



# SANGAM REVIEW-1

## HEALTH CARE AND LIFE SCIENCES

### BACK-UP

Project GitHub repo:

<https://github.com/spider-tronix/Back-Up>

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A photograph of a person's back, showing the spine and shoulder blades. The spine is highlighted with a glowing red, wavy pattern, suggesting pain or inflammation. The person's arms are bent, with hands resting on their hips. The background is a plain, light gray.

# Problem statement

Most of the working population in their 30s or late 20s start facing musculoskeletal disorders, including lower back pain and cervical disc herniation.

People slouch unconsciously from the natural neutral position when working for long hours.

Improper posture increases stress in the spine and neck leading to Musculoskeletal disorder.

May lead to physiotherapy or surgery.



# Existing solutions

## Wearable vest

- Uncomfortable
- Used post diagnosis

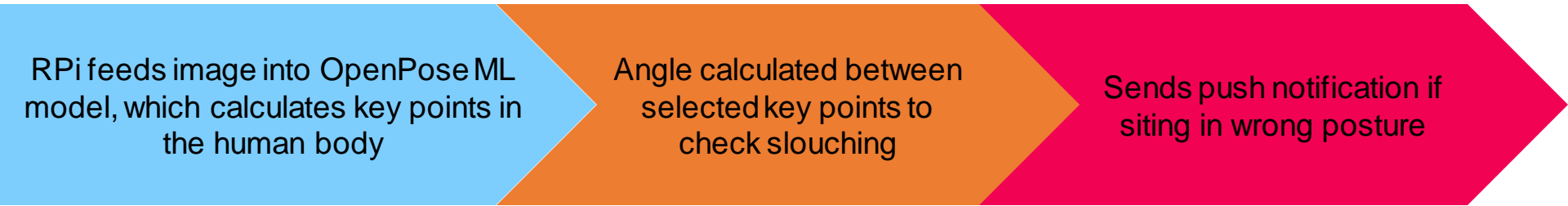


## Ergonomic chairs

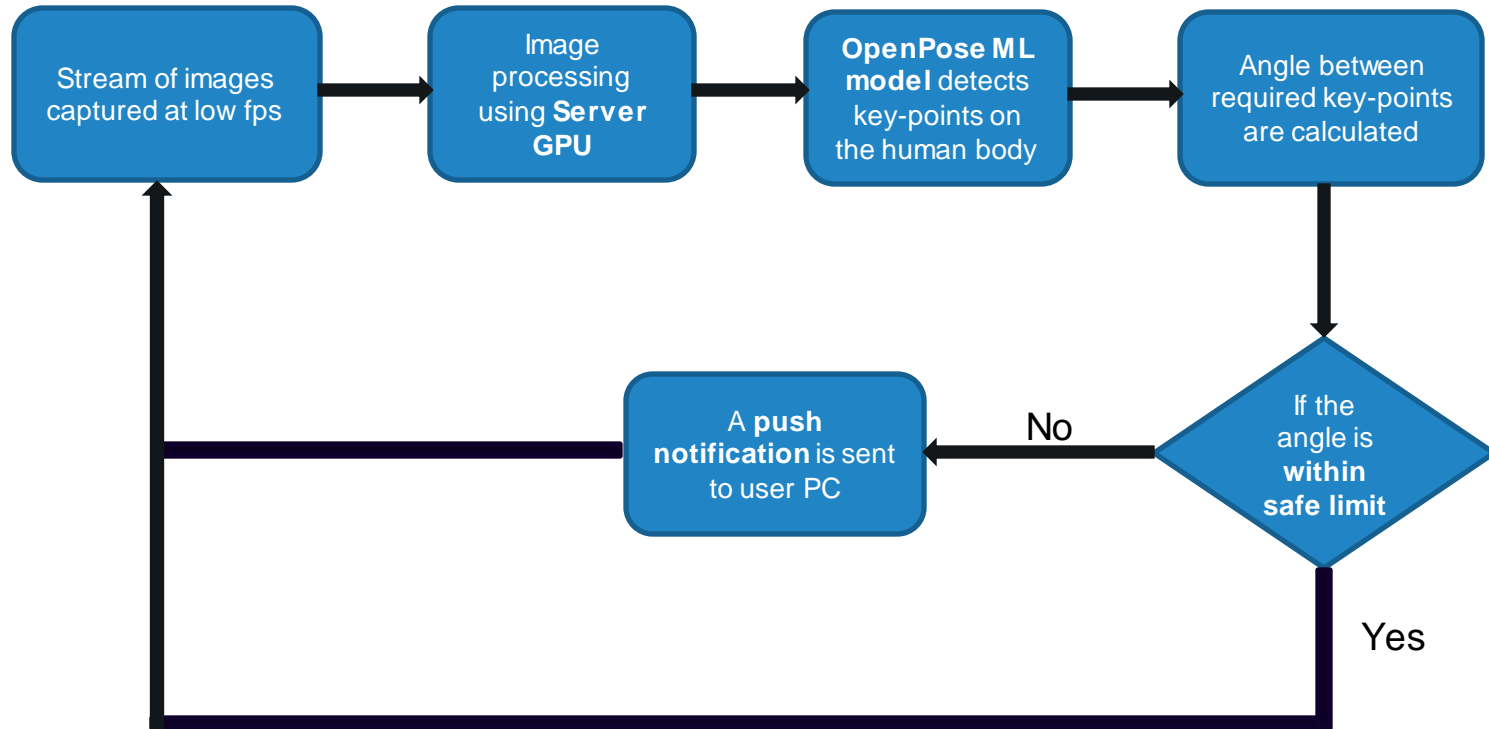
- Expensive
- Doesn't help a lot



# Proposed solution



# Workflow diagram

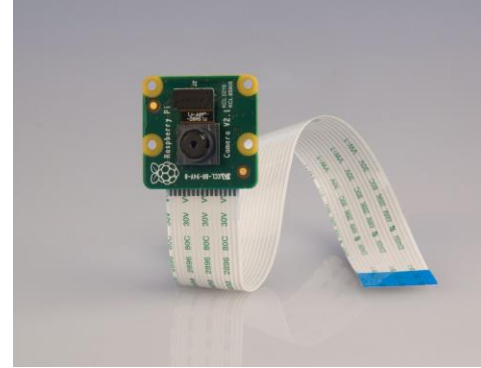


# Components used



## Raspberry Pi 3B+

Used for taking the input from the camera and to transmit the same for processing



## Pi camera V2

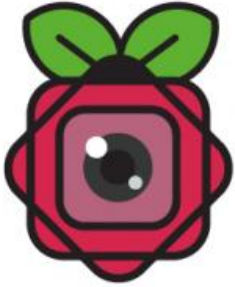
Used for image capture of the people and sharing data with the RPi



