

Wireless Infrared Monitoring System

Midterm I Presentation

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SIEMENS



GROUP 14

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Project Description



Need Statement

“There is a need for an improved method of monitoring critical equipment under operation in power plants.”

Goal Statement

“Design a proposed complete system that can monitor a wide range of equipment for problematic operation.”

Objectives

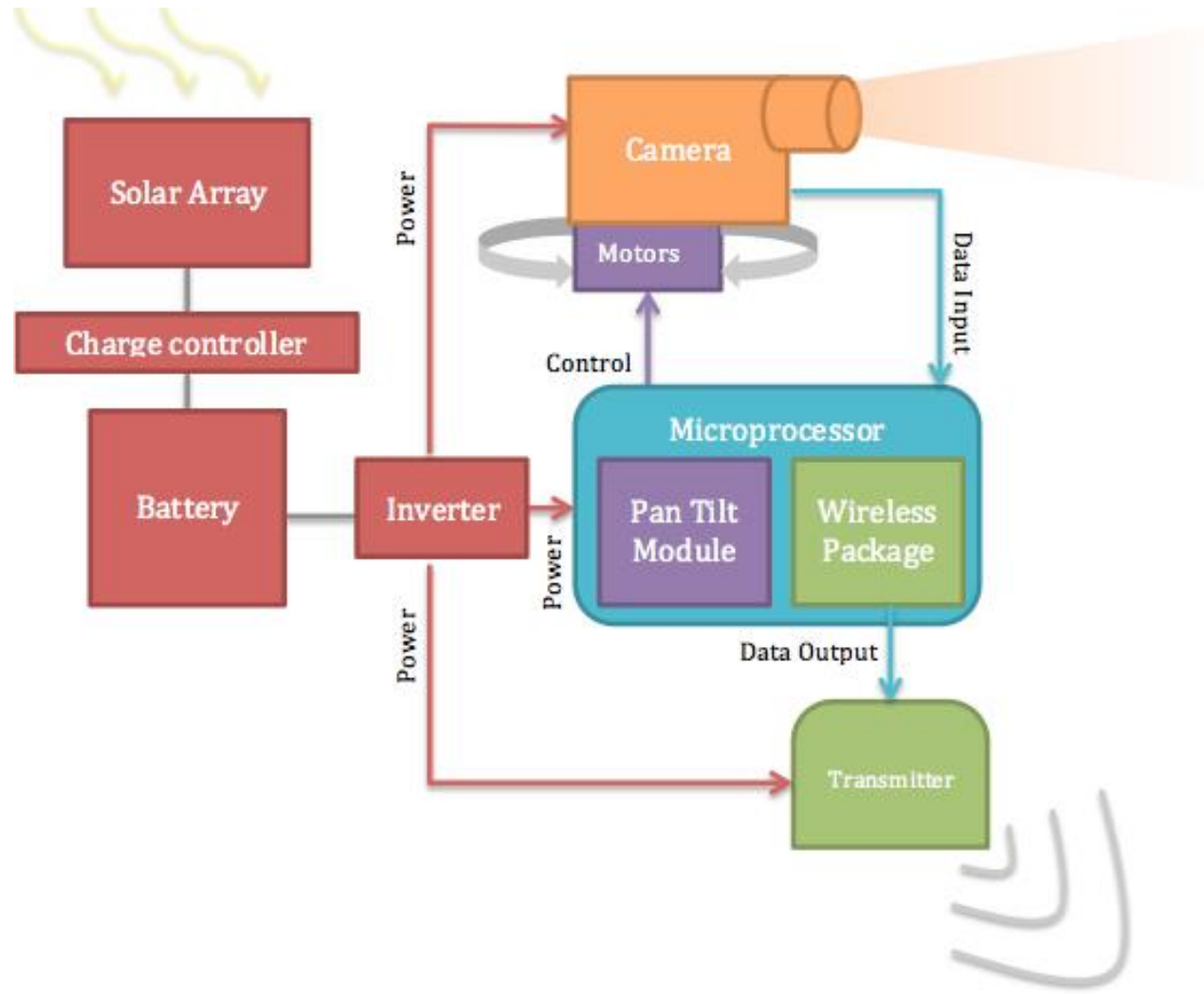
1. Design a stand-alone system that does not consume any auxiliary power
2. Decrease equipment interference on operating systems
3. Decrease manual work needed for preventative maintenance
4. Create cost savings through the elimination of need for numerous existing systems

