

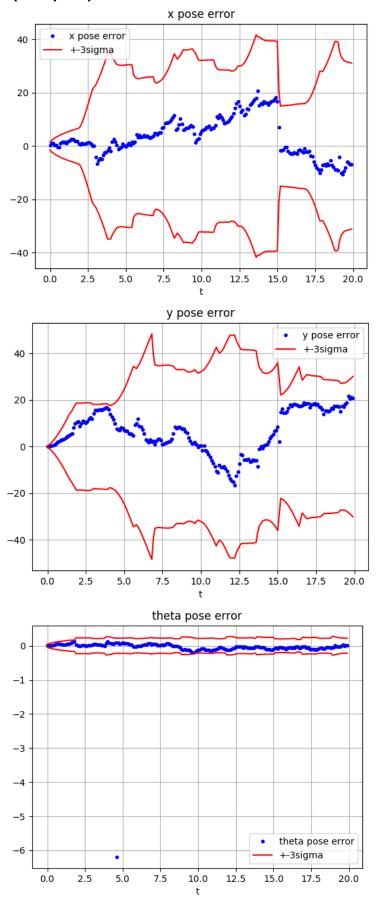
Perseption in Robotics Terms, 2022

considered in run.py $ G_{+} = \frac{\partial g(x_{+}, m_{+})}{\partial x_{+}} = 0 \delta_{1200} \cos(\theta + \delta_{200}) \Rightarrow G_{+} = 0 \delta_{100} \cos(\theta + \delta_{200}) $	ата	Nn Bt	Ср. Чт. Пт. Св. Ве	PS	2	
to the observation function, knowing that the parameter bearing _ std 15 its Standard description. 81	1					
to the observation function, knowing that the parameter bearing _ std 15 its Standard description. 81	A(15).					
to the observation function, knowing that the parameter bearing _ std 15 its Standard description. 81	11.1.1	1 1	1 11	0	0 //	111
to the observation function, knowing that the parameter bearing _ std 15 its Standard description. 81	1 Wate Il	re value je	or the cova	riance & of	the noise	- added
15 its Standard deviation. 81 'bearing stil', 82 type = Plant' 83 aution = Votore' 84 help = Diagonal of Standard deviations of Observations noise Q (2 help = Diagonal of Standard deviations of Observations noise Q (2 help = Diagonal of Standard deviations of Observations noise Q (2 help = Diagonal of Diagonal of Standard deviations of Observations noise Q (2 help = Diagonal of Diagon	1 11	- D				1 . 41
81 'bearing stal', 82 type = 'Plant' 83 action = 'Store' 84 help = 'Diagonal 03 Standard deviations of Observations noise Q (2 deput) = 0.35 \ help = 'Diagonal 03 Standard deviations of Observations noise Q (2 deput) = 0.35 \ help = 'Diagonal 03 Standard deviations of Observations noise Q (2 deput) = 0.35 \ radians [leace Q = [bearing std] = [0.35^2] = [0,1225] 2) Write the equation for the covariance R ₂ of the noise asked to the traps [sudion and their corresponding numeric values for the initial robot command] $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,00]$ $U = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = $	co we obser	varion junca	101 Knowing	that the par	came ber	earing _ Sug
81 'bearing stal', 82 type = 'Plant' 83 action = 'Store' 84 help = 'Diagonal 03 Standard deviations of Observations noise Q (2 deput) = 0.35 \ help = 'Diagonal 03 Standard deviations of Observations noise Q (2 deput) = 0.35 \ help = 'Diagonal 03 Standard deviations of Observations noise Q (2 deput) = 0.35 \ radians [leace Q = [bearing std] = [0.35^2] = [0,1225] 2) Write the equation for the covariance R ₂ of the noise asked to the traps [sudion and their corresponding numeric values for the initial robot command] $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,10,0]$. Find out the default values of alpha $U = [Toots, Oteans of tot_2] = [0,00]$ $U = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = [U,0] = [U,0]$ $U = [U,0] = [U,0] = $	is its of	1. I dovid	time			1
82 type = ! plost 8.3 cution = 'storic 8.4 cution = 'storic 8.4 help = 'Diagonal of Standard deviations of Observations noise Q (2 televal = 0.35 local and of Decaring std = 0.35 radians 1 herce Q = [bearing std] = [0.35^2] = [0,1225] 2) Write the equation for the covariance R_1 of the noise asked to the transform and their corresponding numeric values for the initial robot command $M = [0.001] = [0.10,0]$. Find out the default values of alpha $R_1 = [0.10,0] = [0.10,0]$. Find out the default values of alpha $R_2 = [0.001] = [0.10,0]$. Find out the default values of alpha $[0.001] = [0$	15 113 stan	dara almo	MON.			
