GESTURE CONTROLLED VIRTUAL MOUSE

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INTRODUCTION

- In this project proposes a way to control the position of the cursor with the bare hands without using any electronic device.
- The operations like clicking and dragging etc, of objects will be performed with different hand gestures.
- The proposed system will only require a webcam as an input device.
- The software’s that will be required to implement the proposed system are OpenCV , Mediapipe and python.
- The output of the camera will be displayed on the system’s screen so that it can be further changed by the user.

DEVELOPING ENVIRONMENT

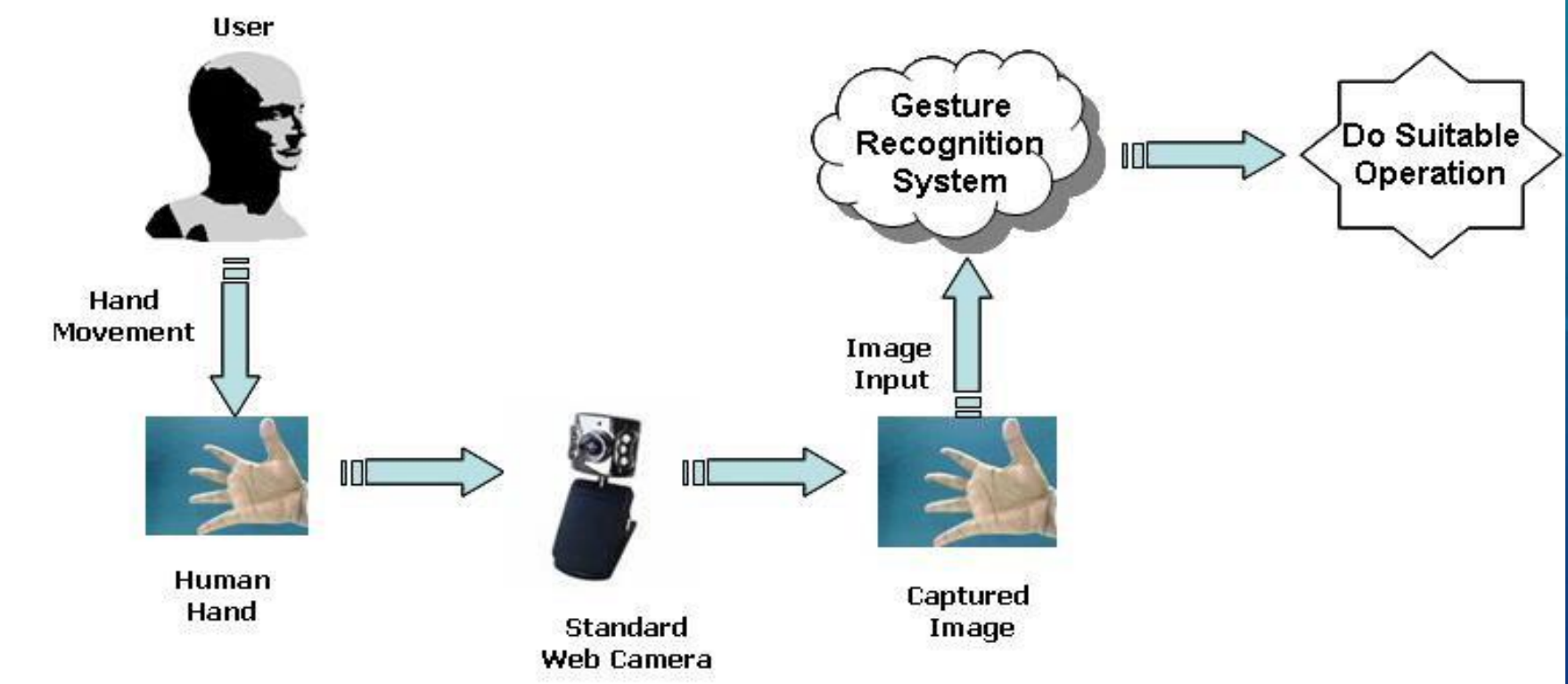
Hardware specification :

- Processor : intel core i3 and above
- Primary memory : 4 GB RAM and above
- Storage : 500GB hard disk and above
- camera

Software specification :

- Front End : python
- Operating system : windows 7 and above
- Back end : pyCharm

METHODOLOGY



In the Methodology, the method used in each component of the system will be explained separately. They are following subsections:

Camera setting

- The runtime operations are managed by the webcam of the connected laptop or desktop. To capture a video, we need to create a Video Capture object.
- Device index is just the number to specify which camera.Since we only use a single camera we pass it as ‘0’.
- After that can capture frame-by-frame.

