



Soletta™

Bringing Intelligence to IoT Devices

Challenges Faced and Soletta
Approach

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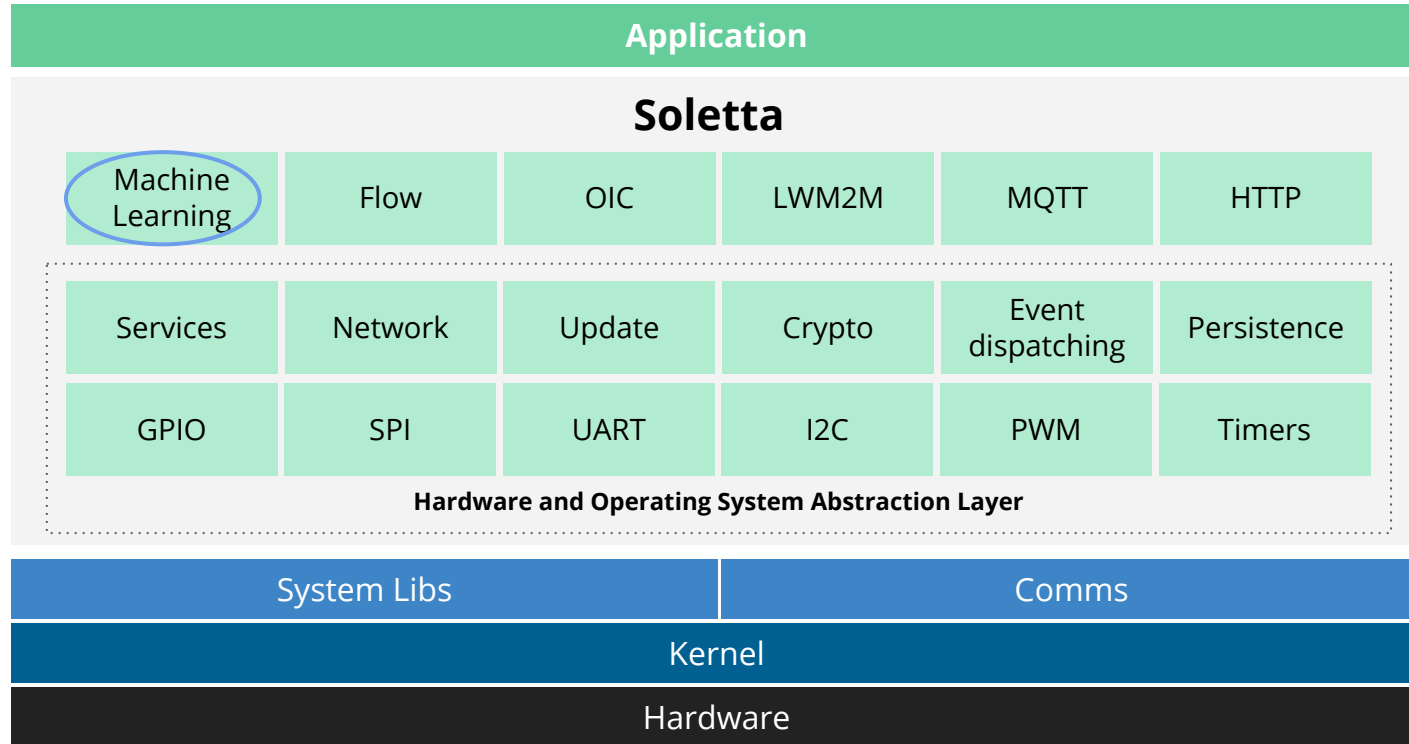
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What is Soletta?

- IoT Framework
- Open Source
- Easy access:
 - Sensors
 - Actuators
 - Communication
- Portable code
- Different platforms, including small OSs



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I have a problem







How can IoT help me?





How can IoT help me?

