



## 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



Hardware to send infrequent telemetry data:

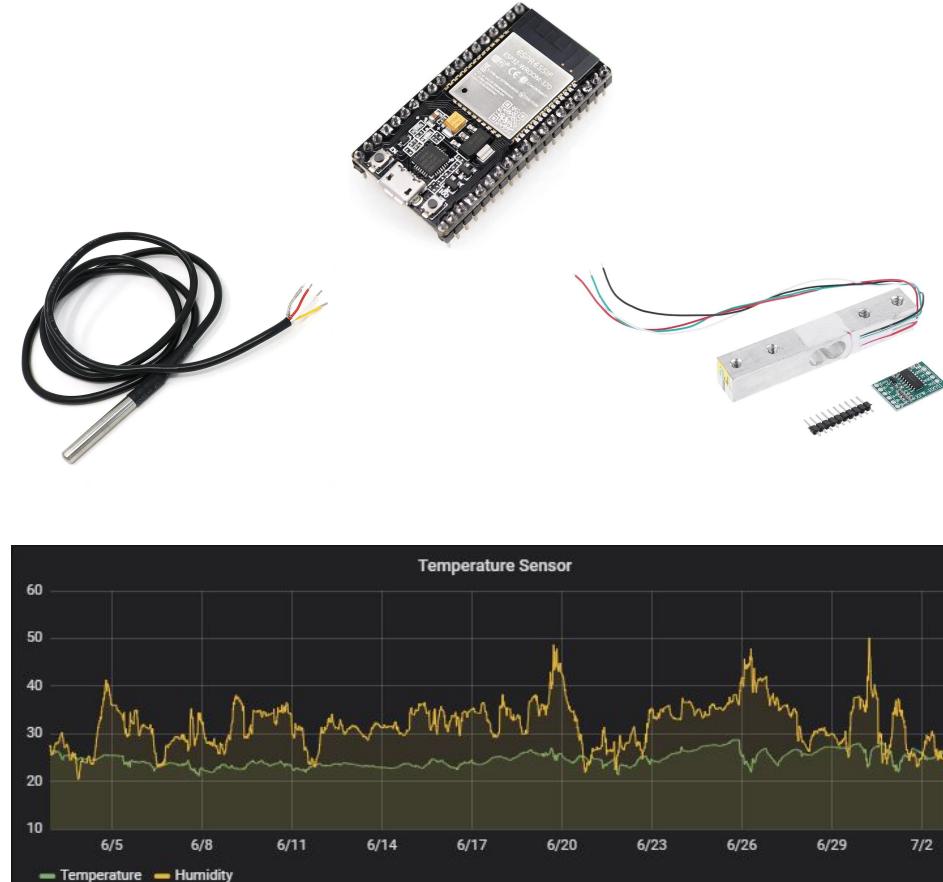
- Hive internal temperature
- Humidity
- Atmospheric pressure
- Hive weight
- CO<sub>2</sub> levels inside the hive
- PM2 pollution outside the hive
- Wind speed
- Audio (optional)

