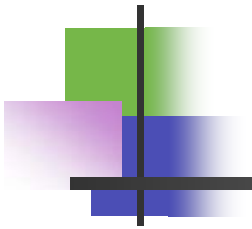


# A Two-Input Polygraph

*Archana Venkataraman*

*Christopher Buenrostro*

*Isaac Rosmarin*

# Outline

- Introduction
- Design Overview
  - The Physiological Sensors
  - The Digital Decision-Making Unit (DDMU)
  - The Output Display
- Conclusion

# Introduction

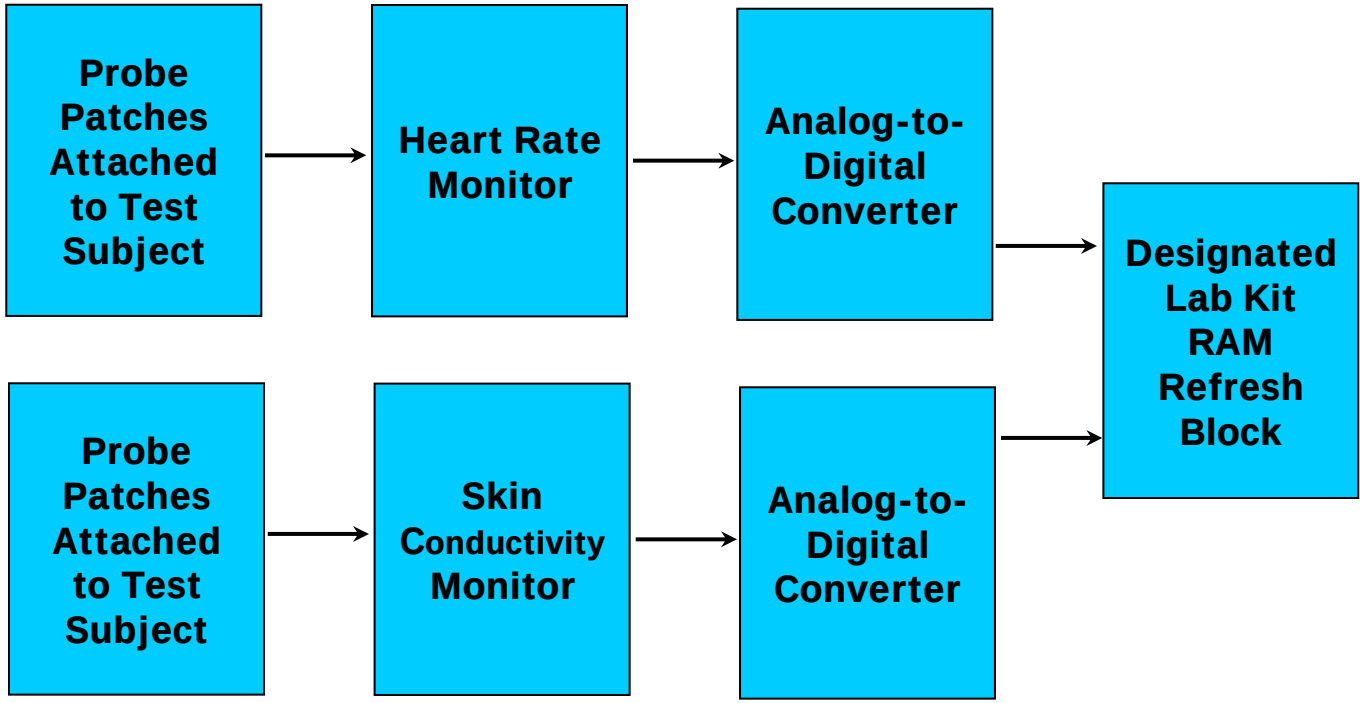
- The polygraph detects stress-related physiological responses commonly linked with deception
- Modern-day polygraphs rely on 4 major variables:
- The Foundation of a lie-detector examination is in its structure
  - Environmental Setting
  - Experience and Conduct of Examinator
  - Questions: Control, Irrelevant, and Relevant
- Decisions are based on the assumption that an innocent subject will react more strongly to the control questions and a guilty subject will react more strongly to the relevant questions

# Introduction

- The project uses 2 inputs to make decision– heart rate and skin conductivity
  - Heart speeds up during times of emotional stress
  - Perspire during times of emotional stress – increases conductivity
- Project divided into three sections
  - The Physiological Sensors
  - The Digital Decision-Making Unit
  - The Output Display