# Feed streaming



# How it works



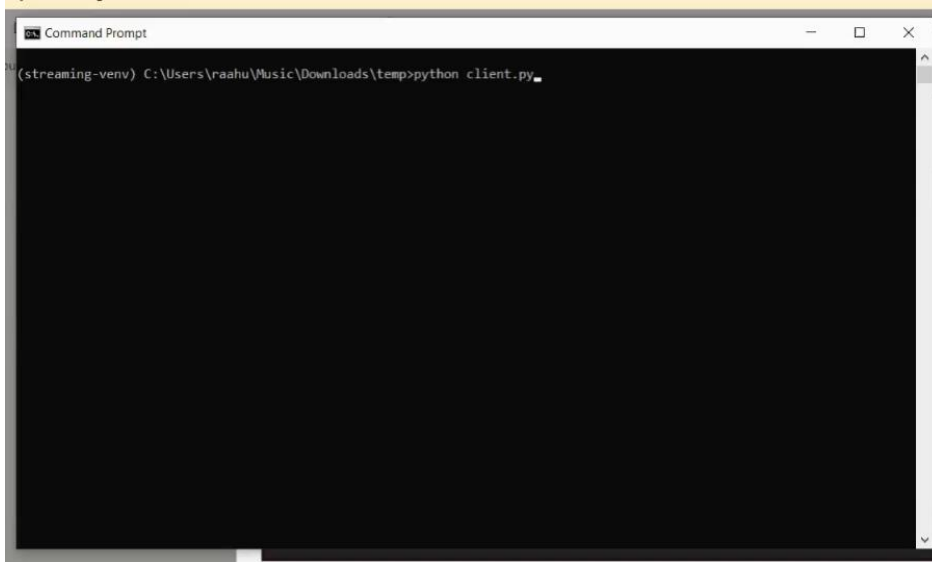
Raspberry Pi takes input from Pi cam

Streams the feed  
wirelessly to server using  
its IP address

Feed viewed by server

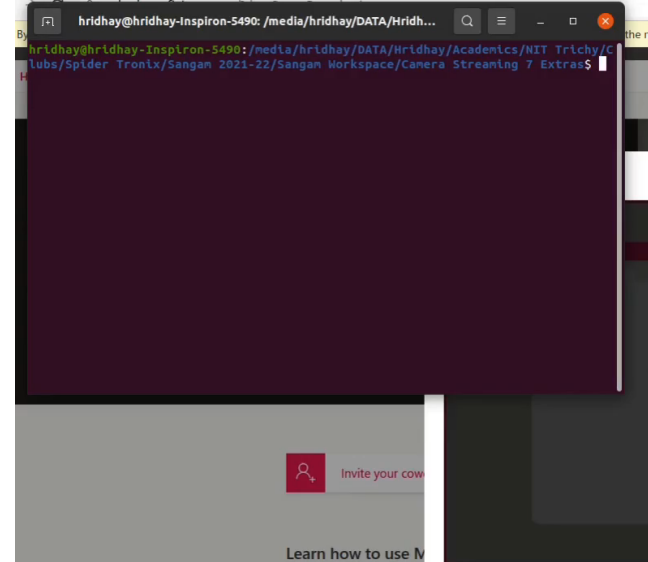
# Working demo

▶ Sender screen

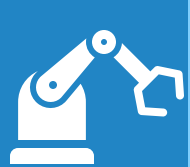


```
Command Prompt
(streaming-venv) C:\Users\raahu\Music\Downloads\temp>python client.py_
```

▶ Receiver Screen



```
hridhay@hridhay-Inspiron-5490: /media/hridhay/DATA/Hridh...
hridhay@hridhay-Inspiron-5490: /media/hridhay/DATA/Hridhay/Academics/NIT Trichy/c
tubs/Spider Tronix/Sangan 2021-22/Sangan Workspace/Camera Streaming 7 Extras$
```

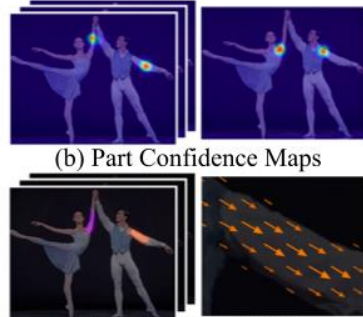


# OpenPose ML model

# How it works



(a) Input Image



(b) Part Confidence Maps

(c) Part Affinity Fields



(d) Bipartite Matching



(e) Parsing Results

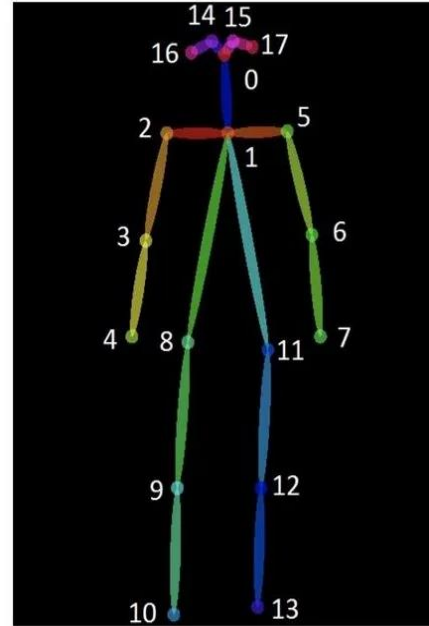
Input image is passed through 10 layers of VGG-19 model to extract feature maps.

