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STUDY AND DEVELOPMENT OF AN AUTOMATED 1-AXIS DRILL

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Supervisor: Dr. Titus Mulembo

ABSTRACT

High quality drilled holes are required in a lot of industrial and medical applications. It is imperative to design a low cost and precise drilling machine that can be used and which monitors vibrations resulting and forces applied to the workpiece during the drilling operation. This project focuses on the development of a one-axis drill system utilizing a polymer workpiece for improving bone drilling operations in medical applications. System monitoring is essential to determine the best parameters that can be used in system control for vibration mitigation while using analytical and computational resources to analyze behavior of PMMA under drilling operation while ensuring reduced chatter or risk if drill bit breakage and ensuring efficient material removal.

MAIN OBJECTIVE

Development of a precise automated one axis drill.

Specific Objectives

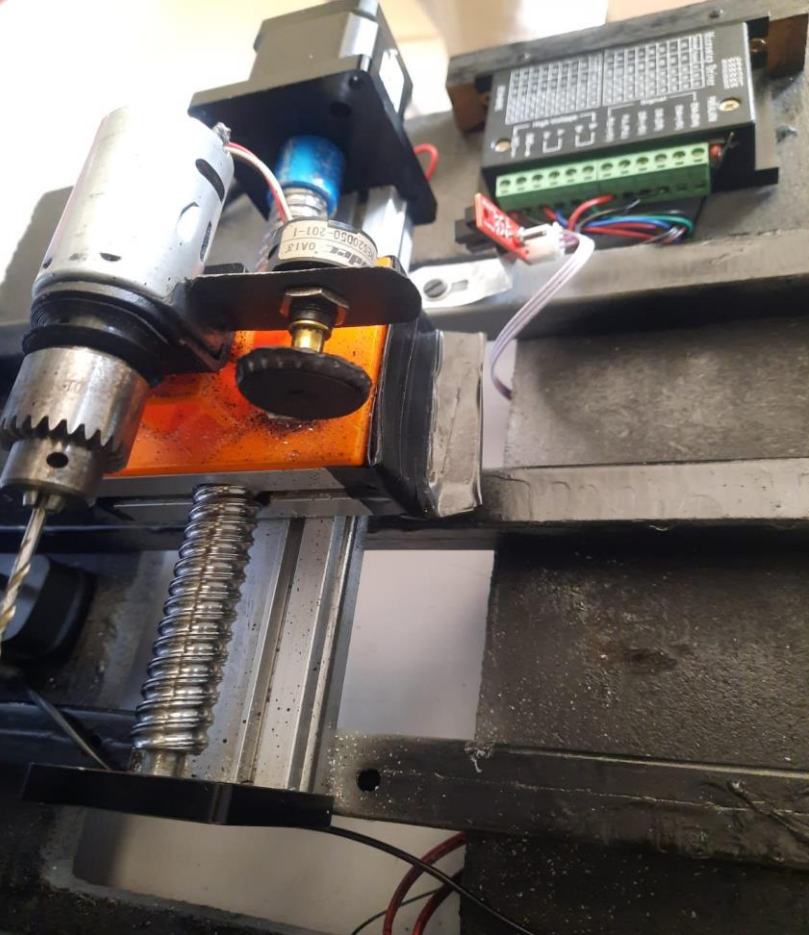
- To design and simulate 3D model of the physical system
- To develop project circuits and firmware to run sensors, actuators and peripherals.
- To carry out experiments and analysis to determine parameters for vibration mitigation