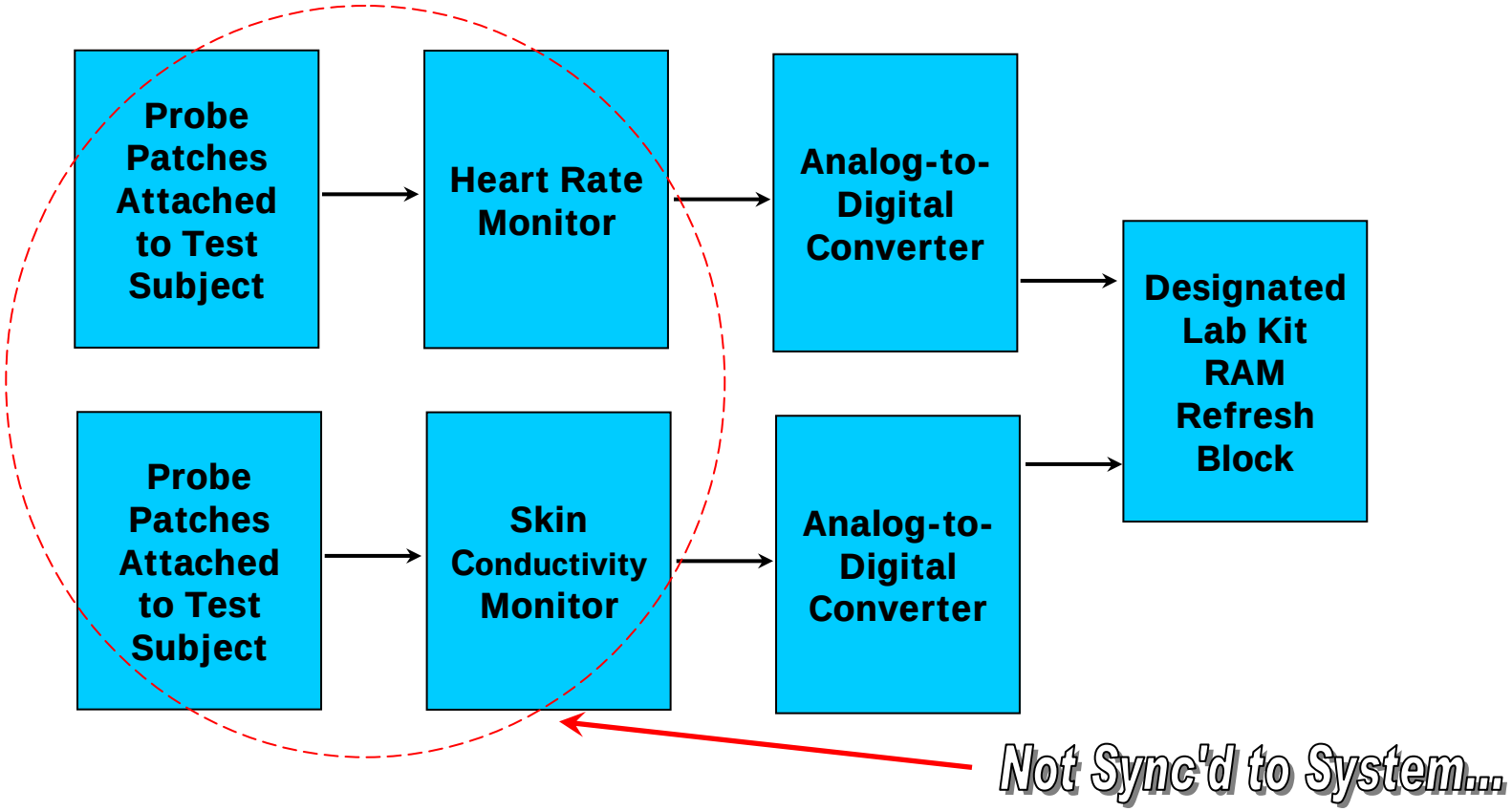
# Input Devices

## Data Acquisition Flow Diagram



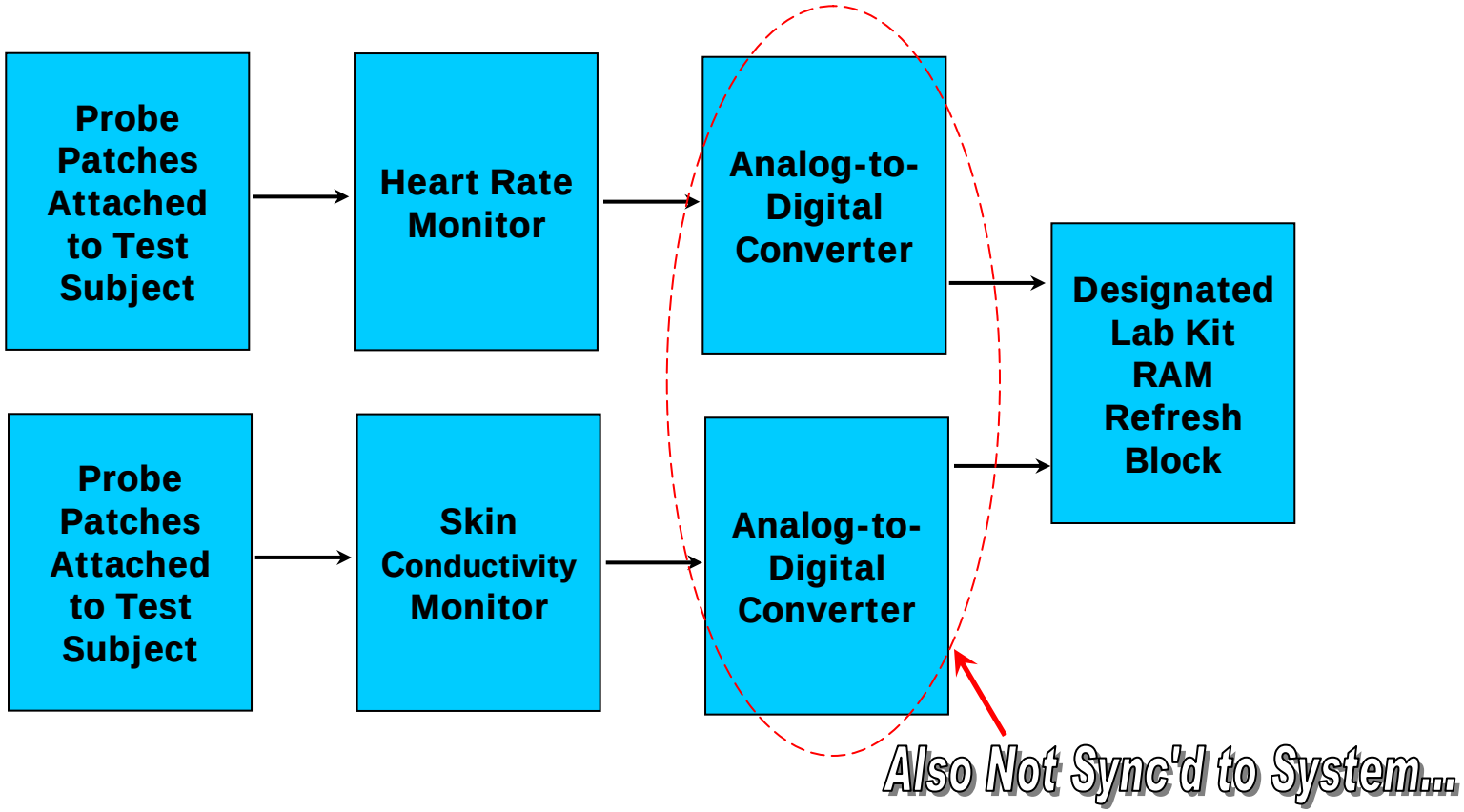
# Input Devices

## Data Acquisition Flow Diagram



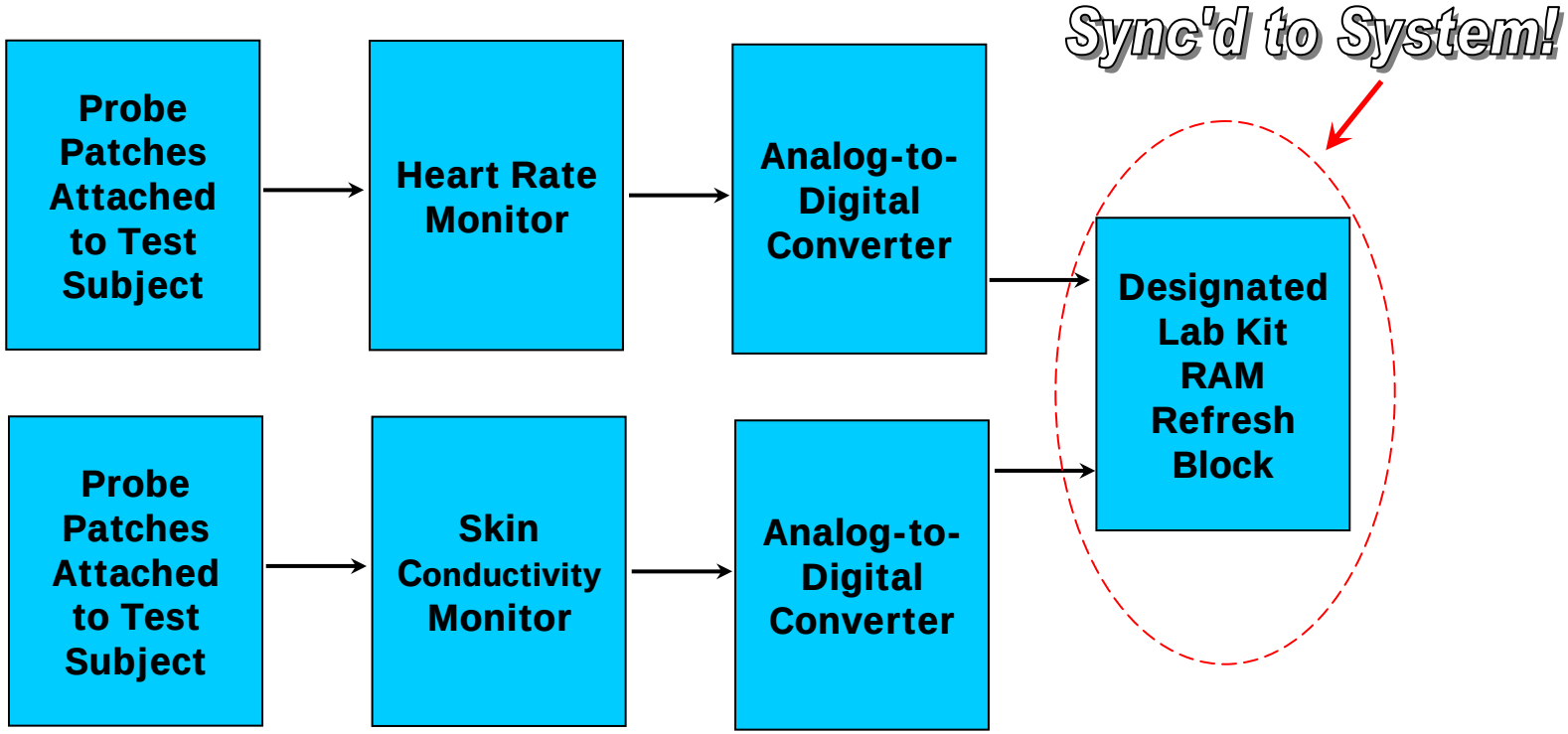
