Proteins present an ecofriendly alternative to many of the synthetic components currently used in electronics. They can therefore in combination with flexibility and electroactivity uncover a range of new opportunities in the field of flexible and green electronics. In this study, silk-based ionic conductors are turned into stable thin films by embedding them with 2D nanoclay platelets. More specifically, this material is utilized to develop a flexible and ecofriendly motion-sensitive touchscreen device. The display-like sensor can readily transmit light, is easy to recycle and can monitor the motion of almost any part of the human body. It also displays a significantly lower sheet resistance during bending and stretching regimes than the values typically reported for conventional metallic-based conductors, and remains fully operational after mechanical endurance testing. Moreover, it can operate at high frequencies in the kilohertz (kHz) range under both normal and bending modes. Notably, our new technology is available through a simple one-step manufacturing technique and can therefore easily be extended to large-scale fabrication of electronic devices.