Grid Eye Sensor System for Multi-Target Tracking and Detection ("Predator")

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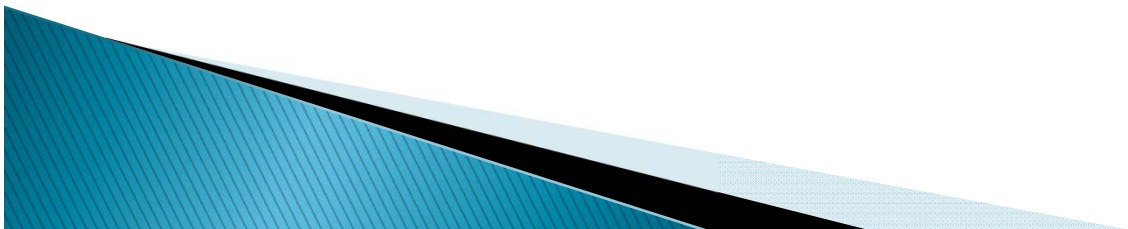
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Background

- This project has been initially proposed and is sponsored by Northrop Grumman Corporation (NGC).
- System design will meet the requirements set by the client and the regulatory compliance for EMC and ESD specifications and standards.
- Finished product will be delivered in due time and it will be up to the client to utilize it in anyway that it meets their needs.

Problem Statement

- Customer's Need: "Design a device which
  - uses a thermal sensor which detects single or multiple targets
  - can also be made to track the target with the highest temperature by allowing an end user from a base computer to switch the mode of the sensor to a Hot Target Mode (HTM)
  - Is networked through a wireless communication liaison between the sensor and an Intel Board Processor."

Design Requirements

Design Parameter	Design Requirement
Weight	Max 1lb desired weight .5lbs
Operational Temperature	-15° C to +49° C.
Detection of Multiple subjects	60° degree cone vision
Scanning Range of Grid-Eye Sensor Assembly Tilt	+/- 90 degrees +/- 20 degrees
Power Supply	9 volt power supply
Desired Distance of wireless operation	100 feet preferred/1500 feet direct line of site desired
Micro-Processing Control	Intel Atom Board

Current Statuses Of Art

| Current Art	Weakness
Passive Infrared Sensor • An electronic sensor that measures infrared light radiating from objects in its field of view	• PIR sensors cannot determine the distance of the user from the sensing device.
Thermopile • An instrument for detecting and measuring heat radiation or for generating a thermoelectric current.	• operation are relatively complex with potential sources of error.
Ultrasonic sensors • Detects targets by interpreting the echoes from radio or sound waves	• high sensitivity to ultrasonic sensors leads to false triggers.
FLIR IR Cameras • Thermal image IR sensor for detecting heat signatures	• Heavy in weight • Hand held device

