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

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DEVICE FUNCTIONALITY

- Bastion The Sentinel will be a multi-tasking that has two main parts.
  - Movement controls
  - Robotic arm controls
- Designed as a semi-autonomous robot
- Robotic arm uses image processing to collect garbages
  - Image recognization by color difference
  - Image recognization by shape
- Operator takes control in emergency situations

DEVICE FUNCTIONALITY

- It has resizable box
- It is accelerating from front wheels
- To increase the maneuver ability, we placed steering wheels to the back
- It uses:
  - Proximity sensor
  - Depth sensor
  - Light sensor
  - Cameras

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OVERALL DESIGN SCHEME

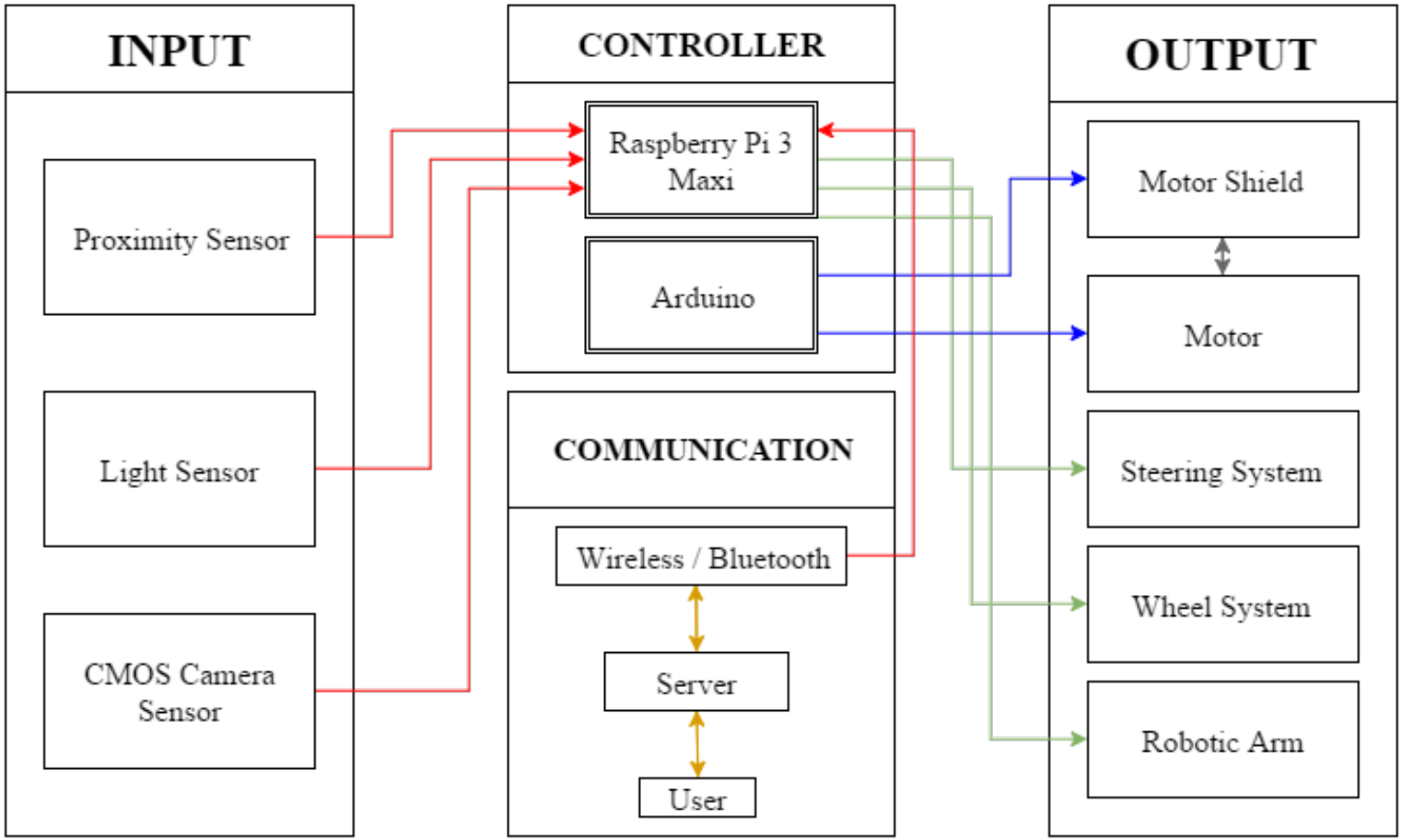

Figure : Block diagram of the system

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DESIGN AND DETAILS

- Input Block
  - Cameras