82 type = ! plost 8.3 cution = 'storic 8.4 cution = 'storic 8.4 help = 'Diagonal of Standard deviations of Observations noise Q (2 televal = 0.35 local and of Decaring std = 0.35 radians 1 herce Q = [bearing std] = [0.35^2] = [0,1225] 2) Write the equation for the covariance R_1 of the noise asked to the transform and their corresponding numeric values for the initial robot command $M = [0.001] = [0.10,0]$. Find out the default values of alpha $R_1 = [0.10,0] = [0.10,0]$. Find out the default values of alpha $R_2 = [0.001] = [0.10,0]$. Find out the default values of alpha $[0.001] = [0$	211 1	hearing S	tel			
83 ciction = 1 store help = 1 Diagonal of Standard deviations of Observations noise Q (2 leavest = 1 Diagonal of Standard deviations of Observations noise Q (2 leavest = 1 Diagonal of Standard deviations of Observations noise Q (2 leaves = 0.35 radians leaves Q = [be aring std] = [0.35^2] = [0, 1225] 2) Write the equation for the covariance R_1 of the noise added to the traps function and their corresponding numeric values for the initial robot command $R = [0.05]$ $R =$	82 1	upe = ! Ploat!				
help = Diagonal of Standard delications of Observations noise Q (2) bearing std = 0.35 raddians Hence Q = bearing std] = [0.35°] = [0,1225] 2) Write the equation for the covariance R_{ij} of the noise added to the trues function and their corresponding numeric values for the initial robot command $N = [0.35]^{T} = [0,10,0]^{T}$. Find out the default values of alpha $R_{ij} = [0.35]^{T} = [0,10,0]^{T}$. Find out the default values of alpha $R_{ij} = [0.35]^{T} = [0.35]^{T}$	23	action - 'ctax	0 1			
Hence Q = [bearing std] = [0,35°] = [0,1225] 2) Write the equation for the covariance R_{ij} of the noise added to the trues function and their corresponding numeric values for the initial robot command $N = [S_{robt}, O_{trans}, S_{rot2}] = [0,10,0]$. Find out the default values of alpha $R_{ij} = [S_{robt}, O_{trans}, S_{rot2}] = [0,10,0]$. Find out the default values of alpha $R_{ij} = [S_{robt}, O_{trans}, S_{rot2}] = [0,10,0]$. Find out the default values of alpha $R_{ij} = [S_{robt}, O_{trans}, S_{rot2}] = [0,10,0]$. Find out the default values of alpha $R_{ij} = [S_{robt}, O_{trans}, S_{rot2}] = [0,10,0]$. Find out the default values of alpha $[S_{ij} = [S_{ij}] = [S_$	84	help = Diag	onal of Stand	and deviations	of Observations	noise Q (Za
Hence Q = [bearing std] = [0.35 ²] = [0,1225] 2) Write the equation for the covariance R_{+} of the noise added to the transformation and their cornesponding runneric values for the initial robot command $N = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}, O_{rot2}, O_{rot2}, O_{rot2}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, O_{tra$	PAST TO THE PAST	elimit = 0,	251	1		
