GRAPHEON

Modular Robotic Beehive

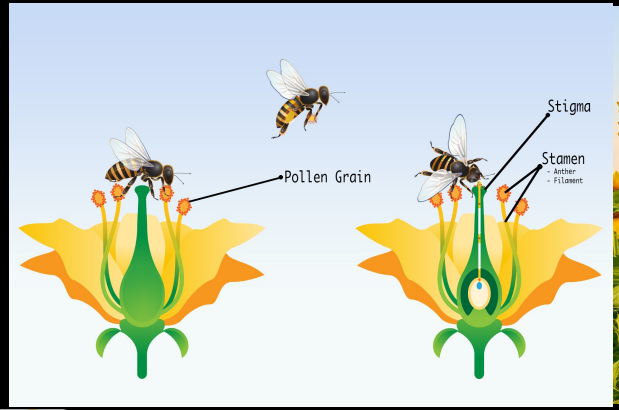
As a Service

Artjom Kurapov

Founding engineer

Problem statement - Food security

- World population to reach 10 Billion, limited resources, need of advanced food production
- 75% of leading crop types are dependent on bees pollinating them (coffee, tomatoes, apples, almonds)
- Farmers can increase crop yields by +37% with precise pollination
- **Beekeepers** providing services to **farmers** earn 9x more than from selling honey
- Demand of pollination grows 2x faster than growth of honeybee colonies






Problem statement - Efficiency

- Beekeepers lose 20-50% of colonies every year, a single colony loss impact > 350 EUR
- Bees swarm, get infested with mites or can be aggressive
- Beekeepers need to perform weekly inspections
- Common beehives are 150 years old and heavy to inspect
- Physical labour is hard to scale, it is a seasonal activity

Vision

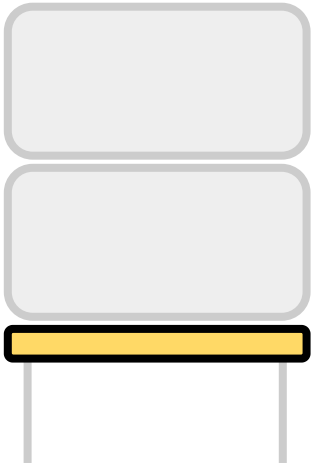
app

Data analytics app for beekeepers

Manages state of the apiary
Performs AI detections and provides advices
Controls modular beehive hardware

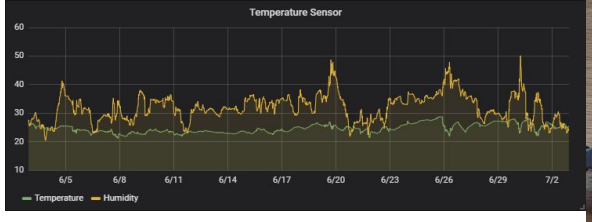
Vision

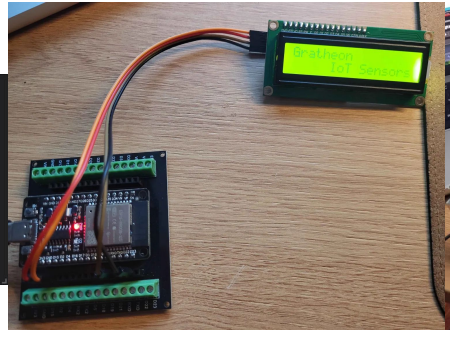
app → Beehive IoT sensors

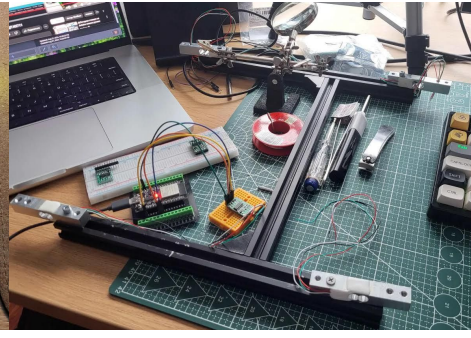


Affordable set of sensors as beehive base

Sends hive internal temperature, weight, humidity
AI detects anomalies
Sends alerts in case of swarming, storms, bear attack