Project Constraints

Subject	Constraint
Location	Fossil Fuel Power Plants
Lifetime	30 years
Wind	Maximum 100 mph
Ambient Temperature	0-110° F
Monitoring	Thermal Imaging
Power	Solar Harvesting
Battery Storage	3 days
Communication	Wireless, Hart Protocol
Compliance	NERC, IBC2006
Weatherproofing	IP55
Movement	360° pan, 90° tilt
Budget	Designed System: \$20,000 /Proof of Concept: \$2,000

Performance Scope

- Self-powered
- Self-supported
- Self-sustaining for 3 days
- Autonomous
- Wireless Communication

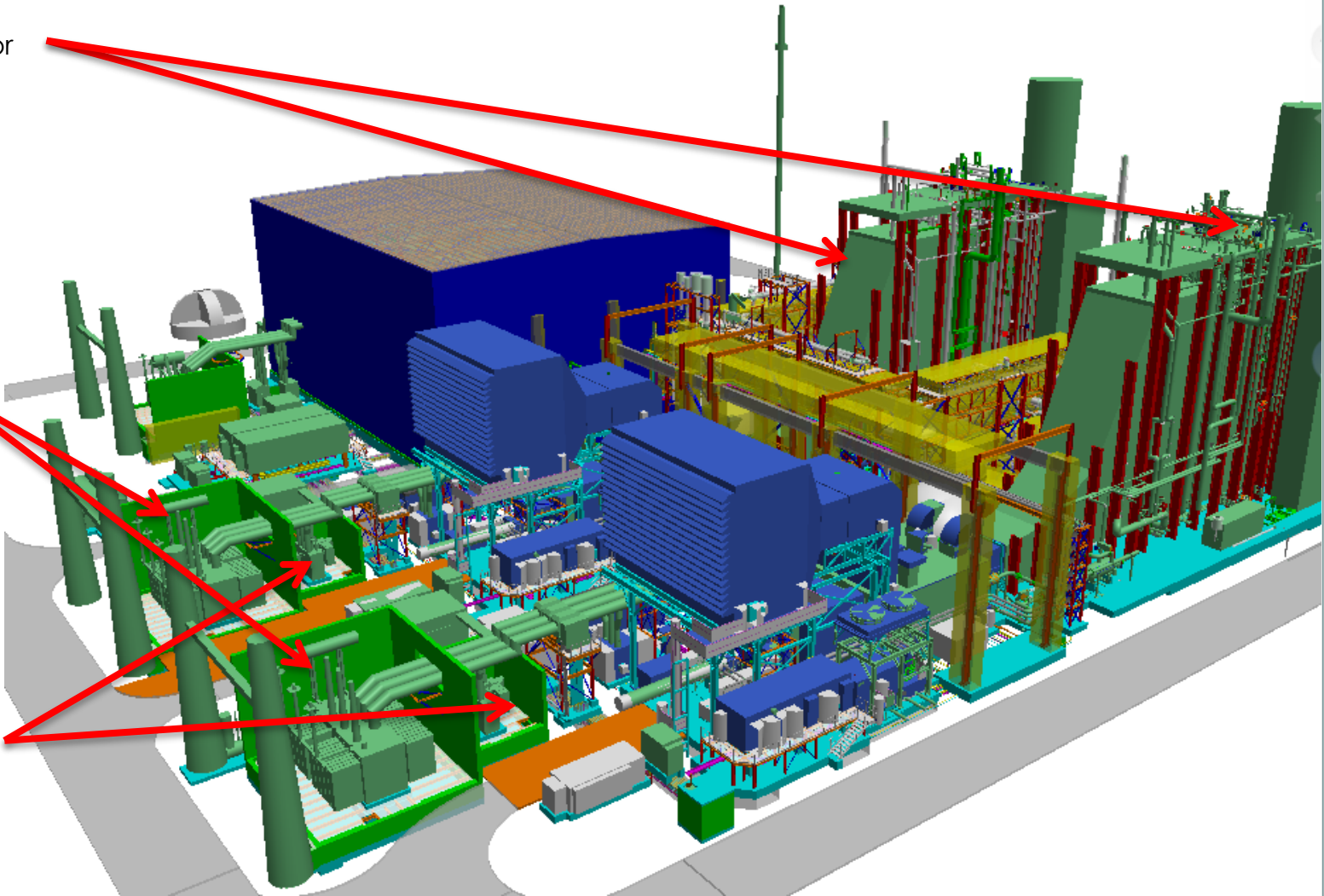


Reference Plant

Heat Recovery
Steam Generator
(HRSG)

Step Up
Transformer (GSU)

Unit Auxiliary
Transformer (UAT)

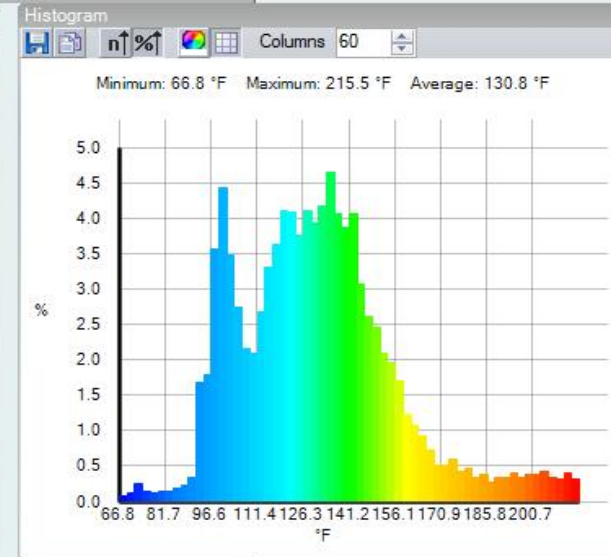
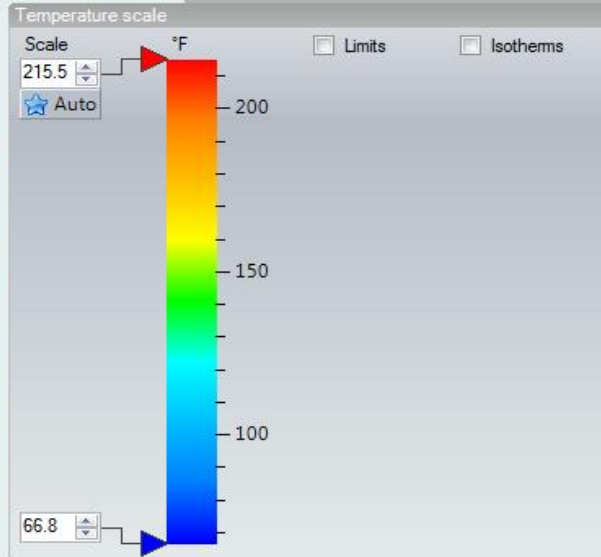
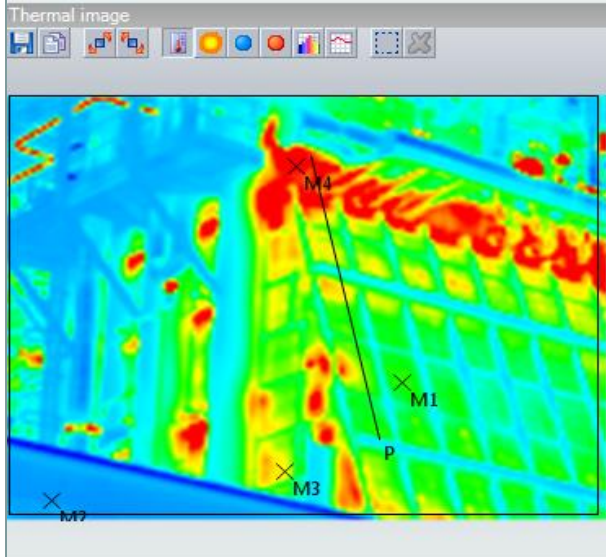


