FlarePath

Advanced Vehicle Fire Safety and Monitoring with Rapid Emergency Dispatch Solutions

R24-058

SLIIT
FACULTY OF COMPUTING

Some vehicle fire incidents in Sri Lanka

Vehicle catches fire on Dehiwala bridge last night (video)

April 2, 2024 at 9:58 AM

NEWSWIRE

A car had caught fire while on the Dehiwala flyover on Monday night (Apr 01), it was reported.

According to reports, it is suspected that the car had caught fire due to a technical fault in the vehicle.

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State Minister Chamara Sampath's vehicle catches fire in Halpe

April 16, 2024 08:55 am

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State Minister Chamara Sampath Dasanayake's vehicle has suddenly caught fire at around 12.45 a.m. today (16), Ada Derana learns.

The incident took place in the Halpe area of Bandarawela when the Dasanayake had been travelling from Mahiyanganaya to Ella.

However, the state minister and his driver have managed to escape the fire unharmed.

The fire trucks of Bandarawela Municipal Council, Ella Police and the residents of the area had tackled the flames

Daily News

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Monday, September 9, 2024 BREAKING NEWS US confirms first human bird flu case with no known animal exposure

Home » Car catches fire near Royal

Popular Posts

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September 4, 2024

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February 13, 2024

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LOCAL

Car catches fire near Royal

August 5, 2023 1:12 am • 0 comment

A fire had erupted in a car which was parked near the Royal College, Colombo 7. The fire brigade doused the fire.

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LATEST NEWS tal dues > Youth missing after being swept away by waves in Panadura > Sri Lanka to chase 219 after England were bundled out for their lowest

Van, cab, and three-wheeler destroyed by fire in Padukka

Saturday, 07 September 2024 - 11:29

The Padukka Police reported that a van, a cab, and a three-wheeler parked at a house in Mahingala, Padukka, were suddenly destroyed by fire.

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Trending News

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08 September 2024

Cess levy on imported cement reduced
08 September 2024

Israeli attacks kill over a 60 people
08 September 2024

NEWSWIRE

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Watch : Vehicle catches fire near Colombo Lakehouse Roundabout

July 31, 2023 at 4:43 PM

NEWSWIRE

A vehicle caught fire near the Lakehouse Roundabout in Colombo today, according to video footage shared by eyewitness.

The Police stated that no injuries or casualties were reported in the incident.

Video footage shows officials from the Sri Lanka Navy and Colombo fire brigade working together to douse the

The Police added that the fire has been doused and vehicular movement has returned to the road.

Thai police arrest driver and work to identify victims of the school bus fire that killed 23

Story by the Associated Press

3 minute read · Updated 2:38 AM EDT, Wed October 2, 2024

Rescuers gather around the school bus that caught fire in suburban Bangkok on October 1. Sakchai Lalit/AP

MORE FROM CNN

Bus crash in central Mexico kills 19 people

Tropical Storm Trami brings severe flooding and landslides to the Philippines, at ...

At least 126 dead and missing in massive flooding and landslides in Philippines

Our Team

MR.NELUM CHATHURANGA AMARASENA
SUPERVISOR

MR.DEEMANTHA NAYANJITH SIRIWARDANA
CO-SUPERVISOR

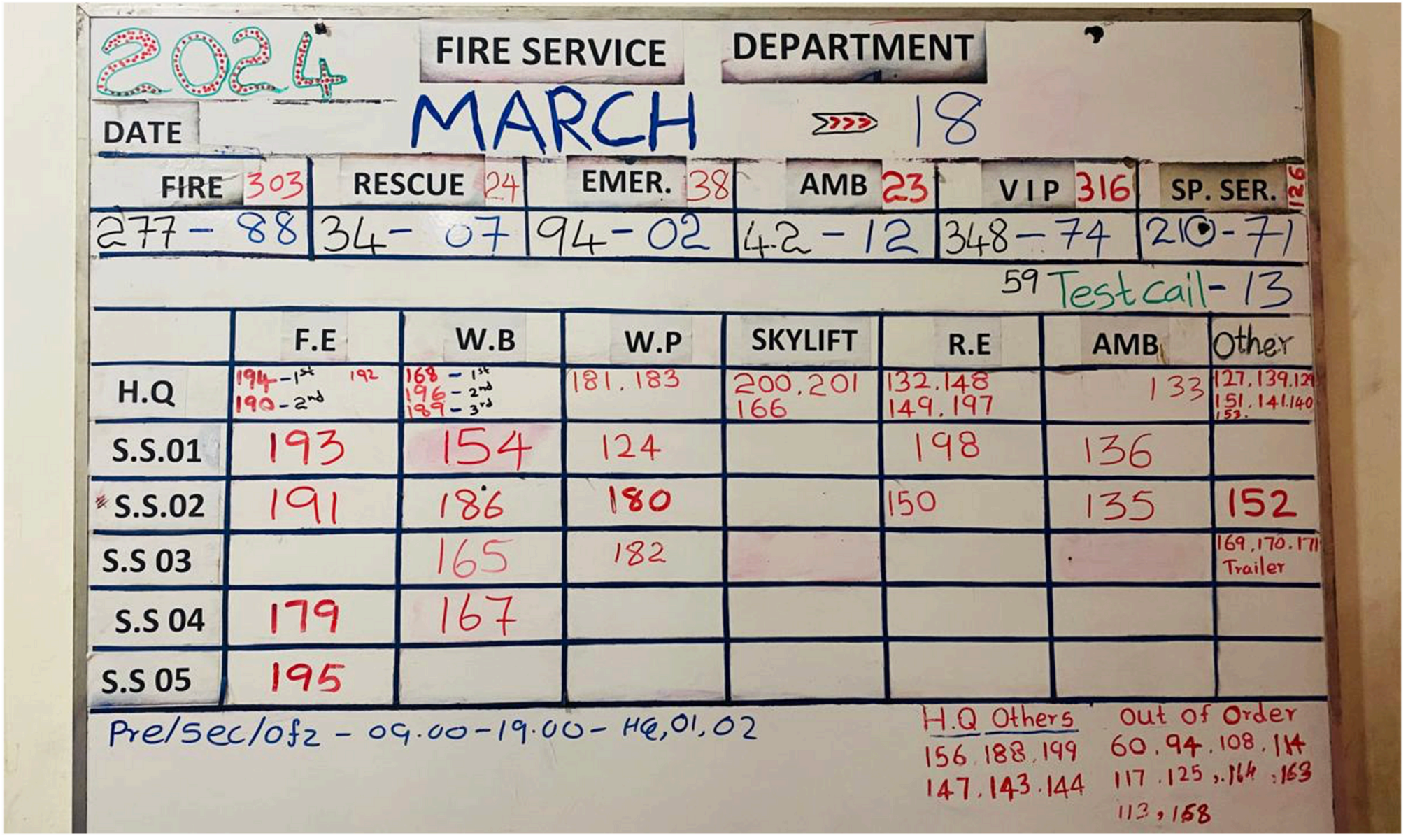
MR. W. D. ONRAY SAHINDA
EXTERNAL-SUPERVISOR

PERAMUNAGE A.N
IT21080562

ABEYWARDHANA D.N
IT21133718

DHARMAGUNAWARDANA W.M.P.I
IT21132346

ANTHICK G.N
IT21096266


2024
FIRE SERVICE DEPARTMENT
DATE
MARCH
18
FIRE 303
RESCUE 24
EMER. 38
AMB 23
VIP 316
SP. SER. 126
277 - 88
34 - 07
94 - 02
42 - 12
348 - 74
210 - 71
59 Test call - 13
F.E
W.B
W.P
SKYLIFT
R.E
AMB
Other
H.Q
194 - 1st 192
190 - 2nd
168 - 1st
196 - 2nd
189 - 3rd
181, 183
200, 201
166
132, 148
149, 197
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S.S.02
191
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180
150
135
152
S.S 03
165
182
169, 170, 171
Trailer
S.S 04
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167
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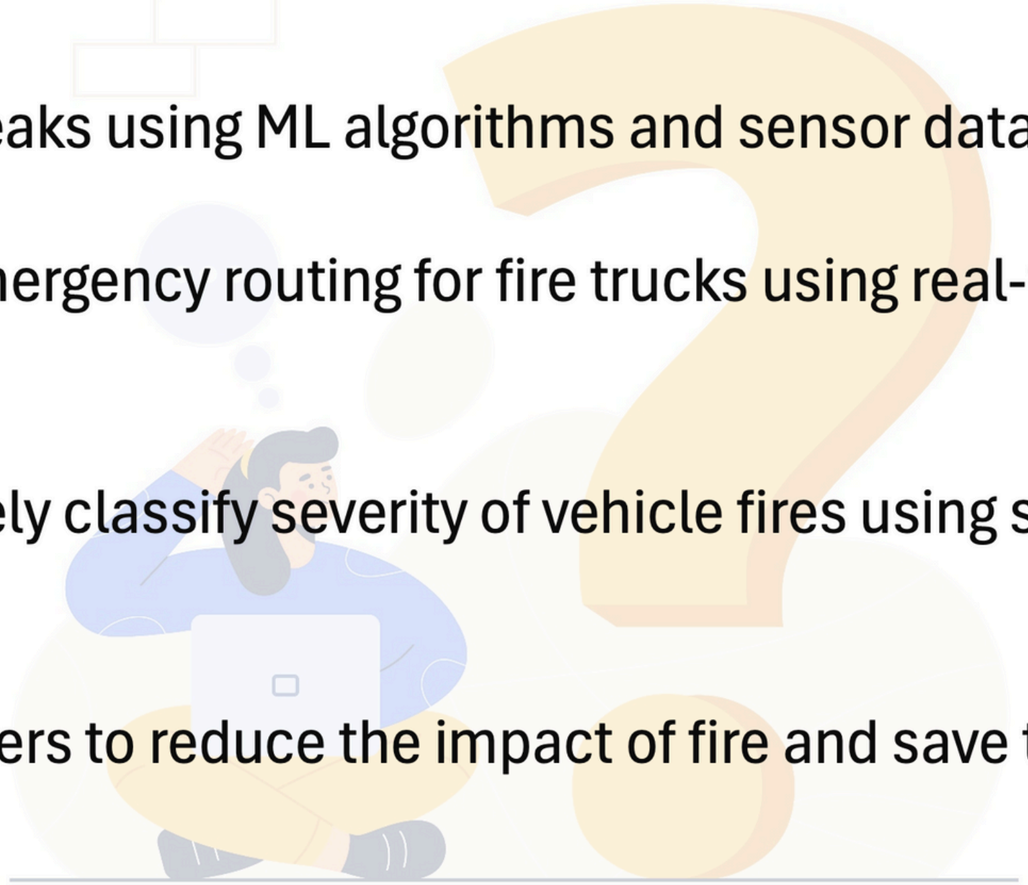
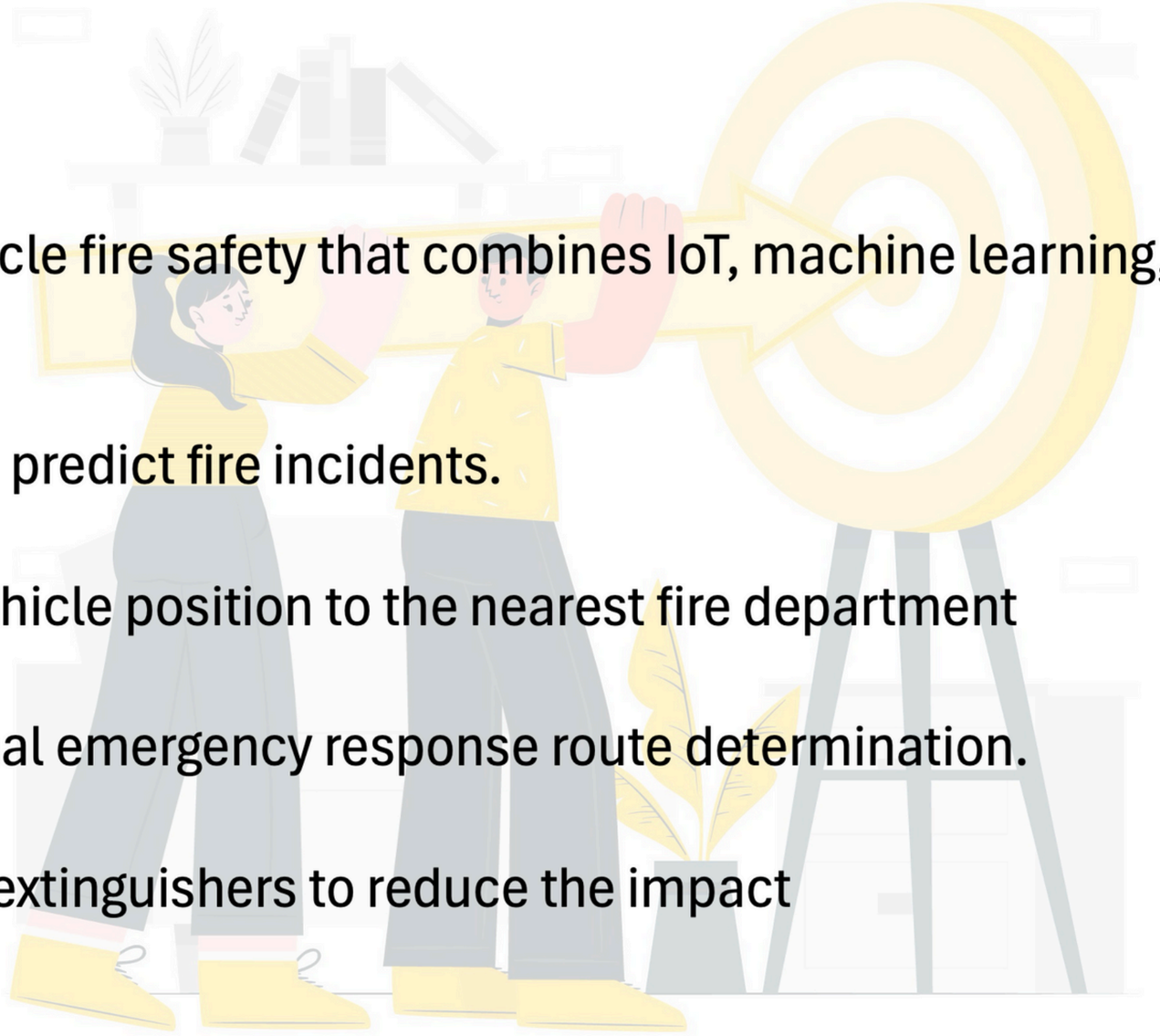
195
Pre/Sec/ofz - 09.00 - 19.00 - HQ, 01, 02
H.Q Others
156, 188, 199
147, 143, 144
Out of Order
60, 94, 108, 114
117, 125, 164, 163
113, 158

Research Problem

- How to accurately predict vehicle fire outbreaks using ML algorithms and sensor data?
- How can cloud-based analytics optimize emergency routing for fire trucks using real-time and historical traffic data?
- What methods can be employed to accurately classify severity of vehicle fires using sensor data?
- How to implement automatic fire extinguishers to reduce the impact of fire and save the vehicle?

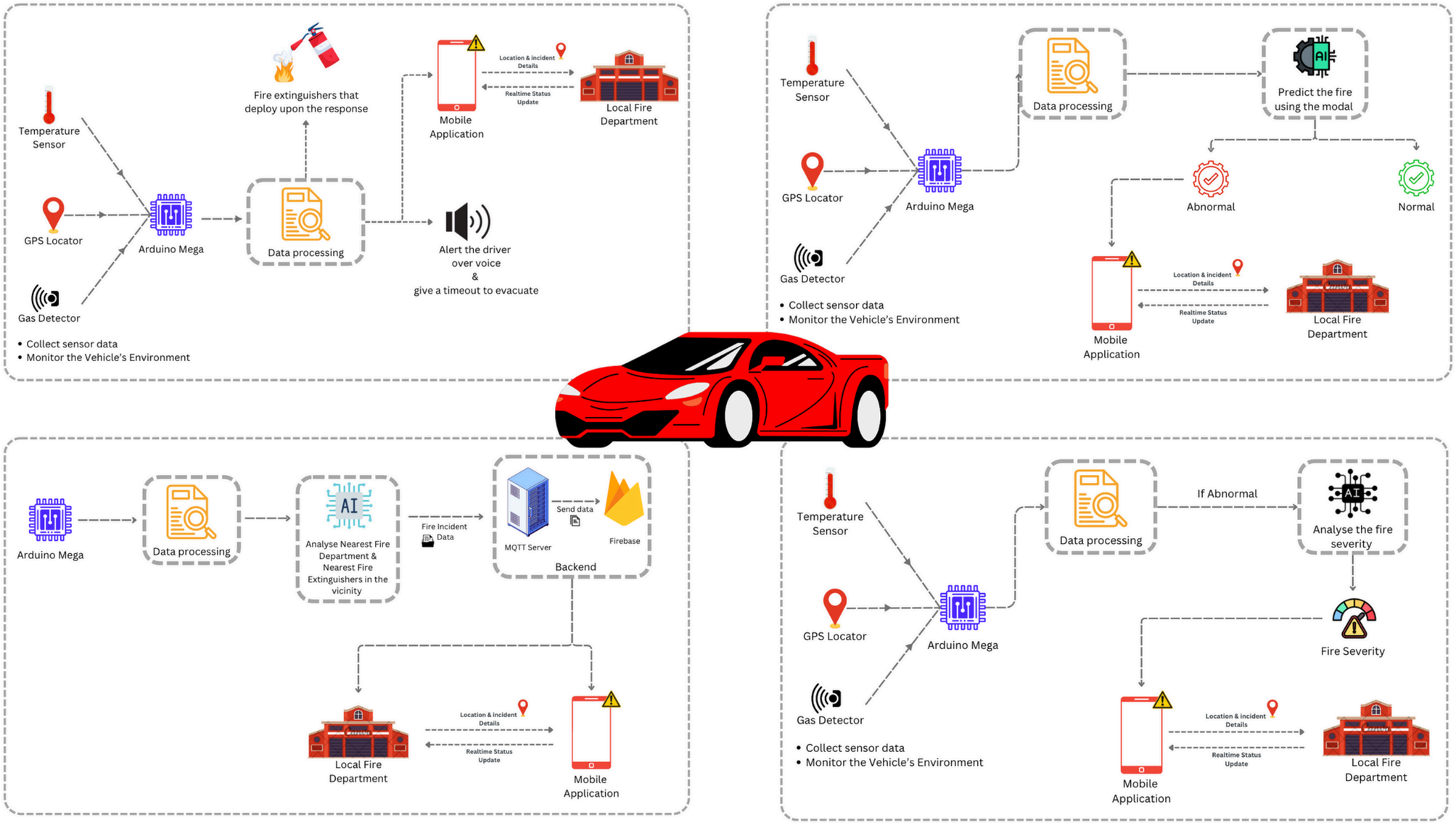


Objectives



- Create an integrated solution for vehicle fire safety that combines IoT, machine learning, and cloud computing.
- Utilize ML to analyze sensor data and predict fire incidents.
- Instantly relay fire information and vehicle position to the nearest fire department
- Monitor vehicle parameters for optimal emergency response route determination.
- Implement IOT based automatic fire extinguishers to reduce the impact

System Overview



Individual Components

Peramunage A.N | IT21080562
Specializing in Information Technology

Vehicle Safety System for Fire Detection and Prevention

Research Problem

Limited proactive fire detection

Current vehicle fire detection systems are reactive, lacking the ability to detect potential fire hazards before they escalate.

Inadequate automotive fire detection technologies

Existing systems are not designed for the automotive environment, leading to suboptimal performance in detecting and preventing vehicle fires.

Inadequate automotive fire detection technologies

The lack of advanced detection mechanisms in vehicles results in delayed response times, reducing the effectiveness of fire prevention measures.

Research Gap

- Research needed for improved early detection and accurate prediction of normal or abnormal events.
- Seamless connection of detection systems with vehicle electronics crucial for swift prediction and response.
- Developing algorithms to accurately classify events as normal or abnormal, facilitating prompt action and mitigating risks effectively.
- Developing streamlined methods for sensor data collection in vehicles to ensure data quality and minimize latency, thereby improving the accuracy and timeliness of fire prediction models.

Objectives

Design and implement a novel fire detection solution for vehicles by installing sensors to detect temperature

- Develop ML algorithms for analyzing sensor data and predicting potential fire situations.
- Establish a real-time data processing system for immediate response to fire threats.
- Create an alert mechanism based on continuous sensor monitoring and integration for accurate detection.
- ML for predictive analysis and continuous learning to enhance detection accuracy.
- Provide customized alerts to improve driver safety and response time.

