

Impact of Heat on Health of Rickshaw Pullers

*Environment  
sensing  
module*

Particulate  
Matter sensor

SO<sub>2</sub> sensor

Accelerometer

Power supply for  
microcontroller

Power supply  
for all sensors

NO<sub>2</sub> sensor

LPG sensor

CO<sub>2</sub> sensor

O<sub>3</sub> sensor

Microcontroller:  
Arduino Mega 2560

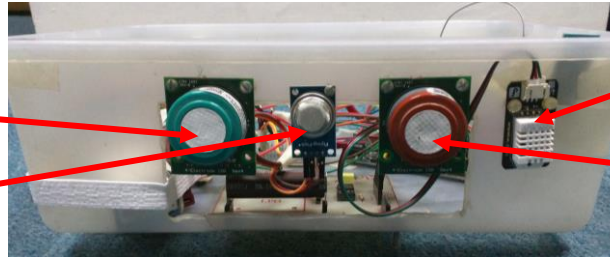
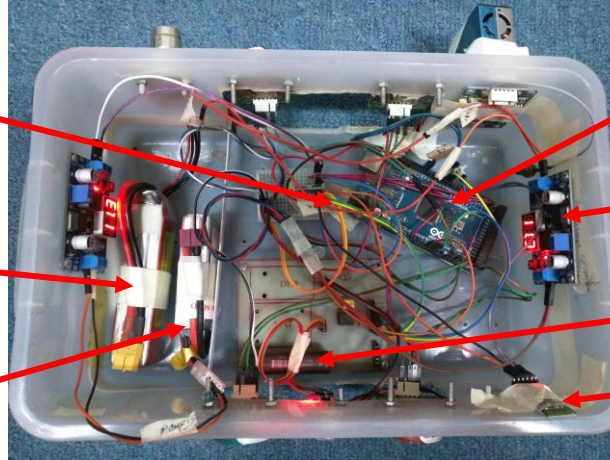
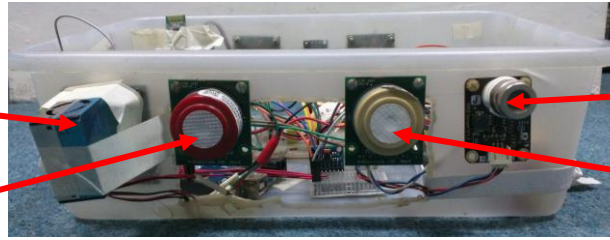
Voltage converter  
12v to 5 v