Subsystem Down-Selection



**INFRARED CAMERA
PAN TILT MODULE
MICROCOMPUTER
BATTERY STORAGE
SOLAR ARRAY**

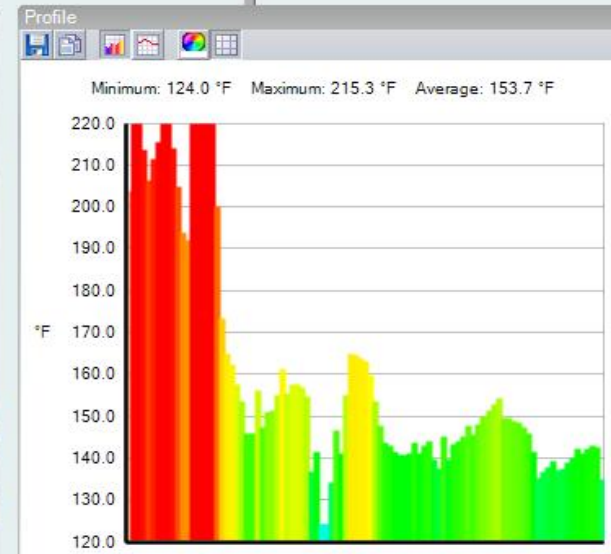
Infrared Software Functionality



Thermal image markers

No	Temp. [°F]	Emiss.	Refl.Temp. [°F]	Remark
M1	143.0	0.95	68.0	
M2	93.2	0.95	68.0	
M3	159.4	0.95	68.0	
M4	+++	0.95	68.0	

Remark



Infrared Camera Selections

FLIR A-Series (A310)

Weight:	11 lb.
Dimensions:	460 x 140 x 159 mm
Protection:	IP66
Temp Range:	-13° to 122°F
Image Temp:	32° to 662°F
Power:	25 W
Output:	MPEG-4 over Ethernet
Resolution:	320 x 240 pixels



Pelco Sarix TI Series

Weight:	7.2 lb.
Dimensions:	376 x 126 x 128 mm
Protection:	IP66
Temp Range:	-40° to 122°F
Image Temp:	-4° to 248°F
Power:	35 W
Output:	MPEG-4 over Ethernet
Resolution:	640 x 480 pixels



Pan-Tilt Module



Design Specifications:

- Pan 360°/Tilt: 90°
- Durable (30 years)
- Efficient
- Support Payload (20 lb)
- Payload Wiring
- Real time control interface
- Software Development Kit (SDK)

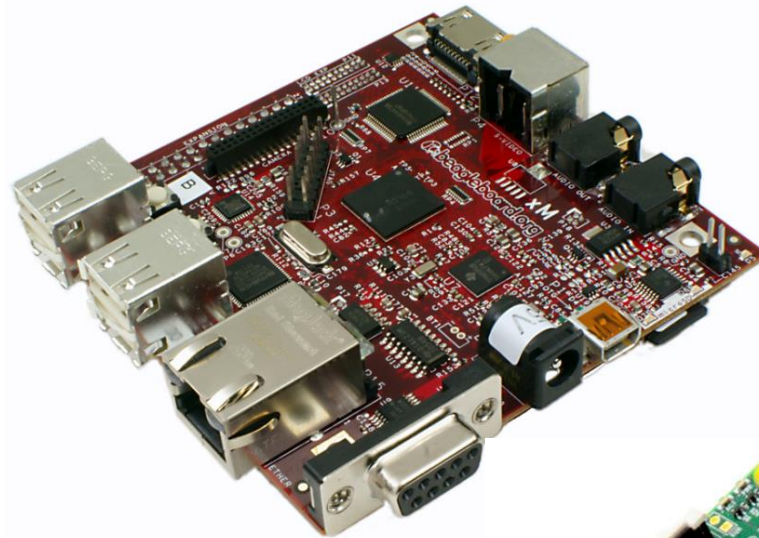
FLIR: PTU D100	
Weight:	19 lb.
Dimensions:	307 x 208 x 200 mm
Protection:	IP67
Temp Range:	-22° to 158°F
Power:	33 W
Max Payload	20 lb.
Pan-Tilt:	Pan: 360°, Tilt: +30°-90°





