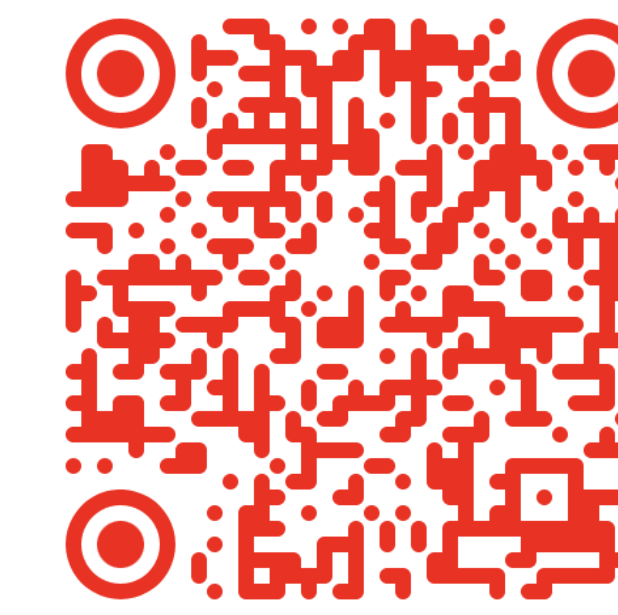


HAPPY FEET

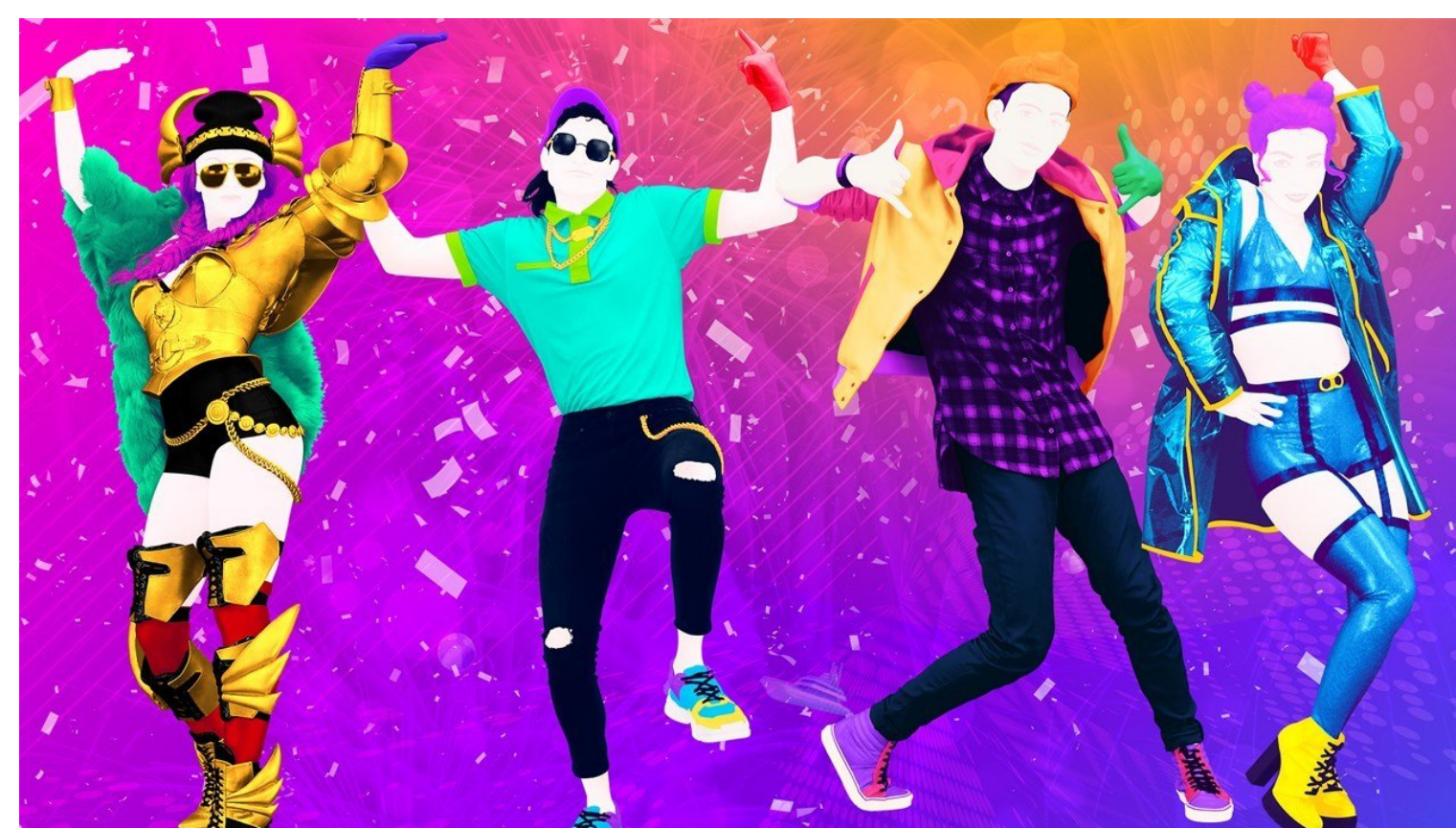
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LET'S DANCE!

