$$
\begin{aligned}
&\underset{(\boldsymbol{x}_{1:N}, u_{1:N}, \boldsymbol{a}_{1:N}, b_{1:N}, T)}{\text{minimize}} && T + (v_{max} - \boldsymbol{x}_{1:N,2})^T (v_{max} - \boldsymbol{x}_{1:N,2}) \\
&\text{subject to} && \boldsymbol{x}_{k+1} = \boldsymbol{I}(\boldsymbol{f}(\boldsymbol{x}_k, u_k, h),\ k = 1 \dots N, \\
& && {\boldsymbol{a}_k}^T \boldsymbol{v}_i - b_k \geqslant 0,\ i = 1 : N_{vertices}, \\
& && {\boldsymbol{a}_k}^T \boldsymbol{x}_k - b_k \leqslant -r_{safe}, \\
& && \boldsymbol{x}_1 = [0, v_{start}], \\
& && \boldsymbol{x}_{N,1} = \boldsymbol{s}(end), \\
& && 0 \leqslant\ \boldsymbol{x}_{k,2} \leqslant v_{max}, \\
& && u_{min} \leqslant\ u_k \leqslant u_{max}, \\
& && T \geqslant 0, \\
& && \|\boldsymbol{a}_k\| \leqslant 1
\end{aligned}
\tag{1}
$$