Gathered Data

Axio 2015

Back				Front				Mid				Back				Front				Mid		
sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3
26.87	26.87	35.95		29.37	29.5	29.25		29.97	29.45	34.91		25.15	29.13	28.99		46.56	37.4	39.76		25.62	29.67	29.15
31.05	27.5	36.84		29.37	29.25	35.62		30.31	30.84	36.23		27.5	29.13	25.35		43.43	42.54	44.16		26.28	26.32	28.92
32.36	36.34	26.39		32.47	32.48	29.37		38.37	33.6	37.65		25.35	26.45	28.45		39.88	44.14	48.39		28.2	28.06	25.21
38.53	29.08	36.84		30.34	29.84	29.08		29.97	29.45	34.91		27.84	27.68	25.14		43.51	47.77	43.32		28.91	28.95	30
28.59	27.4	34.14		32.57	36.39	35.02		33.14	26.2	38.99		29.22	28.79	25.32		38.5	44.25	43.55		29.96	28.4	29.44
28.83	35.63	30.6		34.17	34.78	31.92		38.98	26.15	31.54		25.33	26.58	26.72		40.95	49.72	38.21		29.26	31.45	30.68
26.84	27.37	27.18		34.39	33.3	33.68		38.98	39.17	32.16		25	26.58	25.91		49.34	39.68	39.91		25.81	30.87	31.31
29.93	36.52	33.11		35.19	34.99	29.69		33.93	39.92	32.68		28.73	26.76	25.36		40.54	43.85	41.86		27.64	26.54	28.53
29.71	38.2	35.67		33.29	34.99	36.8		37.03	26.11	32.71		27.74	27.63	27.34		40.96	44.01	44.81		25.94	25.12	31.38
27.85	29.14	39.84		31.11	30.05	30.17		37.67	32.32	31.85		27.51	27.35	28.6		42.81	39.21	49.87		28.37	29.87	30.49
31.39	36.31	37.57		36.8	36.59	34.14		32.63	30.97	29.26		29.64	25.13	26.48		45.8	38.39	44.09		26.43	28.55	26.67
31.37	35.14	33.07		34.48	33.96	32.65		32.93	36.87	36.54		27.01	26.63	28.79		44.75	40.68	38.8		29.31	26.15	25.86
32.6	32.43	33.85		34.62	29.25	30.94		35.94	35.07	39.03		29.95	25.8	26.21		44.81	39.73	38.29		30.64	31	27.29
35.98	33.1	26.86		33.97	30.39	33.55		37.35	33.3	36.26		29.03	29.57	25.26		44.2	38.57	47.74		25.26	25.52	30.89
34.17	39.58	28.46		33.88	36.04	35.77		28.71	27.28	37.88		28.53	26.13	29.49		41.54	38.08	42.36		25.14	31.9	27.8
31.8	37.49	34.91		36.51	31.14	29.06		35.36	34.87	33.23		26.42	27.82	26.9		43.3	48.17	43.43		28.32	28.86	31.37
38.04	32.59	37.42		36.58	31.58	31.72		39.94	29.75	31.71		25.55	29.62	27.81		41.13	45.28	47.59		26.13	27.22	30.15
35.1	33.19	38.1		31.09	32.73	35.68		28.73	29.77	35.17		29.5	26.27	25.17		42.89	38.82	40.5		26.17	29.96	27.81
26.65	29.32	33.06		33.92	31.22	33.46		37.01	26.37	30.22		25.51	27.74	28.24		45.14	43.47	39.3		26.79	26.25	29.59
39.57	30.56	28.21		36.78	30.57	32.71		37.98	32.4	39.15		25.83	27.25	26.85		43.16	42.77	42.63		27.07	29.62	27.89
34.83	35.37	34		29.35	31.4	31.14		29.58	29.61	39.13		27.83	27.1	27.92		42.39	37.31	47.42		27.25	28.93	26.82
27.78	36.27	27.31		33.88	32.85	36.39		29.35	35.93	29.71		29.62	28.63	25.62		41.14	47.21	45.03		27.15	31.8	25.84
34.88	31.69	35.69		30.32	30.51	34.86		30.11	32.58	37.86		29.38	27.49	27.88		47.83	39.09	41.16		29.36	28.64	31.87
39.15	29.77	36.96		32.41	33.21	32.14		37.79	36.71	32.36		25.96	25.1	28.23		39.44	38.78	43.13		30.41	26.18	26.28
32	35.18	33.04		32.38	31.72	34.41		35.44	28.55	30.82		27.37	27.34	28.27		48.09	48.31	46.52		26.03	30.93	31.61
26.26	32.45	36.26		35.88	35.4	34.65		38.08	34.27	37.6		29.16	28.16	26.47		41	47.19	40.62		28.99	29.63	29.26
30.13	33.09	31.52		33.2	32.55	30.11		32.27	28.24	29.12		29.39	28.86	26.71		49.47	46.44	46.5		26.55	25.06	25.86
36.81	36.68	34.35		30.48	33.48	35.29		31.23	39.26	34.24		27.85	26.99	29.56		44	45.81	47.63		30.23	25.22	28.09
39.16	35.82	36.35		31.71	32.21	34.07		31.34	29.58	30.64		25.45	27.88	29.68		42.97	38.29	40.48		29.79	31.37	31.32
37.34	33.99	31.19		29.4	33.98	33.2		31.75	33.07	34.64		29.08	27.89	26.8		42.81	45.31	49.65		25.28	28.56	27.31
32.74	27.76	33.99		30.89	36.98	34.77		33.83	38.79	38.08		27.75	28.04	26.31		42.85	44.05	40.24		26.51	25.3	31.58
32.99	32.18	38.3		32.07	34.42	35.64		28.04	33.39	38.83		28.49	26.89	28.76		45.82	39.88	39.42		25.98	27.91	28.87
30.59	30.92	29.16		35.42	30.43	30.02		34.79	33.05	39.68		25.15	28.98	26.57		43.79	38.4	47.6		25.93	27.09	25.55
34.73	26.8	28.71		36.14	33.31	33.02		38.05	35.72	39.34		28.71	27.61	26.42		49.83	40.68	38.76		31.5	25.47	29.77
28.42	33.32	30.26		31.15	36.37	31.39		35.05	29.95	30.36		25.96	25.32	26.67		49.1	43.37	39.57		29.25	27.87	27.43

Sheet1

Gathered Data

Toyota Corolla 121

Back			Front			Mid			Back			Front			Mid		
sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3
27.84	26.5	33.94	31	32.84	34.59	35.71	33.19	38.63	25	26.58	25.91	38.05	37.09	38.02	25.26	25.52	30.89
26.5	27.84	26.5	31.5	36.23	35.62	30.31	30.84	36.23	25.33	26.58	26.72	38.11	37.17	38.10	25.14	31.9	27.8
31.05	27.5	36.84	32.47	32.48	33.89	38.37	33.6	37.65	25.35	26.45	28.45	38.13	37.20	38.14	28.32	28.86	31.37
32.36	36.34	26.39	30.34	29.84	29.08	29.97	29.45	34.91	27.84	27.68	25.14	38.25	37.23	38.16	26.13	27.22	30.15
34.52	39.15	27.43	32.57	36.39	35.02	33.14	26.2	38.99	29.22	28.79	25.32	38.27	37.28	38.22	26.17	29.96	27.81
30.08	35.56	28.96	34.17	34.78	31.92	38.98	26.15	31.54	25.33	26.58	26.72	38.29	37.37	38.24	26.79	26.25	29.59
32.5	29.57	32.08	34.39	33.3	33.68	38.98	39.17	32.16	25	26.58	25.91	38.32	37.40	38.29	27.07	29.62	27.89
29.15	38.39	38.46	35.19	34.99	29.69	33.93	39.92	32.68	28.73	26.76	25.36	38.43	37.49	38.31	27.25	28.93	26.82
38.53	29.08	36.84	33.29	34.99	36.8	37.03	26.11	32.71	27.74	27.63	27.34	38.60	37.50	38.38	27.15	31.8	25.84
28.59	27.4	34.14	31.11	30.05	30.17	37.67	32.32	31.85	27.51	27.35	28.6	38.67	37.53	38.39	29.36	28.64	31.87
28.83	35.63	30.6	36.8	36.59	34.14	32.63	30.97	29.26	29.64	25.13	26.48	38.78	37.57	38.54	26.43	28.55	26.67
26.84	27.37	27.18	34.48	33.96	32.65	32.93	36.87	36.54	27.01	26.63	28.79	38.80	37.61	38.66	29.31	26.15	25.86
29.93	36.52	33.11	34.62	29.25	30.94	35.94	35.07	39.03	29.95	25.8	26.21	38.83	37.62	38.70	30.64	31	27.29
29.71	38.2	35.67	33.97	30.39	33.55	37.35	33.3	36.26	29.03	29.57	25.26	38.83	37.65	38.72	25.26	25.52	30.89
27.85	29.14	39.84	33.88	36.04	35.77	28.71	27.28	37.88	28.53	26.13	29.49	38.90	37.68	38.83	25.14	31.9	27.8
31.39	36.31	37.57	36.51	31.14	29.06	35.36	34.87	33.23	26.42	27.82	26.9	38.96	37.72	38.89	27.15	31.8	25.84
31.37	35.14	33.07	36.58	31.58	31.72	39.94	29.75	31.71	25.55	29.62	27.81	38.95	37.75	38.93	29.36	28.64	31.87
32.6	32.43	33.85	31.09	32.73	35.68	28.73	29.77	35.17	29.5	26.27	25.17	38.98	37.76	38.95	30.41	26.18	26.28
35.98	33.1	26.86	33.92	31.22	33.46	37.01	26.37	30.22	25.51	27.74	28.24	39.01	37.79	38.96	26.79	26.25	29.59
34.17	39.58	28.46	36.78	30.57	32.71	37.98	32.4	39.15	25.83	27.25	26.85	39.04	37.83	39.00	27.07	29.62	27.89
31.8	37.49	34.91	29.35	31.4	31.14	29.58	29.61	39.13	27.83	27.1	27.92	39.06	38.19	39.23	27.25	28.93	26.82
38.04	32.59	37.42	33.88	32.85	36.39	29.35	35.93	29.71	29.62	28.63	25.62	39.26	38.23	39.26	27.15	31.8	25.84
35.1	33.19	38.1	30.32	30.51	34.86	30.11	32.58	37.86	29.38	27.49	27.88	39.32	38.25	39.34	29.36	28.64	31.87
26.65	29.32	33.06	32.41	33.21	32.14	37.79	36.71	32.36	25.96	25.1	28.23	39.34	38.32	39.36	30.41	26.18	26.28
39.57	30.56	28.21	32.38	31.72	34.41	35.44	28.55	30.82	27.37	27.34	28.27	39.37	38.34	39.41	26.03	30.93	31.61
34.83	35.37	34	35.88	35.4	34.65	38.08	34.27	37.6	29.16	28.16	26.47	39.43	38.44	39.43	28.99	29.63	29.26
27.78	36.27	27.31	33.2	32.55	30.11	32.27	28.24	29.12	29.39	28.86	26.71	39.50	38.56	39.49	26.55	25.06	25.86
34.88	31.69	35.69	30.48	33.48	35.29	31.23	39.26	34.24	27.85	26.99	29.56	39.52	38.58	39.53	30.23	25.22	28.09
39.15	29.77	36.96	31.71	32.21	34.07	31.34	29.58	30.64	25.45	27.88	29.68	39.60	38.61	39.59	29.79	31.37	31.32

Sheet1

Gathered Data

Vitz 2016

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Engine Off												Engine Running										
Back				Front				Mid				Back				Front				Mid		
sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3
32	35.18	33.04		33.97	30.39	33.55		29.35	35.93	29.71		25.96	25.1	28.23		41.54	38.08	42.36		25.26	25.52	30.8
26.26	32.45	36.26		33.88	36.04	35.77		30.11	32.58	37.86		27.37	27.34	28.27		43.3	48.17	43.43		25.14	31.9	27
30.13	33.09	31.52		36.51	31.14	29.06		37.79	36.71	32.36		29.16	28.16	26.47		41.13	45.28	47.59		28.32	28.86	31.1
36.81	36.68	34.35		36.58	31.58	31.72		35.44	28.55	30.82		29.39	28.86	26.71		42.89	38.82	40.5		26.13	27.22	30.
39.16	35.82	36.35		31.09	32.73	35.68		38.08	34.27	37.6		27.85	26.99	29.56		45.14	43.47	39.3		26.17	29.96	27.8
37.34	33.99	31.19		33.92	31.22	33.46		32.27	28.24	29.12		25.45	27.88	29.68		43.16	42.77	42.63		26.79	26.25	29.5
32.74	27.76	33.99		36.78	30.57	32.71		31.23	39.26	34.24		29.08	27.89	26.8		42.39	37.31	47.42		27.07	29.62	27.8
32.99	32.18	38.3		29.35	31.4	31.14		31.34	29.58	30.64		27.75	28.04	26.31		41.14	47.21	45.03		27.25	28.93	26.8
30.59	30.92	29.16		33.88	32.85	36.39		31.75	33.07	34.64		28.49	26.89	28.76		47.83	39.09	41.16		27.15	31.8	25.8
34.73	26.8	28.71		30.32	30.51	34.86		33.83	38.79	38.08		27.01	26.63	28.79		39.44	38.78	43.13		29.36	28.64	31.8
28.42	33.32	30.26		32.41	33.21	32.14		28.04	33.39	38.83		29.95	25.8	26.21		48.09	48.31	46.52		30.41	26.18	26.1
36.6	28.14	31.72		32.38	31.72	34.41		34.79	33.05	39.68		29.03	29.57	25.26		41	47.19	40.62		26.03	30.93	31.6
28.39	37.67	38.43		35.88	35.4	34.65		38.05	35.72	39.34		28.53	26.13	29.49		49.47	46.44	46.5		28.99	29.63	29.1
37.05	33.7	34.73		33.2	32.55	30.11		35.05	29.95	30.36		26.42	27.82	26.9		44.2	38.57	47.74		25.26	25.52	30.8
28.06	37.09	30.2		30.48	33.48	35.29		30.43	35.83	33.88		25.55	29.62	27.81		41.54	38.08	42.36		25.14	31.9	27
38.65	34.23	35.41		31.71	32.21	34.07		32.03	38.38	31.93		29.5	26.27	25.17		43.3	48.17	43.43		28.32	28.86	31.1
32.47	26.76	31.29		29.4	33.98	33.2		36.62	28.36	37.95		25.51	27.74	28.24		41.13	45.28	47.59		26.13	27.22	30.
27.72	35.7	29.09		30.89	36.98	34.77		31.92	35.04	33.48		29.5	26.27	25.17		42.89	38.82	40.5		26.17	29.96	27.8
30.5	32.56	28.94		32.07	34.42	35.64		30.05	37.7	35		25.51	27.74	28.24		45.14	43.47	39.3		26.79	26.25	29.5
30.36	30.33	37.3		35.42	30.43	30.02		37.86	31.17	34.21		25.83	27.25	26.85		43.16	42.77	42.63		27.07	29.62	27.8
38.97	38.57	39.34		36.14	33.31	33.02		31.58	34.39	32.56		27.83	27.1	27.92		42.39	37.31	47.42		30.41	26.18	26.1
40	33.88	39.01		31.15	36.37	31.39		32.65	36.56	28.64		29.62	28.63	25.62		41.14	47.21	45.03		26.03	30.93	31.6
39.43	31.54	31.17		34.65	33.08	35.43		39.67	31.24	35.16		29.38	27.49	27.88		47.83	39.09	41.16		28.99	29.63	29.1
26.67	34.2	28.81		32.94	35.46	34.35		37.25	32.13	29.09		25.96	25.1	28.23		39.44	38.78	43.13		26.55	25.06	25.8
39.93	34.45	26.24		29.53	32.12	32.15		29.11	38.19	33.73		27.37	27.34	28.27		48.09	48.31	46.52		26.03	30.93	31.6
33.49	34.77	32.55		33.94	31.32	31.72		36.36	33.75	30.14		29.16	28.16	26.47		41	47.19	40.62		28.99	29.63	29.1

Sheet1

Gathered Data

Wagon R 2016

Engine Off										Engine Running								
Back			Front			Mid				Back			Front			Mid		
sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3	sensor 1	sensor 2	sensor 3
28.83	35.63	30.6	31	32.48	31.5	28.71	27.28	38.63		25.15	29.13	28.99	38.06	37.10	38.02	25.62	29.67	29.15
26.84	27.37	27.18	31.5	36.23	35.62	30.31	30.84	36.23		27.5	29.13	25.35	38.09	37.17	38.09	26.28	26.32	28.92
29.93	36.52	33.11	32.47	32.48	33.89	28.73	29.77	37.65		25.35	26.45	28.45	38.13	37.18	38.15	28.2	28.06	25.21
29.71	38.2	35.67	30.34	29.84	29.08	29.97	29.45	34.91		27.84	27.68	25.14	38.25	37.22	38.17	28.91	28.95	30
27.85	29.14	39.84	30.32	30.51	34.86	33.14	26.2	38.99		25.96	25.1	28.23	38.27	37.28	38.22	29.96	28.4	29.44
31.39	36.31	37.57	32.41	33.21	32.14	28.73	29.77	31.54		25.33	26.58	26.72	38.28	37.35	38.25	29.26	31.45	30.68
31.37	35.14	33.07	32.38	31.72	34.41	38.98	39.17	32.16		25	26.58	25.91	38.32	37.40	38.28	25.81	30.87	31.31
32.6	32.43	33.85	35.88	35.4	34.65	32.93	36.87	32.68		28.73	26.76	25.36	38.44	37.49	38.30	27.64	26.54	28.53
35.98	33.1	26.86	33.2	32.55	30.11	28.73	29.77	32.71		27.74	27.63	27.34	38.61	37.50	38.37	25.94	25.12	31.38
34.17	39.58	28.46	30.48	33.48	35.29	37.35	33.3	31.85		25.96	25.1	28.23	38.66	37.54	38.40	28.37	29.87	30.49
31.8	37.49	34.91	36.8	36.59	34.14	28.71	27.28	29.26		29.64	25.13	26.48	38.79	37.59	38.53	26.43	28.55	26.67
38.04	32.59	37.42	34.48	33.96	32.65	35.36	34.87	36.54		27.01	26.63	28.79	38.79	37.60	38.67	29.31	26.15	25.86
35.1	33.19	38.1	34.62	29.25	30.94	39.94	29.75	39.03		29.95	25.8	26.21	38.83	37.61	38.69	30.64	31	27.29
26.65	29.32	33.06	33.97	30.39	33.55	28.73	29.77	36.26		29.03	29.57	25.26	38.84	37.66	38.72	25.26	25.52	30.89
39.57	30.56	28.21	33.88	36.04	35.77	37.01	26.37	37.88		28.53	26.13	29.49	38.90	37.68	38.84	25.14	31.9	27.8
34.83	35.37	34	36.51	31.14	29.06	37.98	32.4	33.23		26.42	27.82	26.9	38.95	37.72	38.90	28.32	28.86	31.37
27.78	36.27	27.31	36.58	31.58	31.72	29.58	29.61	31.71		25.55	29.62	27.81	38.97	37.75	38.93	26.13	27.22	30.15
32.6	32.43	33.85	31.09	32.73	35.68	29.35	35.93	35.17		29.5	26.27	25.17	38.98	37.77	38.94	26.17	29.96	27.81
35.98	33.1	26.86	33.92	31.22	33.46	37.01	26.37	30.22		25.51	27.74	28.24	39.03	37.78	38.95	26.79	26.25	29.59
34.17	39.58	28.46	36.78	30.57	32.71	37.98	32.4	39.15		25.83	27.25	26.85	39.03	37.84	39.01	27.07	29.62	27.89
31.8	37.49	34.91	29.35	31.4	31.14	29.58	29.61	39.13		27.83	27.1	27.92	39.06	38.18	39.23	27.25	28.93	26.82
38.04	32.59	37.42	33.88	32.85	36.39	29.35	35.93	29.71		29.62	28.63	25.62	39.26	38.22	39.26	27.15	31.8	25.84
35.1	33.19	38.1	30.32	30.51	34.86	30.11	32.58	37.86		29.38	27.49	27.88	39.30	38.25	39.35	29.36	28.64	31.87
26.65	29.32	33.06	32.41	33.21	32.14	37.79	36.71	32.36		25.96	25.1	28.23	39.34	38.33	39.37	30.41	26.18	26.28
39.57	30.56	28.21	32.38	31.72	34.41	35.44	28.55	30.82		27.37	27.34	28.27	39.36	38.36	39.41	26.03	30.93	31.61
34.83	35.37	34	35.88	35.4	34.65	38.08	34.27	37.6		29.16	28.16	26.47	39.43	38.43	39.42	28.99	29.63	29.26

Gathered Data

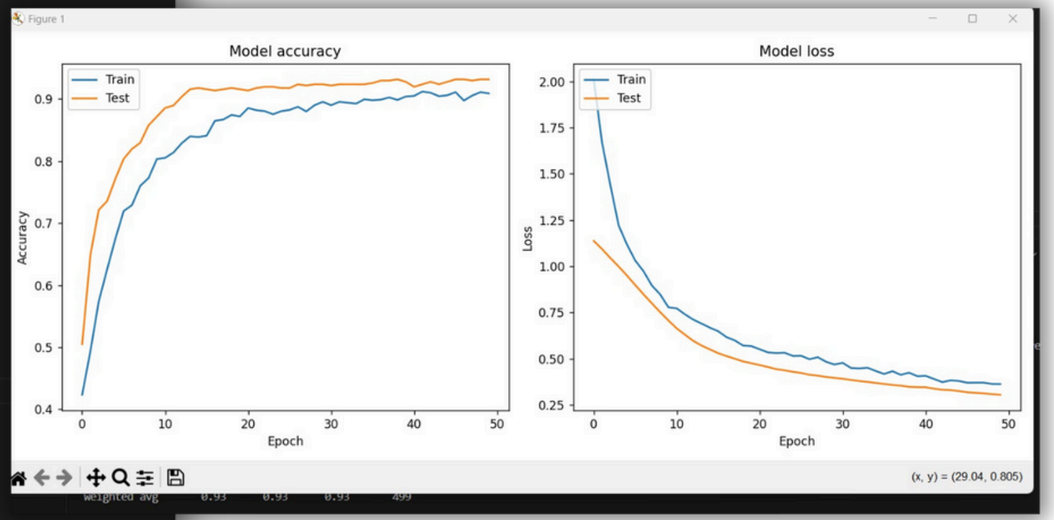
Wagon R 2018

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Engine Off												Engine Running										
Back				Front				Mid				Back				Front				Mid		
sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3		sensor 1	sensor 2	sensor 3
28.83	35.63	30.6		31	32.48	31.5		28.71	27.28	38.63		25.15	29.13	28.99		38.06	37.10	38.02		25.62	29.67	29.15
26.84	27.37	27.18		31.5	36.23	35.62		30.31	30.84	36.23		27.5	29.13	25.35		38.09	37.17	38.09		26.28	26.32	28.92
29.93	36.52	33.11		32.47	32.48	33.89		28.73	29.77	37.65		25.35	26.45	28.45		38.13	37.18	38.15		28.2	28.06	25.21
29.71	38.2	35.67		30.34	29.84	29.08		29.97	29.45	34.91		27.84	27.68	25.14		38.25	37.22	38.17		28.91	28.95	30
27.85	29.14	39.84		30.32	30.51	34.86		33.14	26.2	38.99		25.96	25.1	28.23		38.27	37.28	38.22		29.96	28.4	29.44
31.39	36.31	37.57		32.41	33.21	32.14		28.73	29.77	31.54		25.33	26.58	26.72		38.28	37.35	38.25		29.26	31.45	30.68
31.37	35.14	33.07		32.38	31.72	34.41		38.98	39.17	32.16		25	26.58	25.91		38.32	37.40	38.28		25.81	30.87	31.31
32.6	32.43	33.85		35.88	35.4	34.65		32.93	36.87	32.68		28.73	26.76	25.36		38.44	37.49	38.30		27.64	26.54	28.53
35.98	33.1	26.86		33.2	32.55	30.11		28.73	29.77	32.71		27.74	27.63	27.34		38.61	37.50	38.37		25.94	25.12	31.38
34.17	39.58	28.46		30.48	33.48	35.29		37.35	33.3	31.85		25.96	25.1	28.23		38.66	37.54	38.40		28.37	29.87	30.49
31.8	37.49	34.91		36.8	36.59	34.14		28.71	27.28	29.26		29.64	25.13	26.48		38.79	37.59	38.53		26.43	28.55	26.67
38.04	32.59	37.42		34.48	33.96	32.65		35.36	34.87	36.54		27.01	26.63	28.79		38.79	37.60	38.67		29.31	26.15	25.86
35.1	33.19	38.1		34.62	29.25	30.94		39.94	29.75	39.03		29.95	25.8	26.21		38.83	37.61	38.69		30.64	31	27.29
26.65	29.32	33.06		33.97	30.39	33.55		28.73	29.77	36.26		29.03	29.57	25.26		38.84	37.66	38.72		25.26	25.52	30.89
39.57	30.56	28.21		33.88	36.04	35.77		37.01	26.37	37.88		28.53	26.13	29.49		38.90	37.68	38.84		25.14	31.9	27.8
34.83	35.37	34		36.51	31.14	29.06		37.98	32.4	33.23		26.42	27.82	26.9		38.95	37.72	38.90		28.32	28.86	31.37
27.78	36.27	27.31		36.58	31.58	31.72		29.58	29.61	31.71		25.55	29.62	27.81		38.97	37.75	38.93		26.13	27.22	30.15
32.6	32.43	33.85		31.09	32.73	35.68		29.35	35.93	35.17		29.5	26.27	25.17		38.98	37.77	38.94		26.17	29.96	27.81
35.98	33.1	26.86		33.92	31.22	33.46		37.01	26.37	30.22		25.51	27.74	28.24		39.03	37.78	38.95		26.79	26.25	29.59
34.17	39.58	28.46		36.78	30.57	32.71		37.98	32.4	39.15		25.83	27.25	26.85		39.03	37.84	39.01		27.07	29.62	27.89
31.8	37.49	34.91		29.35	31.4	31.14		29.58	29.61	39.13		27.83	27.1	27.92		39.06	38.18	39.23		27.25	28.93	26.82
38.04	32.59	37.42		33.88	32.85	36.39		29.35	35.93	29.71		29.62	28.63	25.62		39.26	38.22	39.26		27.15	31.8	25.84
35.1	33.19	38.1		30.32	30.51	34.86		30.11	32.58	37.86		29.38	27.49	27.88		39.30	38.25	39.35		29.36	28.64	31.87
26.65	29.32	33.06		32.41	33.21	32.14		37.79	36.71	32.36		25.96	25.1	28.23		39.34	38.33	39.37		30.41	26.18	26.28
39.57	30.56	28.21		32.38	31.72	34.41		35.44	28.55	30.82		27.37	27.34	28.27		39.36	38.36	39.41		26.03	30.93	31.61
34.83	35.37	34		35.88	35.4	34.65		38.08	34.27	37.6		29.16	28.16	26.47		39.43	38.43	39.42		28.99	29.63	29.26

