HIGH LEVEL DESIGN (HLD)

PROGRAMING/AUTOMATION IN CIVIL ENGINEERING

Revision Number: 1.0

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ABSTRACT

In general, civil design process for pipe support structures such as pipe rack / module. We manually locate the beam which support the pipe in STAAD model and apply the load on that beam. This task become time taking and may lead to error with increase in the size of structure and no. of supports increases. This work discusses the implementation of automation in design process to reduce the time required to build a model and also reduces the chances of error.

1 INTRODUCTION

The purpose of this High level Design (HLD) Document is to add the necessary details to the current project description to represent a suitable model for coding. This document is also intended to help detect contradictions prior to coding, and can be used as a reference manual for how the modules interact at high level.

1.1 Scope

This is documents define the pre-processing or document required, methodology and expected output for automation of piping loading on any structure.

1.2 Definitions

Term	Description
StaadPro	Civil Design software
Navis model	3D model of plant with pipe support location and coordinates (North, East, Elevation)
VBA	Visual Basic for applications
Database	Collection of all the information monitored by this system
IDE	Integrated Development Enviroment
Heroku	Cloud base application platform

2 GENERAL DESCRIPTION

2.1 Product Perspective

This automation system is a combination of vba and python code to detect the beam in StaadPro file where load should be applied.

2.2 Problem Statement

In O & G industry, civil and structural team received multiple input on loads location and its values to design structure. This input can be received time to time or updated for piping department. Finding beam no. on which load is applied is a tedious and time-consuming method which can lead to error.

2.3 Proposed Solution

The solution proposed here is VBA & Heroku application to find the beam number in staadpro model on which piping load shall be applied.

2.4 Further Improvements

Auto staad.pro syntax preparation to directly applying the loads on staad.pro. Options for change between metric unit and english units.

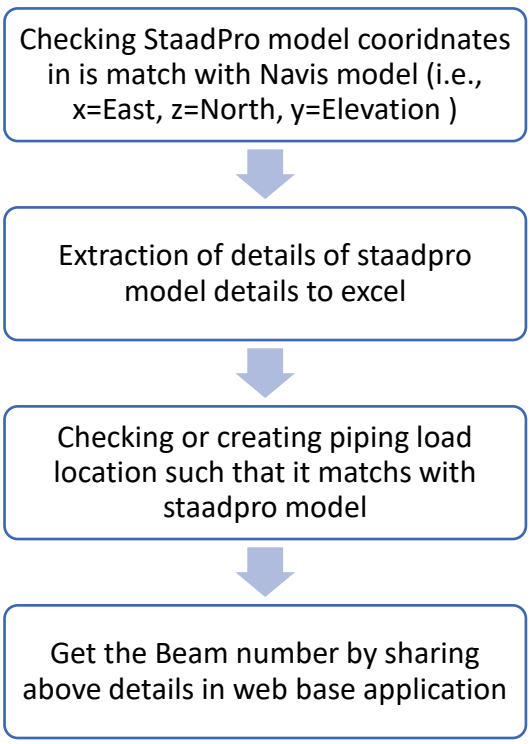
2.5 Technical & Data requirements

StaadPro model shall be prepared in such a way that coordinates of staad model (i.e., x,y,z) shall match navis model coordinates (North, East, Elevation).

Piping load location shall be in term of North, East & Elevation.

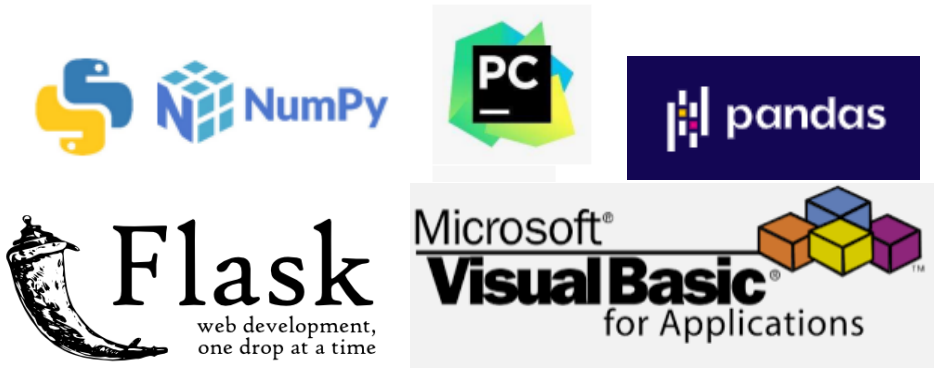
Dimensions are in SI unit.

2.6 Overall Process Flow-Chart



2.7 Tools Used

VBA & python programming language and frameworks as numpy, pandas, & flask.



- PyCharm is used as IDE.
- Heroku is used for deployment of model
- MongoDB is used to retrieve, insert , delete & update the database
- Front end development is done using HTML/CSS
- CircleCi is used as version control system

2.8 Assumption

Location of pipe support is more than 150mm away from a node in staad file. Staad file is properly model with consideration of northing and easting as given in navis model. This system can any detect point in +/-150mm around a beam of staad model.

2.9 ANNEXURE: Example Input File

Standard file format for piping load

A	B	C	D	E	F	G	H
	Location			Load Value			
Line no.	North (m)	East (m)	Height (m)	Fx (KN)	Fy (KN)	Fz (KN)	Friction coefficient
100-test	500	80	10	10	28	0	0.3
101-test	520	90	10	10	28	0	0.3
102-test	480	95	10	10	28	0	0.3