Part confidence and Part affinity maps are created from the feature map.

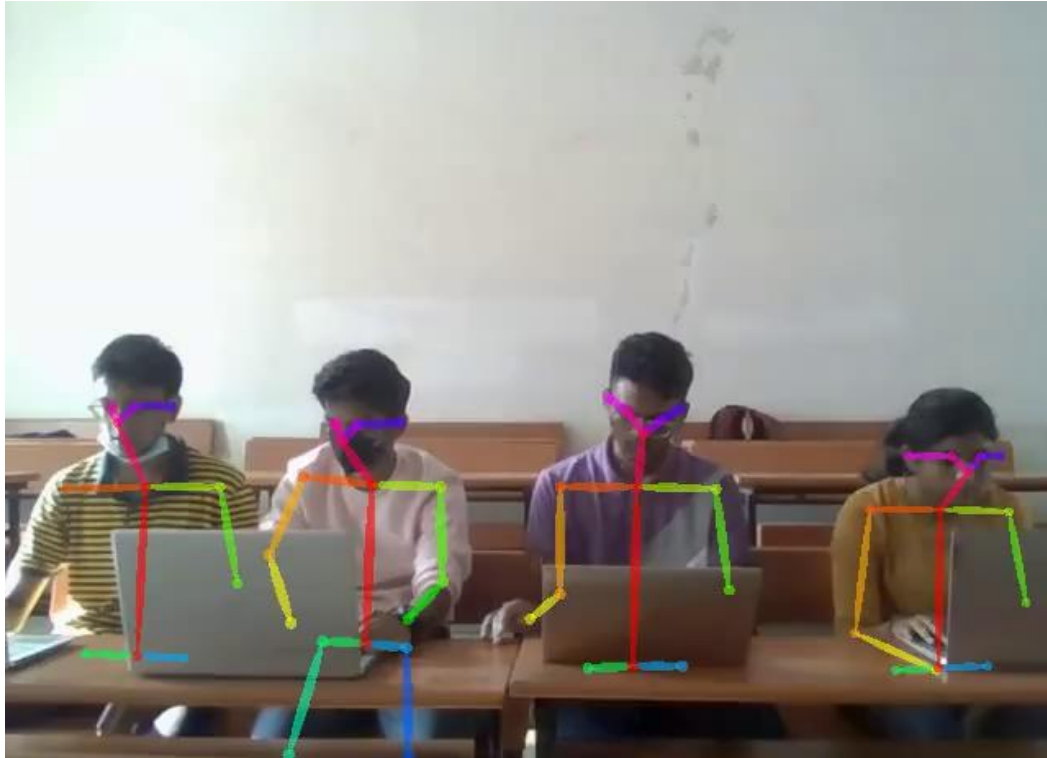
Using the Bipartite matching algorithm, the pose of each person is obtained

# Key-point detection

- 18 key points on single person and up to a total of 135 key points from an image.
- Co-ordinates of key points extracted and saved in a JSON file.
- The angle between them is calculated to detect slouching.



