**List of Figures**

# Table of Contents

# 1. INTRODUCTION ABOUT PROJECT

## 1.1 Overview Of Project

This project is a software part of robot. It is the interface between user and robot. This project uses python programming language and its libraries raspberry-pi (Rpi.GPIO), tkinter , OpenCV.

- This interface controls whole robotic movement with keyboard keys of the pc connected to raspberry pi used in robot.
- This interface controls movement of the bot, 5 robotic arms, 1 pistol and one rifle(movement,shoot and reload), 2 DC on-off motors, movement of 1 camera.
- This interface also displays live streaming of 3 cameras simulteanously.

## 1.2 Scope Of Project

This project can be utilized and modified to be worked on any type robot which uses servos, DC motors, cameras, any type of triggers, pneumatic cylinders etc.
This project can be used as interface for working prototypes of robots and IOT systems.
This project can also be utilized to implement of automation of robots.

## 1.3 Purpose Of Project

Purpose of this project is to control movements of the robots using pc (commonly laptop) and raspberry pi connected with it.

## 2. HARDWARE AND SOFTWARE REQUIREMENT

### 2.1 For Camera Live-Streaming

- Python 2.7 and OpenCV package installed on Raspberry Pi required.
- In this project we used USB webcam to attach on robot. However Raspberry Pi Camera Module V2 is recommended.
- There is video quality issue and some lag in streaming 3 cameras simulteanously on Raspberry Pi because of low processing power. However when run same program on pc connecting multiple webcams to it, there were no issues of lagging and video quality.

### 2.2 For Robotic Movements

- Python 3.6, tkinter RPi.GPIO packages installed on Raspberry Pi required.

## 3. MAIN MODULES OF PROJECT

### 3.1 Pistol and Rifle Movements Module

4 servos are used to support pistol's and rifle's up-down and left-right movements

### 3.2 Robotic-arms Movements Module

- There are total 5 robotic arms. 3 of these use 6 servos each for movement. And other 2 use 5 servos and 1 motor each (cutter and driller).
- These 5 robotic arms are designed to prototype bomb diffuse mechanism.
- Total of 28 servos and 2 DC motors are utilized for robotic arms movements

### 3.3 Bot Movement Module

- There are 4 motors used (each for one wheel) for robot's forward-backward and left-right movements.

### 3.4 Camera Movement Module

- There are total 3 camera's on robot. Each for pistol, rifle and bomb diffusion.
- Bomb diffusion camera angle can be changed rest of others are rigid
- total of 2 servos are used to support camera's up-down and left-right movements

### 3.5 Camera live-Streaming Module

- OpenCV library is used here to live stream 3 connected camera's simultaneously.
- This module can be utilized to work for 'n' number of cameras (depending on processing power and main memory available)

## 4. IMPLEMENTATION DETAILS WITH SNAP SHOT

### 4.1 Camera live-stream program

```
import cv2
import numpy as np

frame0 = None
frame1 = None
frame2 = None

f_x = 0.90
f_y = 0.80

blankimage = cv2.imread("frame.jpg")
blankimage = cv2.resize(blankimage, (0, 0), fx=f_x, fy=f_y)

cv2.namedWindow("preview0")
vc0 = cv2.VideoCapture(0)
vc1 = cv2.VideoCapture(1)
vc2 = cv2.VideoCapture(2)

if vc0.isOpened(): # try to get the first frame
    rval0, frame0 = vc0.read()
else:
    rval0 = False

if vc1.isOpened(): # try to get the first frame
    rval1, frame1 = vc1.read()
else:
    rval1 = False
```

```
if vc2.isOpened(): # try to get the first frame
    rval2, frame2 = vc2.read()
else:
    rval2 = False


while rval1 & rval0 & rval2:
    frame0 = cv2.resize(frame0, (0, 0), fx=f_x, fy=f_y)
    frame1 = cv2.resize(frame1, (0, 0), fx=f_x, fy=f_y)
    frame2 = cv2.resize(frame2, (0, 0), fx=f_x, fy=f_y)
    framearray1 = np.hstack((frame0, frame1))
    framearray2 = np.hstack((frame2,blankimage))
    framearray = np.vstack((framearray1, framearray2))
    cv2.imshow("preview0", framearray)
    rval0, frame0 = vc0.read()
    rval1, frame1 = vc1.read()
    rval2, frame2 = vc2.read()

    key = cv2.waitKey(20) & 0xFF
    if key == 27:  # exit on ESC
        break

cv2.destroyWindow("preview0")
```

