SNail: Sensing the Strains From Fingernail As Always-Available Input

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ABSTRACT
We present SNail, a nail-mounted device that sense user's fingernail contour and bend when force is applied on surface. By using 3×3 array of 0.2mm strain gauges, SNail is small enough to fit within fingernail, and it is flexible and stretchable. Since the device is always available, it enables user to intuitively use smart TV/devices by simply performing gestures on surfaces around without touching devices. We evaluate this interface in motionless and motion mode. The system can achieved 90% accuracy for classifying with different kinds of finger posture angle, levels of pressure in motionless mode. For motion mode, it can distinguish 8 directions of movement with high accuracy(>95%). We also show applications of using SNail, which lower the effort for ????.

Author Keywords
Natural User Interface (NUI); Wearable electronics; fingernail; Strain gauges; Machine Learning; Nail pressure;

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Input devices and strategies (e.g., mouse, touchscreen)

INTRODUCTION
In summary, the main contributions of this paper are as follows:

- Propose the new novel way to input on surface
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RELATED WORK
Camera based
Acoustic based
Surface sensing based

Finger sensing
HARDWARE DESIGN
Sensing Touch Angle
Sensing Force Level
Sensing Movement
PROTOTYPE DESIGN
Hardware
Software
EVALUATION: MOTIONLESS MODE
The goal of this study is to explore whether the system is capable for classifying different kind of finger posture angle. Participants were asked to reproduce a series of instructed angle [1] and force between 1N(Newton) to 5N.

Participants
We recruited 16 participants (13 male, 3 female) between the ages of 20 and 23. All participants were right-handed and drew with their right index fingers on the surface. Each participants received $5 after one hour experiment.

Apparatus
The apparatus is shown in Fig???. We used the electronic load-cell to measure the force from finger and put it in front of user. The error of the force measurement is plus and minus 0.1 grams. We also put a 9DOF sensor on user's index finger, it is used for checking whether user is performing the right position and angle.

Task and Procedure
In each trail, the participants were instructed to adjust their finger pitch and roll angle which are selected from [1] and the forces between 1N to 5N as shown in Fig???. The participants are also asked to straighten finger during all experiment. In front of the user, there is a screen showing current and instructed angle and force. After each trail, participants

Results
EVALUATION: MOTION MODE
Participants
Apparatus
Task and Procedure
Data Processing

Results

INTERACTION DESIGN SPACE

DISCUSSION AND FUTURE WORK

CONCLUSION

REFERENCES

1. Christian Holz and Patrick Baudisch. 2011. Understanding Touch. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11)*. 2501–2510.