# Input Devices

## Data Acquisition Flow Diagram



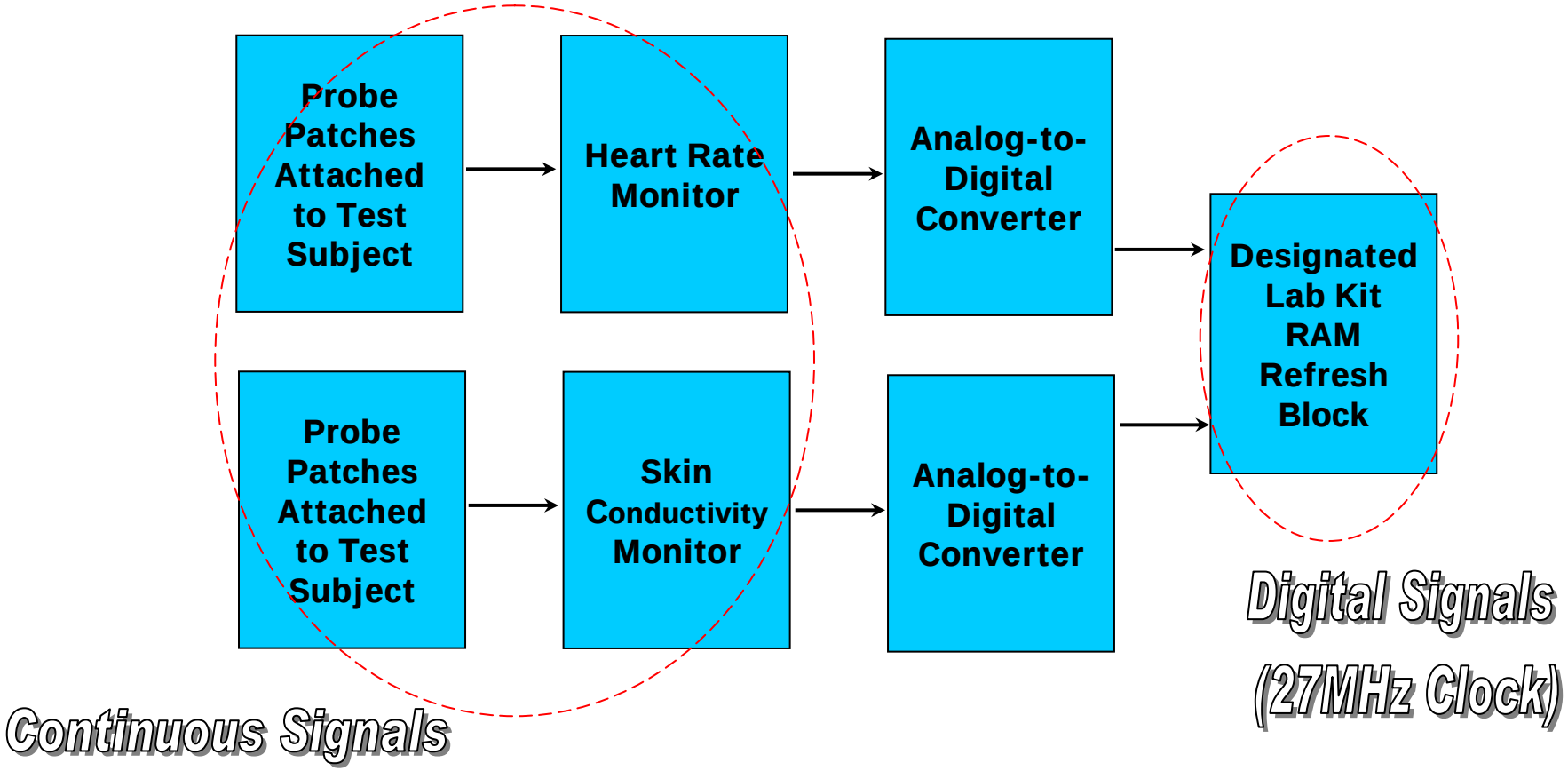
# Input Devices

## Data Acquisition Flow Diagram



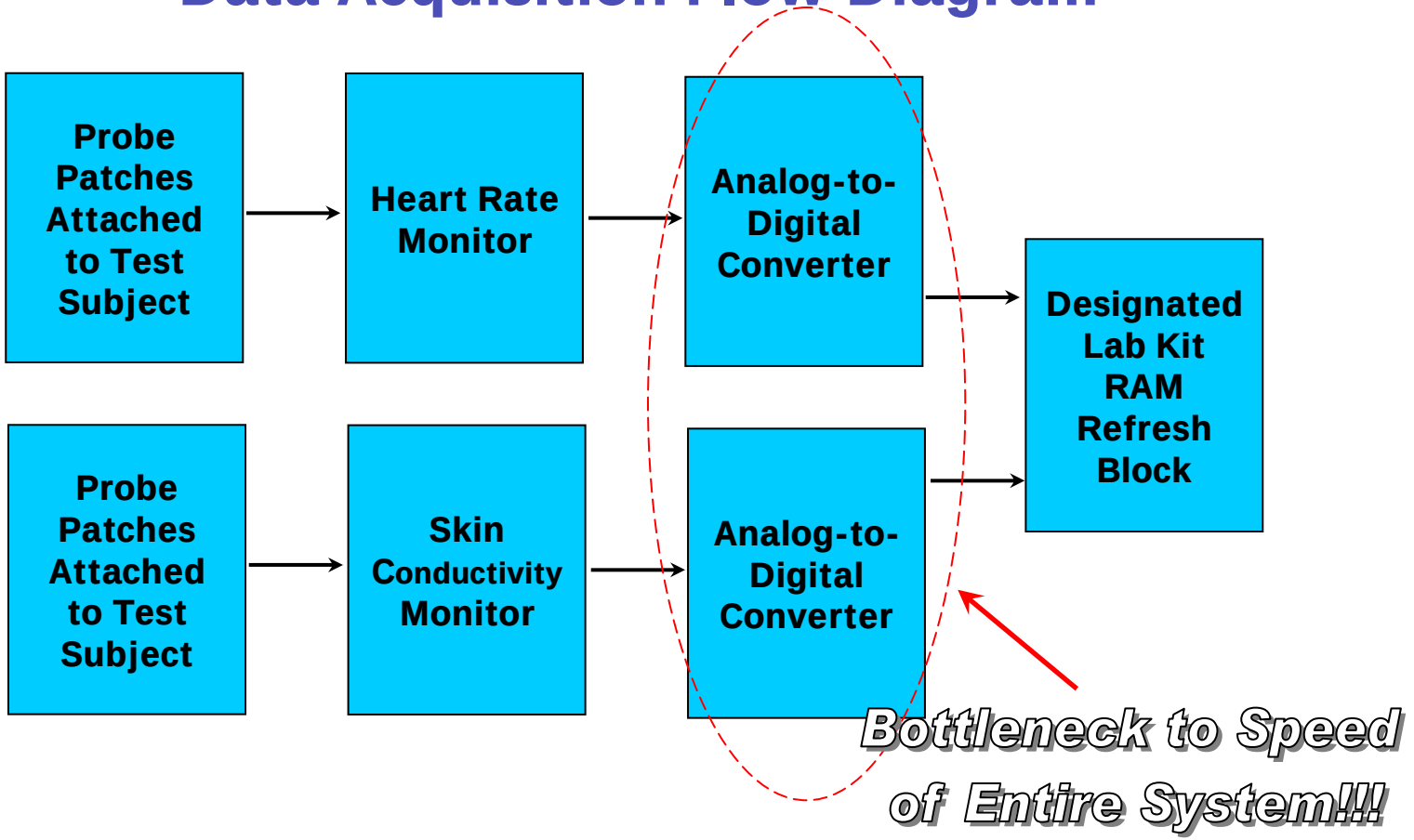
