3D Reconstruction on an IMU enabled Mobile Device

Summer Undergraduate Research Award - 2015

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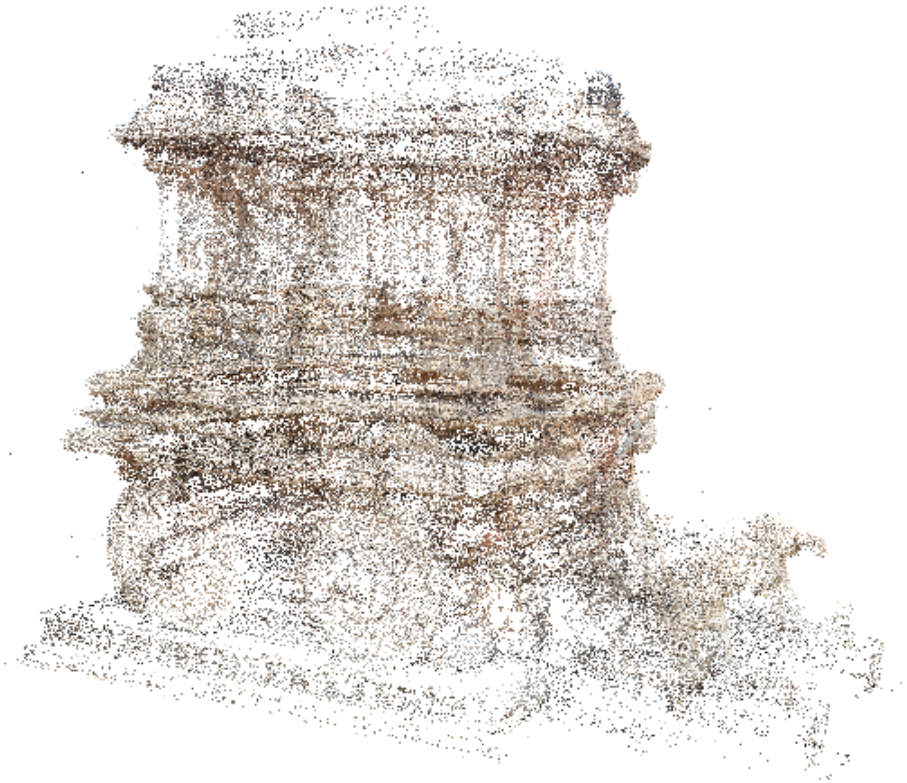
Objectives

3D reconstruction on an IMU enabled mobile device.

What is 3D reconstruction?



(a) Sparse reconstruction

(b) Dense reconstruction

3D reconstruction method

Intrinsic Camera Parameters

- Internal calibration matrix K is internal to the camera itself and is defined in terms of the camera focal length f and the principal points c_x and c_y defined as image centers in pixels.

$$\mathbf{K} = \begin{bmatrix} f & 0 & c_x \\ 0 & f & c_y \\ 0 & 0 & 1 \end{bmatrix} \tag{1}$$

3D reconstruction method

Extrinsic Camera Parameters

- External calibration matrix $[R|\mathbf{t}]$ constitute the rigid transformations viz. the rotation and translation between the camera coordinate system and the world coordinate system.

