# AJDSP: Interactive Signal Processing Education Applications for the Android Platform

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**Final NSF IUSE Workshop
Collaborative Research: Integrated Development of Scalable Mobile
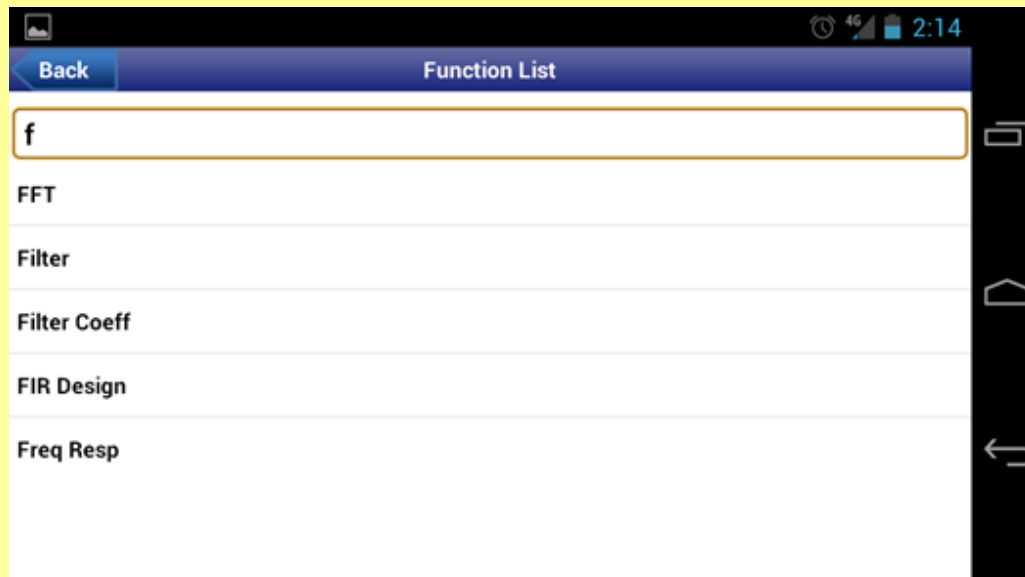Multidisciplinary Modules for STEM**
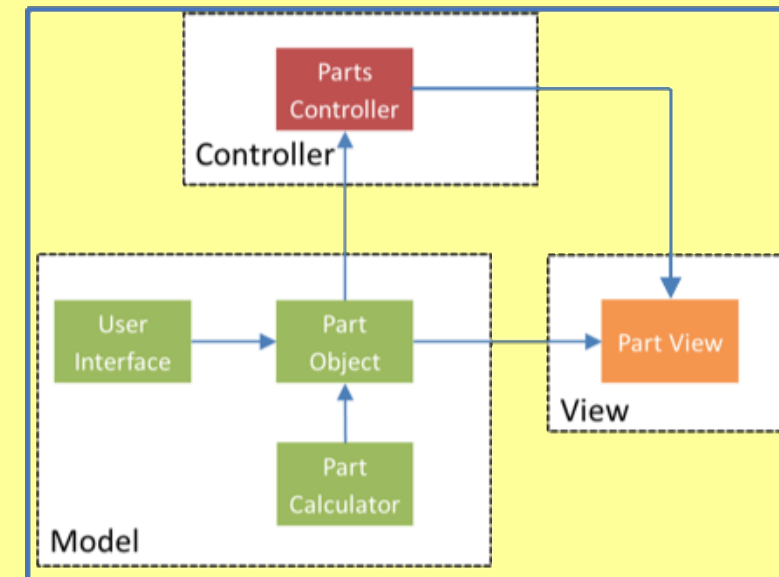
**SenSIP Center, School of ECEE, ASU**

# Android-DSP (AJDSP) Overview

- **AJDSP provides a mobile DSP lab environment.**
- **AJDSP has a rich suite of time and frequency domain signal processing functions.**
- **AJDSP is based on the Model-View-Controller (MVC) paradigm.**