Alternative Design Approach

✓MLX90614 Series Infra RedThermometr
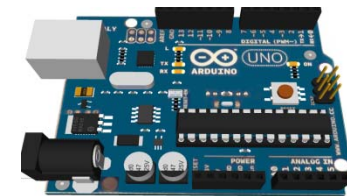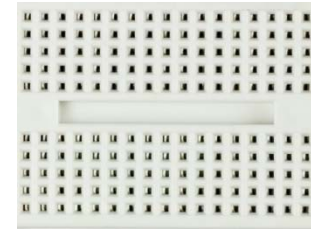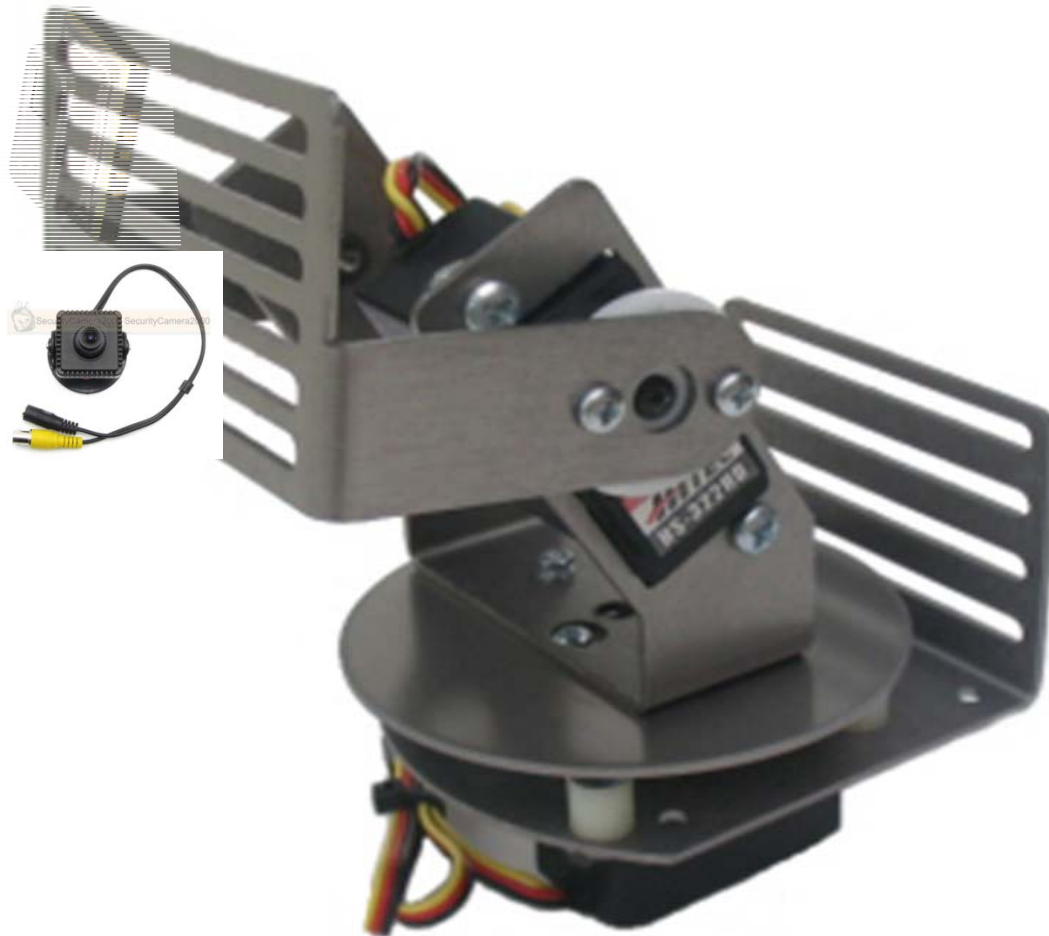
✓6 wire unipolar Stepper Motor
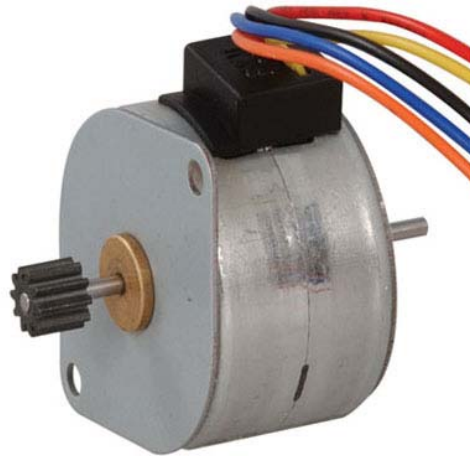
✓BreadBoard
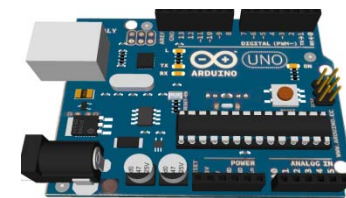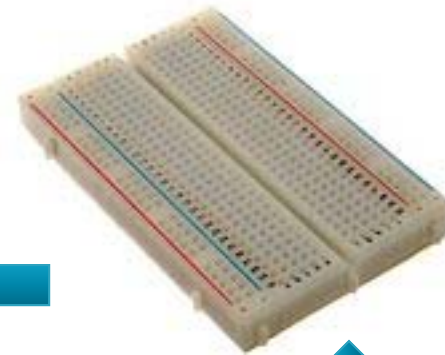
➢ Infra Red thermometer for non contact temperature measurements.