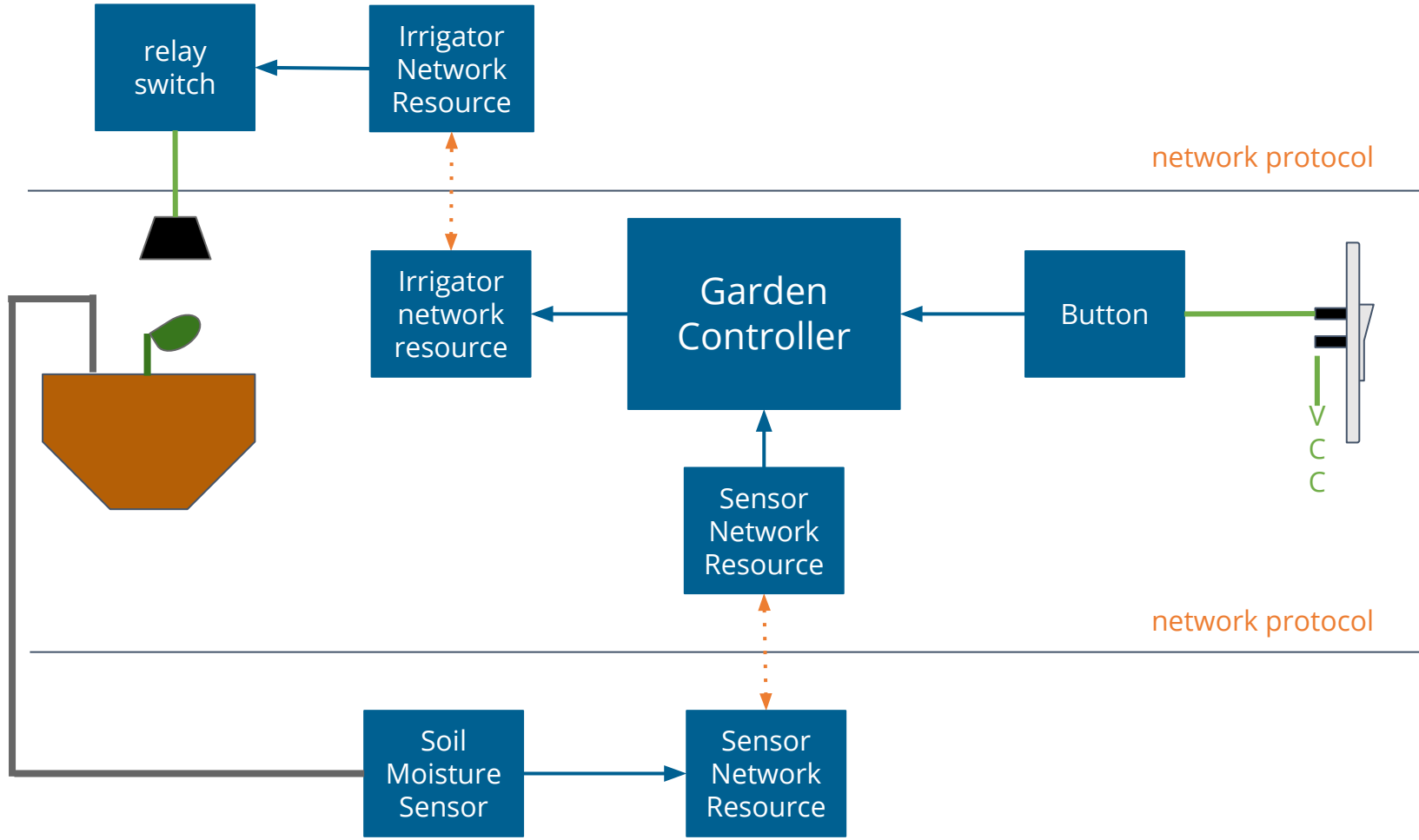


- Sensors monitoring the soil moisture
- Light Sensors monitoring the light incidence in the plants
- The device can send me a message to my smartphone when the plants need to be watered
- I could water my plants remotely
- The device could water the plants for me
- Use a simple timer



