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EECE401 Senior Design I

Howard University

Dr. Charles Kim



Passive Infrared Perimeter Monitoring Alarm System

Digital Dynamic

Tesfayohnes Woldselassi

Jonathan Applewhite

Brittany Jackson



Overview

- Background
- Problem Formulation
- Design Requirements
- Current Status of Art
- Solution Approach
- Tasks and Project Management
- Deliverables
- Cost and Resources
- Conclusion



Background

- In situations where a company or platoon camp temporarily in a certain location to accomplish its mission it may need to establish a defense perimeter around itself.
- For years the military used deadly forces to protect its perimeters. From buried grenades around the compound to tripping wire which activate an explosive devices were used.



Problem Formulation

- In the modern battleground, innocents and their chattel may come upon the perimeter of a platoon and an automated destructive reaction may not be appropriate.
- One intelligent solution for preventing the increasing innocent casualties is the design of a motion detector alarm system.
- The requirements for this project have been principally set by Northrop Grumman NGC.



Design requirements

- Design a concept for deployable passive IR and perimeter monitoring detectors providing audible alarms for intrusions.
- Provide possible low energy solution using 3.0 VDC or secondary cell 2.4 VDC power.
- Produce a breadboard which maintains approximate size, durability, and weight
- The item should be no more than approximately a tennis ball in volume.
- Item may be ground, post, tree or wall deployable.

Current Status of Art

Active Infrared Motion Detector (IR):

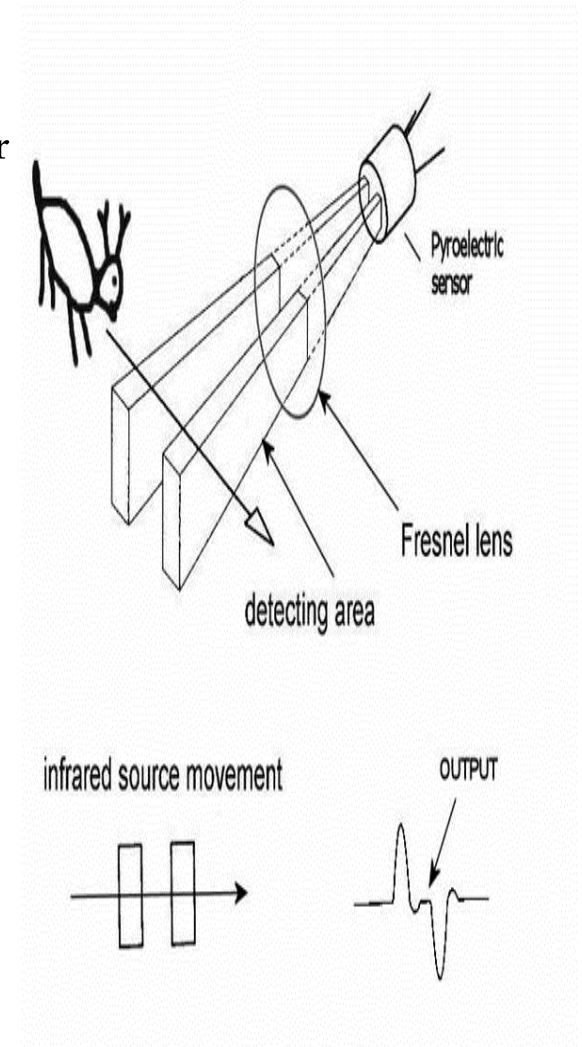
- It detect the signal of heat energy emitted by an intruder as it differs from the constant infrared scanning activity of the detector.

Advantage:

- Low power consumption
- Good low light sensitivity
- Strong human recognition

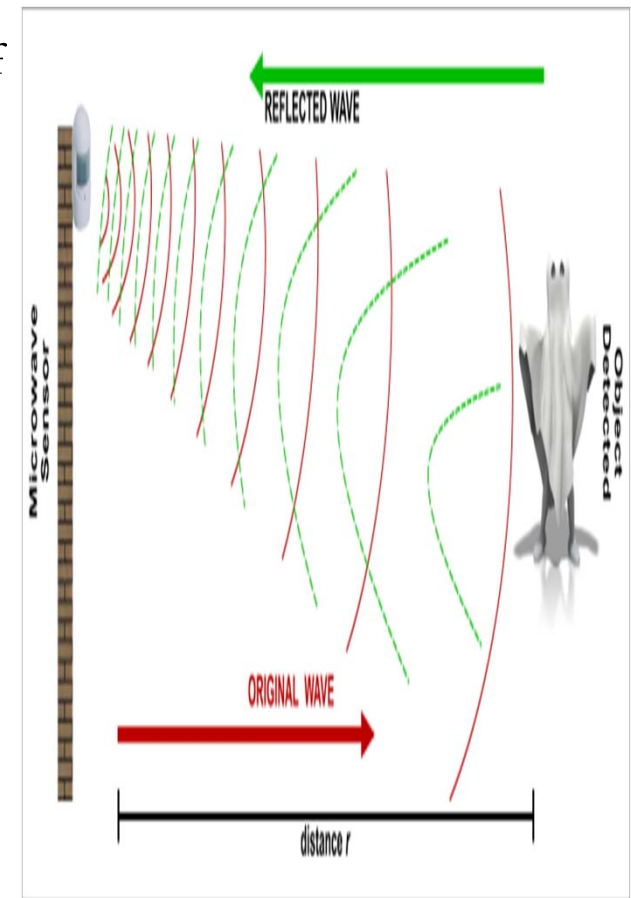
Disadvantage:

- No detection for very close objects
- Disrupted by bright colored materials



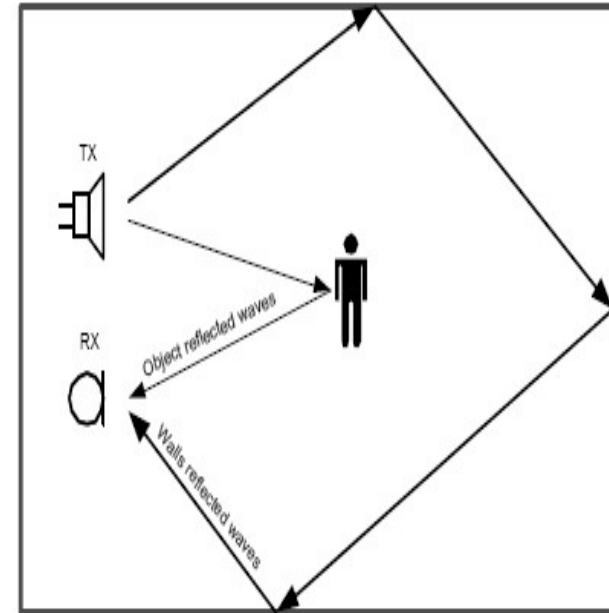
Current Status of Art

- Continuous Wave Radar Motion Detector (CW):
 - It uses microwave signals to emit frequencies to bounce of the surrounding area; in case of intrusion the detector detects when there is a disruption on these frequency.
- Advantage:
 - High resolution distance measurement
 - Good detection range
 - Can penetrate Variety of materials
- Disadvantage :
 - More expensive
 - Can be jammed



Current Status of Art

- Ultrasonic Motion Detector:
 - Ultrasonic sound energy is emitted in waves when the sensor detects movement the sound wave are interrupted which trigger the sensor.
- Advantage:
 - High sensing accuracy
 - Does not depend on optical
- Disadvantage:
 - Require reset time after each detection
 - Disrupted by loud noise



