

μTouch Artifact Guide

Siyuan Wang Ke Li Jingyuan Huang Jike Wang
Cheng Zhang Alanson Sample Dongyao Chen

Artifacts for “μTouch: Enabling Accurate, Lightweight Self-Touch Sensing with Passive Magnets” (PerCom’26)

Quick Links

Code repo github.com/Wangmerlyn/muTouch
MagX base github.com/dychen24/magx
Models Tag backup/3_dim-models-20260121
 (GitHub Releases → Assets)
PCB sources pcb/ (muTouch Altium project;
 legacy Magway.* filenames)

I. Scope

This guide describes the artifact supporting μTouch: hardware (muTouch PCB + magnets) and software (BLE data collection, semi-supervised classifier). It targets reviewers who want to install, run, and validate the pipeline.

II. Bill of Materials & Requirements

A. Hardware (minimal)

- muTouch PCB (Altium project in pcb/; assembled board; filenames use legacy Magway.*). PCB design by Xiaomeng Chen.
- 1–2 passive N52 grade magnets (6–8 mm recommended).
- Host laptop: Ubuntu 20.04+ or macOS 12+, 4-core CPU, ≥8 GB RAM, BLE 4.0+ adapter.
- Optional: BLE USB dongle (if desktop lacks BLE).

B. Software

- Python 3.10; Conda recommended.
- Git with submodules; CMake/Make (only if rebuilding C++ solver).
- Dependencies from pip install -e .[dev].
- Latex/PDF tools not required for runtime; only for this guide.

III. Obtaining the Artifact

- 1) Clone the repository (now public):
git clone --recurse-submodules
git@github.com:Wangmerlyn/muTouch.git
(HTTPS fallback:
https://github.com/Wangmerlyn/muTouch.git)
- 2) Activate env:
conda create -n muTouch python=3.10
conda activate muTouch
- 3) Install deps:
pip install -e .[dev]
pre-commit install (optional for lint).
- 4) Models: snapshot tag backup/3_dim-models-20260121.
Download binaries from GitHub Releases (Assets).

IV. Setup & Configuration

- 1) Flash firmware:
Codes/Arduino/bleReadMultiple/bleReadMultiple.ino in Arduino IDE;
select Feather nRF52; upload.
- 2) Find BLE address: python
Codes/read_raw_ble/find_device.py (copy device
MAC/UUID).
- 3) Calibration:
python Codes/read_raw_ble/read_sensor.py
-addr <BLE_ADDR> -out calibration.npy
Do a brief figure-8 motion away from metal surfaces.
- 4) Offsets/scales: place generated offset-* and scale-* files
in calibration_files/ (or update script paths).
- 5) Models: ensure Codes/read_raw_ble/models/ holds
the downloaded checkpoint set if you need pretrained
classifiers.

V. Running the Artifact

A. Data capture

```
python Codes/read_raw_ble/read_sensor_real.py --  
addr <BLE_ADDR>
```

Outputs timestamped CSVs under datasets/.

B. Real-time classification

```
python Codes/read_raw_ble/read_sensor_real_classifier.py -  
-addr <BLE_ADDR>
```

Ensure the script uses the latest offset-*, scale-*, and model files.

Console prints detected gesture labels; logs are saved under datasets/.

C. Expected outcomes

- Face-touching: ≈93% accuracy (8 gestures) with 3 s fine-tuning/user.
- Scratch detection: ≈95% accuracy across 12 participants.
- Real-time loop maintains >30 Hz inference on a laptop CPU.

VI. Reproducibility Checklist

- Hardware reproducible: PCB sources + BOM (muTouch; files named Magway.* for compatibility) included.
- Software reproducible: All scripts + TS2Vec submodule; pinned deps in Codes/requirements.txt.

- Data: Calibration and small demo runs can be generated locally; full datasets are participant-specific and not included.
- Pretrained models: Provided via GitHub tag backup/3_dim-models-20260121.
- Import errors: confirm submodule init (git submodule update --init --recursive) and Python path from repo root.

VII. Troubleshooting

- BLE not found: retry find_device.py; check power and pairing blocks; use BLE dongle.
- Drifting predictions: recalibrate sensors; ensure distance from large metal; re-run offset/scale.

VIII. Notes on Prior Work

The project builds on MagX (MobiCom'21) codebase for magnetic sensing; source: <https://github.com/dychen24/magx>. This artifact extends it to self-touch sensing and includes updated PCB by Xiaomeng Chen.