Task 4 Test jig Assembly and Stepper Motor Interface

A. Problem Statement

Assemble test jig for DBTM module and develop stepper motor control codes for velocity, acceleration, and motion profiles, including safety and calibration.

B. Sub-tasks Completed

1. Assembled the test jig and resolved mechanical issues (belt, parts).

2. Interfaced Stepper Motor with Test Jig.Building & testing Stepper motor with test codes.

3. Developed and formulated code for object travel using Stepper motor for user-defined modes as follows:

    - Acceleration Mode (user Define acceleration & target velocity).
    - Constant Velocity Mode (user defined velocity).
    - Trapezoidal mode (user defined acceleration distance, deceleration distance, acceleration & cruise velocity).
    - Distance mode (user defined distance).

4. Building and testing additional features:
    - Home / Calibration
    - Emergency overshoot switches for safety
    - Emergency stop

5. Assisted in gyro meter/accelerometer calibration using test jig.

C. Efforts Details

Date	Activity	Description	Duration/Status
2025-06-23	Test jig assembly, stepper motor code	Initial setup; resolved belt issue	1 day – Belt issue resolved
2025-06-24	Continued assembly	Progress delayed due to parts	1 day – Parts issue
2025-06-25	New parts assembled	All parts assembled successfully	1 day – Issue resolved
2025-06-26	Stepper code for velocity/acceleration	Velocity and acceleration code developed	1 day – Code tested
2025-06-27	Constant velocity, home return, calibration, code merge	Code for multiple modes integrated and tested	1 day – Code tested
2025-07-01	Gyrometer/accelerometer testing with test jig	Sensor data collected and analyzed	1 day – Data recorded
2025-07-02	Trapezoidal mode, equation verification, safety switch	Verified motion logic and safety integration	1 day – Code tested

D. Observations / Learnings

- Mechanical issues (belt, parts) are common and require prompt resolution.
- Safety features (limit switches) are essential for reliable operation.
- Trapezoidal motion requires user inputs to satisfy Newton's equations.
- Stepper motor steps configuration and gear ratio concept.

E. Deliverables:

1. https://drive.google.com/drive/folders/14l8GVKDn965BvZs6LdbXEtIGGaPAGgmm
2. https://drive.google.com/drive/folders/11fDq84Dhw3kQpRzCxUMcEHWGkgmYfuBg

F. Conclusion

- Test Jig assembled, tested and validated successfully.
- All codes for motion profiles and safety features are tested and validated successfully.
- Feedback and calibration routines are in place for accurate stepper control.