# Linear CNC Robotic Plotter

## Problem Description

➢ Malawi is one of the poorest country because it doesn't manufacture and produce our own products locally.

➢ We use traditional methods of manufacturing which are more time consuming, require more energy, special skills, man power, are less efficient so don't meet consumer's demand, production is limited, lower quality etc.

## Solution Description

I have developed a low cost wheeled CNC plotter locally, with unlimited working length that uses CAD file to manufacture various products. **Xplota** can work both in or outside space at any smooth floor, it is portable, environmental friendly, low power consumption, doesn't require special skills, can work on various materials

## Potential Impact

- Open new business opportunities in Malawi
- Improve innovation
- Increase and improve both industrial and social-economic growth
- Bridging skills gap among youth
- Increase productivity
- Creating various job opportunities
- Increasing manufacturing/production efficiency
- Allow product customization

## Device/System Design

### Part I: Hardware Design

**Design Feature 1:** Sensors

- Ultrasonic sensor is used to warn a user if a robot is closer to an object to avoid damage and confusion
- End switch are used at both x-axis sides to give it its width limit

**Design Feature 2:** Control Unit Configuration

- Microcontroller translate G-Code into movements of 3 axis with help from motor drivers to drive motors into different coordinates
- Microcontroller is also getting signals from sensors and gives a warning or stop the movements

**Design Feature 3:** Actuators and Displays

- 2 stepper motors with high toque have used to move this whole robotic flame, x-axis and toolhead as z-axis
- Smart controller LCD has used to allow a user to scroll up or down to select a desired file or to change settings

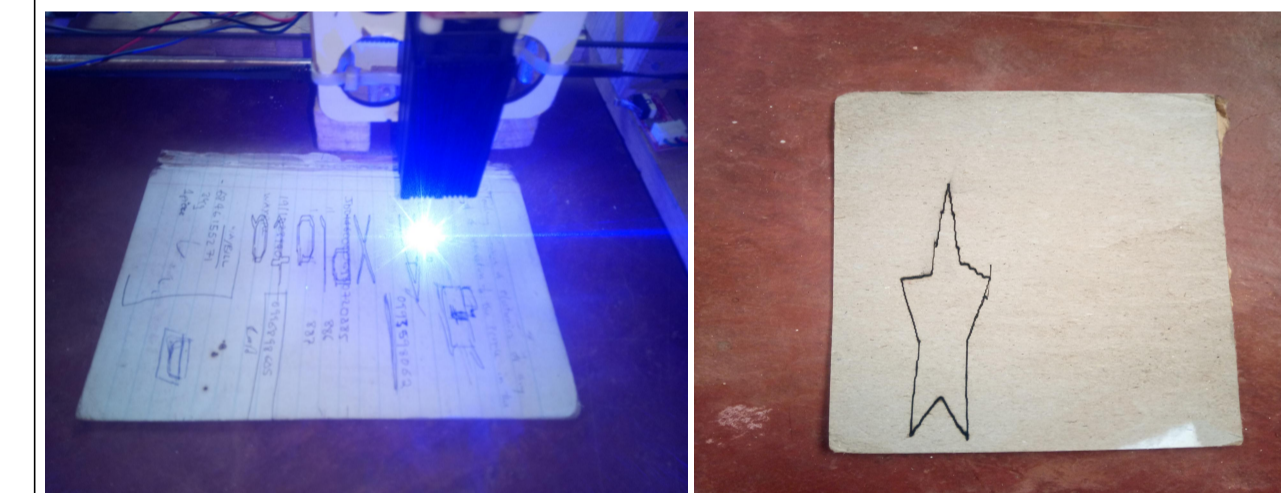### Part II: Software Design

**Design Feature 1:** User Interface

- Open source software is being used to generate a G-code file and transfer it into an SD card
- Or you can use USB cable to print directly from a Computer

**Robotic Plotter (Xplota)**
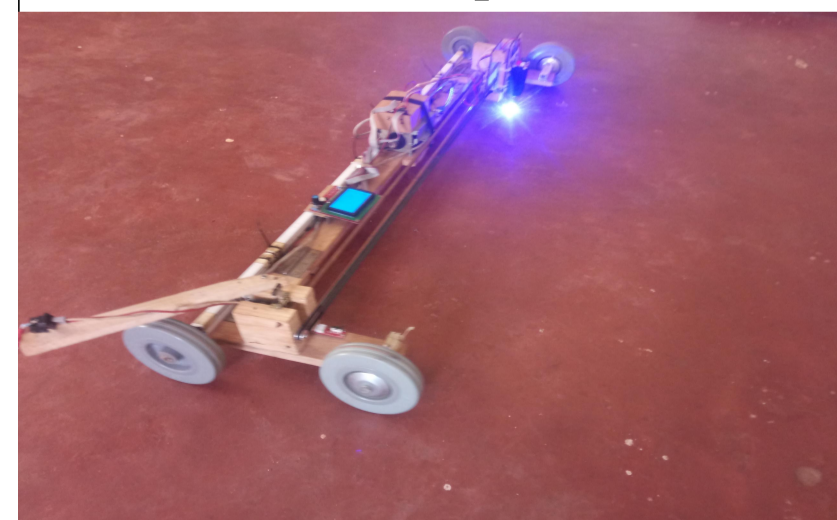


**Generating G-Code**



## Principle of Operation

A 2D model is designed in a CAD software then file has to be converted into a G-Code file. Once a G-Code file is selected, microcontroller is translates these coordinates into movement with help of motor drivers to follow exact dimensions from designed file. This robot will maneuver on floor to plot which can either draw or laser cut.

## Testing Data

**Testing it by drawing an object and printing out worlds**



## Future Design Plans

- Use big trucks for stability
- Design a universal automated toolhead switcher
- Add a robotic arm to assist the work
- Add more sensors to improve its intelligence
- Add IoT system to be monitored and controlled wirelessly
- Should be able to work together with it's own kind to share the tasks
- Use a camera for a feedback