Capturing frames

- he infinite loop is used so that the web camera captures the frames in every instance and is open during the entire course the program.
- capture the live feed stream, frame by frame.

Display the frame

- A window will pop up on the screen of the user displaying the hands of the user and the subordinates lines controlling the cursor the output can be shown.

Mouse movement

- Calculate the difference between the fingers and the specific assigned value meet the the difference value then the mouse movement started.

MEDIA PIPE

- MediaPipe is a framework which is used for applying in a machine learning pipeline, and it is an opensource framework of Google.
- The MediaPipe framework is useful for cross platform development.
- The MediaPipe framework is multimodal, where this framework can be applied to various audios and videos .
- The MediaPipe framework is used by the developer for building and analyzing the systems through graphs, and it also been used for developing the systems for the application purpose.

MediaPipe offers cross-platform, customizable ML solutions for live and streaming media.

End-to-End acceleration: *Built-in fast ML inference and processing accelerated even on common hardware*

Build once, deploy anywhere: *Unified solution works across Android, iOS, desktop/cloud, web and IoT*

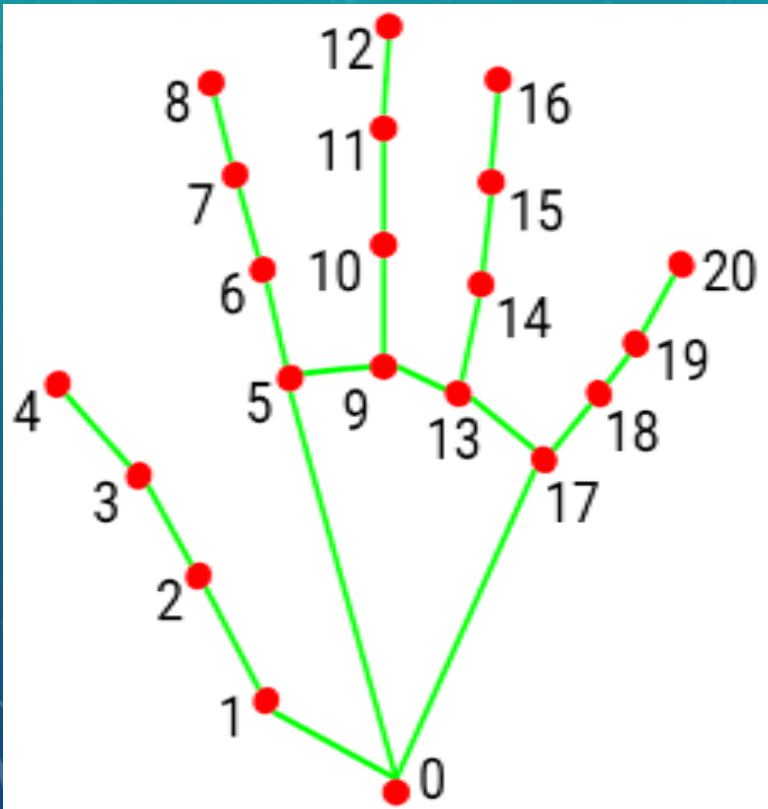
Ready-to-use solutions: *Cutting-edge ML solutions demonstrating full power of the framework*

Free and open source: *Framework and solutions both under Apache 2.0, fully extensible and customizable*

