

# 第9回 国際イノベーションコンテスト 国内予選

## Domestic Competition of 9th international Contest of InnovAtion (iCAN'18) in Japan



# PEN $\pi$

*A Hand you need for writing*

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## I. Introduction

### Purpose

PEN $\pi$  is an improved version of pens we can find in our daily life. In addition to writing normally, the pen records your writing and convert it into electronic documents to simplify note-taking.

### Benefits

Usable on any surface of writing, this pen is not only flexible but cheaper on long term basis.

### MEMS Sensor Used

Gyroscope, Accelerometers, and Magnetometer.

## II. Features

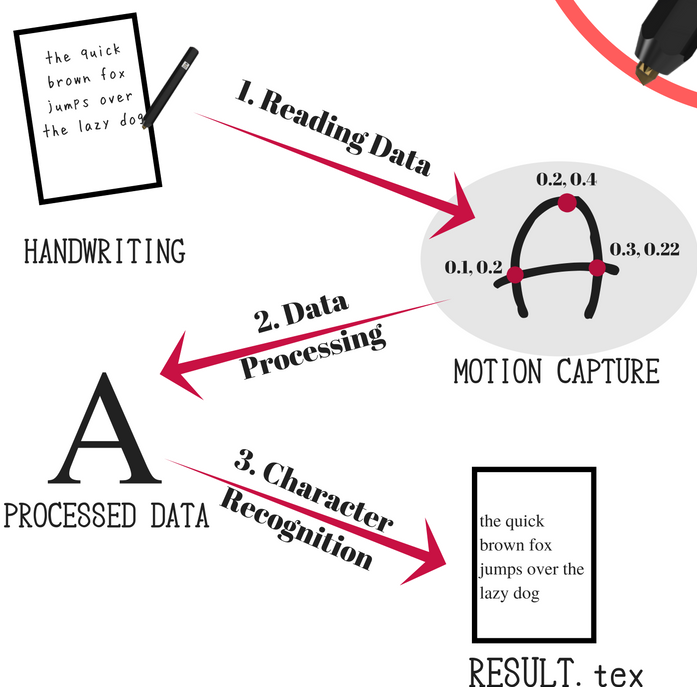
Aiding note taking by actively recording writings and convert it into LaTeX, an electronic document, through an API developed by machine learning, making it accessible on various devices.

Unlike other smart pens on the market which relies on special paper to be used, the MEMS sensor attached on the pen records the motion and copy it electronically.

### Future Possibilities

INSTANTLY SOLVE EQUATION  
ONLINE NOTE SHARING  
CLASSROOM NETWORK  
KANJI RECOGNITION

## III. Mechanism



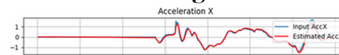
## IV. Principle

### Raw Data

0.005001, -0.002476, -0.000443, 0.981406  
0.004999, -0.001137, 0.000743, 0.980657  
0.005000, 0.000420, -0.001406, 0.977831  
0.005013, 0.001257, 0.000083, 0.978815  
0.005008, 0.001194, -0.001486, 0.977071  
0.005007, -0.000104, 0.002194, 0.979718  
0.005008, -0.001009, 0.001387, 0.977307

The device captures motion as raw data of position and gravitational acceleration

### High Pass Filter



Frequencies higher than the cutoff frequency are selected and acceleration data are obtained

### Integral



By trapezoid integration, the velocity are obtained

### Integral



By doing another trapezoid integration, the position are obtained

These methods are done for both x and y-axis. While z-axis is neglected

Why Trapezoid integration ?

Trapezoid integration approximates the result of integration close enough such that the result are far more accurate.