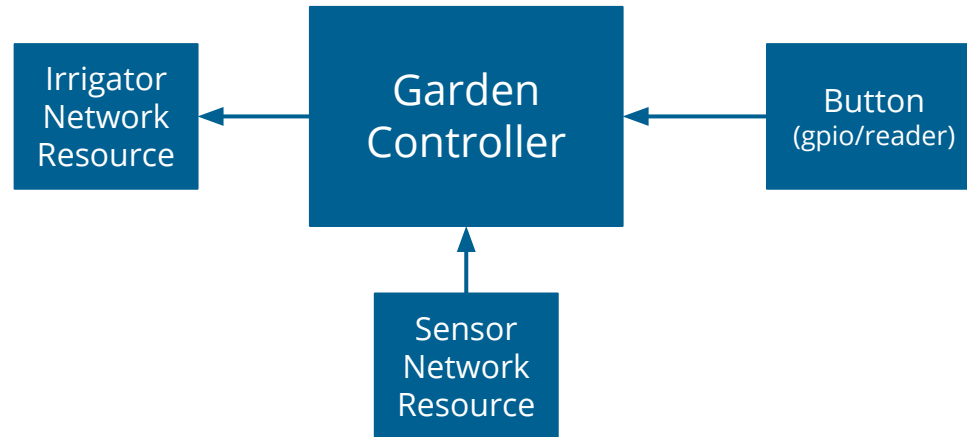
Simple Watering Sample





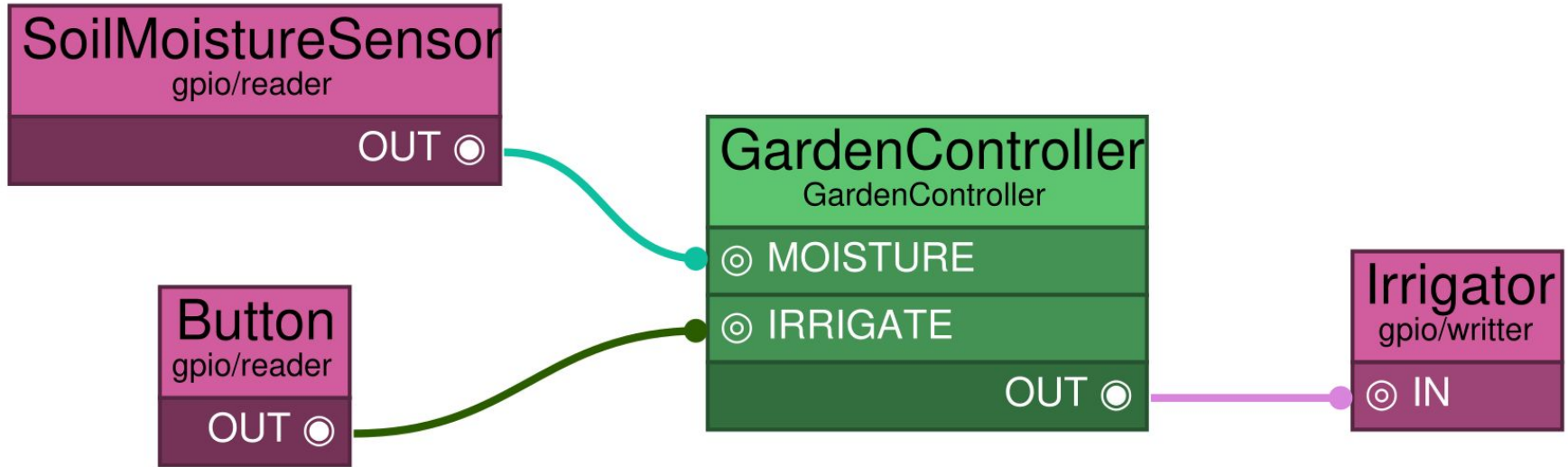
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Simple Watering Sample



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Simple Watering Sample







When should we water the plants?