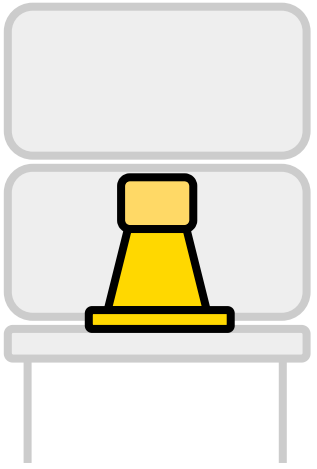






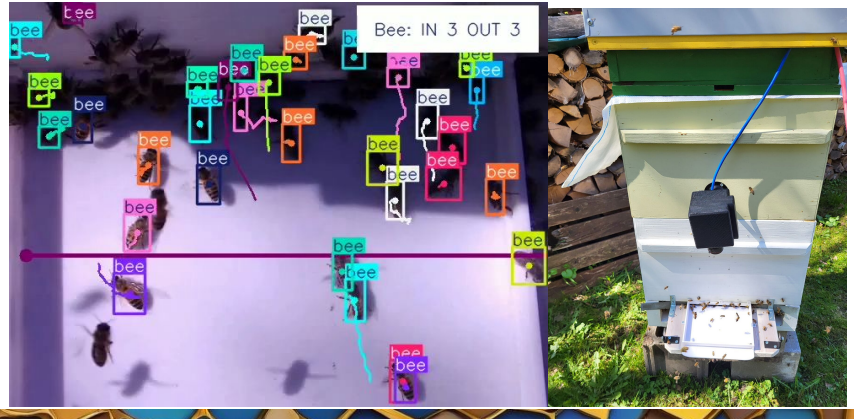
Vision

app → Beehive IoT sensors → Entrance Observer



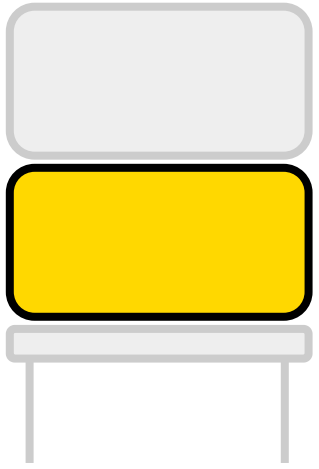
Hive entrance video monitoring device

Incoming/Outgoing bee count to estimate colony strength
Hornet and Varroa mite detection
Video streaming & playback

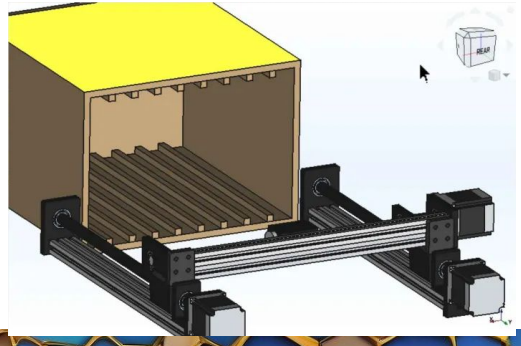


Vision

app → Beehive IoT sensors → Entrance Observer → Robot



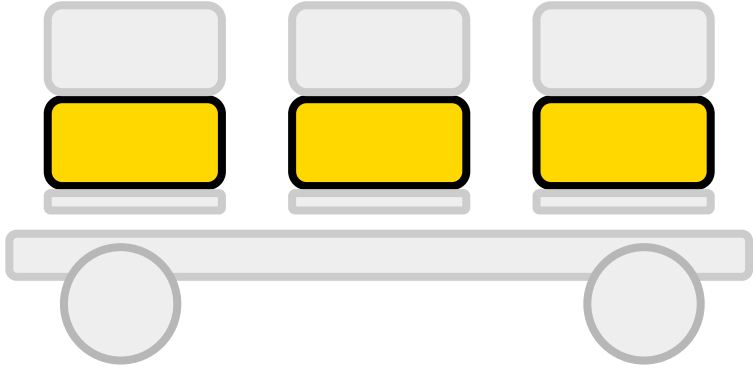
Beehive frame extraction mechanism
Autonomously inspect colony internal state
Alerts in case of swarming, starvation or missing queen
Colony development over time



