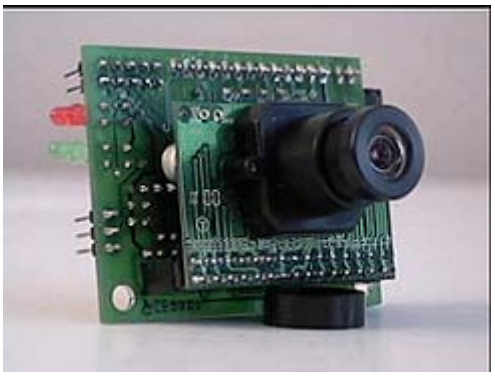
University of Florida
Department of Electrical and Computer Engineering
EEL5666C
Intelligent Machine Design Lab
Summer 2005

Special Sensor Report: CMUcam Vision Board



Student: Wai Ping Lau

TAs: William Dubel and Steven Pickles

Instructors: A.A. Arroyo and E.M. Schwartz

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Introduction

The Carnegie Mellon University (CMUcam) cam is a versatile sensor. At 17 frames per second, CMUcam can do the following:

- track the position and size of a colorful or bright object
- measure the RGB or YUV statistics of an image region
- automatically acquire and track the first object it sees
- physically track using a directly connected servo
- dump a complete image over the serial port
- dump a bitmap showing the shape of the tracked object

For simple image processing, a CMUcam is a low power and low cost ($109) solution.

Purpose

E.L.R.A.Y. (Electronic Love Robot Attracted to You) will use the CMUcam for motion detection and tracking. Elray will track the first object it sees, this provides one of Elray's behavior of falling in love easily with anyone. Elray does not discriminate. The camera would also act as a signal for the led heart and led sad face to light up when motion is detected. The purpose for this behavior is nothing other than for pure entertainment.

Interface

The CMUcam has the option of using RS232 or TTL logic for interfacing with the processor. The RS232 on the Mavric-IIB will be utilized to communicate with the CMUcam. Commands to the CMUcam can be sent using ASCII text.

My serial communication parameters are as follows:

- 38,400 Baud
- 8 Data Bits
- 1 Stop Bit
- No Parity
- No Flow Control

38,400 baud rate was chosen for its low percentage error. At 16MHz, the USART will have a 0.2% error with a 38,400 baud rate. The fastest the camera can run at is 115,200 baud but that produces a 2% error. A higher percent error is acceptable but the receiver will have less noise resistance.

Problems

The CMUcam is suppose to track the first object it sees but I do not know if the camera will still track the object if it leaves its field of vision and returns later after some time. If that poses a problem, I can just reset the vision board.

Low lighting is always a problem for color tracking. I do not believe that low lighting will pose a problem because motion quality does not change will lighting. If it does, I will probably need to make Elray calibrate the room's lighting to suit the camera.

The CMUcam's has a 25 degree field of vision which is small so the object has to be relatively close which means I have to change the sonar's threshold. I could change the lens for a wider angle but I do not think I will replace the lens.

Other Sensors

For obstacle avoidance, ultrasonic range finders are used. The range is 4-864 and its threshold is 23 which is about 5 inches. The sonars allow Elray not to bump into object of affection.

For obstacle collision, tactile switches are used. Analog to digital conversion is used to determine which switch is being pressed. The switches allow Elray to move away from an object if it accidentally hits an object.

For line avoidance, digital photoreflectors are used. The photoreflectors output a logic 1 when it detects white and output a logic 0 when it detects black. The photoreflectors will allow Elray to stay in its designated area.

Conclusion

The CAMcam is ideal for robot applications because of its low cost and versatile operations. The image processing is not perfect but it will satisfy many that do not need accurate images. Though its field of vision is small, it is easily remedied by replacing the lens with a wider viewing angle. I think Elray will be happy with the CMUcam because the camera outputs x-y coordinates for him to stalk its victim.

References

The Atmel ATmega128 Manual.

http://www.atmel.com/dyn/resources/prod_documents/doc2467.pdf

The CMUcam website

http://www-2.cs.cmu.edu/~cmucam/Downloads/CMUcamManual.pdf
http://www-2.cs.cmu.edu/~cmucam/qanda.html