

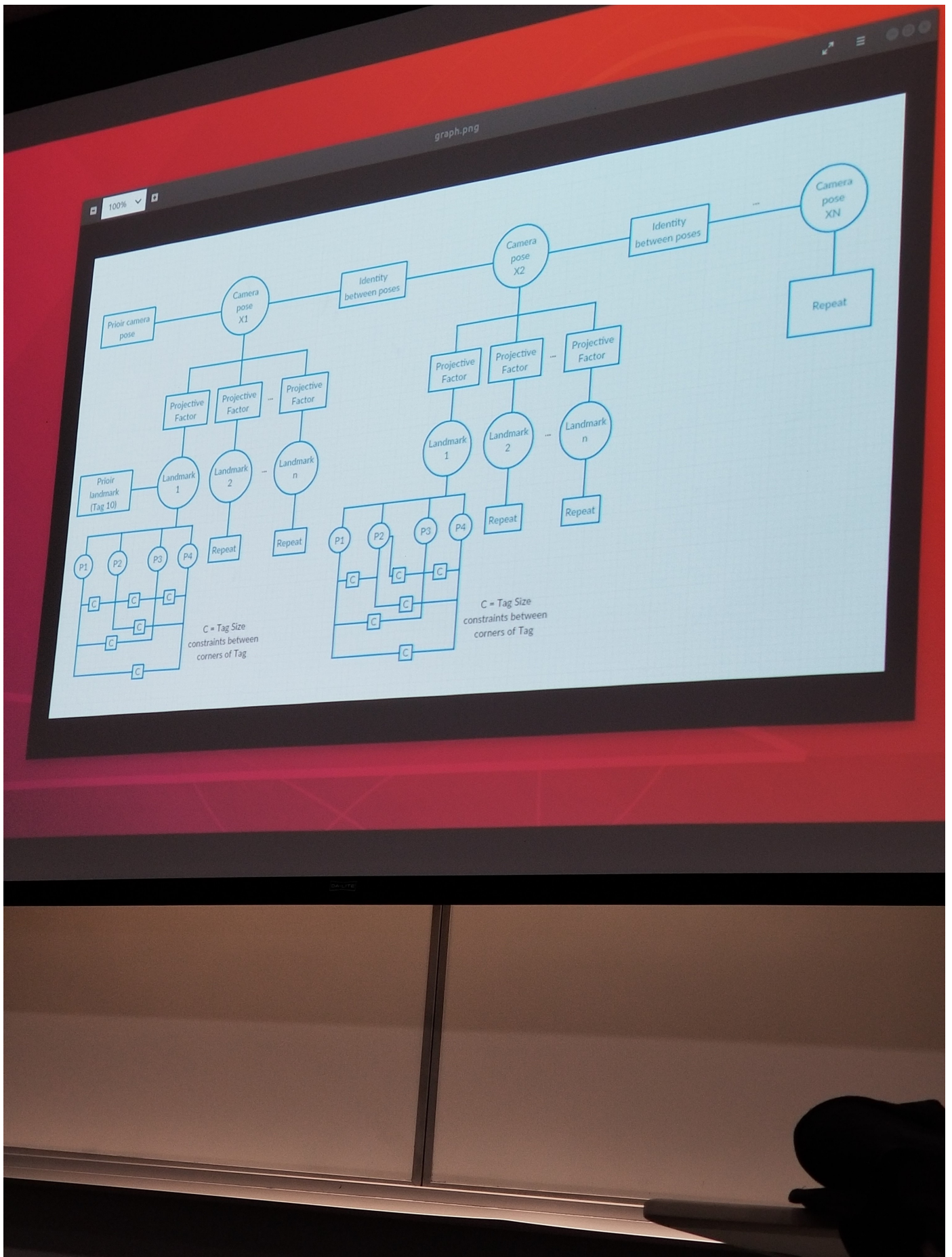
GTSAM Final Project

General Overview

- DetAll contains information from the device
 - IMU data - don't need it
 - April Tags - Image Locations
 - Images are just for reference - april tag locations are needed
- Final output should be a plot of april tags with relative location of the device plotted

GTSAM Overview

- Each time step become a section of the graph
 - Camera pose
 - n Projective Factors
 - n Landmarks- April tag corner points
 - Prior landmark (initially Tag 10)
 - Prior camera pose
- Factor graph details relationships - use it as a function



- Initialize odometry to 0 since the camera is slow

Get 3D Landmark Locations

- Have: location of corners, size of the tag in the world, assume tags are on plane $Z = 0$
- Can find world coordinates using a Homography
 - H between tag in image and tag in world (More in project notes)
 - $$\begin{bmatrix} u \\ v \\ w \end{bmatrix} = KH \begin{bmatrix} X \\ Y \\ Z \\ W \end{bmatrix}$$
 - $H = \begin{bmatrix} r_1 & r_2 & r_3 & T \end{bmatrix}$
- **MATLAB Functions for Estimating Homography** - Should be a Piazza post about it, 3rd party
- Know location of origin tag in world
- Homography between image tag and world tag origin
- Moves points from April Tag/Image plane to world system around chosen origin

Process

- Set 1st april tag to be origin of world
- H between location in world and location in image
- Calculate locations of all other tags in image relative to origin
- Do this for every frame in the data set
 - If world origin tag (ID=10) is not visible, use any tag that was visible in previous frame
- For each frame in data set, using all tag locations, use `estimateCameraPose()` to solve PnP problem
- Set up factor graph based on these measurements - refine estimate further