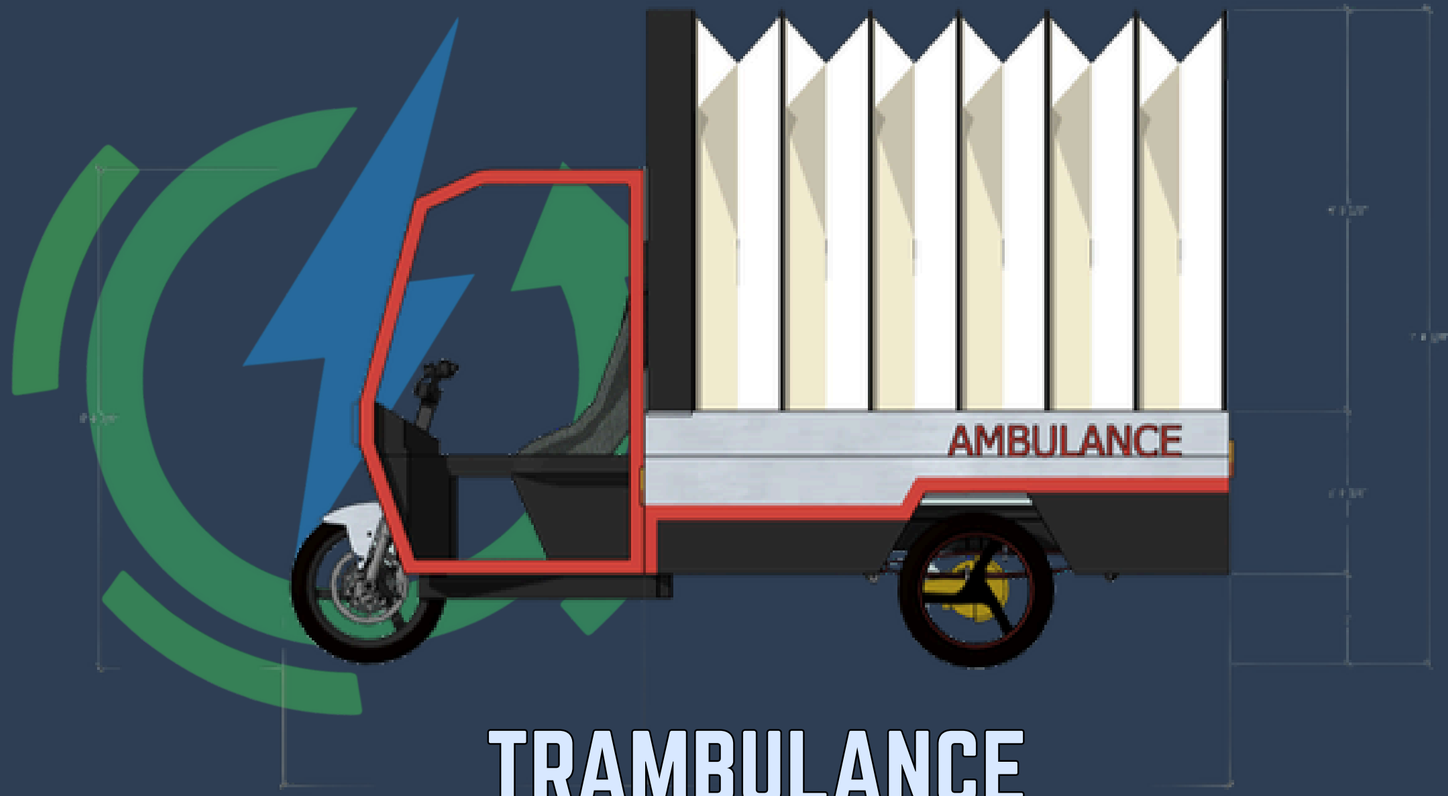


TRAMBULANCE

Rownak Shahriar Ruhan

L-4, T-2 Student

Department of Mechanical Engineering

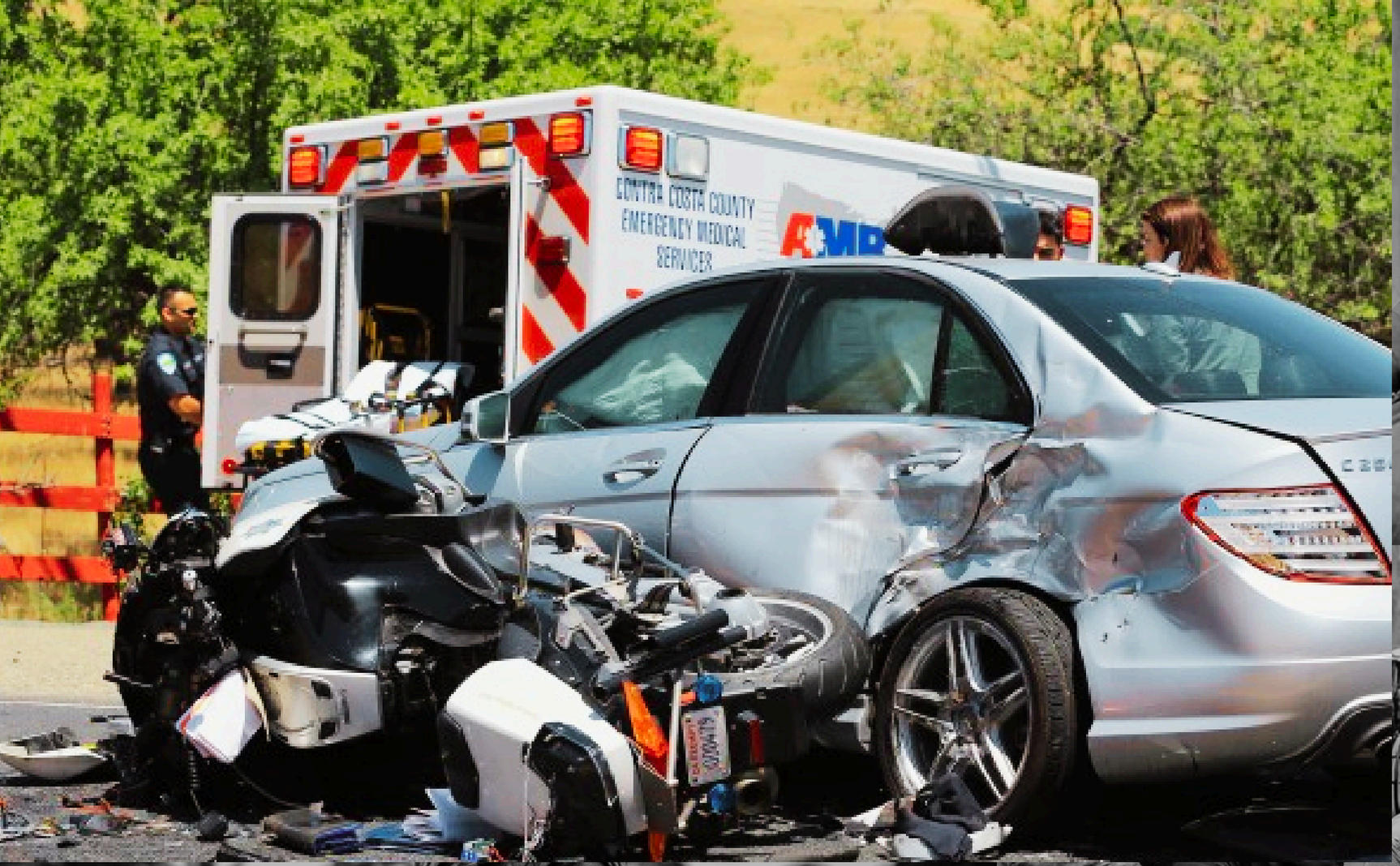
Bangladesh University of Engineering and Technology (BUET)

Problem
STATEMENT

Puran Dhaka

Ambulance cannot reach Patient—due to over traffic it's unable to **maneuver** through the **congested, narrow roads** of Overpopulated Cities like Dhaka.