Vision

app → Beehive IoT sensors → Entrance Observer → Robot → Robotic Apiary

Multi-hive robot
Cost-effective
Mobile for easy positioning



👨🏻‍🚀 Customer

Addressable market - **370 thousand semi-professional beekeepers in Europe**

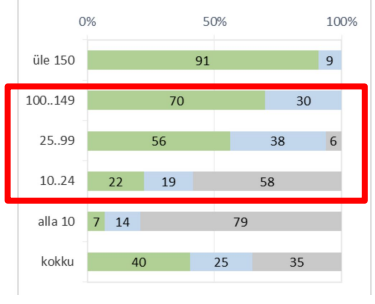
Europe in total has 620k beekeepers, 19-25M colonies
~ 60% beekeepers have > 25 bee colonies
> 50% have legal company (thus B2B)

Additional users - hobby beekeepers
Early adopters - young, tech-savvy beekeepers

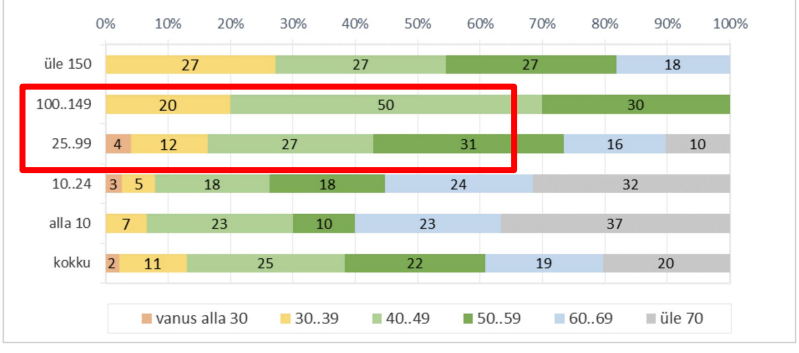
Table 1 – Number of beekeepers in selected EU countries

EU countries with more than 20 000 beekeepers	Total number of beekeepers	Beekeepers with >150 hives	
		Number	Average No of hives
Germany	116 000	81	587
Poland	62 575	324	272
Italy	50 000	2 000	413
Czech Republic	49 486	107	260
France	41 560	1 717	366
United Kingdom	37 888	50	443
Austria	25 277	380	233
Greece	24 582	7 288	165
Spain	23 816	5 361	406
Romania	22 930	1 545	194
Hungary	21 565	1 546	218

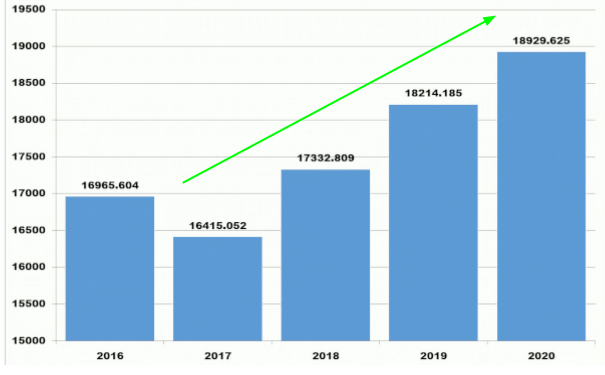
percentage of customers registered as company, depending on amount of hives, (based on estonian market research)



age distribution depending on hive count (based on estonian market research)



number of beehives in EU over the years (in thousands)



💶 Business model

Subscription model for data management and analytics, usage dependent

Low-margin hardware with open hardware and software to ease adoption and trust

Moat - hardware-to-software integration,
Hard to migrate (telemetry) data out

Community tier	Essential tier	Professional tier
free	**15** EUR / month 2 weeks trial, annual billing	**5** EUR per beehive per month + **10** EUR per user per month
5 hives max	20 hives max	

	🌡️ Beehive IoT sensors	🧿 Entrance Observer	🧿 Robotic Beehive	🪬 Robotic Apiary
Web-app subscription	5 EUR / month	20 EUR / month	50 EUR / month	200 EUR / month
Purchase retail price (estimated)	200 EUR	~ 600 EUR	~ 3000 EUR	~ 10 beehives ~ 6000 EUR
Rent (annual billing)	20 EUR / month	50 EUR / month	250 EUR / month	500 EUR / month