**(a) Function search feature in AJDSP**

**(b) The architecture of AJDSP based on the Model-View-Controller paradigm**
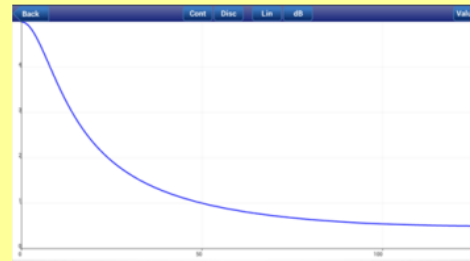
Ranganath, S., Thiagarajan, J. J., Rajan, D., Banavar, M. K., Spanias, A., Fan, J., ... & Tepedelenlioglu, C. (2019). Interactive Signal Processing Education Applications for the Android Platform. *The ASEE Computers in Education (CoED) Journal*.
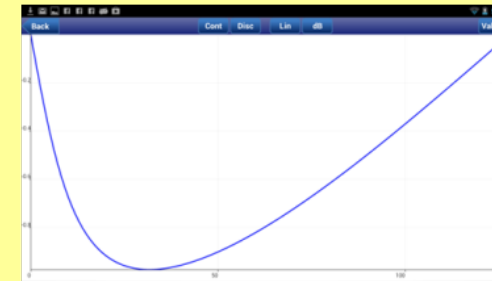
J-DSP
Editor

J-DSP
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# AJDSP Simulation Example

**Block Diagram**
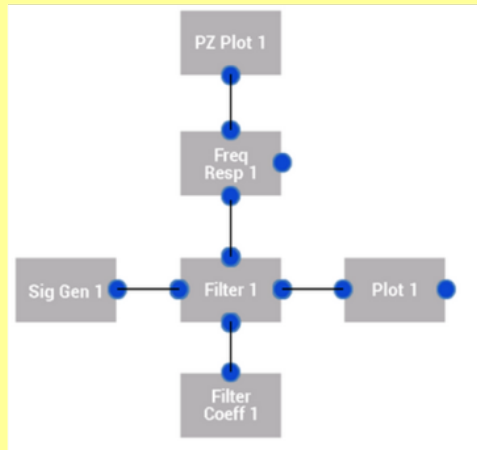


**Freq. Resp Magn**



**Freq. Resp Phase**



**Sig Gen Menu**

| | |
|---|---|
| Signal Type | Delta |
| Gain | 1.0 |
| Pulsewidth | 256.0 |
| Periodic | No |
| Period | 10.0 |
| Timeshift | 0.0 |

**Filter Coeff**

| a0 | 1.0 | b0 | 1.0 |
|---|---|---|---|
| a1 | -0.9 | b1 | 0.0 |
| a2 | 0.1 | b2 | 0.0 |
| a3 | 0.0 | b3 | 0.0 |

