1-kalman filter:

- What is kalman filter?

. is an algorithm that uses a series of measurements observed over time, containing statistical noise and other inaccuracies, and produces estimates of unknown variables that tend to be more accurate than those based on a single measurement alone, by estimating a joint probability distribution over the variables for each timeframe.

.The algorithm works in a two-step process. In the prediction step, the Kalman filter produces estimates of the current state variables, along with their uncertainties. Once the outcome of the next measurement (necessarily corrupted with some amount of error, including random noise) is observed, these estimates are updated using a weighted average, with more weight being given to estimates with higher certainty. The algorithm is recursive. It can run in real time, using only the present input measurements and the previously calculated state and its uncertainty matrix; no additional past information is required.

. Extensions and generalizations to the method have also been developed, such as the extended Kalman filter and the unscented Kalman filter which work on nonlinear systems. The underlying model is similar to a hidden Markov model except that the state space of the latent variables is continuous and all latent and observed variables have Gaussian distributions. Also, Kalman filter has been successfully used in multi-sensor fusion, and distributed sensor networks to develop distributed or consensus Kalman filter.

To explain more about it and its calculations :.

-read

https://www.bzarg.com/p/how-a-kalman-filter-works-in-pictures/

-watch

https://www.youtube.com/watch?v=2R38dt0DyaU

-Applications:

1- 3D hand tracking using Kalman filter in depth space:

* أولا kalman ما هو الا حسابات معتمدة علي مجموعة قياسات للنقطة اللي بتتحرك فبالتالي انا محتاج حاجه تحددلي موضع النقطه اللي انا هشتغل عليها وهأخذ النتيجه وادخلها لل filter وهو هيطلع الحركة بتاعه النقطة ديه في المثال ده استخدم TOF camera "ديه من مميزاتها انها بتحسب الdepth بتاع الصورة" وبأخذ من خلالها رقم معين الصور اللي بتحدد النطة اللي انا عاوزها ديه اتحركت ازاي خلال الفترة ديه وبعدها بيجمع الصور ديه ويطلعلي حاجه اسمها motion image وبيعمل عليها filtering عشان يقلل ال noise وبعدها بيحسب حسابات kalman filter .

-the article:

https://link.springer.com/article/10.1186/1687-6180-2012-36

-TOF "Time-of-flight" camera

https://en.wikipedia.org/wiki/Range_imaging#Time-of-flight

2- Long Short-Term Memory Kalman Filters: Recurrent Neural Estimators for Pose Regularization

مفهمتش اوى الجزء ده بس كل تعاملاته مع RNN وان ال long short term ده عبارة عن part من ال NN وانه بيستخدم kalman عشان يعمل optimize . وده اللي لقيته عن الموضوع .

- https://deepai.org/publication/continual-learning-in-deep-neural-network-by-using-a-kalman-optimiser

- http://openaccess.thecvf.com/content_ICCV_2017/papers/Coskun_Long_Short-Term_Memory_ICCV_2017_paper.pdf

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3- Model-Based Hand Tracking Using an Unscented Kalman Filter:

هنا كل اللي جيه ال KF algorithms

https://drive.google.com/open?id=1NSCLS8WMNM_FSB6fnaMfOM-TwMq1H1RC

4- Implementation of an Extended Kalman Filter for optical motion capture with real–time 3D visualization

هنا معتمد علي IR cameras عشان يحدد الحركه لكل نقطه في الجسم.

https://drive.google.com/open?id=1KnvT17-duilEqDfLaaRfsGLhw0iO_OVq

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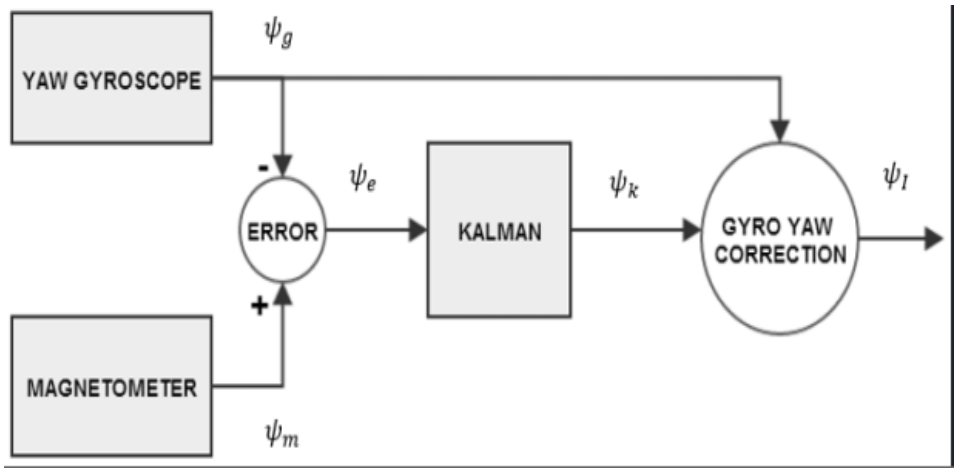
-kalman filter with IMU :

نفس الكلام وظيفه ال IMU sensor انه يحدد ال positions وال kalman filer هيستخدم القيم اللي هتطلع من ال sensor في حساباته ويعمل tracking للحركة.



- https://www.researchgate.net/publication/261038357_Embedded_Kalman_Filter_for_Inertial_Measurement_Unit_IMU_on_the_ATMega8535
- https://www.instructables.com/id/Guide-to-gyro-and-accelerometer-with-Arduino-inclu/

*وده مثال له بال sourse code بتاعه

- https://www.youtube.com/watch?v=p8H2-vkUM0I
- https://github.com/danicomo/9dof-orientation-estimation