

Senior Design I
Initial Project and Group Identification Document
May 2013

KnightCop

Remote Controlled Scout Robot



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Group 11

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Motivation

Law enforcement and security personnel face increasingly hazardous circumstances every day. The motivation behind this project is to lessen some of the risks involved in their routine.

KnightCop will aim to provide an affordable and expendable tool to navigate treacherous areas and remotely interact with potentially unsafe objects.

Situations like a bomb explosion or a fire fight are too threatening for an officer to be sent in immediately. An unclaimed duffel bag sitting in the middle of a busy park is too risky to be handled manually. It is in these situations KnightCop can be sent forth as a scout to assess the situation.

Cause	Cases
Assault	1
Duty related illness	3
Fall	2
Gunfire	49
Heat exhaustion	1
Stabbed	5
Struck by vehicle	6

Table 1: Law Enforcement Deaths, USA, 2012

courtesy www.odmp.org

These statistics do not include any K9 units that died in line of duty. Many of these deaths could have been avoided with a robot companion like Seizer. Our goal, therefore, is to develop a prototype that is functional enough that officers feel confident using it as a proxy of themselves on the field.

Goals and Objectives

- Wireless video and audio feed of the robot's immediate vicinity
- Remotely controllable undercarriage and arm
- A remote control (possibly a modified game controller)
- A split hook to grab objects
- One to two degrees of freedom for the arm
- Possible add-on sensors:
 - radiation
 - heat
 - CO₂
- Feedback from sensors onto a screen

Function of the Project

The primary function of the robot is to be a remote controlled scout capable of interacting with objects. Secondary function is ambient feedback, including, but not limited to: video from a camera mounted on the robot.

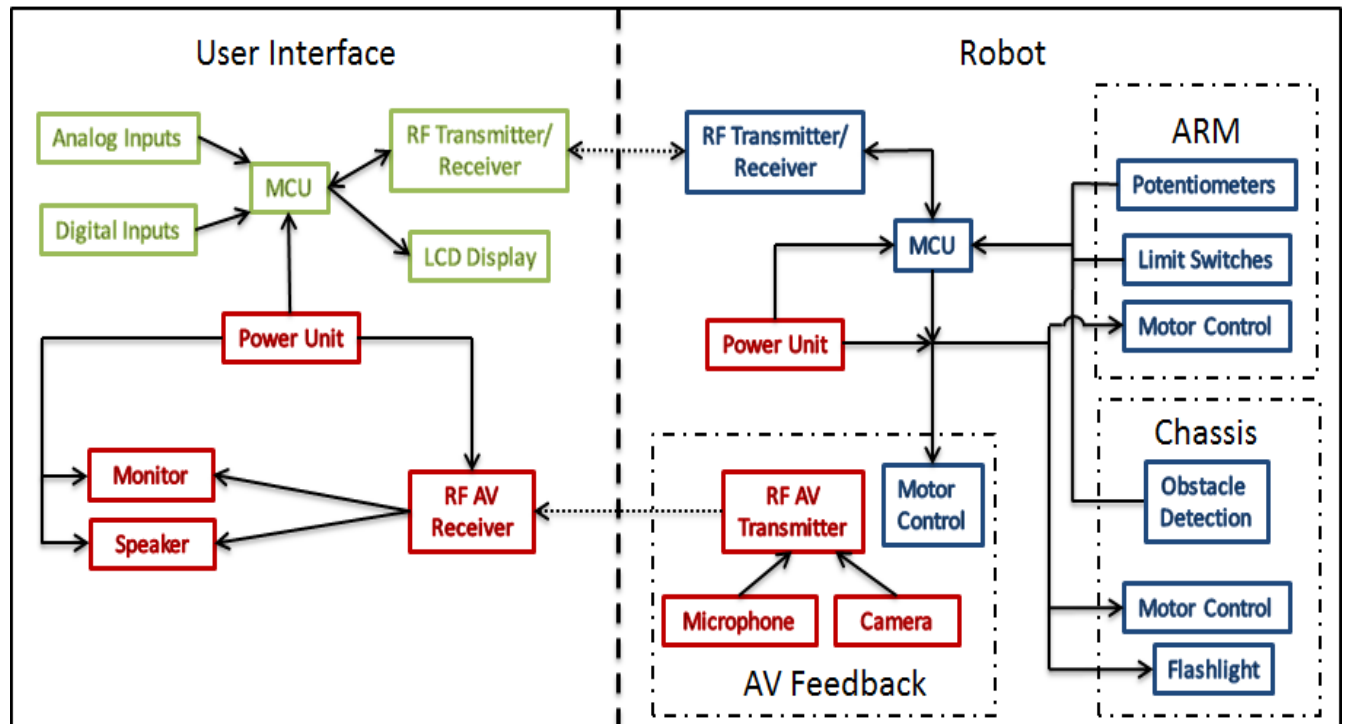
Specifications and Requirements

Maximum Dimensions	l x b x h	50 x 50 x 50 cm
Operating range		50 m
Operating frequency		2.4 GHz
Power supply voltage		24 V
Minimum Speed		1 m/s
Maximum Robot weight		50 Kg
Arm		
	Minimum Lifting capacity	2.5 Kg
	Rotation span	120 degrees
	Hook states	open/close
Video feed		640 x 480 px
		30 fps

