ARDUINO HAND GESTURE LED CONTROL USING PYCHARM:

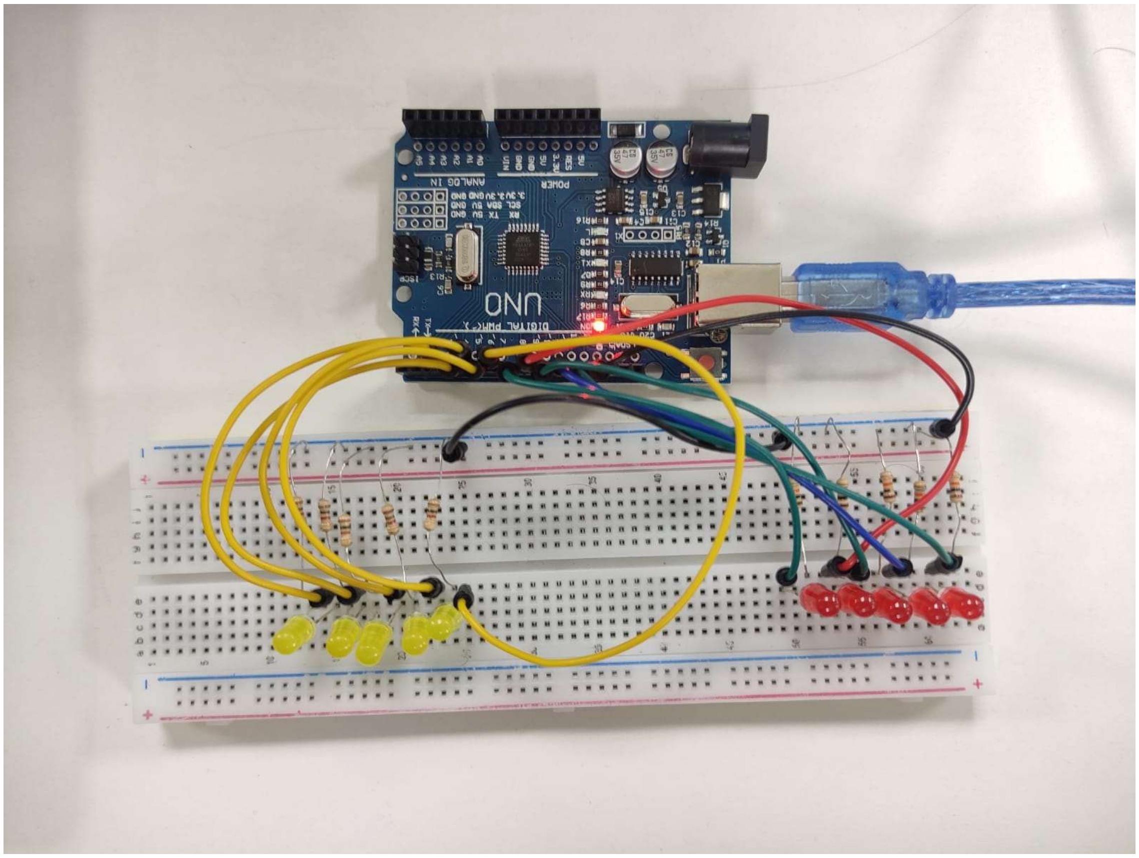
Objective: To make LEDS glow based on hand gestures. Show your left hand and LEDs on the left light up. Show your right hand and LEDs on the right light up.

Requirements:

- Arduino Uno Kit - UNO Board, Bread board, 10 LEDs, connecting wires, 10 resistors(1k/100 Ohms), USB Arduino wire.
- Arduino IDE
- Pycharm Community IDE.