Ambulances are very scarce in rural area outside of Capital. Again the **cost is unbearably high**. On top of that, it will take a long and difficult journey to reach you, **crossing the muddy rural roads** of Bangladesh.



AI GEN.

5 Problems of the Traditional Ambulance System in LMICs

- Incoordination
- High Cost
- Vehicle size
- Limited Accessibility
- Inexpert EMP

TRAMBULANCE

An Affordable Tri-Wheeled Battery-Powered Ambulance for LMICs

for both patient transport and emergency medical cargo.

Availabile and fast response

Sustainable Design

Affordable

INCOORDINATED
EMERGENCY TRANSPORT SYSTEM

Current challenges

Fragmented Contacts
Too many hospital-based ambulance calling number; lack of a coordination.

No real time data
999 has not updated data and real time location of ambulance.

Concentrated Docking Hub
Hospital-based parking keeps ambulances leaving long round trips.

COORDINATED EMERGENCY TRANSPORT SYSTEM

Dhaka has 87 hospitals, 270 ambulances [1]

Current Solution

Hospital based Outpost

Normal Hospital Parking based Ambulance response time

Overnight- 38 min
Weekend- 45 min
Rush Hour- 85 min [1]

Proposed Solution

Decentralized Outposts

Emergency response time after establishing outposts at strategic locations

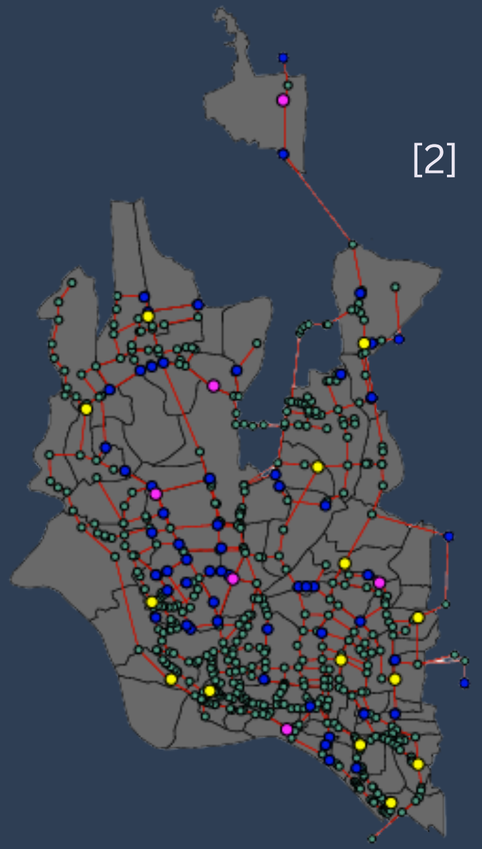
Overnight- 24.1 min
Weekend- 33.3 min
Rush Hour- 47.2 min [1]

(1) Razzak, J. A.; Kellermann, A. L. Emergency Medical Care in Developing Countries: Is It Worthwhile? Policy Pract.