CONCEPT OF HAND TRACKING

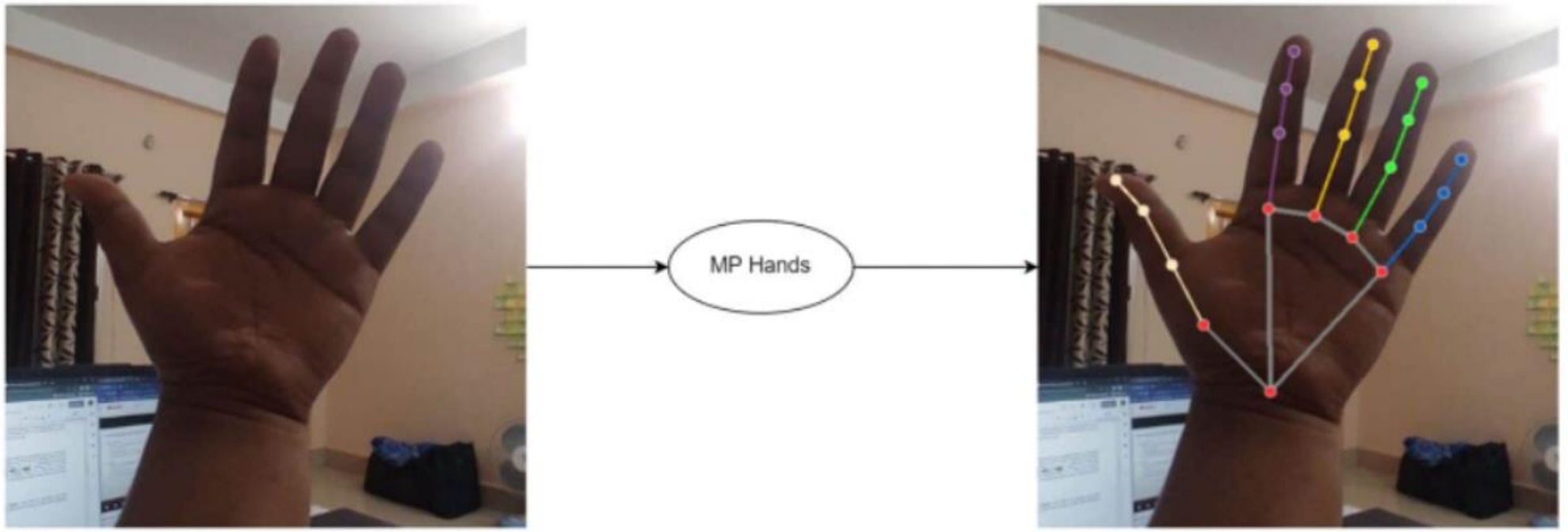
Hand tracking using MediaPipe involves two stages :

- **Palm detection** - MediaPipe works on the complete input image and provides a cropped image of the hand.
- **Hand landmarks identification** - MediaPipe finds the 21 hand landmarks on the cropped image of the hand.



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

HAND BEFORE AND AFTER



OPENCV

COMPUTER VISION

- Computer vision is a process by which we can understand the images and videos how they are stored and how we can manipulate and retrieve data from them.
- Computer Vision is the base or mostly used for Artificial Intelligence. Computer-Vision is playing a major role in self-driving cars, robotics as well as in photo correction apps