# Input Devices

## Data Acquisition Flow Diagram



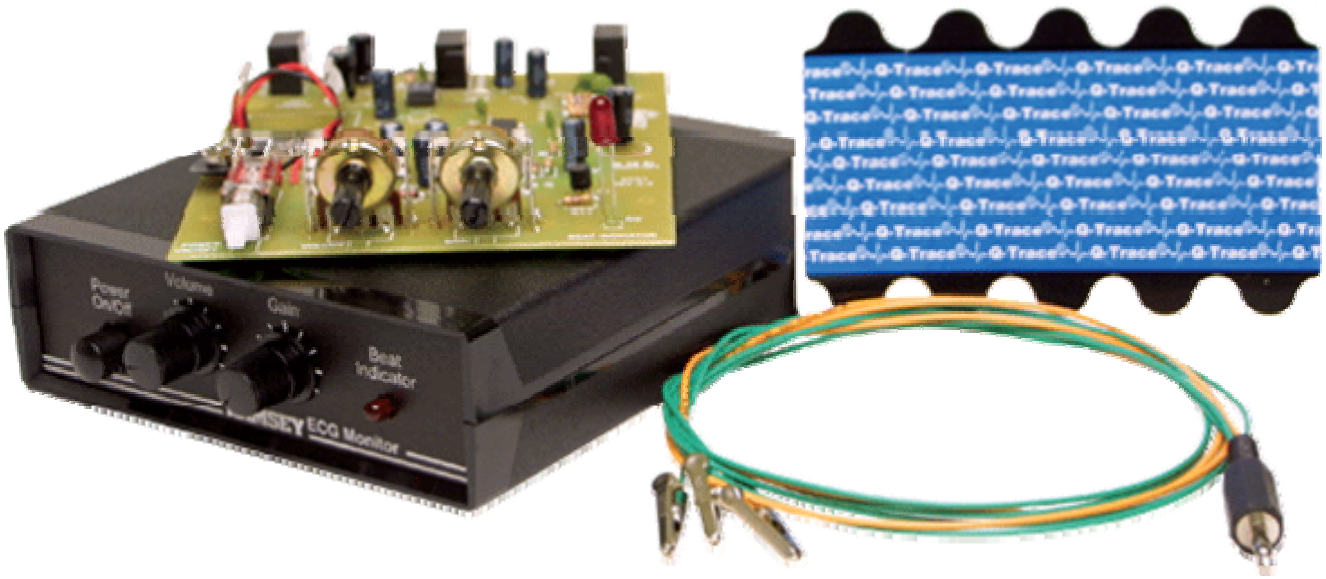
# Input Devices

## Data Acquisition Flow Diagram



# Electrocardiogram Heart Monitor

## Ramsey Electronics ECG1C



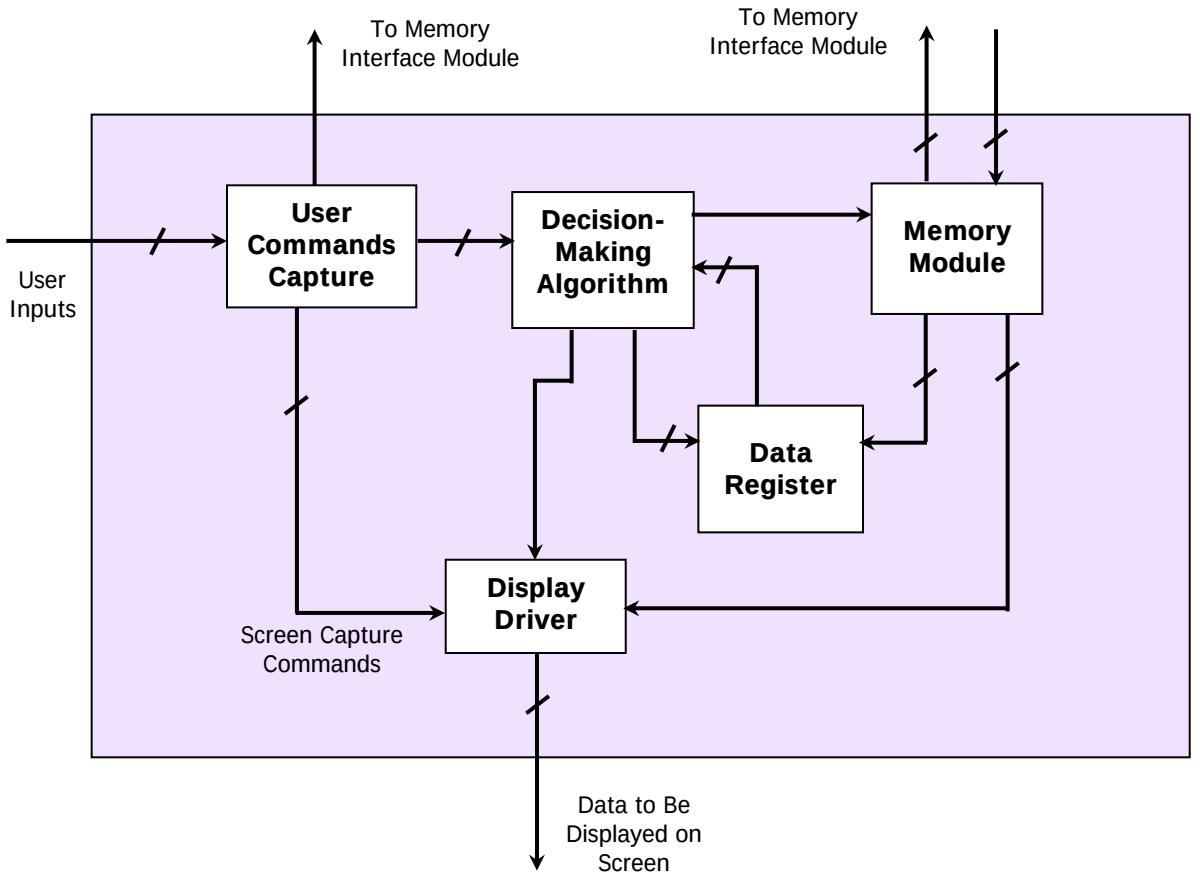

*Images from http://ramseyelectronics.com

# Skin Conductivity Monitor

## The Galvactivator

***Images from http://vismod.media.mit.edu/tech-reports/TR-542.pdf with credit to Rosalind W. Picard and Jocelyn Scheirer**