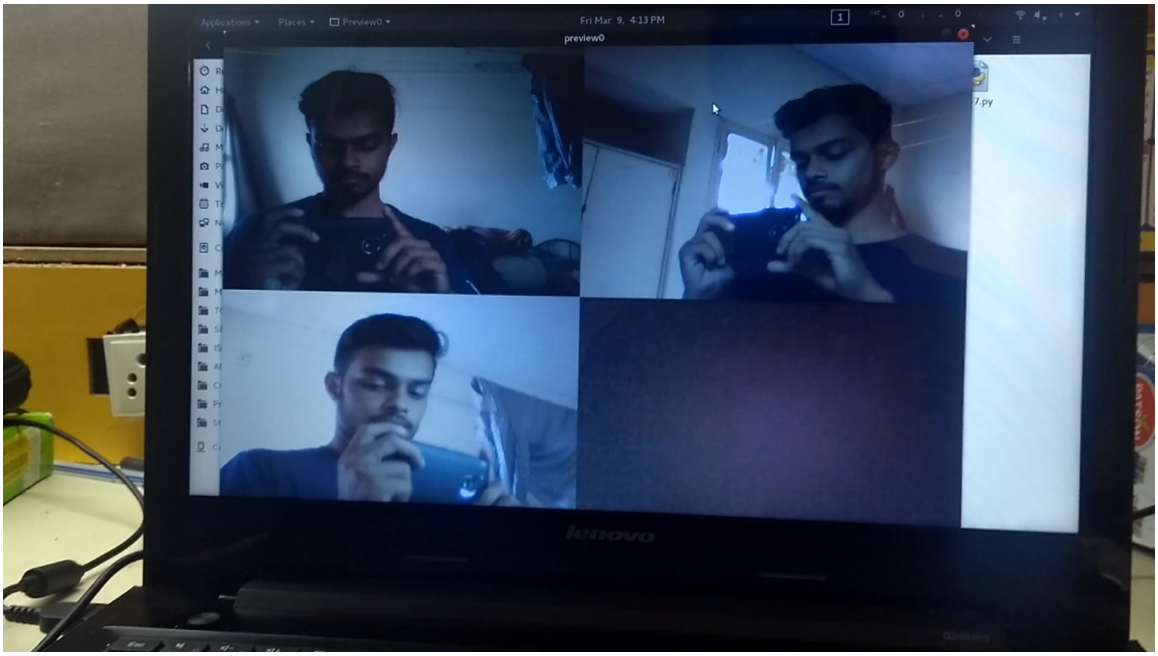


**Figure 1 : Camera Live Streaming-1**

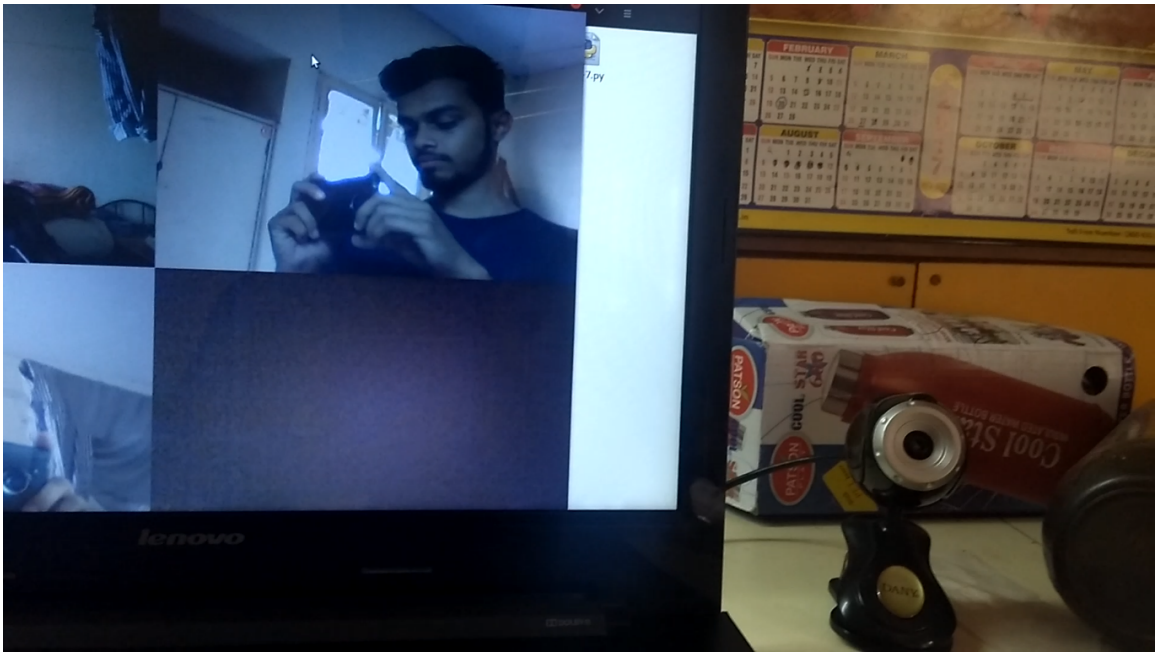


**Figure 2 : Camera Live Streaming-2**

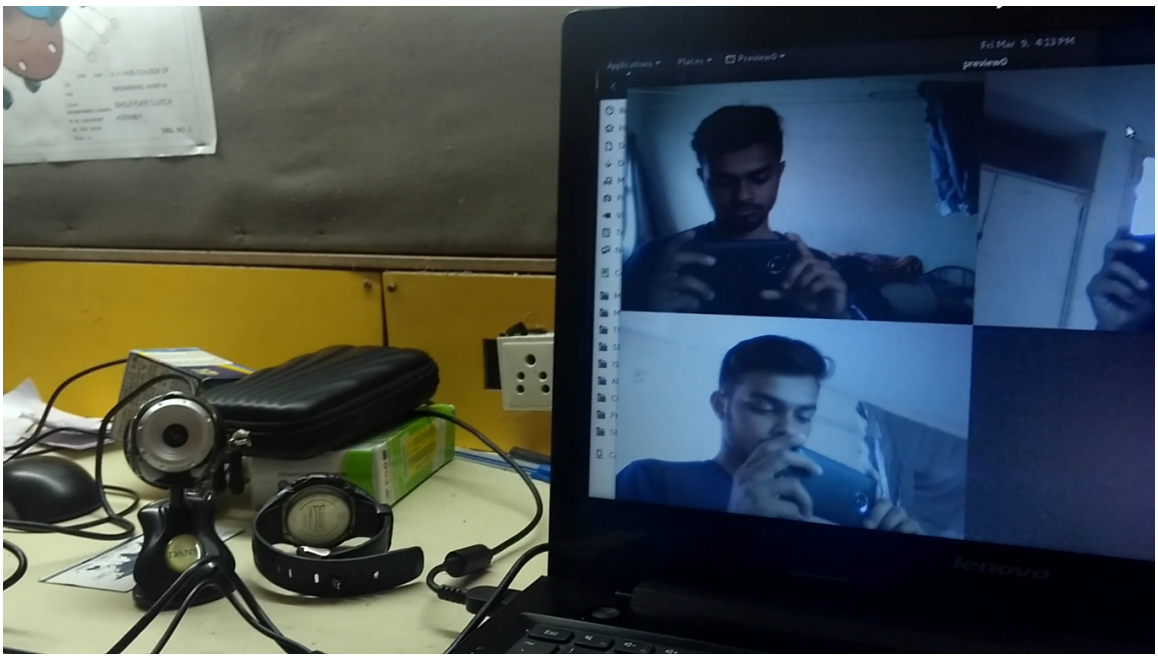


**Figure 3 : Camera Live Streaming-3**

### 4.2 Bot Movement

(this is just the protopytpe of the actual code not any module is implemented in this code)

```
from tkinter import *

# Bot Movement

def keypressed(event):
    keycode = event.keysym
    if keycode == "Left":
        print("Bot Movement Left")
    elif keycode == "Right":
        print("Bot Movement Right")
    elif keycode == "Up":
        print("Bot Movement Front")
    elif keycode == "Down":
        print("Bot Movement Rear")

    # Rifle and Pistol Reload and Shoot

    elif keycode == "m":
        print("Rifle Reload")
    elif keycode == "comma":
        print("Rifle Shoot")
    elif keycode == "period":
        print("Pistol Reload")
    elif keycode == "slash":
        print("Pistol Shoot")

    # 3.6 RA DC motor

    elif keycode == "bracketleft":
        print("36 DC Motor Run")

    # 4.6 RA DC motor

    elif keycode == "semicolon":
        print("46 DC Motor Run")

    # Camera Servos
```

```
elif keycode == "h":
    print("Camera Servo Left")
elif keycode == "j":
    print("Camera Servo Right")
elif keycode == "k":
    print("camera Servo Up")
elif keycode == "l":
    print("Camera Servo Down")

# Pistol Servos

elif keycode == "u":
    print("Pistol Servo Left")
elif keycode == "U":
    print("Pistol Servo Right")
elif keycode == "i":
    print("Pistol Servo Up")
elif keycode == "I":
    print("Pistol servo Down")

# Rifle Servos

elif keycode == "o":
    print("Rifle Servo Left")
elif keycode == "O":