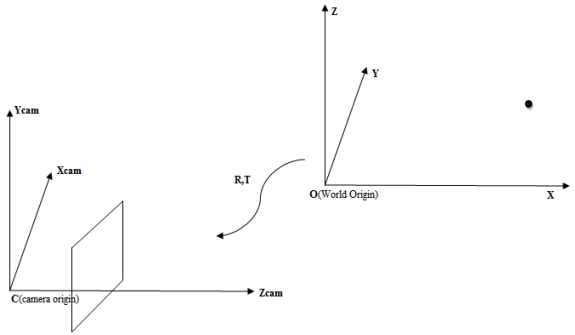


Figure : External calibration

- Together they form the projection matrix P

$$P = K[R|\mathbf{t}]$$

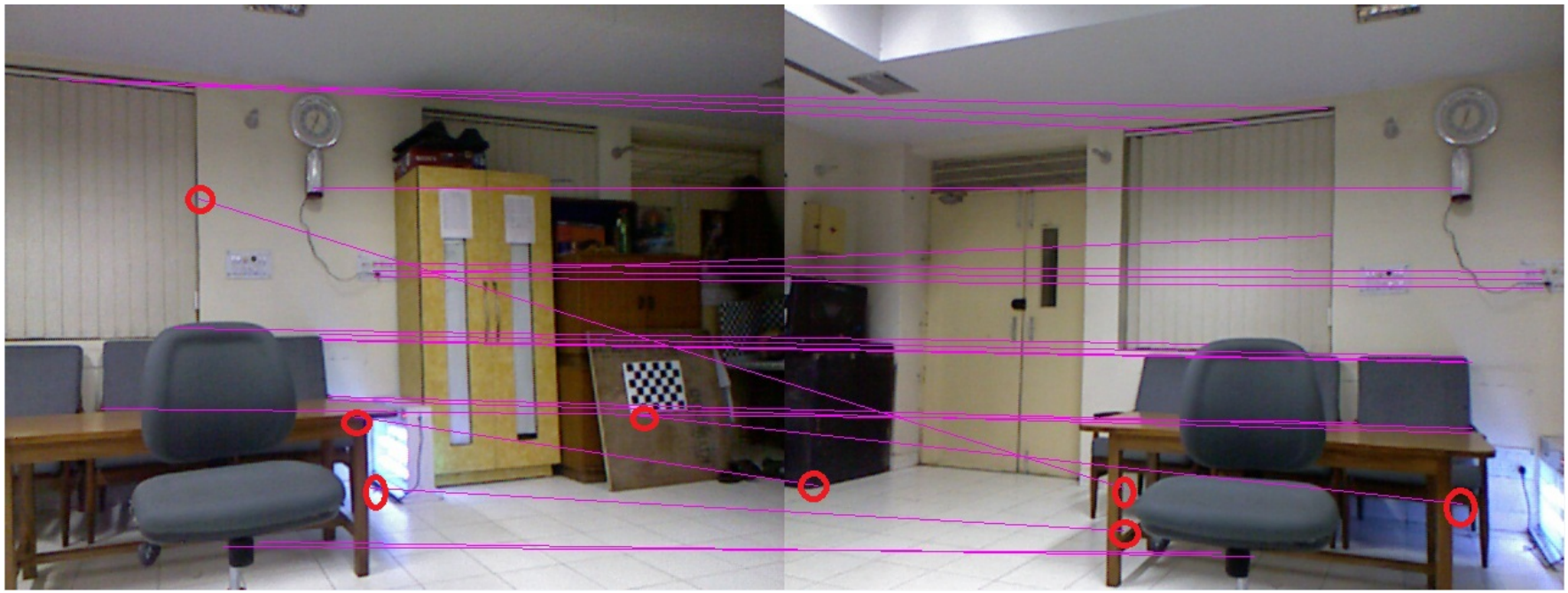
s.t.

$$\mathbf{x} = P\mathbf{X}$$

