Northeastern

Motivated Copter

(Brain-controlled drone)

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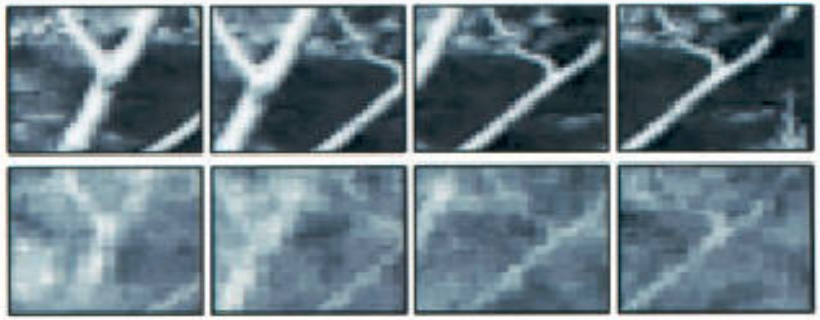
Goal

A BRAIN COMPUTER INTERFACE

Brain Computer Interface - History

•1970s: Fetz and colleagues first showed that monkeys could learn to control the deflection of a biofeedback meter arm with neural activity.
•1980s: Apostolos Georgopoulos found mathematical relationship between the motor-cortex neurons in monkeys and the direction they moved their arms.
•Mid-1990s: Niels Birbaumer trained severely paralysed people to self-regulate the *slow cortical potentials in their EEG to such an extent that these signals could be used as a binary signal to control a computer cursor.*

History Contd.



•1999: Yang Dan decoded neuronal firings to reproduce images seen by cats (UC Berkley).

•2000: Miguel Nicolieus decoded brain activity in monkeys and used the devices to reproduce monkey movements in robotic arms.

http://www.youtube.com/watch?v=gnWSah4RD2E

Applications

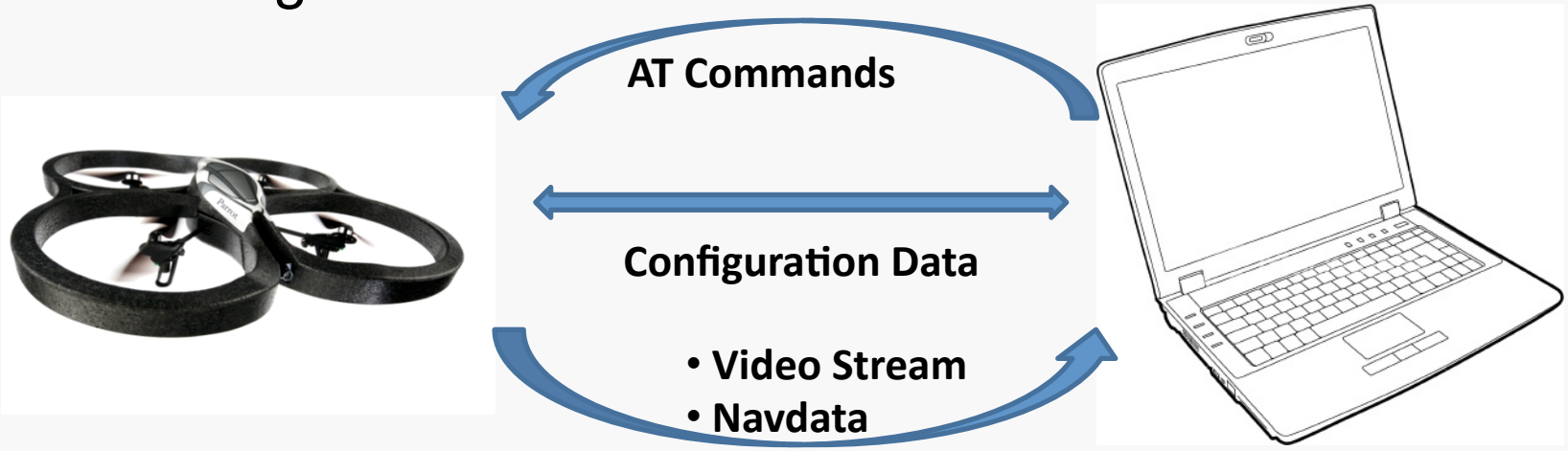
- Restore sight
- Restore hearing
- Overcome other disabilities
- Cognitive sciences
- Gaming

A.R. Drone

- A quad-copter, with four engines for extra stability.
- Drone has two cameras, installed in front and bottom.
- Front camera can be used for object recognition.
- Bottom camera enables to stay stable even with perturbation.
- An Ultra-Sound sensor installed at bottom, can be used as an altimeter.
- Control from any client device supporting WiFi ad-hoc mode.