    print("Rifle Servo Right")
elif keycode == "p":
    print("Rifle Servo Up")
elif keycode == "P":
    print("Rifle Servo Down")

# Robotic Arm 1

elif keycode == "1":
    print("RA1 servo1 front")
elif keycode == "2":
    print("RA1 servo2 front")
elif keycode == "3":
```

```
    print("RA1 servo3 front")
elif keycode == "4":
    print("RA1 servo4 front")
elif keycode == "5":
    print("RA1 servo5 front")
elif keycode == "6":
    print("RA1 servo6 front")
elif keycode == "exclam":
    print("RA1 servo1 rear")
elif keycode == "at":
    print("RA1 servo2 rear")
elif keycode == "numbersign":
    print("RA1 servo3 rear")
elif keycode == "dollar":
    print("RA1 servo4 rear")
elif keycode == "percent":
    print("RA1 servo5 rear")
elif keycode == "asciicircum":
    print("RA1 servo6 rear")

# Robotic Arm 2

elif keycode == "q":
    print("RA2 servo1 front")
elif keycode == "w":
    print("RA2 servo2 front")
elif keycode == "e":
    print("RA2 servo3 front")
elif keycode == "r":
    print("RA2 servo4 front")
elif keycode == "t":
    print("RA2 servo5 front")
elif keycode == "y":
    print("RA2 servo6 front")
elif keycode == "Q":
    print("RA2 servo1 rear")
elif keycode == "W":
    print("RA2 servo2 rear")
elif keycode == "E":
```

```
    print("RA2 servo3 rear")
elif keycode == "R":
    print("RA2 servo4 rear")
elif keycode == "T":
    print("RA2 servo5 rear")
elif keycode == "Y":
    print("RA2 servo6 rear")

# Robotic Arm 3

elif keycode == "a":
    print("RA3 servo1 front")
elif keycode == "s":
    print("RA3 servo2 front")
elif keycode == "d":
    print("RA3 servo3 front")
elif keycode == "f":
    print("RA3 servo4 front")
elif keycode == "g":
    print("RA3 servo5 front")
elif keycode == "A":