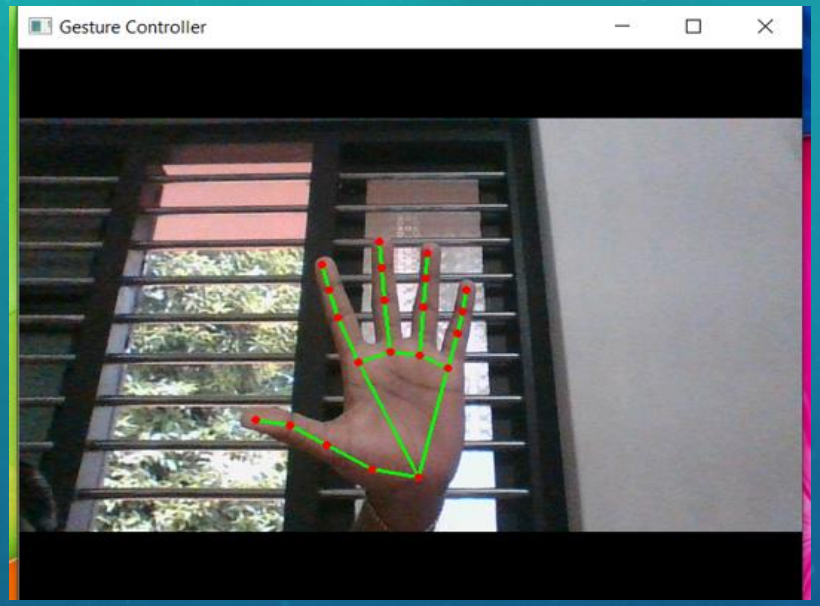
OPENCV

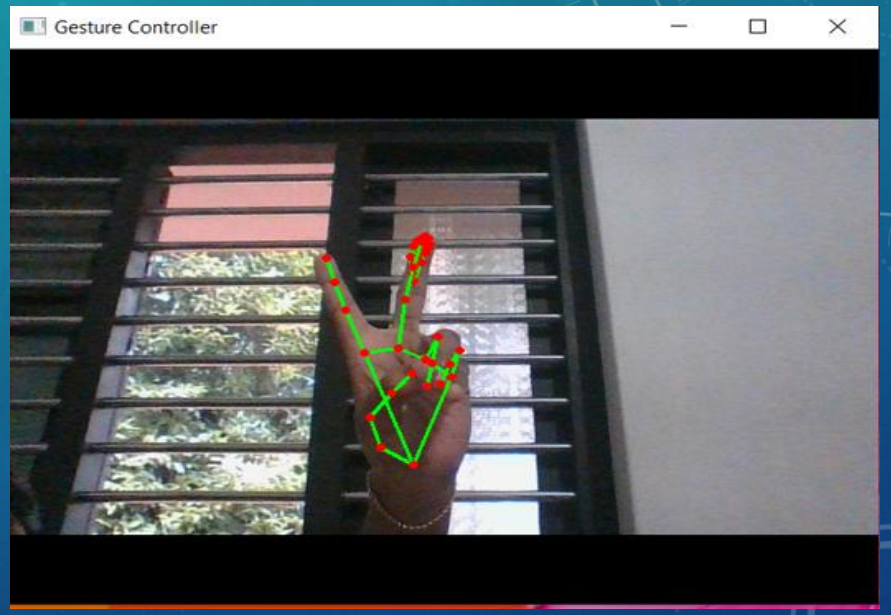
- OpenCV is the huge open-source library for the computer vision, machine learning, and image processing .
- .By using it, one can process images and videos to identify objects, faces, or even handwriting of a human.
- When it integrated with various libraries, such as ***NumPy, python*** is capable of processing the OpenCV array structure for analysis.
- To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.

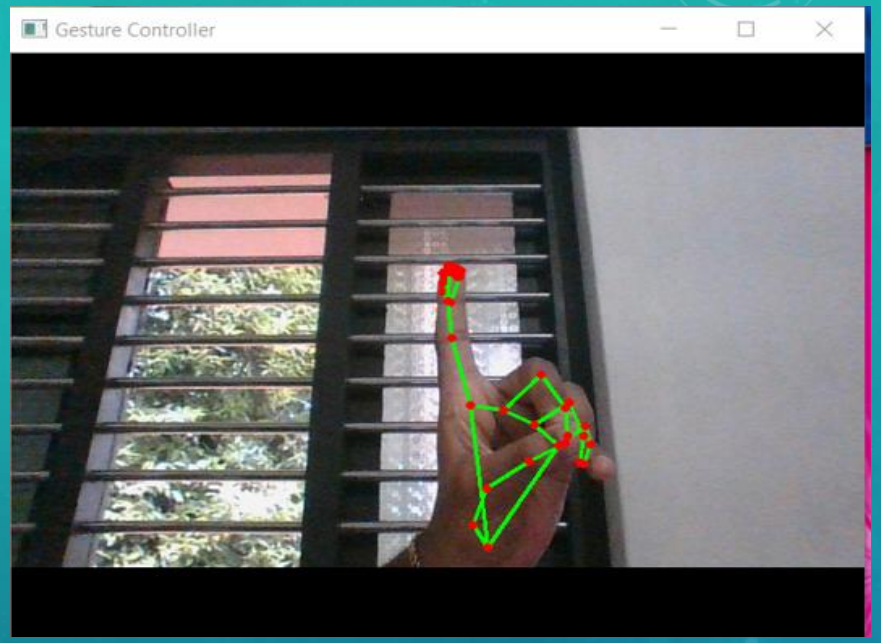
Steps to capture a video:

