We present a method of describing all timelike surfaces in $S^3_1(1) \subset \mathbb{R}^4_1$. Using null coordinates $(u, v)$ and the complex variable $w = u + iv$. Using stereographic projection we identify the Grassmannian of spacelike planes in $\mathbb{R}^4_1$ with a quadric in complex projective space. We give necessary and sufficient conditions for lifting our isotropic surface in $S^3_1(1)$ into the complex quadric in terms of three complex valued functions. We recover the surface as the real part of this lifting. We also obtain a system of differential equations in terms of the complex functions which characterize minimal surfaces. In the case where the functions are holomorphic we can solve the system explicitly. (Received August 06, 2018)