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



Hive entrance video monitoring / IoT device

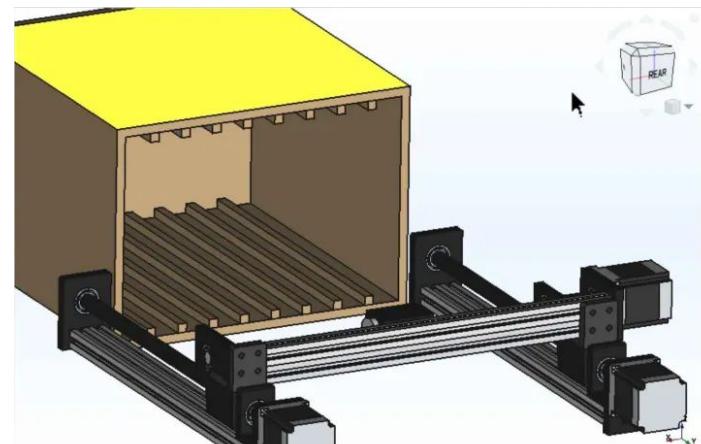
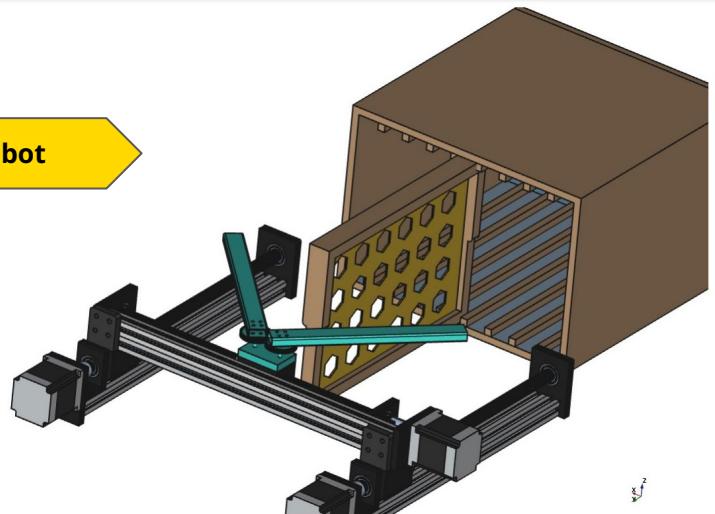
- Video streaming & playback
- Incoming/Outgoing bee counter
- Varroa mite detection
- Pesticide exposure seizures
- Pollen foraging activity
- Ant infestation
- Queen mating flight
- Stealing state alert
- Hornet alerts



# 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

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**Artjom Kurapov**

Founding engineer / beekeeper  
(ex-Pipedrive, Clarifai)

**Aleksei Prokopov**

Electronics engineer  
volunteer

**Muhammad Zain Shakeel**

Mechanical engineer volunteer

**Kurban Ramazanov**

UX engineer volunteer

**Ahmed Daoudi**

Fullstack engineer volunteer

**Aleksei Zaitsev**

Fullstack engineer volunteer

Research advisors, Czech Republic

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**Šimon Bilík**

Researcher, PHD  
System engineer / Beekeeper

**Adam Ligocki**

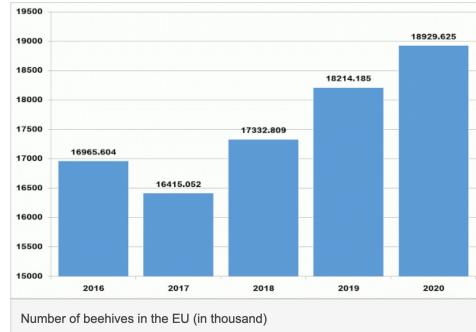
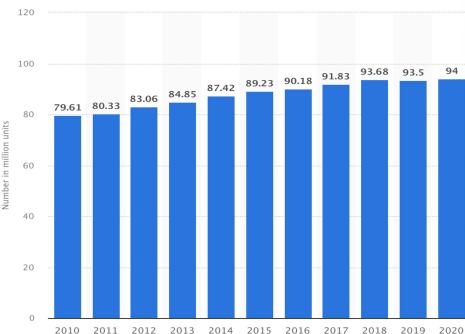
ML engineer, PHD



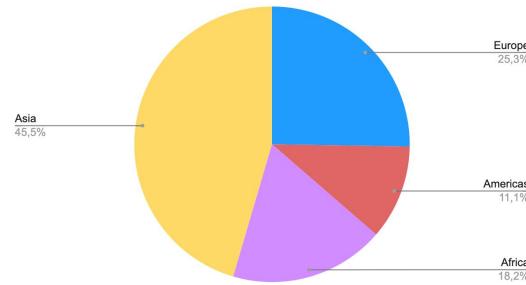


# Market

- 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

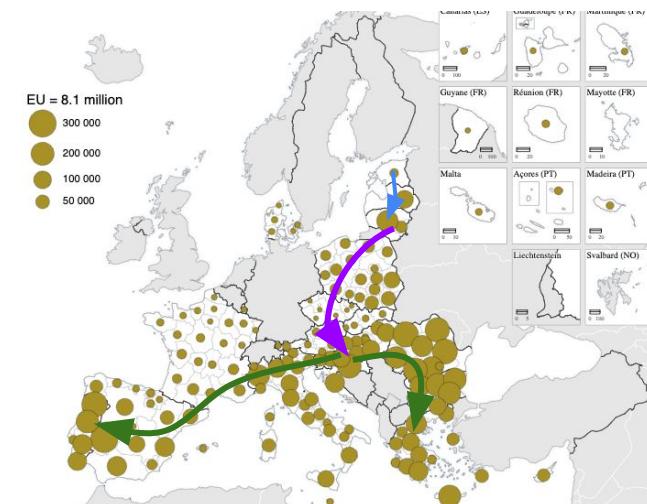
## Go to market strategy by Product development