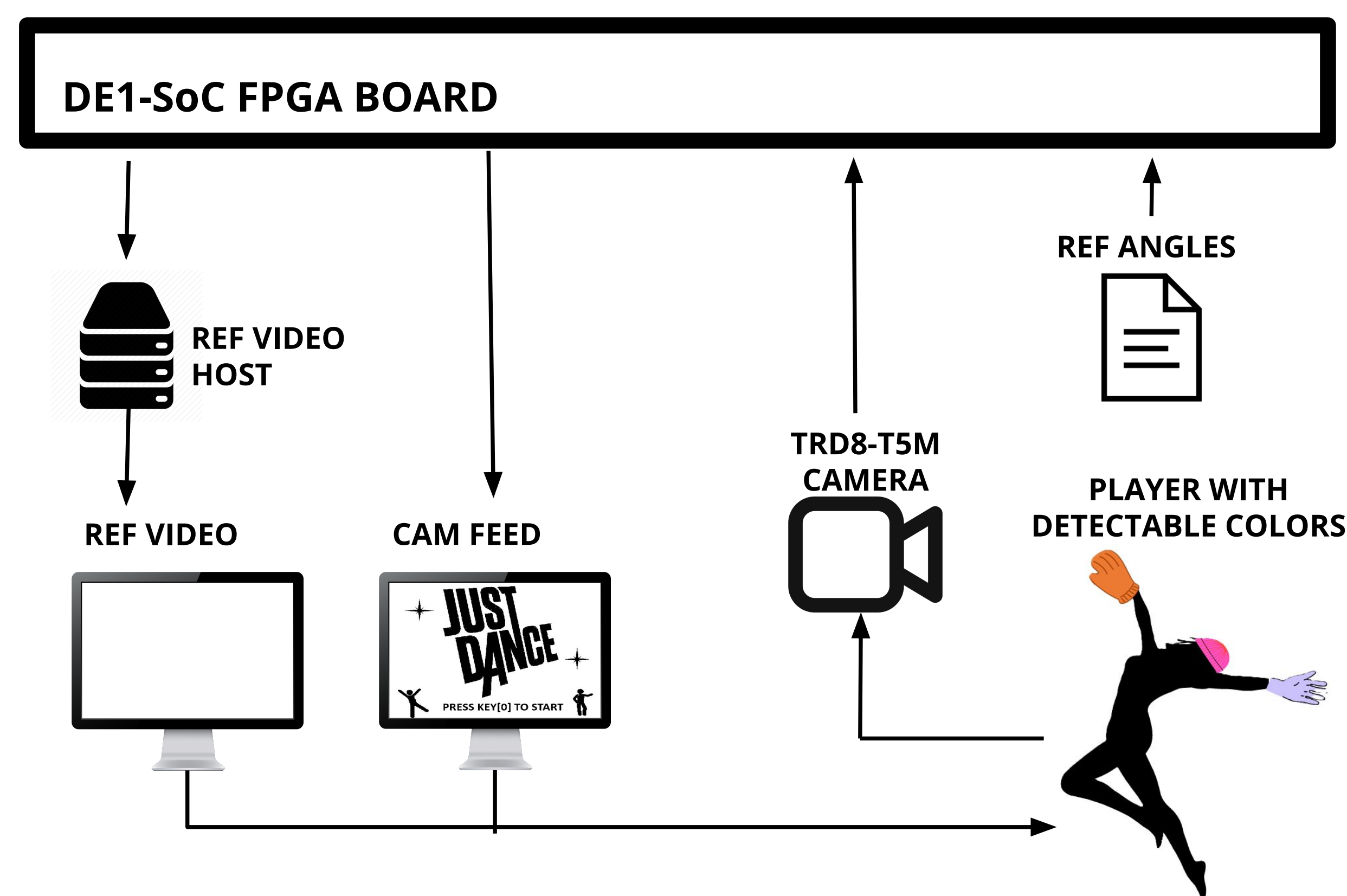
- Test your dancing skills with our game!
- Happy Feet is a lite version of the popular dancing game Just Dance
- It's an interactive dance experience where players follow on-screen choreography to popular music
- We wanted to see how hard it would be to make this with a tiny camera and FPGA
- Made this to reach our daily steps goal