CO sensor

Bluetooth module

Temperature  
and humidity

NO<sub>x</sub> sensor



GSR sensor on  
upper arm

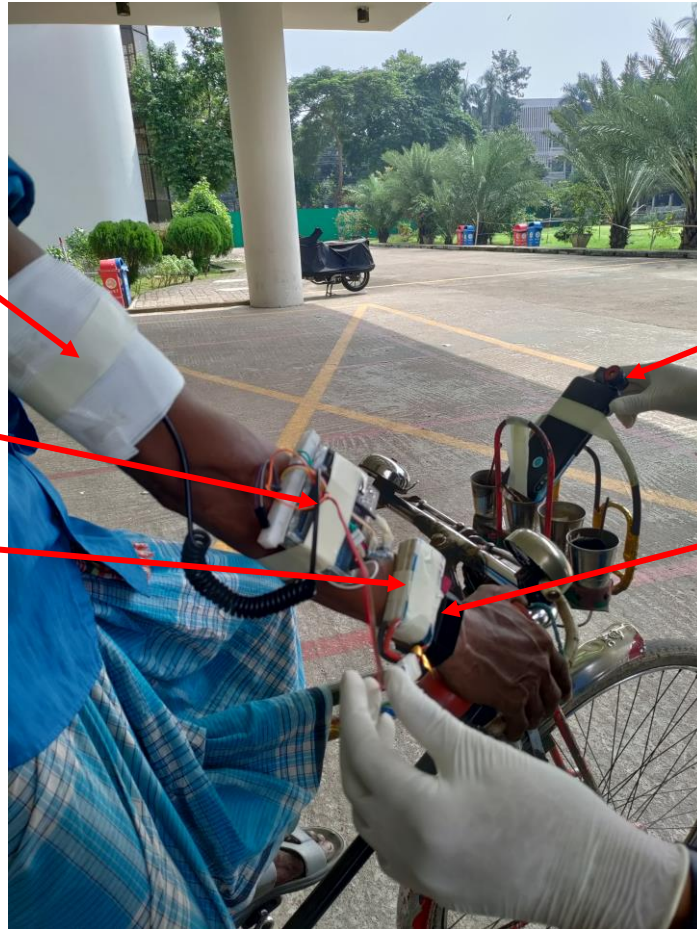
GSR ckt

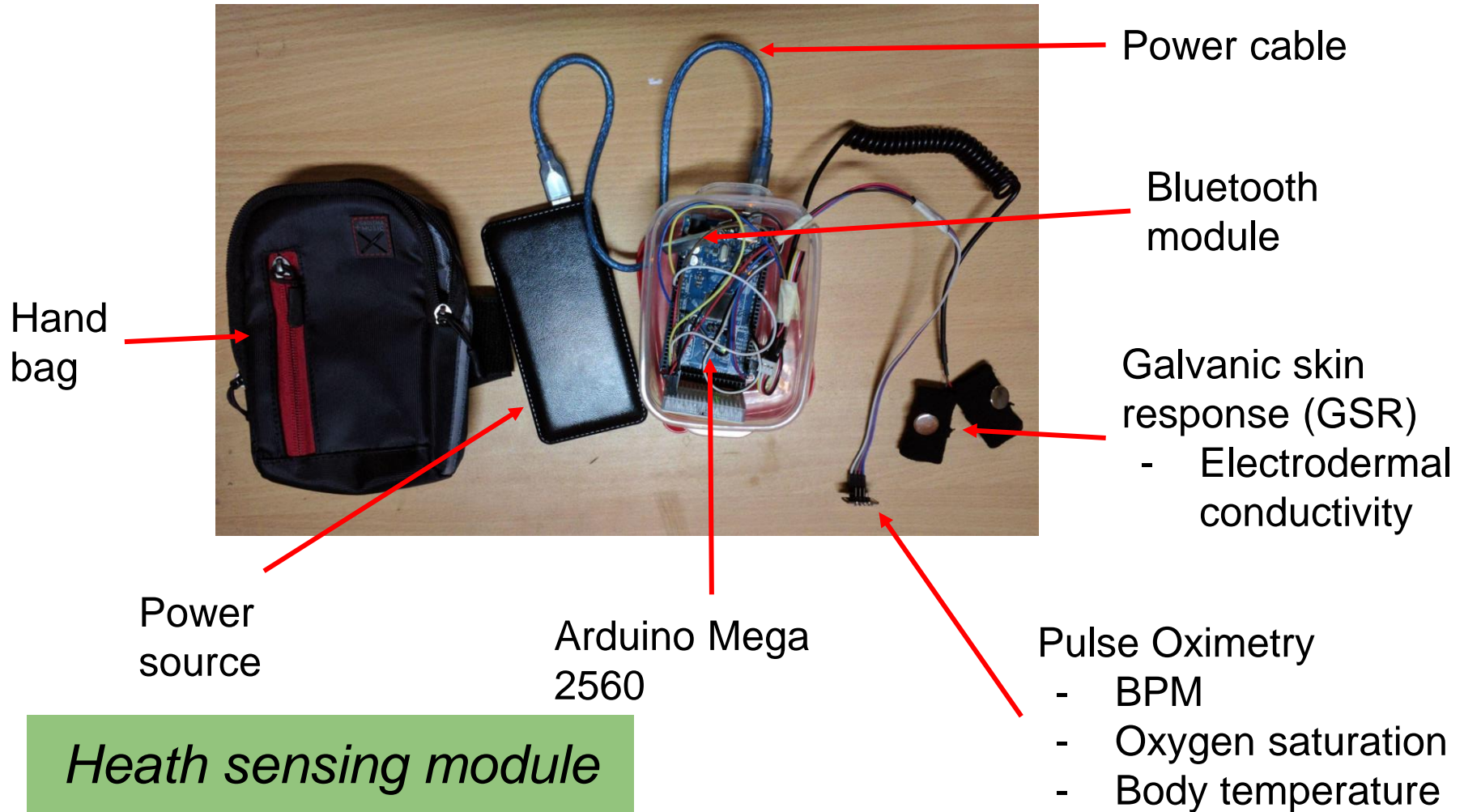
Power supply for  
GSR

Thermal  
camera

Fitbit

*Deployment of heath  
sensing module*









1. GSR sensor on upper arm
  - Rounded by a clinical standard band

2. Pulse oximetry on thumb
  - Mounted with masking tape

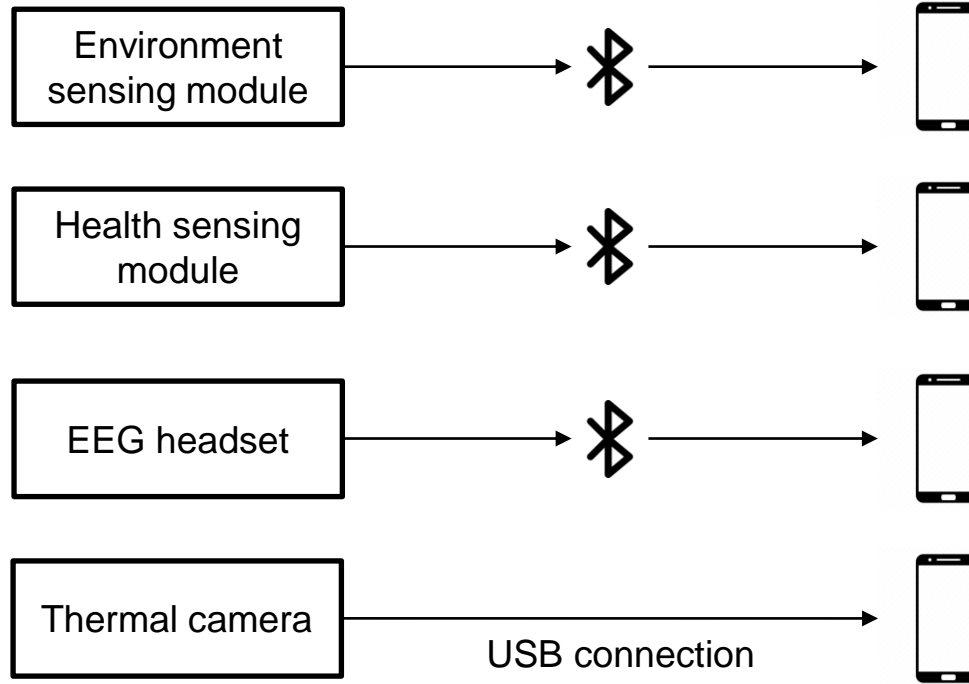
3. Other system components inside a handbag
  - Mounted with lower arm

*Deployment of health sensing module*



4. EEG headset
  - mounted on forehead and earlobe





*Data aquisition*



## Health sensing module

- Left hand
  - GSR
  - Pulse oximetry
- Right hand
  - Fitbit

Environment sensing module on back sit of rickshaw

*Integration of all system components*

# 30 Sept, 2022 – Trip1

- Age = 62
- Weight = 44 kg
- Height = 160 cm
- BMI = 17.2 kg/m<sup>2</sup>

## Active sensors:

1. All environmental sensors
2. GSR

Data Collection Checklist

Serial no (yyyy-mm-dd-xxx): 2022-09-30-001

Name: Fiaul Hoque Age: 62  
Blood group: \_\_\_\_\_  
Area of living: Jhigata Height: 5'3"  
Area of origin: Jhigata Weight: 44.05 kg  
For how many years living in Dhaka: 32  
NID: \_\_\_\_\_

Smoker: Yes ☒ No ☐  
Health issues: \_\_\_\_\_  
Food habits: 1 meal/day

Per day income: 500/600  
Per day passenger: \_\_\_\_\_  
Trip count per day: \_\_\_\_\_

Serial no (yyyy-mm-dd-xxx): 0

Date: \_\_\_\_\_ Start time: 10:51, 10:56  
End time: 10:58, 11:00  
11:02, 11:32