Hence Q = [bearing std] = [0.35 ²] = [0,1225] 2) Write the equation for the covariance R_{+} of the noise added to the transformation and their cornesponding runneric values for the initial robot command $N = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. Find out the default values of alpha $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [0, 10, 0]^{T}$. $R_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, S_{rot2}]^{T} = [C_{rot}, O_{rot2}, O_{rot2}, O_{rot2}, O_{rot2}, O_{rot2}]^{T}$ $C_{+} = [C_{rott}, O_{trans}, O_{tra$			7	bearing_std	= 0.35 rd	dians
Write the equation for the covariance R_{+} of the noise added to the traps function and their corresponding numeric values for the initial robot command $M = L$ rots, decays σ rots $T = L_{0}, l_{0}, 0, 0, 0$. Find out the default values of alpha $R_{+} = L_{+} + $	11.	TO				
function and their corresponding numeric values for the initial robot command $ U = \begin{bmatrix} \nabla_{oot} & \nabla_{oot} &$	Tience W=	bearing 5	[d] = [0.50	= [0,1223		
function and their corresponding numeric values for the initial robot command $ U = \begin{bmatrix} \nabla_{oot} & \nabla_{oot} &$	2) Wzite	Il anten	1 H course	D 1 16	11.	1 1 1/4 /
$N = \begin{bmatrix} \sqrt{2} \cot t, \sqrt{2} \cos t, \sqrt{2} \cos t, \sqrt{2} \end{bmatrix} = \begin{bmatrix} 0, 10, 0 \end{bmatrix}. \text{ Find out the default values of alpha} \\ R_{t} = \begin{bmatrix} \sqrt{2} \cos t, $	4) 1	The equation	gor the cora	cance to you	e house agree	10 CM GLAMA
$N = \begin{bmatrix} \sqrt{2} \cot t, \sqrt{2} \cos t, \sqrt{2} \cos t, \sqrt{2} \end{bmatrix} = \begin{bmatrix} 0, 10, 0 \end{bmatrix}. \text{ Find out the default values of alpha} \\ R_{t} = \begin{bmatrix} \sqrt{2} \cos t, $	Luden an	I their imne	- diny umas	in water for	the initial role	It comment
$R_{+} = \begin{bmatrix} \lambda_{1} & \delta_{rot_{1}} + \lambda_{2} & \delta_{train} \\ 0 & \lambda_{3} & \delta_{train} \end{bmatrix} = \begin{bmatrix} 0 & \lambda_{1} & \delta_{rot_{1}} + \delta_{rot_{1}} \\ 0 & \lambda_{3} & \delta_{train} \end{bmatrix} = \begin{bmatrix} 0 & \lambda_{1} & \delta_{rot_{1}} + \delta_{rot_{1}} \\ 0 & \lambda_{2} & \delta_{rot_{1}} + \delta_{rot_{1}} \end{bmatrix} = \begin{bmatrix} 0 & \lambda_{3} & \delta_{1} & \delta_{1} \\ 0 & \lambda_{3} & \delta_{1$						
$R_{+} = \begin{bmatrix} \lambda_{1} & \delta_{rot_{1}} + \lambda_{2} & \delta_{train} \\ 0 & \lambda_{3} & \delta_{train} \end{bmatrix} = \begin{bmatrix} 0 & \lambda_{1} & \delta_{rot_{1}} + \delta_{rot_{1}} \\ 0 & \lambda_{3} & \delta_{train} \end{bmatrix} = \begin{bmatrix} 0 & \lambda_{1} & \delta_{rot_{1}} + \delta_{rot_{1}} \\ 0 & \lambda_{2} & \delta_{rot_{1}} + \delta_{rot_{1}} \end{bmatrix} = \begin{bmatrix} 0 & \lambda_{3} & \delta_{1} & \delta_{1} \\ 0 & \lambda_{3} & \delta_{1$	11 = 1 0 mote	8 3 10	= [0.10.0]	Find out the	delault val	es of alpha
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	H .	-				1
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	n 2,0	not + Le dere	0		0	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	K+=			-, 52		2=0,001
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		O	2 trun + 2 410	roti + Crot21	0	1
Relations of the Jacobians $(r, \sqrt{t}, t$		0		1 1 2	1/52	~3=0,03
Relaxions for the Jacobians G_{t} ,		U		1 2012	+ ~ 2 tran	Ly=0,01
