

Bastion The Sentinel

Park Cleaner Robot

Istanbul Bilgi University

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SCOPE

- Consuming essential for humans
- It leads to pollution
- Our main goal is separating and recycling the garbages

DEVICE FUNCTIONALITY

- Bastion The Sentinel will be a multi-tasking that has three main parts.
 - Movement controls
 - Robotic arm controls
 - Camera
- Robotic arm uses image processing to collect garbages
 - Image recognition by color difference
- Operator takes control in emergency situations

DEVICE FUNCTIONALITY

- It has a box for collecting garbages.
- It has 6 wheels.
- It uses a camera to detect objects.

OVERALL DESIGN SCHEME

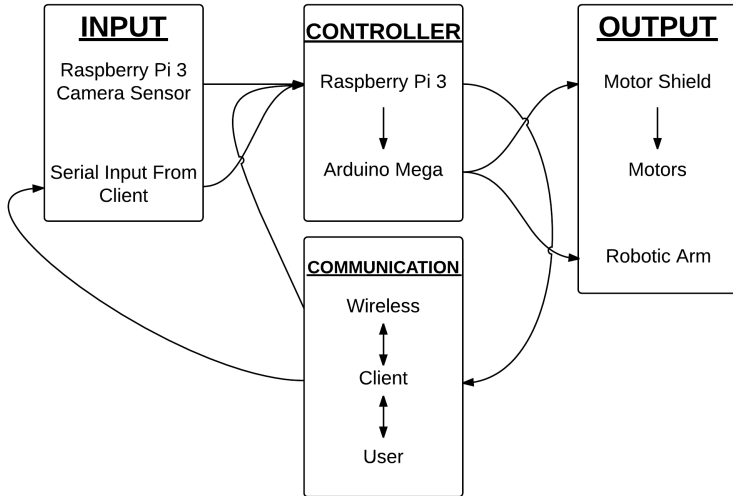


Figure : Block diagram of the system

DESIGN AND DETAILS

- Input Block
 - Camera Sensor
 - Serial Input
- Control Block
- Output Block
- Communication Block

Input Block

- Raspberry Pi transfers the video data to client over the WIFI.
- On the client side image processing performed by using OpenCV library.
- Detecting garbages by their color range.
- Raspberry and Arduino connected as master-slave.
- Raspberry manages the serial connection on Arduino.

Control Block

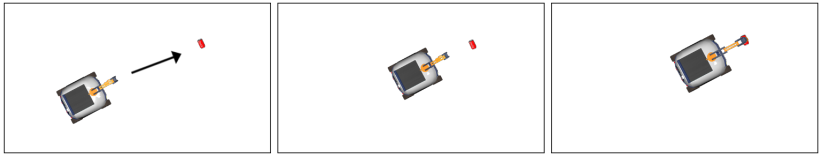


Figure : **Bastion The Sentinel** is approaching to an object.

Raspberry Pi will manage the Arduino to use the motor shields.

- Raspberry Pi is in charge of controlling the Arduino.
- Aurdino is connected to the motor shields and the robotic arm.
- Bastion The Sentinel has two different speed choice. Slow for fine adjustments and fast for quick jobs.
- Robotic arm has 3 joints and has 1 gripper.
- Arm can rotate 360° and it can be collapsed to minimize the area.
- Also gripper part will have the ability to rotate up to 180° .

Communication Block

- Serial connection over the WIFI.
- Real time video data will be gathered on the robot and will be sent to client.
- Video data will be processed on the client side.
- Simultaneous data transmission.

Communication Block



```
python3 bastion_serial_connection.py

Bastion The Sentinel Controller
Written by Furkan Karakoyunlu

* * * * *

waiting for command ...

w -> forward, s -> backward, a -> left, d -> right, space -> stop

Press 'Q' to exit | BASTION CONTROLLER
```

The image shows a terminal window with a dark background. The title bar at the top reads 'python3 bastion_serial_connection.py'. The main content of the terminal displays the program's title 'Bastion The Sentinel Controller' in red, followed by the author's name 'Written by Furkan Karakoyunlu'. Below this is a separator line of five asterisks. The program then enters a loop, displaying 'waiting for command ...'. At the bottom, a list of controls is shown: 'w -> forward, s -> backward, a -> left, d -> right, space -> stop'. The very bottom of the terminal has a light gray prompt area that says 'Press 'Q' to exit | BASTION CONTROLLER'.

Figure : Serial connection screen from PC

Communication Block

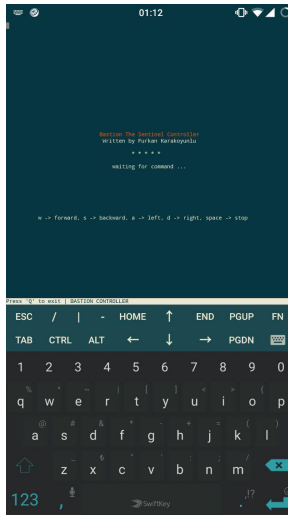


Figure : Serial connection screen from smart phone

Image Processing

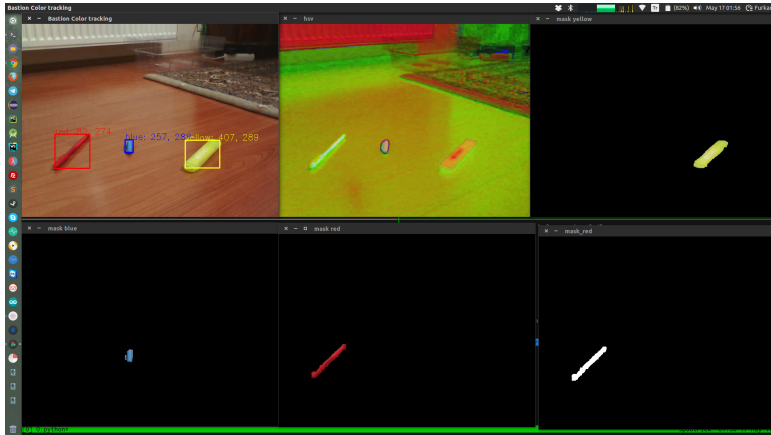


Figure : Image processing screen on the client.

BUDGET

Item	Price(TL)
Dagu Wild Thumper 6WD All-Terrain Chassis	1.363,88
VNH5019 Motor Driver	212,70
7,4 Volt 4000 mAh LiPo Battery	149,72
Battery charger unit	195,39
3D Printed Robotic Arm	400,00
Arduino Mega	181,48
Raspberry Pi 3 Model B	190,86
2 x Raspberry Pi Camera Module	113,00
8 x Servo Motor	228,00
Tools	87,23
Total	3122,26

Table : Budget for building the robot

BUSINESS PLAN

- In Turkey, pollution rates are higher than other countries
- There is no proper way to solve this problem
- The purpose of creating this robot is to protect the nature and speed up the recycling process
- It takes so many years for some materials to dissolve in nature
- %75 of garbages are recyclable but %30 percent of it used used in recycling process
- Someone should step up and do something about it
- While we are making the nature cleaner, also we are aiming to build a robot which has recyclable parts as much as possible.

Demonstration

Thank you for listening.

Furkan Karakoyunlu
112200036