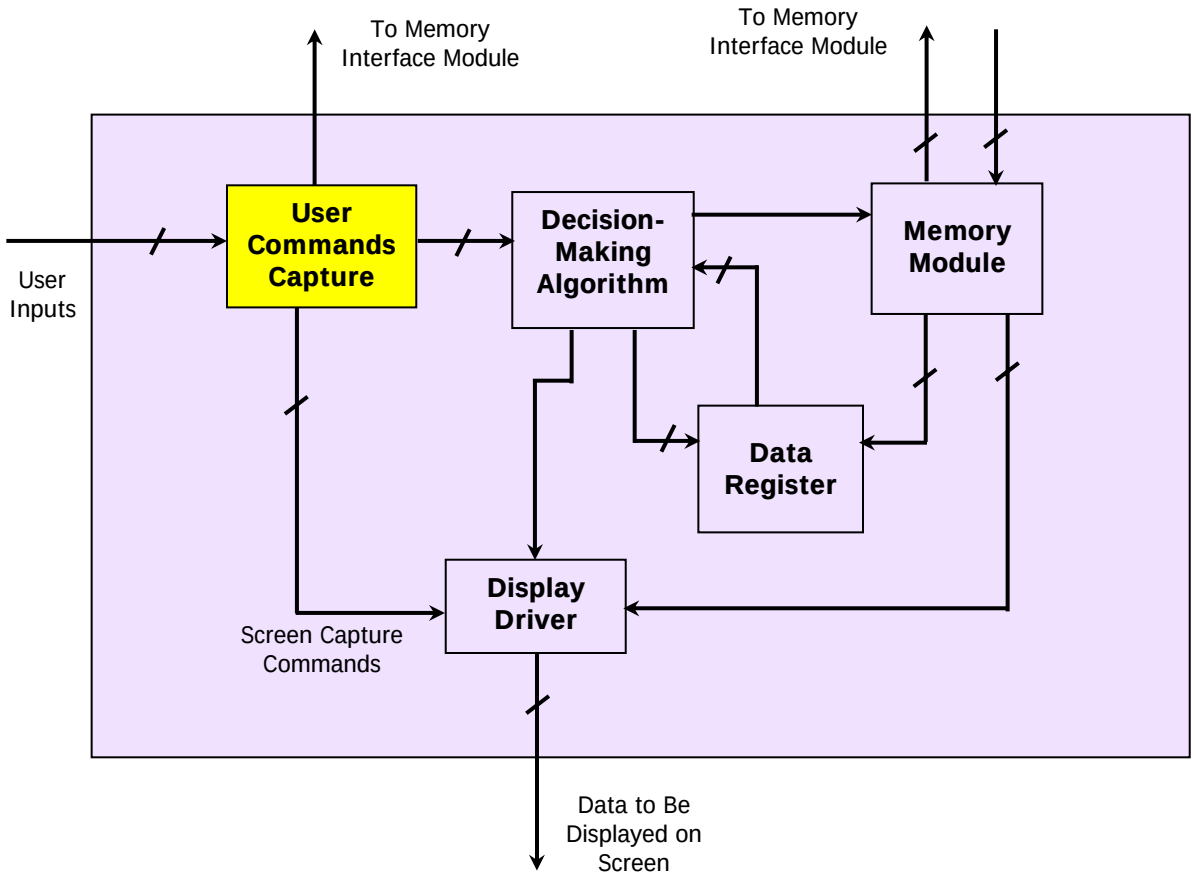
# The Digital Decision-Making Unit




## Design Overview

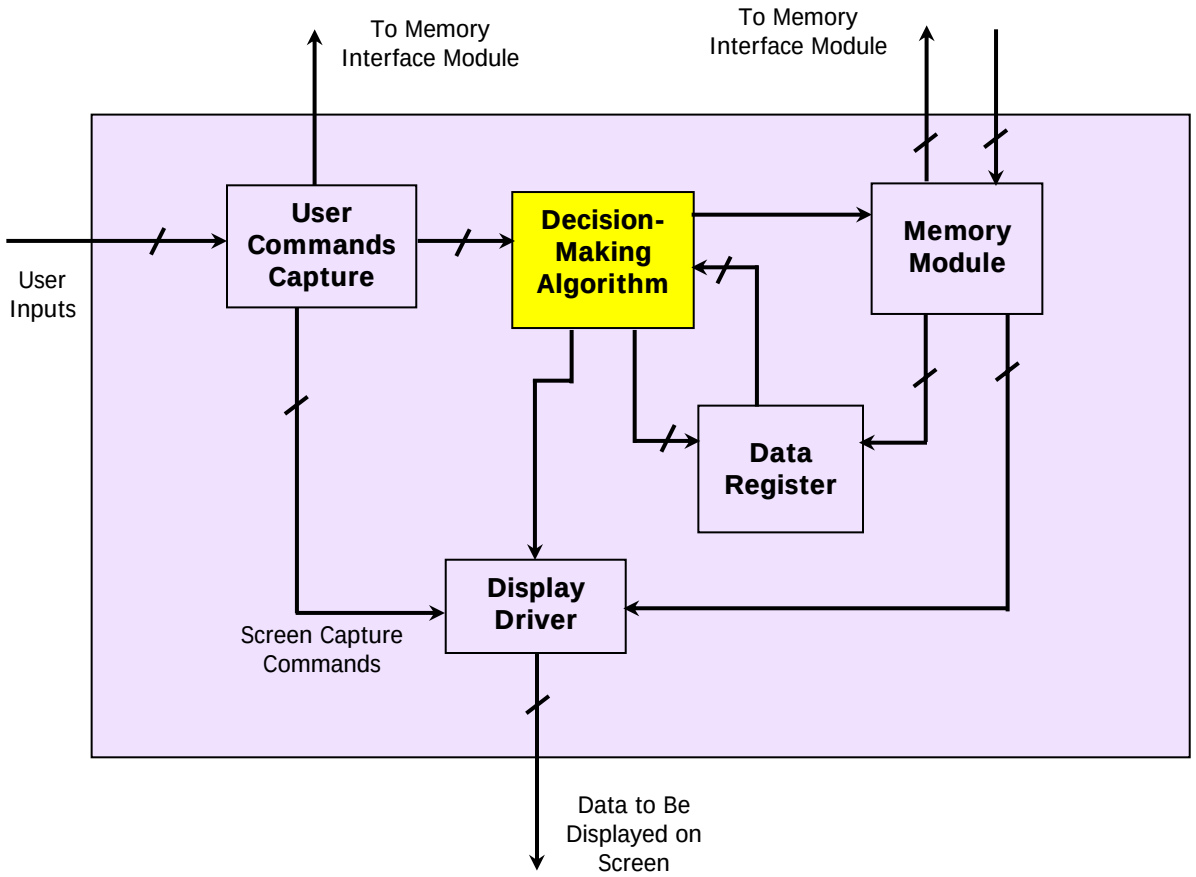
- User Interface
- Decision-Making Portion Based on Polygraph Data
- Additional Functions
  - Obtain Data Stored Externally in RAM
  - Prepare/Send Data to Display Unit

# Capturing User Commands



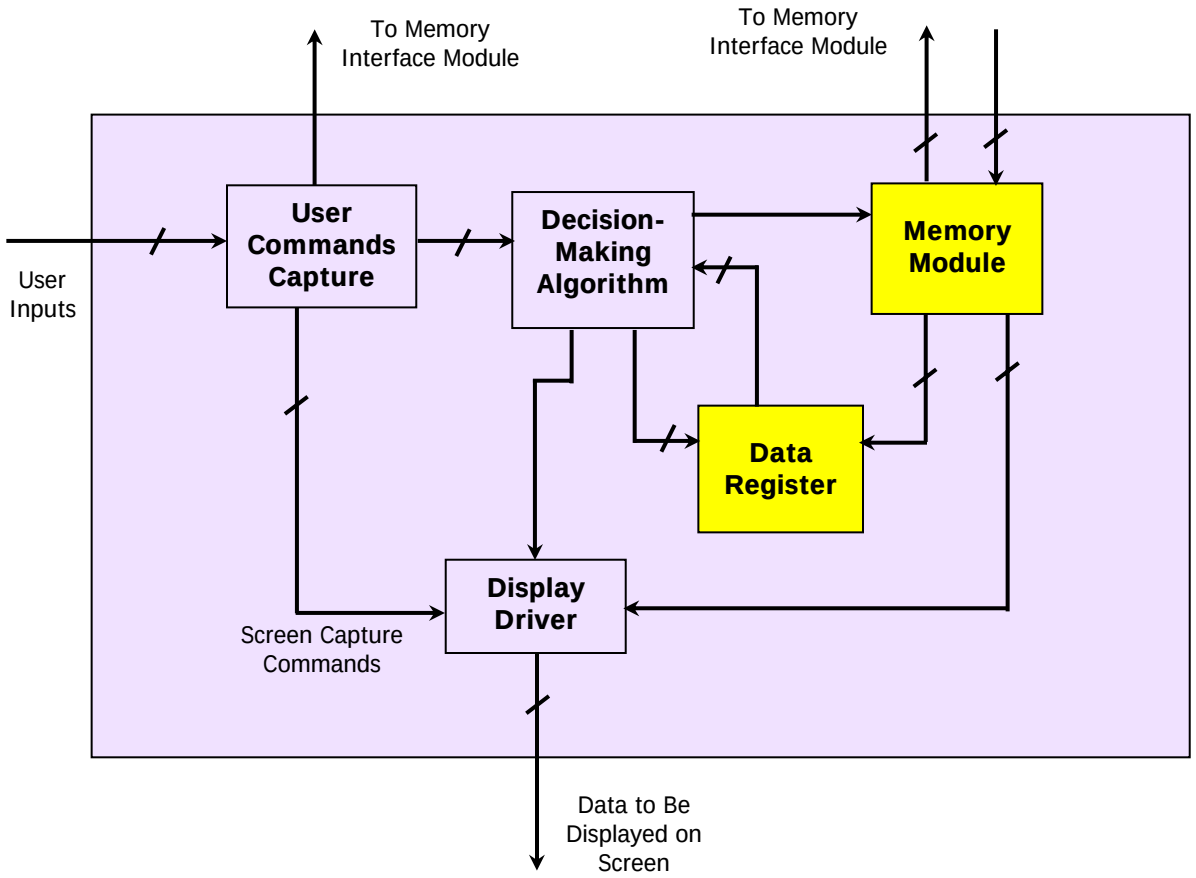

- Module registers all user inputs and passes them to appropriate module
- User Commands:
  - Type of Question
  - Analyze Results
  - Display Data
  - Store Data
  - Screen Capture

