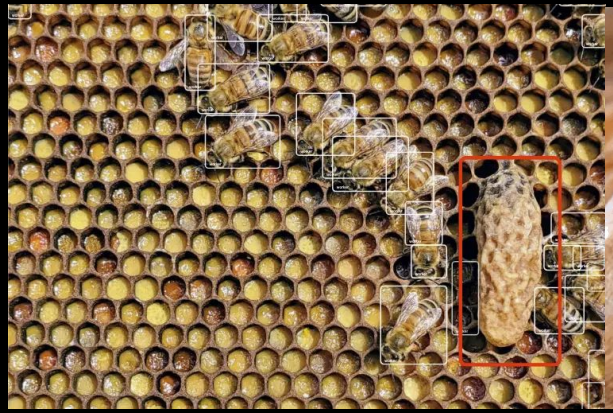
GRAPHEON

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

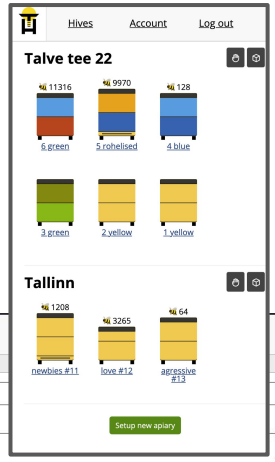
- Pollination boosts crop yields (+10-30%)
- Farmers lack sufficient amount of pollinators
- Beekeepers providing services to farmers earn 9x more money compared to their honey income
- Demand of pollination grows 2x faster than growth of honeybee colonies

Vision

app

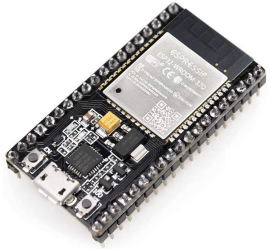
Data analytics SaaS app for beekeepers

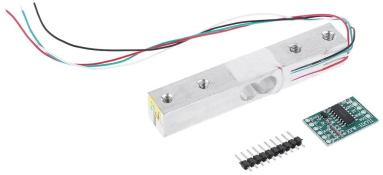
- ☑ AI detections of a frame photo
  - ☑ Bee counts
  - ☑ Queen and queen cups
  - ☑ Varroa mites
  - ☑ Frame cells
- ☑ Manage apiaries, hives, frames, photos
- ☑ AI advisor
- ☑ Mobile app
- ☑ Manual inspections, inspection timeline
- ▢ Re-train on user data



Vision

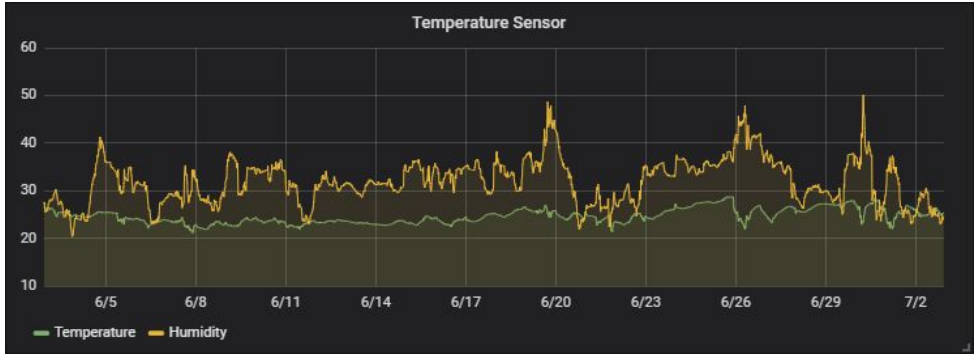
app → Beehive IoT sensors





Hardware to send infrequent telemetry data:

- Hive internal temperature
- Humidity
- Atmospheric pressure
- Hive weight
- CO2 levels inside the hive
- PM2 pollution outside the hive
- Wind speed
- Audio (optional)



In web-app:

- Plot result timeseries data in grafana
- Analytics (graphs) to find correlations/anomalies
- Alerts

In mobile app:

- easy way to connect device to the app (wifi / LoRa)