EXPECTED OUTCOMES

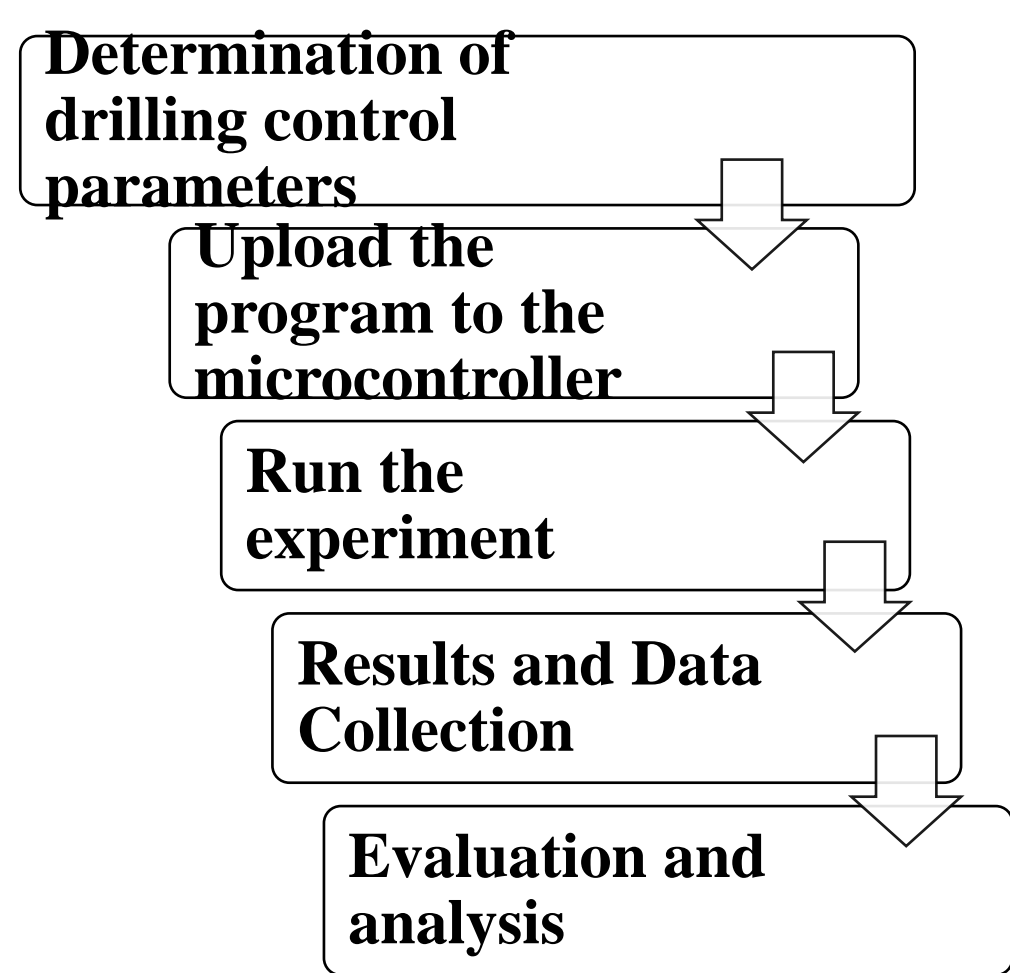
- ✓ To have an efficient firmware program for the working of sensors, actuators and peripherals for precise drilling operation
- ✓ To establish optimal drilling parameters from experimental and computational analysis.
- ✓ To visualize forces and vibration on the PMMA with respect to drill and feed speeds
- ✓ To mitigate vibrations, chatter and reduced risk of drill bit breakage and ensure efficient material removal during drilling.

