CENTRAL TEACHING INNOVATION FUND

FINAL REPORT

AUTODESK TINKERCAD SOFTWARE FOR COURSE DIGITAL SYSTEM

COURSE REPRESENTATIVES (CR)

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Academic Development Center

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A. Title Page

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1. PROJECT SUMMARY

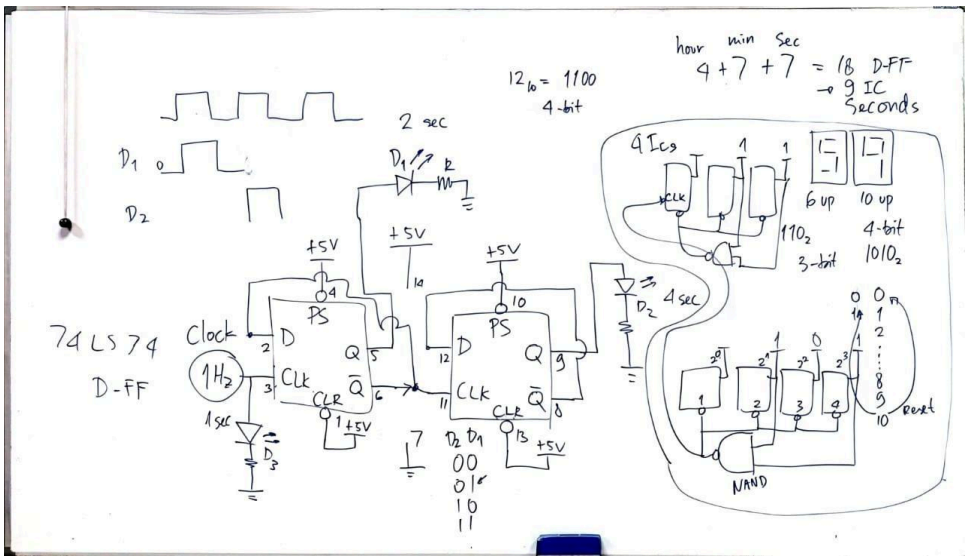
This report outlines the implementation and outcomes of integrating Autodesk TinkerCAD software into the Digital Systems course (H651-1BELA) at SGU. The primary goal was to enhance the student learning experience by providing a modern, efficient tool for designing and simulating electronic circuits. This initiative aimed to bridge the gap between theoretical knowledge and practical application through hands-on, project-based learning, ultimately improving student comprehension and assessment methods compared to traditional prototyping board techniques.

2. TEACHING INNOVATION IMPLEMENTATION

2.1 Project Activities

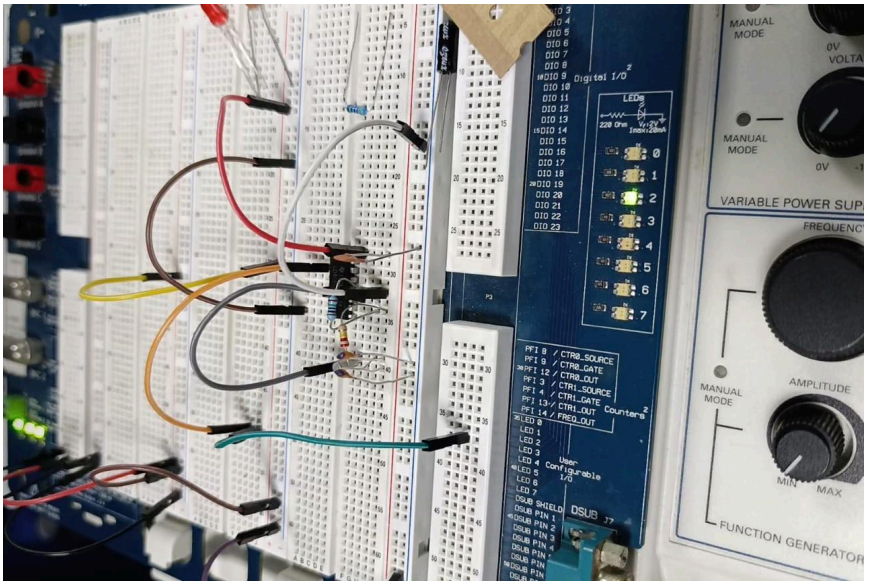
The implementation of Autodesk TinkerCAD in the Digital Systems course involved several key steps:

1. **Conceptualization and Design (Whiteboard Schematics):**



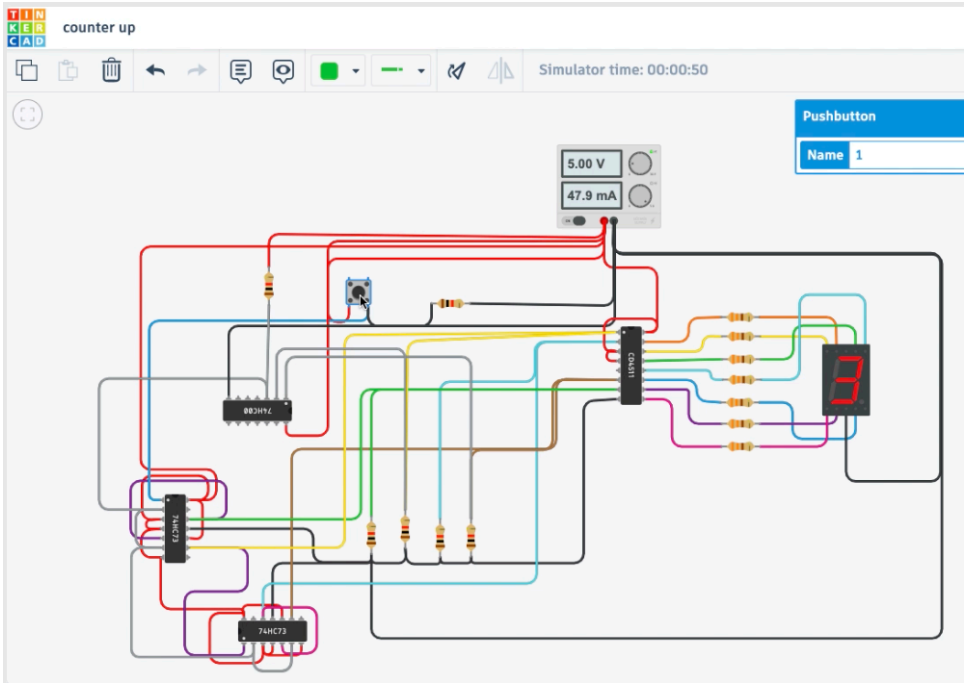
Initial circuit designs and logic were mapped out. For instance, designs for counters using D-Flip Flops (like the 74LS74 IC) were sketched, detailing component connections, clock inputs, and expected outputs (as seen in the provided whiteboard image showing circuit diagrams and timing waveforms). This stage helped solidify the theoretical understanding before simulation.

2. **Prototyping (Physical Breadboard):**



Students were introduced to the basic concepts by first working with physical components on a breadboard. This provided a tangible understanding of how circuits are constructed using components like ICs, resistors, LEDs, and jumper wires (as depicted in the image of the wired breadboard setup).

3. **Simulation (Autodesk TinkerCAD):**



The core of the innovation was the utilization of Autodesk TinkerCAD. Students translated their whiteboard schematics and breadboard experiences into digital simulations. For example, a counter circuit was designed and simulated in TinkerCAD, allowing for virtual testing and observation of circuit behavior, such as

displaying count values on a 7-segment display (as shown in the TinkerCAD screenshot with a counter circuit). This step allowed for rapid prototyping, easy modification, and immediate feedback on circuit functionality without the constraints of physical components.

The project timeline was aligned with the course modules covering logic gates, flip-flops, and counters. Key milestones included the successful simulation of basic logic circuits, followed by more complex sequential circuits like counters.

2.2 Challenges & Solutions

- **Challenge:** Due to the small class size, there was an opportunity to provide more individualized attention. However, this also meant that the overall pace of the group might be dictated by those requiring more assistance.
- **Solution:** The pace of the lessons was adapted to be slower, ensuring that all students could grasp the concepts and successfully complete their TinkerCAD simulations. This approach allowed for the achievement of a small project example (e.g., a functional counter), ensuring foundational understanding and practical application of the software.

3. OUTCOMES

The success and effectiveness of integrating Autodesk TinkerCAD were assessed through the following:

- **Metrics to measure outcomes:**
  - **Student Engagement:** Observation of student participation in TinkerCAD-based lab sessions and their enthusiasm for using the software.
  - **Learning Outcomes:**
    - Ability to successfully design and simulate logic circuits (e.g., counters, adders) in TinkerCAD, aligning with course learning outcomes 2, 3, and 4.
    - Improved understanding of the practical application of theoretical concepts (Boolean algebra, flip-flop operations).
    - Proficiency in using TinkerCAD for circuit design and testing (contributing to learning outcome 5).
  - **Digital Adoption:** Rate of successful circuit simulations and project completions using TinkerCAD compared to time/effort typically spent on physical breadboarding.
  - **Quality of Designs:** Complexity and correctness of the circuits designed and simulated by students in TinkerCAD.
- **Methods for collecting data:**

- **Lab Assignments & Project Submissions:** Assessing the functionality and design correctness of TinkerCAD projects (e.g., the counter circuit).
- **Direct Observation:** Observing students during lab sessions to gauge their interaction with the software and problem-solving approaches.
- **Student Feedback:** Informal Q&A sessions and direct feedback from students regarding their experience with TinkerCAD compared to traditional methods.
- **Performance Analytics (if available in TinkerCAD for educators):** Tracking student progress and common issues encountered within the software.

- **Plans for monitoring and refining the innovation based on evaluation results:**
  - **Regular Review of Student Work:** Continuously analyze the quality of TinkerCAD submissions to identify areas where students might be struggling.
  - **Solicit End-of-Course Feedback:** Implement a formal survey at the end of the course to gather comprehensive student opinions on the effectiveness of TinkerCAD in achieving learning outcomes and its ease of use.
  - **Iterative Improvement of Teaching Materials:** Refine tutorials, examples, and project guidelines based on student feedback and observed challenges to better support future cohorts.
  - **Explore Advanced Features:** Investigate further capabilities of TinkerCAD or complementary software to introduce more complex projects in subsequent course offerings.

4. BUDGET REALIZATION *(if applicable)*

- No budget was used.

5. SEMESTER LEARNING PLAN

- SLP (Semester Learning Plan) is in this link.
  https://docs.google.com/document/d/15JnI-6fhZfe2IhmYGt2oAuN_-JbkyEoyfMQO90btyLo/edit?usp=sharing