Basic Calculations Using Live Hand Gestures

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Artificial Intelligence and Machine Learning, Lambton College

CBD1214 - Python Programming

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Feasibility & Requirements:

1. Python >= 3.5,
2. Webcam,
3. Integrated Development Environment,
4. Hand Recognition,
5. Hand Data Points Detection,
6. Optical Character Recognition

Modules/Packages:

1. Mediapipe,
2. Numpy,
3. Tensorflow >= 2.0,
4. Keras,
5. OpenCV,
6. Tesseract

SDLC:

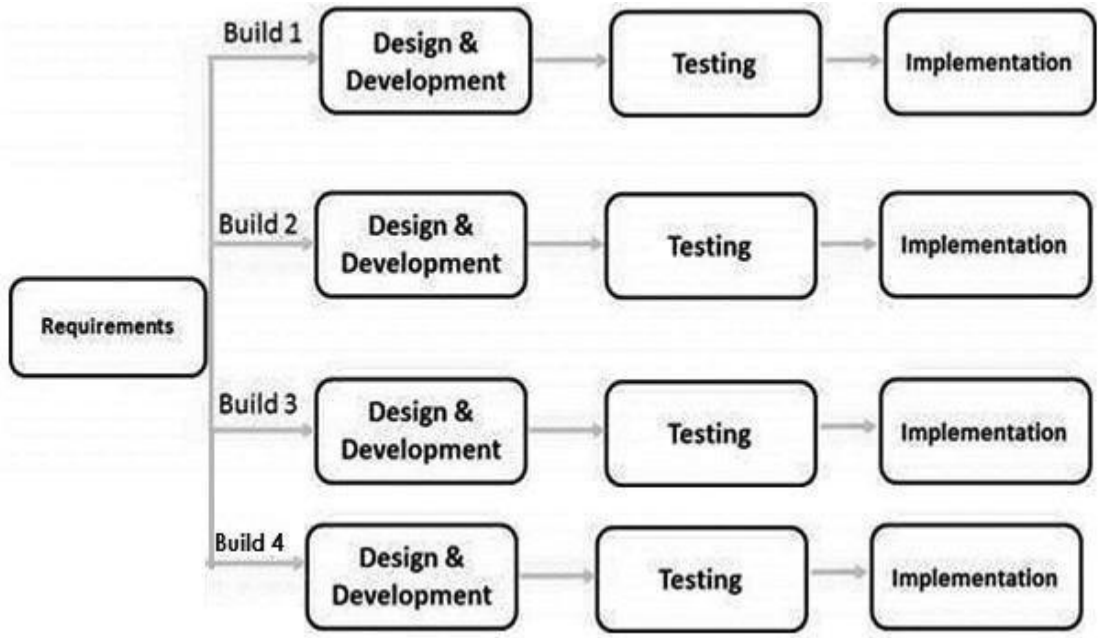

Fig: Software Development Incremental Model

The incremental build model is a method of software development where the product is designed, implemented and tested incrementally until the product is finished. It involves both

development and maintenance. The product is defined as finished when it satisfies all of its requirements. This model combines the elements of the waterfall model with the iterative philosophy of prototyping. In this model the whole requirement is divided into various builds and multiple development cycles take place. We are planning to use this model focusing on two phases.

The incremental Software Development Model is the hybrid form of the Waterfall and Prototype Model. The steps or procedures of this model are going to be implemented in this project.

System Architecture:

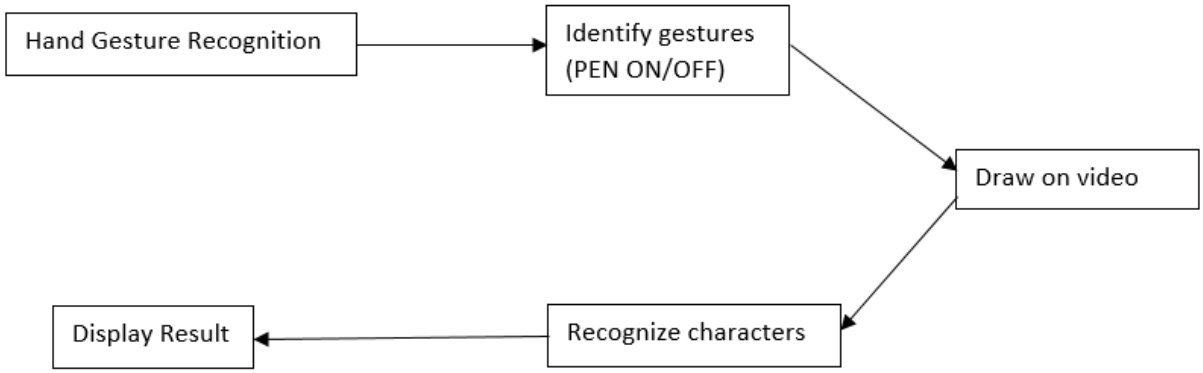

Fig: System Architecture Diagram

The flow of the process is as stated below -

1. Hand Gesture Recognition: Access the webcam and use the video feed to recognize hand gestures within the frame using mediapipe library (Open-Source provided by Google). The hand detected from the frame is in 3D domain but this project utilizes only the 2D (X, Y) co-ordinates.
2. Identify gestures (PEN ON/OFF): Coordinates are assigned to the joints on each finger to identify the gesture. The action of a hand holding a pen, wherein the index and thumb finger are in close proximity, is determined as the **Pen ON** stage while the opposite is considered as **Pen OFF**.
3. Draw on Video: In order to draw on the video frame, this project utilizes OpenCV - a python library for Computer Vision.

4. Recognize characters: Once the sliced frames are retrieved from the video frame, they are passed towards the tesseract module (a model trained on Neural Network). OCR is performed on the frame and the recognized characters are extracted.
5. Display Results: Once the calculations are performed on extracted characters, OpenCV is used to display the answer as text on canvas. Bitwise and/or operation is carried out to attach the canvas on frame for displaying to the user.

Team Member Responsibilities:

1. Nabin Prasad Dev
- Hand Gesture recognition using Mediapipe
- Testing and Documentation
- Presentation

2. Abhilasha Gaur
- Identify gestures for Pen ON and OFF
- Testing and Documentation
- Presentation

3. Sushil Basi
- Draw on the frame of the video captured
- Testing and Documentation
- Presentation

4. Samir Khanal
- Get part of the frame and recognize the character using OCR
- Testing and Documentation
- Presentation

5. Sunil Thapa
- Operate the mathematical operations and display them on the video frame
- Testing and Documentation
- Presentation

References:

https://docs.opencv.org/4.x/d6/d00/tutorial_py_root.html
https://google.github.io/mediapipe/getting_started/python_framework.html
https://nanonets.com/blog/ocr-with-tesseract/
https://stackify.com/what-is-sdlc/