MIDDLE EAST TECHNICAL UNIVERSITY

ELECTRICAL & ELECTRONICS ENGINEERING

Weekly Report 12

EE 494

Cat Feeding Project

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Contents

1 Mechanical and Electrical Design

This week the configuration of the electronic devices are made. They are placed so that one can easily reach to the problematic are when there exist a problem in the components. The hardest part of connecting the electronic devices is the placement of wires. We have solved this problem by connecting wires at the back of the card. By this way an user or an engineer which will solve the problem will be able to see the electronic components clearly. Following figures 1, 2, 3, 4 shows the current situation of the wooden card that electronic components are attached to it.

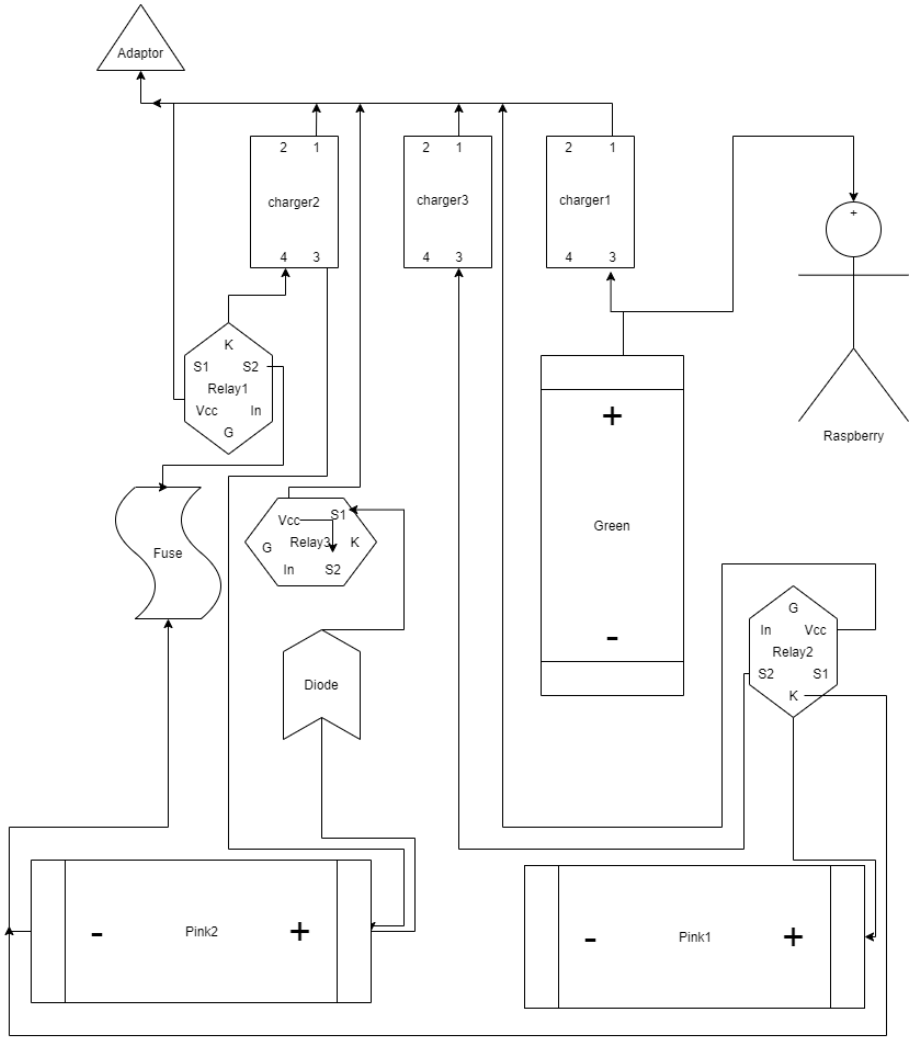


Figure 1: Interior Design of the Electrical Components

Also, we have completed the followings:

