Disease Diagnosis using Microscopic Image Processing
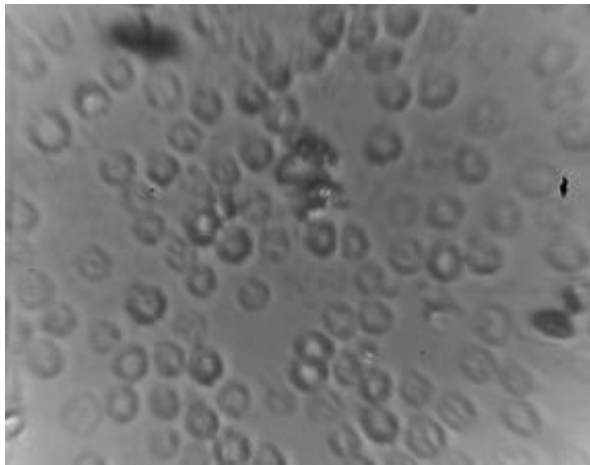
A 125$ versatile diagnostic device was developed, for carrying out various medical tests. Machine vision algorithms were developed to obtain accurate detection from an innovative low cost imaging setup. Malaria Detection, and counting of RBCs, WBCs were achieved. The project won accolades in national level innovation challenges organized by IIT Bombay and Somaiya Trust.
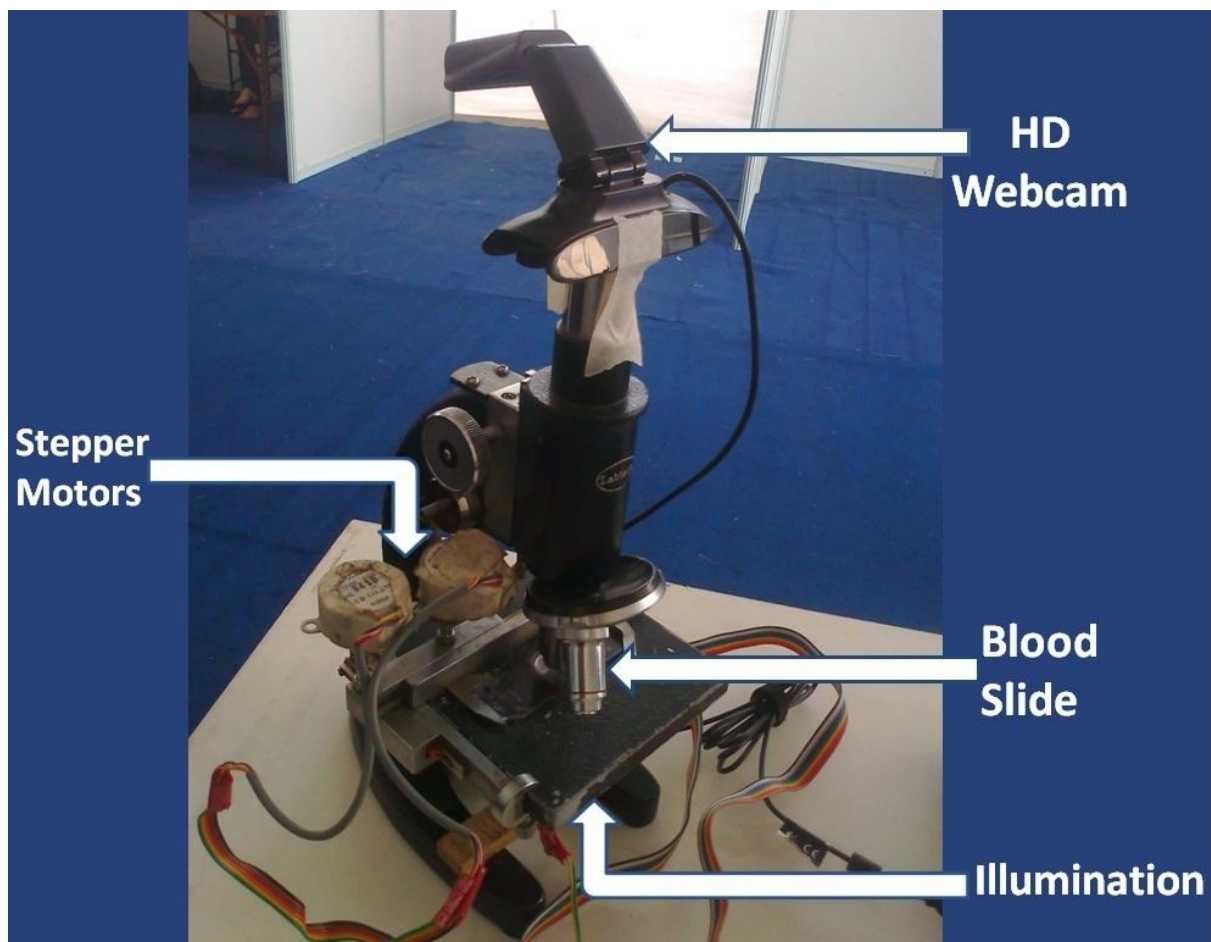
Microscope Arrangement