3D reconstruction method

Stereo Correspondance Generation

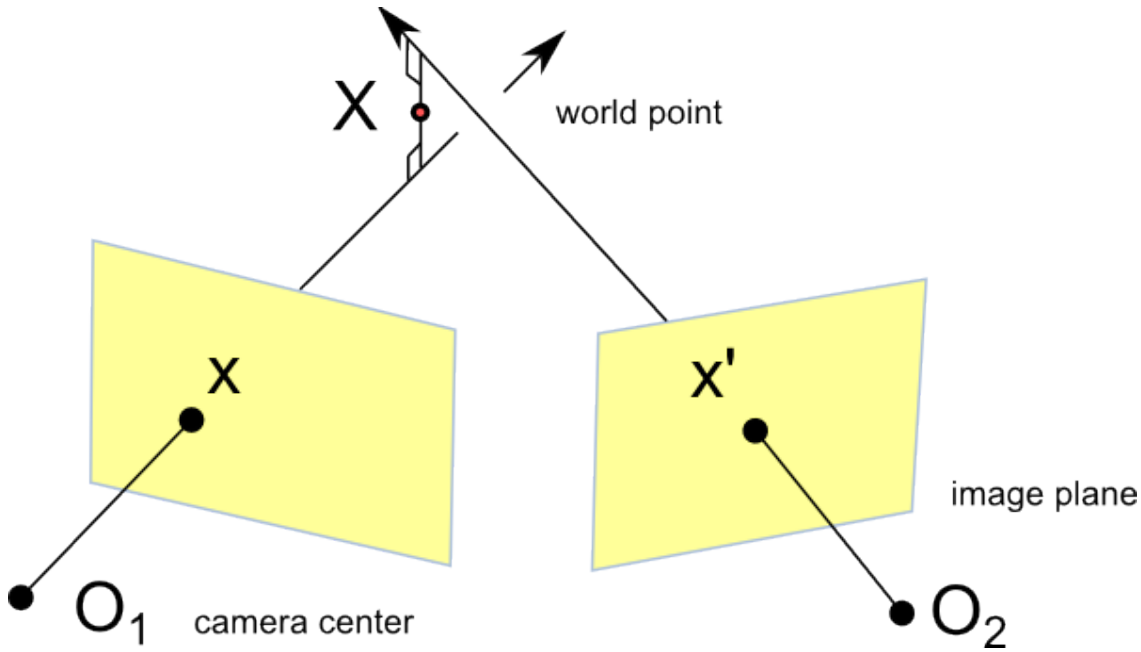
- Use image descriptors like SIFT for finding set of matching feature points $\mathbf{x}'$ and $\mathbf{x}$ in between a pair of images.



