Smart Phone Solar Tracker

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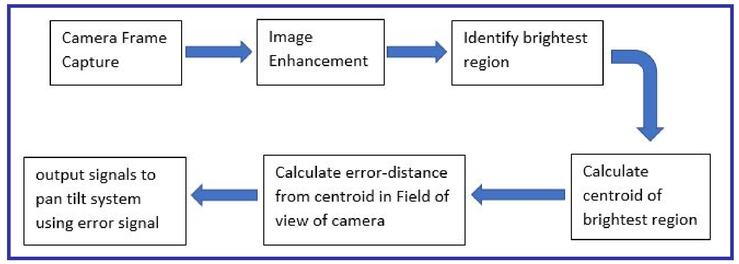
Introduction

- Our project utilizes a smartphone camera and an android application to track the sun's position.
- The motivation of this project is to have a self-sustainable system that can function in remote areas with no network access. The advantages of this project are its low cost and utilization of available resources.

Methods

Image Processing



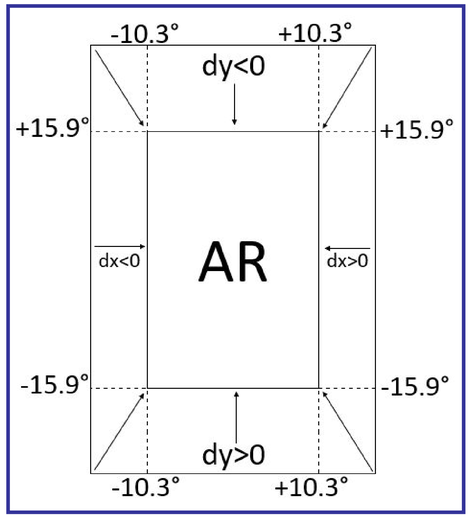
Brightest point found by the image processing algorithm

Android App

STEP 1 - Serial communication
- Via a UsbSerial driver library and OTG Cable, the Android phone scans for USB devices
- Once the pan/tilt is detected, instructions are sent

STEP 2 - Agnostic Search
- Pan/tilt sweeps the azimuth and zenith angles incrementally, searching for the light source

STEP 3 - Sun Tracking
- Once the light source is within scope, the program checks whether the light source is within the acceptable region (the middle 60% of the screen)



$$for\ dx > 0, velocity_{pan} = K_{pan} * dx$$

$$for\ dx < 0\ velocity_{pan} = K_{pan} * dx$$

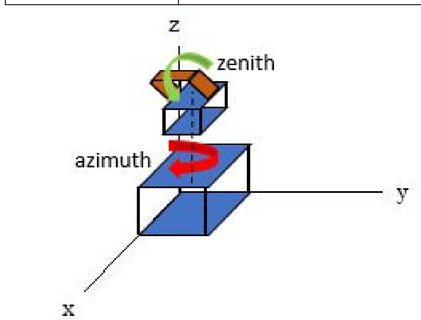
$$for\ dy > 0\ velocity_{tilt} = K_{tilt} * dy$$

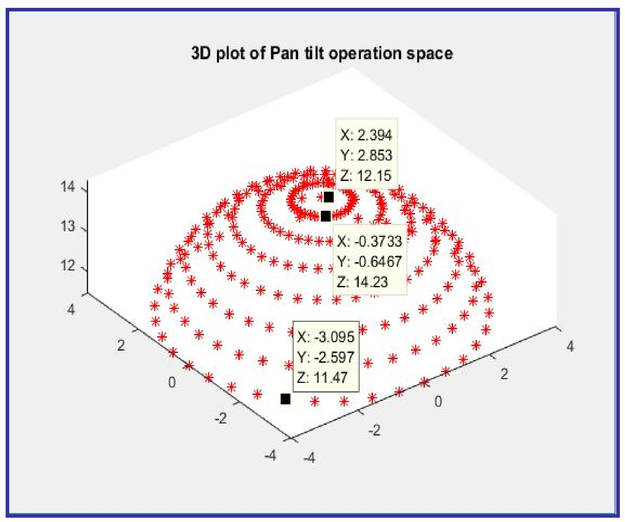
$$for\ dy < 0\ velocity_{tilt} = K_{tilt} * dy$$

Specifications

Specification	Proposed	Achieved
Dimensions (m)	0.38 * 0.38 * 0.38	0.36 * 0.24 * 0.25
Azimuth range*	0° - 330°	0° - 318°
Zenith range**	0° - 90°	0° - 120°
Pointing accuracy	±0.5°	~±5.1° azimuth ~±6.7° zenith
Operating System	Android 4.4 (KitKat) or above	Android 4.4 or above
Sensors	Ambient light sensor, Camera (> 5 MP), Accelerometer	Camera

Performance	Specification
Longest Search	~10 s
Tracking Error	maximum 266 pixel (different for other phones)





Future Work

- Reducing AR area to increase accuracy
- Generating optimal trajectory for motion of pan tilt system using centroid position on screen to reduce tracking time.
- Self powered system that can charge the phone and move the pan/tilt
- Using power output as a feedback to find optimal position