- Control Block
- Output Block
- Communication Block

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Input Block

- **Bastion The Sentinel**'s robotic arm divided by three joints and has one gripper.
- Robotic arm can rotate 360° and it can be collapsed to minimize the area. Also the gripper part will have the ability to rotate up to 180°.
- Garbage detection is reinforced by proximity sensor. It will provide information about whether there is an object around of the robot.
- Depth sensor will be used to verify incoming data's from proximity sensor. If they match the robotic arm will start the collecting process.

Input Block

Cameras:

- There are 3 CMOS Camera Sensor
- Two of them will be used as both depth sensor and vision camera
- We will switch between two mods:
  - Depth mode
  - Vision mode
- Third camera will help us to put garbages in the box

Control Block

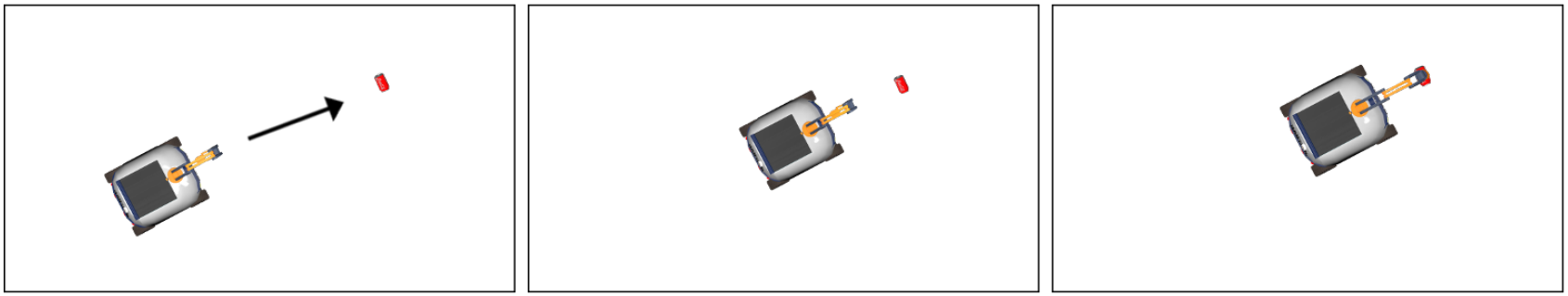
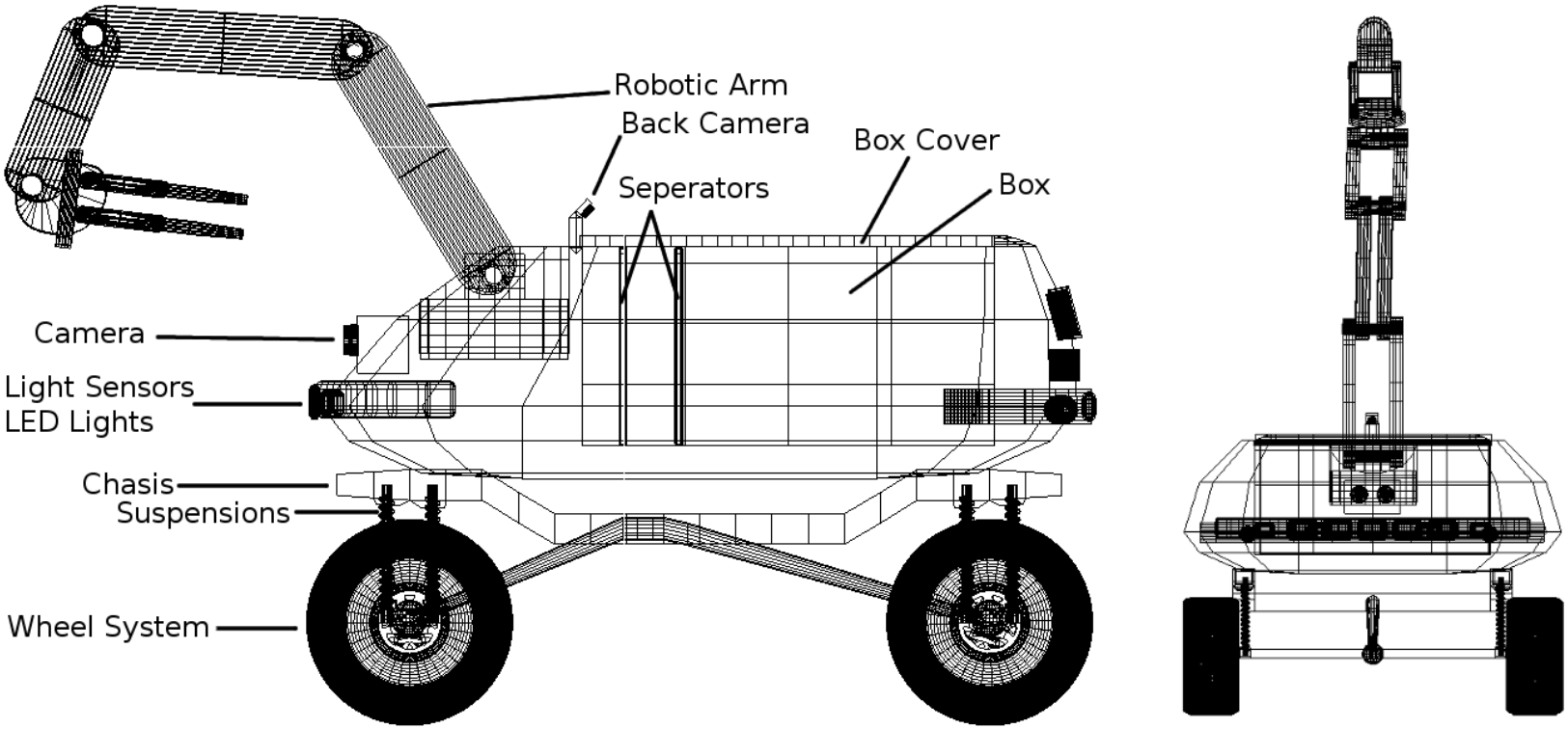