**Impulse Resp**
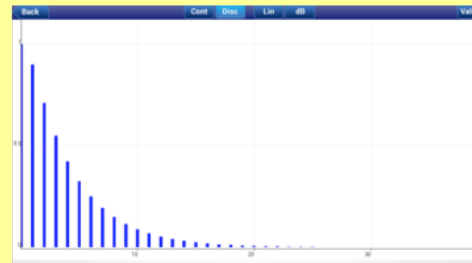


**PZ Plot**
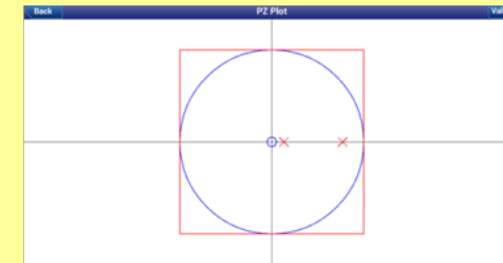


**Filter design simulation in AJDSP shows the impulse and frequency response of a filter**

## Outreach & Assessments

- **A lecture on the pertinent signal processing concepts.**
- **Having the students take a pre-quiz on the concepts involved in the laboratory exercise.**
- **Having the students perform the described simulation exercises and laboratories using AJDSP.**
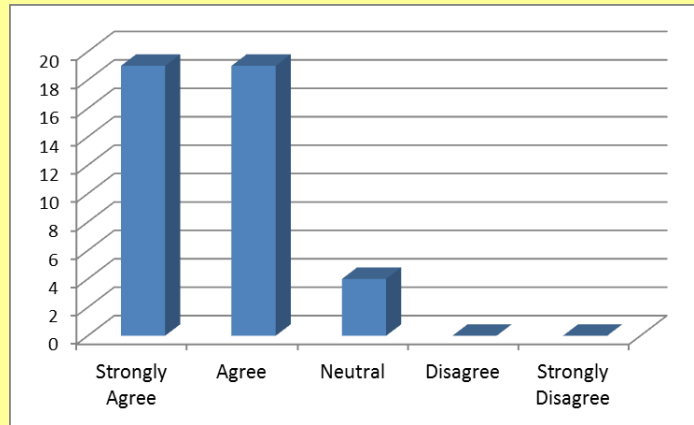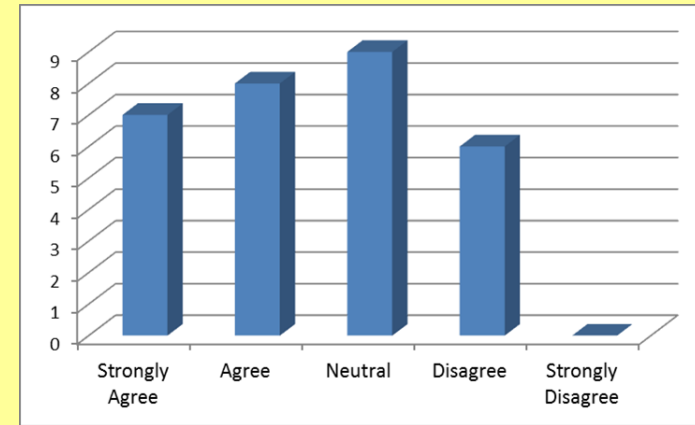- **having the students then take a post-quiz to test conceptual understanding.**



**(a) CDS high school**
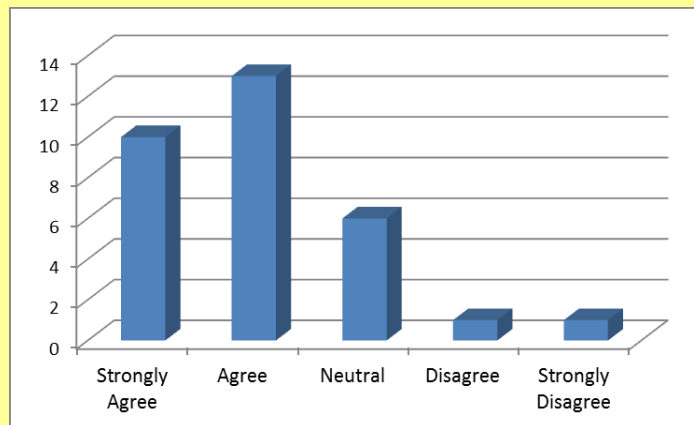


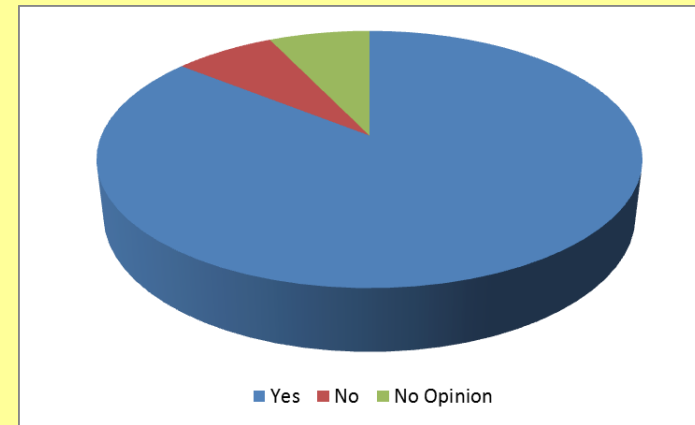**(b) Hermanas conference at Phoenix College**