➢ stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps
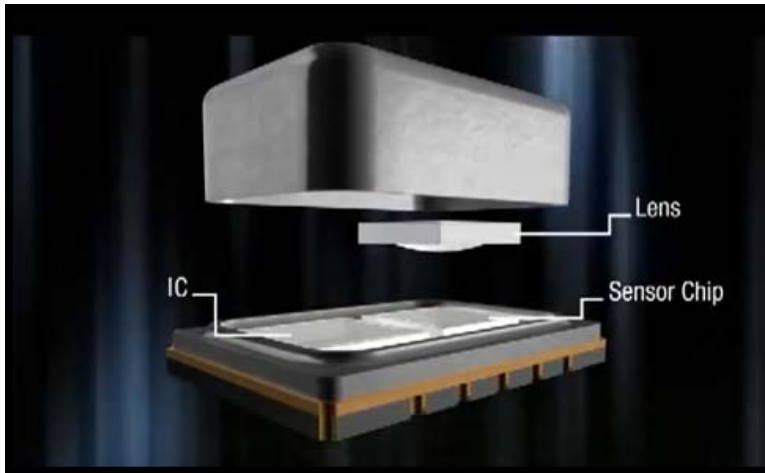➢ A unipolar stepper motor has one winding with center tap per phase
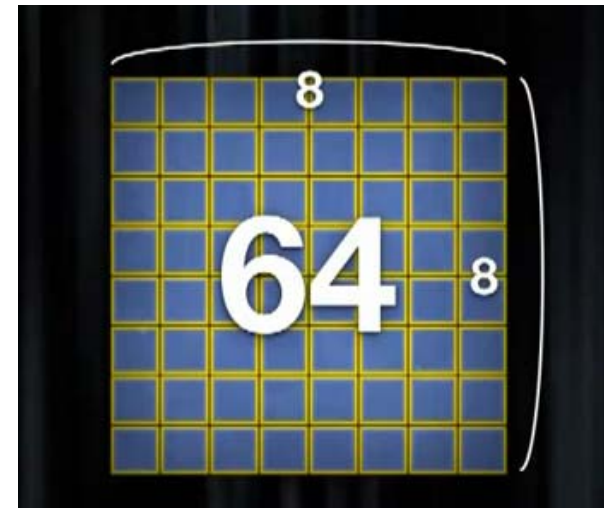
Design 2 – Adopted Approach

Grid Eye Sensor

Sensor Components
.429" X .307" X .169"
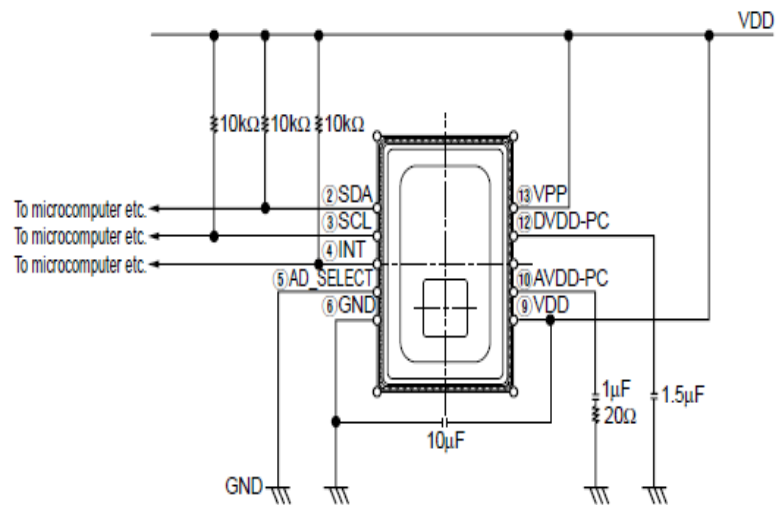

64 Thermopile Elements

➢ Passive infrared sensor
➢ Viewing Angle of 60 degrees
➢ Detects multiple objects
➢ Small surface mount package
➢ Can be easily integrated to a computer