Fare: 150 + 200

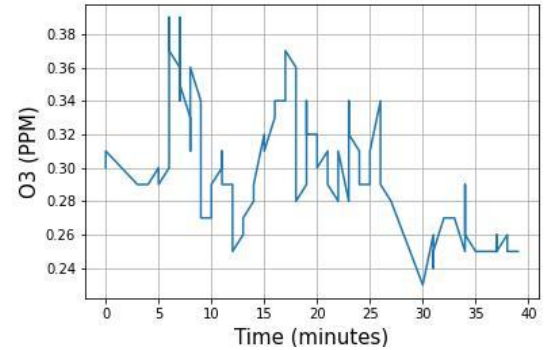
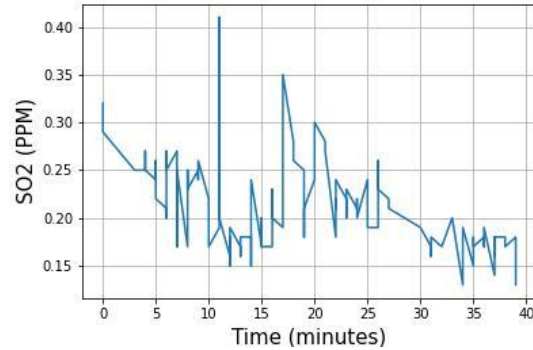
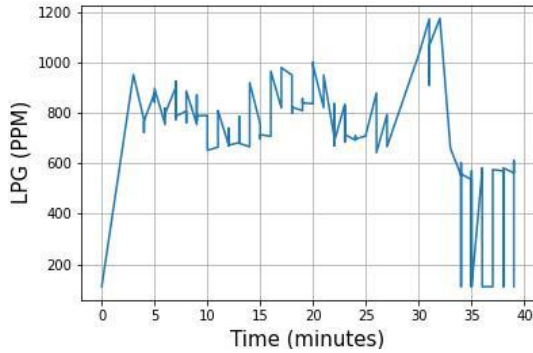
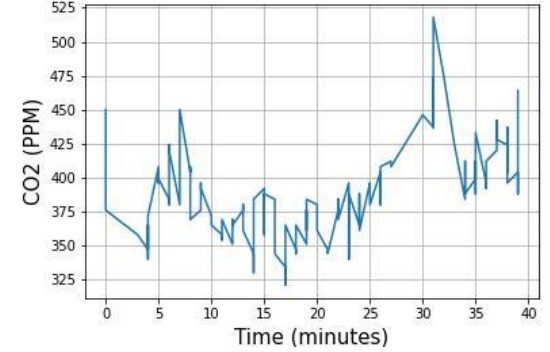
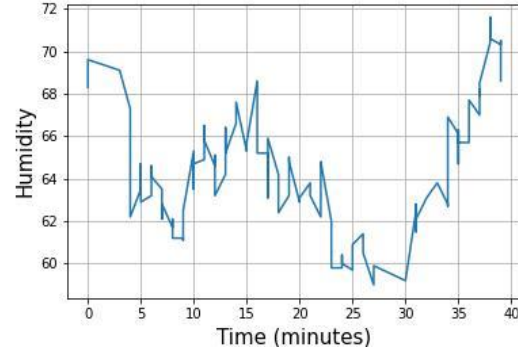
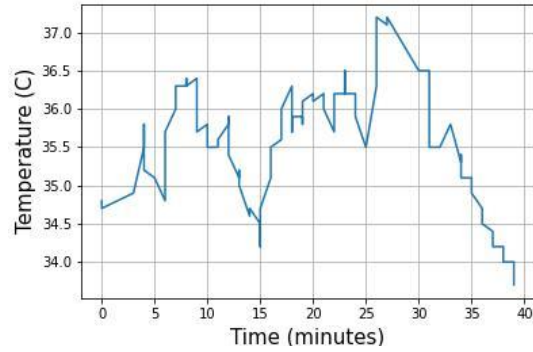
Location  
Source: FCE  
Destination: Jhigata  
Distance: \_\_\_\_\_  
Surroundings: \_\_\_\_\_  
Trip count: To ☒ Back ☒  
Record trip using smartphone ☒