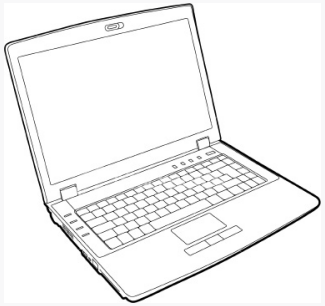
Drone SDK

- AR Drone comes with API and some examples.
- Drone provides three main communication services.
- API has built in functionalities to For:
  - AT Command (Control commands to maneuver Drone)
  - NavData (Information about current state of Drone)
  - Video (Video captured by two cameras on Drone)
  - Configuration



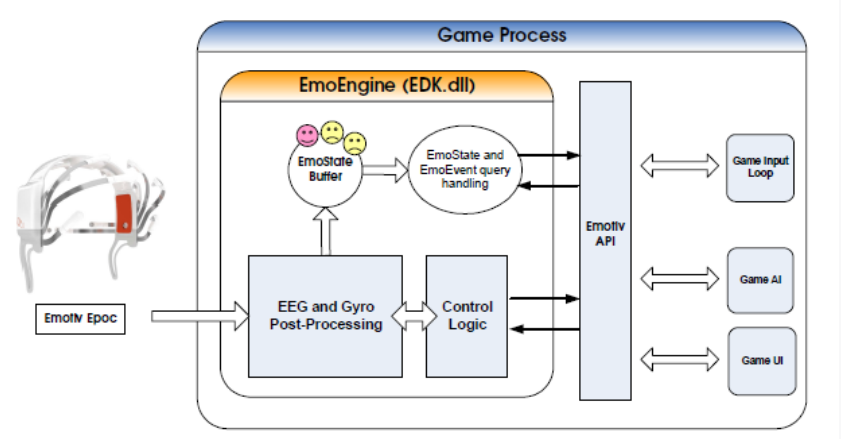
Emotiv Headset

- Emotiv headset for capturing electroencephalographic (EEG) signal.
- A very good alternative to the medical EEG headset.
- Uses fourteen probes
- Can be trained to capture:
  - Conscious thoughts (Cognitive suite)
  - Emotions (Affective suite)
  - Facial expressions (Expressive suite)
  - Head rotation



Preprocessed Data

Emotiv SDK



- EmoEngine: capture and process signals
- Control Panel:
  - Cognitive suite: display Cognitive state
  - Affective suite: display Affective State
  - Expressive suite: Display Expressive state
- EmoKey: can send key events associate with a particular state
- EmoComposer: Simulates EmoEngine inputs.