- Interfaces with:
 - Infrared Camera
 - Transceiver
 - Pan Tilt Module
- Must process infrared data and package it to be sent to the transceiver
- Control the functions of the motors & camera with proper drivers

Key Common Component: the Microcomputer



Battery Selections

Lead Acid Based

Pro

- low cost per Watt-hour
- Low self-discharge
- High specific power
- Good low & high temperature performance
- Economically priced

Con

- Low specific energy
- Slow charge
- Prone to sulfation
- Limited cycle life
- Flooded version requires watering
- Transportation restrictions on flooded type

Nickel Based

Pro

- 1,000 charge/discharge cycles
- Good load performance
- Long shelf life
- Simple storage and transportation
- Good low-temperature performance
- Economically priced

Con

- Relatively low specific
- needs periodic full discharges
- High self-discharge

Lithium Based

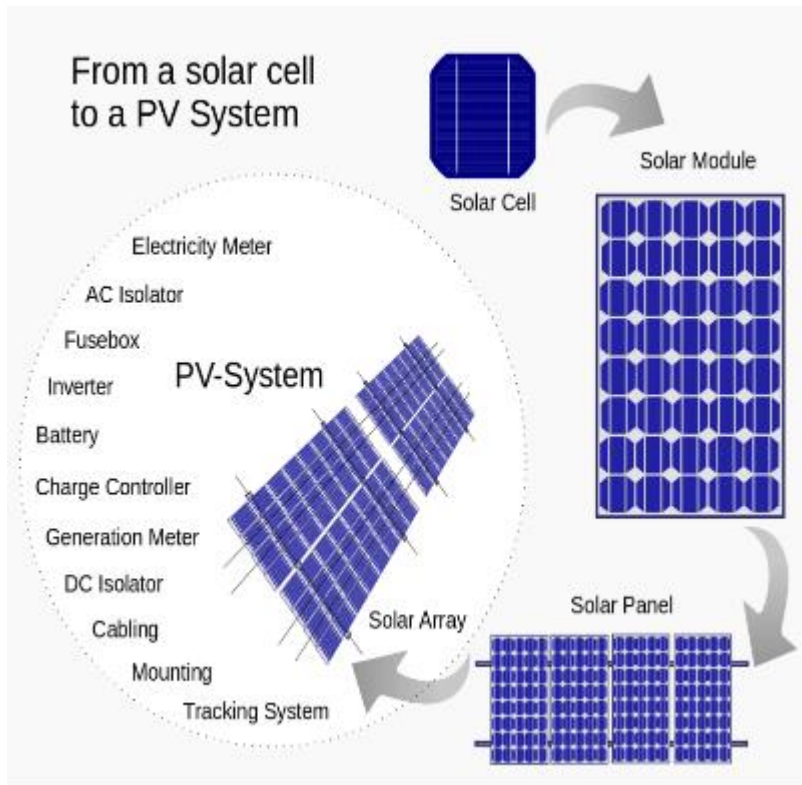
Pro

- High energy density
- Relatively low self-discharge
- Low maintenance.

Con

- Requires protection circuit to limit voltage & current
- Subject to aging
- Transportation regulations

Solar Panel Selections



Solar Panels

Crystalline
modules

Thin
modules

Poly
crystalline

Mono
crystalline

Rigid

Flexible

Preliminary Battery & Solar Panel Choice

Monocrystalline Solar Panel

- Advantages
 - Highest efficiency rates of 15-20%
 - Monocrystalline silicon are space-efficient
 - Monocrystalline panels live the longest ~25 year warranty
- Disadvantages
 - Monocrystalline solar panels are the most expensive
 - Possibility of breakdown from partial shading
 - More efficient in warm weather

Lead Acid Battery

- Flooded
- Deep cycle
- Low maintenance
- More charge/discharge cycles

Lead Acid
Battery

Deep
Cycle

Flooded

Project Schedule



Questions?