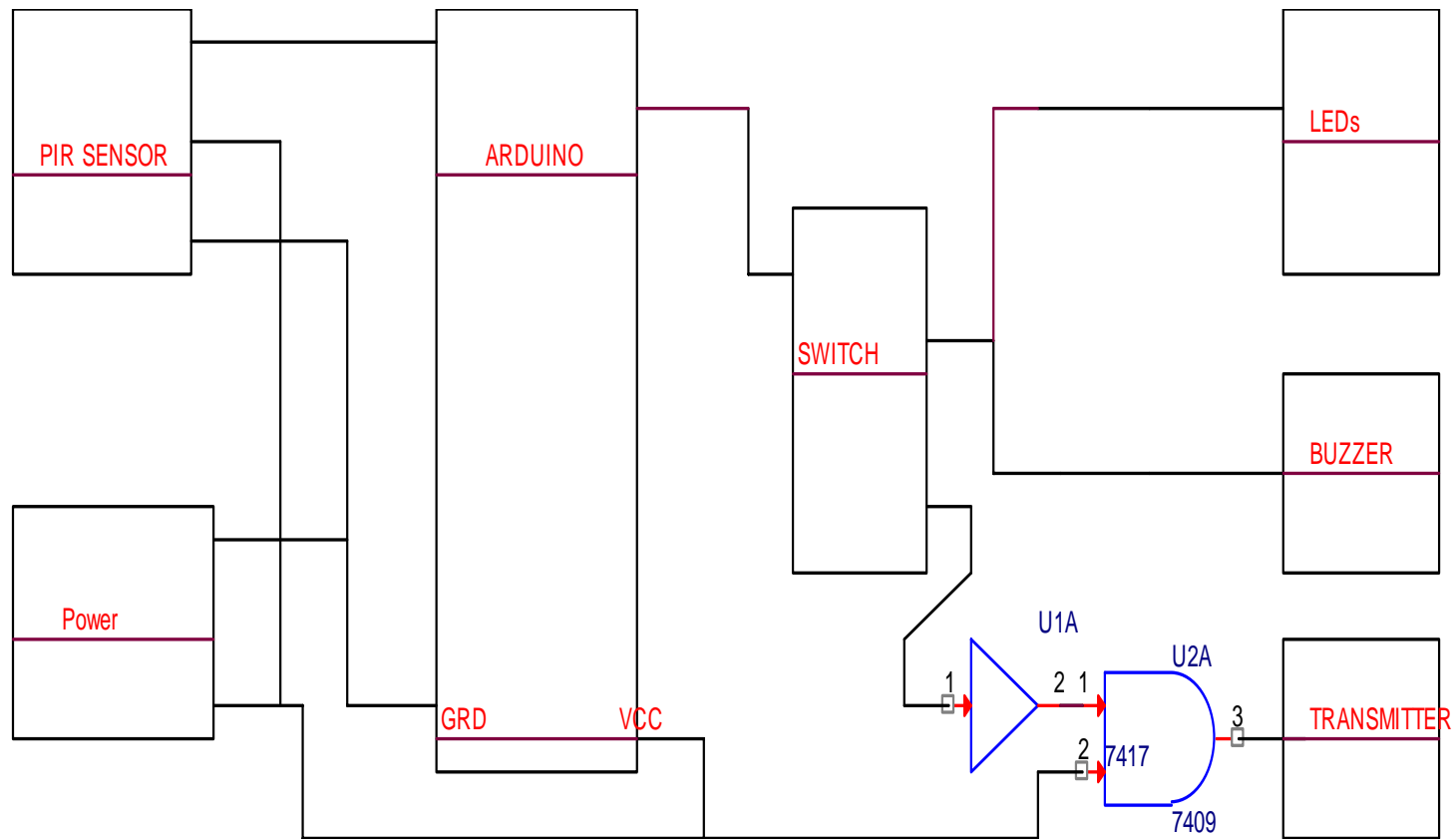


Current Status of Art

- Vibration Motion Detector:
 - Detect simple vibrations
- Advantage
 - Stands high temperature
 - Detect low level of movement
- Disadvantage :
 - Low detection range
 - Easy to disrupt

Solution Approach

- The following block diagram shows the major layout of the whole system.





Solution Approach

- The Passive Infrared Sensor:
 - Sensitivity range: up to 20 feet (6 meters) 110 degrees x 70 degrees detection range.
 - Digital pulse high (3V) when triggered (motion detected) digital low when idle (no motion detected).
 - Source power 3.3V – 5.0 V



Solution Approach

- Microcontroller :
 - Arduino Nano or similar small microcontroller
 - The output of the sensor will be connected in one of the pins
 - The Arduino Nano microcontroller will give us control on the alarm system.