Then derive the equations for the Tacobians (r_t, V_t, H_t) and evaluation at the initial mean date $[m_t = [x, y, \theta]^T = [180, 50, 0]^T$ as it considered in run.py $G_t = \frac{1}{2} (x_{t-1}, m_t) = 0$ $1 = 0$ 1	n ı	0.05.0+	0 001.102 0	0	7 6.000	
Then derive the equations for the Jacobians G_{t} , V_{t} , H_{t} and evaluation at the initial mean state $M_{t} = [x, y, \theta]^{T} = [180, 50, 0]^{T}$ as it considered in tup. py $G_{t} = \frac{\partial g(x_{t-1}, m_{t})}{\partial x_{t-1}} = 0$ I Stron $\cos(\theta + \delta_{root})$ $G_{t} = \frac{\partial g(x_{t-1}, m_{t})}{\partial x_{t-1}} = 0$ I Stron $\cos(\theta + \delta_{root})$	K	=		1 1		
3) hen derive the equations for the Jacobians G_t , V_t , H_t and evaluation at the initial mean state $M_t = [x, y, \theta]^T = [180, 50, 0]^T$ as it considered in tup. py $G_t = \frac{\partial g(x_{t-1}, M_t)}{\partial x_{t-1}} = 0$	Clarida, 23,0	24 0	0,05.10+0	01(0+0) 0	= 0	0,25
3) hen derive the equations for the Jacobians G_t , V_t , H_t and evaluation at the initial mean state $M_t = [x, y, \theta]^T = [180, 50, 0]^T$ as it considered in tup. py $G_t = \frac{\partial g(x_{t-1}, M_t)}{\partial x_{t-1}} = 0$				2 2 2	2 1 0	
3) hen derive the equations for the Jacobians G_t , V_t , H_t and evaluation at the initial mean state $M_t = [x, y, \theta]^T = [180, 50, 0]^T$ as it considered in tup. py $G_t = \frac{\partial g(x_{t-1}, M_t)}{\partial x_{t-1}} = 0$	$H_{i}H_{j}$	0	V	0,05 +0 +0	1.10	0 0,0001
them at the initial mean state $M_1 = [x, y, \theta]^T = [180, 50, 0]^T$ as it considered in zun.py $ \begin{bmatrix} 0 & -\delta_{tran}\sin(\theta + \delta_{root}) \\ -\delta_{t} & -\delta_{tran}\sin(\theta + \delta_{root}) \end{bmatrix} \Rightarrow \begin{bmatrix} -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} \\ -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_{t} & -\delta_$	2) The do	the or	water len to	Taliane	CVA	and evalue
considered in tup.py $G_{+} = \frac{\partial g(x_{+}, m_{+})}{\partial x_{+}} = 0 \delta_{tran} \cos(\theta + \delta_{roc}) \Rightarrow G_{+} = 0 \delta_{tran} \cos(\theta + \delta_{tran}) \Rightarrow G_{+} = 0 $	3/ Then ac	rue in	marions you a		titi	
considered in tup.py $G_{+} = \frac{\partial g(x_{+}, m_{+})}{\partial x_{+}} = 0 \delta_{tran} \cos(\theta + \delta_{roc}) \Rightarrow G_{+} = 0 \delta_{tran} \cos(\theta + \delta_{tran}) \Rightarrow G_{+} = 0 $	them at	the initial	mean state	m= Tx, 4, 6	77 = [180 5	ool as it
$G_{\pm} = \frac{\partial g(x_{\pm 1}, m_{\pm})}{\partial x_{\pm 1}} = 0 \delta_{12001} \cos(\theta + \delta_{2001}) \Rightarrow G_{\pm} = 0 \delta_{1001} \cos($,		1.1.	1 /	
$G_{\pm} = \frac{\partial g(x_{\pm 1}, m_{\pm})}{\partial x_{\pm 1}} = 0 \delta_{12001} \cos(\theta + \delta_{2001}) \Rightarrow G_{\pm} = 0 \delta_{1001} \cos($	considered	In Tun. Py	9 5	C 1		
$G_{\pm} = \frac{\partial g(x_{\pm 1}, m_{\pm})}{\partial x_{\pm 1}} = 0 \delta_{1200} \cos(\theta + \delta_{2001}) = \delta_{\pm 21} = 0 10$			[1 0 -0	sin(0+0root)		0 0
02,	1 09	(x, , m,)	5		=> Gt	10
0 X t-1 me 0 0 1	G, = -		= 0 1 0	1204 COS (A 1 0 2001		1 10
		O Xty ma	21 0 0			0 0 1

