DIGITAL SYSTEM DESIGN

Term Projects – 2024

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Complex Engineering Problem - Attributes

Attribute	Description	Applicable Projects
WP1: Depth of knowledge	The project shall involve in-depth engineering knowledge related to the area of Digital Design. [WK-4, Engineering Specialization].	All Projects are required to demonstrate considerable complexity in terms of the datapath being designed and algorithm being ported to H/w.
WP2: Range of conflicting requirements	The project has multiple conflicting requirements in terms of optimal usage of resources and performance.	Carefully architect your design according to the conflicting requirements provided.
WP3: Depth of analysis required	-	-
WP4 Familiarity of issues	-	-
WP5 Extent of applicable codes	The projects expose the students to broadly defined problems which require development of codes that may be partially outside those encompassed by well documented standards.	All Projects
WP6 Extent of stakeholder involvement and conflicting requirements		-
WP7 Interdependence	The projects shall have multiple components at hardware level and software level for verification and analysis	All Projects are expected to have various FSMs and hardware modules interacting with each other.

PROJECT

- Multiple Difficulty Levels
  - Advanced   ● ● ● ● ●
  - Moderate   ● ● ●
  - Simple   ● ●

- Weightage
  - MS (Theory 15%)
  - UG (Theory 15%, Lab 15%)

AUDIO PRE-PROCESSOR

- Get an Audio Data
    - From stored values (read from file) • •
    - From Serial Port • • •
    - From Audio Interface • • • • •

- Process
    - Perform Audio Filtering (Bass + Tribble + Band Pass Filtering+Echo+..) • • •
    - Spectrogram Computation (Output via Serial Port) • • • • •

- Conflicting Requirements / Optimization Knobs

Quantization
like Qn.m
n => integer
m => float

- Quantization vs Quality

- Pipelined vs Parallel design while keeping the area overhead minimized

- Optimization trees for Multi-Operand Addition - Evaluate area overhead

- Output
    - Audio data stored in a file • •
    - Audio Data Via Serial Port • • •
    - Audio Out via Speaker • • • • •

VIDEO PROCESSOR

- Get Video Data
  - From stored values (read from file) • •
  - Video Data Via Serial Port • • •
  - From I2C /Video Interface (Base Code Provided) • • •

- Process
  - Perform Video Processing - Change Detection • • •
  - Perform Video Processing - Filtering • • • •
  - Perform Video Processing - 3D Filtering (a basic CNN) • • • • •

- Conflicting Requirements / Optimization Knobs
  - Quantization Vs Quality
  - Pipelined vs Parallel design while keeping the area overhead minimized….
  - Optimization trees for Multi-Operand Addition- Evaluate area overhead

- Output
  - Video data stored in a file • •
  - Video Data Via Serial Port • • •
  - Video Out via VGA Interface (Base Code Provided) • • •

Accelerator of your choice

You may propose an accelerator of your choice. E.g.