METHODOLOGY

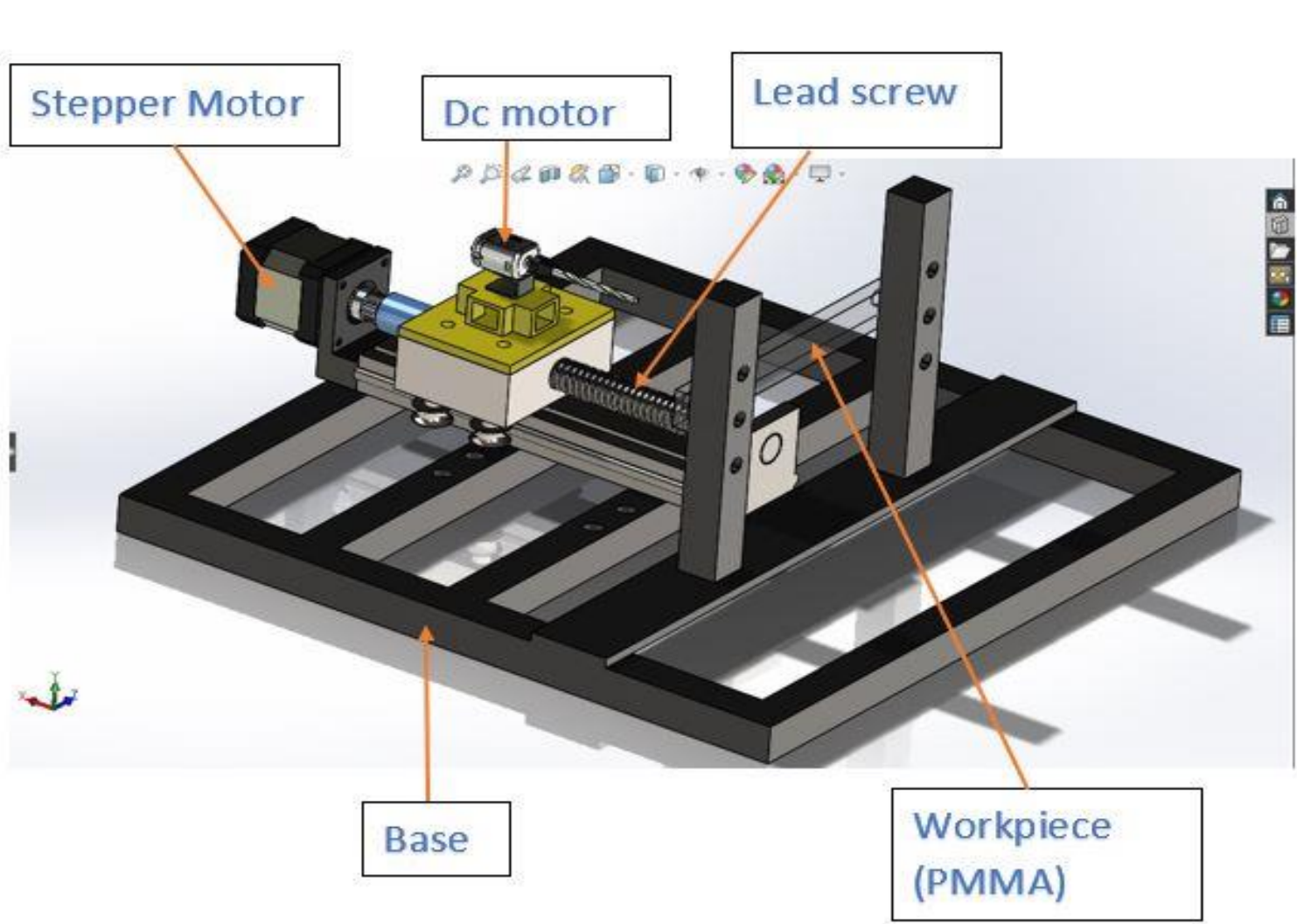
1. Assessment of existing physical model