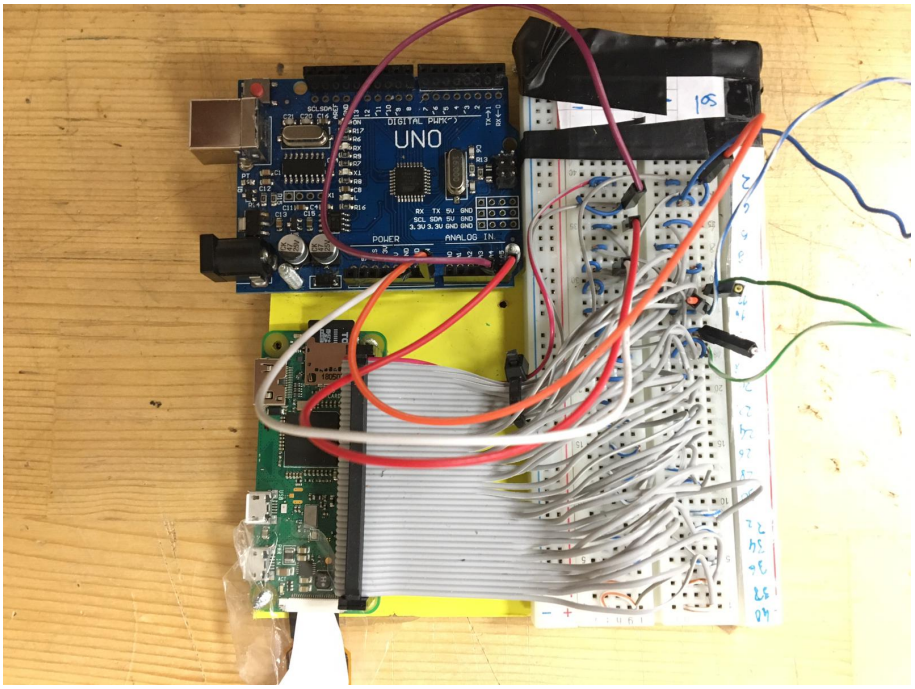


Figure 2: Cabling of the controller unit

- Interior design
- Improving the identification algorithm
- Design of the website
- Writing the critical design report

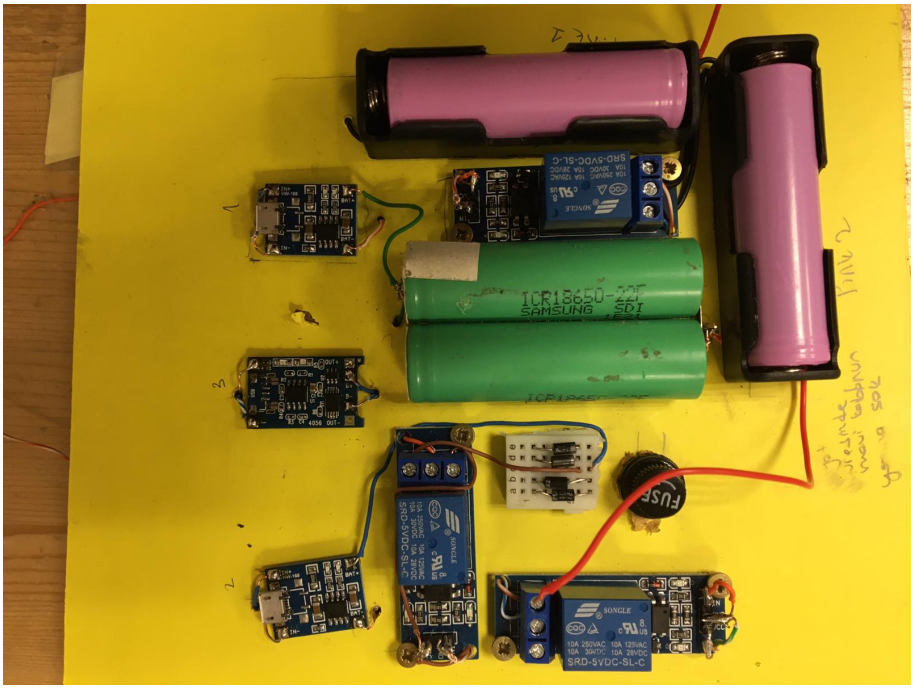


Figure 3: Cabling of the Supply Unit

Figure 4

2 Computer Vision

Previous week SIFT based identification is set and some results are given for photos found on Facebook. Note that these values are lack of practical considerations since no stable system currently exists and test can be done. Database created for the SIFT is given in figure 5a whereas the results for only 3 cat images are given in figure 5b. However, the test set is very small and the results are not very reliable. After knowing test methods, product design, camera replacement; tests will be finalized and extensive tests will be done. Only, online images or small databases can be used in the current set of tests. Note the results are given for the approximate solution with FLANN matcher.

```
Number of classes in total : 17
Number of vectors per class :
        ase                             :   290
        bahar                           :   164
        cem                             :    58
        ceren                           :   154
        deniz                           :     8
        dilara                          :    50
        duygu                           :    24
        ekin                            :    28
        esr                             :   162
        esra                            :  4130
        ezg                             :  1082
        ezgi                            :    26
        haza                            :     6
        hazal                           :     0
        melis                           :    74
        seda                            :    66
        selin                           :   374
        ------------------------------- : ----+
        Total                           :  6696
```

