Advance Condition Based Predictive Maintenance of Electric Motors in Ships

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Understanding the problem

Item 1	Item 2	Item 3
Downtime: shipping is the lifeblood of the global economy and operational disruptions are not only costly for shipping companies but also other key players in the supply chain.	High maintenance cost. This has been a challenge due to reduce profit margins experienced during maintenance of onboard equipment.	After the warranty period motors can still be useful and there is no necessity to replace the undamaged parts.

Target audience

This project will be beneficial to the following entities in the shipping industry:

- Owners
- Classification Societies
- Surveyors
- Engineers
- Manufacturers

Industry Trends

Observations of industry practices show that past industry experience in reliability is heavily based on trial-and-error test procedures. Most of the reliability research in industry still focuses on two distinct periods of the product life: the warranty period, where most of the failures are due to product malfunctions or quality related problems, and wear-out period, where the failures are due excessive wear and use.

Client Implications:

- Increased cost of operations
- Downtime that results in adverse effects throughout the “goods” supply chain

Project objective:

To monitor the health of ship motors improving reliability and preventing downtime in ships.

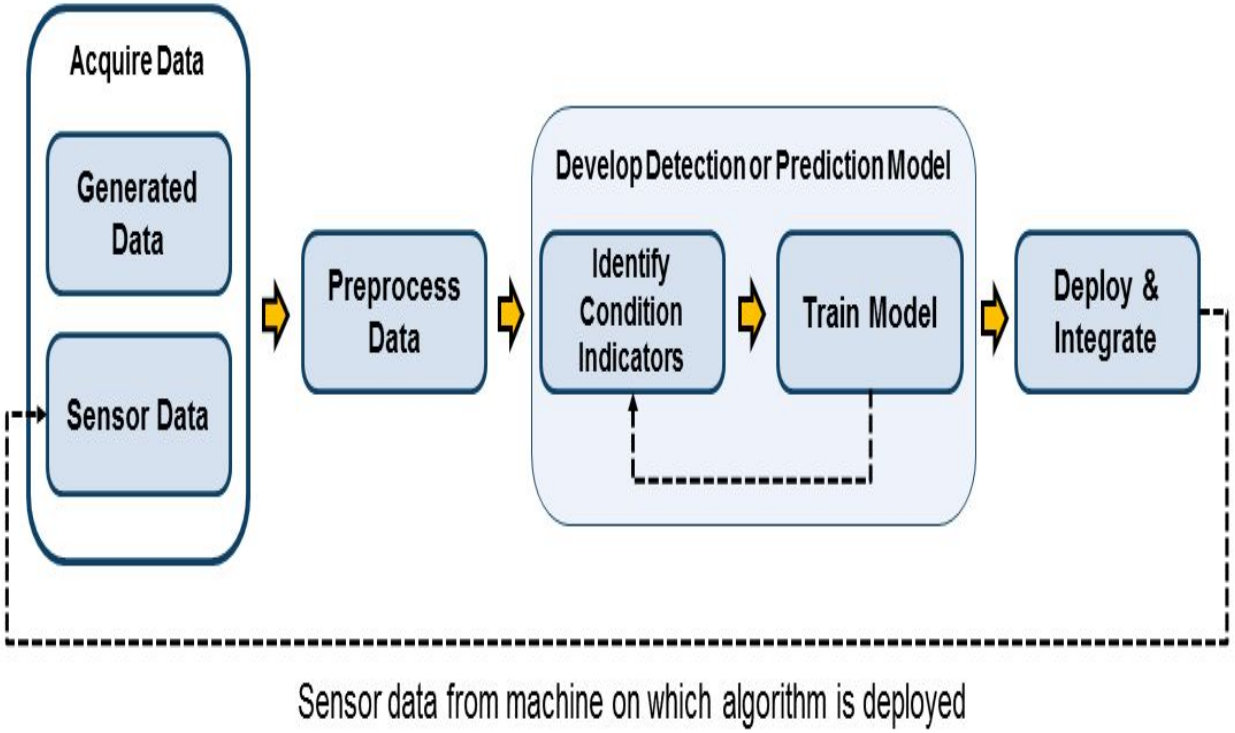
JUSTIFICATION

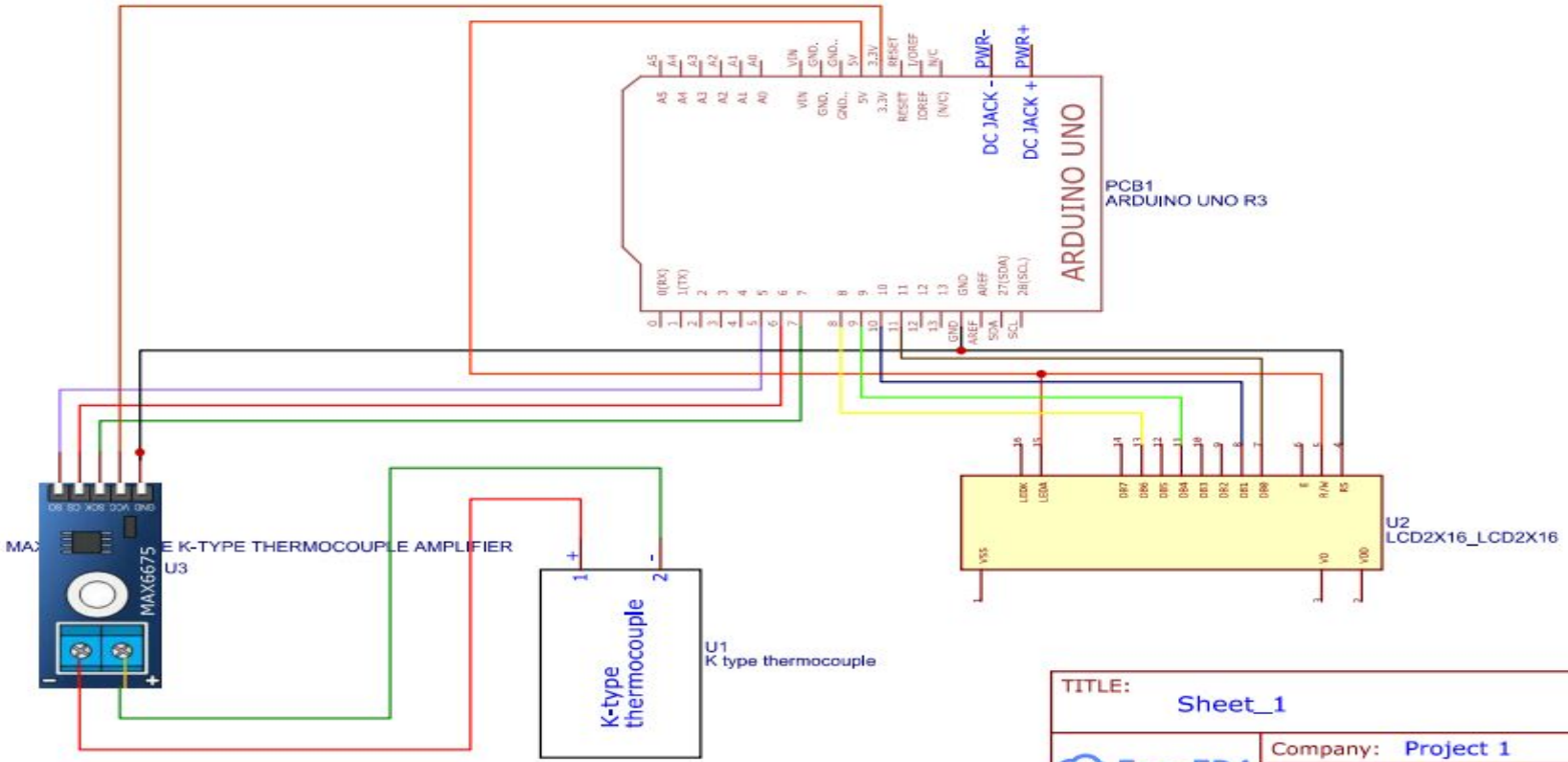
Electric motors serve as a critical component for any facility. They are prone to failures which may disrupt business operations and decrease productivity.