Grid Eye Senor Circuits

RECOMMENDED EXTERNAL CIRCUIT
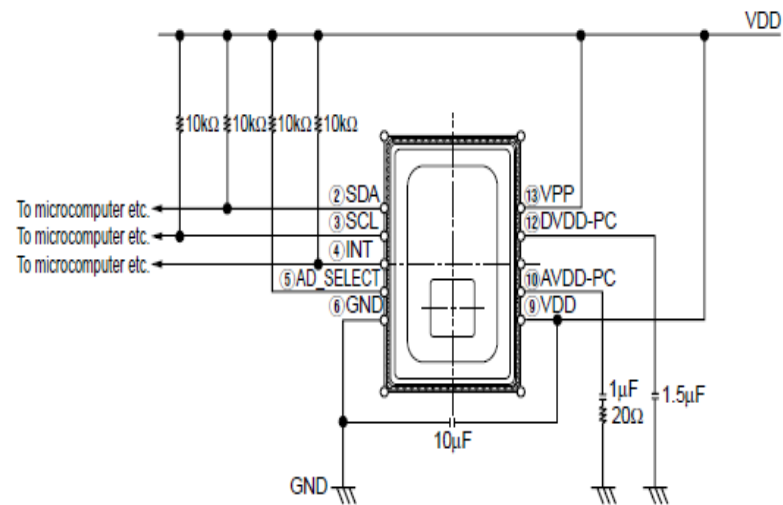
1. In case of setting I²C slave address of the sensor 1101000
* Connect terminal ⑤ (AD_SELECT) to GND.

2. In case of setting I²C slave address of the sensor 1101001
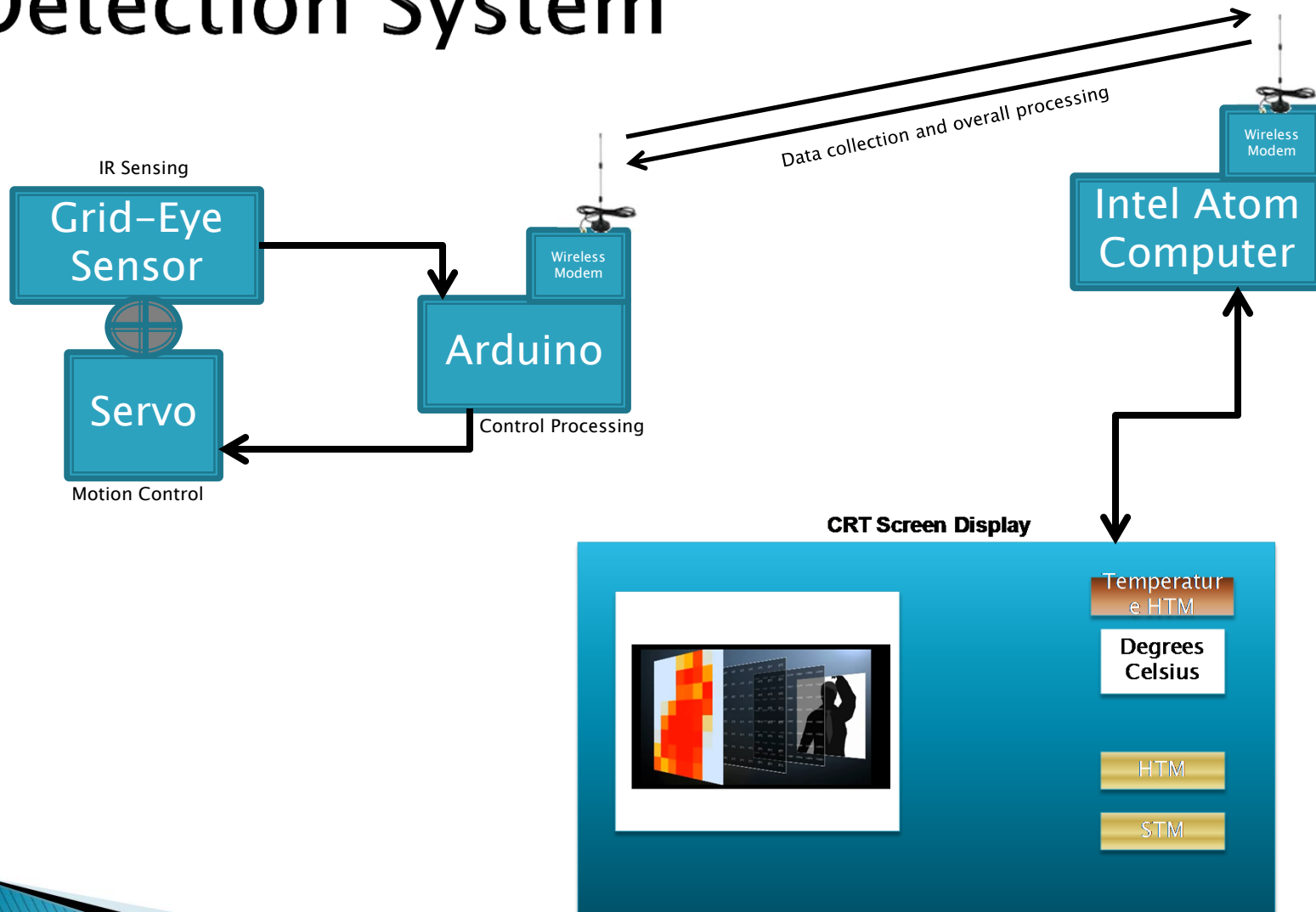* Connect terminal ⑤ (AD_SELECT) to VDD.