- 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





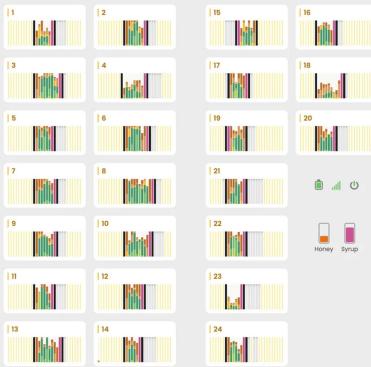
- Raising 35k angel investments
  - Hardware development (Entrance observer)
  - Field testing with local beekeepers
  - GPU hosting cluster + cloud video storage
- Raising 1M pre-seed round for runway: 24 months
  - **Team of 4** + external contractors & beekeepers
  - AI models improvements
  - Robot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

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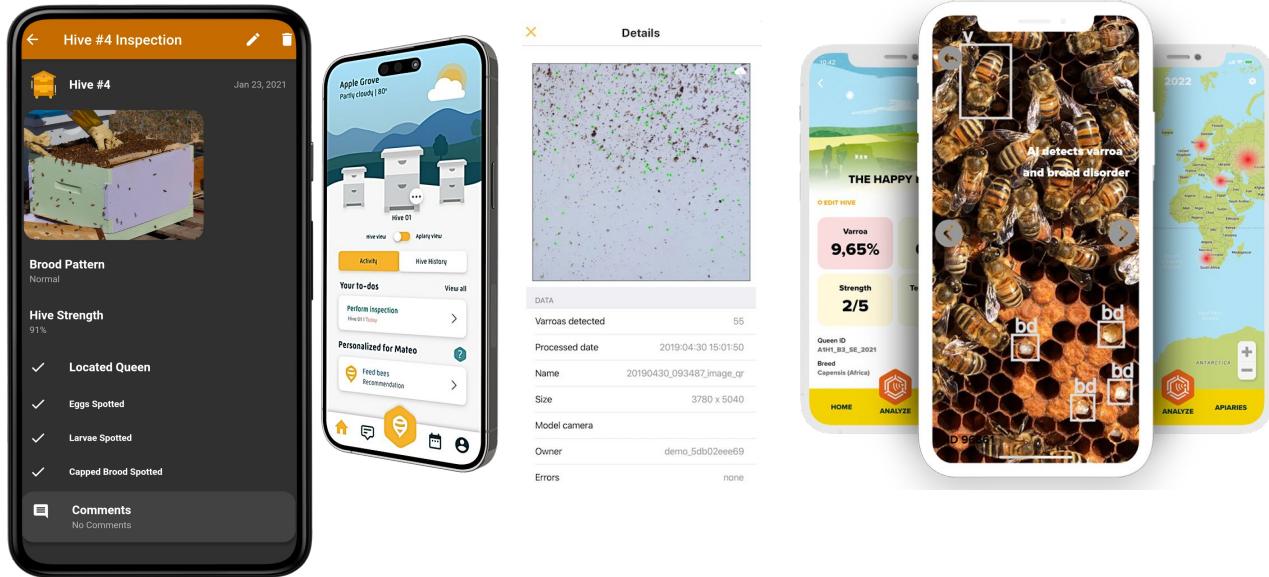
# Competition - Vision AI and hardware

- 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

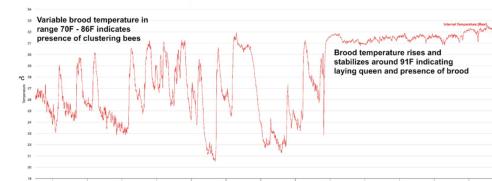


Fig. 2: Using Brood temperature to detect onset of laying queen in late winter/early spring

