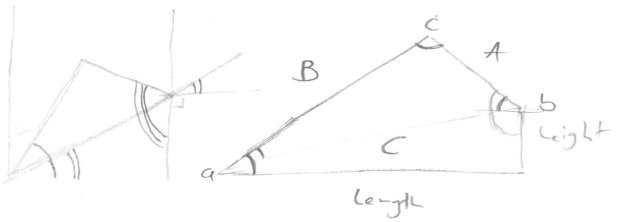
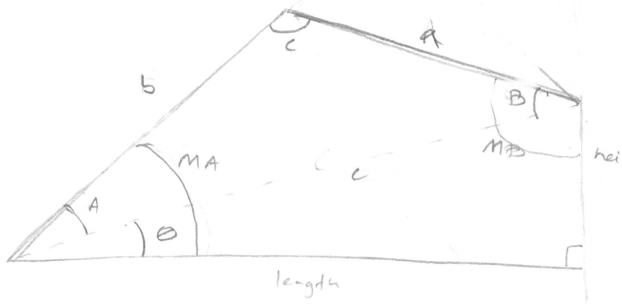
Maintaining Constant Height while changing length



known: (A, B)
measurable: a, C, b (iffy)
~~desired~~ target: length, height
need to find: C

a - angle from line B to floor
b - angle from line a to floor in terior



Law of Sines & Cosines

known: A, B
measured: a, c, b (possibly)
~~finding~~: C

$\frac{\sin A}{\cancel{A}a} = \frac{\sin C}{\cancel{C}c} \Rightarrow \cancel{\frac{A}{\sin A}}$

$C = \sin C \cdot \frac{A}{\sin A}$

finding ~~73~~ b

$\frac{\sin A}{\cancel{A}a} = \frac{\sin B}{\cancel{B}b}$

$b = \sin^{-1}\left(B \cdot \frac{\sin a}{A}\right)$

$\tan\theta = \frac{c}{a}$

Target angle MA = $\tan^{-1}\left(\frac{\text{height}}{\text{length}}\right) + a$.

length of C = $\sqrt{\text{height}^2 + \text{length}^2}$ or $C = \frac{\text{height}}{\sin\theta}$

or $C = \frac{\text{length}}{\cos\theta}$

$\cos A = \left(\frac{b^2 + c^2 - a^2}{2bc}\right)$

($\sqrt{\text{height}^2+\text{length}^2}$ = known; b known; c known; a ~~known~~ found)

& Finding Target angles:

MA given target height & length, lengths A & B

$MA = \theta + \alpha A \qquad \theta = \tan^{-1}\left(\frac{\text{height}}{\text{length}}\right)$

$\alpha = \frac{\sin A}{\cancel{A}a} = \frac{\sin B}{\cancel{B}b} = \frac{\sin C}{\cancel{C}c}$

given target height & length, $C = \sqrt{\text{height}^2 + \text{length}^2}$

finding angle c: ~~SAS~~

$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

OR $C = \cos^{-1}\left(\frac{a^2 + b^2 - (\text{height}^2 + \text{length}^2)}{2a \cdot b}\right)$

$MA = \tan^{-1}\left(\frac{\text{height}}{\text{length}}\right) + \cos^{-1}\left(\frac{b^2 + \text{height}^2 + \text{length}^2 - a^2}{2 \cdot b \cdot \sqrt{\text{height}^2 + \text{length}^2}}\right)$

$MB = \tan^{-1}\left(\frac{\text{length}}{\text{height}}\right) + \cos^{-1}\left(\frac{\text{height}^2 + \text{length}^2 + a^2 - b^2}{2 \cdot a \cdot \sqrt{\text{height}^2 + \text{length}^2}}\right)$

target angle $C = \cos^{-1}\left(\frac{a^2 + b^2 - (\text{height}^2 + \text{length}^2)}{2 \cdot a \cdot b}\right)$

Now to put this into code.....

Robot Arm:

↔ like a visual Basic "Class"

CREATING A STRUCTURE & Using it:

Stuff To store in it:

lengths of both "bones"/appendages/arms

~~current~~

~~etc~~

nest?
- motors ~~etc~~ ports used -
  - can refer to port directly, through name given in ~~motors~~ #pragma config (motors & sensors setup)
- motor encoder ports used
- calibration values
- gear ratios — CREATE A LIST of results!

nest?
- current length
- start length
- end length

nest?
- current coordinate (x, y)
- start coordinate (x, y)
- end coordinate (x, y)

Data Types

int — integer -1 ± 32767

(not usable) → ~~double — decimal, more accurate than float~~

float - floating-point. ~~not as accurate as double.~~

bool - boolean, t/f (true/false)

byte - number from -128 to 127

char - single character

float - decimal, can be larger than 1.

long - whole number ranging from ±2,147,483,648

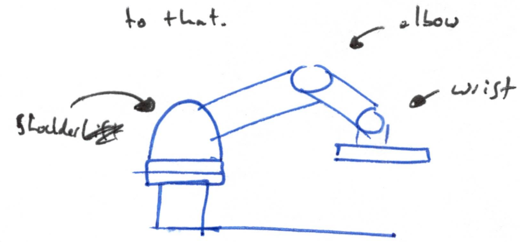
short - ~~is~~ like int

String - "LoL, what?"

+ Sensors

"standard" RobotC Sensors & pins.

if you set up a touch sensor as "bump" on dgtl1, then you can set a variable (integers work) equal to that.



motor control structure -
- encoder port
- motor port
- calibration value
- gear ratio
- ~~encoder value~~ → probably shouldn't do, shouldn't it need much updating.

arm length substructure
// — should I include math here?
// let's go with ~~yes~~.

From page on Maintaining Constant Height While Changing Length

☆ need a calibration function!

~~Target angle MA is can be found by~~

current angle MA can be found by getting the degrees from flat of the shoulder.