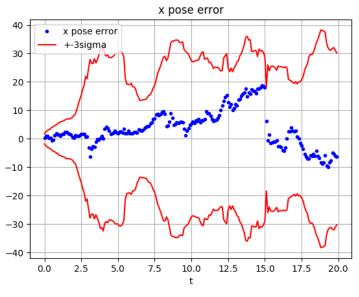


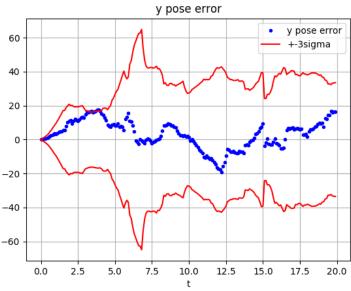
V = F	28(x,,)	m+)	trang Sir	(O + Szot)	cos (0 + 0 20	(t) 0	
+ 4	0 me	5,	zan · Cos	$(\theta + \delta_{rot})$ $(\theta + \delta_{rot})$	Sin 10 + 82	0	
			1		0		
V = 0	1 0		347	2) I The		1	
10	0 0	1, 1		1 = 2	7 , -	Mx-72 -1	
	0 1		0 10		- W	y My p	
		9 =	(AT - 4)	$^{2}+(m_{x}-x)$	The state of		
	2 h(x,)	11/	ny-4	_ /nx - 2		Mz-50	
// _t =	3x4		9	9	-11-1	(my 50)2 1/mx	130)
9/=	(m = 1,)	2 + (m, -)	2				
1	(1"4 71	(/12 44					
H =	my - 5	50		m - 180		7	
-	The state of the s) + (mz-	180)2/	mz - 180	(m -10 -)	- -	
	97	11/2		11124 30	(/"x 100/		