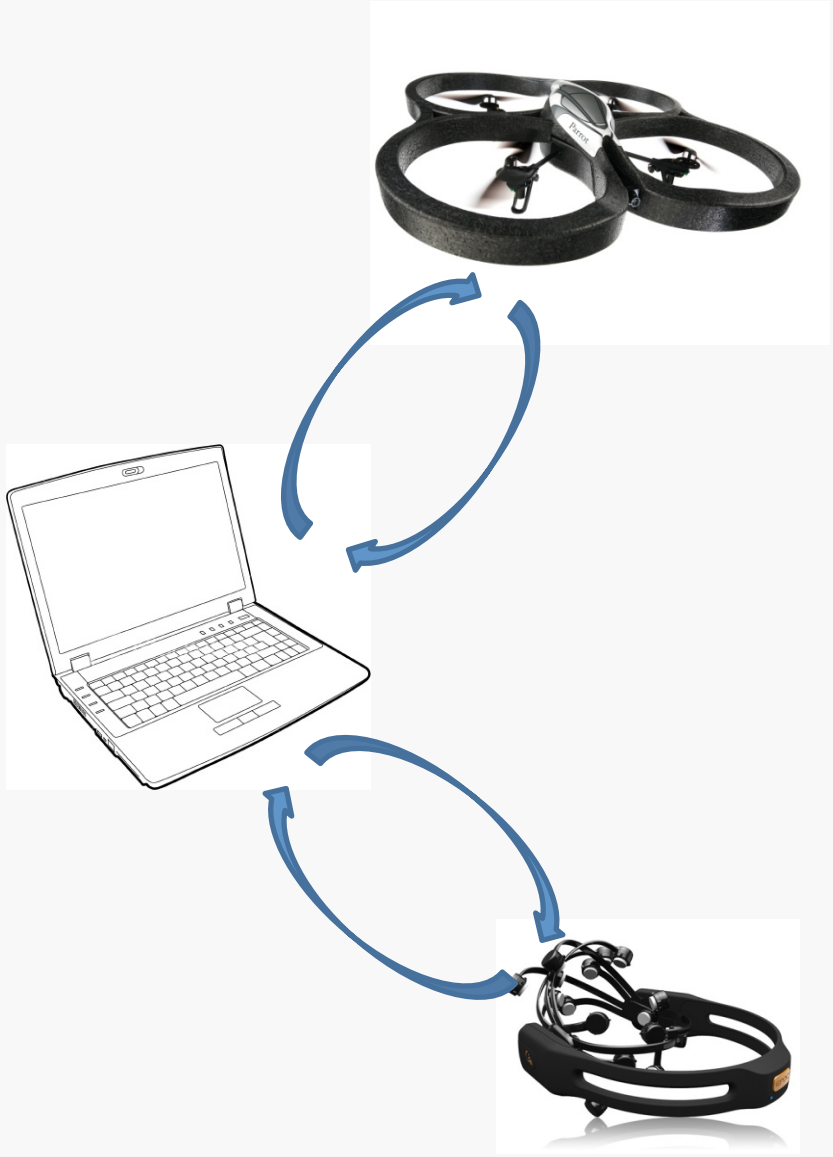
Project Outline

Step1
- Control AR.Drone from Customized code
  - Based on SDK templates
  - User defined control signals

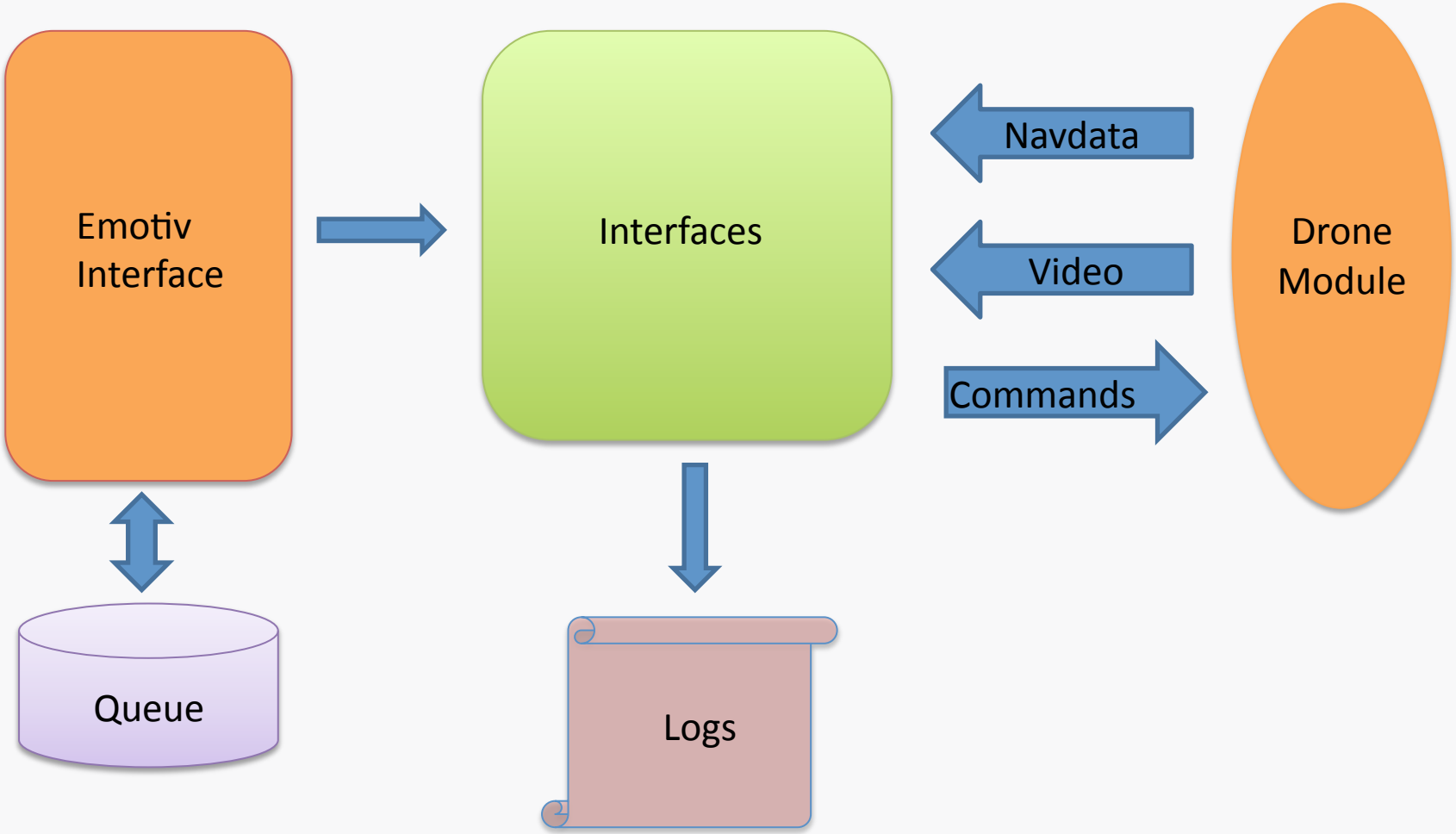
Step 2
- Write a custom code capture inputs from EmoEngine/EmoComposer
- Parse and filter the input signals .