Market estimate for IoT sensor product

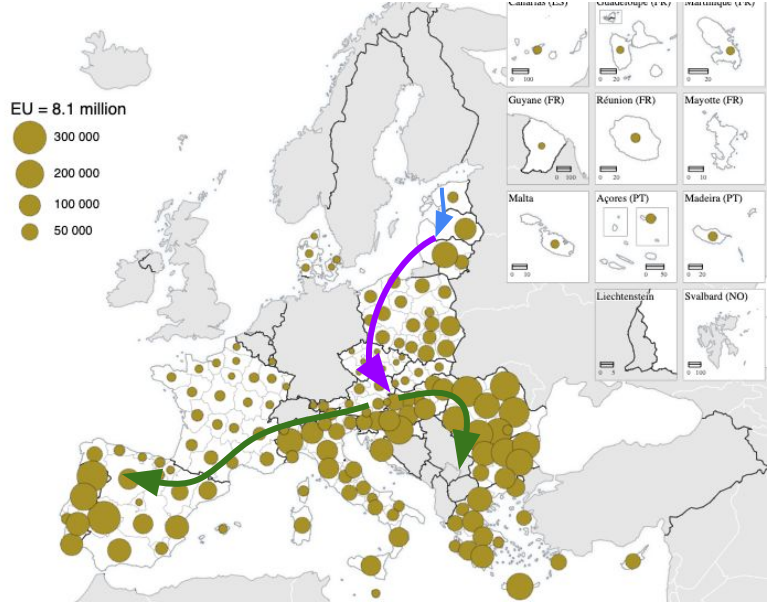
Estimated EU market penetration = 70%
Essential tier monthly price = 15 EUR/month
Essential tier estimated beekeeper ratio = 80%

620k × 0.7 × 0.8 × 15 = **62.5M EUR ARR**

Pro tier monthly price = 5 EUR/month/hive + 10 EUR/user
Pro tier estimated beekeeper ratio = 20%
Estimated average hive count = 32
Estimated IoT sensors coverage = 50%

620k × 0.7 × 0.2 × (10 + 5 × 32 × 0.5) = **93.7M ARR**

Go to market strategy by region



🐝 Team

Research and engineering heavy team
with unique company values

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

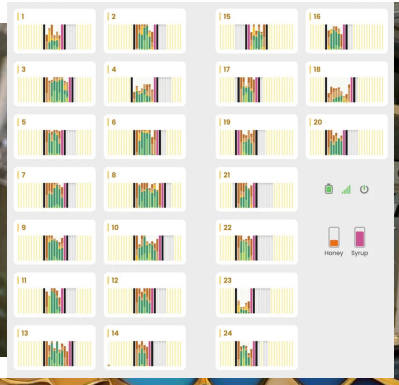
Aleksei Prokopov
Robotics, backend engineer
(ex-Fits.me, ex-Coop)

Research advisors, Estonia

Vjatšeslav Kekšin
Researcher, PhD student
TalTech

Competition in AI vision and robotics

- beewise.ag - robotic multi-colony container hive, total raised 120M $
- beehero.io - IoT, total raised 64M $
- nectar.buzz - SaaS, raised 820k $
- beemate.buzz - counts bees
- apic.ai
- bestbees.com



Traction

- 100 registered users (0 paying)
  - 10 mobile app installs
- Community and volunteer building
  - 5+ contributors
  - 70+ discord members
  - Reached out from local research institutions (Kood Jõhvi, Vidrik.TalTech, University of Tartu)
- Publicity
  - 2 interviews to local newspapers
  - 200+ followers on linkedin
- Marketing channels
  - Facebook ad for beekeeping communities
  - Telegram channels for beekeepers
  - Local beekeeping group meetups