Grid Eye Sensor Circuit PCB
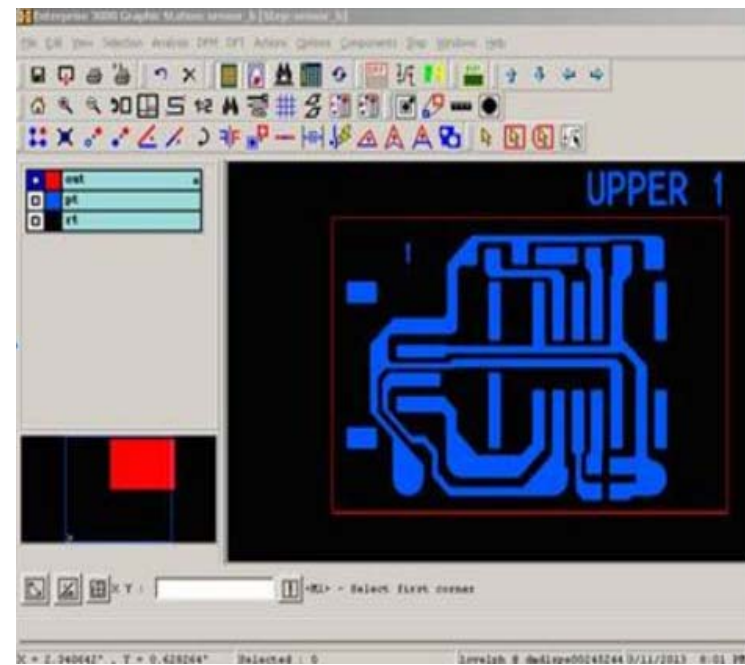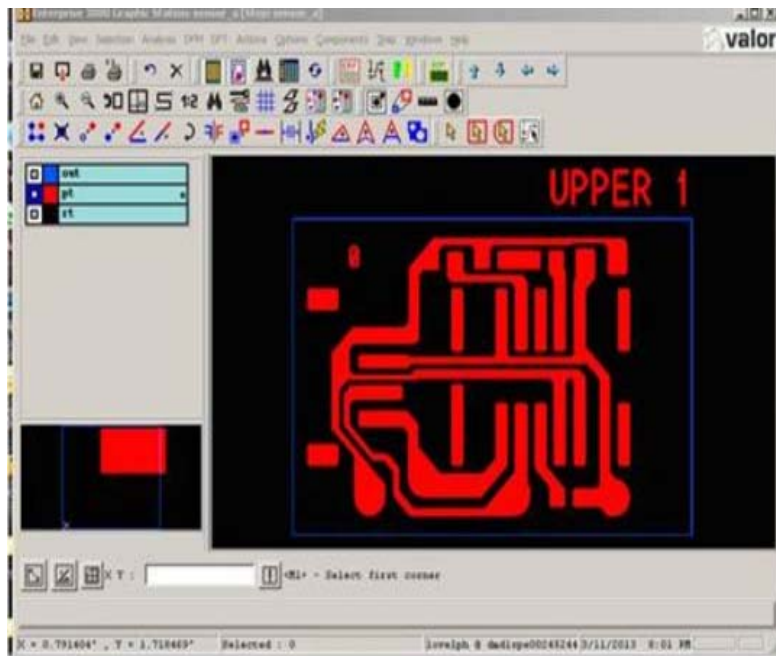
Schematics of the Thermal Detection System