Sheet1

CNN Model

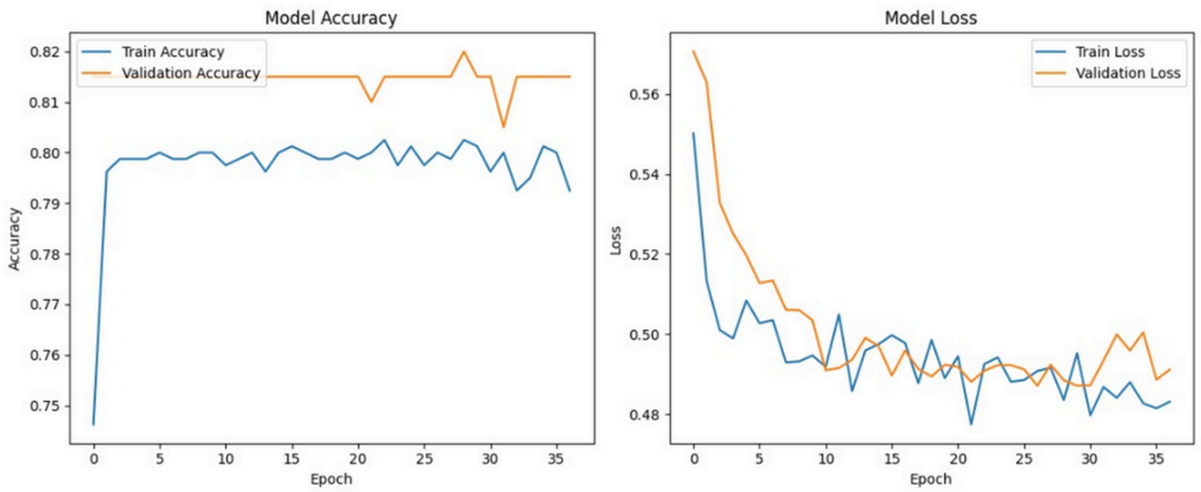
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv1D, Flatten, MaxPooling1D, Dropout, BatchNormalization
from tensorflow.keras.regularizers import l2
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.callbacks import EarlyStopping
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay, classification_report

# Load the adjusted dataset
df = pd.read_csv('car_temp_abnomility_dataset.csv')

# Label encoding: Convert 'normal' to 0 and 'abnormal' to 1
df['label'] = df['label'].apply(lambda x: 0 if x == 'normal' else 1)

# Feature Scaling
scaler = MinMaxScaler()
X = scaler.fit_transform(df[['sensor_front', 'sensor_mid', 'sensor_back']])

# Convert labels to categorical (one-hot encoding)
y = to_categorical(df['label'])

# Reshape X to 3D array (samples, timesteps, features)
X = X.reshape(X.shape[0], X.shape[1], 1)

# Moderate noise to slow down initial learning
noise_factor = 0.15  # Moderate noise factor
X_train_noisy = X + noise_factor * np.random.normal(loc=0.0, scale=1.0, size=X.shape)
X_train_noisy = np.clip(X_train_noisy, 0., 1.)

# Split the data
X_train, X_test, y_train, y_test = train_test_split(X_train_noisy, y, test_size=0.2, random_state=42)
```



Abnormal	0.94	0.95	0.94	247
accuracy			0.94	499
macro avg	0.94	0.94	0.94	499
weighted avg	0.94	0.94	0.94	499

RNN Model(LSTM)

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Dropout, BatchNormalization
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.callbacks import EarlyStopping, ModelCheckpoint
from tensorflow.keras.optimizers import Adam

# Load the dataset
df = pd.read_csv('sensor_reading_abno.csv')

# Prepare the input features and labels
features = ['1000_rpm_temprature', '1000_rpm', '2000_rpm_temprature', '3000_rpm_temprature',
            '4000_rpm_temprature', '5000_rpm_temprature', 'cabin_without_ac_sunny_day',
            'rear_without_ac_sunny_day', '2000_rpm', '3000_rpm', '4000_rpm', '5000_rpm']
X = df[features].values
y = df['label'].apply(lambda x: 0 if x == 'normal' else 1).values
y = to_categorical(y)

# Normalize features using StandardScaler
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
X_scaled = X_scaled.reshape(X_scaled.shape[0], X_scaled.shape[1], 1)

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split( *arrays: X_scaled, y, test_size=0.2, random_state=42)
```




```
25/25 - 0s - loss: 0.4831 - accuracy: 0.7925 - val_loss: 0.4911 - val_accuracy: 0.8150 - 213ms/epoch - 9ms/step
7/7 [==============================] - 1s 3ms/step
Accuracy: 81.50%
```

SVM Model

```python
# Build SVM model
svm_model = SVC(class_weight='balanced')  # Adjusting class weights for handling imbalanced data
svm_model.fit(X_train, y_train)

# Predict labels for test set
y_pred = svm_model.predict(X_test)

# Calculate accuracy
accuracy = accuracy_score(y_test, y_pred)
print("SVM Accuracy:", accuracy)

# Confusion Matrix
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, fmt="d", cmap='Blues', xticklabels=['Normal', 'Abnormal'], yticklabels=['Normal', 'Abnormal'])
plt.title('Confusion Matrix for SVM Model')
plt.ylabel('True Label')
plt.xlabel('Predicted Label')
plt.show()

# Classification Report with zero_division=1
print("\nClassification Report:\n", classification_report(y_test, y_pred, zero_division=1))
```

```
SVM Accuracy: 0.58

Classification Report:
              precision    recall  f1-score   support

           0       0.84      0.60      0.70       163
           1       0.22      0.51      0.31        37

    accuracy                           0.58       200
   macro avg       0.53      0.55      0.50       200
weighted avg       0.73      0.58      0.63       200
```

Model Accuracy

Used Algorithm	Overall Accuracy
CNN Algorithm	94.0%
Support Vector Machine(SVM)	81.50%
RNN Model(LSTM)	81.50%

CNN Model Tests

```python
import numpy as np

from tensorflow.keras.models import load_model


model = load_model('car_temp_abnomility_model.h5')

def predict_sensor_data(sensor_data):

    fire_state = ['normal' , 'abnormal']

    sensor_data = np.array(sensor_data).reshape(1, 3, 1)  # Reshape for the model
    prediction = model.predict(sensor_data)
    label = np.argmax(prediction, axis=1)[0]

    return fire_state[label]


new_data = [24, 26, 31]  # Example new sensor data
fire_state = predict_sensor_data(new_data)
print(fire_state)

```

```
PROBLEMS 7  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  COMMENTS

  warnings.warn(
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metr
l.
WARNING:absl:Error in loading the saved optimizer state. As a result, your model is starting with a freshl
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 71ms/step
normal
```

```python
import numpy as np

from tensorflow.keras.models import load_model


model = load_model('car_temp_abnomility_model.h5')

def predict_sensor_data(sensor_data):

    fire_state = ['normal' , 'abnormal']

    sensor_data = np.array(sensor_data).reshape(1, 3, 1)  # Reshape for the model
    prediction = model.predict(sensor_data)
    label = np.argmax(prediction, axis=1)[0]

    return fire_state[label]


new_data = [146, 105, 95]  # Example new sensor data
fire_state = predict_sensor_data(new_data)
print(fire_state)

```

```
PROBLEMS 7  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  COMMENTS

  warnings.warn(
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics` will be empty until you train
l.
WARNING:absl:Error in loading the saved optimizer state. As a result, your model is starting with a freshly initialized optimizer.
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 73ms/step
abnormal
```

IOT Integration

```python
def read_sensor_values():

    line = ser.readline().decode('utf-8').strip()

    # Split the line by comma
    data = line.split(',')

    # Print the data

    if len(data) == 8:
        # print(data)

        temsensor1 = int(data[0])
        temsensor2 = int(data[1])
        temsensor3 = int(data[2])

        gassensor1 = int(data[3])
        gassensor1 = int(data[4])
        gassensor1 = int(data[5])

        gps_long = data[6]
        gps_lat = data[7]

        return data
```

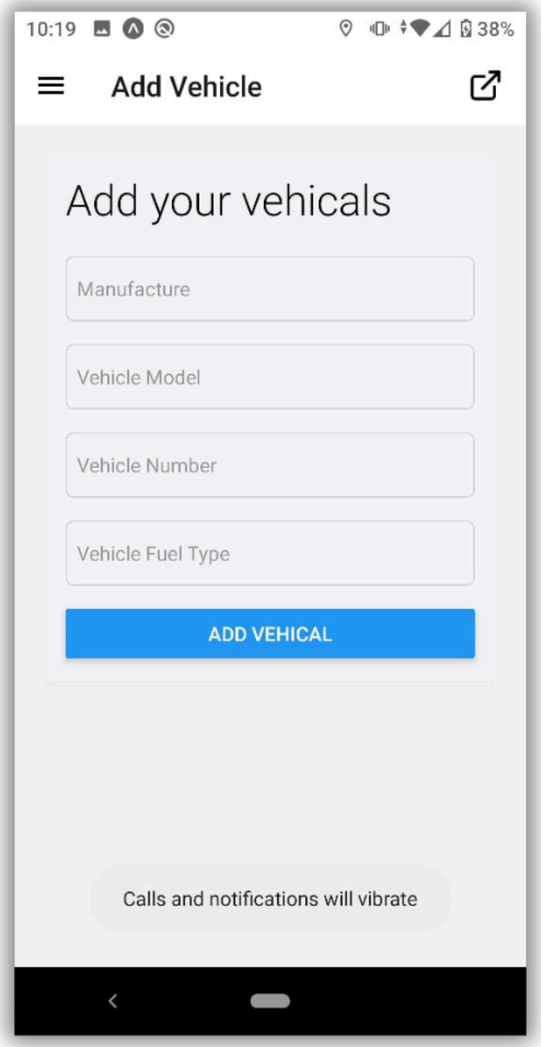
```python
    sensor_values = read_sensor_values()



if sensor_values is not None:
    # print("Sensor 1: {sensor_values[0]}, Sensor 2: {sensor_values[1]}, Sensor 3: {sensor_values[2]},
    #       Sensor 4: {sensor_values[3]}, Sensor 5: {sensor_values[4]}, Sensor 6: {sensor_values[5]}" #gas
    #       f", Sensor 6: {sensor_values[6]}, Sensor 6: {sensor_values[7]}")   # GPS --> All comeing as str

    veryfi = 1


    w_sensors = [ int (sensor_values[0]),int (sensor_values[1]),int (sensor_values[2]),
                  int (sensor_values[3]),int (sensor_values[4]),int (sensor_values[5]),
                  sensor_values[6],sensor_values[7],veryfi]
```

```python
from arduino_communication_2 import get_sensor_data , send_actuators_data ,send_actuators_reset,arduino_systme_init_wait
import time

arduino_systme_init_wait(info=False)


for x in range(2000):

    sensor_deta = get_sensor_data()

    print(sensor_deta)

    time.sleep(1)


# while True:
```

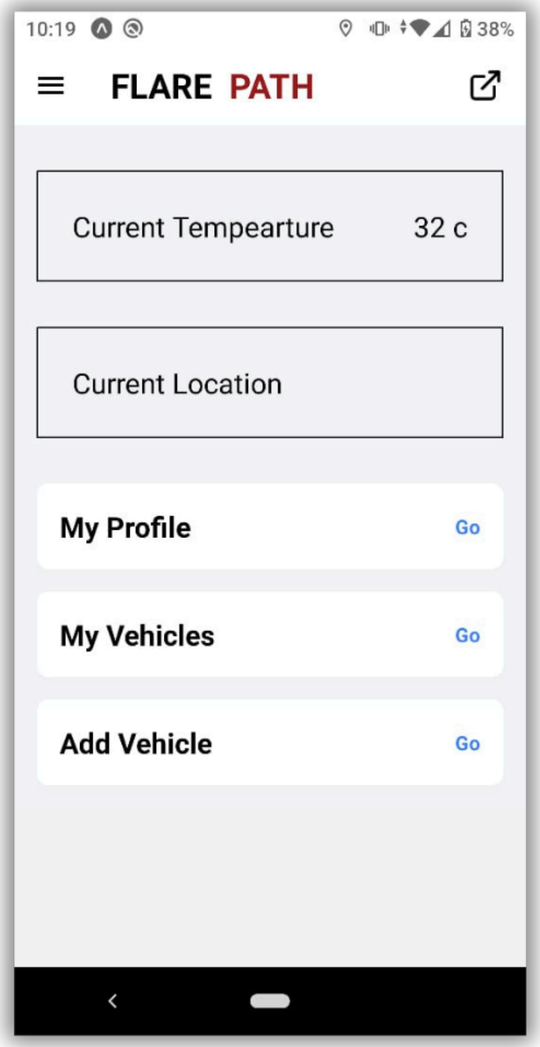
```python
data = get_sensor_data()

temsensor1 = int(data[0])
temsensor2 = int(data[1])
temsensor3 = int(data[2])

gassensor1 = int(data[3])
gassensor2 = int(data[4])
gassensor3 = int(data[5])

gps_lat = data[6]
gps_lon = data[7]


fire_type_sensor_data = [temsensor1, temsensor2, temsensor3]
fire_type = predict_fire_type(fire_type_sensor_data)

new_data = [temsensor1, temsensor2, temsensor3]
fire_state = predict_sensor_data(new_data)

print(type(fire_type) , fire_state)
```

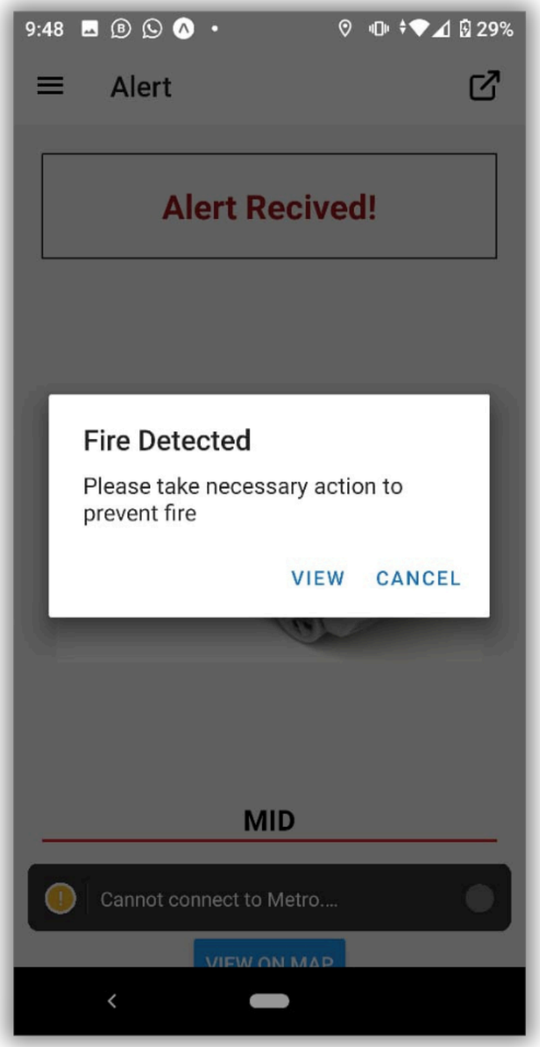
```python
if fire_state == 'abnormal':

    payload = str(gps_lat) + ',' + str(gps_lon)  + ',' + str(wehical_no) + ',' + str(fire_type)
    car_clnt.publish('f_station', payload)

    print('Signal Send successful....')


if fire_state != 'normal':

    send_actuators_data([0, 1])
```

Mobile App


10:19
38%
Add Vehicle
Add your vehicals
Manufacture
Vehicle Model
Vehicle Number
Vehicle Fuel Type
ADD VEHICAL
Calls and notifications will vibrate


10:20
38%
Alert
Alert Recived!


10:19
38%
FLARE PATH
Current Tempearture
32 c
Current Location
My Profile
Go
My Vehicles
Go
Add Vehicle
Go


9:48
29%
Alert
Alert Recived!
Fire Detected
Please take necessary action to prevent fire
VIEW
CANCEL
MID
Cannot connect to Metro....

Mobile App - Codes

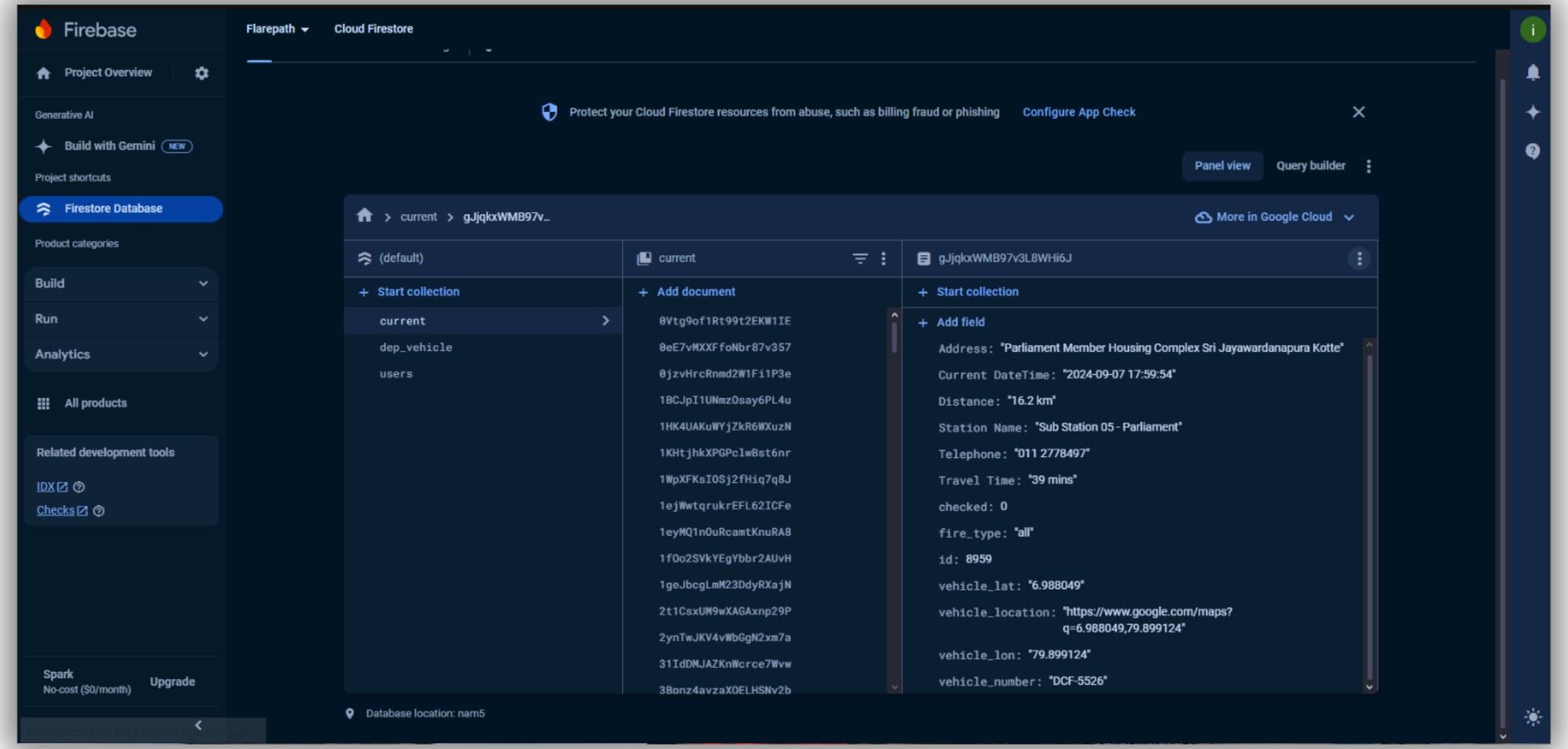
```
import { View, Text} from 'react-native'
import React, { useEffect, useState } from 'react'
import axios from 'axios'

import { useRouter } from 'expo-router'
import { Drawer } from 'expo-router/drawer'
import * as Location from 'expo-location';
import { HomeIcon } from 'lucide-react-native'



const UserHome = () => {

  const [location, setLocation] = useState(null);
  const [errorMsg, setErrorMsg] = useState(null);

  const [ad,setAd]=useState('')

  const router = useRouter()


  useEffect(() => {
    (async () => {

      let { status } = await Location.requestForegroundPermissionsAsync();
      if (status !== 'granted') {
        setErrorMsg('Permission to access location was denied');
        return;
      }
```

```
LEMS 2  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  COMMENTS

History restored
```

```
import { View, Text,TextInput,Button, Alert, ActivityIndicator } from 'react-native'
import React,{useState} from 'react'
import { Drawer } from 'expo-router/drawer';
import {  Plus } from 'lucide-react-native';
import { db } from '../../utils/firebaseConfig';
import { addDoc, arrayUnion, collection, doc,setDoc,updateDoc } from 'firebase/firestore';
import { useAuth } from '../../context/authContext';

const VehicalRegistration = () => {

  const [values, setValues] = useState({
    manfacture: '',
    modelName: '',
    fuelType: '',
    vehicalNumber:''
  })

  const [loading, setLoading] = useState(false)

  const {user}=useAuth()

  async function handleSubmit() {

    console.log(values)

    if (values.fuelTypename==='' || values.manfacture==='' ||
      values.modelName==='' || values.vehicalNumber==='') {
      return Alert.alert('Please fill all fields','all the fields are required')
    }
```

```
MS 2  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  COMMENTS
```

Mobile App - Firebase



Methodology

Requirement Analysis

Functional Requirements

- Install sensors for temperature
- Implement algorithms for sensor data analysis and fire prediction.
- Process sensor data in real-time for immediate response.
- Develop a mechanism to alert drivers of potential fire hazards and mobile app.
- Monitor sensor performance continuously for accurate detection.

