SWARM Extreme

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Agenda

- Hardware Used
  - A R Drone
  - Emotiv EPOC
- Similar Works
- Our Objective
- Approach
- Design
- Problems
- Future Enhancements
- Conclusion

A. R. Drone Technical Details

- Embedded computer system
  - ARM9 processor, 128MB RAM, Wi-Fi b/g, USB, Linux OS
- Inertial guidance systems
  - 3 axis accelerometer
  - 2 axis gyro-meter
  - 1 axis yaw precision gyro-meter
- Specs:
  - Speed: 5m/s; 18km/h
  - Weight: Less than 1 pound
  - Flying time ~12 mins.
- Ultrasound altimeter
  - Range: 6 meters – vertical stabilization
- Camera
  - Vertical high speed camera: up to 60 fps – allows stabilization

Emotiv EPOC headset tech specs

- Based on EEG, 14 sensors – positioned for accurate spatial resolution
- Detecting facial expressions are very fast (<10ms)
- Wireless chip is proprietary and operates on frequency 2.4GHz
- Hacked to use via Python
  - https://github.com/daeken/Emokit/blob/master/Announcement.md
  - https://github.com/daeken/Emokit

Similar Works

- http://dsc.discovery.com/videos/prototype-this-mind-controlled-car.html
- http://www.autonomos.inf.fu-berlin.de/subprojects/braindriver
- http://sensorlab.cs.dartmouth.edu/pubs/neurophone.pdf
- http://www.engadget.com/2011/02/19/german-researchers-take-mind-controlled-car-for-a-carefully-cont/