- Lots of false matches

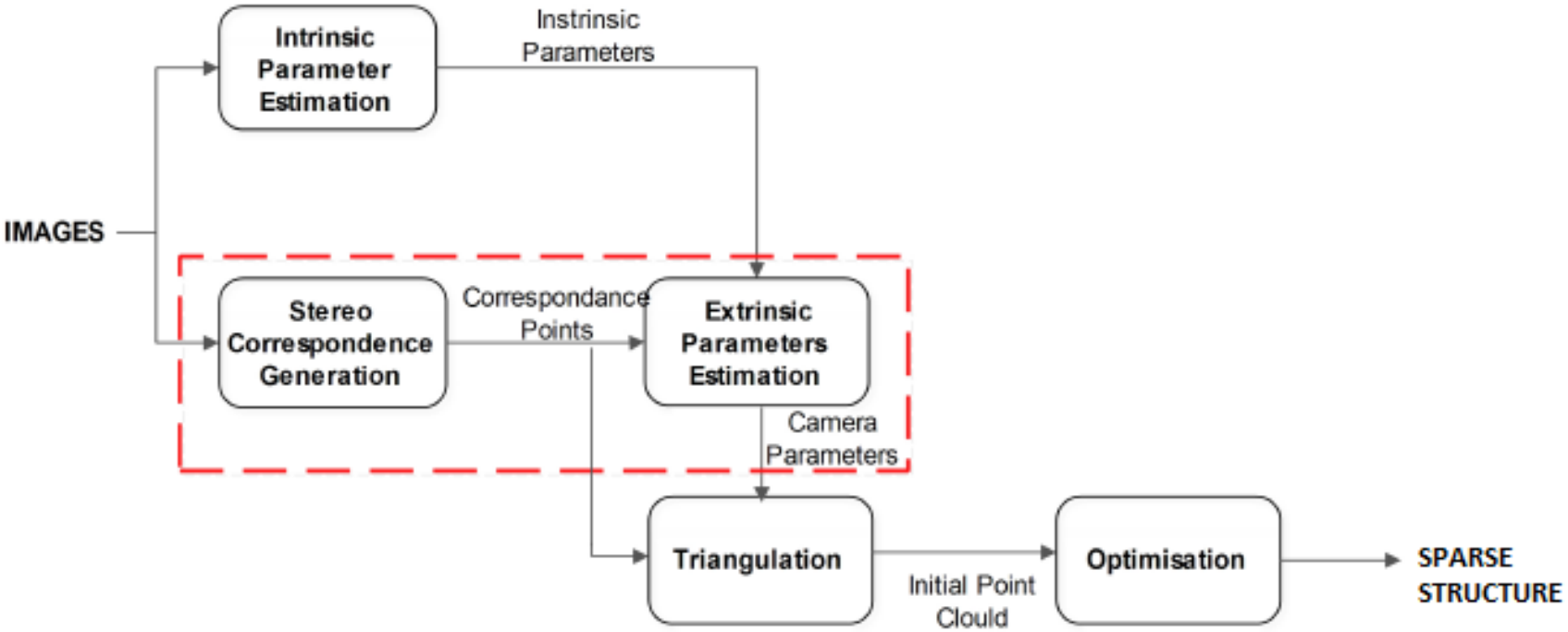
3D reconstruction method

Triangulation

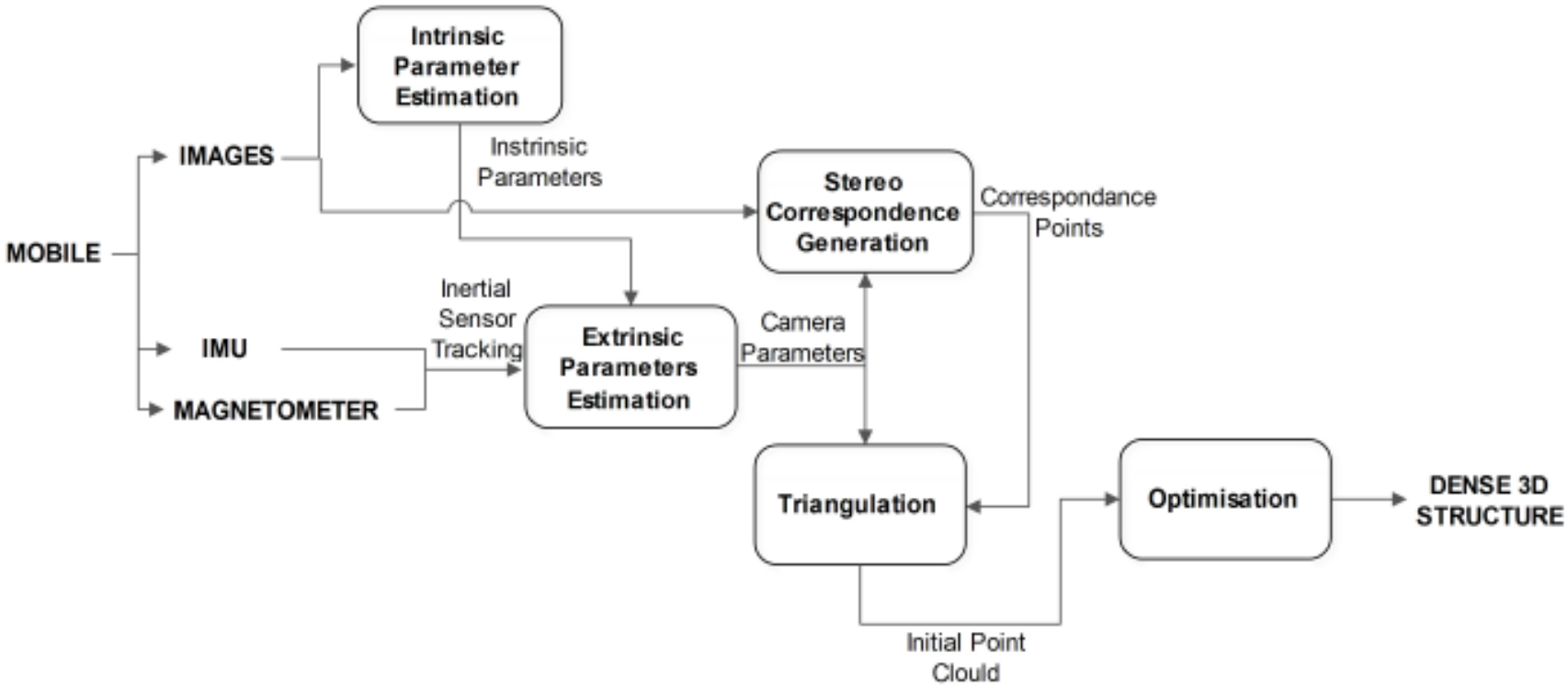


3D reconstruction method

Present Pipeline