Non-Functional Requirements

- **Ensure quick data processing and alert generation.**
- **Provide accurate detection and alerting under all conditions.**
- **Design the system to accommodate a large number of vehicles and sensors.**
- **Protect sensor data from unauthorized access.**
- **Create a user-friendly interface for easy understanding and response.**
- **Ensure the system is easy to maintain and update.**

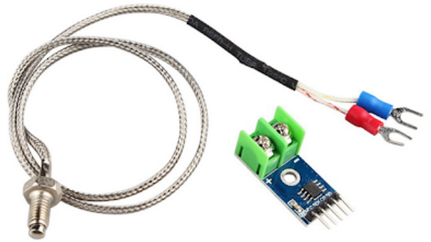
Tools and Technologies

Hardware Tools

- ESP32
- Arduino mega board
- Arduino UNO board
- max6675 K type thermocouple
- Temperature Sensor

Software Tools

- Micro Python
- Pycharm
- Python
- React Native



References

[1] Research on Prediction Method of Armored Vehicle Fire Control System Based on BAS-RVM. (2020, August 5). IEEE Conference Publication | IEEE Xplore. https://ieeexplore.ieee.org/document/9353131

[2] Li, D., Zhu, G., Zhu, H., Yu, Z., Gao, Y., & Jiang, X. (2017, September 1). Flame spread and smoke temperature of full-scale fire test of car fire. Case Studies in Thermal Engineering. https://doi.org/10.1016/j.csite.2017.08.001

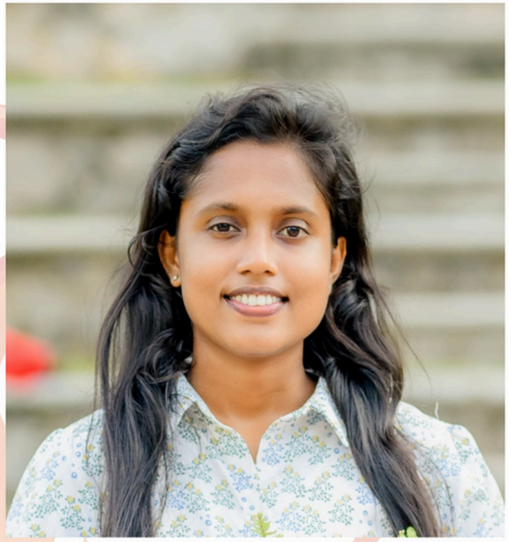
[3] Jiang, X., Zhu, G., Zhu, H., & Li, D. Y. (2018, January 1). Full-scale Experimental Study of Fire Spread Behavior of Cars. Procedia Engineering.

[4]Shintani, Y., Kakae, N., Harada, K., & Takahashi, W. (2004, March 1). *Experimental Investigation of Burning Behavior of Automobiles*. ResearchGate.

[5]Deckers, X., Haga, S. J., Tilley, N., & Merci, B. (2013, April 1). *Smoke control in case of fire in a large car park: CFD simulations of full-scale configurations*. Fire Safety Journal. https://doi.org/10.1016/j.firesaf.2012.02.005

Abeywardhana D.N| IT21133718

Specializing in Information Technology



Fire Severity Assessment for Emergency Services

Research Problem

How can fire departments optimize their protocols to enable firefighters to anticipate and mitigate fires more efficiently before upon arrival?

Fire department emergency systems are not designed with prepare their resources related to real time fire severity with more efficiency before reaching the current location.

How can fire departments prepare their equipment and resources in advance to mitigate potential risks?

Existing fire Emergency systems are not designed with identify the vehicle fire severity to manage their resources and safety of the responders and the public before arriving.

Research Gap

- Detecting the real time localization of the spreading fire position(Front/Mid/Back) on a vehicle at the moment of the fire.
- Effectively integrating and analysing data from variety of sensors(flame,temperature,smoke) in real time to predict how fire spreading with locations and fire severity levels.
- Show the real time fire severity levels through mobile application and the fire department dashboard.

Objectives

Predict the classification of fire severity of the vehicle fire

- **Install sensors in vehicle to detect various fire indicators**
- **Train highly accurate ML models with a collection of real-time data from sensors under various conditions.**
- **After Analyzing data then predict fire severity level and Send to the cloud and find a nearest fire department.**
- **Display the real time fire severity level in the mobile app.**

SVM Model

```python
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score
from sklearn.preprocessing import LabelEncoder


def load_and_prepare_data(csv_filename):

    data = pd.read_csv(csv_filename)

    label_encoder = LabelEncoder()
    data['label'] = label_encoder.fit_transform(data['label'])

    X = data.drop('label', axis=1)
    y = data['label']
    return X, y, label_encoder


def train_svm_model(X_train, y_train):
    # Initialize and train the SVM model
    svm_model = SVC(kernel='linear', random_state=42)
    svm_model.fit(X_train, y_train)
    return svm_model


def evaluate_model(svm_model, X_test, y_test):
    # Make predictions and evaluate the model
    y_pred = svm_model.predict(X_test)
    accuracy = accuracy_score(y_test, y_pred)
    print(f"Model Accuracy: {accuracy}")


def predict_with_new_data(svm_model, label_encoder, new_data):
    # Structure the new data with column names
    column_names = ['sensor_front', 'sensor_mid', 'sensor_back']  # Ensure these match your training data
    new_data_df = pd.DataFrame([new_data], columns=column_names)
    prediction = svm_model.predict(new_data_df)
    # Decode the numerical prediction back to a label
    predicted_label = label_encoder.inverse_transform(prediction)
    return predicted_label


csv_filename = 'fire_type_detection_train_dataset.csv'
X, y, label_encoder = load_and_prepare_data(csv_filename)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
svm_model = train_svm_model(X_train, y_train)
evaluate_model(svm_model, X_test, y_test)


def predict_fire_type(new_sensor_data):
    global svm_model

    predicted_label = predict_with_new_data(svm_model, label_encoder, new_sensor_data)

    return predicted_label[0]
```

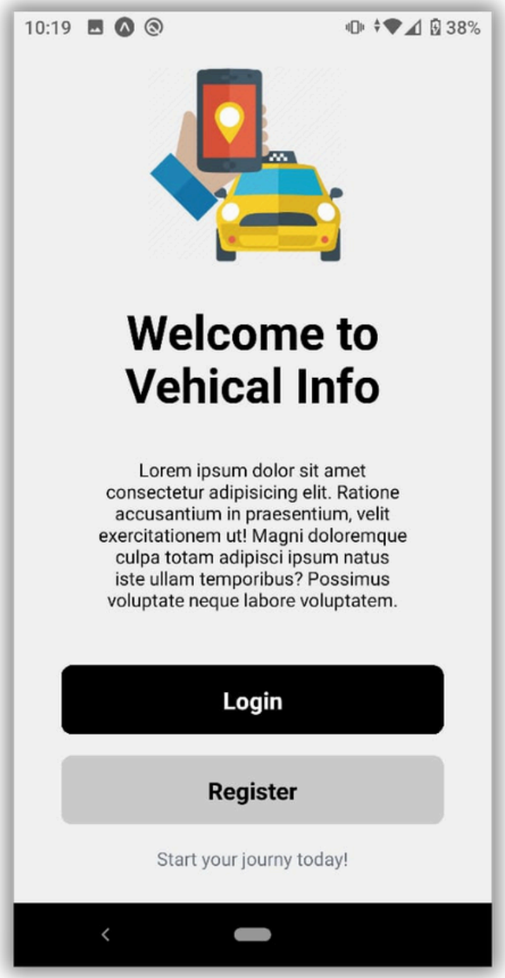
Model Accuracy: 95.20%

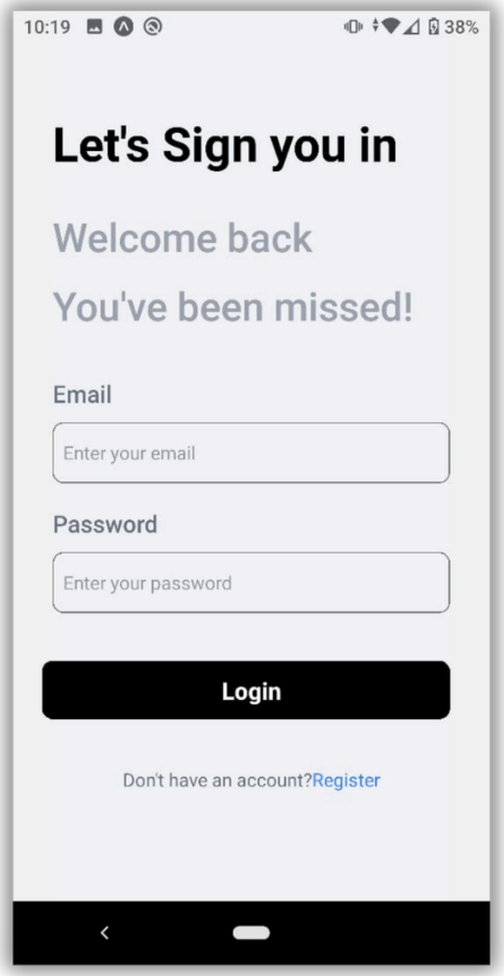
Arduino Intergration

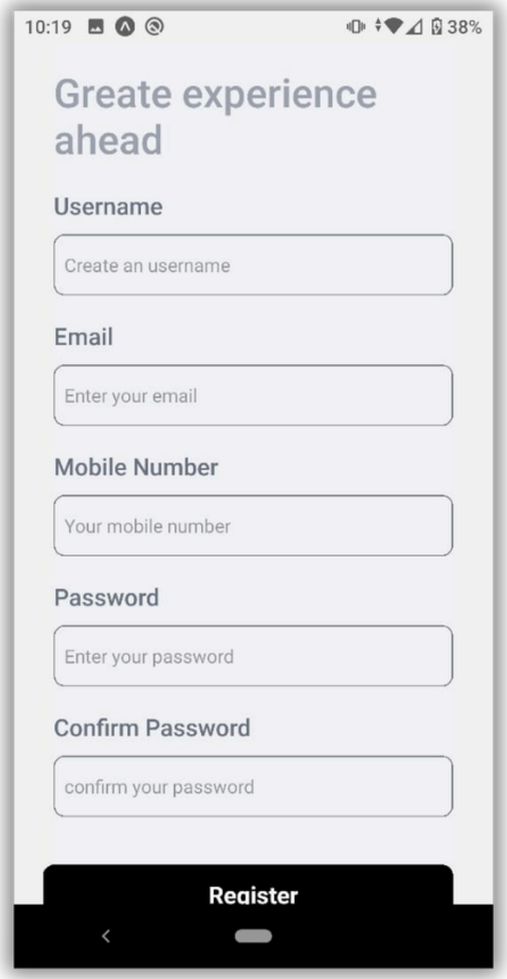
```python
fire_type_sensor_data = [temsensor1, temsensor2, temsensor3]
fire_type = predict_fire_type(fire_type_sensor_data)

new_data = [temsensor1, temsensor2, temsensor3]
fire_state = predict_sensor_data(new_data)

print(type(fire_type) , fire_state)



if fire_state == 'abnormal':

    payload = str(gps_lat) + ',' + str(gps_lon)  + ',' + str(wehical_no) + ',' + str(fire_type)
    car_clnt.publish('f_station', payload)

    print('Signal Send successful....')



if fire_state != 'normal':

    send_actuators_data([0, 1])


demo_mood(gps_lat , gps_lon , wehical_no ,fire_type)

time.sleep(1)
```

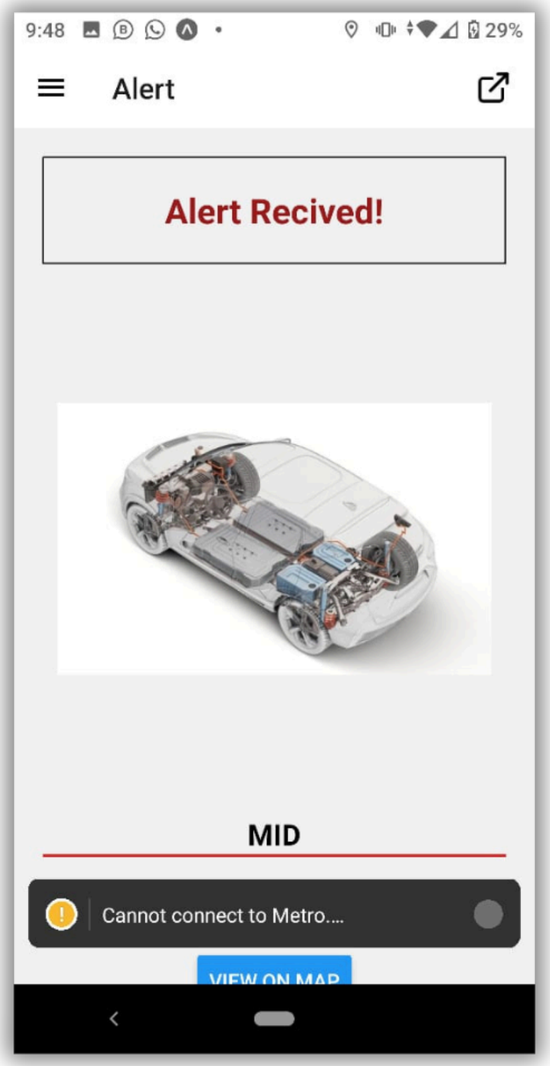
```python
def run_sensor_task(serial_port='COM6', baud_rate=9600):  ########  <------ Set comport


    ser = serial.Serial(serial_port, baud_rate, timeout=1)

    def send_command(command):
        ser.write(command.encode())


    def read_sensor_values():

        line = ser.readline().decode('utf-8').strip()

        # Split the line by comma
        data = line.split(',')

        # Print the data

        if len(data) == 8:
            # print(data)

            temsensor1 = int(data[0])
            temsensor2 = int(data[1])
            temsensor3 = int(data[2])

            gassensor1 = int(data[3])
            gassensor1 = int(data[4])
            gassensor1 = int(data[5])

            gps_long = data[6]
            gps_lat = data[7]

            return data

        else:

            return [0,0]
```

Mobile App


10:19
38%
Welcome to Vehical Info
Lorem ipsum dolor sit amet consectetur adipisicing elit. Ratione accusantium in praesentium, velit exercitationem ut! Magni doloremque culpa totam adipisci ipsum natus iste ullam temporibus? Possimus voluptate neque labore voluptatem.
Login
Register
Start your journy today!


10:19
38%
Let's Sign you in
Welcome back
You've been missed!
Email
Enter your email
Password
Enter your password
Login
Don't have an account?Register


10:19
38%
Greate experience ahead
Username
Create an username
Email
Enter your email
Mobile Number
Your mobile number
Password
Enter your password
Confirm Password
confirm your password
Register


9:48
29%
Alert
Alert Recived!
MID
Cannot connect to Metro....

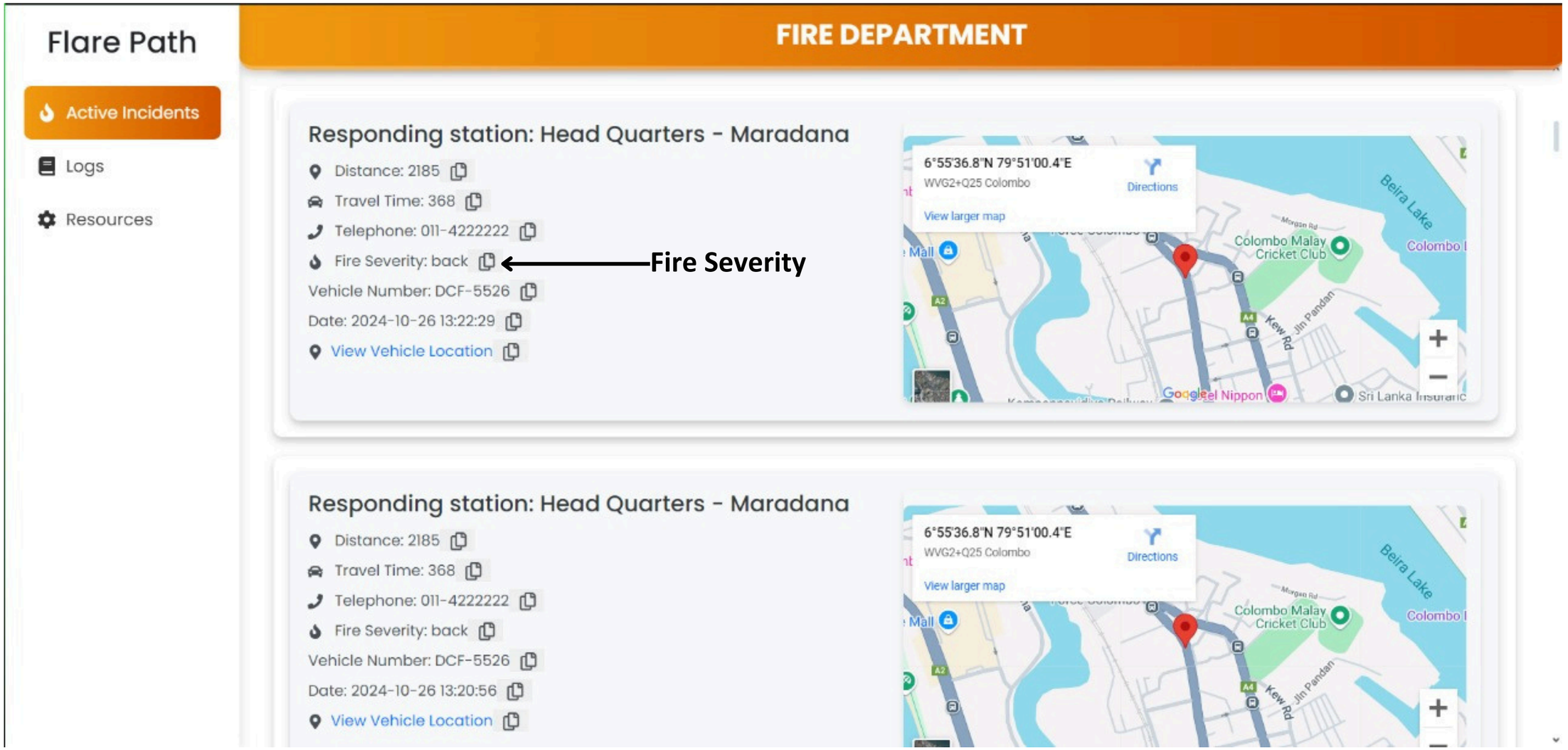
Mobile App - Codes

```
import { auth } from '../utils/firebaseConfig'
import { signInWithEmailAndPassword } from 'firebase/auth'

import { useAuth } from '../context/authContext'

const Login = () => {

  const { setUser, setAuthenticated } = useAuth()

  const [email, setEmail] = React.useState('')
  const [password, setPassword] = React.useState('')
  const [emailError, setEmailError] = React.useState(false)
  const [passwordError, setPasswordError] = React.useState(false)
  const [error, setError] = React.useState()

  const [loading, setLoading] = React.useState(false)

  const router = useRouter()

  async function login_user() {

    setEmailError(false)
    setPasswordError(false)

    if (email.length < 1) {
      setEmailError(true)
      return
    }
    if (password.length < 1) {
      setPasswordError(true)
      return
    }

    setLoading(true)
```

```
import { View, Text,TextInput,Button, Alert, ActivityIndicator } from 'react-native'
import React,{useState} from 'react'
import { Drawer } from 'expo-router/drawer';
import {  Plus } from 'lucide-react-native';
import { db } from '../../utils/firebaseConfig';
import { addDoc, arrayUnion, collection, doc,setDoc,updateDoc } from 'firebase/firestore';
import { useAuth } from '../../context/authContext';

const VehicalRegistration = () => {

  const [values, setValues] = useState({
    manfacture: '',
    modelName: '',
    fuelType: '',
    vehicalNumber:''
  })

  const [loading, setLoading] = useState(false)

  const {user}=useAuth()

  async function handleSubmit() {

    console.log(values)

    if (values.fuelTypename==='' || values.manfacture==='' ||
      values.modelName==='' || values.vehicalNumber==='') {
      return Alert.alert('Please fill all fields','all the fields are required')
    }
```

MS 2 OUTPUT DEBUG CONSOLE TERMINAL PORTS COMMENTS

Dashboard


Flare Path
FIRE DEPARTMENT
Active Incidents
Logs
Resources
Responding station: Head Quarters - Maradana
Distance: 2185
Travel Time: 368
Telephone: 011-4222222
Fire Severity: back
Fire Severity
Vehicle Number: DCF-5526
Date: 2024-10-26 13:22:29
View Vehicle Location
6°55'36.8"N 79°51'00.4"E
WVG2+Q25 Colombo
Directions
View larger map
Beira Lake
Colombo Malay Cricket Club
Kew Rd
Jln Pandan
Responding station: Head Quarters - Maradana
Distance: 2185
Travel Time: 368
Telephone: 011-4222222
Fire Severity: back
Vehicle Number: DCF-5526
Date: 2024-10-26 13:20:56
View Vehicle Location
6°55'36.8"N 79°51'00.4"E
WVG2+Q25 Colombo
Directions
View larger map
Beira Lake
Colombo Malay Cricket Club
Kew Rd
Jln Pandan

Tools and Technologies

Software Technologies

- Python
- Pandas , NumPy
- Flask
- Firebase
- networkx
- NodeJS
- React Native

Requirement Analysis

Functional Requirements

- System should be able to collect and store real-time data under various conditions from IoT-enabled sensors.
- System should be able to send real time fire severity to the mobile app without any delay.
- System should be able to send real time fire severity levels to the fire department dashboard without any delay.
- The system must be capable of integrating with existing vehicle systems.