Figure : **Bastion The Sentinel** is approaching to an object.

In this block, Arduino (and Raspberry Pi) will manage the wheel system. It gives impulse to front wheels while it only rotates from back wheels. Two motor shields will drive four wheels.

Output Block



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Communication Block

- Wireless connection on Raspberry Pi 3
- Sensor information will be processed on the robot and will be sent to user
- Video data will be processed on user side
- Simultaneous data transmission

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TIME TABLE AND WORK SCHEDULE

Task name	Start date	End date
Bastion: The Sentinel	23/09/16	17/04/17
Phase I	23/09/16	20/10/16
Submission Of the Entry Form	23/09/16	23/09/16
Reading Contest Documents	24/09/16	25/09/16
Research About The Topic	26/09/16	30/09/16
Brainstorm	01/10/16	04/10/16
3D Design	05/10/16	10/10/16
Logo Design	11/10/16	12/10/16
Selecting Components	13/10/16	14/10/16
Writing Proposal	15/10/16	19/10/16
Submitting the Proposal to Laureate	20/10/16	20/10/16
Phase II	21/10/16	17/04/17
Buying Needed Parts	21/10/16	29/11/16
Sensor Parts	30/11/16	08/02/17
Control Unit Parts	30/11/16	08/02/17
Prep. of Web Server & DB	30/11/16	08/02/17
Building The Body	09/02/17	28/02/17
Integrating Whole Parts to Body	01/03/17	12/03/17
Testing All Parts And System	13/03/17	01/04/17
Last Controls	02/04/17	16/04/17
Submitting The Video To Laureate	17/04/17	17/04/17