Weather conditions  
Local: \_\_\_\_\_  
Online: sunny

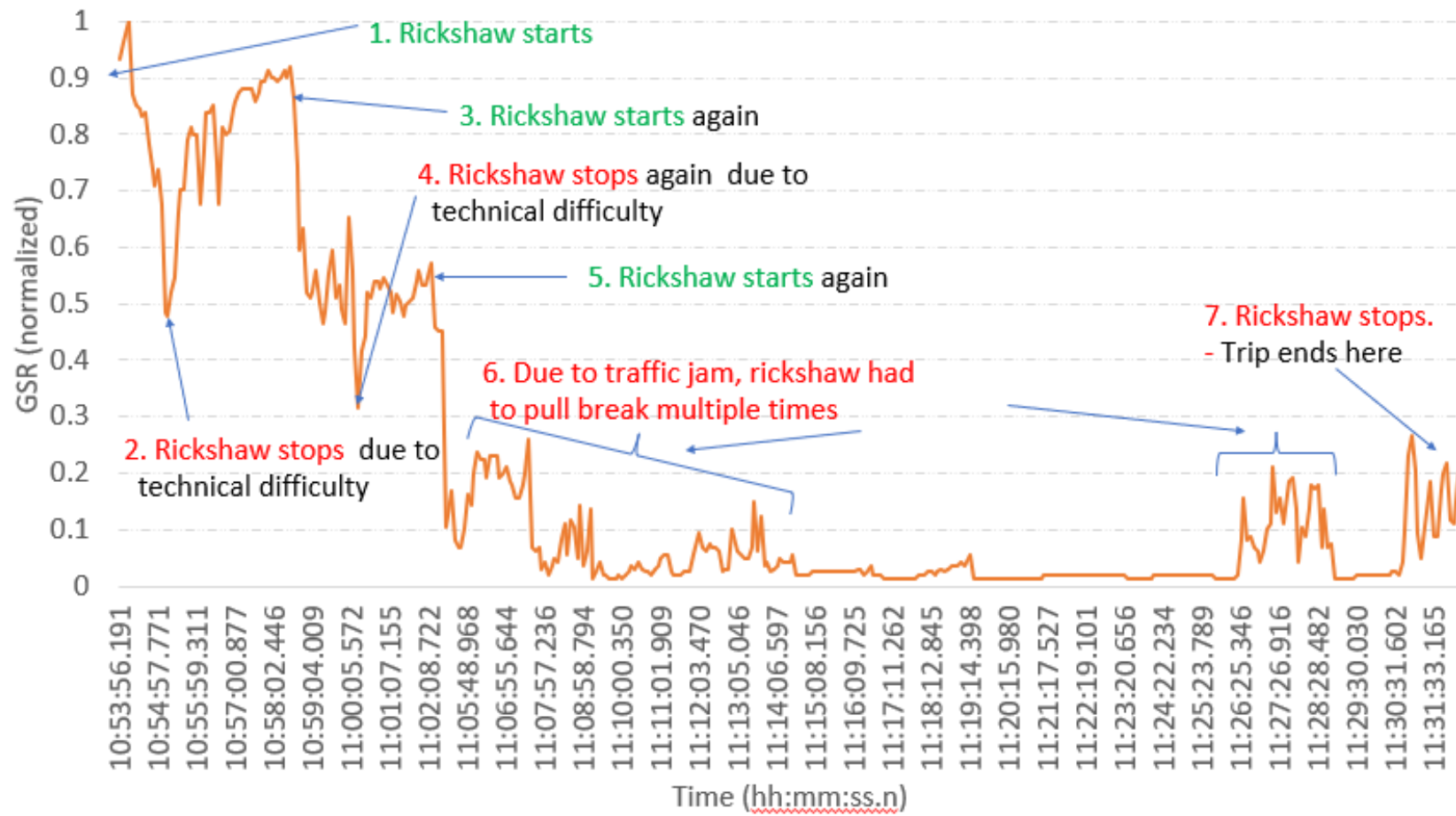
Comorbidity: \_\_\_\_\_

Sensors  
Fitbit ☒ EEG ☒ GSR ☒ (base: 514)  
Thermal camera ☒ Air pollution meter ☒