Grayscale images were acquired for counting of RBCs and WBCs, and colour images were acquired for Malaria detection. Sample images were as follows:

Blood cell count

Malaria Detection

The algorithms developed for the same tasks were as follows:

Pre Processing

| Histogram Equalization | Background Subtraction | Contrast Adjustment | Thresholding |

Further Processing

| Removing White Dots | Morphological Opening | Hole Filling | Erosion |

Final Classification and Counting

| Size Segmentation | Object Counting |
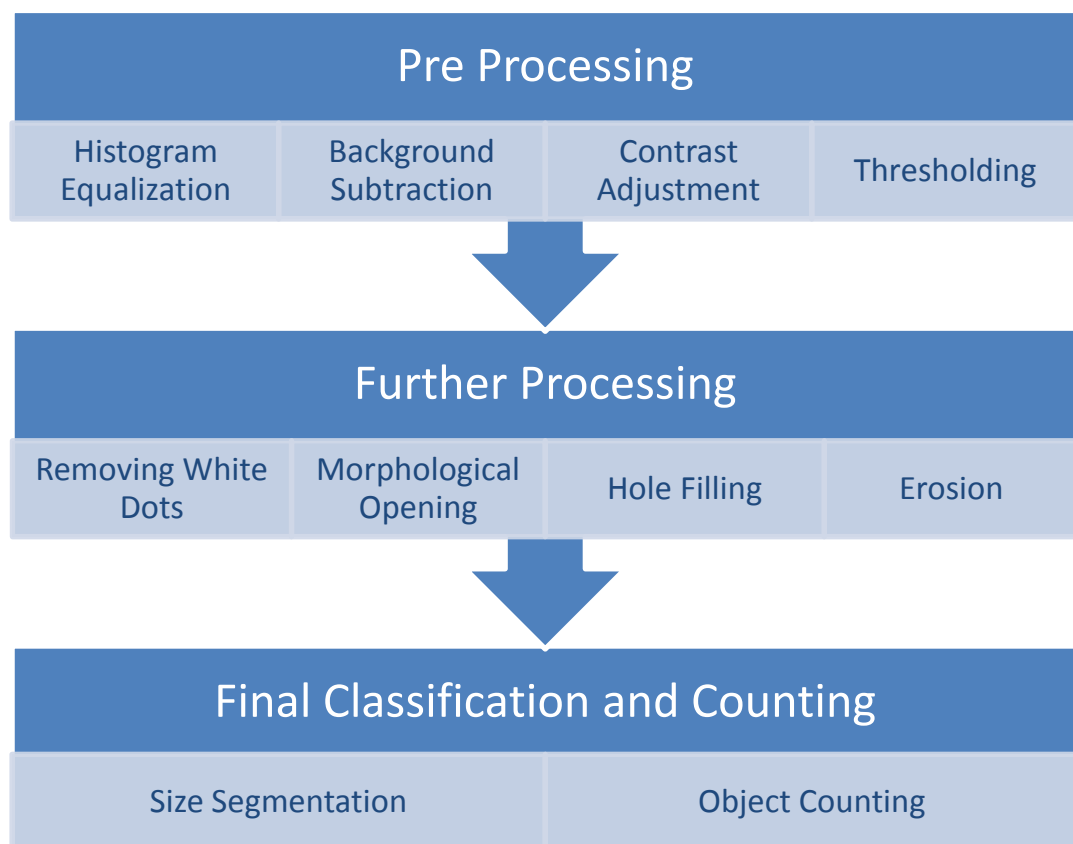
Algorithm for Blood Cell Count

```
┌─────────────────────────────┐
│      Acquire the image       │
└─────────────────────────────┘
              ⇓
┌─────────────────────────────┐
│   Convert the RGB planes into│
│         HSV planes           │
└─────────────────────────────┘
              ⇓