Traditionally, maintenance involves routine inspection and repair done manually.

Methodology

How can This be achieved?

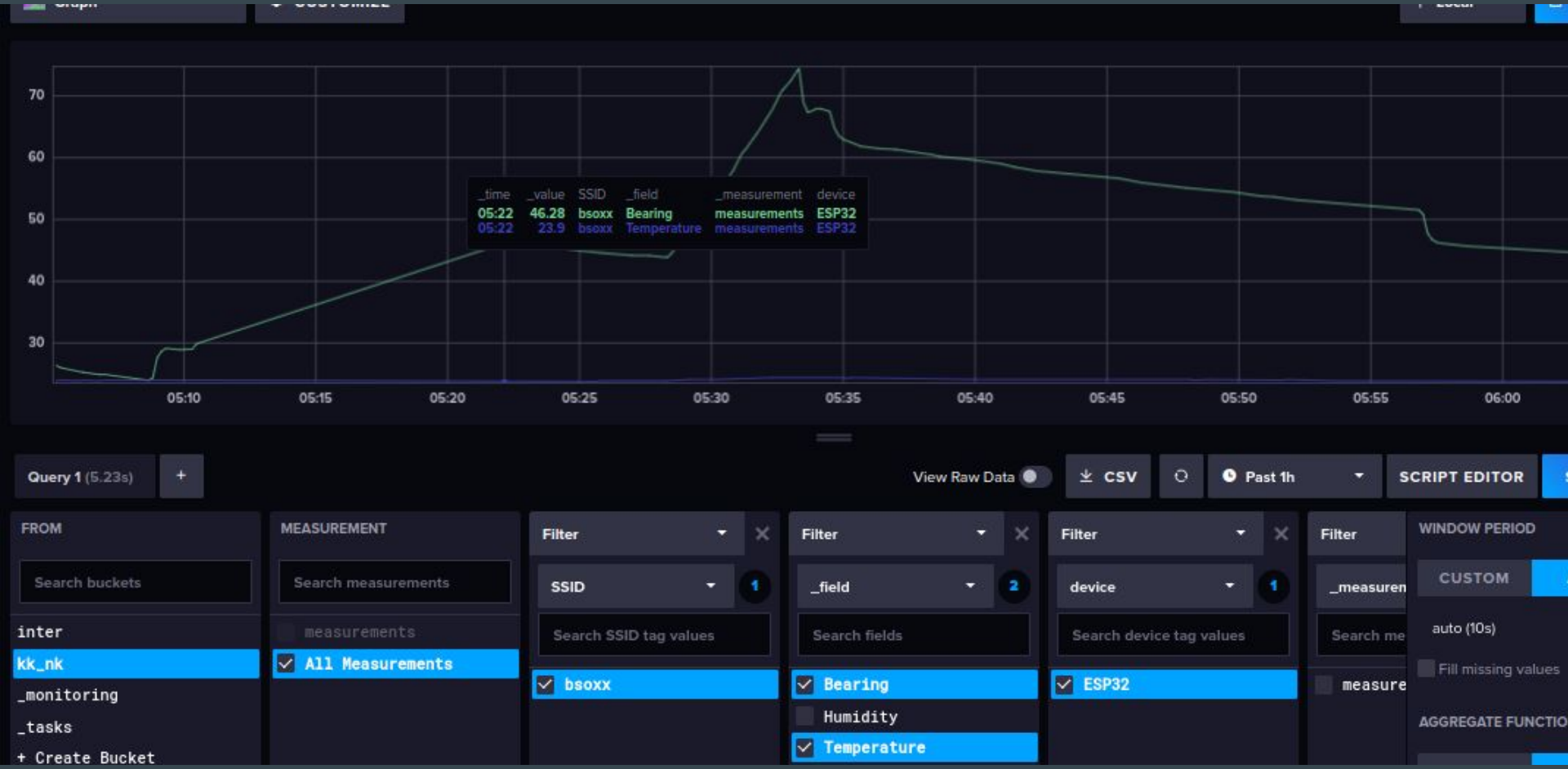



PWR-
PWR+
DC JACK -
DC JACK +
ARDUINO UNO
PCB1
ARDUINO UNO R3
MAX6675
U3
K-TYPE THERMOCOUPLE AMPLIFIER
K-type thermocouple
U1
K type thermocouple
U2
LCD2X16_LCD2X16
TITLE:
Sheet_1
EasyEDA
Company: Project 1
Date: 2022-07-10
Drawn By: Kibichii

Data logs

ble an	_measurement group string	_field group string	_value no group double	_start group dateTime:RFC3339	_stop group dateTime:RFC3339	_time no group dateTime:RFC3339
	measurements	Bearing	55.28	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:47:50.000Z
	measurements	Bearing	55.19	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:48:00.000Z
	measurements	Bearing	55.155	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:48:10.000Z
	measurements	Bearing	55.06	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:48:20.000Z
	measurements	Bearing	55	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:48:30.000Z
	measurements	Bearing	54.94	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:48:40.000Z
	measurements	Bearing	54.88	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:48:50.000Z
	measurements	Bearing	54.78	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:49:00.000Z
	measurements	Bearing	54.69	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:49:10.000Z
	measurements	Bearing	54.63	2022-12-19T02:47:40.922Z	2022-12-19T03:02:40.922Z	2022-12-19T02:49:20.000Z

Data Querying



Normal motor Benchmark

Motor 1 and 3 comparison

_time	_value	_start	_stop	SSID	_field	_measurement	device	result