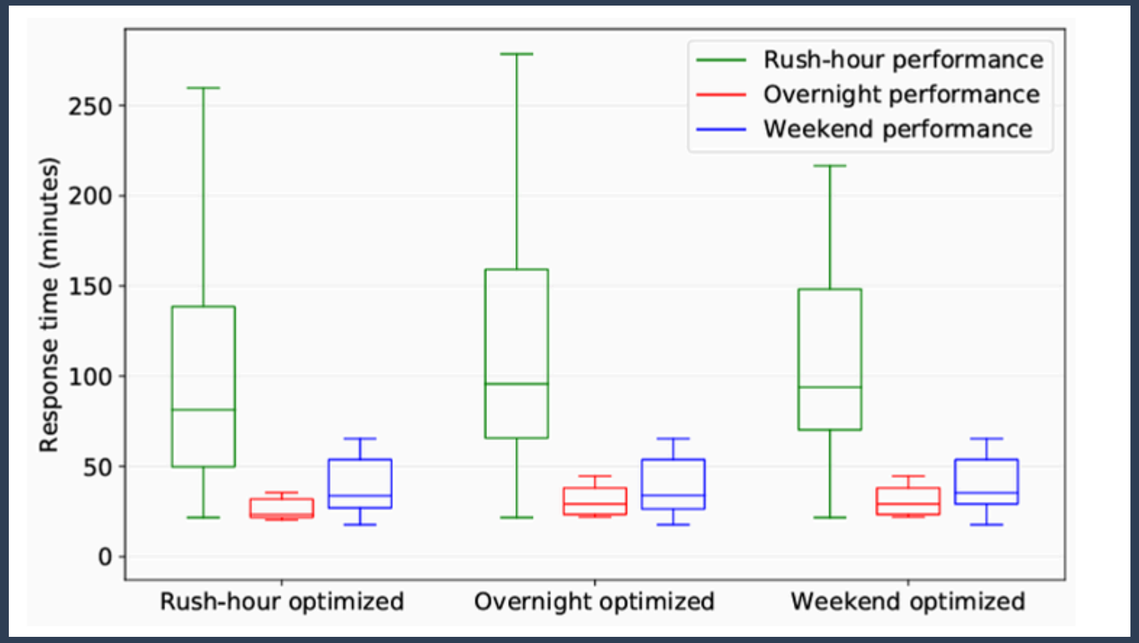
This shows-

significant improvements

44%
IMPROVED
ROAD ACCESS



[2]



[2] Plugging into green growth: Towards e-mobility and renewable energy by James Dixon, Zhaoqi Zhou, Sounthisack Phommachanh

COORDINATED
EMERGENCY TRANSPORT SYSTEM

Proposed Solution

GPS App based Coordination

Real time live location of Near-by Trambulance and Driver Details and contact Info

Centralized Cost Transparency

COORDINATED
EMERGENCY TRANSPORT SYSTEM

flare [3] OLA

Like **India's Ola Emergency** Ambulance,
Kenya's Flare app

Uber pathao

Integrated with Trambulance Emergecncy app and
Uber, Pathao

Route Optimization on the basis of Machine Learning and AI

HIGH COST

MANUFACTURING COST

ICU-equipped ambulance (Toyota Hiace) costs

৳4–5 million

Imported, fully equipped ICU ambulances

৳7–8 million

Locally modified vans (stretcher + oxygen cylinder)