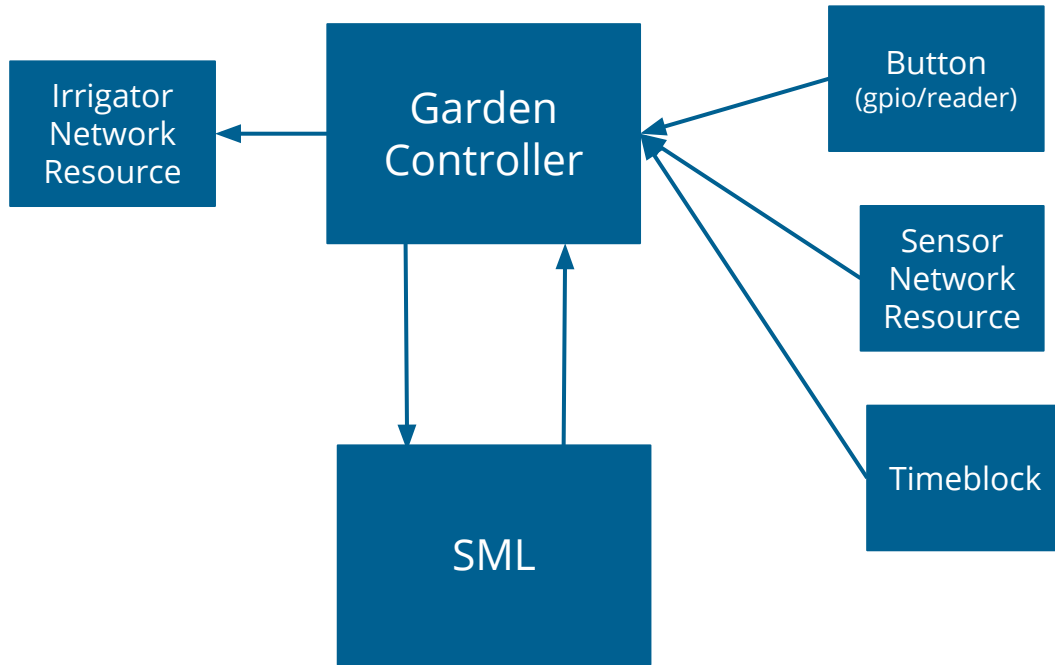
How much water should we use?



