Face Tracker

Project overview

The purpose for this project was to build a face tracking device. The idea was to use a PC to process the video from the webcam and then send serial commands to Arduino which then controls the RC servo motors.

User has three different ways to control the Face Tracker:

- **Automatic face following**
  - Tracks a face automatically so that the face stays in the middle of the picture.
- **Joystick**
  - Manual orientation of the camera using a joystick from a Playstation 2 controller.
- **Keyboard**
  - Manual orientation of the camera using the keyboard on the PC.

Technical description

Movement around two axes were needed (pan/tilt). This was done using two RC servo motors that were connected to corner brackets. The servo motors were controlled using Arduino Uno. Camera was mounted on the top and connected to a PC.

Mechanical components

Components listed:

- Plastic box (185x105x55 mm)
- 2 x Corner brackets (60x60x50 mm)
- Screws and nuts
- Plastic holder for the tilting servo
- Plastic slide bearing for the tilting axis
- Joystick from a PS2 controller
- Power switch
- 4 AA battery holder

The base of the Face Tracker is a box which houses the electronics and one servo (pan). A corner bracket is fixed to the panning servo. The tilting servo is then fixed to this corner bracket. Another corner bracket is then fixed to the tilting servo which acts as the base for the web camera. Joystick is fixed to the rear side of the box.
Electrical components

Components listed:

- Arduino Uno
- 2 x RC servo motors (TowerPro MG995)
- Web camera (Microsoft Lifecam HD-3000)
- 1 x Resistor (4.7 kΩ)
  - Pull-down resistor for the joystick button
- 1 x Led
  - Indicates when joystick is used for controlling the tracker
- 4 x AA batteries

Arduino Uno was used to control the two RC servo motors via the PWM outputs. The motors were powered by 4 AA batteries since the power output from the USB powered Arduino was not enough to move the two RC servos at the same time. The joystick was basically just a combination of two potentiometers; one for each axis. The pull-down resistor was used for the joystick button, which controlled switching between the face tracking and the manual joystick mode. The led was used to indicate which mode was activated. Below you can see the electronics schematic.

Software

Software used:

- Processing development platform on PC to control the serial commands
- JMyron libraries for reading the webcam stream
- OpenCV libraries for face recognition
• Arduino environment to program the Arduino Uno

The PC side of programming was done completely with Processing development platform. JMyron libraries for Processing were used to read the video stream from the webcam. The OpenCV libraries were then used to process the video stream to recognise facial features. The location of these faces were then compared to the center of the picture. Correct messages were then sent to Arduino via serial to orientate the camera towards the face pattern. The facial recognition could also be overridden by pressing shift and control the camera with the arrow keys on the keyboard.

On Arduino the code was very simplistic; listen to the serial and move the servos according to the serial commands. You could also override the serial commands by pressing the joystick and moving the camera with that instead.

### Components and budget

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<th>Description</th>
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### User manual

1. Automatic face follower (default)
   - Show your face to the camera

2. Joystick
   - Press the joystick downwards and you’ll see the LED light up
   - Use the joystick to move the camera

3. Keyboard
   - Make sure the LED indicator is off (press the joystick to turn it off)
   - Press SHIFT-key on the keyboard
   - Use arrow keys to move the camera

### Conclusions and suggestions

The Face Tracker worked as planned, however there are some improvements that should be considered.

- All the gears in the RC servos should be made out of metal. The gear on the servo arm that was made out of plastic became rounded after a while and needed to be glued.
- The RC servos have a rotational range of 180° and therefore the Face Tracker has a limited turning range. This problem could be solved by changing the panning RC servo motor for a stepper motor.

### Links

Processing development platform: [http://processing.org/](http://processing.org/)


OpenCV for Processing: [http://ubaa.net/shared/processing/opencv/](http://ubaa.net/shared/processing/opencv/)