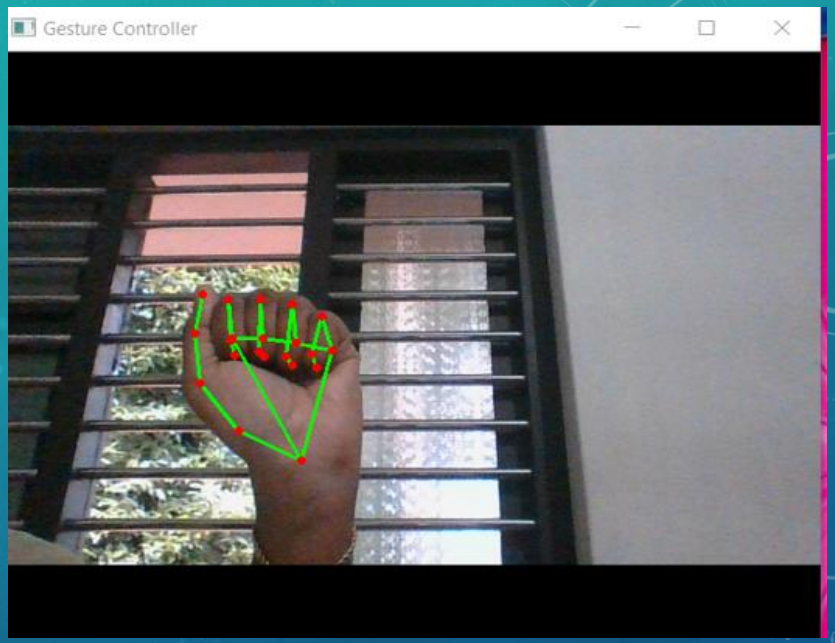
- Use cv2.VideoCapture() to get a video capture object for the camera.
- Set up an infinite while loop and use the read() method to read the frames using the above created object.
- Use cv2.imshow() method to show the frames in the video.
- Breaks the loop when the user clicks a specific key
- Frame Capture A frame is an image that forms a single instance of a video. A video consists of a lot of frames running per second .

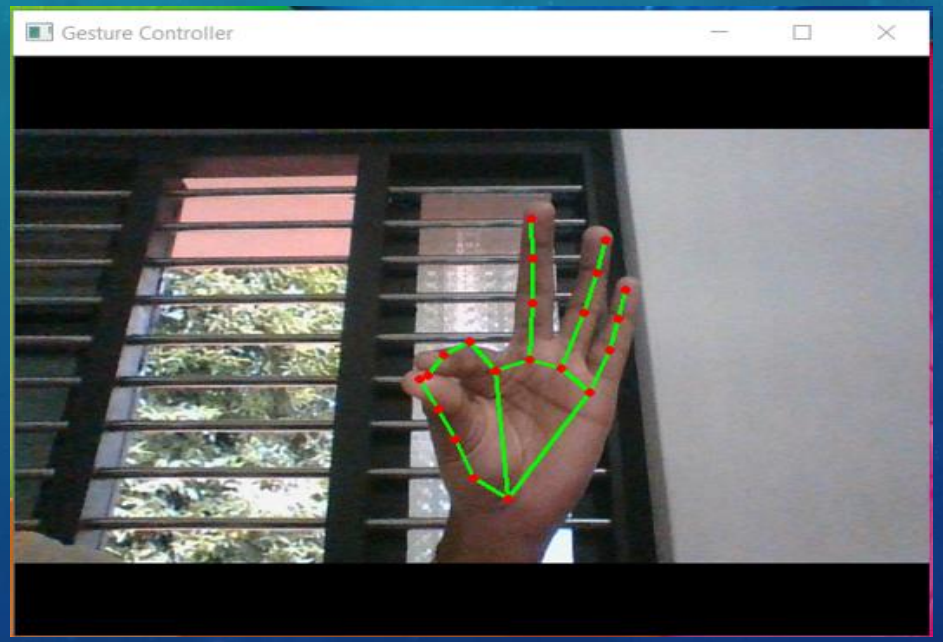
SCREEN SHORT






Gesture Controller


Gesture Controller


Gesture Controller

FUTURE SCOPE

- The current project gives us the best results in a plain background and therefore in future will need to work on color background as well.
- The future work will include implementation of additional gestures which will enable the user to perform more functions with ease.
- The proposed system in this project uses only the right hand to perform gestures.
- Improvement of the implemented technique in future can be possible using both hands for performing different gesture movement.

