Model Predictive Control (MPC) is a control methodology that uses a model of the system to predict future behavior and optimize control actions. In the context of this diagram, the model predictive control algorithm takes as input the reference signal and the current state estimate $\hat{x}(k)$, and outputs the control signal $u(k)$.

The algorithm works by predicting the system's response to a sequence of control actions $[u(k), u(k+1), \ldots, u(k+w)]$ for a prediction horizon $w$. The predicted outputs $\hat{y}(k)$ are then compared to the actual outputs $y(k)$, and the difference is used to update the state estimate $\hat{x}(k)$.

The state estimate is then used to calculate the optimal control signal $u(k)$, which is applied to the actuators to control the plant. The sensors measure the plant's response, which is then compared to the reference signal to generate the feedback signal for the next iteration of the control algorithm.

The extended Kalman filter (EKF) is used to estimate the state of the system and to update the state estimate based on the measurements from the sensors. The EKF also provides a way to estimate the uncertainty in the state estimate, which can be used to improve the robustness of the control algorithm.

The buffer is used to store the predicted control signal $\hat{u}(k)$ before it is applied to the actuators, and to store the measurements from the sensors before they are used to update the state estimate. The buffer helps to smooth out the control signal and to reduce the impact of noise in the measurements.

The diagram shows a closed-loop control system with feedback from the sensors to the model predictive control algorithm and feedback from the actuators to the plant. The system is designed to be robust and to handle disturbances and uncertainties in the plant and the environment.