# ubicomplab
UNIVERSITY OF WASHINGTON

**Professor Shwetak N. Patel**
ubicomplab.cs.washington.edu
PAUL G. ALLEN SCHOOL OF COMPUTER SCIENCE & ENGINEERING
Electrical Engineering
Design. Use. Build.

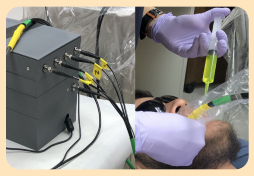
# HEALTH TECHNOLOGIES

## Screening & Diagnostics

**RDTScan**
A mobile system for digital curation and interpretation of rapid diagnostic tests

**GlucoScreen**
A reimagined glucose strip that directly interfaces with a smartphone's touchscreen


**Stroke Screening**
Smartphone-based system for predicting stroke risk from facial blood flow patterns



**O-pH**
Low cost optical pH sensor to measure acidity of oral plaque and assist in caries diagnosis

**BiliCam**
Using mobile phones to monitor newborn jaundice

**PupilScreen**
Using smartphones to assess signficiant head trauma

**BiliScreen**
Smartphone-based system for assessing scleral jaundice

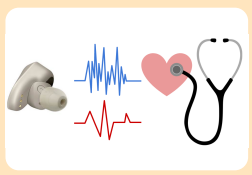
**HemaApp**
Noninvasive screening of hemoglobin concentration using a smartphone camera

**CoughSense**
Automatic, privacy-preserving ambulatory cough monitoring from a mobile phone

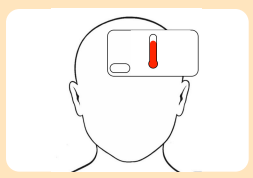
## Vital Signs

**Contactless Vitals**
Using smartphones to measure vitals signs without direct contact

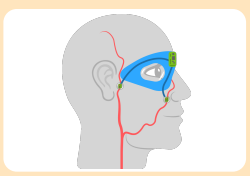
**SpO2 Sensing**
Hypoxemia screening using an unmodifiified smartphone camera and deep learning



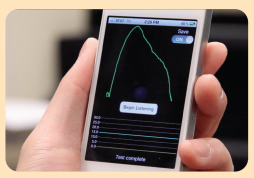
**EarSteth**
Cardiac acoustic sensing using commodity earbuds



**FeverPhone**
Monitor changes in body temperature using an unmodified smartphone



**Facial PPG Sensing**
Noninvasive continuous pulse wave sensing using a face mask

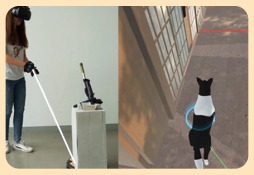


**SpiroSmart**
Measure lung function using a mobile phone

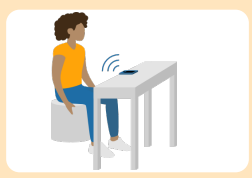
# MOBILE, VIRTUAL REALITY, AND WEARABLE INTERACTION

**AuraRing**
Tracking accurate finger motion using magnetic sensing

**Aura**
An inside-out electromagnetic 6-DoF tracking system for handheld controllers

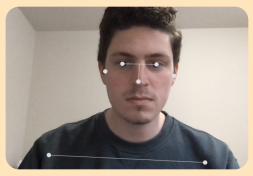


**MoveVR**
Enabling Multiform Force Feedback in Virtual Reality using Household Cleaning Robots

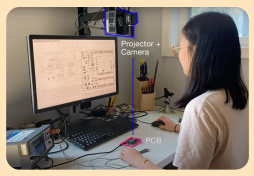


**Exercise Sonar Sensing**
Activity recognition through non-contact acoustic sonar sensing

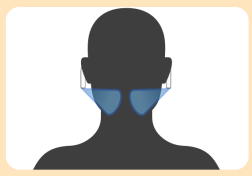
**MaskFlow**
Help people design better homemade facemasks by assessing mask breathability with audio



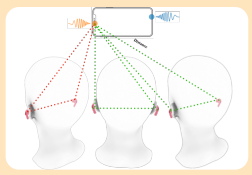
**SlouchSense**
Using computer vision to assess sitting posture during computer use




**PCB Debug Tool**
Exploring augmented reality interactions to make printed circuit debugging more intuitive, efficient, and accessible



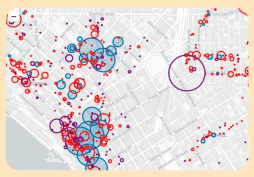
**ClearVoice**
Earbuds with microphones that eliminate background noise and voices for on-the-go calls



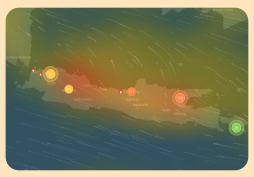
**FaceOri**
Enabling new intereaction by sensing head position with ultrasonic communicaiton between phone and earbuds