# Evaluation with Graduate Students
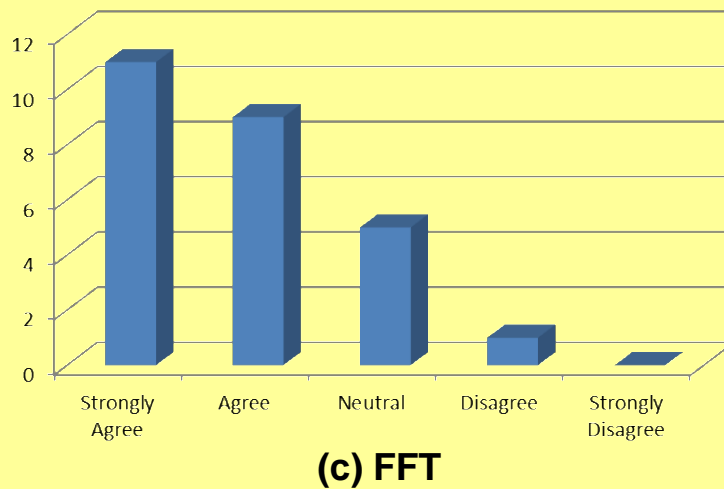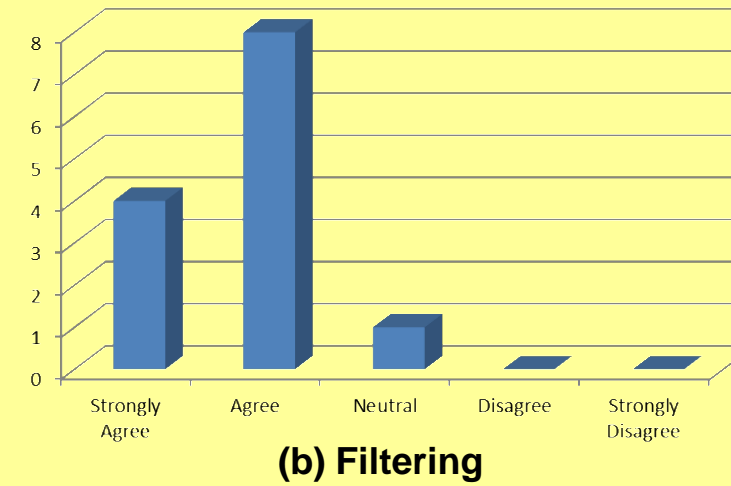


**(a) Education value**



**(b) User interface**



**(c) Robustness**



**(d) Satisfaction of speed**

# Evaluation with Undergraduate Students



(a) Convolution

(b) Filtering

(c) FFT

(d) Undergrad research
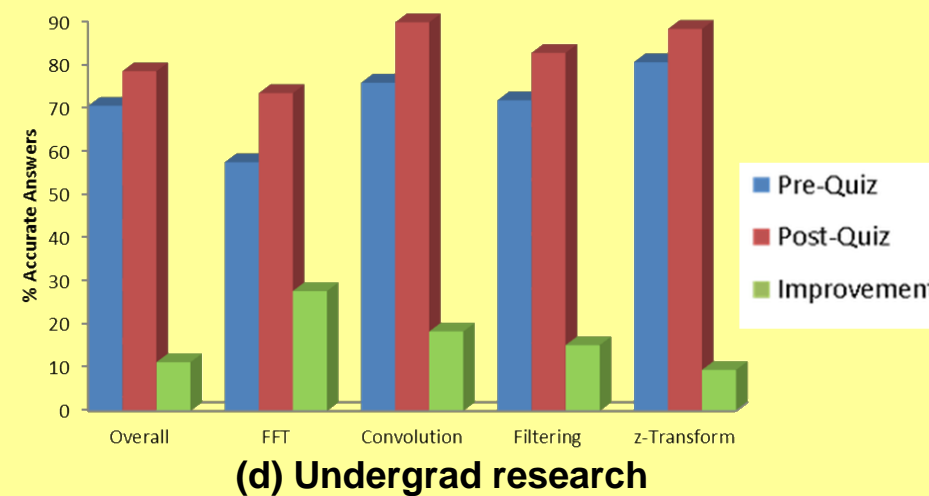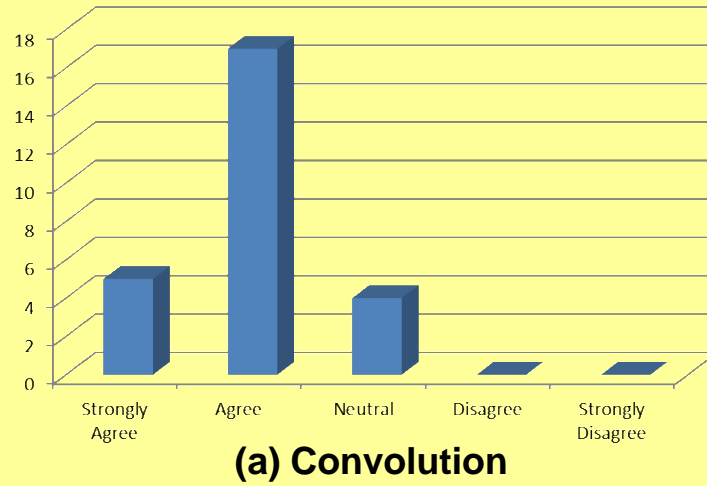
# AJDSP Mobile Health Demos
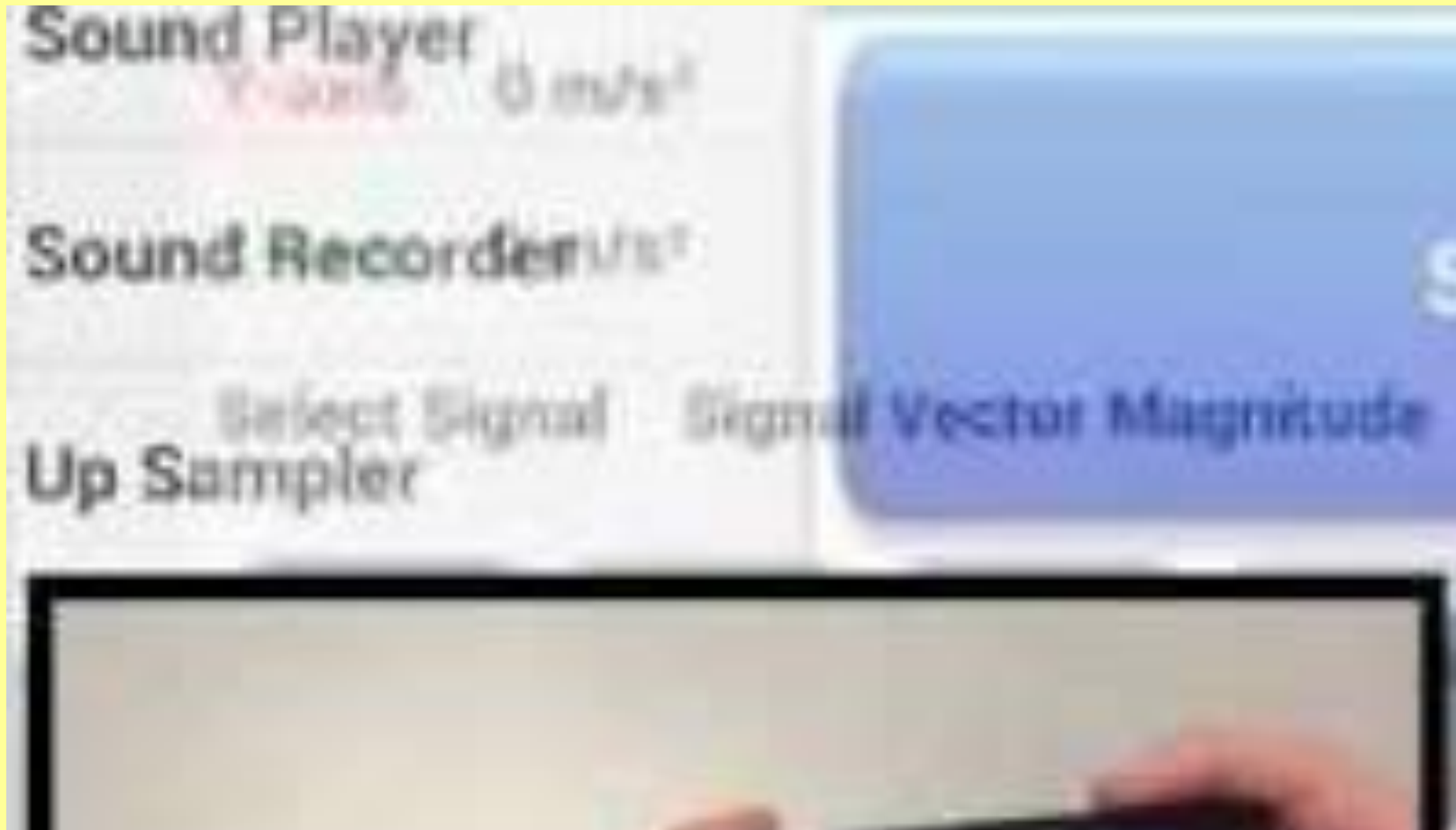


Rajan, D. (2013). *Designing m-Health Modules with Sensor Interfaces for DSP Education.* Arizona State University.

# AJDSP Remarks

- **AJDSP employs graphical programming, which enables the student to concentrate on the DSP concepts.**
- **The key features of AJDSP included signal processing modules, interactive animations, and an intuitive graphical user interface.**
- **Feedback from the workshops helps determine improvements and possible future directions for application development.**
- **AJDSP remains under development and maintenance to provide more education applications with respect to the recent Android APIs and the privacy policy of Google Play.**