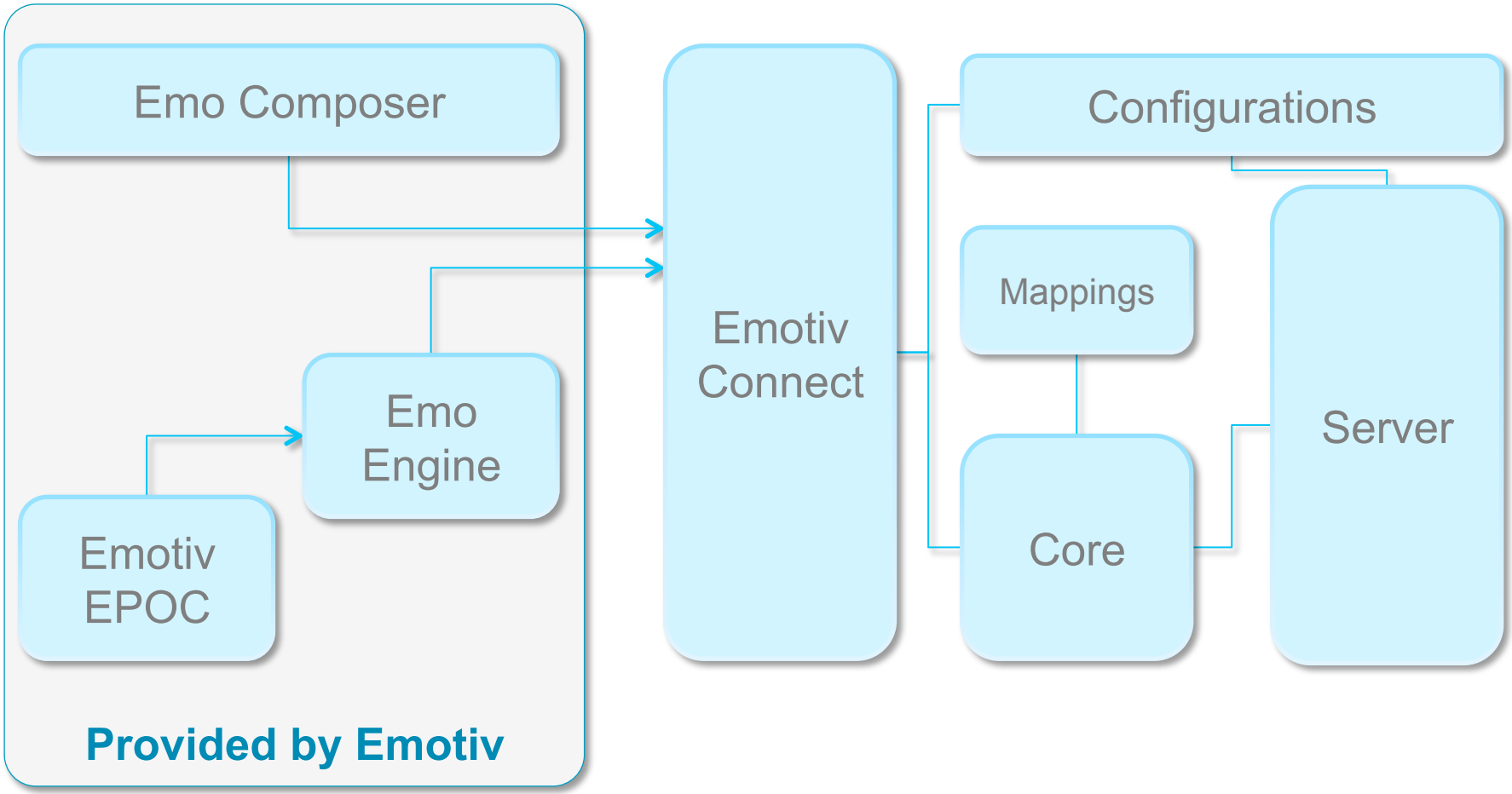
Our Goal

- Our goal is to control the A R Drone using thoughts via Emotive EPOC
  - Control the A.R. Drone using Computer
  - Get the commands from Emotiv EPOC and process those
  - Design an architecture to connect both and is extendable to incorporate multiple devices.
  - Establish connections and fine tune the data for smooth controlling

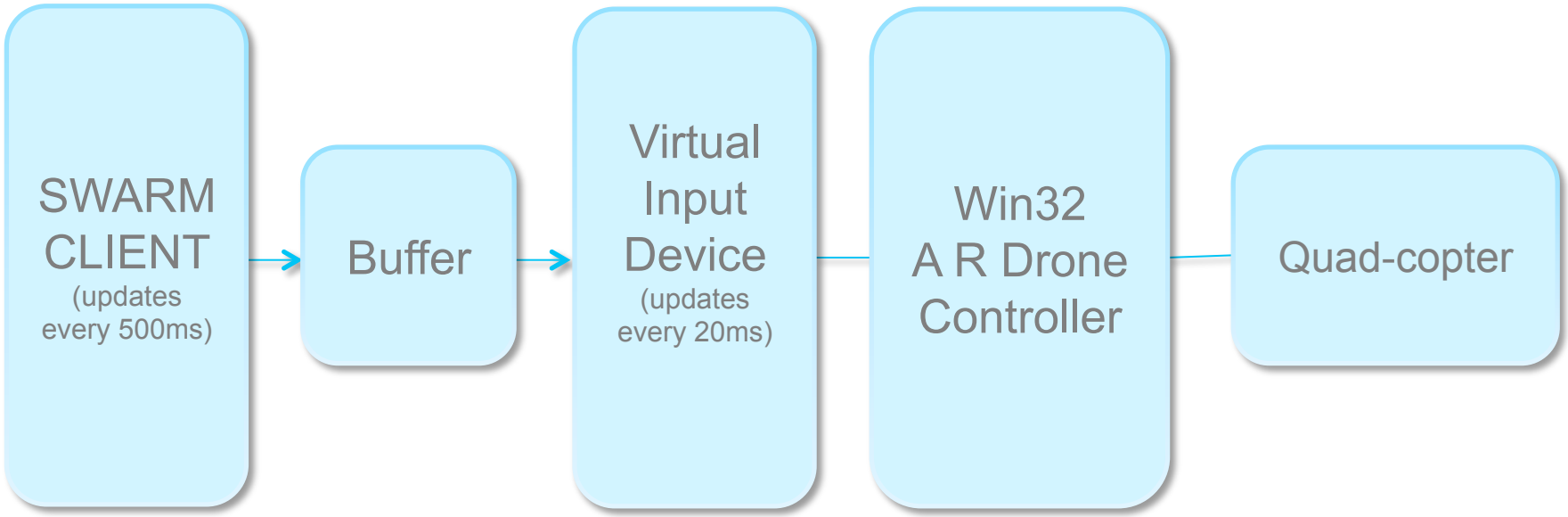
Our Approach

- Map headset signals to reasonable commands
- Create a channel between the commands from headset interface and A. R. Drone
  - client/server architecture
  - allows us to control multiple A. R. Drones remotely
  - programs can be extended to run on different environments

Design (Server)



Design (Client)



Problems

- Emotive SDK is platform dependent
- Headset sends many signals
  - States change very rapidly – causes noisy interstates
- Training requires to focus and not interchangeable from person to person
  - There is no universal training method to get same results

Future Enhancements

- Current System:
  - Enhance the system to connect with multiple clients
  - Enable the system to work remotely via Internet
  - Client could be made more intelligent in order to handle emergency situations
- Long Term:
  - The technology could be used to control devices which we used in daily routine, like cars, phones, other electronics etc.
  - On long run the EEG devices could be improved to a level where controlling devices will become as natural as controlling once body parts.

Conclusion

We are able to fully control the A R Drone using earlier by facial expression and gyro-meter and later by only using the cognitive commands. Given time this system could be future enhanced to control multiple devices simultaneously with a higher accuracy.

The available technology for reading and processing the thoughts is pretty good to control a system with limited command set, but it needs a lot of improvement in order to be used for complex systems.

Great learning experience