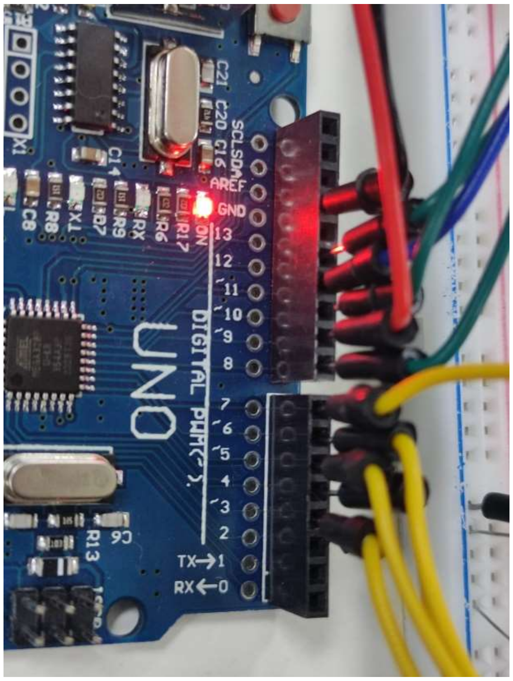
To be accomplished: Integrate the Inbuilt webcam of personal computer with an Arduino UNO Board. Link LEDs with Arduino UNO kit and use dc power sources(either from PC Or external source). Use PyCharm Community for coding section using OpenCV 2 Library files.

CIRCUIT LAYOUT:



Instructions for assembling the circuit:

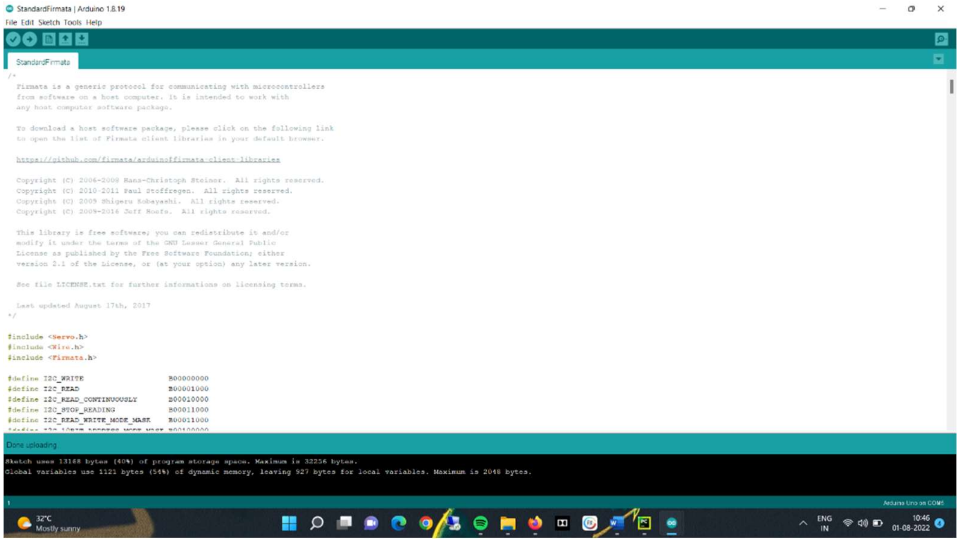
1. Place 10 LEDS as 2 sets of 5 on the breadboard as shown above.
2. Connect 1K or 100 Ohms resistors in series with the LEDs at the shorter leg which is the Cathode(-ve).
3. The other end of the resistors are placed in the negative railing for grounding on the bread board.
4. Wires are placed in the pin slots of the UNO Board as shown.
5. The wire from the GND slot is connected to the negative railing of the bread board.
6. Pins 3 to 12 are connected to the longer legs of the LEDs, i.e. Anode(+ve).
7. Grounding on both sides of the bread board is given by connecting a common wire between the LEDs.



Instructions for the program:

1. Install Pycharm Community IDE and Arduino IDE.
2. Click File -> New Project and name it.
3. Open Pycharm and go to File -> Settings and Search for Python Interpretor.
4. Click on the + icon and install the following packages in the project directory.
   a. Pip
   b. cvtools
   c. Cvzone
   d. opencv
   e. Mediapipe
   f. Pyfirmata
   g. Tensorflow

