

- wherein the sequence of values corresponds to the sequence of discrete graphical choices;
- a codeword generator in signal communication with the converter, the codeword generator producing a sequence of codewords by applying a decoding function of an error correcting code to each value in the sequence of values;
- an offset calculator in signal communication with the codeword generator, the offset calculator calculating an offset between each value in the sequence of values and the corresponding codeword in the sequence of codewords to generate a sequence of offsets; and
- a hasher in signal communication with the codeword generator, the hasher applying a hash function to the sequence of codewords to produce a hash of the sequence of codewords.
- 40.** The apparatus of claim 39 wherein a discrete graphical choice in the sequence of discrete graphical choices comprises a selected point on the graphical interface.
- 41.** The apparatus of claim 40 further comprising a point generator in signal communication with the graphical interface, the point generator highlighting a plurality of points on the graphical interface as alternative graphical choices for each discrete graphical choice in the sequence of discrete graphical choices.
- 42.** The apparatus of claim 41 further comprising a memory element in signal communication with the graphical interface, the memory element containing a plurality of images and a sequence of images, wherein receiving a discrete graphical choice in the sequence of discrete graphical choices triggers the graphical interface to display the next image in the sequence of images from the plurality of images contained in the memory element.
- 43.** The apparatus of claim 42 further comprising:
- a training logic element in signal communication with the graphical interface, the training logic element prompting a user to enter a match pattern upon receiving the secret pattern by causing the graphical interface to display the first image in the sequence of images, wherein the match pattern is a sequence of match points; and
- a comparator in signal communication with the graphical interface, the comparator comparing the match pattern to the secret pattern.
- 44.** The apparatus of claim 43 wherein the training logic element, during or after receiving a match point in the sequence of match points on the graphical interface, causes the graphical interface to highlight the selected point associated with the image on the graphical interface.
- 45.** The apparatus of claim 43 wherein the training logic element, during or after receiving a match point in the sequence of match points on the graphical interface, causes the graphical interface to display a line from the match point to the selected point associated with the image on the graphical interface.
- 46.** The apparatus of claim 39 further comprising a memory element in signal communication with the offset calculator, the memory element storing the sequence of offsets from the offset calculator for use in authenticating a user.
- 47.** The apparatus of claim 39 wherein the memory element is in signal communication with the hasher, the memory element storing the hash of the sequence of codewords from the hasher for use in authenticating a user.
- 48.** An apparatus for authenticating a user, the apparatus comprising:
- a graphical interface capable of receiving graphical input, the graphical interface receiving an input pattern as graphical input, the input pattern comprising a sequence of discrete graphical choices;
- a converter in signal communication with the graphical interface, the converter converting each discrete graphical choice in the sequence of discrete graphical choices into an input value to produce a sequence of input values, wherein the sequence of input values corresponds to the sequence of discrete graphical choices;
- a memory element in signal communication with a summer, the memory element containing a sequence of offsets;
- the summer in signal communication with the converter and the memory element, the summer summing each input value from the sequence of input values with the corresponding offset from the sequence of offsets to generate a sequence of intermediate values;
- a codeword generator in signal communication with the summer, the codeword generator producing a sequence of codewords by applying a decoding function of an error correcting code to each intermediate value in the sequence of intermediate values; and
- a hasher in signal communication with the codeword generator, the hasher applying a hash function to the sequence of codewords to produce a hash of the sequence of codewords for use in authenticating a user.
- 49.** The apparatus of claim 48 further comprising a comparator in signal communication with the hasher, the comparator comparing the hash of the sequence of codewords to a stored hash and producing an authentication signal if the hash of the sequence of codewords matches the stored hash.
- 50.** The apparatus of claim 49 wherein the authentication signal enables access to a resource.
- 51.** The apparatus of claim 50 wherein the authentication signal enables access to at least one of a hardware device, a computer system, a portable computer, a software application, a database, and a physical location.
- 52.** The apparatus of claim 48 further comprising a communication system in signal communication with the hasher, the communication system transmitting the hash of the sequence of codewords to an authentication device and receiving an authentication signal from the authentication device if the hash of the sequence of codewords matches the stored hash.
- 53.** The apparatus of claim 48 wherein a discrete graphical choice in the sequence of discrete graphical choices comprises a selected region on the graphical interface.
- 54.** The apparatus of claim 48 wherein a discrete graphical choice in the sequence of discrete graphical choices comprises a selected point on the graphical interface.
- 55.** The apparatus of claim 48 further comprising a logic element in signal communication with the graphical interface, the logic element causing the graphical interface to display a new image in response to the graphical interface