Laser Bridge Coordinate Measuring Machine (LBCMM)

Mohammadanas Tuffaha, Hisham Fannoun
Supervisor: Majdy Zalloum
Mechanical Engineering Department
College of Engineering
Palestine Polytechnic University

Introduction

In the mechatronics environment, implementation of certain ideas is crucial for deep understanding. This implementation can be done by research and by physical simulation and testing. Regarding this, the main idea that we want to study and physically implement is called the “laser bridge coordinate measuring machine”. This machine falls in the coordinate measuring machines categories. This project will implement the idea of measurement and sensory as well as motion and feedback control. It will provide us with a deep understanding of the working principles of the laser modeling system and the motion control system. Also, the interfacing between these two systems will be of great significance.

Project Objectives:

The main objectives of this project are:

1. Designing a fully functional machine that is well mechanically designed and implemented.

2. Highlighting basic bonds between software programming and mechanical interaction.

3. Building an interface environment between computer software , microcontrollers, sensors, and actuators.

4. Using this project as starting point for CNC development (merging additional functions such as routing after scanning).

Results:

1. Extract a text file consisting of coordinate points that describe the object.

2. Establish a connection between a personal computer and the LBCMM for automatic machine mode.

3. Enabling a manual mode for easy use and user comfort.

4. Setting a resolution that the user commands based on the existing time that he can offer.

Proposed project

The Laser Bridge Coordinate Measuring Machine, also called ”3D Laser Scanner” is the project intended to be built, experimented with, and controlled. This device analyzes a real-world object in order to collect data on its shape. The main structure of this machine includes three axes of motion. The probing system used is laser triangulation with high level technology. The machine is run by electrical drives with feed forward and feedback systems. High movement accuracy is achieved by this electrical drive provoking high precision coordinate estimation and modeling.

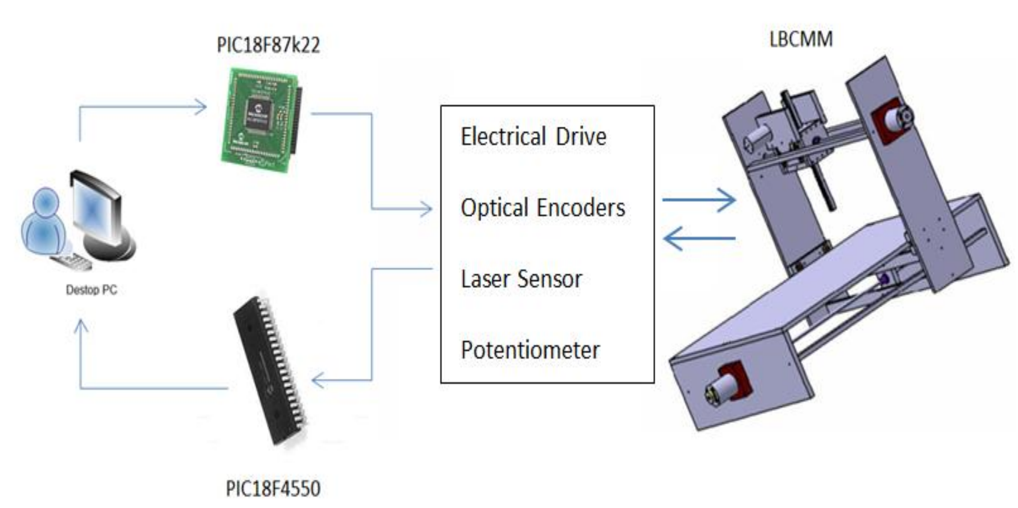

Figure 1: LBCMM System

Project Block Diagram:

As shown in Figure 2, the hardware that will be used in this project are the PIC microcontroller, motor drives, DC brushed motors, ball screw drives(or power screws), rack and pinion, incremental encoders, a potentiometer, and the laser triangulation sensor. As for the software, the computer will use certain programmed software, as well as the microcontroller, in order to send out control commands and receive and process signals.

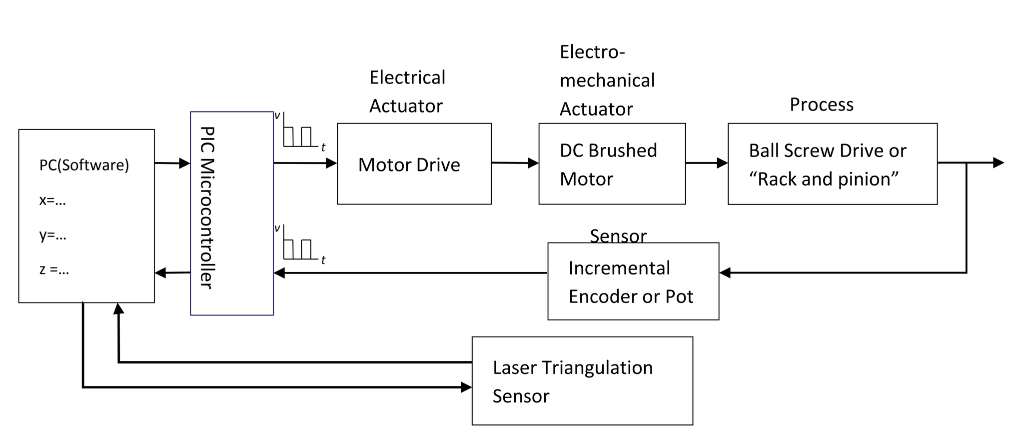

Figure 2 : System General Block Diagram.

The received signals will then be processed and conditioned. These signals will then be converted into x, y, and z coordinate points using simple mathematical formulas for further conditioning on Catia V5 software. This will lead to a clear point cloud and an image of the object.