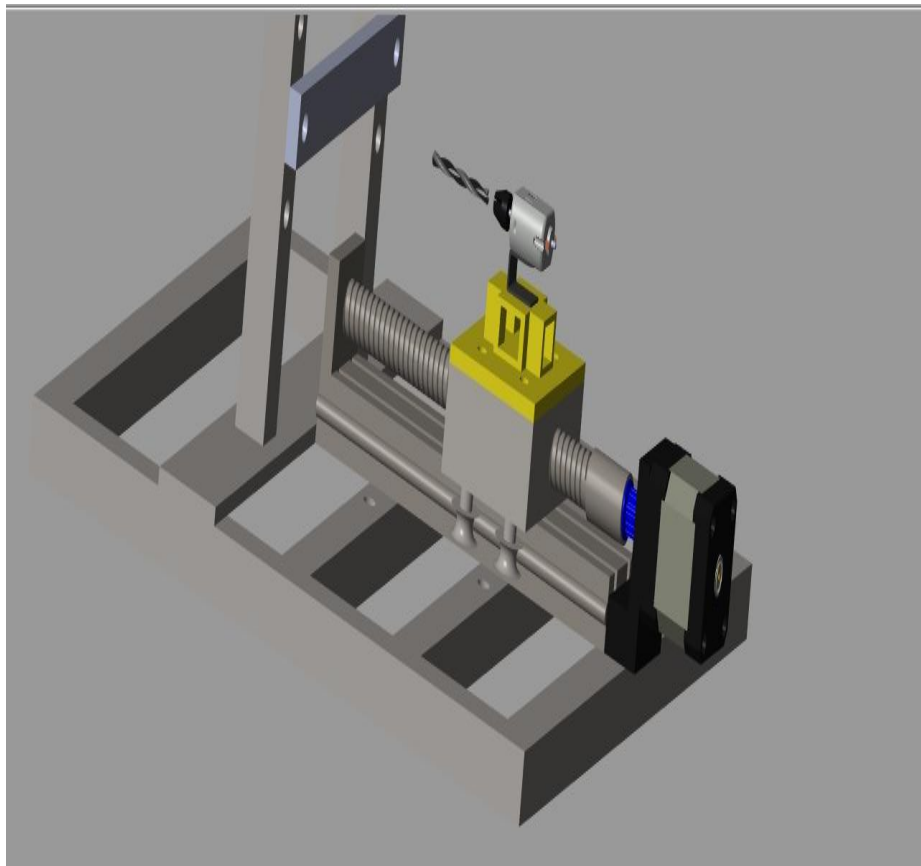
2. Development of program flowchart



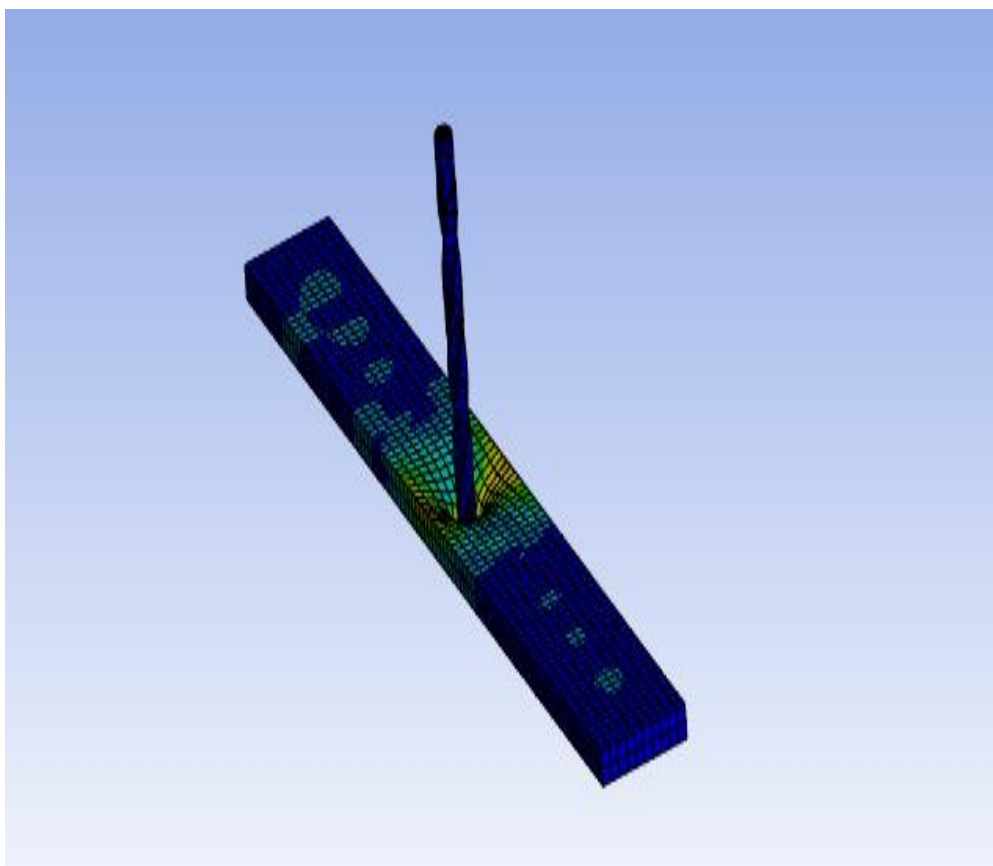
3. CAD Design in Solidworks



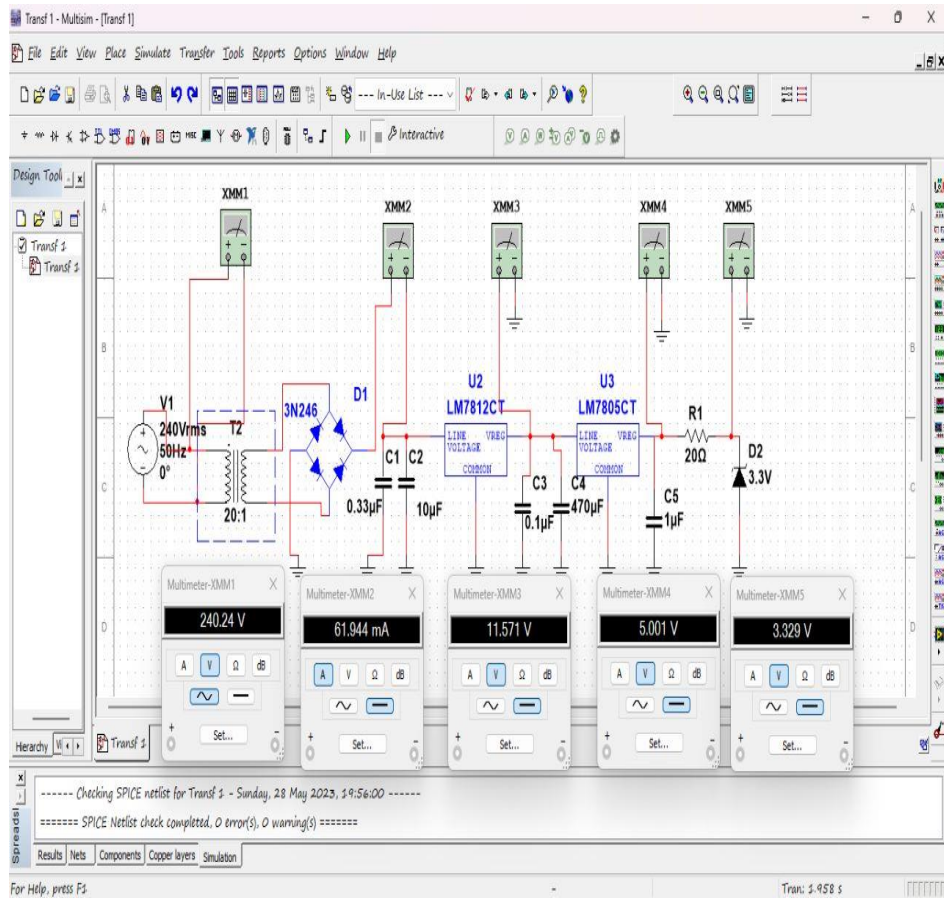
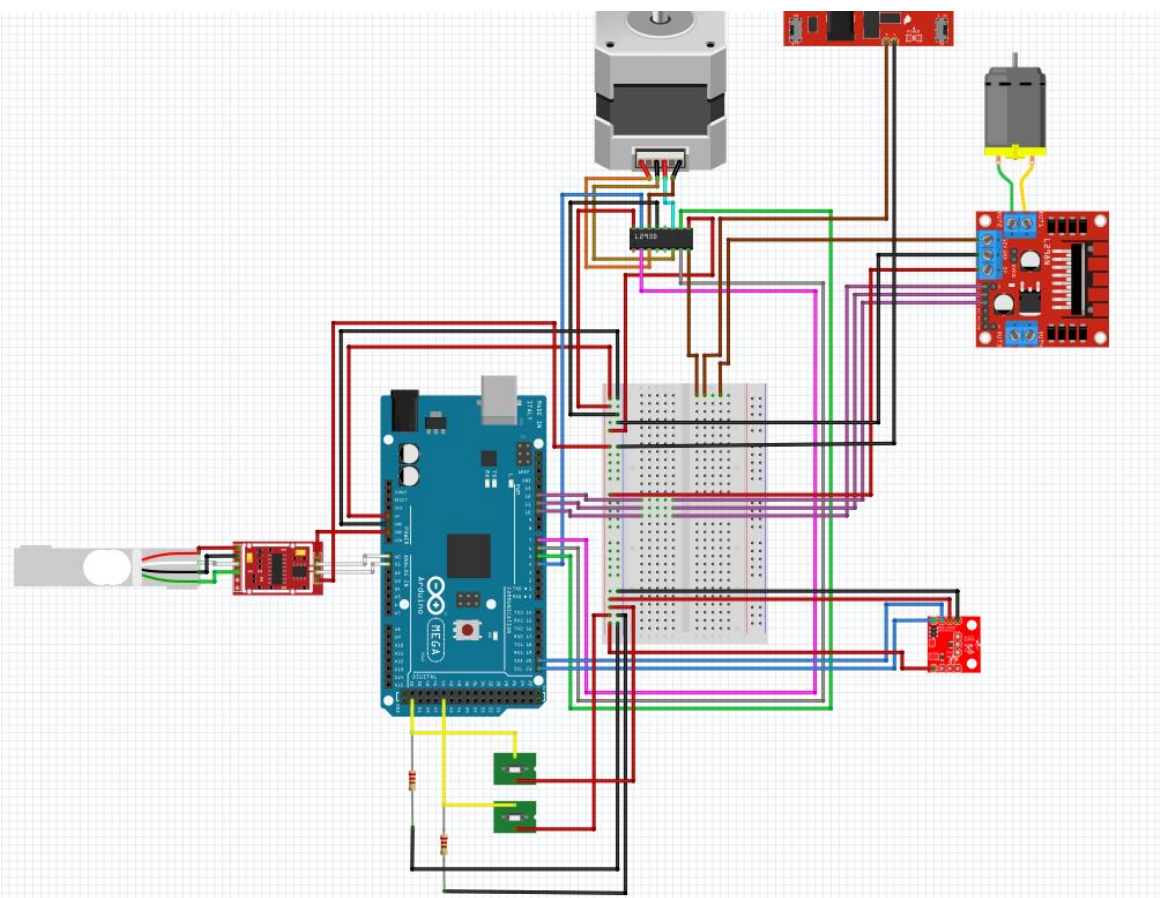
3. Importing & simulating working system in Matlab Simscape



4. Finite element analysis in Ansys



5. Programming and circuit simulation in Proteus, Multism, Fritzing



ACHIEVEMENTS

- ✓ Mechanical design of the project in Solidworks and simulation of the working motors in Matlab
- ✓ Circuit design in Proteus and simulations using Multism and Fritzing
- ✓ Development of working firmware program to read accurate real time vibration and load cell sensor data and control dc and stepper motor using motor drivers and other peripherals.