- RISC-V based Micro-Controller - Open Source Contribution

ITU
Dr. Rehan Hafiz

Project
Deliverables
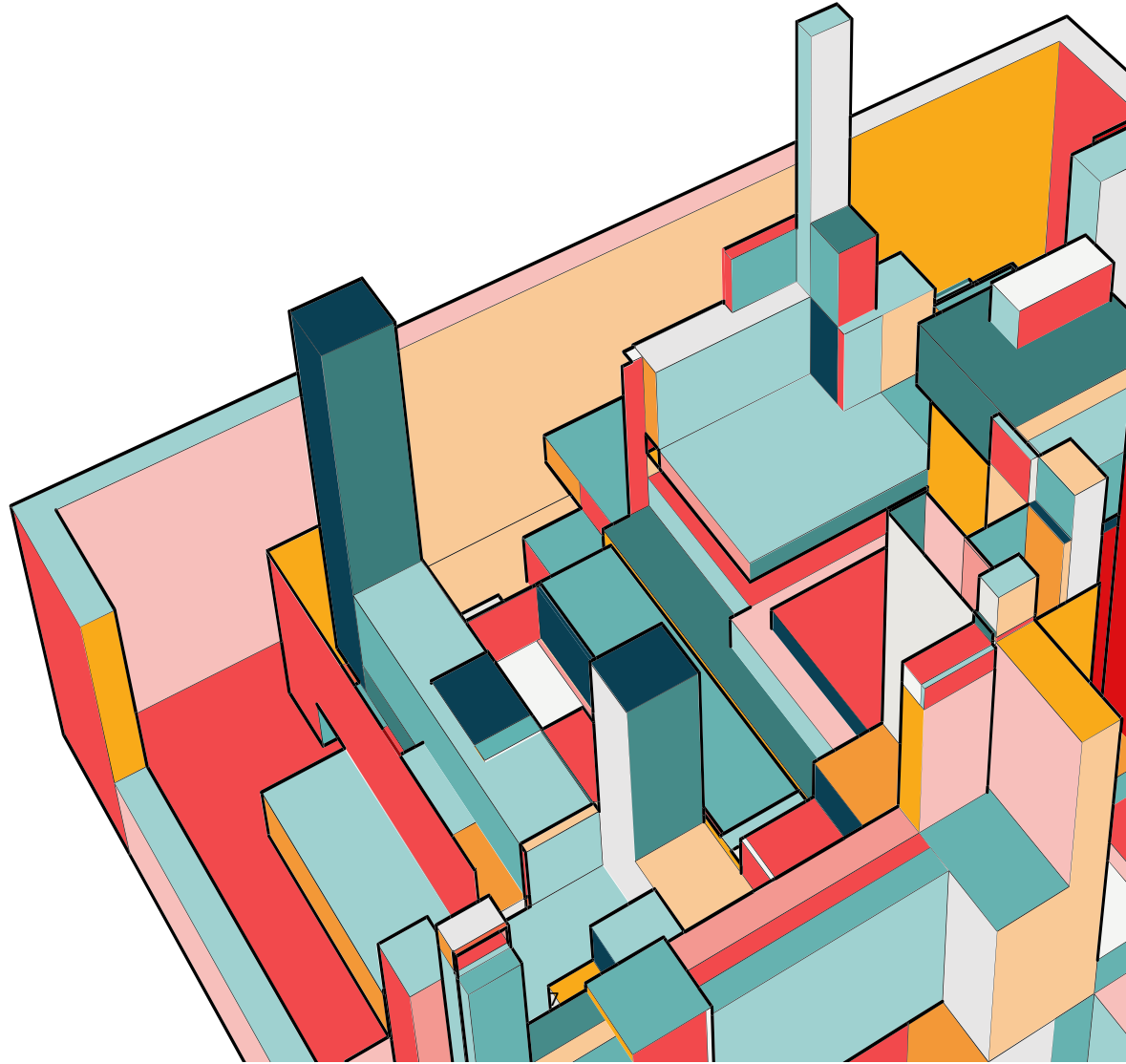
- Project Title (PT) Submission - 11th Nov - Negative 5% on non-submission

- Project Marathon Session-I - 12th Nov

- Project Scope Section - (19th Nov) - 10%

- Project Marathon Session-II - 2nd Dec (Saturday)

- In-Class Submission of Micro-Architecture - 3rd Dec

- Micro-Architecture + Design Goals & Optimization Strategy - 6th Dec - 20%

- Pre-Final Project Evaluation (with Code Submission) - 12th Dec - 20%

  - Report Template:
    https://docs.google.com/document/d/15QKfo44zxNAjunY9ayFw_-pZToBiTzSFwGXt9jsUxEs/edit#heading=h.ow21cmsjqc8x

- Post-Final Project Evaluation (with Code Submission) -27th Dec 2024 - 50%

- Project Related Open Ended Lab to be carried out next week