Non-Functional Requirements

- Interfaces should be more user-friendly.
- Application should be reliable
- Should respond Realtime.
- Should have high security.

References

[1]Jiang, X. H., Zhu, G. Q., Zhu, H., & Li, D. Y. (2018). Full-scale Experimental Study of Fire Spread Behavior of Cars. Procedia Engineering, 211, 297–305. https://doi.org/10.1016/j.proeng.2017.12.016

[2] Mohd Tohir, M. Z., & Spearpoint, M. (2013). Distribution analysis of the fire severity characteristics of single passenger road vehicles using heat release rate data. Fire Science Reviews. http://www.firesciencereviews.com/content/2/1/5

[3] Sowah, R., Ampadu, K. O., Ofoli, A. R., Koumadi, K., Mills, G. A., & Nortey, J. (2019, March). A Fire-Detection and Control System in Automobiles: Implementing a Design That Uses Fuzzy Logic to Anticipate and Respond. IEEE Industry Applications Magazine, 25(2), 57–67. https://doi.org/10.1109/mias.2018.287518

[4]Mathavan, J. J., Faslan, A., Basith, N. U. A., & Wanigasinghe, W. (2020, June). Hardware Implementation of Fire Detection, Control and Automatic Door Unlocking System for Automobiles. *2020 4th International Conference on Trends in Electronics and Informatics (ICOEI)(48184)*. https://doi.org/10.1109/icoei48184.2020.9142990

Dharmagunawardana W.M.P.I| IT21132346

Specializing in Information Technology

IoT-based Fire Extinguisher Mechanism

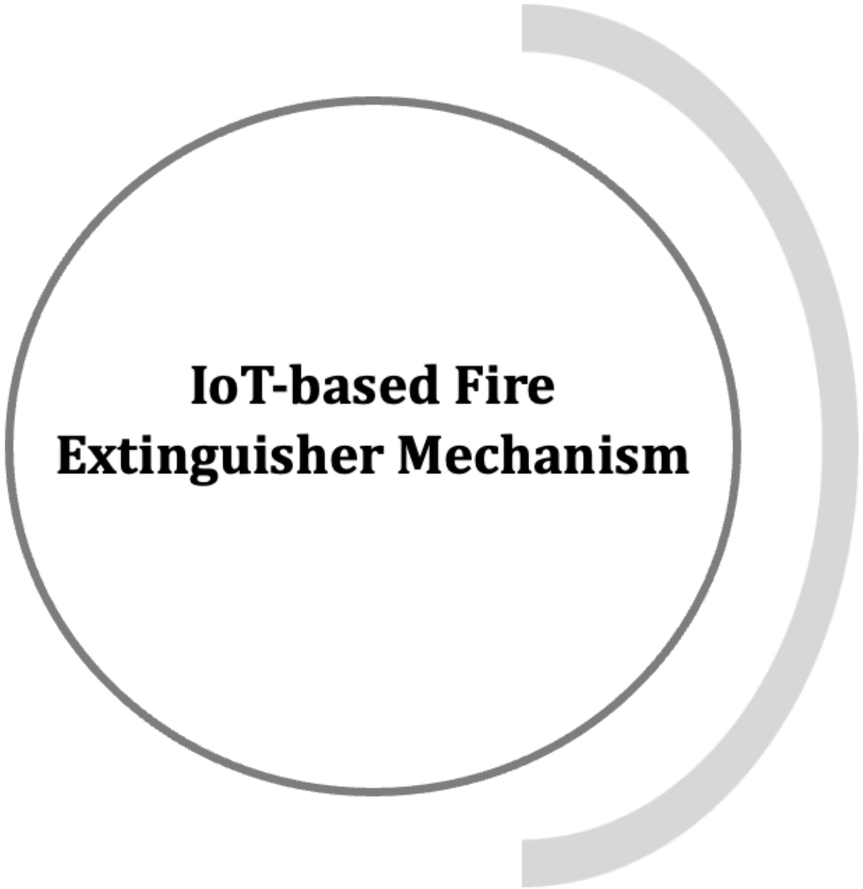
Research Problem

- How To Implement A Such System Inside A Vehicle?
- Ensure Passenger Safety ?
- Ensure Vehicle Safety?
- What Are The Social And Economic Benefits ?

Research Gap

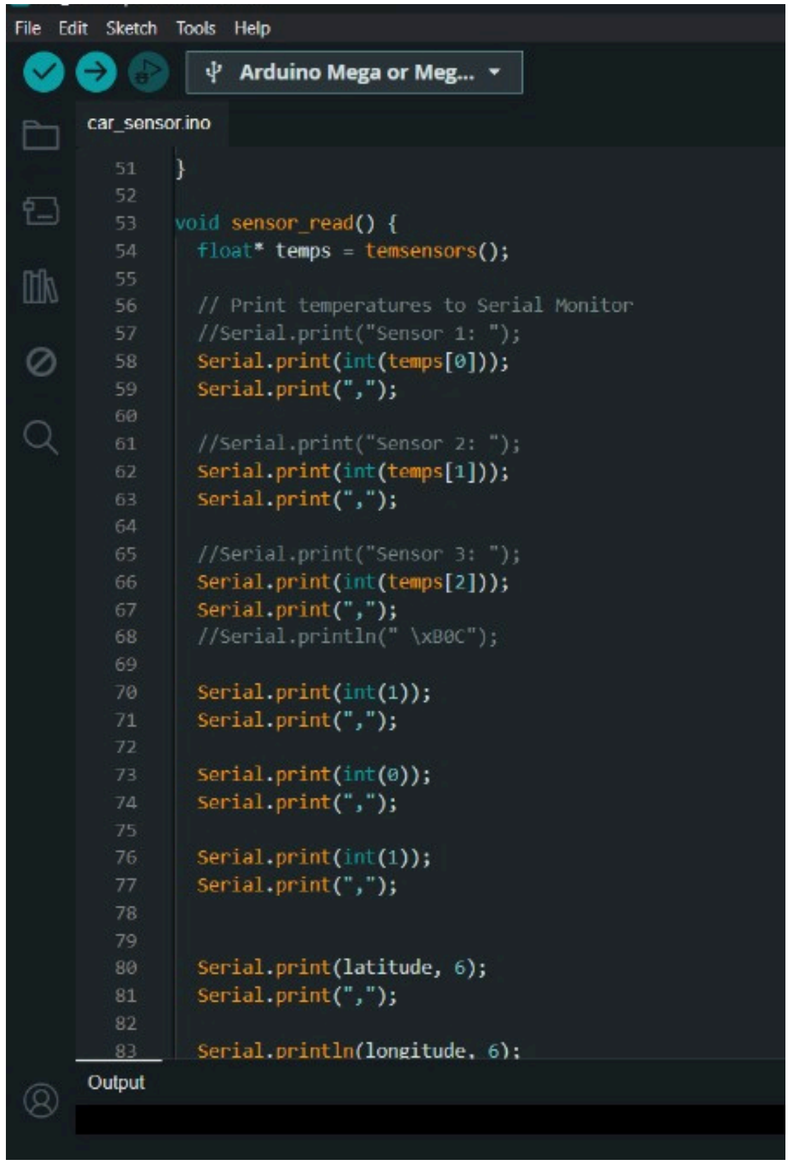
- Installing automatic fire extinguishers into vehicles can revolutionize safety measures.
- To make the IoT-based fire extinguishing system economically viable.
- An IoT-enabled automatic fire extinguisher system significantly minimize the risk and damage.
- An Immediate action is taken, at the moment of potential fire is detected.

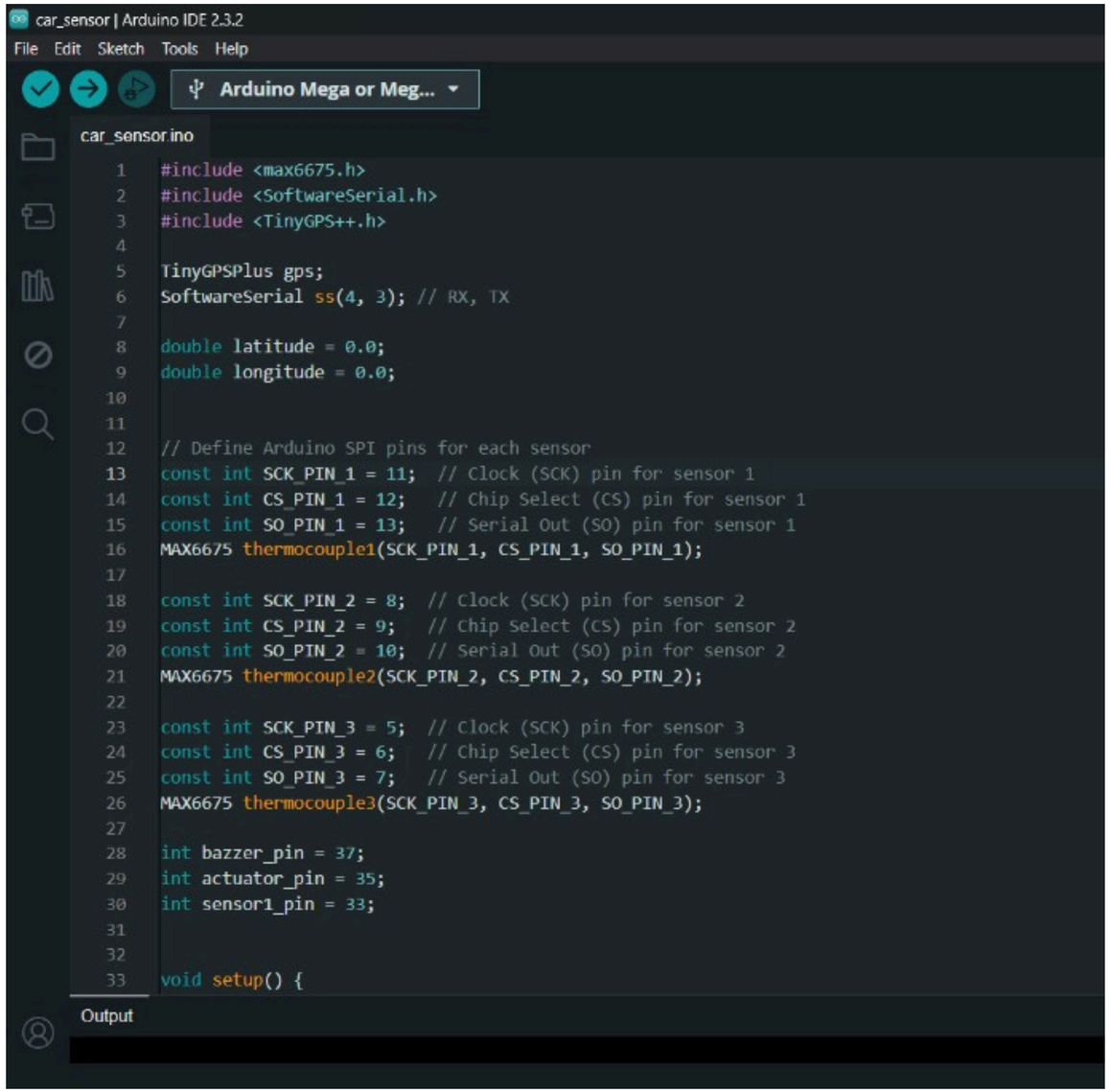
Objectives



- IOT device that monitor the vehicle
- Alert the driver about Fire incident
- Give the time out to evacuate the vehicle
- Based on the Response it sprays the Dry Powder

Implementation





Implementation

car_sensor | Arduino IDE 2.3.2

File Edit Sketch Tools Help

Arduino Mega or Meg...

car_sensor.ino

```
31
32
33  void setup() {
34
35
36    digitalWrite(bazzer_pin, LOW);
37    digitalWrite(actuator_pin, HIGH);
38
39    pinMode(bazzer_pin, OUTPUT);    // Set pin 37 as an output
40    pinMode(actuator_pin, OUTPUT);  // Set pin 35 as an output
41    pinMode(sensor1_pin, OUTPUT);   // Set pin 33 as an output
42
43    digitalWrite(bazzer_pin, LOW);
44    digitalWrite(actuator_pin, HIGH);
45
46    delay(200);
47    Serial.begin(9600);
48    Serial1.begin(9600);
49    delay(100);
50
51  }
52
53  void sensor_read() {
54    float* temps = temsensors();
55
56    // Print temperatures to Serial Monitor
57    //Serial.print("Sensor 1: ");
58    Serial.print(int(temps[0]));
59    Serial.print(",");
60
61    //Serial.print("Sensor 2: ");
62    Serial.print(int(temps[1]));
63    Serial.print(",");
```

Output

car_sensor | Arduino IDE 2.3.2

File Edit Sketch Tools Help

Arduino Mega or Meg...

car_sensor.ino

```
91  }
92
93  void gps_data() {
94    while (Serial1.available() > 0) {
95      gps.encode(Serial1.read());
96
97      if (gps.location.isUpdated()) {
98        latitude = gps.location.lat();
99        longitude = gps.location.lng();
100
101       // Serial.print("Latitude= ");
102       // Serial.println(latitude, 6);
103       // Serial.print("Longitude= ");
104       // Serial.println(longitude, 6);
105     }
106   }
107 }
108
109 void loop() {
110
111   sensor_read();
112
113   gps_data();
114
115   if (Serial.available() > 0) {  // Check if data is available to read
116
117     char received = Serial.read();  // Read the incoming byte
118
119     // Serial.println(received);
120
121     if (received == '1') {
122       digitalWrite(bazzer_pin, HIGH);
```

Output

Implementation

car_sensor | Arduino IDE 2.3.2

File Edit Sketch Tools Help

Arduino Mega or Meg...

car_sensor.ino

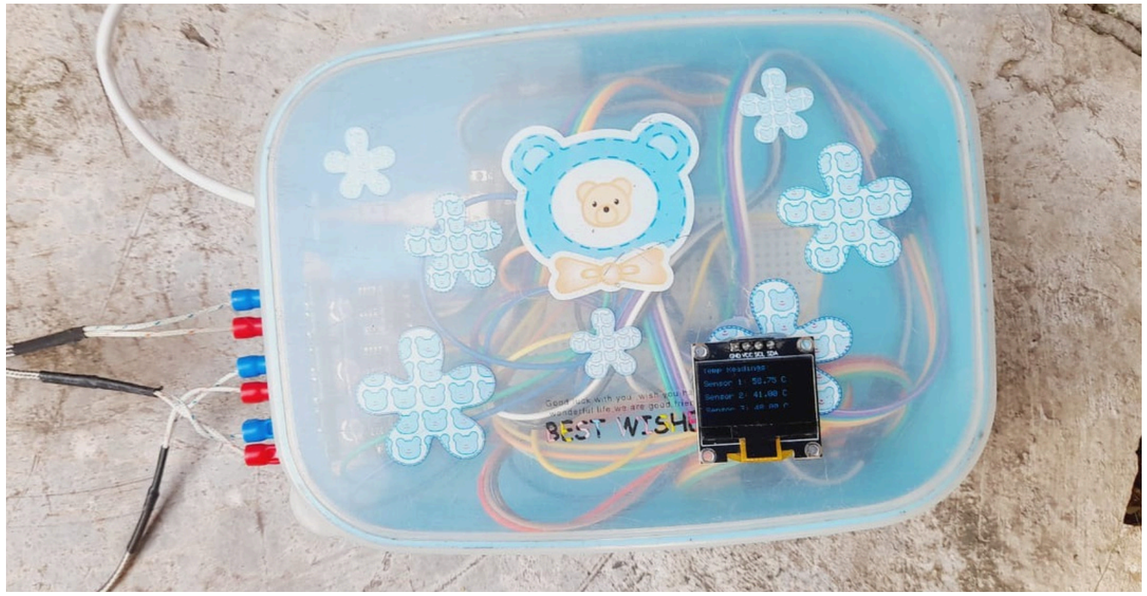
```
123       }
124
125       else if (received == '2') {
126         digitalWrite(actuator_pin, LOW);  //low mean on
127       }
128
129       else if (received == '3') {
130
131         digitalWrite(bazzer_pin, HIGH);
132         digitalWrite(actuator_pin, LOW); // low mean on
133
134       }
135
136       else if (received == '0') {
137         digitalWrite(bazzer_pin, LOW);
138         digitalWrite(actuator_pin, HIGH); // high mean off
139       }
140     }
141
142
143   }
144
145   // Function to read temperatures from all three sensors and return as an array of floats (in Celsius
146   float* temsensors() {
147     float* temperatures = new float[3];
148
149     temperatures[0] = thermocouple1.readCelsius();
150     temperatures[1] = thermocouple2.readCelsius();
151     temperatures[2] = thermocouple3.readCelsius();
152
153     return temperatures;
154   }
155
```

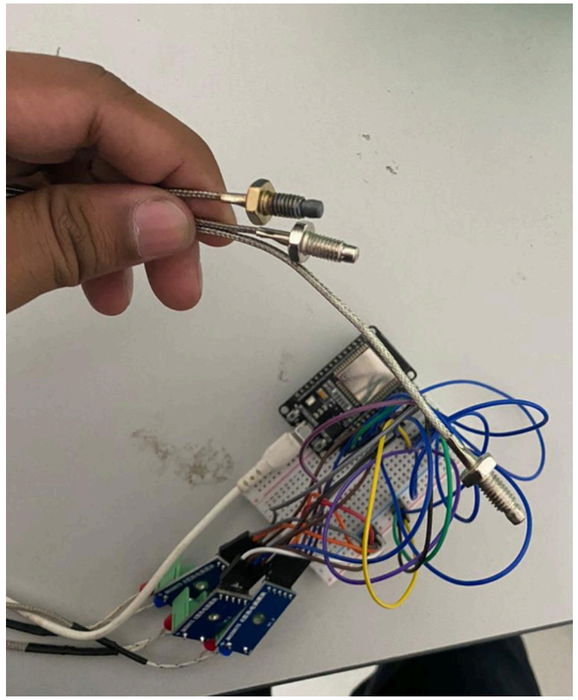
Output

main_car.py > ...