05:33	74.81	2022-12-19 5:30:47 AM	2022-12-19 5:40:47 AM	bsoxx	Bearing	measurements	ESP32	mean
05:33	55.9	2022-12-19 5:30:47 AM	2022-12-19 5:40:47 AM	bsoxx	Humidity	measurements	ESP32	mean
05:33	24.5	2022-12-19 5:30:47 AM	2022-12-19 5:40:47 AM	bsoxx	Temperature	measurements	ESP32	mean

OUTCOMES

Outcome 1	• A functional motor health monitoring device has been developed
Outcome 2	• Predictive maintenance algorithm has been achieved that can notify of anomalies
Outcome 3	• The multiple sensor module has been achieved that can synonymously monitor multiple paramaters
Outcome 4	• Electric system motor performance and efficiency has been optimized using insights from real-time data collected.

ITEM	SPECIFICATIONS	QUANTITY	PRICE
Arduino	Uno Rev3 USB 2.0 Cable Type A/B	1	3000
Thermocouple Amplifier	MAX31855K	1	1600
WiFi Development Board	NodeMCU 32S ESP32/CH340C	1	1400
Thermocouple K type	Operating Temperature:0-600°C Probe Material: Stainless Steel Probe Diameter:8mm Probe Length:50mm Cable Length:1m	1	760
Thermocouple DH 22	3.3-6V Input 1-1.5mA measuring current 40-50 uA standby current temperature range -40°C - 80°C	1	750
Power unit	12V/5W SMPS Module Rated input voltage: 100-240V Input voltage range: 90-264V	1	600
Memory card	Mixza 16GB micro SDHC US	1	600
Breadboard	Model MB102 165*55*50mm	1	200
Jumper wires	20cm male to female 20 cm female to female	80	200
Total			9110

WORK PLAN

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
Project Refinement												
System Modelling												
Controller Modelling												
Circuit Design												
Preparing Project Report												
Presentation												