Why not learning from users

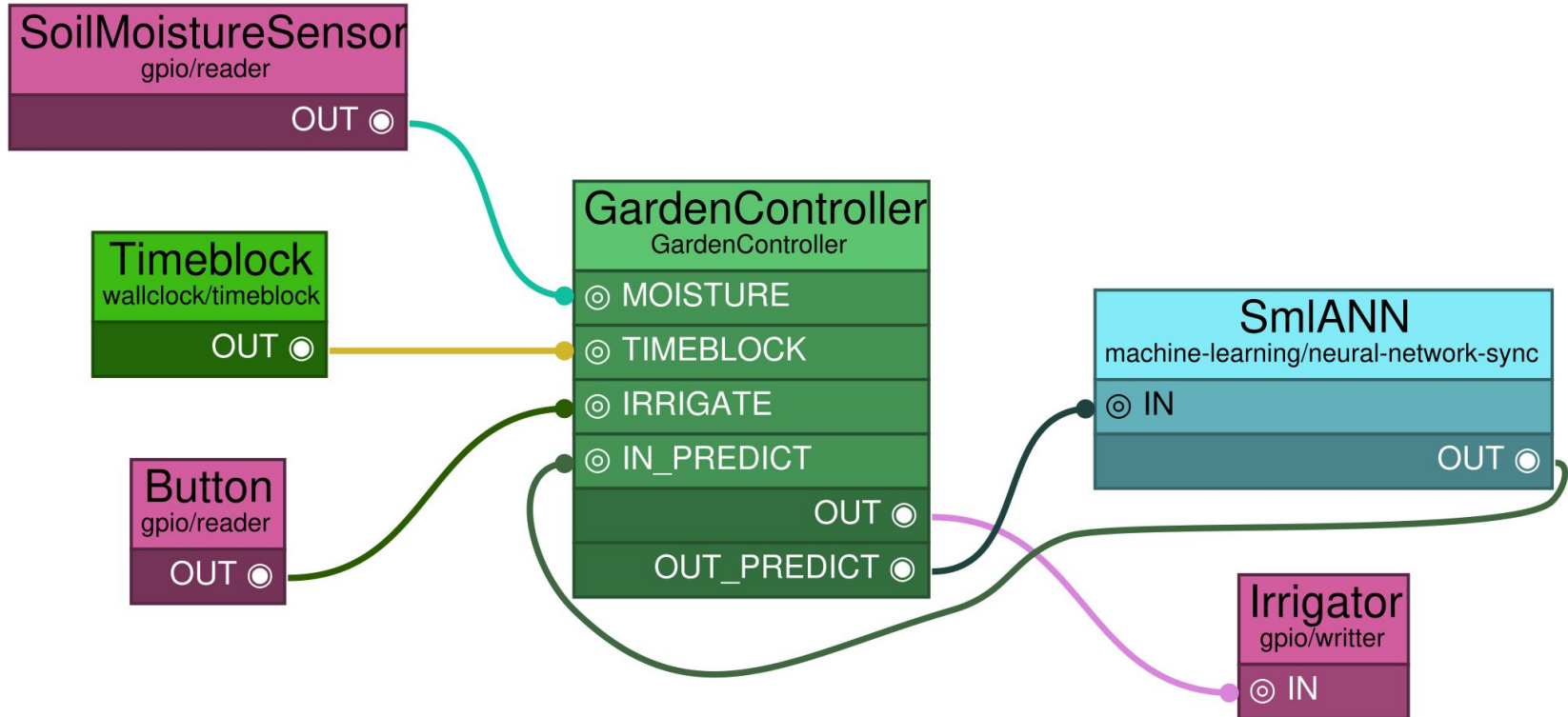
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Simple Watering Sample



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Simple Watering Sample



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Soletta Garden

- 2 plants for 2 backends
- Parrot Flower Power to monitor soil moisture
- Both backends learned how to water the plants :)



What else could we do?

- Car air conditioning and stereo system
 - Changing configurations according to who is in the car.
- Shower temperature and water volume
 - Based on body temperature, weather and who is in the shower
- TV channel selection
 - Based on mood and number of people in the house
- Delivery food suggestion
 - Based on mood and number of people in the house
- Controlling house lights
 - Turn on and off lights when needed (security, comfort, economy)



SML Overview



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Soletta Machine Learning



- Machine Learning module for Soletta framework
- Learns from user's behavior
- 2 different backends:
 - Fuzzy Logic algorithm
 - Artificial Neural Network
- Extensible
- It is not necessary to have deep knowledge in ML to use it
- Runs locally

Why not running in the cloud?

- Privacy
- Security
- Connectivity issues

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Soletta Machine Learning



- Developer defines sensors (INPUTS) and actuators (OUTPUTS)
- SML learns from reading sensors and actuators status
 - Training (learning)
 - Trying to figure out how value read from sensors affects actuators
- SML predicts actuator values based on current sensor values
 - We can act in actuators using predicted values
- We don't need to keep all collected data to train SML

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Fuzzy

x

ANN



- Uses Fuzzylite library
- Adapts faster when user's behavior changes
- Better results
- Only give predictions when current sensors state is similar to a state that has happened before

- Uses Fast Artificial Neural Network library (FANN)
- Learning is faster
- Always give predictions
- Lower memory consumption when using a large number of inputs/outputs
- Tends to forget old events



Challenges



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Challenges: Validating Results

- Simulations
- Prototypes
- Lamp prototype
 - First sample to gather real data
 - Change lamp color when a different user arrives near the lamp area



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Challenges: Incorrect predictions