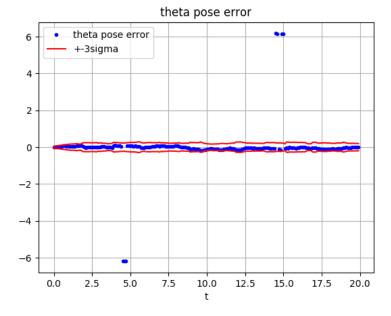
Task C. (20 pts) Extended Kalman Filter



Particle Filter



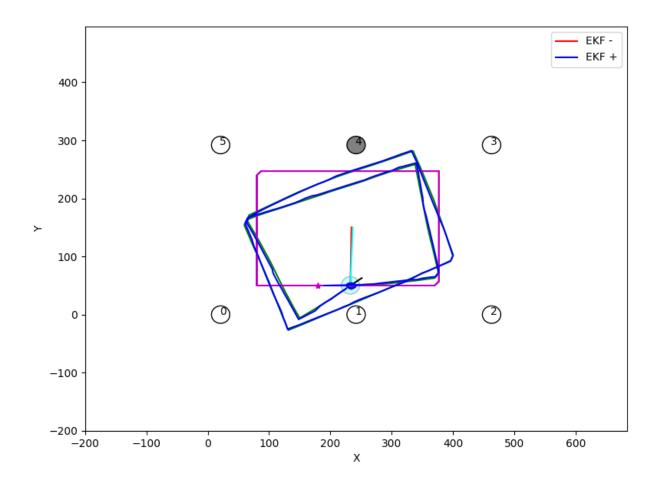


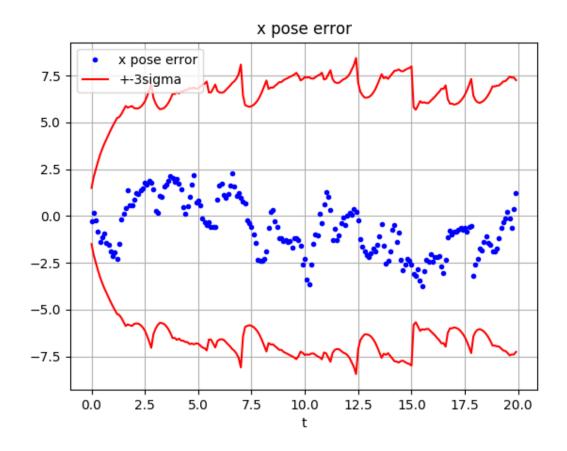


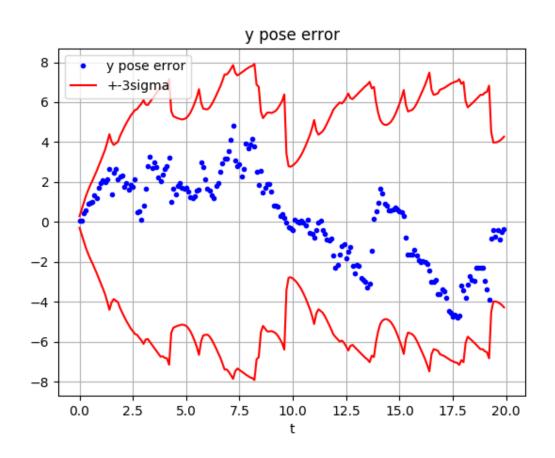
Seems like for both EKF and PF x and y state errors lie right in +-3 sigma uncertainty bounds. But for theta state errors we observe several outliers. Not that much, and this is an acceptable event (assuming Gaussian statistics).

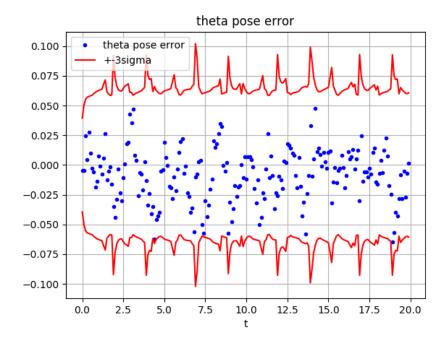
Task D. (15 pts)

- 1) For EKF let's analyze two sources of noise: Sensor noise (Q matrix) and Motion noise (R matrix). We want to investigate filters behavior as the noise goes toward zero.
 - Sensor noise reduction (Q 100 times smaller)
 Noise reduction leads to the reduction of sensor uncertainty (the covariance ellipsoid collapses). So we consider the sensor to be more accurate. Hence we get more accurate precise results trajectory (no errors between Ground truth and EKF+). Robot finds out his true positions



