Card Counting
Project Design

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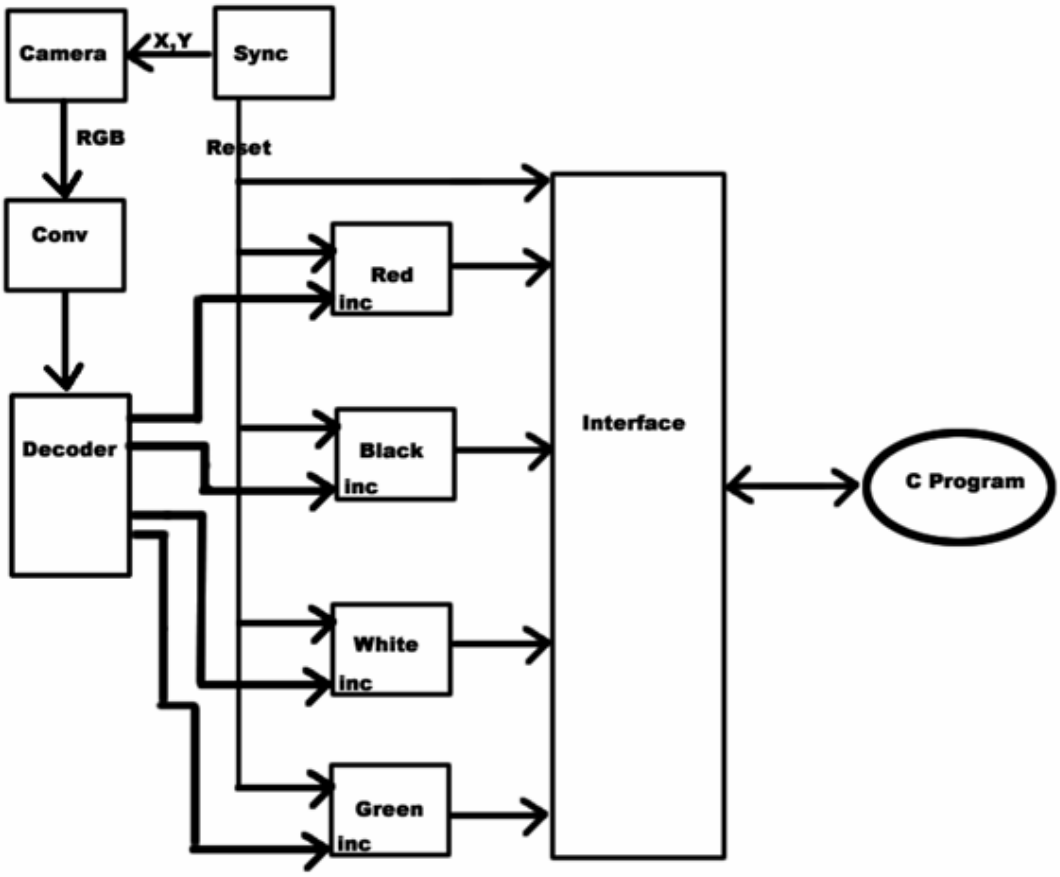
Card Counter

Overview

Our goal in this project is to take real-time data from cards and interpret that into a future probability of the cards to come. Using a camera as input to the system, the digital data retrieved will be allocated into registers based on color levels determining a unique identifying pattern for each card. This process will allow a characteristic mark for the cards and a basis on which to determine what a future card is classified as.

After the system is loaded we will start a statistical summary of cards viewed and adjust the probabilities of future cards in real time. This section will be done in software.

Block Diagram



Components

Camera:

input: x,y: integers
output: r,g,b: 8bits each
on every clock tick (r,g,b) is the value of the color at position (x,y) on the camera.
The range of x,y is implementation dependent.
If the input is out of range r,g,b is undefined.

Sync:

output: reset(bit), x,y(integers)
This module first sets reset=1. Then, on the next tick, it sets reset=0 and iterates x and y through their range. This is done by iterating first over y and then over x, e.g.:

```
for (y=0; y<480; y++)
    for (x=0; x<640; x++)
```

[Note: the code is only for illustration purposes, sync is a hardware module]
When it has iterated over all values it starts over (reset=1 and so on).

Conv:

input: r,g,b: 8bits each
output: c: 2bits, representing either of red, black, white, green
conv converts the RGB value to a color that is one of the possible colors on a card. It does so by using thresholds.

Decoder:

standard 2-bit decoder
counters: standard up counters with reset signals
The counters count the number of pixels per color. In essence the hardware implementation produces a histogram of the visual input. The decoder is responsible for selecting a counter.

Interface:

input: four integers
The software will poll the hardware implementation from time to time to ask for the values of the four counters. The interface is responsible for storing the values of each counter right before a reset signal is produced by the sync module. The interface also includes the bus interface, responsible for communicating with the software.

Software:

The software is open ended. Our plan is to make it so that it first reads and "learns" the values of each of the cards' histograms so that it can recognize them without assistance after the learning process.

Pseudo C program to interface with hardware.

```
//predefined constants
#define NEW_CARD 10
#define MATCH_CARD 01
#define DO_NOTHING 00
#define RESET 11

//data type
struct _histogram
{
int red;
int green;
int blue;
int black;
int white;
int yellow;
}  ;

struct _card
{
_histogram hist;
char* card; //string card name
int value; //unique id
}card;

//definitions
bool doMatch(_histogram c, _card  cs[]); //match card c to deck cs
void saveCard(_histogram c, int value, card cards[]);//add card
void doReset();//clear the data
void calcStats();//future implementatoin of card stats
void listener();//poll to catch and handle events
void listener();//poll to catch and handle events

bool equal(_histogram s,_histogram m);
_histogram readRegStates();

_card cards[64]; //hold new cards
bool event_raise; //hardware event
int event_cond; //hardware call


int _tmain(int argc, _TCHAR* argv[])
{
      listener();
      return 0;
}

bool equal(_histogram s, _histogram m)
{

 return (s.black==m.black && s.blue==m.blue   && s.green==m.green &&
s.red==m.red  && s.white==m.white  && s.yellow==m.yellow);
```

```
}

void listener()
{

    bool eventSaveCard=false;
      //poll catch events
    for(;;)
    {

        if(event_raise)//event rise
        {
            //switch on hardware call
            switch(event_cond)
            {
            case NEW_CARD:
             eventSaveCard=true;
            break;
            case MATCH_CARD:
              if(eventSaveCard){
                 _histogram hs= readRegStates();
                 saveCard(hs);
                 eventSaveCard=false;
    `         }else{
                 histogram hs=readRegStates();
                 doMatch(hs,cards[] cs);
                   }
            break;
            case DO_NOTHING:

            break;
            case RESET:
                cards[]=null;
            break;
             }
        }
    }

}
```