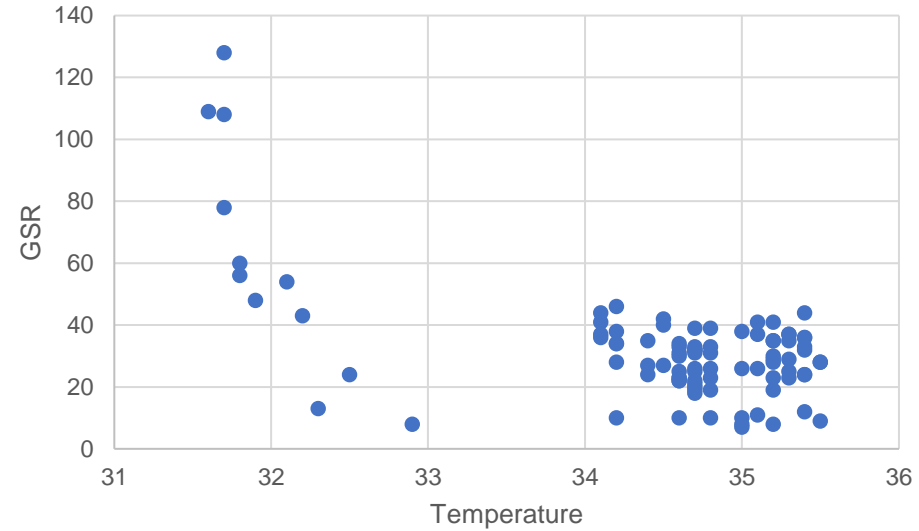
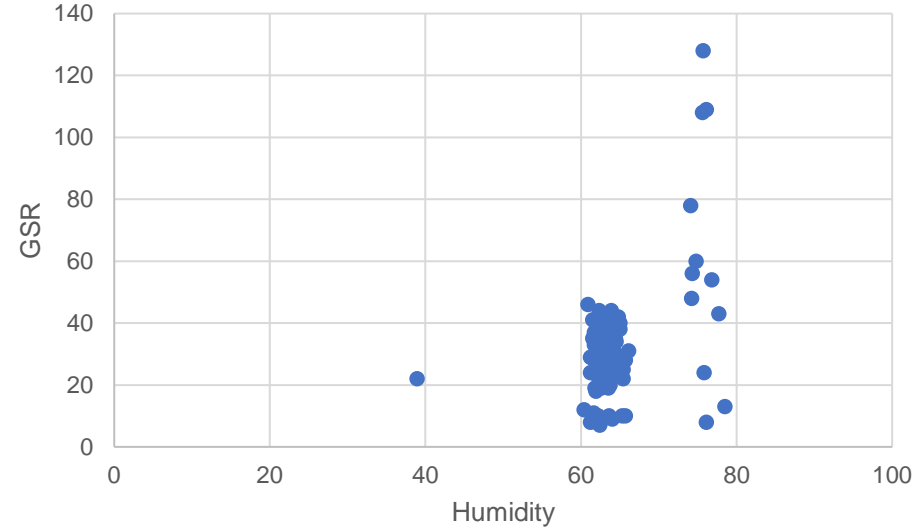


*Figure: Change in environmental parameters with time*



*Figure: Change in health parameters with time*

Environmental parameters		Standard PM 1.0	Standard PM 2.5	Standard PM 10	CO	CO2	LPG	Temperature	Humidity	NO2	NOx	SO2	O3
Galvanic Skin Response	Corr	-0.06846	-0.06286	-0.07809	-0.12388	0.115282	-0.40851	-0.56294	0.409834	0.145573	-0.06683	-0.10134	0.438906
	p-value	0.366614	0.407208	0.302952	0.1014	0.127615	1.82E-08	4.22E-16	1.62E-08	0.053884	0.378146	0.180791	1.11E-09



*Figure: Correlation between environmental and health parameters*

# 06 Oct, 2022 – Trip 1

- Age = 50
- Weight = 68.55 kg
- Height = 170 cm
- BMI = 20.3 kg/m<sup>2</sup>

## Active sensors:

1. All environmental sensors
2. Heart rate
3. Body temperature
4. Thermal camera

## Sampling rate

- Environmental sensors: 9 s per sample
- Health sensors: 11 s per sample

Data Collection Checklist

Serial no (yyyy-mm-dd-xxx): 2022-10-06-01

Name: Dalal Age: 50  
Blood group: NA

Area of living: Dhaka  
Area of origin: Jamalpur, Shurpur  
For how many years living in Dhaka: 35  
Height: 5'9" ft / 169 cm  
Weight: 58.55 kg

NID: NA

Smoker: Yes ☐ No ☒ 2018

Health issues: Bladder problem for 2 years

Food habits: 3 meals a day 2 Rice

Per day income: 400-500 tk  
Per day passenger: 15-16 tk  
Trip count per day: 20

Serial no (yyyy-mm-dd-xxx): 2022-10-06-01

Date: 2022-10-06 Start time: 1:27  
End time: 2:08

Fare: 120 + 350 (Round)

Location

Source: ECE, BUET  
Destination: ~~Police station~~ gate, by road market, Paltan road, Tea, Carjen hall, Shahidullah hall, Shahid minar, BUET