(a) SIFT Database

```
deniz -> deniz
ezg -> melis
deniz -> ceren
Detailed accuracy report :
        Cat name deniz with accuracy   : 0.500000
        Cat name ezg with accuracy     : 0.000000
Calculated accuracy is 0.3333333333333333
```

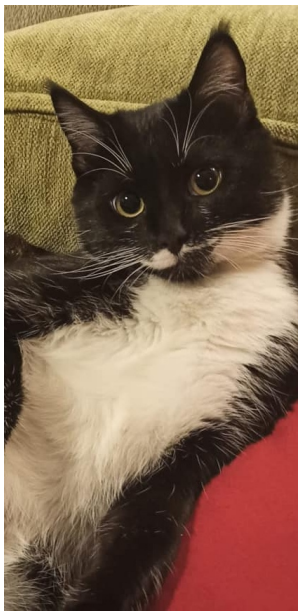
(b) SIFT Test with only 3 Images

Figure 5: SIFT Results

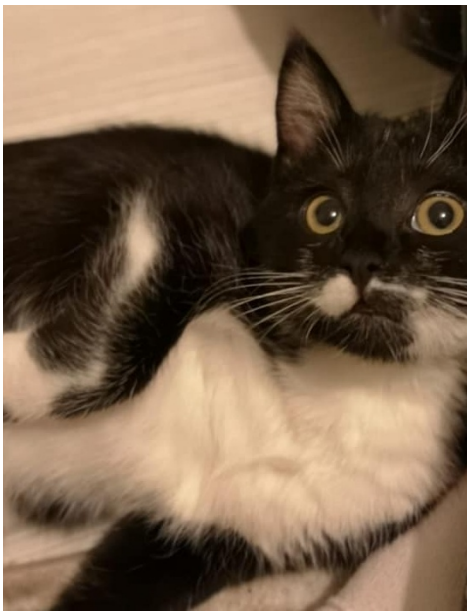
Methods based on feature descriptors required a lot of effort, computational complexity and computation power. Therefore, a new approach is developed such that color based identification is the current topic of search. Histograms are the metrics used in the identification process. Thanks to their useful information on the frequency of colors, they are used for identification with comparison metrics of MSE(mean squared error), MAE(mean absolute error) and "Count Peak method". A static threshold for the resemblance is put. This method will be implemented if it is powerful as required, otherwise; a hybrid approach, both SIFT and color histograms are used. However, samples needed to tune and decide on the method.

Some histograms are given in figures 9 and 8 where their correspondence images are in figures 7 and 6 respectively. Note the similarity between the histograms which

is mainly because of HSV color space which distinguishes the colors on an axis and measures the color hue. This is independent of light, illumination and other light disturbing effects in theory. Therefore, graphs present purely color information where we use it for most of cats.