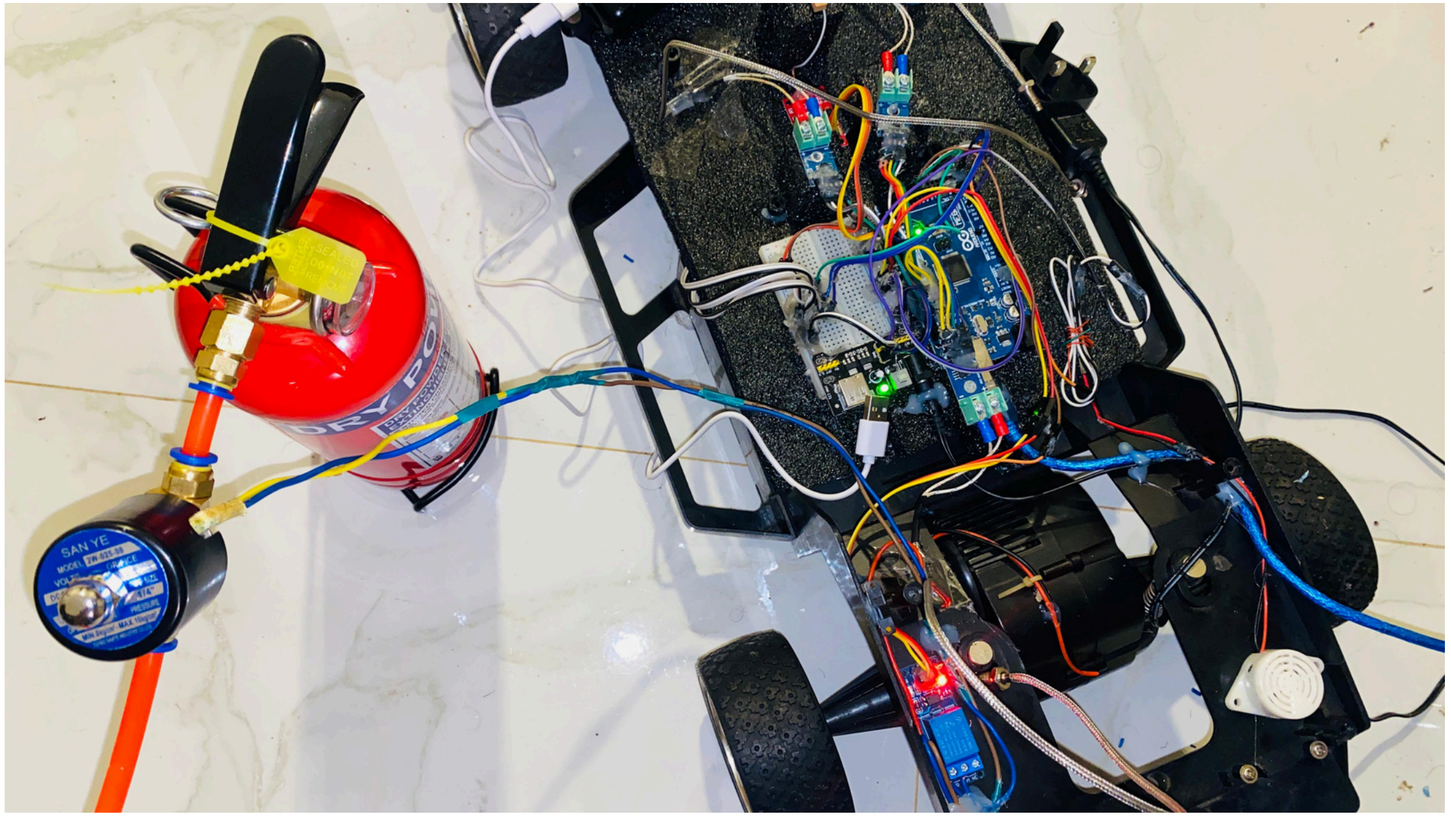
```
1   import time
2
3   from arduino_communication_2 import get_sensor_data
4   from arduino_communication_2 import send_actuators_data
5   from arduino_communication_2 import send_actuators_reset
6   from arduino_communication_2 import arduino_systme_init_wait
7
8   from fire_type_detection import predict_fire_type
9   from car_temp_abnomility import predict_sensor_data
10
11  from Mqtt_engine import mqtt_clint
12
13  arduino_systme_init_wait(info=True)
14
15
16
17  wehical_no = 'DCF-5526'
18
19  # gps_lat = 6.926878  # Test latitude
20  # gps_lon = 79.850117  # Test longitude
21
22  car_clnt = mqtt_clint("gagan",
23                        "gagan4002187",
24                        "92ebc34b18f347d2aa1a9f2f04a453b2.s1.eu.hivemq.cloud",
25                        8883,
26                        'fff')
27
28
29  def demo_mood(gps_lat , gps_lon , wehical_no , fire_type):
30
31
32      if msg == 'fir':
33          payload = str(gps_lat) + ',' + str(gps_lon) + ',' + str(wehical_no)+ ',' + str(fire_type)
34          car_clnt.publish('f_station', payload)
35          # send_actuators_data([1, 1])
36
37          print('Signal Send successful....')
38
39      if msg == 'reset':
40          send_actuators_reset(True)
41
42      if msg == 'ftype':
43          send_actuators_data([0, 1])
```

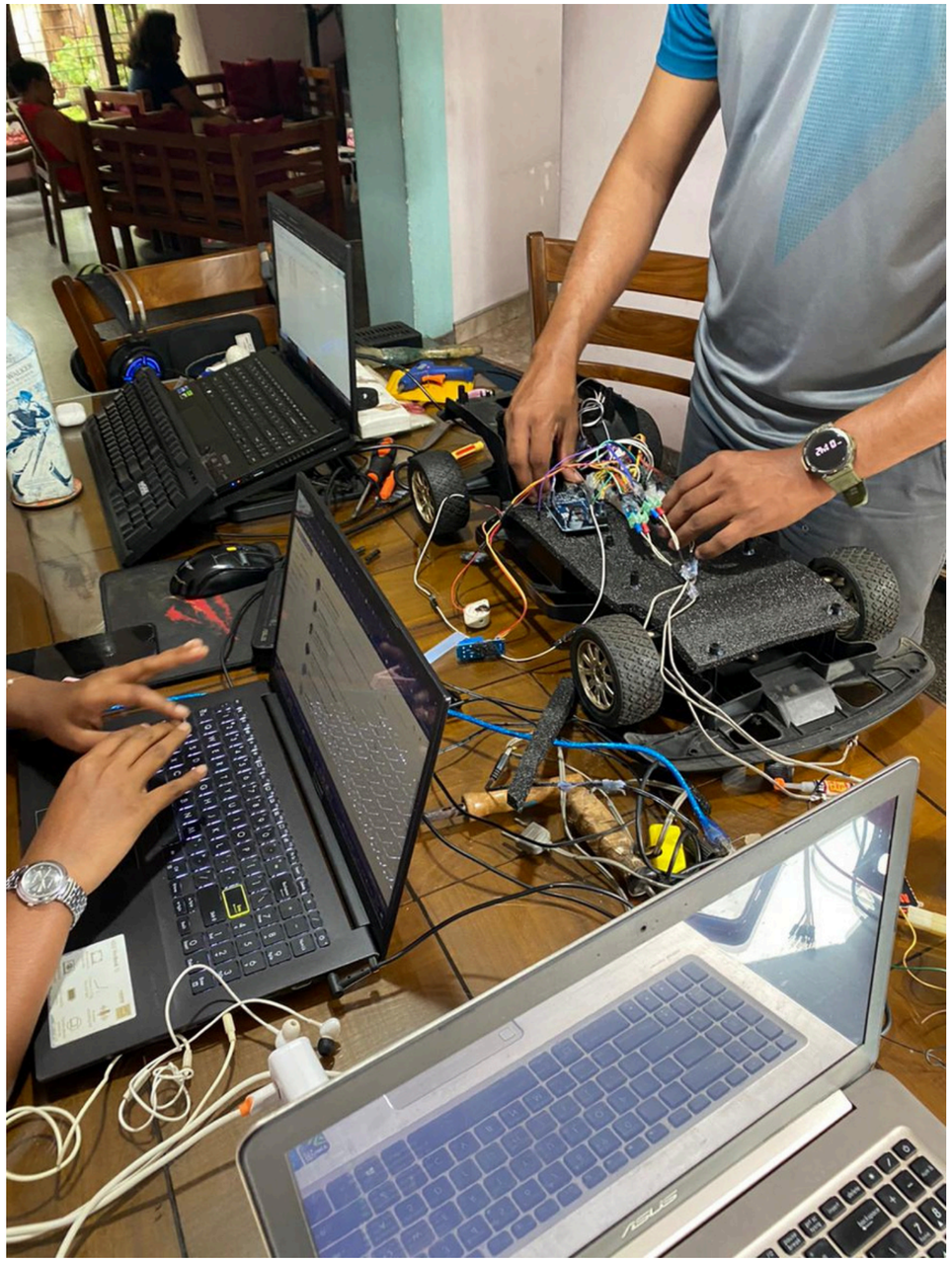
Implementation





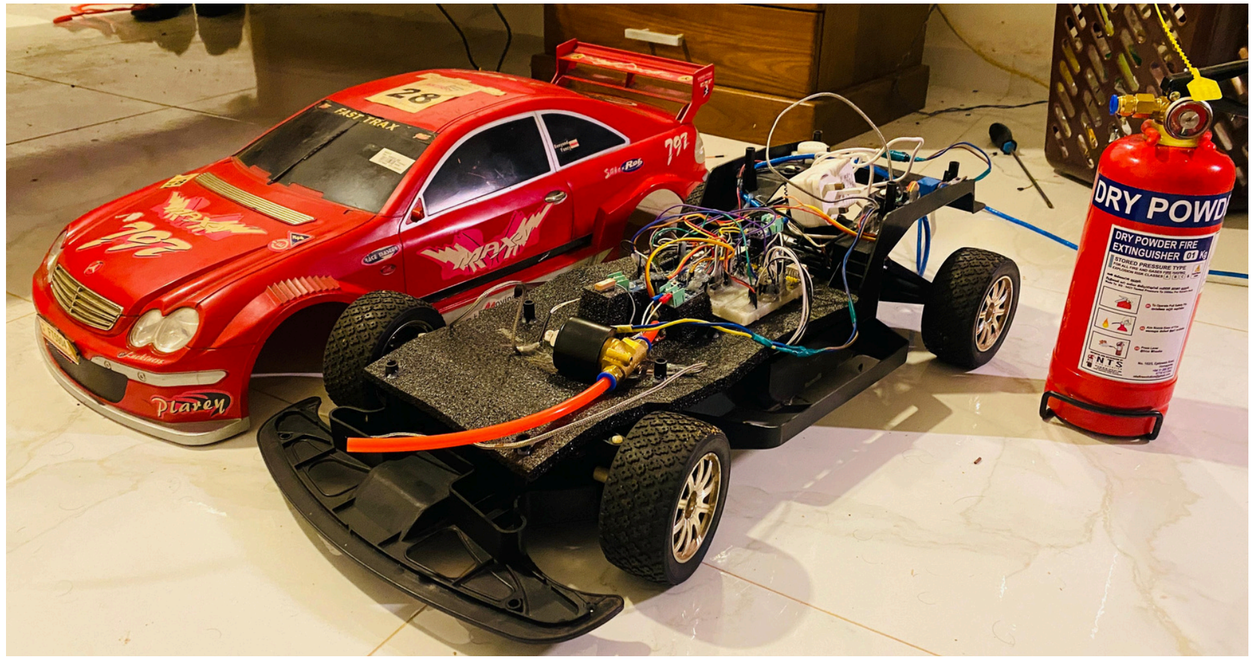
Implementation



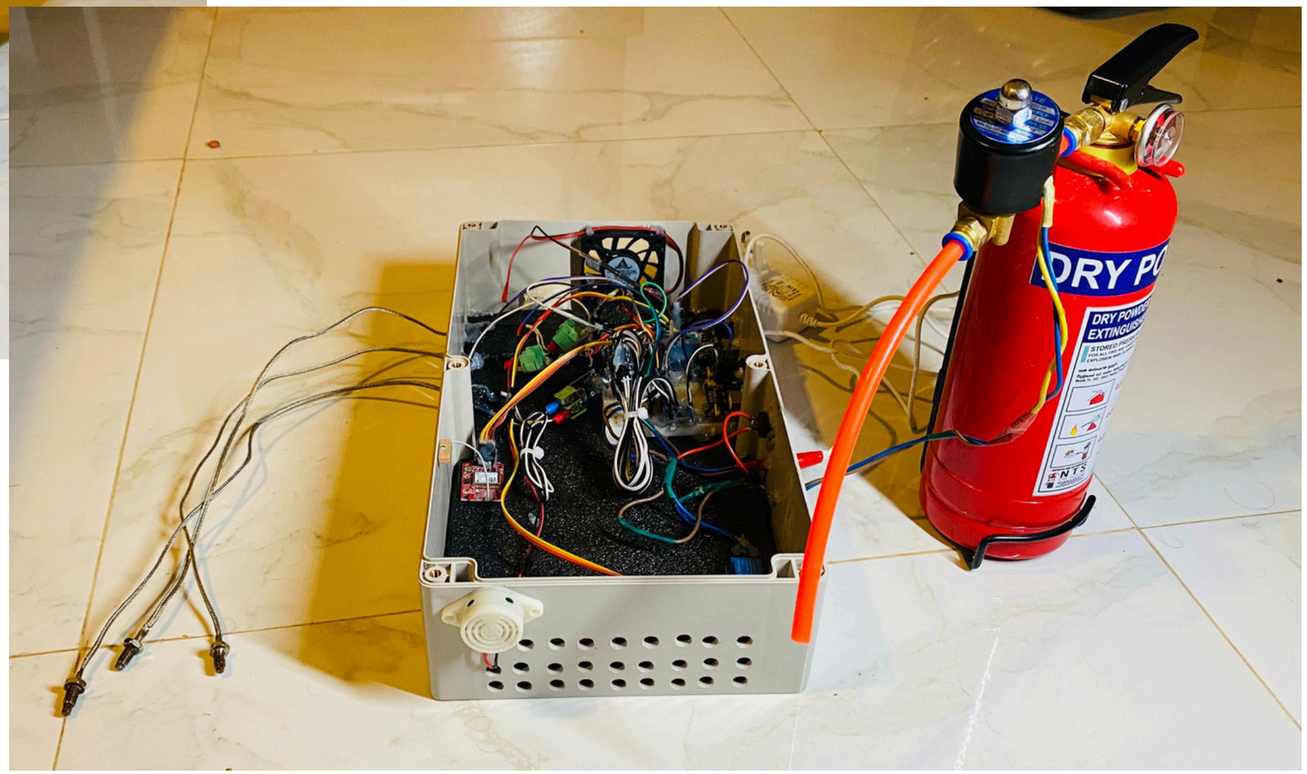


Prototype 1


FAST TRAX
DRY POWDER FIRE EXTINGUISHER
FT59041


FAST TRAX
DRY POWDER FIRE EXTINGUISHER

Prototype 2



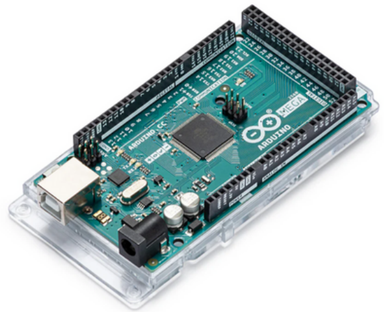
Tools and Technologies

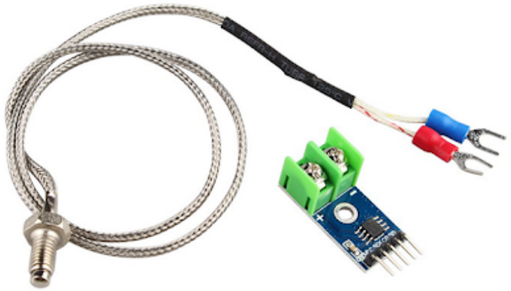
Hardware Tools

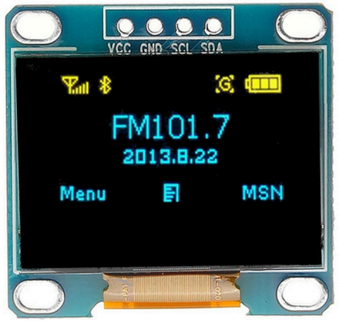
- ESP32
- Arduino mega board
- Arduino UNO board
- max6675 K type thermocouple
- Temperature Sensor
- Mini Ublox neo 6m gps module
- Alarm Buzzer
- OLED 128X64 0.96 inch Display Module
- 12V Power supply
- Bread board
- Bread board power supply
- Fire Extinguisher
- Solenoid valve
- 1 channel relay module

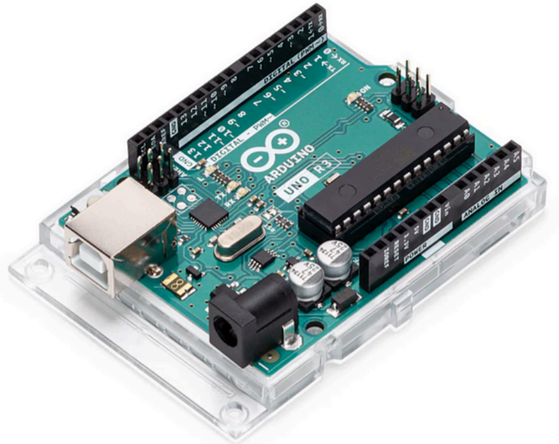
Software Tools

- Micro Python
- c/c++
- Arduino IDE
- Pycharm
- Python









Requirement Analysis

Functional Requirements

- The system must transmit the collected data securely to a cloud.
- The system must provide real-time feedback to drivers based on the situation.
- The system must include a user-friendly interface.
- The system must be capable of integrating with existing vehicle systems.
- The Fire extinguishers must be easy to install without modifying

Non-Functional Requirements

- The system must be reliable with minimal downtime.
- The solution should be cost-effective
- The system must process and analyze data in real-time.
- The system should be easy to maintain.

References

[1] Habib, M. R., Khan, N., Ahmed, K., Kiran, M. R., Asif, A., Bhuiyan, M. I., & Farrok, O. (2019, September). Quick Fire Sensing Model and Extinguishing by Using an Arduino Based Fire Protection Device. 2019 5th International Conference on Advances in Electrical Engineering (ICAEE). https://doi.org/10.1109/icaee48663.2019.8975538

[2] Kumar, D. D., Bharathraj, B., Vishak, V. N., Jasith, S., & Raja, L. (2023, March 23). IoT Based Fire Protection System. 2023 4th International Conference on Signal Processing and Communication (ICSPC). https://doi.org/10.1109/icspc57692.2023.10125807.

[3] Mathavan, J. J., Faslan, A., Basith, N. U. A., & Wanigasinghe, W. (2020, June). Hardware Implementation of Fire Detection, Control and Automatic Door Unlocking System for Automobiles. 2020 4th International Conference on Trends in Electronics and Informatics (ICOEI)(48184). https://doi.org/10.1109/icoei48184.2020.9142990

[4] P, C., Venusamy, K., S, N., EL, J., & Vickyath, S. (2023, May 4). Design and Implementation of IoT based Multi Degree Rotating Fire Extinguisher System. 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC). https://doi.org/10.1109/icaaic56838.2023.10140798

Anthick.G.N| IT21096266
Specializing in Information Technology

Optimizing Emergency Response Paths with Resource Allocation

Research Problem

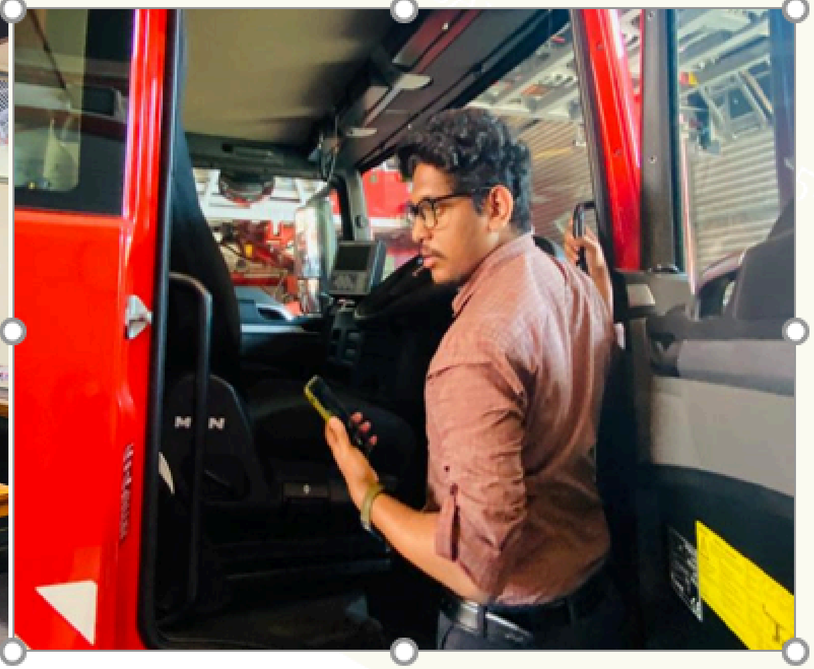
Inefficiency of Manual Call Verification

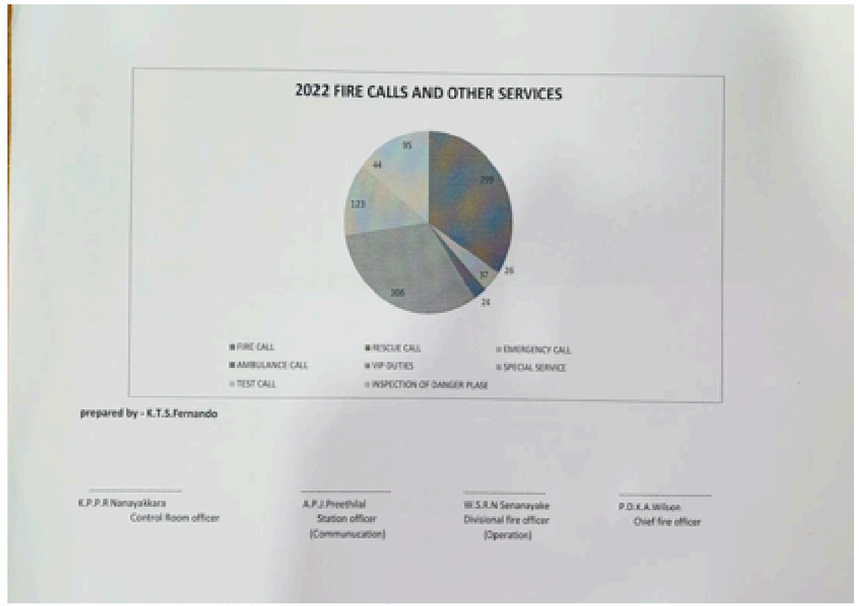
Lack of Real-Time Response Information

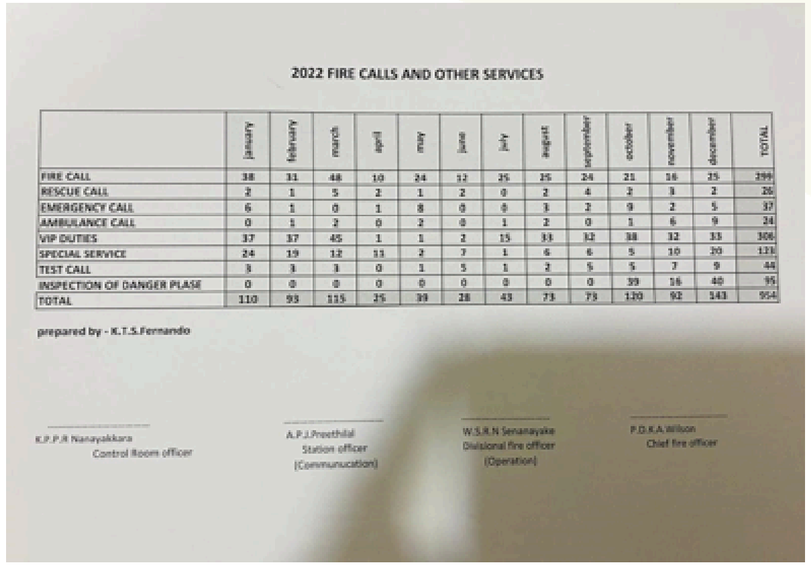
Caller Helplessness During Emergencies

Introduction

Research Problem







2022 FIRE CALLS AND OTHER SERVICES

	january	february	march	april	may	june	july	august	september	october	november	december	TOTAL
FIRE CALL	38	31	48	10	24	12	25	25	24	21	16	25	299
RESCUE CALL	2	1	5	2	1	2	0	2	4	2	3	2	26
EMERGENCY CALL	6	1	0	1	8	0	0	3	2	9	2	5	37
AMBULANCE CALL	0	1	2	0	2	0	1	2	0	1	6	9	24
VIP DUTIES	37	37	45	1	1	2	15	33	32	38	32	33	306
SPECIAL SERVICE	24	19	12	11	2	7	1	6	6	5	10	20	123
TEST CALL	3	3	3	0	1	5	1	2	5	5	7	9	44
INSPECTION OF DANGER PLASE	0	0	0	0	0	0	0	0	0	39	16	40	95
TOTAL	110	93	115	25	39	28	43	73	79	120	92	143	954

prepared by - K.T.S.Fernando

K.P.P.R Nanayakkara
Control Room officer

A.P.J.Preethilal
Station officer
(Communucation)

W.S.R.N Senanayake
Divisional fire officer
(Operation)

P.D.K.A.Wilson
Chief fire officer

Research Gap

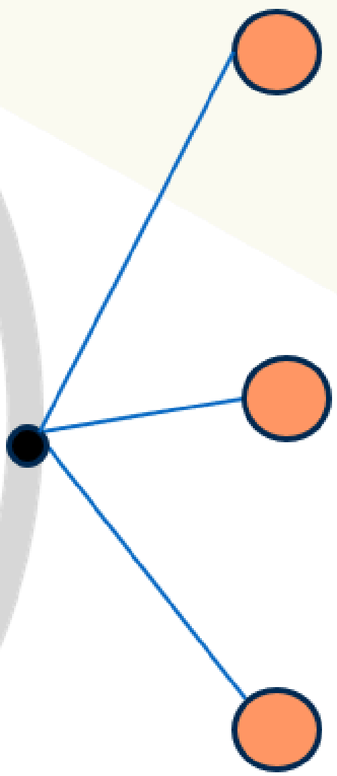
•Essential for reducing response times in vehicle fire emergencies.