Block Diagram

Color Coding: Elean Nitin Wesley

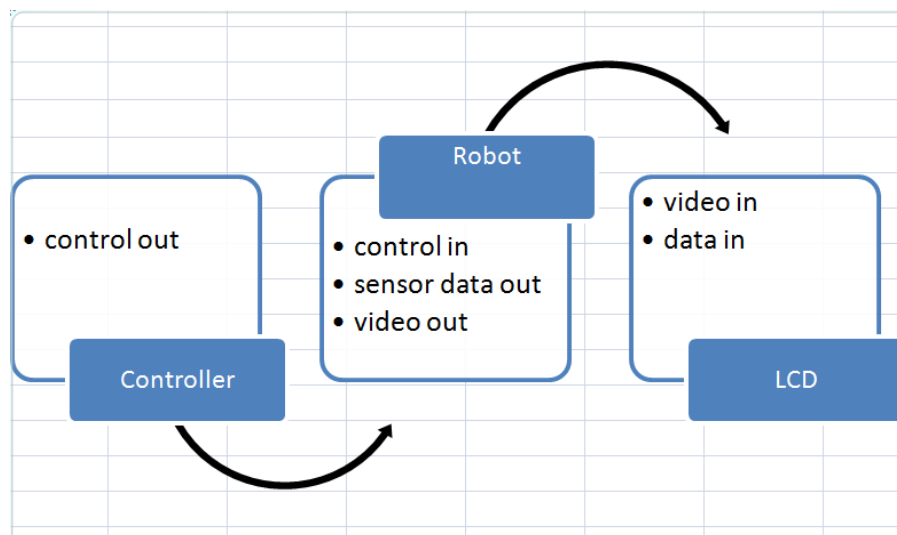
An



Hardware Block Diagram

** All blocks are on research state*

*** MCU blocks represent software and hardware*



Software Block Diagram - Nitin and Elean

** All blocks are on research state*

Budget and Financing

Group 11 will attempt to find sponsorship, utilize samples and donations, but members are prepared to cover all remaining cost of the project.

Item Number	Part	Unit Cost	Quantity	Total Cost
1	CMOS camera	\$10	1	\$10
2	PCB	\$50	2	\$100
3	FM transmitter/receiver	\$20	2	\$40
5	Battery	\$20	2	\$40
6	PlayStation 2 controller	\$10	1	\$10
7	Mechanical Components	\$350	1	\$350
8	Arm Servo Motor	\$20	2	\$40
9	Camera Servo Motor	\$20	2	\$40
10	Drive Motor	\$20	2	\$40
11	Flashlight	\$10	1	\$10
12	Misc Sensors	\$10	5	\$50
13	AV Trasmmitter	\$30	1	\$30
14	AV Receiver	\$30	1	\$30
15	Motor Controller	\$100	1	\$100
16	Monitor	\$70	1	\$70

17	speaker	\$10	2	\$20
18	LCD display	\$20	1	\$20

Expected total cost	\$1000
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Project Milestones

Phase	May	Jun	Jul	Aug	Sep	Oct	Nov
Writing	x	x	x	x	x	x	x
Initial Documentation	x						
½ Final Documentation		x					
Final Documentation I		x	x	x			
Final Documentation II						x	x
Final Presentation							x
Research							
Hardware		x	x				
RF Transmitter/Receiver		x	x				
Power Unit		x	x				
Arm		x	x				
Potentiometers		x	x				
Limit Switches		x	x				
Motor Control		x	x				
Chassis		x	x				
Sensors		x	x				
Motor Control		x	x				

Flashlight		x	x				
A/V Feedback		x	x				
Digital Inputs		x	x				
Analog Inputs		x	x				
LCD		x	x				
Power Unit		x	x				
Monitor		x	x				
Speaker		x	x				
Software		x	x				
Design & Prototype							
Chassis		x	x	x			
Arm		x	x	x			
A/V Feedback		x	x	x			
Power Unit		x	x	x			
Micro-Control Unit		x	x	x			
PCB		x	x	x			
Order Parts			x	x			
Assembly							
Chassis					x		
Arm					x		
A/V Feedback					x		
Power Unit					x		
Micro-Control Unit					x		
Unit Integration					x	x	

Testing							
Microcontroller					x	x	
Sensors					x	x	
Camera					x	x	
Complete Unit					x	x	x