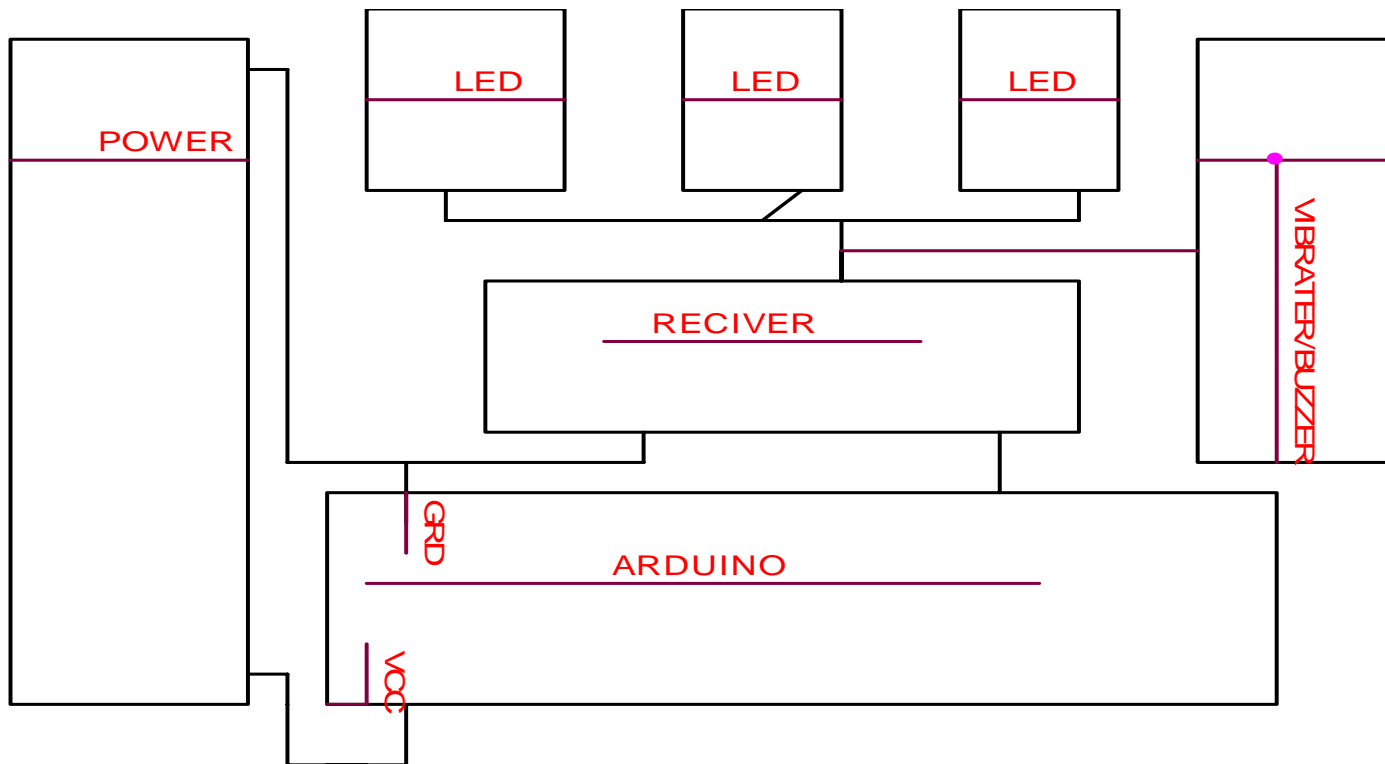


Solution Approach

- Other components included in the diagram are 5mm or 3mm LEDs and buzzer alarm will then be connected.
- We may also use amplifiers, transistors, resistors, and capacitors in order to get a clear and audible alarm system.
- Software that will be used for processing:
 - Arduino compiler
 - C++

Solution Approach

- In case of secret missions there will be hand held device that will notify the user.





Tasks and Project Management

- Study and understand the function of each component in our system
- Develop a layout block diagram that represents the communication between each part.
- Determine the input and output to each part of the block diagram and the system in general.
- Design software desirable for the implementation of control between functional block of the system.
- Test and modify product if necessary

Task and Management

Objective	Date
Proposal presentation	October 2013
Final written proposal	November 2013
Evaluation	November 2013
Peer evaluations	November 2013
Design finalization	December 2013
Ordering of parts	December 2013
Development of the design	January 2014
Testing of project	February 2014
Documentations of project	March 2014
Final product presentation	April 2014



Task and Management

- The team will work together in all aspect of our design. From the initial planning to the final test we will work together in every detail of the project.
- “Coming together is a beginning.
Keeping together is progress.
Working together is success.”

- Henry Ford



Deliverables

- The team plans on having a functioning prototype by the end of February, 2014. This prototype will satisfy all the design requirements set by our client.

Cost and Resources

UNIT	QUANTITY	PRICE
PIR Sensor	3	\$45
Transmitter	3	\$45
Receiver	1	\$15
Arduino Board	4	\$120
LEDs	---	\$5
Battery	----	\$5
Buzzer	3	\$35
	Total	\$270



Conclusion

- Our aim is to design a deployable passive IR perimeter monitoring alarm system:

That is power efficient, cost efficient, easy-to-use, and reliable which can be used in any part of the world for military perimeter protection.



Questions?



Thank you !