•Absence of real-time support for both emergency responders and vehicle owners, hindering prompt responses.

•Vehicle owners lack immediate access to crucial emergency support like nearby fire extinguishers. This research aims to address these gaps by implementing a comprehensive, integrated solution.

Objectives

Enhance emergency response times for vehicle fires a system that facilitates real-time data sharing between fire departments and vehicle owners.



- **Develop an automated system to detect and report vehicle fire locations to the cloud.**
- **Implement an algorithm to automatically identify and notify the nearest fire department with details of the incident.**
- **Create an model to inform vehicle owners about nearby fire.**

Implementation

Flask Server

current.json | station_main.py | server.py | TestScreen.js | GPS_calculations.py

Backend > server.py > real_station

```python
from datetime import datetime, date
import os
import json
import time
import random
import firebase_admin
from flask import Flask, jsonify
from flask_cors import CORS
from flask_socketio import SocketIO, emit
from threading import Thread
from firebase_admin import credentials, firestore
from station_main import get_signals_from_network  # from station_main file


app = Flask(__name__)
cors = CORS(app)
app.config['CORS_HEADERS'] = 'Content-Type'
app.config['SECRET_KEY'] = 'your-secret-key'
socketio = SocketIO(app, cors_allowed_origins="*")
PORT = 5000


# File paths
current_file = 'current.json'
history_file = 'history.json'
vehicles_file = 'vehiclesleft.json'

# Initialize Firebase app
cred = credentials.Certificate("C:\\Users\\ACER NITRO\\Desktop\\Station\\Backend\\firebase\\firebase-adminsdk.json")
firebase_admin.initialize_app(cred)
```

PROBLEMS | OUTPUT | DEBUG CONSOLE | TERMINAL | PORTS

```
    self._target(*self._args, **self._kwargs)
  File "C:\Users\ACER NITRO\Desktop\Station\Backend\server.py", line 125, in send_new_station_periodically
    current_data = json.load(f)
  File "C:\Users\ACER NITRO\AppData\Local\Programs\Python\Python310\lib\json\__init__.py", line 293, in load
    return loads(fp.read(),
  File "C:\Users\ACER NITRO\AppData\Local\Programs\Python\Python310\lib\json\__init__.py", line 346, in loads
    return _default_decoder.decode(s)
  File "C:\Users\ACER NITRO\AppData\Local\Programs\Python\Python310\lib\json\decoder.py", line 337, in decode
    obj, end = self.raw_decode(s, idx=_w(s, 0).end())
  File "C:\Users\ACER NITRO\AppData\Local\Programs\Python\Python310\lib\json\decoder.py", line 355, in raw_decode
    raise JSONDecodeError("Expecting value", s, err.value) from None
json.decoder.JSONDecodeError: Expecting value: line 1 column 1 (char 0)
```

Frontend Code

frontend > src > components > screencomponents > TestScreen > TestScreen.js > TestScreen > map() callback

```javascript
import React, { useState, useEffect, useRef } from "react";
import {FaPhone, FaMapMarkerAlt, FaCar, FaFire, FaRegCopy,} from "react-icons/fa";
import Swal from "sweetalert2"; // Import SweetAlert2
import { io } from "socket.io-client";
import { collection, getDocs, onSnapshot, doc, updateDoc } from "firebase/firestore"; // Import Firestore functions
import { db } from "../../../firebase/firebase.js";
import { GoogleMap, LoadScript, Marker } from '@react-google-maps/api';

import "./TestScreen.css";

// const socket = io("http://localhost:5000"); // Adjust the URL as needed

const TestScreen = () => {
  const [selectedStation, setSelectedStation] = useState(null);
  const [actionedStations, setActionedStations] = useState([]);
  const [currentStations, setCurrentStations] = useState([]);
  const [vehiclesLeft, setVehiclesLeft] = useState([]);
  const [tab, setTab] = useState("current");
  const [loading, setLoading] = useState(false);
  const [cardsLoading, setCardsLoading] = useState(true);
  const userInteractedRef = useRef(null);

  const newItemRef = useRef(null);
  const intervalRef = useRef(null);

  useEffect(() => {
    // Add an event listener to capture user interaction
    const handleUserInteraction = () => {
      console.log("has is done");
      userInteractedRef.current = true;
      // Remove the event listener after the first interaction
      document.removeEventListener("click", handleUserInteraction);
      document.removeEventListener("keydown", handleUserInteraction);
      document.removeEventListener("scroll", handleUserInteraction);
    };

    // Attach the event listeners
    document.addEventListener("click", handleUserInteraction);
    document.addEventListener("keydown", handleUserInteraction);
    document.addEventListener("scroll", handleUserInteraction);
```

Implementation

```python
import pandas as pd
import numpy as np

def nearest_station(y_lat, my_lon, radius=300):

    file_path = 'extinguishers.csv'  # Your file path
    data = pd.read_csv(file_path)

    def haversine(lat1, lon1, lat2, lon2):
        R = 6371000  # Radius of the Earth in meters
        phi1 = np.radians(lat1)
        phi2 = np.radians(lat2)
        delta_phi = np.radians(lat2 - lat1)
        delta_lambda = np.radians(lon2 - lon1)
        a = np.sin(delta_phi / 2.0) ** 2 + np.cos(phi1) * np.cos(phi2) * np.sin(delta_lambda / 2.0) ** 2
        c = 2 * np.arctan2(np.sqrt(a), np.sqrt(1 - a))
        return int(R * c)


    # Calculate distance between your location and all extinguisher stations
    data['distance'] = data.apply(lambda row: haversine(y_lat, my_lon, row['Latitude'], row['Longitude']), axis=1)

    # Filter stations that are within the radius (300 meters)
    stations_within_radius = data[data['distance'] <= radius]

    if stations_within_radius.empty:
        return "No fire extinguisher stations found within 300 meters."

    # Convert the filtered DataFrame to a list of dictionaries
    nearest_stations_info = stations_within_radius.to_dict('records')

    return nearest_stations_info

```

Calculating Nearest Extinguishers

```
PS C:\Users\ACER NITRO\Desktop\Station> cd Backend
PS C:\Users\ACER NITRO\Desktop\Station\Backend> python nearast_etg_main.py
Nearest extinguisher Information:
Extinguisher Details:
no: 1
name: Kia Motors - Workshop & Collision Repair Center
Latitude: 6.917058265
Longitude: 79.97257495
water: y
foam: n
powder: y
co2: y
wet_chemical: n
distance: 161

Extinguisher Details:
no: 2
name: Tesco Office Automation (Pvt) Ltd
Latitude: 6.916702431
Longitude: 79.97298493
water: n
foam: n
powder: y
co2: y
wet_chemical: n
distance: 139

Extinguisher Details:
no: 3
name: Punchi Car Niwasa
Latitude: 6.916545363
Longitude: 79.97238275
water: n
foam: y
powder: y
co2: y
wet_chemical: n
distance: 102

Extinguisher Details:
no: 4
name: Pizza Hut - Kothalawala
Latitude: 6.916317544
Longitude: 79.97236758
water: y
```

Implementation

Extinguishers near SLIIT Dataset

no	name	Latitude	Longitude	water	foam	powder	co2	wet_chemical
1	Kia Motors - Workshop & Collision Repair Center	6.917058265	79.97257495	y	n	y	y	n
2	Tesco Office Automation (Pvt) Ltd	6.916702431	79.97298493	n	n	y	y	n
3	Punchi Car Niwasa	6.916545363	79.97238275	n	y	y	y	n
4	Pizza Hut - Kothalawala	6.916317544	79.97236758	y	y	y	y	y
5	Ky Mart	6.916011475	79.97224681	y	n	n	y	n
6	P&S (Perera and Sons) - Malabe	6.914903526	79.9720504	y	y	y	y	n
7	Mansa Fitness	6.914873697	79.97213944	y	n	n	n	n
8	Cargills Food City - Welivita	6.914704616	79.97206031	y	n	n	y	n
9	Sen-Saal Waliwita	6.914124147	79.97223734	y	y	n	n	n
10	Malabe Auto Car mart (Pvt)	6.914065567	79.97206702	n	n	n	y	y
11	SPAR Supermarket - Malabe	6.911995477	79.97228405	n	y	y	y	n
12	AutoSpa Malabe	6.911515749	79.97205599	n	y	y	y	y
13	Dinlo Lanka Pvt Ltd	6.911118909	79.97176331	y	n	y	n	n
14	Hotel Queensbury	6.918854667	79.97440902	y	n	n	y	n
15	Sugath Car Decor	6.919936875	79.97443643	n	y	y	y	n
16	Cargills Food City - Kothalawala	6.920075695	79.97413194	y	n	n	y	n
17	NIRO LANKA AUTO TRADERS	6.920947796	79.97492925	n	n	y	y	n
18	Domino's Pizza - Kaduwela	6.921115723	79.97459431	n	y	y	y	y
19	Bubble Mania - Malabe	6.921208673	79.97468686	y	y	n	y	n
20	Jetters	6.921194606	79.97525984	y	n	n	n	n
21	Sarasavi Building	6.921640501	79.97528825	y	n	n	n	n
22	Sitrek Lanka - Kaduwela	6.921596206	79.97621364	n	n	n	y	n
23	Okidmo Preschool & Daycare	6.921628671	79.97652039	y	n	y	n	n
24	Sanoora Auto Traders	6.921923103	79.97688464	n	n	n	y	n
25	Land of Kings Cafe & Restaurant	6.923685466	79.97781486	n	n	y	y	n

Implementation

Calculating Nearest Fire sub station

Backend > GPS_calculations.py > find_optimal_route

```python
import networkx as nx
import pandas as pd
import googlemaps
from datetime import datetime
# import webbrowser  # To open the map in a browser

# csv_path = 'GPS_calculations_Stations_Coordinates.csv'
# api_key = 'AIzaSyA_ZSQQ7qESG6TPvKviBf0XUIlIcGd84I4'



def get_current_datetime():
    return datetime.now().strftime("%Y-%m-%d %H:%M:%S")


def fetch_road_data_from_google(start_coords, end_coords, gmaps):
    """
    Use Google Maps API to fetch road segment data, including distance, speed, and traffic conditions.
    """
    # traffic_model='best_guess' to get real-time traffic data
    road_info = gmaps.directions(start_coords, end_coords, mode="driving", departure_time="now", traffic_model='best_guess')
    if road_info:
        leg = road_info[0]['legs'][0]
        distance = leg['distance']['value']  # in meters
        duration = leg['duration_in_traffic']['value']  # in seconds
        # Get Google Maps directions URL
        directions_url = f"https://www.google.com/maps/dir/?api=1&origin={start_coords[0]},{start_coords[1]}&destination={end_coords[0]},{end_coords[1]}&travelmode=driving"
        return distance, duration, directions_url
    return None, None, None


def create_graph_from_google_data(stations_df, lat, lon, gmaps):
    """
    Create a directed graph using the station coordinates and Google Maps road data.
    """
    G_combined = nx.DiGraph()  # Graph for combined weight

    # Add the incident node to the graph
    G_combined.add_node('incident')  # This ensures the 'incident' node exists in the graph

    directions_urls = {}  # Dictionary to store directions URLs
```

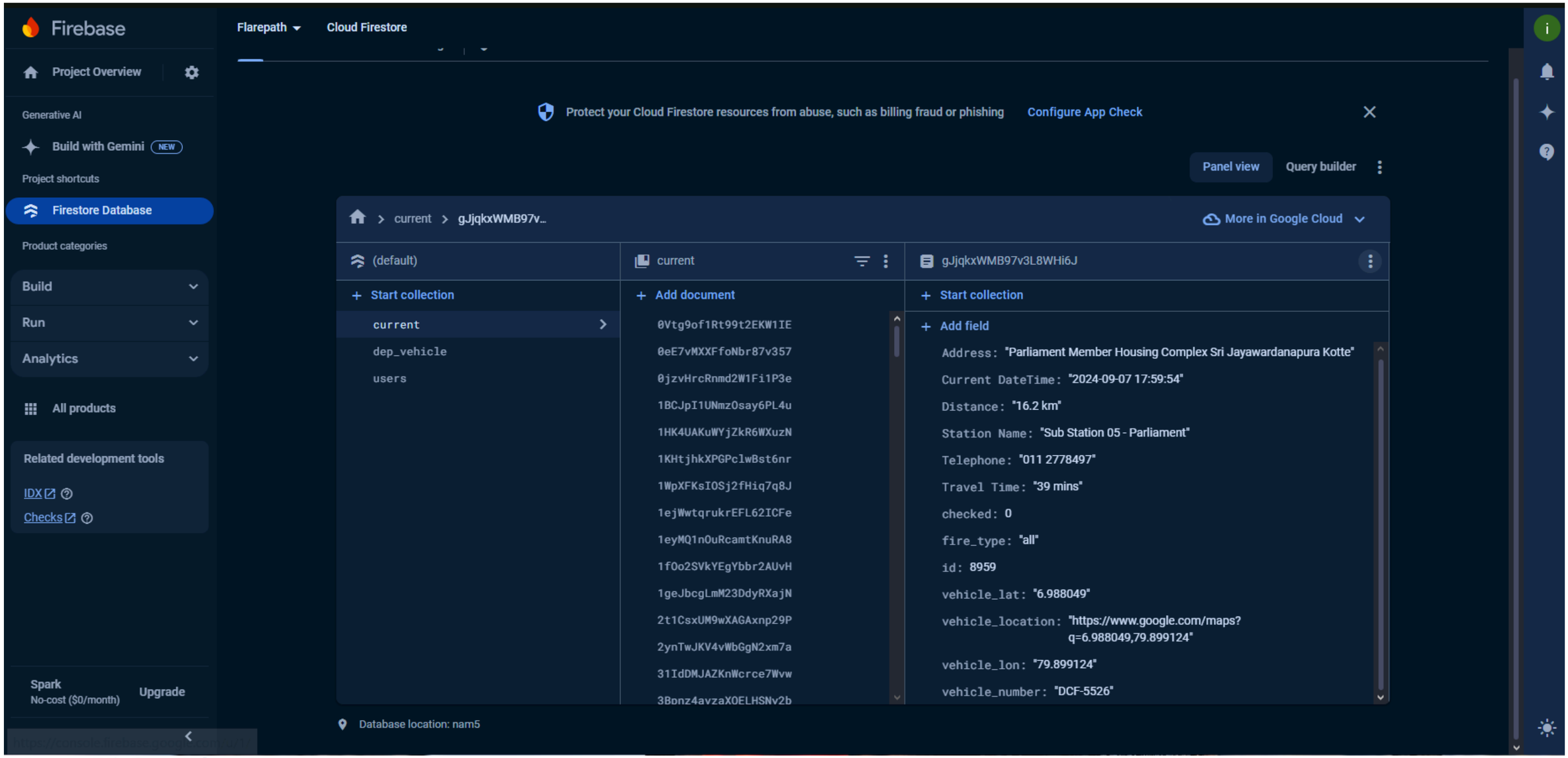
Implementation

Nearest Fire sub station Output

```
PS C:\Users\ACER NITRO\Desktop\Station\Backend> python GPS_calculations_main.py
Station: Head Quarters - Maradana, Distance: 2185m, Duration: 354s
Combined Weight for Head Quarters - Maradana: 1635.7
Station: Sub Station 01 - Hettiyawaththa, Distance: 4643m, Duration: 692s
Combined Weight for Sub Station 01 - Hettiyawaththa: 3457.7
Station: Sub Station 02 - Gaspaha, Distance: 3089m, Duration: 469s
Combined Weight for Sub Station 02 - Gaspaha: 2302.9999999999995
Station: Sub Station 03 - Wellawaththa, Distance: 8075m, Duration: 1045s
Combined Weight for Sub Station 03 - Wellawaththa: 5966.0
Station: Sub Station 04 - Pettah, Distance: 5535m, Duration: 776s
Combined Weight for Sub Station 04 - Pettah: 4107.299999999999
Station: Sub Station 05 - Parliament, Distance: 12925m, Duration: 1494s
Combined Weight for Sub Station 05 - Parliament: 9495.7

Shortest path by combined weight (in order):
Station: Head Quarters - Maradana, Combined Weight: 1635.7
Station: Sub Station 01 - Hettiyawaththa, Combined Weight: 3457.7
Station: Sub Station 02 - Gaspaha, Combined Weight: 2302.9999999999995
Station: Sub Station 03 - Wellawaththa, Combined Weight: 5966.0
Station: Sub Station 04 - Pettah, Combined Weight: 4107.299999999999
Station: Sub Station 05 - Parliament, Combined Weight: 9495.7

Nearest Station Info: {'Station_Name': 'Head Quarters - Maradana', 'Distance': 2185, 'Travel_Time': 354, 'Address': 'T.B. Jaya Mawatha, Colombo 10', 'Telephone': '011-4222222', '
Current_DateTime': '2024-09-08 21:19:04'}
PS C:\Users\ACER NITRO\Desktop\Station\Backend>
```

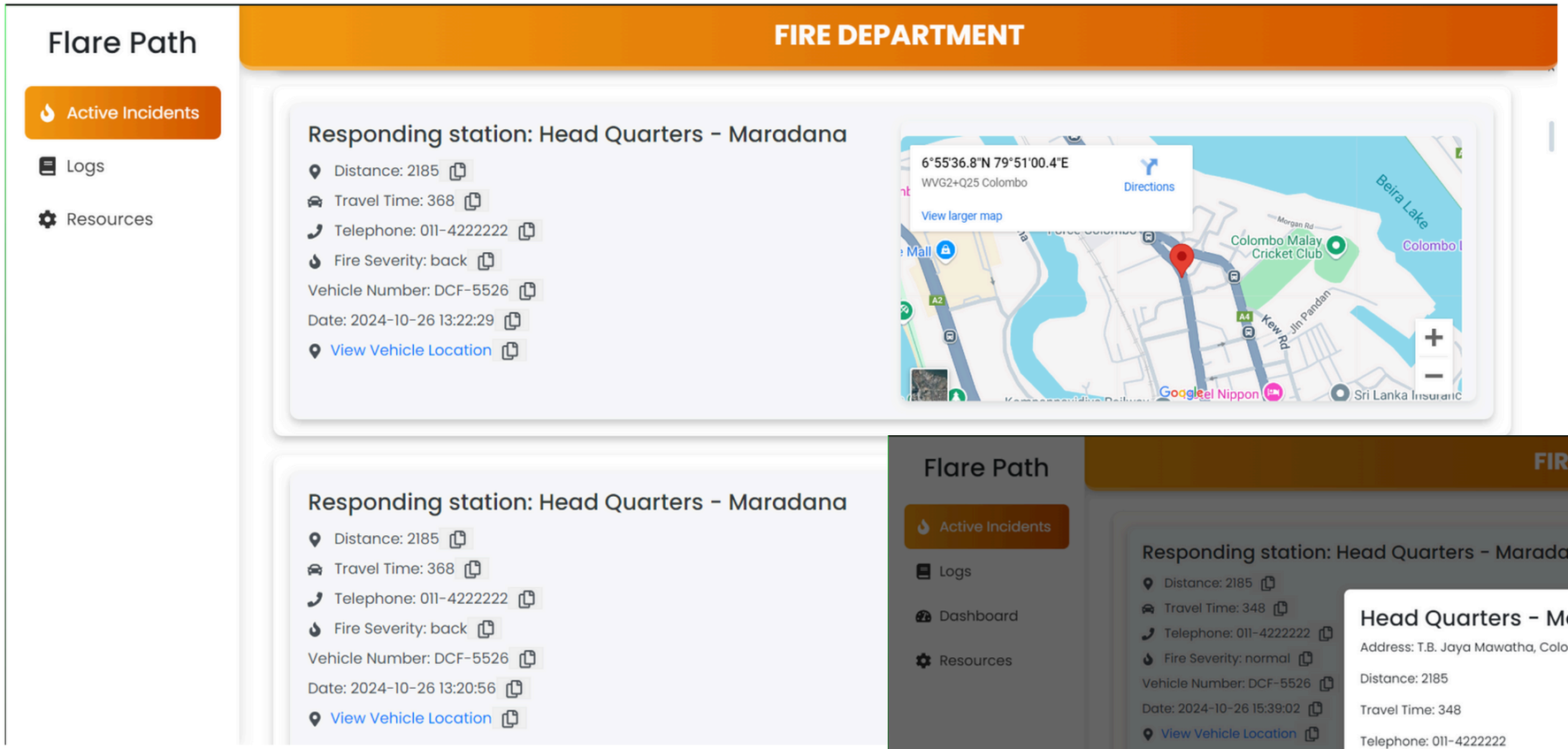
Implementation

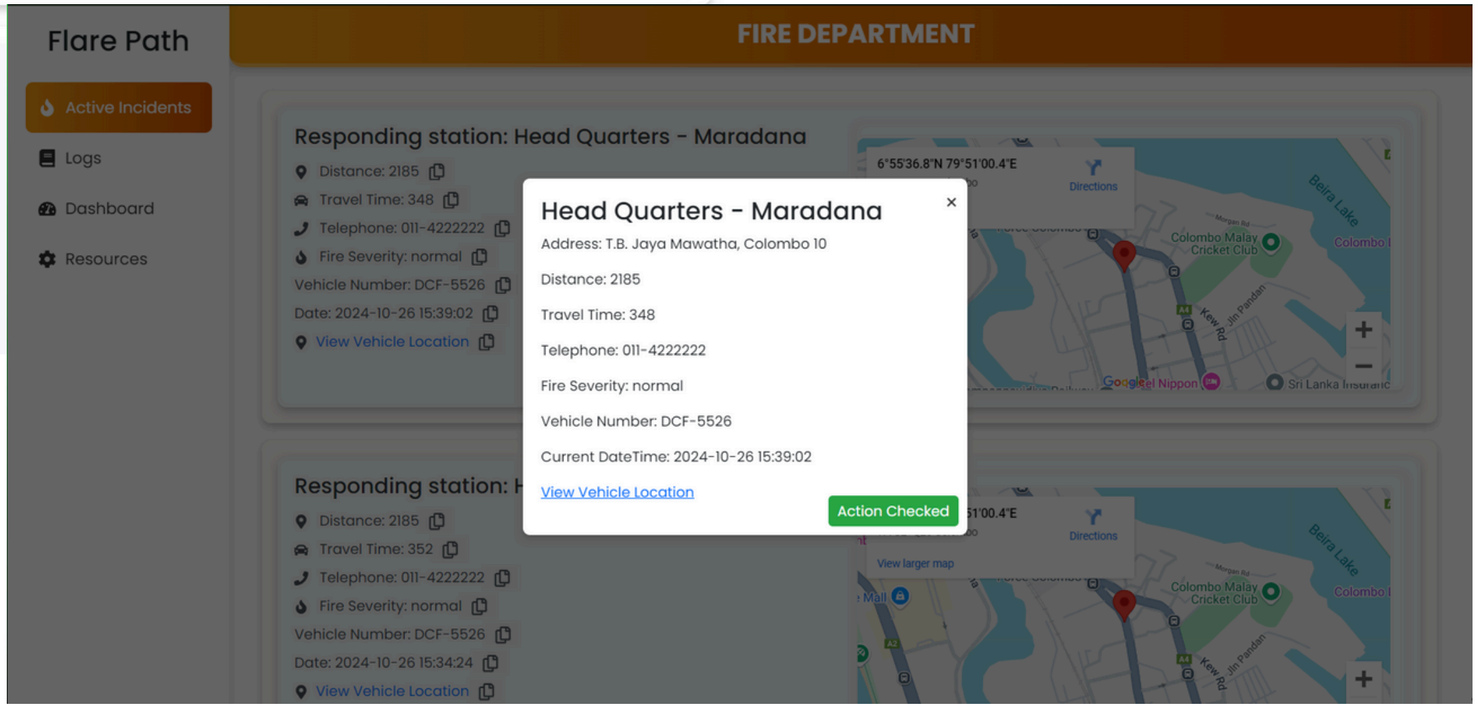
Firebase (Firestore Database)