# Decision-Making Algorithms



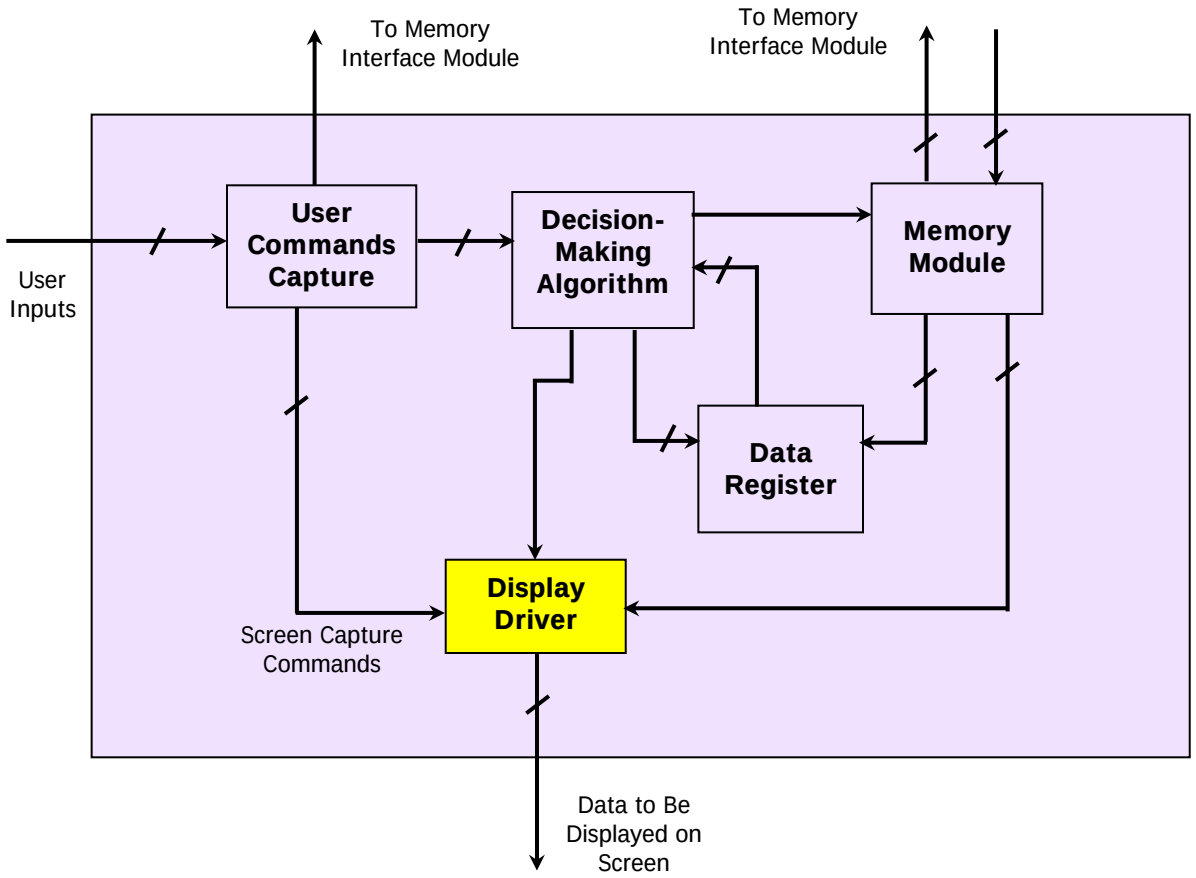

- Main Module of the DDMU – Analyzes sensor data and outputs binary "TRUTH/LIE" decision
- Digital Pre-Processing on data to remove extraneous, environmental factors
  - Average incoming data
  - Highpass Filter
- Implement one or more of following algorithms:
  - Compare statistics of time signal
  - Convert to frequency domain and compare
  - Hypothesis Testing

# The Memory Module and Data Register



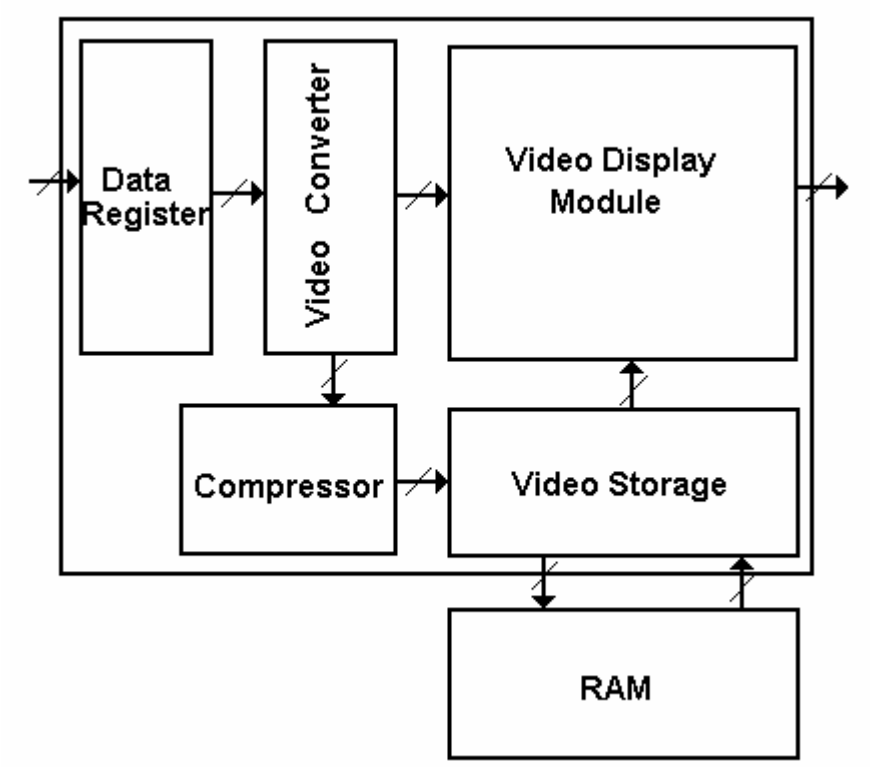

- The Memory Module signals Memory Interface to Read from and Write to RAM by asserting a “request” signal
- Data Register holds critical values for the Decision-Making Algorithm:
  - Time sequences to be compared
  - Computed Statistics

# Display Driver




- Gathers data to be sent to Display Unit
  - Sensor Data
  - Decision (T/F)
  - Screen Capture Command