# ENVIRONMENTAL SENSING

**CapHarvester**
Harvest stay electric fields without earth grounding by using a battery-free, stick-capative harvester



**RouteRationale**
Analyzing urban pedestrian routes as a function of urban topology and street level scene



**AirQualityGig**
Assessing the effects of poor air quality on the gig economy

**Monitor River Pollution**
Monitoring waterway plastic, debris, and litter that is ocean bound

**Viral Sensing in Transit**
Method for passively detecting the presence of viruses in urban transit infrastructure

**FireScan**
Using passive and active cameras to detect early stage wildfires

## SHWETAK PATEL AWARDED:

MacArthur 'Genius' Award
ACM Prize in Computing
Sloan Research Fellow
MIT TR-35 Top Innovator
Microsoft Research Faculty Fellow
Presidential Early Award for Scientists & Engineers (PECASE)

## AWARDS:

34 Best paper awards & nominations
3 Test of time / 10-year impact awards
7 National Science Foundation Fellows
3 Microsoft Research Fellows
2 Qualcomm Innovation Fellows
1 National Defense in Science & Engineering Fellow
1 Microsoft Women's Graduate Research Fellow
1 Adobe Research Fellow

## FUNDING SOURCES:

Bill & Melinda Gates foundation
Disney
NIH
Washington Research Foundation
Wallace H. Coulter Foundation
Google
NSF
facebook
Microsoft Research
intel

ubicomplab
UNIVERSITY OF WASHINGTON

# ABOUT THE LAB

The Ubiquitous Computing Lab (UbiComp Lab) is an interdisciplinary research lab led by Professor Shwetak Patel aimed at leveraging the ubiquity of modern computers such as sensors on smartphones, wearables, and embedded devices for social good. By designing and developing hardware and software-defined AI systems, the lab focuses on a wide range of applied sensing including mobile health sensing, novel user-interactions, and environmental and infrastructure sensing. We deploy and evaluate these technologies to solve real-world problems in public health, screening and diagnostics in health, sustainability, and more. In addition to the lab's scholarly endeavors, much of the work has been translated to products through startups, licensing, and open-sourcing that has impacted new innovation directions in industry.

# HEALTH TECHNOLOGIES

## Screening & Diagnostics

Many health conditions – such as anemia, jaundice, tuberculosis, influenza, and traumatic brain injuries – have biosignals that are associated with the disease state. These signals can be sensed by commodity sensors, such as cameras or microphones on smartphones, wearables, or with purpose-specific sensors given added signal processing. The UbiComp Lab focuses on leveraging the ubiquity of these commodity devices to make healthcare more available. This allows us to both provide accessible symptom screening outside of the clinic as well as understand the longitudinal trends across entire populations once these systems achieve broad adoption in deployment.

## Vital Signs

Vital signs are routinely monitored by medical professionals, however, the measurement only gets recorded during clinical visits. This hinders the quality of data healthcare providers use to make decisions. The UbiComp Lab addresses this by building technology to obtain vital signs noninvasively using commodity smart devices, off-the-shelf purpose-specific sensors, as well as low-cost emerging sensors. We believe these technologies, paired with seamless usability, can spread access to quality healthcare and reshape how we monitor conditions over time.

# MOBILE, VIRTUAL REALITY, AND WEARABLE INTERACTION

New computing platforms are becoming increasingly coupled to the user and the spaces we occupy. Wearable devices like smartwatches, smart rings, and head-mounted mixed reality devices are offering unprecedented access to computing and information on-the-go. As computing platforms evolve from devices we carry with us to devices we wear, there is an increased demand for input techniques that are decoupled from the display. The Ubicomp Lab focuses on building or leveraging existing wearable devices that are both continuously available and subtle. These technologies support various user and environmental contexts while enabling robust and expressive interaction. We also explore spatial computing (AR/VR) experiences that enable more productive and more natural interactions in user's daily workflows.

# ENVIRONMENTAL SENSING

People and their behavior can provide complex social signals which can be sensed by their devices. By leveraging the ubiquity of smart devices already deployed, we can begin to evaluate aggregate trends and the root causes of sustainable and unsustainable choices. Through this lens, we can study the coevolution of society and the built environment and built systems to promote their sustainability. Beyond personal commodity devices, the UbiComp Lab works with purpose-specific embedded sensors such as home energy monitoring devices and environmental sensors like cameras to combat unnecessary energy consumption and detect natural disasters related to climate change.

**Prof. Shwetak N. Patel**
ubicomplab.cs.washington.edu
PAUL G. ALLEN SCHOOL OF COMPUTER SCIENCE & ENGINEERING
Electrical Engineering
Design. Use. Build.