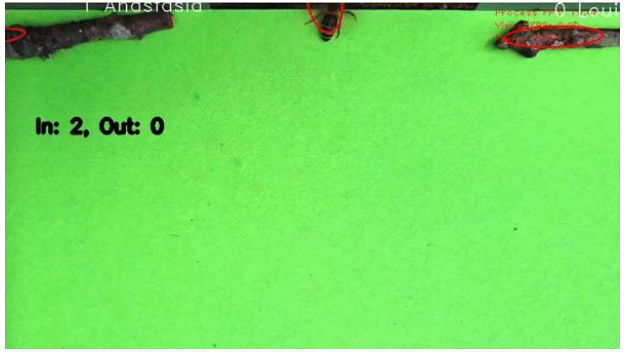
Vision

app → Beehive IoT sensors → Entrance Observer

Hive entrance video monitoring / IoT device

☑ Video streaming & playback
▢ Incoming/Outgoing bee counter

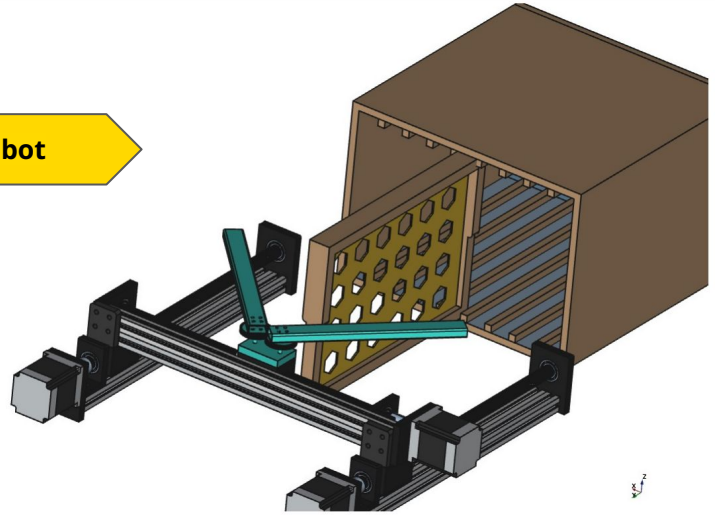
▢ Varroa mite detection
▢ Pesticide exposure seizures
▢ Pollen foraging activity
▢ Ant infestation
▢ Queen mating flight
▢ Stealing state alert
▢ Hornet alerts

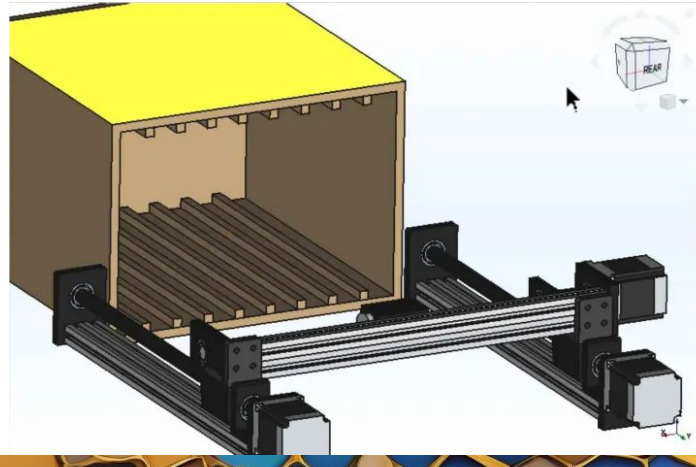


Vision

app → Beehive IoT sensors → Entrance Observer → Robot

- 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-effictive multi-hive robot. Moves on rails
- Temperature, humidity, weight, audio monitoring
- Ventilation, Automatic feeding
- Anti-varroa mite treatment



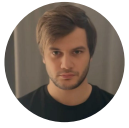


🐝 Team

Artjom Kurapov
Founding engineer / beekeeper
(ex-Pipedrive, Clarifai)

