Palmtree Report

Palm trees

Coconut tree

- First fruits in 5 years, full production after 15 years [5]

Date palm

- First fruits 4 years, full bearing 10 years [6]

Palm-oil palm

- production after ~5 years

About RPW

RWP (Red Palm Weevil) is a beetle that can bring havoc to palm trees. RWP infested palm tree will die in 6 months and beetles from the tree will spread to infest surrounding trees.

- most active in 27°C+ and no rainfall [3]
- Size:
    - adult male 4cm [3]
    - adult female 3cm [3]
- Life of RPW: [2]
    - Egg-3-5 days
    - Larva-45-60 days
    - Pupa-20-25 days
    - Adult-60-90days

RPW infestation symptoms

- tunnels in the tree from which thick yellow brow fluid oozing out [2]
- infestations have noticeable effect on tropical tree's core's temperature [1]
- How RPW attack coconut tree [4]
    - through shoot straight into cabbage of coconut tree

- through hole in the trunk
  - digging through ground & tunneling through root system

RPW automatic detection methods

- high-resolution infrared imaging is effective link
- tree-radar-unit 83% detection rate link
- Acoustic detection using microphone and signal processing unit can achieve 98% success rate [8].
- Smart traps can be used monitor the spread of RPW [7]
- Seismic device can reliably detect chewing sounds produced by RPW larva [9] [10]
- Agrint device available on market achieves 95% of accuracy on infestations within few days. Solution used in device is accelerometer that is mounted on a screw that is drilled 10-15 into tree's core

Traps

- Semiochemicals baited traps were found useful to assess and forecast spatial and temporal distribution of RPW.
- Picusan® was found superior to most tested traditional traps.
- Effective operation of traps requires continuous water supply.
- Optimal trap **distance** was approx. **60 m** (preliminary data).

Competitors

Agrint

- seismic (accelerometer) probe 10-15 cm screws into tree, reports infestation in days with 95% accuracy

What we want to do

Agrint device is already very good in terms of performance and we think competing only on price is not great strategy. So we want to come up with something more to offer. Thus we want to build a system of 2 devices:

- smart traps - together with cloud-based analytical platform to monitor number of pests in area, single smart traps can effectively cover area of 90m² so does not need to be installed in every tree
- tree probe
    - accelerometer - same as agrint
    - thermometer - cannot give answers as fast as accelerometer based probe about infestation, but could still be useful in hot climate to monitor health of tree

Market analysis

- Q: who are our customers?
- A: basically any municipality who suffers from RWD infestations will be interested in our service, if affordable
- FAO research that date palms with growing 90% in the NENA region are destroyed by the RPW which cause damage worth 480MEUR in Mediterranean countries.
- 15 countries of NENA region are Bahrain, Egypt, Iraq, Jordan, Kuwait, Libya, Mauritania, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, the United Arab Emirates and Yemen.
- Khalifa international award for date palm and agricultural innovation, international center for advanced Mediterranean agronomic studies, International center for Biosaline Agriculture probably are potential customers.

Proposed solution

We decided to sell the device but also include a monthly service for the data treatment (analytics, automated data received,...)
At this stage of the project it is decided to go for temperature sensor solutions since it is the most satisfactory alternative regarding the budget constraint (under 15 USD per device).
Once we test and implement this solution, we might look also into accelerometer sensor alternative since accuracy might be better.

Implementation decisions

Tree module

- ds18b20 waterproof thermometer ±0.5°C very widely available, NTC based
- accelerometer - right now we have MPU6050 trying to get it working with st board. But maybe good idea would be to use ST accelerometer if we use ST board
- we have decided on ST based MCU
  - Q: is stm32l0 low power line good enough to do signal processing required by accelerometer
- Wisol module for Sigfox communication

~~Smart traps module~~

We have decided to focus on temperature based sensor
- ~~Detection~~
  - ~~Right now we are deciding between few different approaches:~~
    - ~~IR gates based counter~~
      - ~~In one research [7] short IR beam pulses of 32µs every 1ms were used and achieved battery life of 2 months and accuracy of 95%. We need to figure out if we can get more battery.~~
    - ~~limit switch~~
    - ~~scales based measurement~~
    -
- ~~MCU~~
  - ~~st l0 based mcu~~

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References

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