Distance:   
Sundownings: cloudy and mild rain at first, then sunny and clear

Trip count: To ☒ Back ☒

Record trip using smartphone ☒

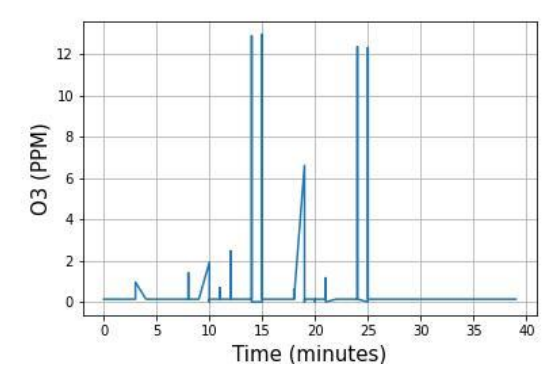
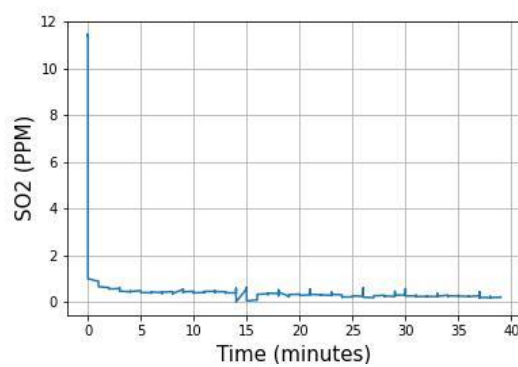
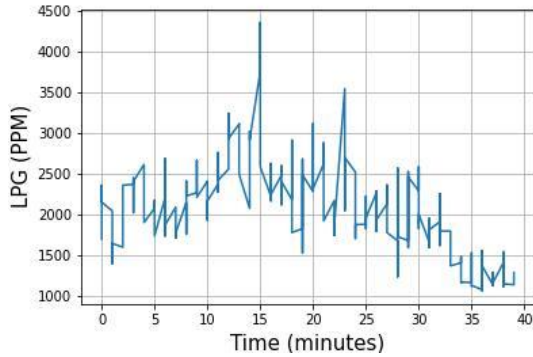
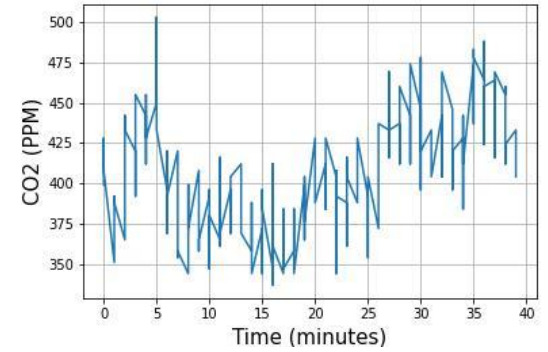
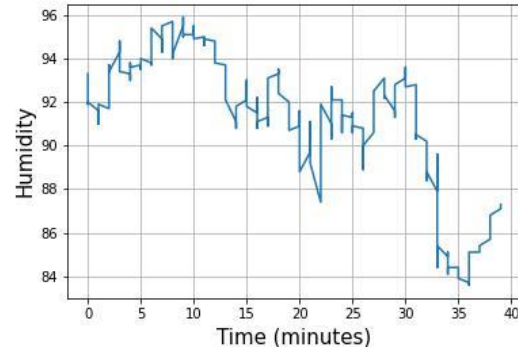
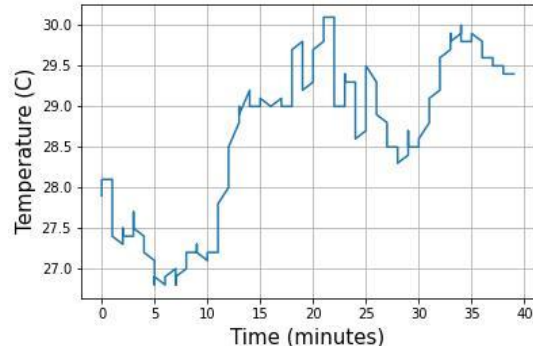
Weather conditions