5. After installing the required packages, open a new python file(.py) for writing the code.
6. Make use of the file handtracking.py as a separate program and the other 2 code files as a separate program as the two serve 2 different purposes.
7. After including the code lines, debug the code.
8. Connect the UNO board via USB to the PC and open the Arduino IDE.
9. Note the port in which the board is connected and use the same port name in the pycharm program.
10. Go to File -> Examples -> Firmata -> StandardFirmata in the Arduino IDE.
11. Upload the program to the board till the prompt Done uploading shows up on the screen.



```
/*
  Firmata is a generic protocol for communicating with microcontrollers
  from software on a host computer. It is intended to work with
  any host computer software package.

  To download a host software package, please click on the following link
  to open the list of Firmata client libraries in your default browser.

  https://github.com/firmata/arduino#firmata-client-libraries

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  Copyright (C) 2009 Shigeru Kobayashi.  All rights reserved.
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  version 2.1 of the License, or (at your option) any later version.

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  Last updated August 17th, 2017
*/

#include <Servo.h>
#include <Wire.h>
#include <Firmata.h>

#define I2C_WRITE                   B00000000
#define I2C_READ                    B00001000
#define I2C_READ_CONTINUOUSLY       B00010000
#define I2C_STOP_READING            B00011000
#define I2C_READ_WRITE_MODE_MASK    B00011000
```
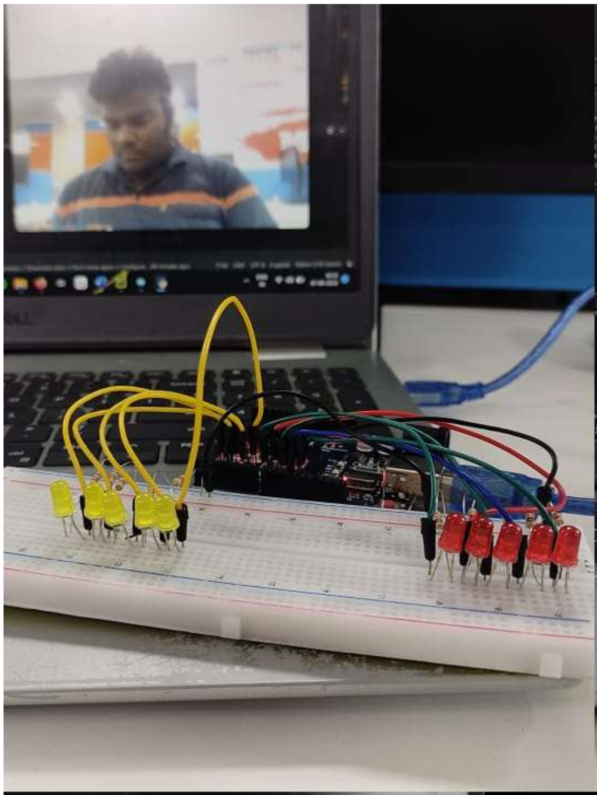
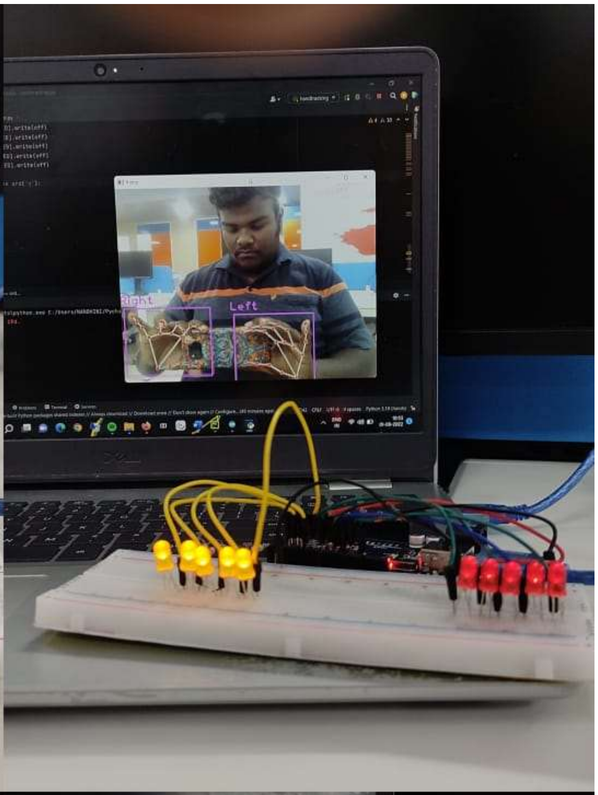
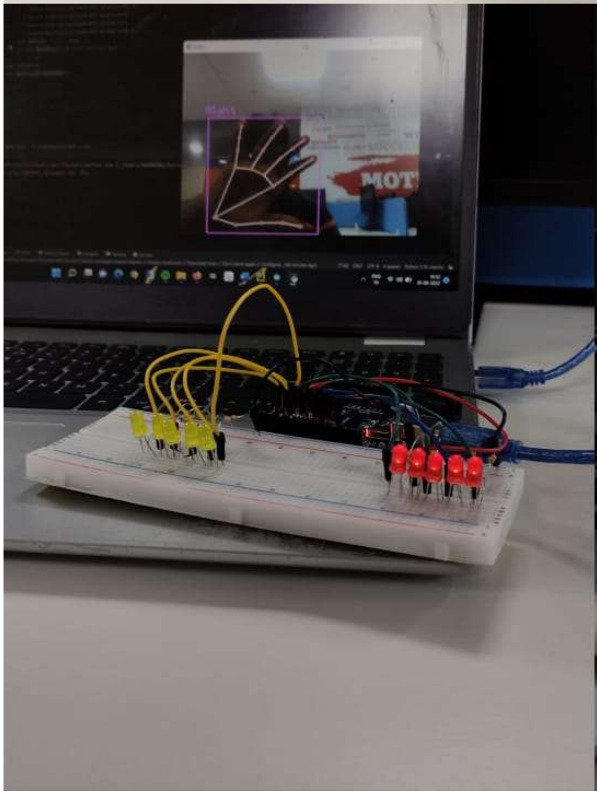