Implementation

Dashboard for Fire Department





Tools and Technologies

Software Technologies

- Python
- Pandas , NumPy
- Flask
- Firebase
- networkx
- NodeJS
- React Native

Requirement Analysis

Functional Requirements

- Detect the location of a vehicle on fire and transmit this data
- Identify and notify the nearest fire department about the incident, including sending detailed information about the location and severity of the fire.
- Display the available emergency resources, including fire trucks and their operational status.
- Provide real-time updates to vehicle owners about the proximity and availability of fire extinguishers and other emergency resources.
- Ensure system compatibility with emergency dispatch protocols.

Non-Functional Requirements

- Interfaces should be User-friendly
- Application should be reliable
- Application should be able to give fast results

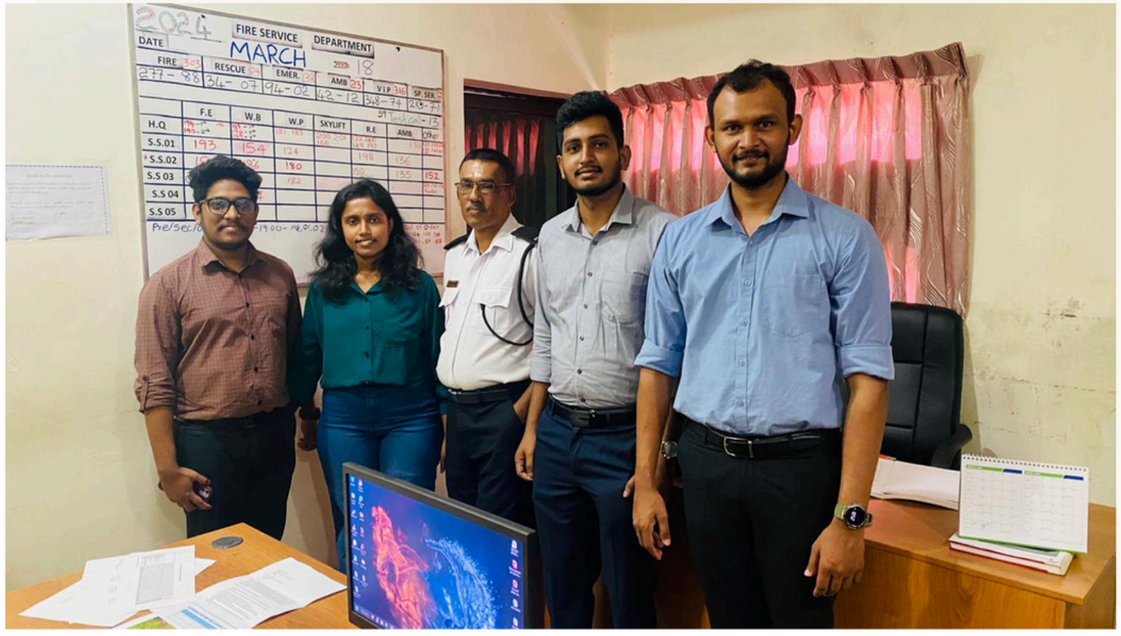
References

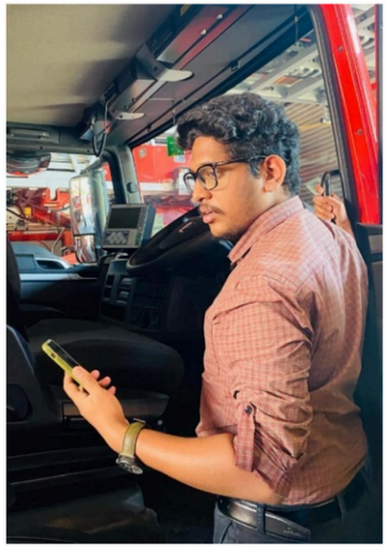
[1] J. Zhang et al., “Vehicle routing in urban areas based on the Oil Consumption Weight -Dijkstra algorithm,” IET Intelligent Transport Systems, vol. 10, no. 7, pp. 495–502, Sep. 2016, doi: 10.1049/iet-its.2015.0168.

[2] A. Candra, M. A. Budiman, and K. Hartanto, “Dijkstra’s and A-Star in Finding the Shortest Path: a Tutorial,” 2020 International Conference on Data Science, Artificial Intelligence, and Business Analytics (DATABIA), Jul. 2020, Published, doi: 10.1109/databia50434.2020.9190342.

[3] D. Fan and P. Shi, “Improvement of Dijkstra’s algorithm and its application in route planning,” 2010 Seventh International Conference on Fuzzy Systems and Knowledge Discovery, Aug. 2010, Published, doi: 10.1109/fskd.2010.5569452.

SNAPS FROM THE FIELD VISITS





SNAPS FROM THE FIELD VISITS

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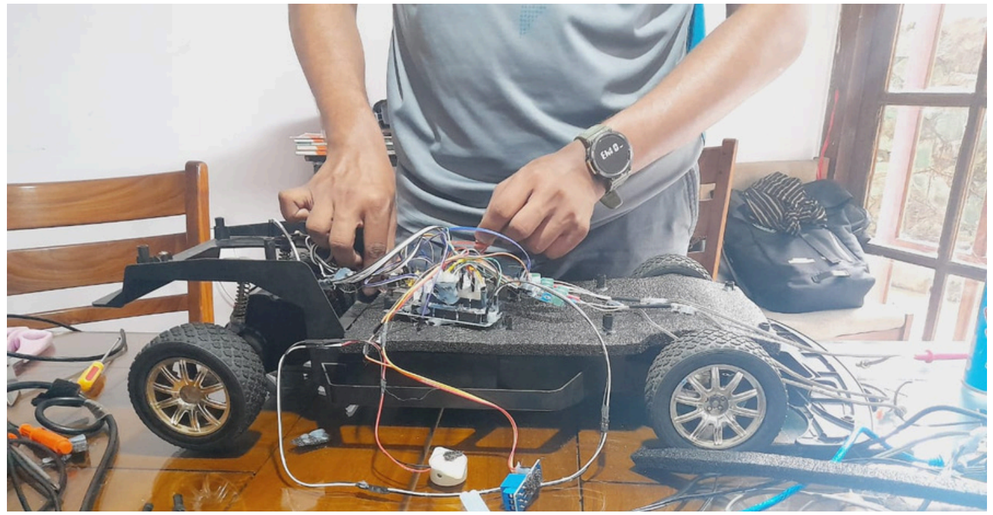
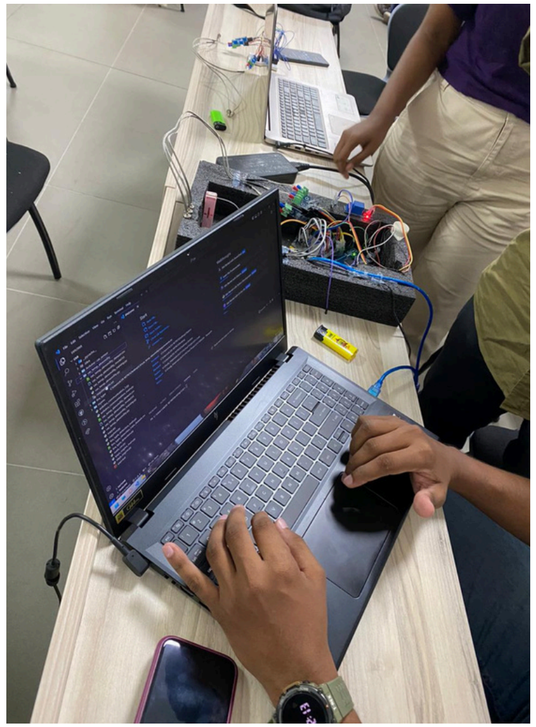
28





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Commercialization

- Collaborate with automobile manufacturers to install the system directly into new vehicles.

- Utilize collected data on fire events and responses to provide consultancy services to automobile manufacturers, assisting them in designing safer vehicles.

Poster Design

Advanced Vehicle Fire Safety and Monitoring with Rapid Emergency Dispatch Solutions

Embodies the pinnacle of innovation in vehicle safety, transforming advanced monitoring technology into life-saving solutions. With our cutting-edge approach, we not only detect potential hazards but also ensure swift emergency dispatch, setting new standards in vehicle fire safety and response effectiveness.

DHARMAGUNAWARDANA W.M.P.I
Faculty of Computing, SLIIT
Malabe, Sri Lanka
it21132346@my.sliit.lk

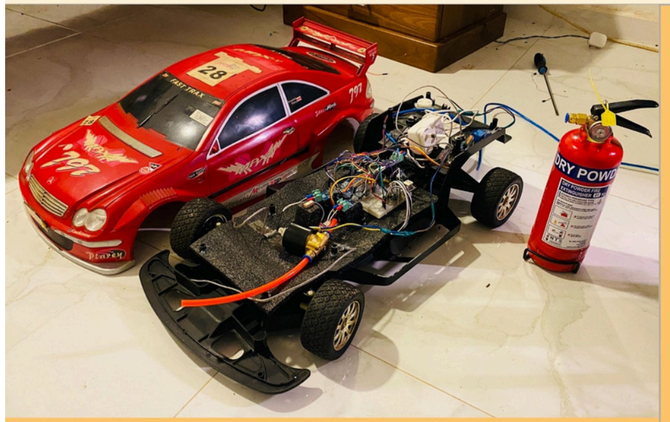
ANTHICK G.N
Faculty of Computing, SLIIT
Malabe, Sri Lanka
it21096266@my.sliit.lk

ABEYWARDHANA D.N
Faculty of Computing, SLIIT
Malabe, Sri Lanka
it21133718@my.sliit.lk

PERAMUNAGE A.N
Faculty of Computing, SLIIT
Malabe, Sri Lanka
it21080562@my.sliit.lk

NELUM CHATHURANGA AMARASENA
Faculty of Computing, SLIIT
Malabe, Sri Lanka
nelum.a@sliit.lk

DEEMANTHA SIRIWARDANA
Faculty of Computing, SLIIT
Malabe, Sri Lanka
deemantha.s@sliit.lk



01. Introduction

Vehicle fires, often caused by mechanical failures or accidents, present serious risks to occupants and the environment. Current fire detection systems are reactive, alerting only after a fire has started, which delays responses. This research develops a proactive solution using IoT and Machine Learning (ML) to detect, classify, and mitigate vehicle fire hazards in real-time, while improving emergency response efficiency.

02. Research Problem

Lack of proactive vehicle fire detection and slow emergency dispatch response.

Objectives

- Develop IoT-based fire safety systems with real-time sensors.
- Improve emergency dispatch times using cloud computing and optimized routing algorithms.
- Classify fire severity with machine learning algorithms.
- Implement automatic fire suppression systems within vehicles

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03. Methodology

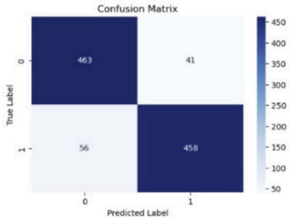
- **IoT Sensors:**
  - Temperature, Smoke, Gas, and Flame detectors.
  - Real-time data transmission to the cloud.
- **Machine Learning Models:**
  - Algorithms: CNN, RNN, and SVM.
  - Fire Severity Classification: Minor, Moderate, Severe.
  - Training and Testing: 70:30 split for model training, real-time classification accuracy of 90%.
- **Cloud System:**
- **Emergency response information is transmitted using real-time and historical traffic data to optimize routes.**
- **Automatic Fire Suppression:**
- **Activated upon detection of severe fire conditions.**

04. Results/Findings

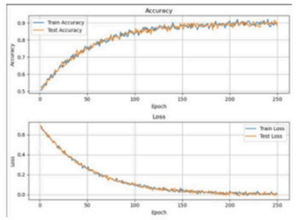
- The system achieved notable success in terms of overall accuracy and response times. The Convolutional Neural Network (CNN) model demonstrated the highest accuracy at 90%, while both the Support Vector Machine (SVM) and Recurrent Neural Network (RNN) models achieved 81.5% accuracy in detecting and classifying vehicle fire incidents. The response time from the moment a fire is detected to the generation of an alert was impressively quick, averaging less than 2 seconds, ensuring timely notifications to both vehicle occupants and emergency responders. Additionally, the use of optimized emergency routes, which accounted for real-time and historical traffic data, resulted in a 20% reduction in travel time for emergency response vehicles, significantly enhancing the overall efficiency of fire incident interventions. This improvement in both detection accuracy and response times is crucial for minimizing fire damage and increasing the chances of vehicle occupant safety.

05. Analysis

The accuracy and loss graphs in the analysis represent the performance of the machine learning models trained for fire incident detection and classification. The accuracy graph shows that both training and test accuracy gradually improve over time, stabilizing around 90% after 250 epochs, indicating strong predictive performance. The loss graph reveals a consistent reduction in both training and test loss, reflecting the model's decreasing error rate as training progresses. These results suggest that the model is well-optimized and generalizes effectively, with minimal overfitting observed between the training and test sets



Accuracy increases, loss decreases-model performance improves over epochs.



The system maintained a low rate of false positives (1.5%) and false negatives (0.5%), ensuring that alerts are reliable and actionable.

06. Conclusion

In conclusion, the research demonstrates a comprehensive approach to vehicle fire safety through the integration of IoT, machine learning, and real-time data processing. The system achieved high accuracy in detecting fire incidents and classifying their severity, with a 90% accuracy rate and minimal false positives and negatives. The optimized emergency response system reduced travel times by 20%, significantly enhancing the efficiency of fire incident interventions. This solution represents a significant advancement in proactive vehicle fire detection, severity classification, and emergency dispatch, ultimately improving safety and response times.

Research Paper Acceptance

Acceptance Notification - ICAC 2024 External Inbox ×

Microsoft CMT <email@msr-cmt.org> Thu, Oct 17, 1:00 PM (6 days ago)

to me

Dear Glen Nitish Anthick,

Congratulations! We are pleased to inform you that your paper has been accepted to be presented at the 6th International Conference on Advancements in Computing 2024.

Paper ID: 291
Paper Title: FlarePath: Advanced Vehicle Fire Safety and Monitoring with Rapid Emergency Dispatch Solutions

Please visit https://cmt3.research.microsoft.com/6ICAC2024/Submission/Index to view the reviews given during the double-blind review process.

When preparing the camera-ready version of your paper, please address all the review comments and follow the camera-ready guidelines given in the https://icac.lk/for-authors

Please note that the camera-ready deadline is 5th of November 2024 and camera-ready submission portal on CMT will be available starting from 20th October 2024.

Camera-ready Submission Guidelines for Authors:
(also available at https://icac.lk/for-authors)
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1. Check the reviewers' comments for your paper through the Microsoft CMT system. The authors are expected to address all reviewer comments and change the paper accordingly.
(Note: You are not allowed to make major structural changes to the accepted paper).
2. The paper must comply with IEEE format in order to be published in IEEE Xplore. Authors can get the IEEE templates and instructions from https://www.ieee.org/conferences/publishing/templates.html
3. The title, author names, and affiliations must be in the correct format.

Research Paper Acceptance

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View Reviews

Paper ID	291
Paper Title	FlarePath: Advanced Vehicle Fire Safety and Monitoring with Rapid Emergency Dispatch Solutions
Track Name	Autonomous Intelligent Machines & Systems

Reviewer #1

Questions

2. FORMAT - How well does the paper comply with IEEE paper formatting guidelines?
Good

3. RELEVANCE - Manuscript content is relevant to the conference themes
Good

4. READABILITY - Manuscript content is well-structured and well organized using the correct use of language.
Good

5. LITERATURE - The literature review is comprehensive and highlights the research gap.
Good

6. NOVELTY - The manuscript presented is of acceptable novelty.
Good

7. METHODOLOGY - The methodology employed for the study is appropriate and well explained.
Good

8. RESULTS - The results are clearly presented, and the discussion is well-articulated while meeting the original objectives stated in the manuscript.
Good

9. CONTRIBUTIONS - The manuscript demonstrates adequate scientific contribution and sufficient technical depth and contributes considerably to the theory and/or practice.
Good

10. REFERENCES - The manuscript contains citations/ references to adequate, up-to-date, reputed scientific sources and the underpinning background is well supported by using timely and credible references.
Good

11. REVIEW COMMENT: Please include a detailed evaluation of the manuscript
All the tables should NOT be inserted as figures. Some sub heading are bolded, which is not aligned with IEEE guidelines Please follow the correct table captions. Citations should be inserted before the end of a sentence.

Reviewer #3

Questions

2. FORMAT - How well does the paper comply with IEEE paper formatting guidelines?
Average

3. RELEVANCE - Manuscript content is relevant to the conference themes
Average

4. READABILITY - Manuscript content is well-structured and well organized using the correct use of language.
Average

5. LITERATURE - The literature review is comprehensive and highlights the research gap.
Average

6. NOVELTY - The manuscript presented is of acceptable novelty.
Average

7. METHODOLOGY - The methodology employed for the study is appropriate and well explained.
Average

8. RESULTS - The results are clearly presented, and the discussion is well-articulated while meeting the original objectives stated in the manuscript.
Average

9. CONTRIBUTIONS - The manuscript demonstrates adequate scientific contribution and sufficient technical depth and contributes considerably to the theory and/or practice.
Average

10. REFERENCES - The manuscript contains citations/ references to adequate, up-to-date, reputed scientific sources and the underpinning background is well supported by using timely and credible references.
Average

11. REVIEW COMMENT: Please include a detailed evaluation of the manuscript
Its not index terms. it need to change as Keywords. and max number of keywords allowed is 5. So, add the main relevant keywords only.

The line spacing between the paragraphs not set according to the IEEE paper guidelines. Carefully read the IEEE paper template and do the correct formatting.

wrong citation, the citation needs to add before the .

better to add a system diagram when explaining the methodology.

Its unnecessary to add UI prototype to the research paper.

Table caption need to set above the table and please check the numbering.

Research Paper Acceptance

Decision on Abstract Submission to BCAS ICMR 2024 External Inbox ×

BCAS Conference - iCMR <conference@bcas.ac> Mon, Oct 7, 12:19 PM

to

Dear Sir/Madam,

Thank you for submitting your manuscript to BCAS ICMR 2024.

After careful evaluation, we are pleased to inform you that your manuscript ID:053 titled '**FlarePath: Advanced Vehicle Fire Safety and Monitoring with Rapid Emergency Dispatch Solutions**', has been **accepted with minor modifications**. The review comments are attached.

Please upload the below 02 documents to your previous submission in CMT without removing any of the previously submitted attachments on or before 31st October 2024.

1. Modified abstract with author names and affiliations (Document should be renamed as 'Camera-ready Paper')
2. Extended-abstract (Template can be downloaded at https://conference.bcas.ac/)

Both submissions should be in word format. Do not upload pdf files.

For any further clarifications, please contact conference secretary on +94765204507.

Research Paper Acceptance

Notification of abstract acceptance for 11th International Conference on Combustion, Incineration/Pyrolysis, Emission and Climate Change

External Inbox ×

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to me

Dear Authors (Submission ID: 32)

Thank you for submitting to 11th International Conference on Combustion, Incineration/Pyrolysis, Emission and Climate Change. We are delighted to inform you that your abstract entitled FlarePath: Advanced Vehicle Fire Safety and Monitoring with Rapid Emergency Dispatch Solutions has been accepted. Please submit the full paper in the author's console by clicking edit submission and uploading your full paper in the following link: https://cmt3.research.microsoft.com/iCIPEC2024/Submission/Index.

The due date for the full paper submission: 31 October 2024
For further inquiries, please visit https://mech.utm.my/icipec/.
Thank you.

Kind regards,
ICIPEC 2024 committee

Thank You !