┌─────────────────────────────┐
│    Separate RBCs WBCs and    │
│    Malaria dots by HSV and   │
│    pixel area thresholding   │
└─────────────────────────────┘
              ⇓
┌─────────────────────────────┐
│    Separate RBCs WBCs and    │
│    Malaria dots by HSV and   │
│    pixel area thresholding   │
└─────────────────────────────┘
              ⇓
┌─────────────────────────────┐
│   Dilate the RBC image, and  │
│  compute its intersection with│
│         Malaria dots         │
└─────────────────────────────┘
              ⇓
┌─────────────────────────────┐
│   Count the number of objects│
│       in resultant image     │
└─────────────────────────────┘
              ⇓
┌─────────────────────────────┐
│     If count> 0 Positive     │
│        Else Negative         │
└─────────────────────────────┘
```
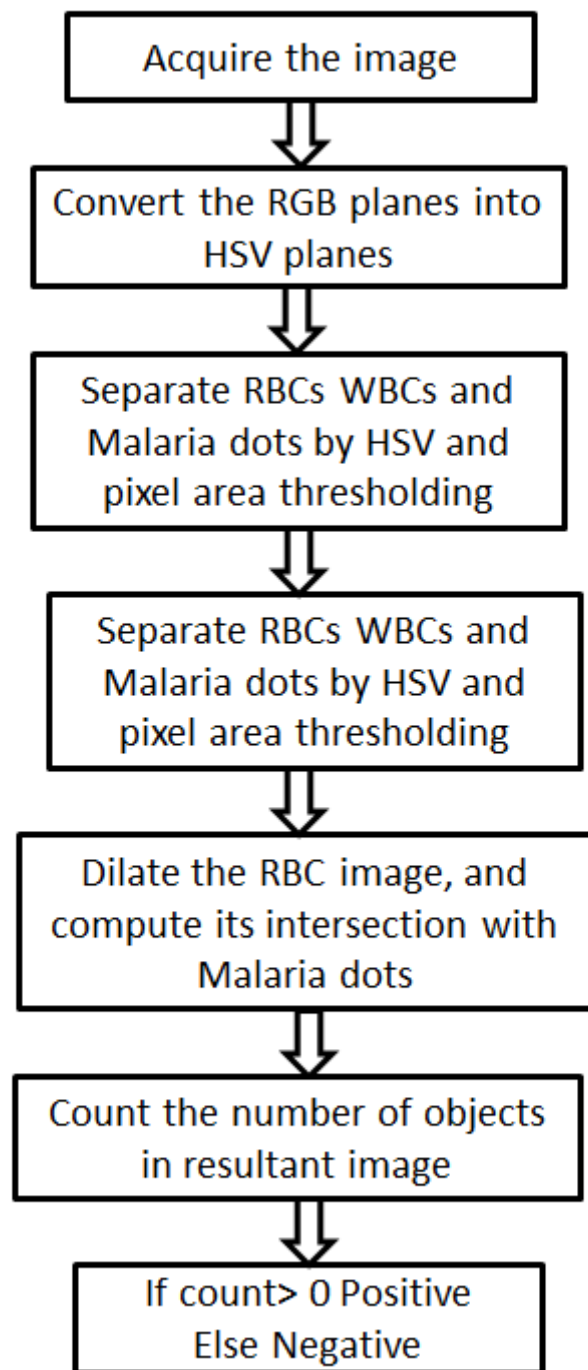
Malaria Detection Algorithm