Done uploading.

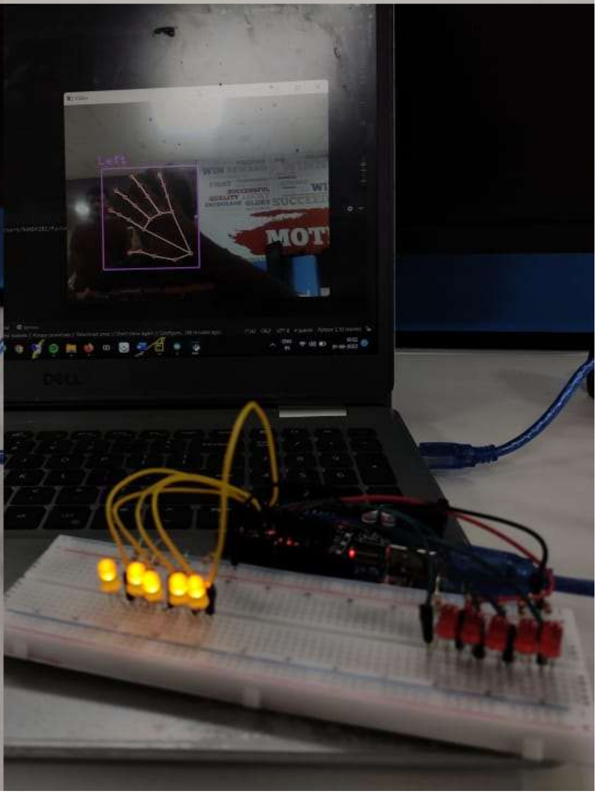
```
Sketch uses 13168 bytes (40%) of program storage space. Maximum is 32256 bytes.
Global variables use 1121 bytes (54%) of dynamic memory, leaving 927 bytes for local variables. Maximum is 2048 bytes.
```

12. Go back to the Pycharm Interface and run the program handtracking.py
13. The webcam gets powered up and the video shows up on the screen.
14. Show up any 1 hand and the system detects whether it is the right or the left hand and the LEDs glow up accordingly.
15. If both hands are shown on the screen both the sets of LEDs glow up. Similarly No LEDs when No hands are detected.




Right
Left


Right


Left

Program 2:

- Ensure that the 2 files controller.py and Arduino.py are in the same directory.
- Run the program
- The video input is displayed on the screen.
- Bring up the right hand in front of the camera.
- If the fist is closed then none of the lights glow up.
- For each finger detected, one yellow and one red LED glows.