System Design and Implementation:

In order to scan data, appropriate movement commands must be addressed. This means that the user interfacing this machine must input the starting position of the scanning device and the position of completion in addition to the speed for desired resolution. Also, according to the figure above, the user must also give authorization, status request, maintenance command, and scan request. In return, the machine will supply us with its main status and acknowledge the command set by the user. This can all be done by integrating between the components then software programming the status and command functions of these components. Below is the system context diagram:

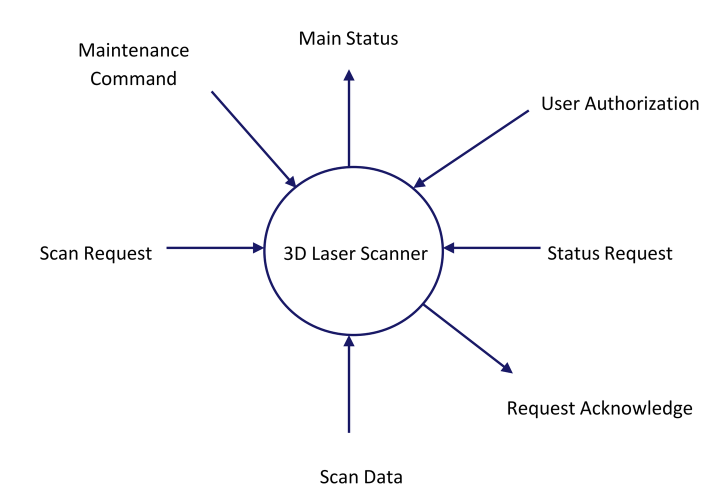

Figure 3: System Context Diagram

The general flowchart diagram that controls the flow of information between system components is shown in Figure 4.

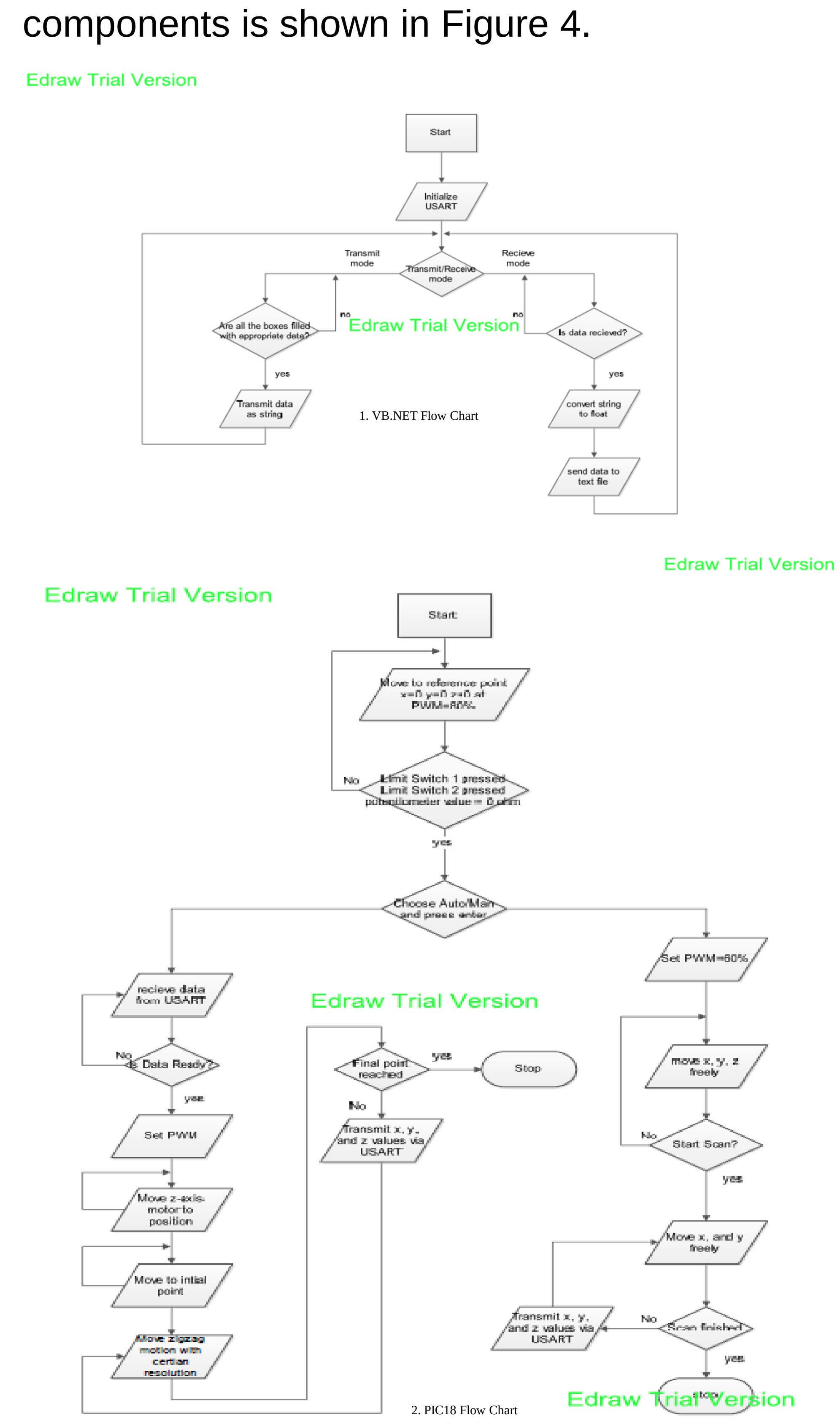

Figure 4: System Design Options