Data collection and overall processing

IR Sensing

Grid-Eye Sensor

Servo

Motion Control

Wireless Modem

Arduino

Control Processing

Intel Atom Computer

Wireless Modem

Wireless Modem

CRT Screen Display

Temperature HTM

Degrees Celsius

HTM

STM

Implementation/Management

Group Member	Task
Pierre Charles	Development of alternative designs and Load analysis
Daley Gunter	Develop a wireless communication protocol between the Arduino and Intel Atom Board
Shaddy Abdelaal	Detection and tracking of objects by the sensor and the subsequent transmission of temperature data from the sensor to the Arduino Board
All	Testing, Thermal Imaging, Building of the complete base.
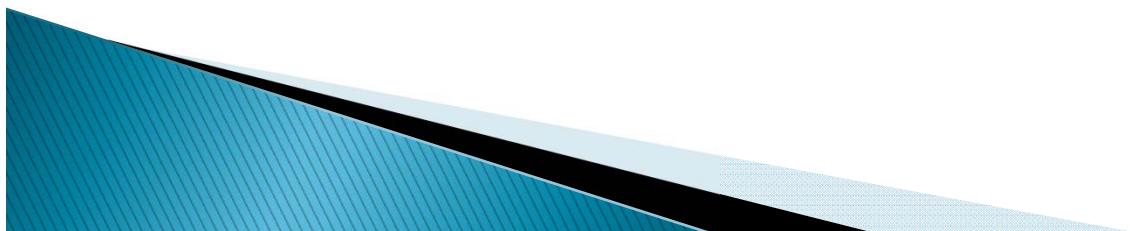
Testing and Evaluation

Testing	Method	Outcome
Weight	Digital Scale	Weight of complete system .6lbs, requirement met
Operational Temperature	Arduino Code	Complete

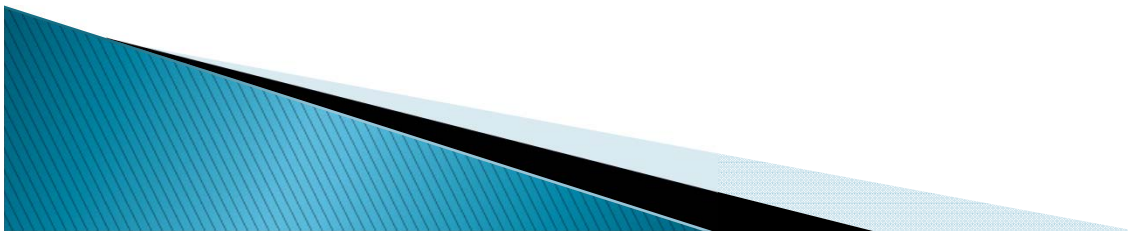| Testing	Method	Outcome
Pan/Tilt	Arduino Code (Programming)	Complete.
Detection Of Multiple Objects	Arduino Code (Programming)	Incomplete.
GUI appearance	Arduino Code + Grid Eye sensor (Programming)	Complete

Cost & Resources

Part	Quantity	Vendor	Price
Grid Eye Sensor	5	Digikey	$196.05
XBEE wireless Kit	1	Trossen Robotics	$139.95
S3 pan tilt system	1	Crustcrawler	$79.99
Hitec Servo	2	Crustcrawler	$17.99
18" Heavy Duty Servo Wire	2	Crustcrawler	$4.39
5.8GHZ 200MW FPV Wireless Modem	1	HobbyKing	$61.23
9v Power Adapter	1	bixnet	$3.00
9v Battery	1	Amazon	$1.59
Total		$504.19	$504.19

Conclusion

- ✓ The main feature of the proposed system is the thermal image of a target by the Grid-Eye sensor.

- ✓ Projection of the thermal image on a screen and wireless communication between the microprocessor and the microcontroller.

- ✓ Low-cost and efficient system which can be utilized for detection and tracking of targets.

Questions ?