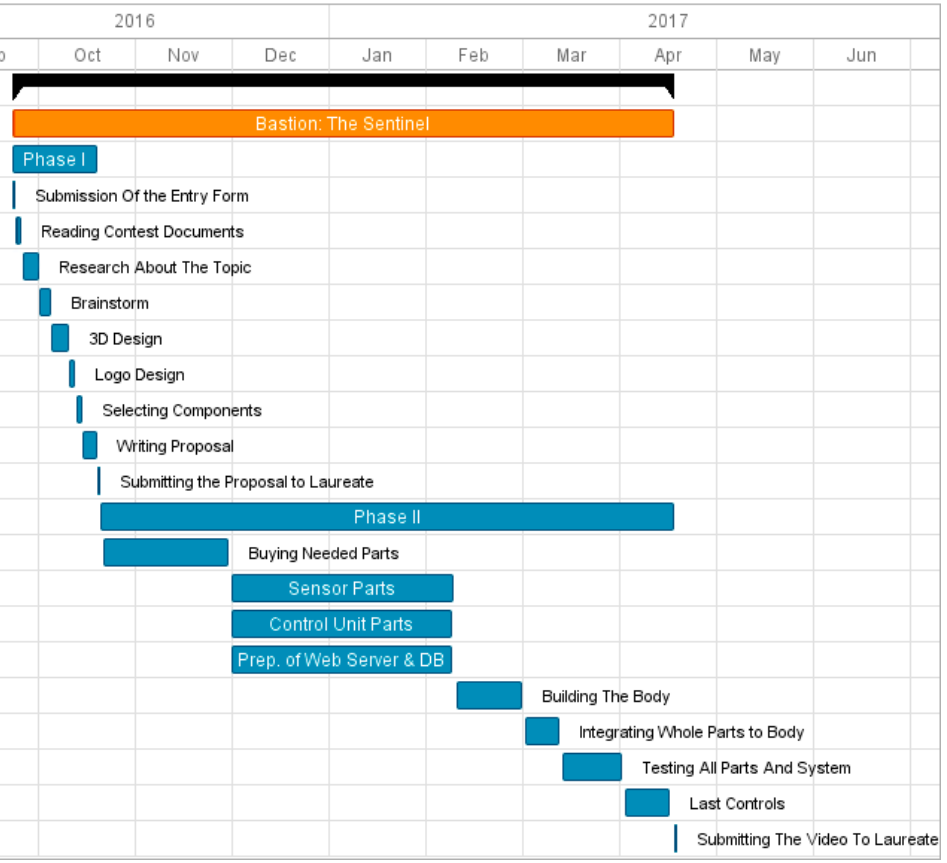

Figure : Phase I and Phase II in details

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CAD DESIGN AND DEVICE DIMENSIONS

Figure : CAD design, Approximate Dimensions: Length=50cm Width=45cm Height=40cm

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BUDGET

Materials				
Number	Material Name	Quantity	Unit Price ($)	Total Cost($)
	DC Motor	2	$30	$60
	Servo Motor	6	$8	$48
	Wheel	4	$15	$60
	Bearing Hub	4	$12	$48
	Carbon Fiber Chassis	1	$60	$60
	Upper Plexy Body	1	$45	$45
	Robotic Arm Components	1	$250	$250
	Shock Absorber	8	$15	$120
Kits				
-	Kit Name	Quantity	Unit Price ($)	Total Cost($)
	Raspberry Pi3 Maxi	1	$150	$150
	Arduino Mega Rev3	1	$40	$40
	Arduino Motor Shield	2	$15	$30
Sensors				
-	Sensor Name	Quantity	Unit Price ($)	Total Cost($)
	Proximity Sensor	1	**	
	Light Sensor	1	**	
	CMOS Camera Sensor	3	$40	$120
Communication and Internet				
-	Name	Quantity	Unit Price ($)	Total Cost($)
	Wireless	1	**	
	Domain Name	1	$25	$25
	Web expenses	1	$30	$30

*** indicates that Raspberry Pi 3 Maxi Kit includes this sensor*

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SAFETY AND ENVIRONMENTAL SUSTAINABILITY

- Robot operates in a semi-autonomous way
- Robot will interact with the environment
- It leads some dangerous situations
- In this type of situations operator will take the control

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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.

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