Invest

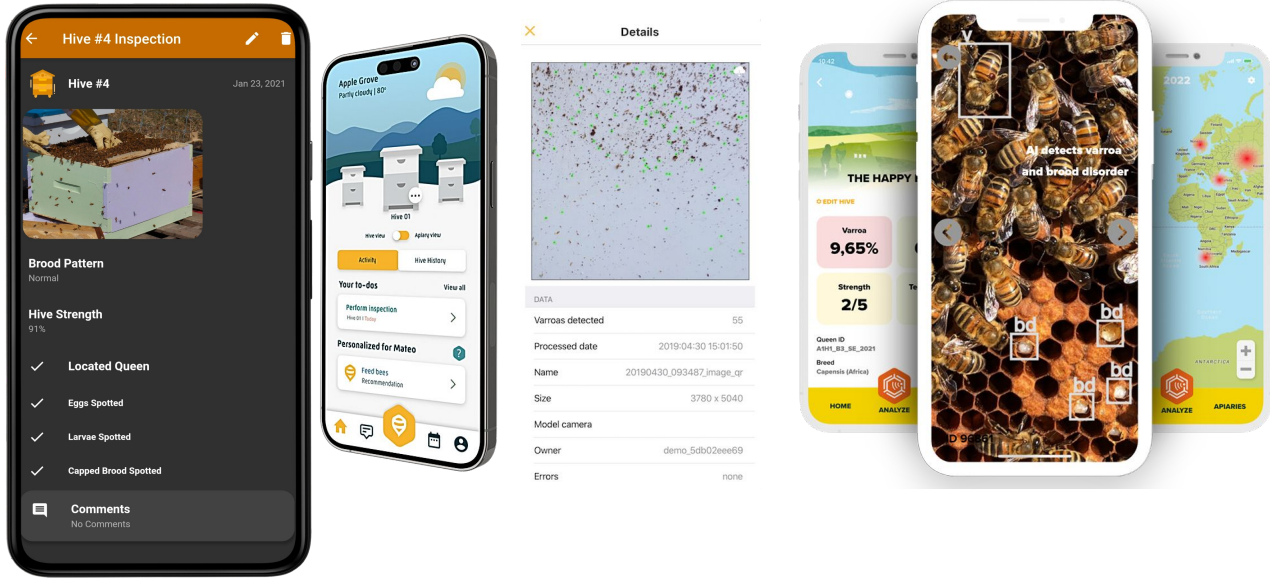
Raising 1M pre-seed round for 24 months runway

- Min. 2 summers are needed for field testing
- **Team of 4** + external contractors & beekeepers
- IoT sensors product development and release to the market
- Field testing with local beekeepers
- Entrance observer product development
- Robot prototype development

pilot@gratheon.com

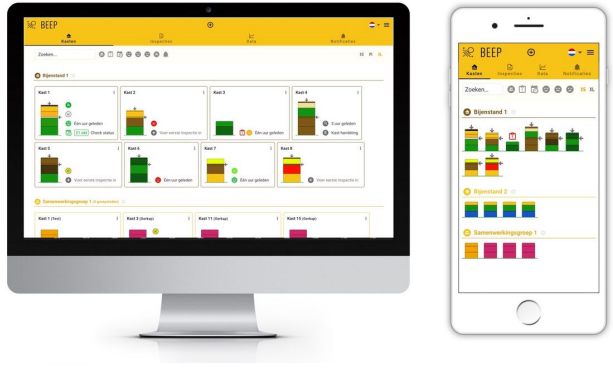
Competition - Data organizer apps

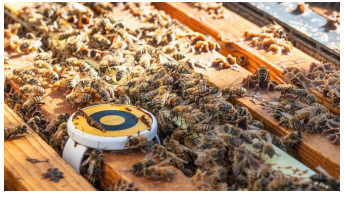
- BeeScanning
- ApiZoom
- HiveTracks
- HiveBloom
- BeeQueenDetector
- apimanager
- apiary book



🏇 Competition - IoT (audio, humidity, temperature)

- 3bee.com
- beep.nl - opensource
- broodminder.com
- beelab.se
- intelligenthives.eu
- beehivemonitoring.com
- solutionbee.com
- beehivemonitoringusa.com
- osbeehives.com
- beesage.co





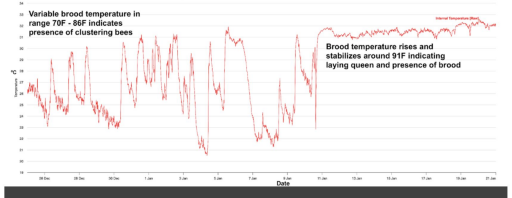


Fig. 2: Using Brood temperature to detect onset of laying queen in late winter/early spring