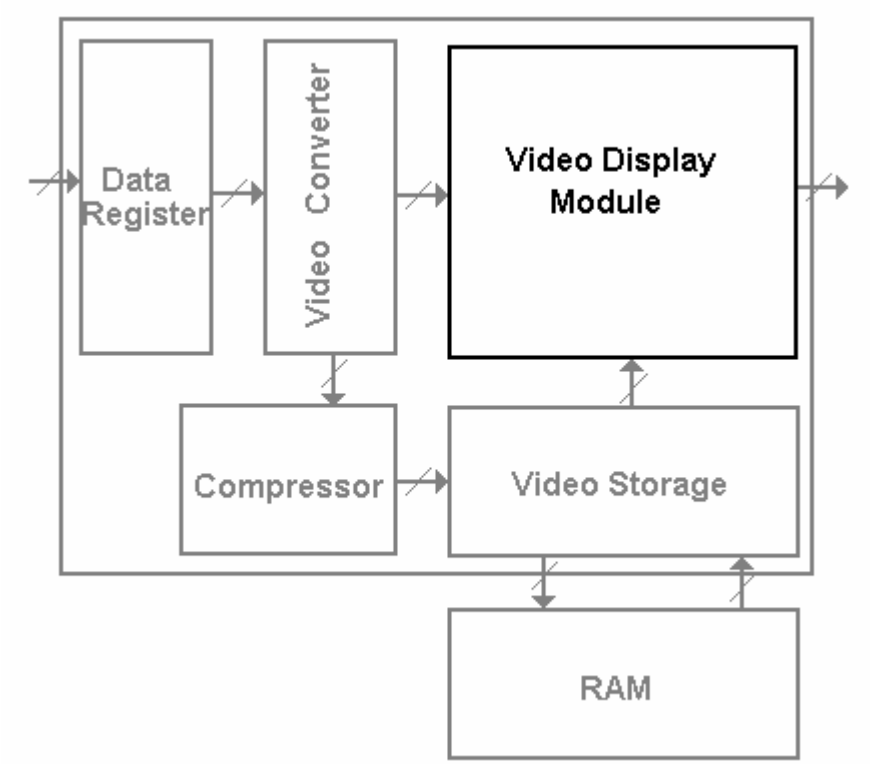
# Video Display




## Job of the Video Display

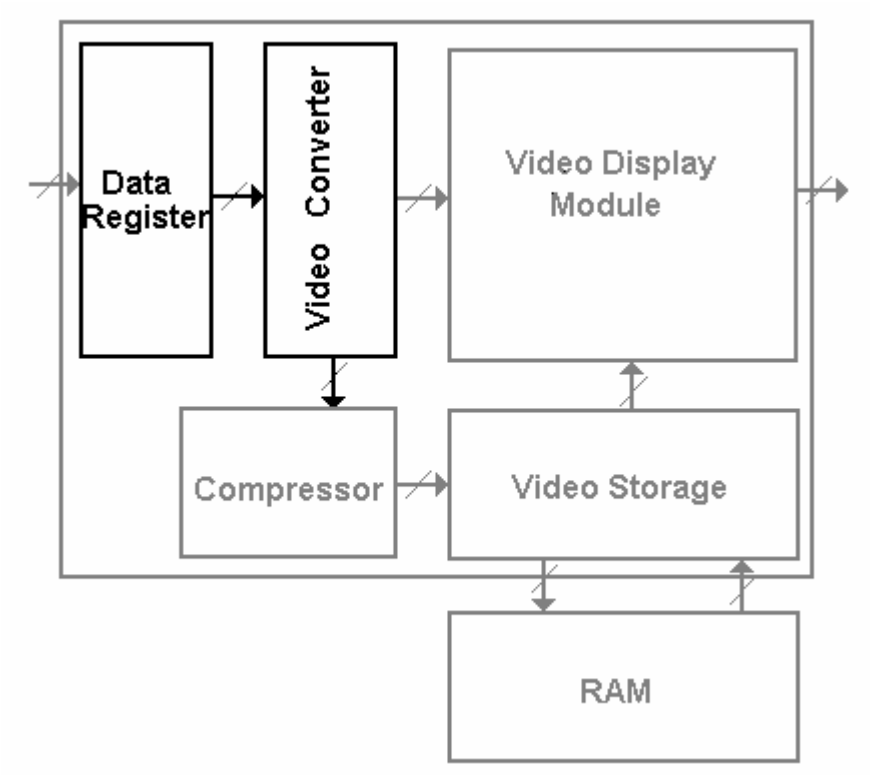
- Take in data and convert to a visually appealing format
- Display data
- Save previous data for reference

# Video Output



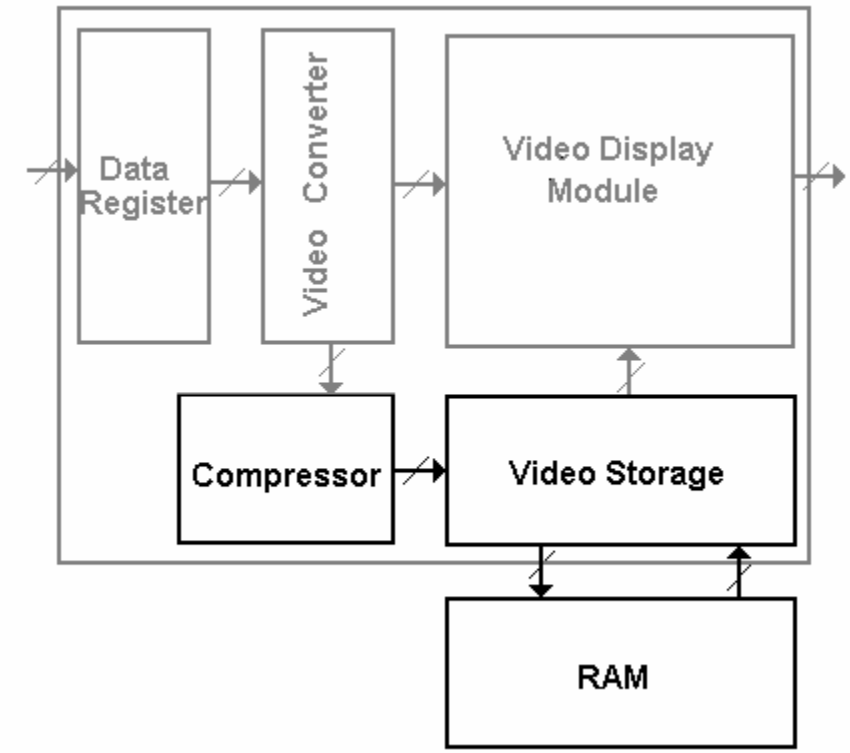

- On computer monitor
- Like PS3/Lab 4
- Higher Resolution

# Data Inputs

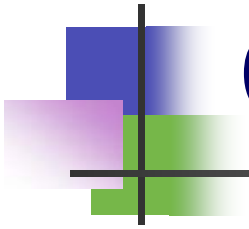



- Register data on vsync refresh
- Convert data into an eye-pleasing format

# Video Storage




- Compresses data to save
- Displays previous data
- Interacts with onboard RAM
- Changes based on user input



# Conclusion

- Design is modular
- Project is good extension to material presented in class
- Polygraph is an interesting real-world application