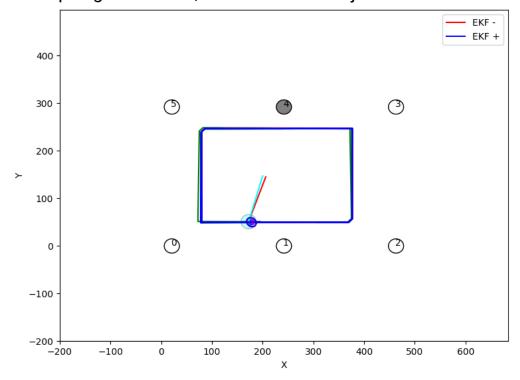


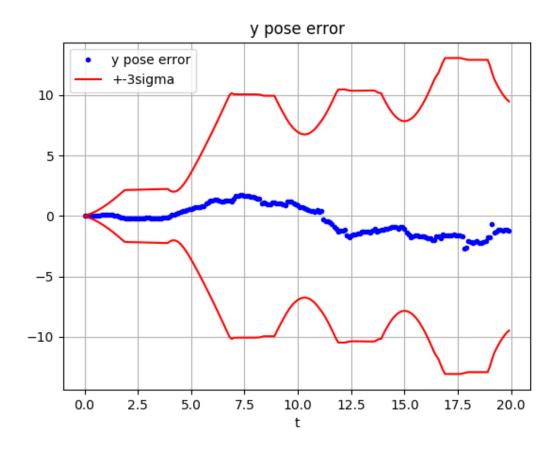


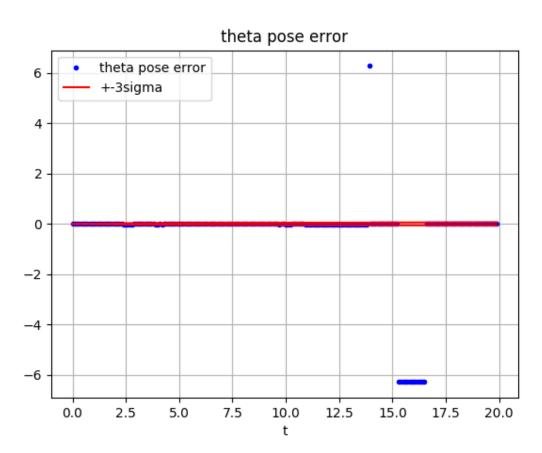


2. Motion noise reduction (R 100 times smaller)

Motion noise reduction means that a robot's motion should be executed in a more accurate way without any shifts. Reconstructed trajectory (EKF-) becomes much closer to the ground truth. And EKF+ itself becomes closer to the Ground truth (because of accurate motion measurements). Hence we get almost absolute overlap in ground truth, EKF- and EKF+ trajectories.

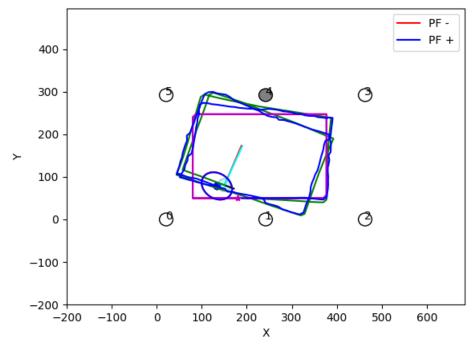




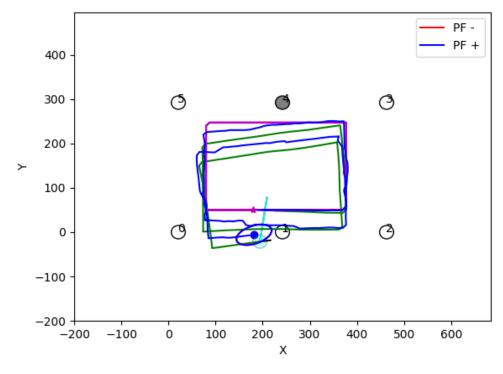


Thus, no matter what the noise is, its reduction leads to an increase in the accuracy of the EKF.

2) Let's investigate how do PF behave as the number of particles decrease:



N_particles = 400



N_particles=100

The more particles you have the better approximation you get. Less particles leads to worse precision of localization.

3) If the filter noise parameters underestimate or overestimate the true noise parameters? Please clarify what underestimation and overestimation of noise is?

Underestimated true noise parameters means that state errors are out of 3 sigma bounds of uncertainty. So filter become biased from true, since it is more certain and there are a lot of pretty close to true states out of bounds.

Overestimated true noise parameters means that we consider 3 sigma bounds to be much bigger than they should be. Less biased, but more state errors are inside of uncertainty bounds.

Both problems lead to the lack of accuracy in localization.