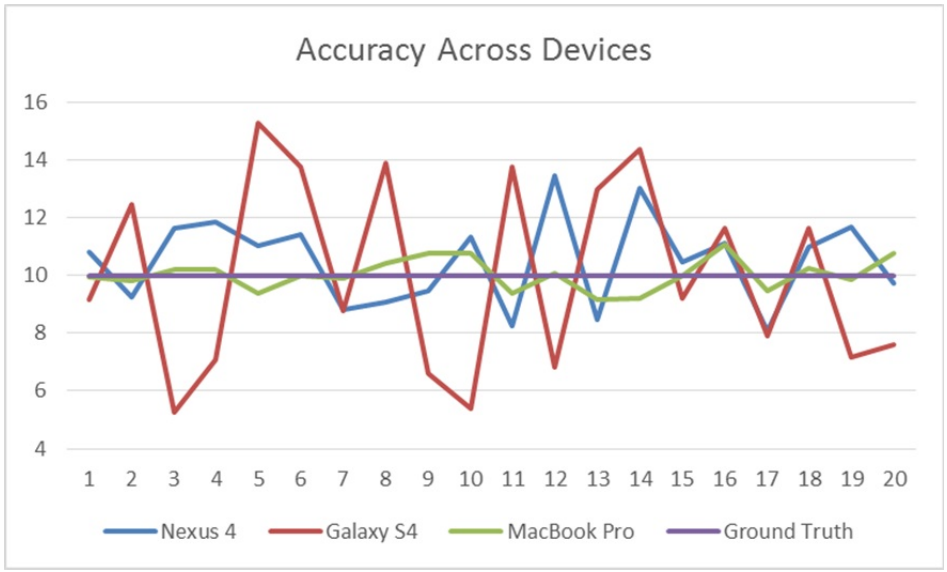


Proposed Framework

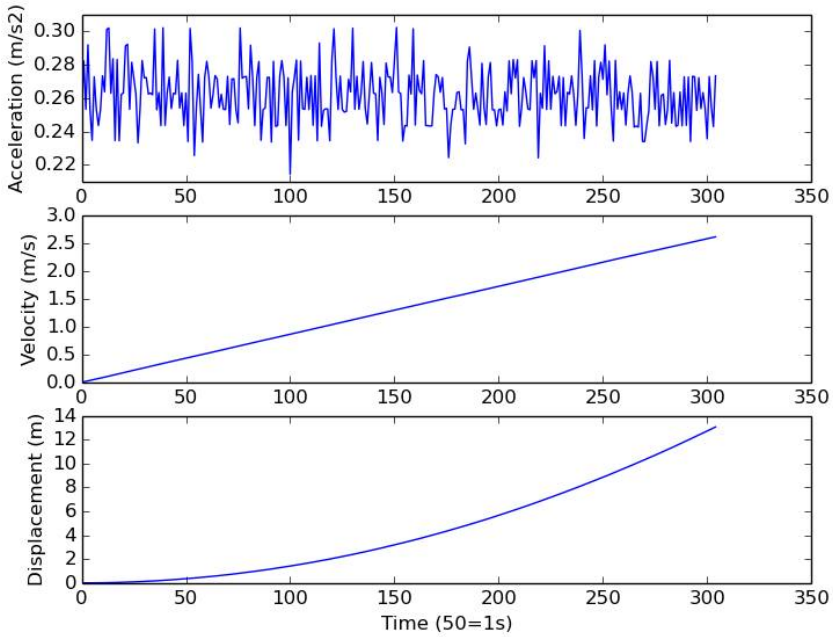


Phases of the Project

Our experience so far



(a) Accuracy of accelerometer data across different devices (scale cm)