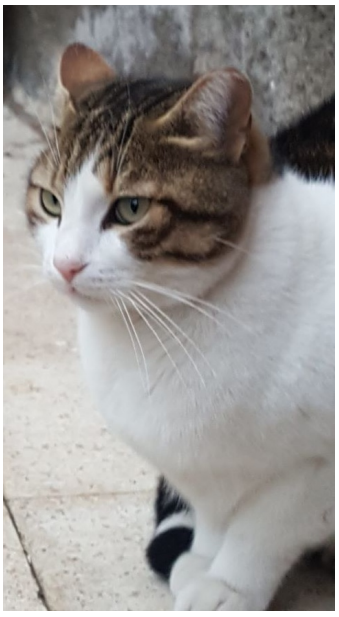
(a) Ceren 1



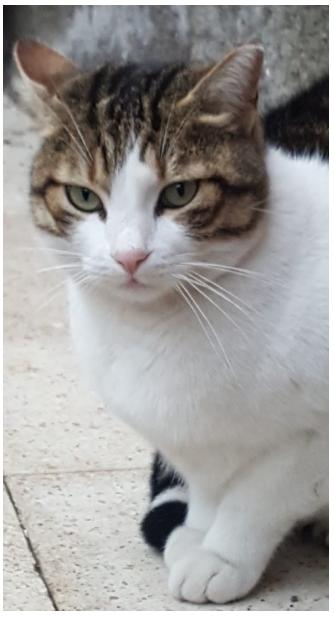
(b) Ceren 2

Figure 6: Sample Images for Cat Ceren

The results however, are not very distinctive, as can be seen from the figure 10b and 10a which represent MAE and MSE respectively, distinguish is not perfect. Therefore, measuring the similarity with these metrics are useless which makes it the final decision to use "First N Peak Values in Histograms" which results in accuracy of 1 for this small set. However as mentioned earlier, complete system integration and camera data are required for further tests, improvements, and reliable results.

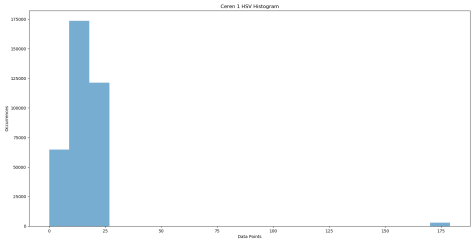


(a) Esra 1

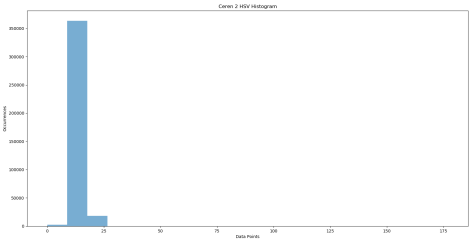


(b) Esra 2

Figure 7: Sample Images for Cat Esra

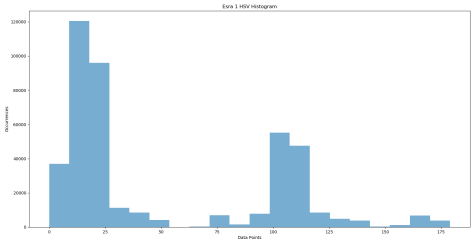


(a) Ceren 1 Histogram

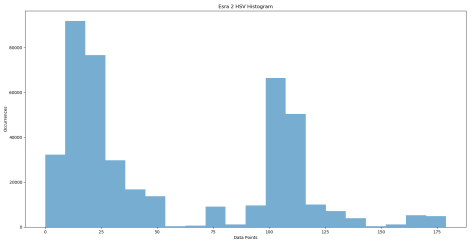


(b) Ceren 2 Histogram

Figure 8: Histograms for Ceren



(a) Esra 1 Histogram



(b) Esra 2 Histogram

Figure 9: Histograms for Esra

```
Cost from Ceren 1    to Ceren 2    = 0.474402
Cost from Ceren 1    to Esra 1     = 0.334977
Cost from Ceren 1    to Esra 2     = 0.429901
Cost from Ceren 2    to Ceren 1    = 0.474402
Cost from Ceren 2    to Esra 1     = 0.697440
Cost from Ceren 2    to Esra 2     = 0.774694
Cost from Esra 1     to Ceren 1    = 0.334977
Cost from Esra 1     to Ceren 2    = 0.697440
Cost from Esra 1     to Esra 2     = 0.109571
Cost from Esra 2     to Ceren 1    = 0.429901
Cost from Esra 2     to Ceren 2    = 0.774694
Cost from Esra 2     to Esra 1     = 0.109571
```

(a) MSE Results

```
Cost from Ceren 1    to Ceren 2    = 0.779643
Cost from Ceren 1    to Esra 1     = 0.793972
Cost from Ceren 1    to Esra 2     = 1.054197
Cost from Ceren 2    to Ceren 1    = 0.779643
Cost from Ceren 2    to Esra 1     = 1.295844
Cost from Ceren 2    to Esra 2     = 1.452933
Cost from Esra 1     to Ceren 1    = 0.793972
Cost from Esra 1     to Ceren 2    = 1.295844
Cost from Esra 1     to Esra 2     = 0.268473
Cost from Esra 2     to Ceren 1    = 1.054197
Cost from Esra 2     to Ceren 2    = 1.452933
Cost from Esra 2     to Esra 1     = 0.268473
```

(b) MAE Results

Figure 10: Results

3 Future Work

Planned future work is given as follows:

Future Works:

- Completing the critical design report.
- Finalizing the mechanical placement.
- Improving the website.
- Implementing motor power relay to decrease power consumption.
- Generating data and tuning - deciding on models.

References