Local:   
Online: 34°C

Comorbidity: \_\_\_\_\_

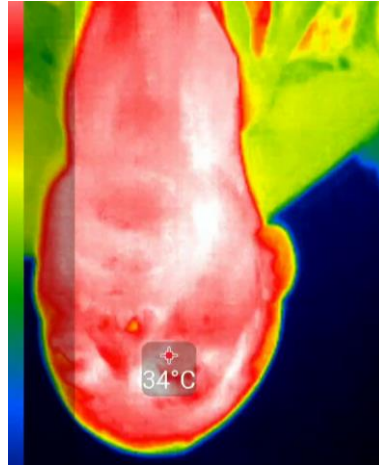
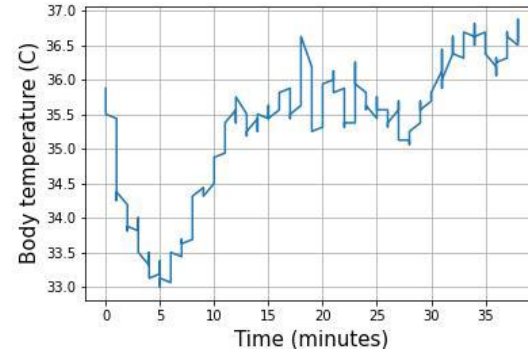
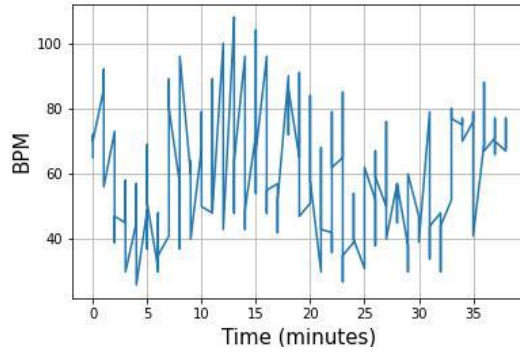
Sensors

Fitbit ☐ Thermal camera ☒ EEG ☒ Air pollution meter ☒ GSR ☒ (maybe not worked)

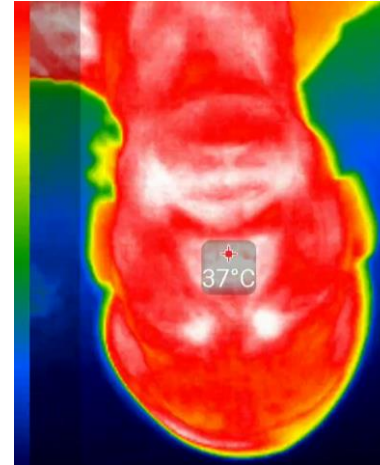


*Figure: Change in environmental parameters with time*



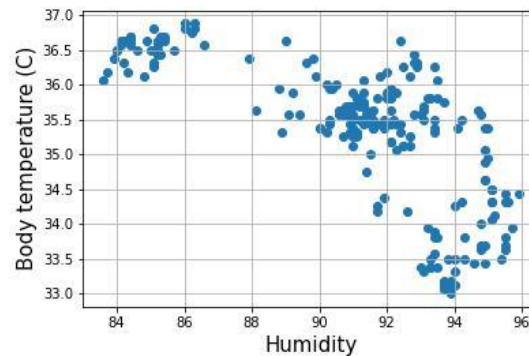
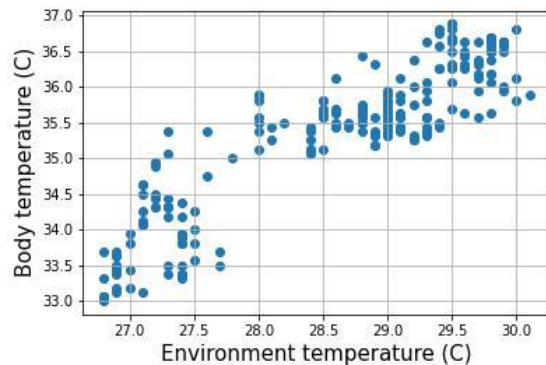


Start of trip (34 °C)



End of trip (37 °C)

*Figure: Change in health parameters with time*



Enviromental params		Standard PM 1.0	Standard PM 2.5	Standard PM 10	CO	CO2	LPG	Temperature	Humidity	NO2	NOx	SO2	O3
Health params	BPM	0.16	0.16	0.16	-0.01	-0.14	-0.09	0.20	-0.22	0.15	0.09	0.04	-0.02
	Body temperat ure (C)	0.06	0.06	0.06	0.09	0.14	-0.29	0.90	-0.73	-0.05	0.12	-0.25	0.04

*Figure: Correlation between environmental and health parameters*