(b) Obtaining velocity and displacement from static accelerometer data

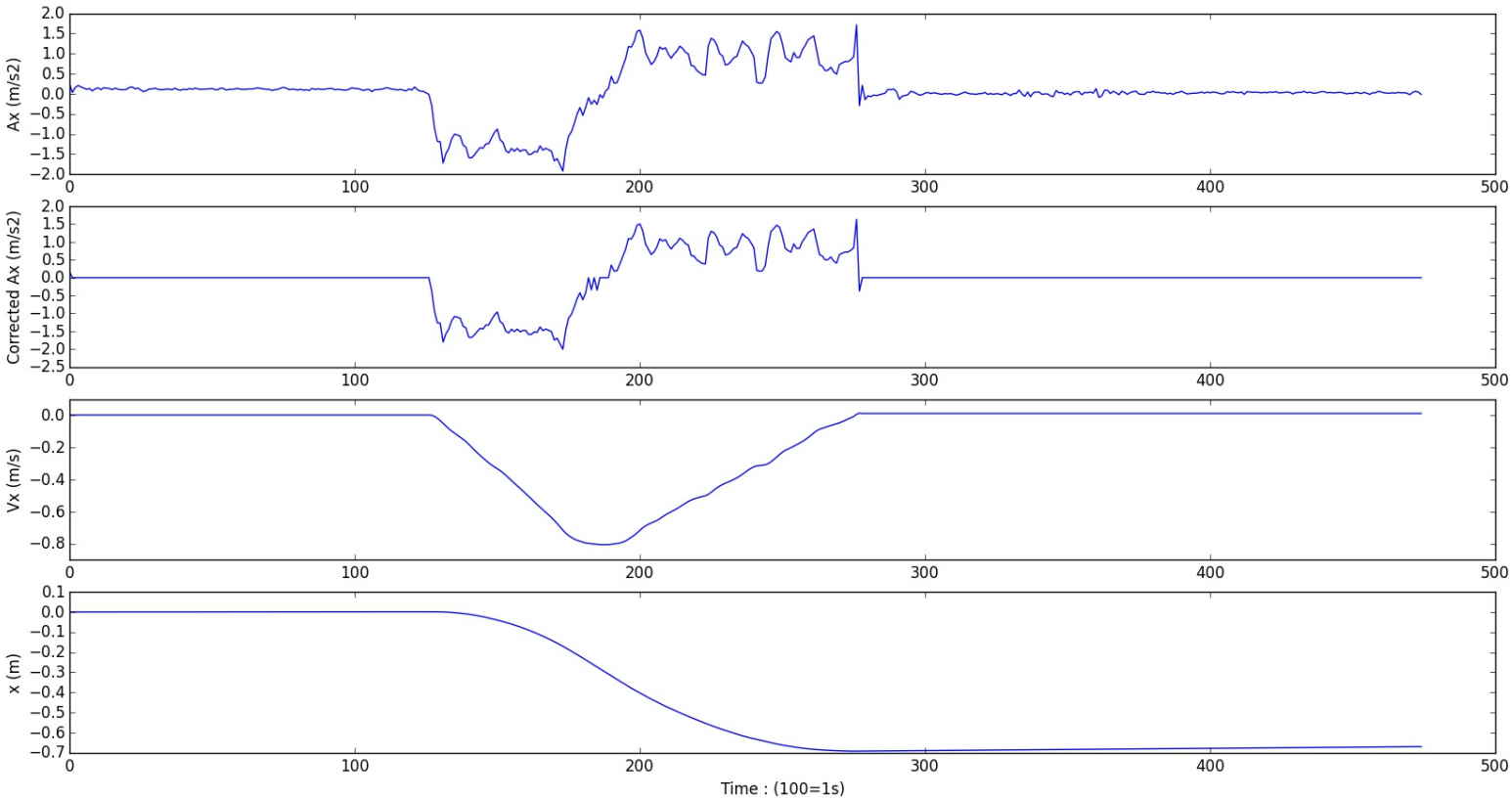


Figure : Applying smoothening techniques

More Applications

- Quick 3D printable file
- Field of medical science
- Archaeological application
- Localization of tourist sites

Budget

Budget

Rs. 25000 to purchase an android smart phone having high quality sensors and a high resolution camera.

Thank You

Second Slide Title

- First item.

Second Slide Title

- First item.
- Second item.

Second Slide Title

- First item.
- Second item.
- Third item.

Second Slide Title

- First item.
- Second item.
- Third item.
- Fourth item.

Second Slide Title

- First item.
- Second item.
- Third item.
- Fourth item.
- Fifth item.

Second Slide Title

- First item.
- Second item.
- Third item.
- Fourth item.
- Fifth item. Extra text in the fifth item.

Blocks

Block Title

You can also highlight sections of your presentation in a block, with it's own title

Theorem

There are separate environments for theorems, examples, definitions and proofs.

Example

Here is an example of an example block.

Summary

- The first main message of your talk in one or two lines.
- The second main message of your talk in one or two lines.
- Perhaps a third message, but not more than that.

- Outlook
  - Something you haven't solved.
  - Something else you haven't solved.

For Further Reading I


A. Author.
Handbook of Everything.
Some Press, 1990.


S. Someone.
On this and that.
Journal of This and That, 2(1):50–100, 2000.