MagiWrite: Touchless Digit Entry using 3D Space Notes

Introduction

* Touchless digit entry system which allows the user to draw digits in the mobile device's 3D space
* User must hold a 'properly shaped' magnet which is picked up by the device's magnetic sensor

Initial Problem

* Intends to improve interaction with small devices, as it can be quite difficult to operate a small screen such as a smart watch etc

Current Idea

* The user-held magnet has an impact on the magnetic field based around the device's magnetic sensor.
* Pre-defined formats for the magnetic field are associated to digits
* Only provides support for digits, however can be applied to other alpha-numeric characters too

Technology

* Device Magnetic Sensor
  + No major hardware improvements as the hardware can be cheap to install, if not already installed
  + User magnetic sensor provides a measure of magnetic strength in X, Y and Z dimensions (ranging from -128 to 128)
  + Can be affected by 3rd party magnetic interferences such as magnetic noise or the Earth's magnetic field
* Based on 'Around Device Interaction (ADI)' which proposes using the space around a mobile device to interact with it
  + ADI Techniques tend to use one of the following
    - Camera
    - Infrared Distance Sensor
    - Rear Touch Screen
    - Proximity Sensor
    - Electric Field Sensing

Usability

* User magnet does not need to be in direct line of sight as the magnetic field can pass through materials
  + User can dial a number without having to take the phone out of pocket/bag
* User magnet can be something inconspicuous such as rod, ring, pen etc
* User can register their current writing style using a simple training phase
* Does not have an impact on visually/hearing impaired users

Testing

* User friendly demo application
  + Installed on an iPhone 3GS; tests simple digits which have already been pre-installed
  + User presses a button whilst they are drawing the digit, to help reduce the amount of magnetic noise
* 3 screens
  + Testing Screen: To see what would be recognised when the user 'writes' a digit
  + Training Screen: Allows the system to understand the user's writing style by allowing the user to store their own registered templates for a particular digit
    - User must hold the record button to record the template
  + Load/Save Screen: Allows the user to store/restore registered templates for future use
* When the digit is written at an angle, then 10 is added onto the digits value.

Tutorial Notes

* Cheap, already found within a phone
* No evaluation mentioned, could have been tested but not included
* May be good to use with small devices such as smart watches
* May be good with people who have lost motor skills due to illness
* User-Magnet
  + Could damage nearby things such as devices or debit cards
  + Could be lost
* Everyone using the same device, there could be interference between all devices
* Privacy problem
  + If multiple users are near together with the MagiWrite, can write down information on someone else's device
  + People can see what you are writing due to the gestures you are performing, especially if it is private information
* Is it safe?: for health reasons, possible health implications
* big gestures are not socially acceptable, find them to be disruptive. can be found annoying or strange
* No feedback, so unaware if the gesture has picked up the correct character if not looking at the screen
* Possibility to use the gesture to perform other actions as, change song, turn page, scroll etc.
* Button must be pressed in order for the device to pick up the gesture, if this isn't true then battery will be drained as the magnetic field would be continuously changing. Hence being picked up with the device
* Can't use front/back feature if the phone is in pocket or bag, unable to determine which direction the phone is facing
* Whilst walking
  + motion of the hand may be different in comparison when the user is static, hence it may not be accurate
  + magnetic field may constantly be changing as the environment may have an impact on the device's magnetic field