PROJECT PLAN

ID	Task Name	Start Date	End Date	Days	Status
1	Sprint 1	16/04/2022	28/04/2022	13	completed
2	Sprint 2	05/05/2022	18/05/2022	14	completed
3	Sprint 3	24/05/2022	06/06/2022	14	completed
4	Sprint 4	10/06/2022	05/07/2022	10	Completed

PRODUCT BACKLOG

User story ID	Priority <High/Medium/Low>	Size (Hours)	Sprint <#>	Status <planned/in progress/ completed>	Release Date	Release Goal
1	Medium	13	1	Completed	28/04/2022	Camera configuration
2	High	15	2	Completed	18/05/2022	Hand recognition
3	High	15	3	Completed	06/06/2022	Gesture identification
4	High	10	4	Completed	05/07/2022	Mouse working

SPRINT BACKLOG PLAN

SPRINT 1

Backlog item	Status & completion	Original estimate in hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day14
Camera configuration	19/04/2022	6	1	0	3	2	0	0	0	0	0	0	0	0	0	0
coding	26/04/2022	12	0	0	0	0	3	2	0	3	0	1	3	0	0	0
testing	28/04/2022	4	0	0	0	0	0	0	0	0	0	0	0	2	2	0
total		22	1	0	3	2	3	2	0	3	0	1	3	2	2	0

SPRINT BACKLOG PLAN

SPRINT 2

Backlog item	Status & completion	Original estimate in hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
Coding	06/05/2022	10	0	0	0	0	2	1	0	3	1	1	2	0	0	0
Testing	18/05/2022	4	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Total		14	0	0	0	0	2	1	0	3	1	1	2	2	2	0

SPRINT BACKLOG PLAN

SPRINT 3

Backlog item	Status & completion	Original estimate in hour	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
coding	24/05/2022	15	2	3	0	1	1	3	0	3	0	0	2	0	0	0
Testing	06/06/2022	5	0	0	0	0	0	0	0	0	0	0	0	2	2	1
total		20	2	3	0	1	1	3	0	3	0	0	2	2	2	1

SPRINT BACKLOG PLAN

Sprint 4

Backlog item	Status & completion	Original estimate in hour	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
coding	10/06/2022	5	2	1	0	1	0	0	0	0	0	1	0	0	0	0
Testing	05/07/2022	5	0	0	0	0	0	0	0	0	0	0	0	2	2	1
total		10	2	1	0	1	0	0	0	0	0	1	0	2	2	1

SPRINT BACKLOG ACTUAL

SPRINT 1

Backlog item	Status & completion	Original estimate in hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
Camera configuration	19/04/2022	6	1	0	3	2	0	0	0	0	0	0	0	0	0	0
coding	26/04/2022	12	0	0	0	0	3	2	0	3	0	1	3	0	0	0
testing	28/04/2022	4	0	0	0	0	0	0	0	0	0	0	0	2	2	0
total		22	1	0	3	2	3	2	0	3	0	1	3	2	2	0

SPRINT BACKLOG ACTUAL

SPRINT 2

Backlog item	Status & completion	Original estimate in hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
Coding	06/05/2022	10	0	0	0	0	2	1	0	3	1	1	2	0	0	0
Testing	18/05/2022	4	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Total		14	0	0	0	0	2	1	0	3	1	1	2	2	2	0

SPRINT BACKLOG ACTUAL

SPRINT 3

Backlog item	Status & completion	Original estimate in hour	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
coding	24/05/2022	15	2	3	0	1	1	3	0	3	0	0	2	0	0	0
Testing	06/06/2022	5	0	0	0	0	0	0	0	0	0	0	0	2	2	1
total		20	2	3	0	1	1	3	0	3	0	0	2	2	2	1

SPRINT BACKLOG ACTUAL

Sprint 4

Backlog item	Status & completion	Original estimate in hour	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
coding	10/06/2022	5	2	1	0	1	0	0	0	0	0	1	0	0	0	0
Testing	05/07/2022	5	0	0	0	0	0	0	0	0	0	0	0	2	2	1
total		10	2	1	0	1	0	0	0	0	0	1	0	2	2	1

THANK YOU