    print("RA3 servo1 rear")
elif keycode == "S":
    print("RA3 servo2 rear")
elif keycode == "D":
    print("RA3 servo3 rear")
elif keycode == "F":
    print("RA3 servo4 rear")
elif keycode == "G":
    print("RA3 servo5 rear")

# Robotic Arm 4

elif keycode == "z":
    print("RA4 servo1 front")
elif keycode == "x":
    print("RA4 servo2 front")
elif keycode == "c":
    print("RA4 servo3 front")
```

```
elif keycode == "v":
    print("RA4 servo4 front")
elif keycode == "b":
    print("RA4 servo5 front")
elif keycode == "Z":
    print("RA4 servo1 rear")
elif keycode == "X":
    print("RA4 servo2 rear")
elif keycode == "C":
    print("RA4 servo3 rear")
elif keycode == "V":
    print("RA4 servo4 rear")
elif keycode == "B":
    print("RA4 servo5 rear")


# Robotic Arm 5

elif keycode == "7":
    print("RA5 servo1 front")
elif keycode == "8":
    print("RA5 servo2 front")
elif keycode == "9":
    print("RA5 servo3 front")
elif keycode == "0":
    print("RA5 servo4 front")
elif keycode == "minus":
    print("RA5 servo5 front")
elif keycode == "ampersand":
    print("RA5 servo1 rear")
elif keycode == "asterisk":
    print("RA5 servo2 rear")
elif keycode == "parenleft":
    print("RA5 servo3 rear")
elif keycode == "parenright":
    print("RA5 servo4 rear")
elif keycode == "underscore":
    print("RA5 servo5 rear")
```

```
root = Tk()

root.geometry("600x300")
root.title("Remote Control")

root.bind("<Key>", keypressed)

root.mainloop()
```

## 5. FURTHER ENHANCEMENT

- Right now we have different standalone programs for camera live-streaming and bot movement. Furthermore we can utilize this two programs into one all-in-one program so that we can control and monitor the bot on the same screen.