How to play:

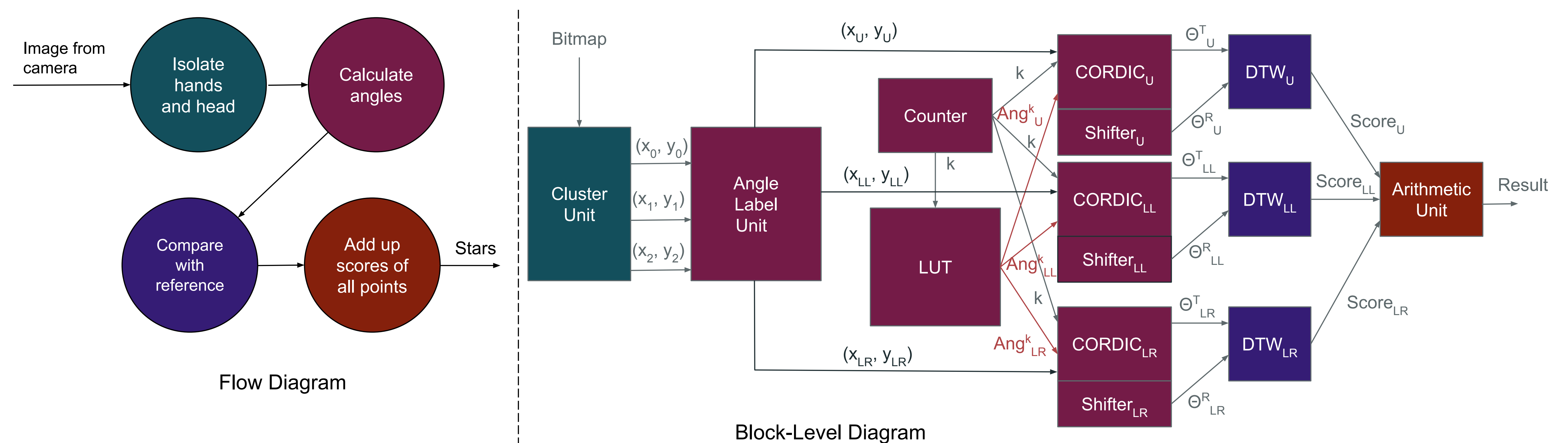
- Wear the Happy Feet Hat and Gloves
- Press Key 0
- Start dancing!
- Wait a few seconds to see your score