Step3
- Interface Emo inputs with ARDrone controller.

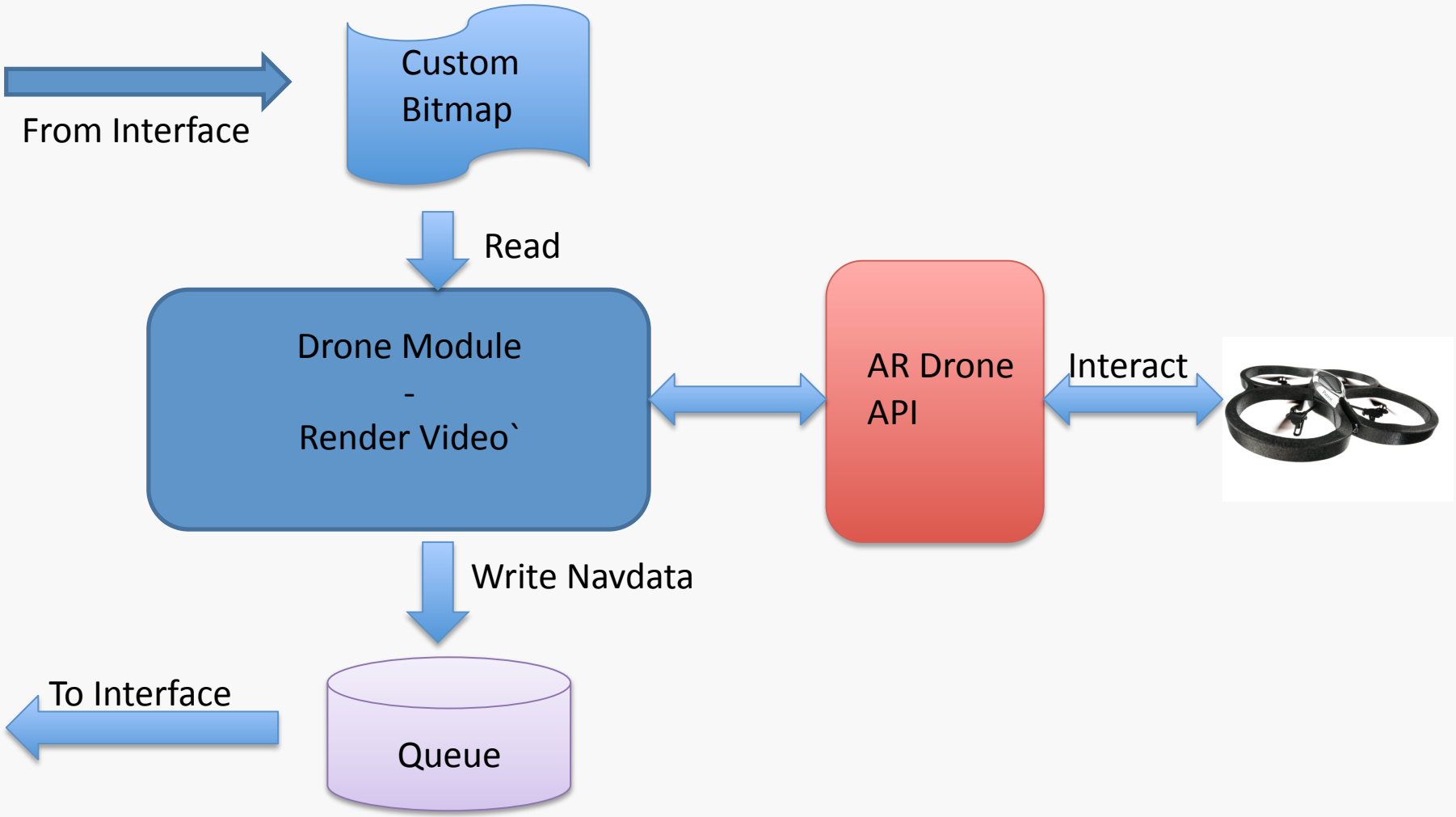
Step4
- Replace EmoComposer with EmoEngine
- Connect the headset!!!



Project Architecture



AR Drone Module



Emotive Interface

Emotiv Engine

EmotiveI nterface

To the Interface

Filter

Queue

Experience

Microsoft C++ Development
Ease of availability of BCI component.

Thank You