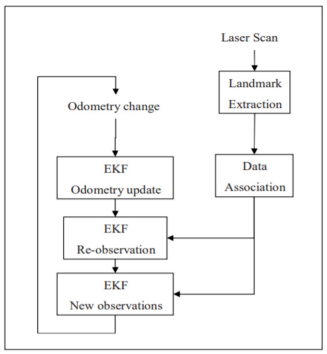
Ideation, Principles and explanations

Tuesday, June 1, 2021 7:51 PM

Working of SLAM: Why are we using it, what does it do and over all what does it help us accomplish:

1) The go to opening here will be the ability to map a locale.
2) Cameras, or in this our case a webcam using a keras model will be taking upto 90 images a second, and by coupling it with lidar, we will be able to gauge distances.
3) The map is built using a set of relative points. It tries to measure how far it has gone relative to its previous location on the map
4) One more sensor that is of use here is an odometer, this takes into account the rotation of a the bot's wheel or by using inertial measurement units, to gauge speed and acceleration.
5) Now all of this is fed into a Kalman filter algorithm, that will take all this sensor data and put it through a process called sensor fusion.



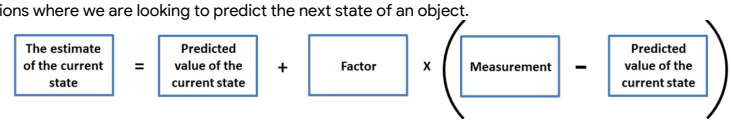
Monocular Slam:
Slam algorithms are algorithms that simultaneously tracks the movement of the camera (usually mounted onto a robot/car/etc.) and create a point cloud map of the surroundings that they passed. They create a map of the surroundings and localize them self within this map

From <https://medium.com/@j.zijlmans/lsd-slam-vs-orb-slam2-a-literature-based-comparison-20732df431d>

The **Extended Kalman Filter** (EKF): This is the tool stated in the SLAM model. The EKF is a prediction model first and foremost. It works on trying to predict the future state of an object in motion based on its current location.

The EKF works on the basic statistics ideas of mean, variance, deviation and the probability distribution function of a normal distribution. Using these statistical tools, we come up with a set of 5 equations known as the Kalman equations where we are looking to predict the next state of an object.

1)



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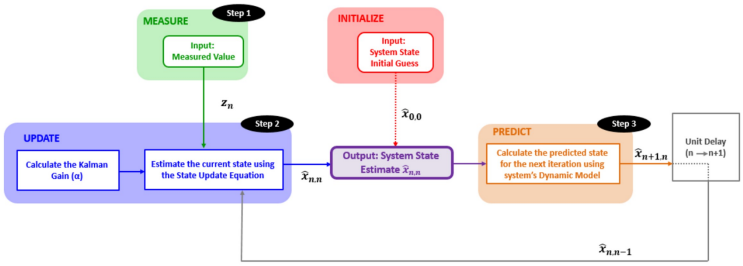
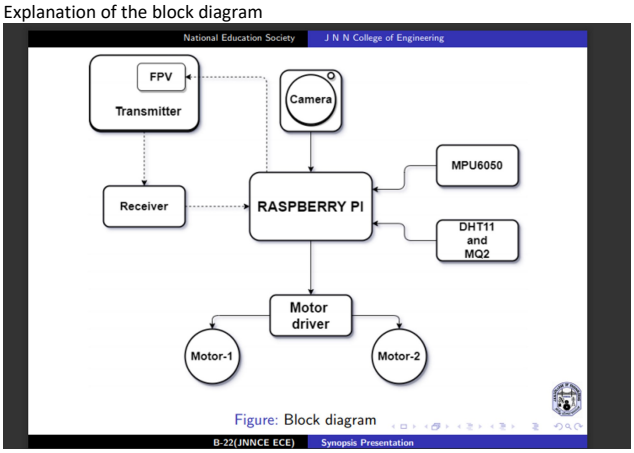


The above is the estimation equations that are used in EKF, where through a series of iterations of gain to a formula we are able to get close to the expected value.

3) Use of α-β filters for trying to find out the measurement factors and deviations
4) And also α-β-γ filters are considered.
5) For further explanation and understanding visit www.kalmanfilter.net , applies to all 3 geniuses.

Explanation of the block diagram



Raspberry pi is the computing, processing and decision making unit of the system. It is interfaced with a multiple cameras to provide stereo vision capability to help in sensing depth to objects and to more accurately map its surroundings. It will be linked to an MPU6050 gyroscope to balance the bot through a feedback loop with PID values. The camera footage is transmitted to a remote system via what? Receiver is used to receive commands from humans to direct surveying, identification, or providing more detailed maps by directing the bot to move to a certain location within its FOV. The raspberrypi is connected to a motor driver that is in turn connected to two motors.

The sensors used, in this block diagram are the DHT11 and MQ2, which are responsible for sensing humidity, temperature and gas leakage issues. But, the sensors can be configured as per requirements, say for surveying, the a LiDAR can be used, or if the bot is present in search and rescue ops an infrared camera can be attached to aid in faster identification of people.

Methodology explanation:

1) Ensuring the bot remains in a stable position. This is achieved by continuously monitoring MPU6050's relative angular position as compared to it's stable position, the change is counteracted by moving the bot by in the direction of angular position change and regaining stability.
2) The bot should be able to transmit images and video feed and receive instructions as to what to be explored, making its decision making system semi-autonomous
3) Transmit data generated by sensors to the required system/ground station/etc.