Muhammad Zain Shakeel
Mechanical engineer volunteer

Ahmed Daoudi
Fullstack engineer volunteer



Kurban Ramazanov
UX engineer volunteer

Aleksei Zaitsev
Fullstack engineer volunteer

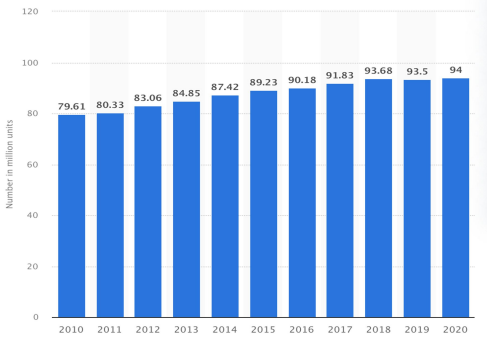
Research advisors, Czech Republic

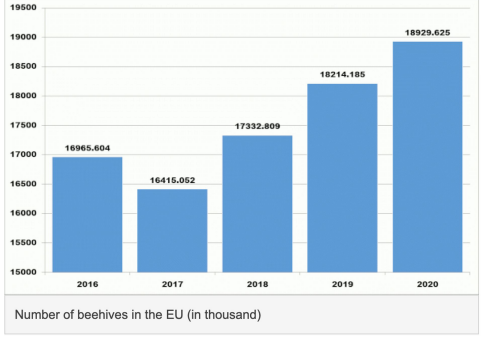
Šimon Bilík
Researcher, PHD
System engineer / Beekeeper

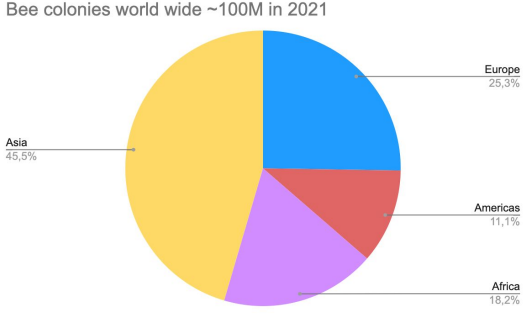
Adam Ligocki
ML engineer, PHD

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







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

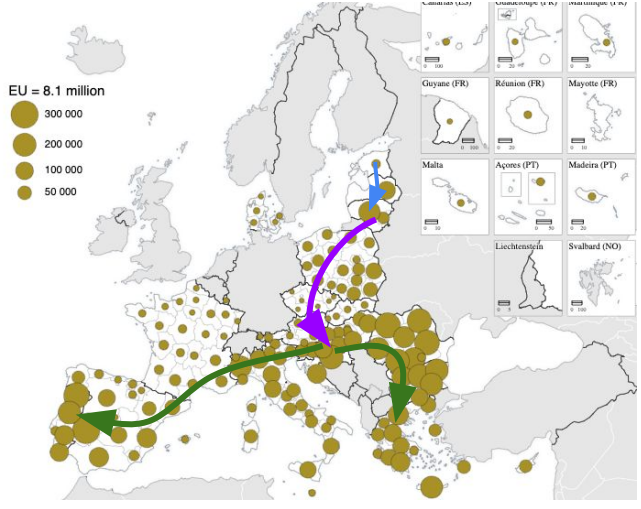
- Web-app
- Entrance observer
- Robotic beehive + apiary

