Hornet detection



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



early prototype





Team

Research advisors, Czech Republic



Artjom Kurapov

Founding engineer / beekeeper
(ex-Pipedrive, Clarifai)



Muhammad Zain Shakeel

Mechanical engineer volunteer



Aleksei Zaitsev

Fullstack engineer volunteer



Ahmed Daoudi

Fullstack engineer volunteer



Šimon Bilík

Researcher, PHD
System engineer / Beekeeper



Adam Ligocki

ML engineer, PHD



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

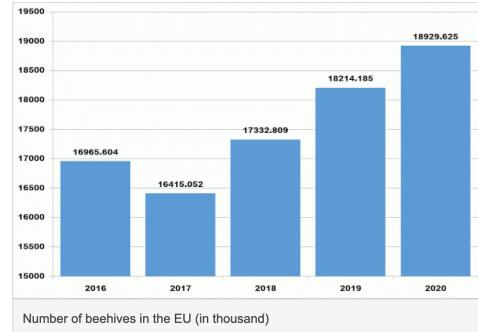
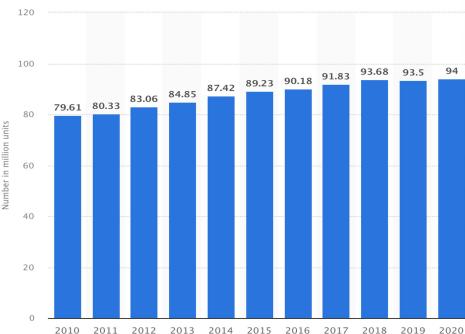
	 Entrance Observer	 Robotic Beehive	 Robotic Apiary
Purchase retail price (estimated)	600 EUR - 1 hive 1200 EUR - 4 hives	~ 3000 EUR	~ 10 beehives (arranged in a line) ~ 7000 EUR
Rent (annual billing)	+ 100 EUR / month	+ 150 EUR / month	+ 250 EUR / month



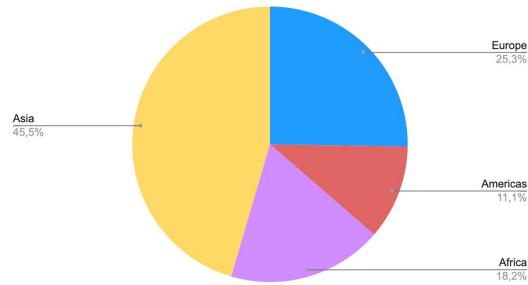


Market

- 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

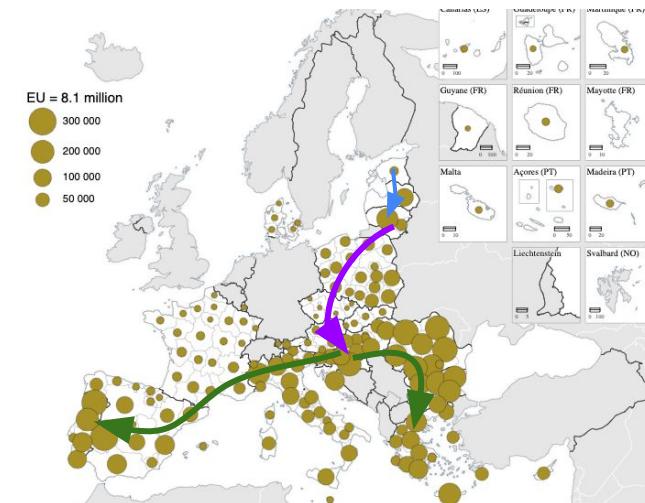
Go to market strategy by Product development

- 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





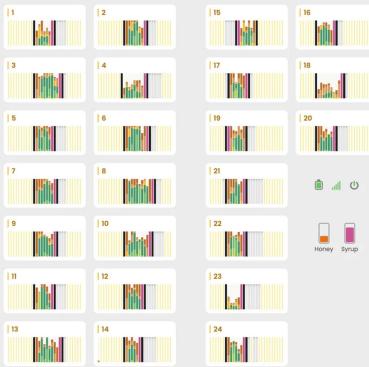
- Raising 35k angel investments
 - Hardware development (Entrance observer)
 - Field testing with local beekeepers
 - GPU hosting cluster + cloud video storage
- Raising 1M pre-seed round for runway: 24 months
 - **Team of 4** + external contractors & beekeepers
 - AI models improvements
 - Robot R&D

pilot@gratheon.com



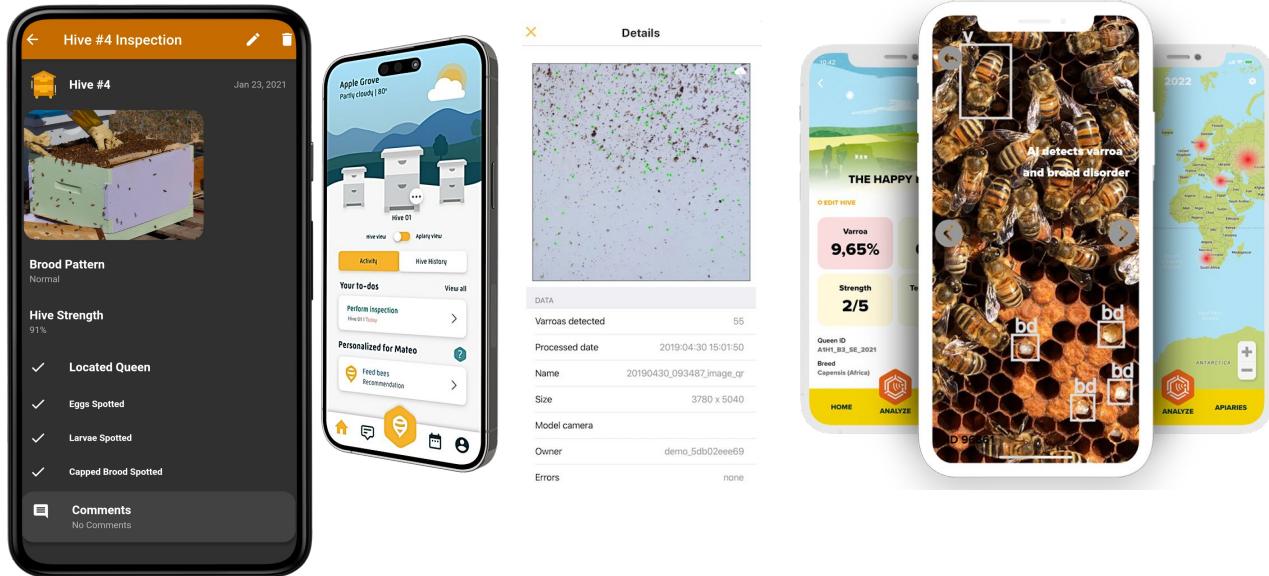
Competition - Vision AI and hardware

- 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

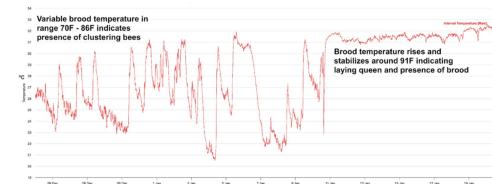


Fig. 2: Using Brood temperature to detect onset of laying queen in late winter/early spring