SYSTEM LEVEL DIAGRAM



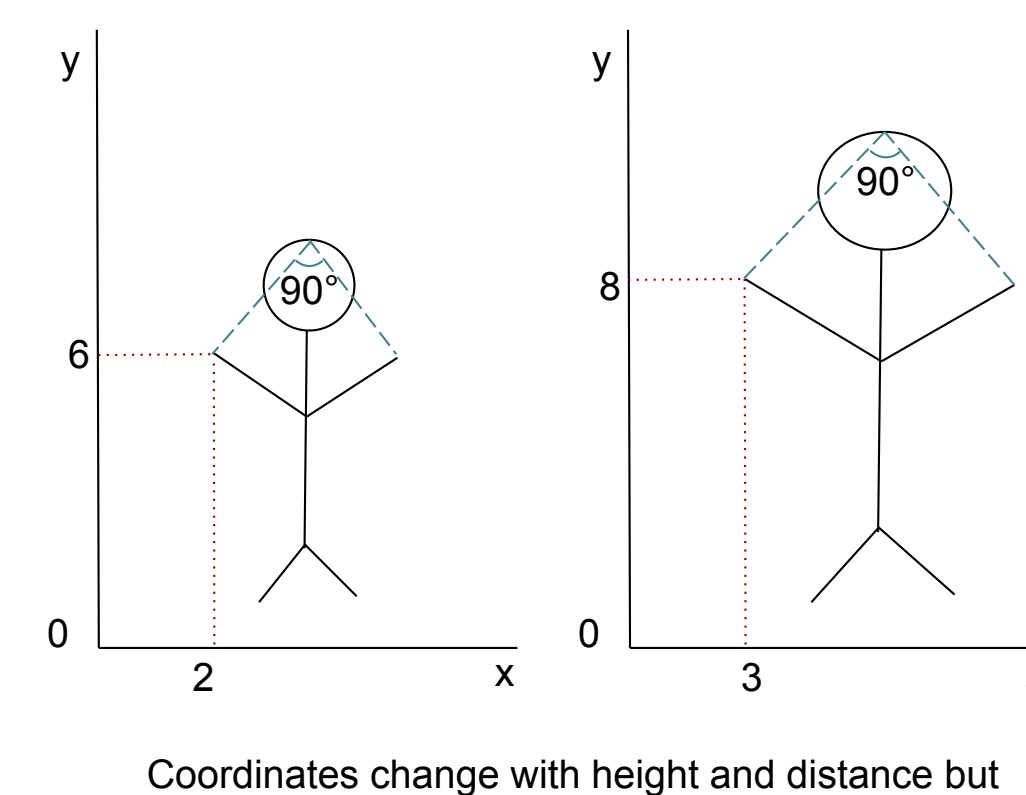
- FPGA keys to start game and LEDs to display exact score
- External computer connected via UART for reference video