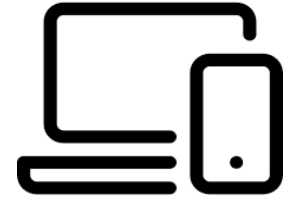
# Working demo





# Push notification

# How it works



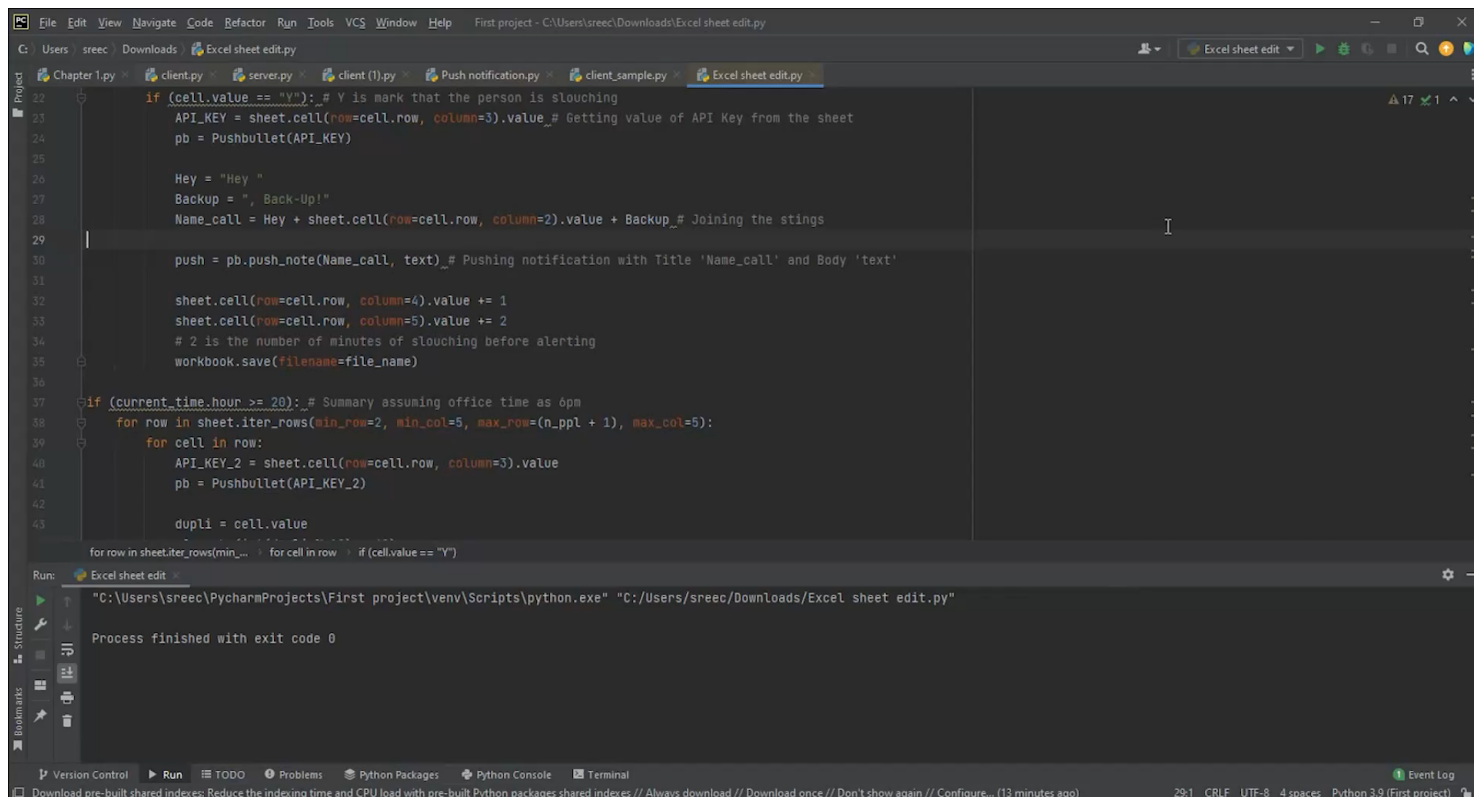
Server sends push notifications to the respective person