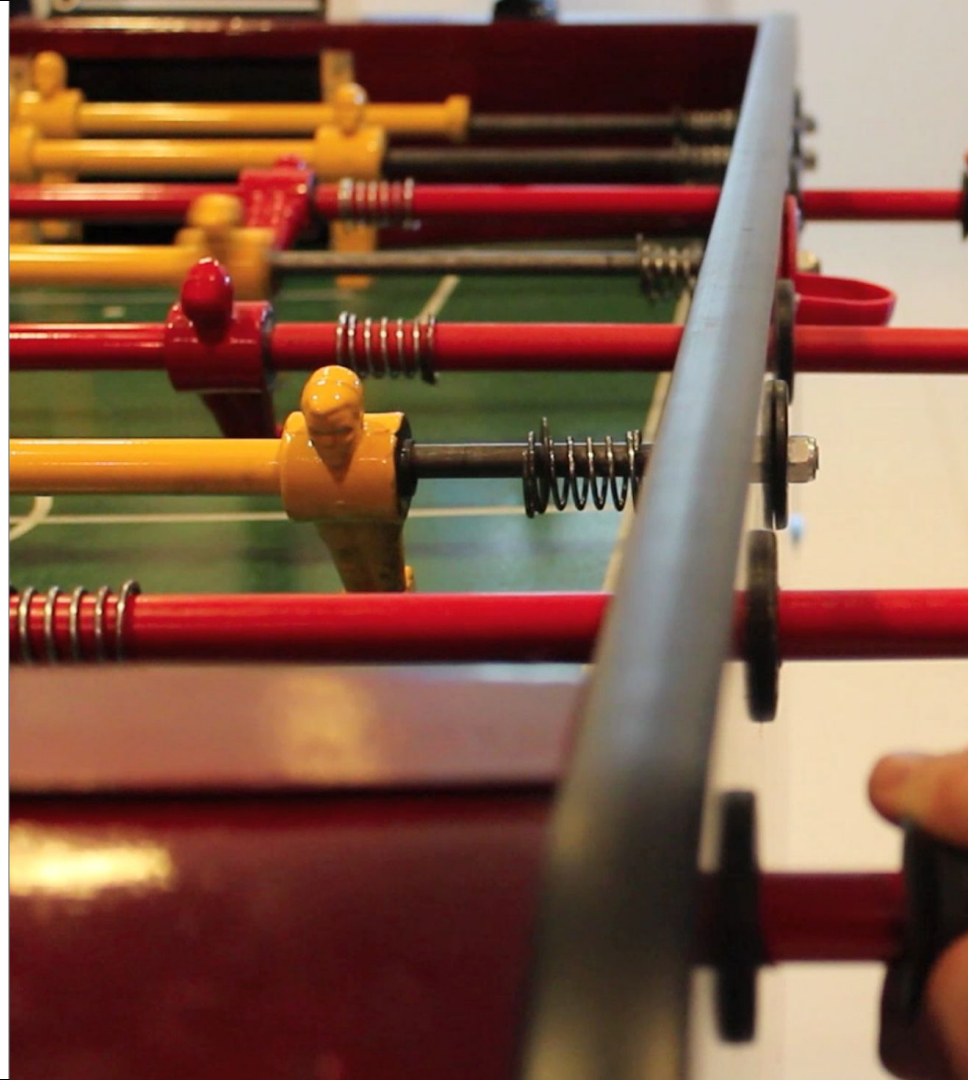
- What if SML prediction is not what user is expecting?
- Garden: What if we are over watering the plants?
- We need a way of sml knowing that users dislike the prediction
- Suggestions



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Challenges: Party!

- How will a party or a vacation affect SML learning process?
- How fast are we going to learn a new user's behavior?





What's next?



What is next?



- Adding support for different backends
 - Why not a backend that runs on the cloud?
- Creating new prototypes and use SML in real world scenarios
 - Gather more real data to validate results
- Extra simulations

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Community



- IRC: #soletta @freenode
- Mailing Lists: <https://lists.solettaproject.org>
- Code:
<https://github.com/solettaproject/soletta-machine-learning>
- Wiki:
<https://github.com/solettaproject/soletta/wiki/Soletta-Machine-Learning>

Q&A

Thanks

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