FPGA DESIGN



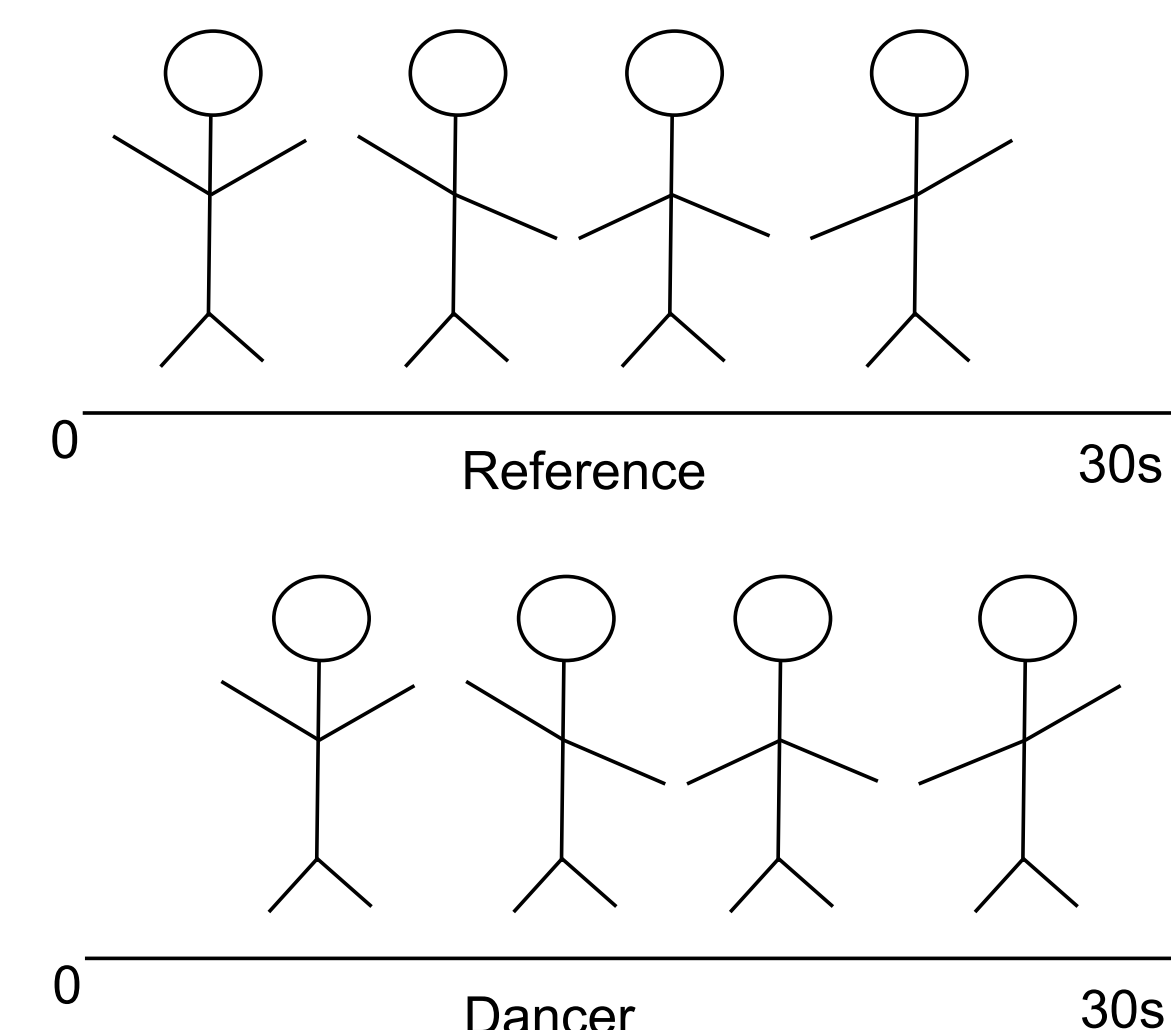
ALGORITHMS

CORDIC



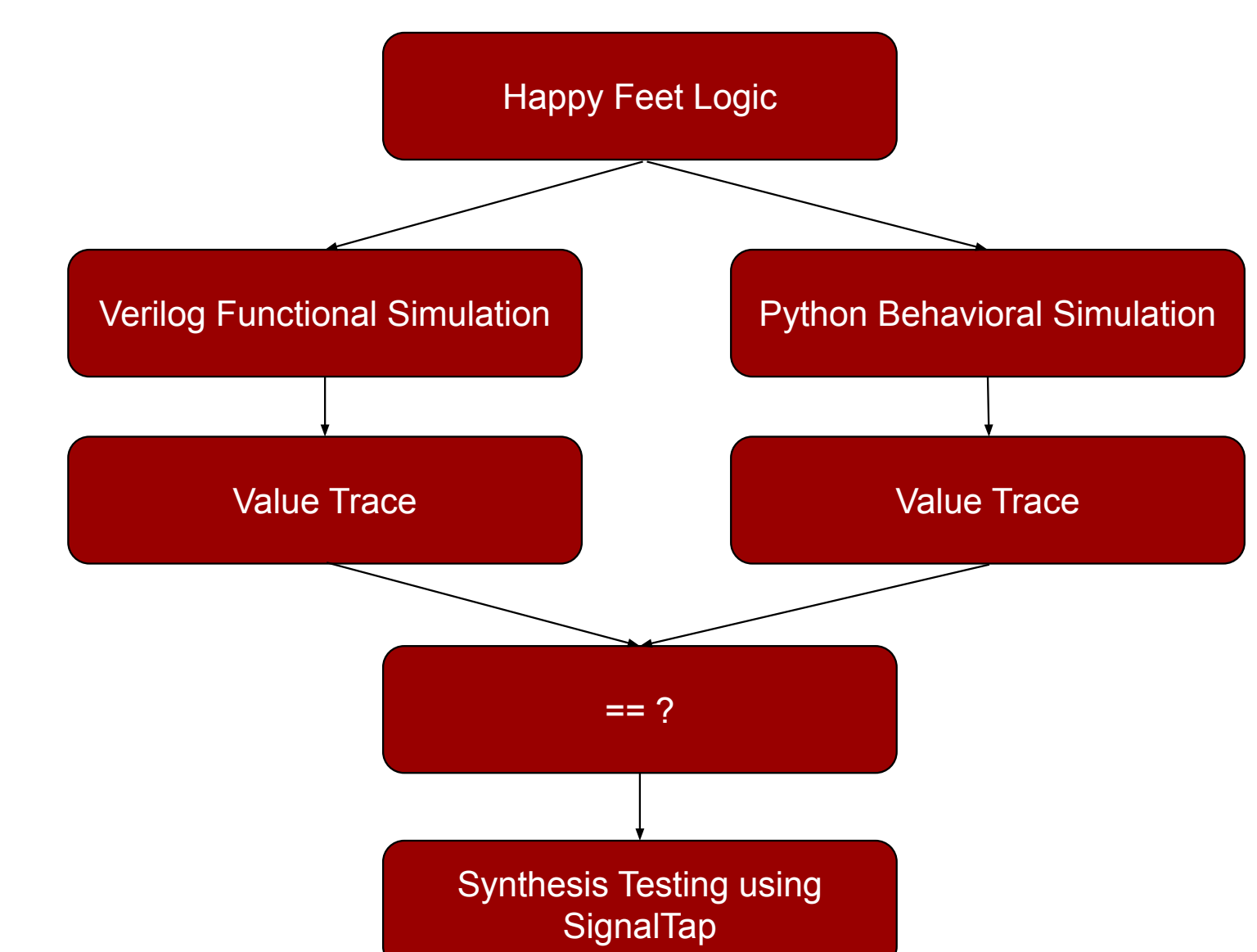
- Calculates angles fast while using minimal area
- Accuracy can be easily adjusted with negligible effect on speed
- Referenced [1] for the architecture

DTW



- Accounts for time shifts while calculating score
- Optimized it to be 150x faster and 98.5% smaller than the research paper we referenced [2]

VALIDATION METHODOLOGY



- Python for logic confirmation
- Modelsim for Verilog

AREAS FOR IMPROVEMENT

- Store video on board rather than external device
- Track whole body
- Image normalization to account for human diversity
- Use a more robust camera

REFERENCES

1. F. De Dinechin and M. Istvan, "Hardware Implementations of Fixed-Point Atan2," 2015 IEEE 22nd Symposium on Computer Arithmetic, Lyon, France, 2015, pp. 34-41, doi: 10.1109/ARITH.2015.23.
2. M. Hormigo-Jiménez and J. Hormigo, "High-Throughput DTW accelerator with minimum area in AMD FPGA by HLS," Repositorio Institucional de la Universidad de Málaga, pp. 1-6, Nov. 2023, DOI: 10.1109/dcis58620.2023.10335963.