Let $A_n = \left(0, \frac{1}{n}\right)$, then $A_{n+1} = \left(0, \frac{1}{n+1}\right)$. As $\frac{1}{n+1} < \frac{1}{n}$ then $A_{n+1} \subset A_n$.

Suppose there is some $x$ that is part of every $A_n$ and it's the smallest such element.

$$0 < x < \frac{1}{n}$$

$x$ would be in form $\frac{1}{k}$, where $k \in (0, n)$. But we could find a number $\frac{1}{2k}$ that is smaller.

$$\frac{1}{2k} < \frac{1}{k}$$

In other words we could find an interval $\left(0, \frac{1}{2k}\right)$, where $x$ is not a member. But this is contradiction. Hence $\cap_{n=1}^{\infty} A_n = \emptyset$.
QED.