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

Invest

- 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

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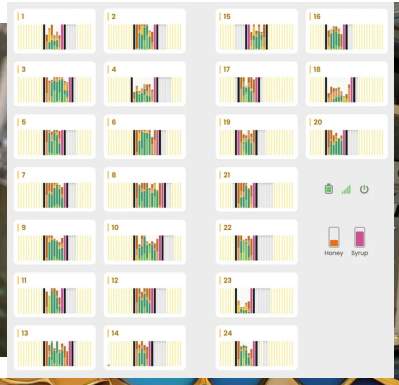
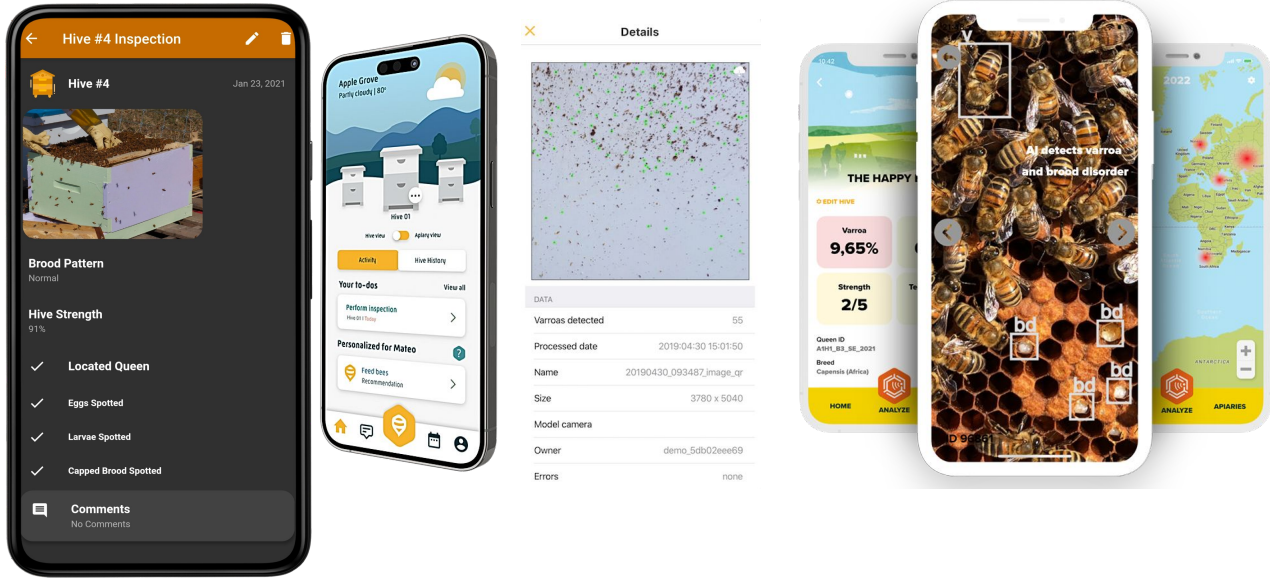
Competition - Vision AI and hardware

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



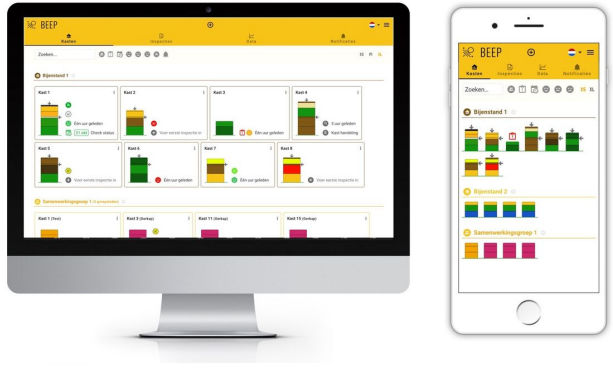
Competition - Data organizer apps

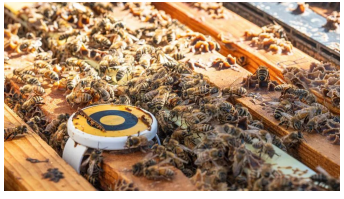
- nectar.buzz
- BeeScanning
- ApiZoom
- HiveTracks
- HiveBloom
- BeeQueenDetector
- apimanager
- apiary book

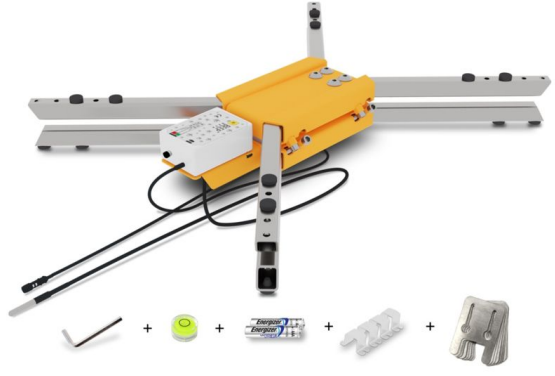


IoT – analog data (audio, humidity, temperature)

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







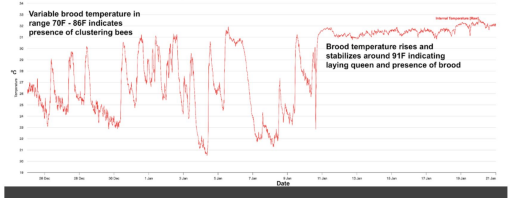


Fig. 2: Using Brood temperature to detect onset of laying queen in late winter/early spring