Push bullet API used for achieving this

Compatible with both computers and cell phones



# Working demo



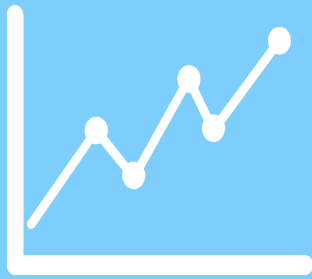
The screenshot displays the PyCharm IDE interface. The main editor window shows a Python script named 'Excel sheet edit.py' with the following code:

```
22 if (cell.value == "Y"):# Y is mark that the person is slouching
23     API_KEY = sheet.cell(row=cell.row, column=3).value_# Getting value of API Key from the sheet
24     pb = Pushbullet(API_KEY)
25
26     Hey = "Hey "
27     Backup = ", Back-Up!"
28     Name_call = Hey + sheet.cell(row=cell.row, column=2).value + Backup_# Joining the strings
29
30     push = pb.push_note(Name_call, text)_# Pushing notification with Title 'Name_call' and Body 'text'
31
32     sheet.cell(row=cell.row, column=4).value += 1
33     sheet.cell(row=cell.row, column=5).value += 2
34     # 2 is the number of minutes of slouching before alerting
35     workbook.save(filename=file_name)
36
37 if (current_time.hour >= 20):_# Summary assuming office time as 6pm
38     for row in sheet.iter_rows(min_row=2, min_col=5, max_row=(n_ppl + 1), max_col=5):
39         for cell in row:
40             API_KEY_2 = sheet.cell(row=cell.row, column=3).value
41             pb = Pushbullet(API_KEY_2)
42
43             dupli = cell.value
44
45             for row in sheet.iter_rows(min_row=2, min_col=5, max_row=(n_ppl + 1), max_col=5):
46                 for cell in row:
47                     if (cell.value == "Y"):
```

The Run console at the bottom shows the execution output:

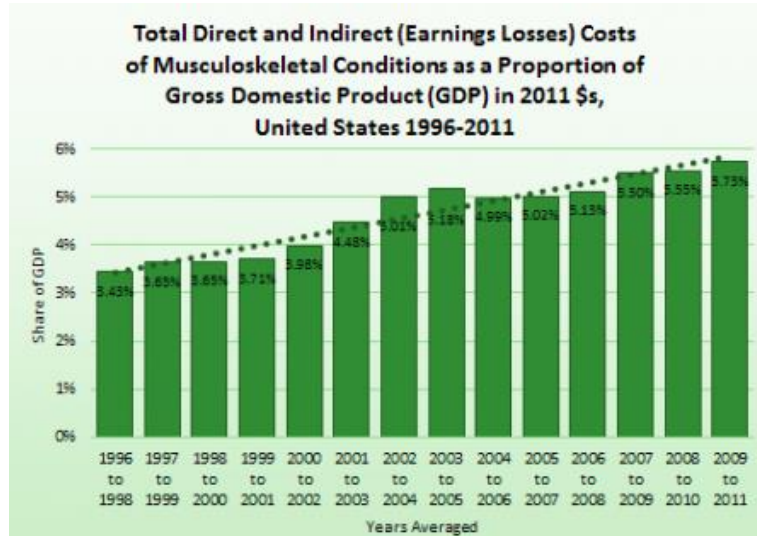
```
Run: C:\Users\sreec\PycharmProjects\First project\venv\Scripts\python.exe "C:/Users/sreec/Downloads/Excel sheet edit.py"
Process finished with exit code 0
```

The status bar at the bottom indicates the file encoding is UTF-8, the tab width is 4 spaces, and the Python version is 3.9 (First project).



# Impact

# WHO stated facts



Approx. 1.71 billion people worldwide

Low back pain causes highest burden - 568 million people.

Limit mobility and dexterity, leading to early retirement from work, lower levels of well-being.

Has been increasing and is projected to increase in the next decades.



# Novelty and future works



### **Cost-effective**

Hardware requirement less.



### **Maximum comfort**

No physical attachment



### **New approach**

No implementation yet



### **Prevention**

Prevents from slouching, saves  
from risk of back pain.



### **Ease of implementing**

Can run on existing server and  
cameras

# Work to be done

Write code for image streaming

Implement image streaming in raspberry pi

Extract key point coordinates and calculate angle between them

Integrate hardware, image streaming, OpenPose model and notification into single product



# Thank You