৳2-3 million

HIGH COST

OPERATIONAL COST

Basic ambulance ride:
৳2,000–৳5,000

ICU/CCU ambulances:
৳8,000–৳15,000

Dhaka to remote districts:
৳15,000–৳25,000

Trambulance’s Affordability & Cost-Effectiveness

Manufacturing Cost

Price-0.25 million BDT

30 Trambulances = 1 Hi-Ace Ambulance

Trambulance’s Affordability & Cost-Effectiveness

Only 10% of Total Cost

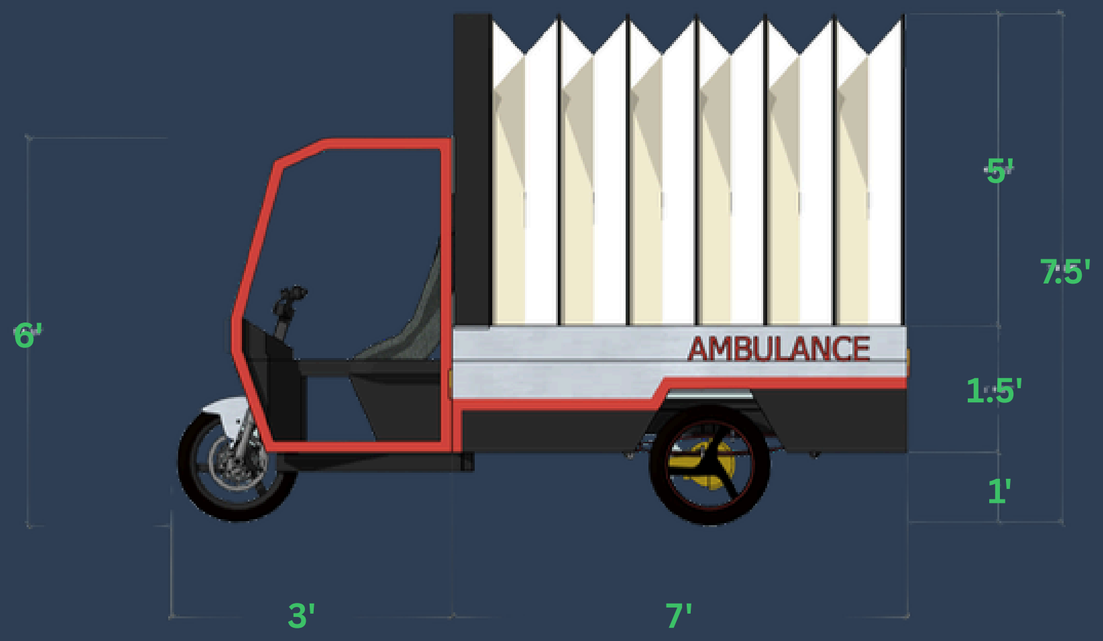
Operating Cost

Fuel/Energy
IC engine Ambulance 5–7 km/litre Petrol
→ BDT 15–20/km

Trambulance 0.15–0.25 kWh/km
→ BDT 1.5–2/km

Annual Operating Cost (10,000 km)
IC engine Ambulance ~BDT 3-4 millions
Trambulance ~BDT 0.3-0.5 million

Vehicle Size



10' X 4'

TRAMBULANCE

28 min

20' X 6'

VAN AMBULANCE

35 min

20% Reduced Response Time

Trambulance CAD model for Manufacturing

Nimble & Agile

Speed

65 KMH

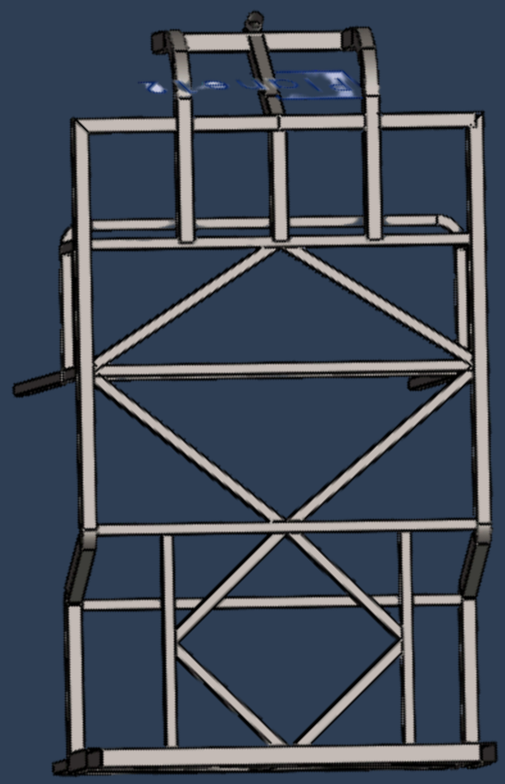
Turning Radius

2m

Mechanical Feature

Chassis and Dimension

The optimized chassis features compact dimensions for improved maneuverability in narrow lanes through SolidWorks and Ansys.

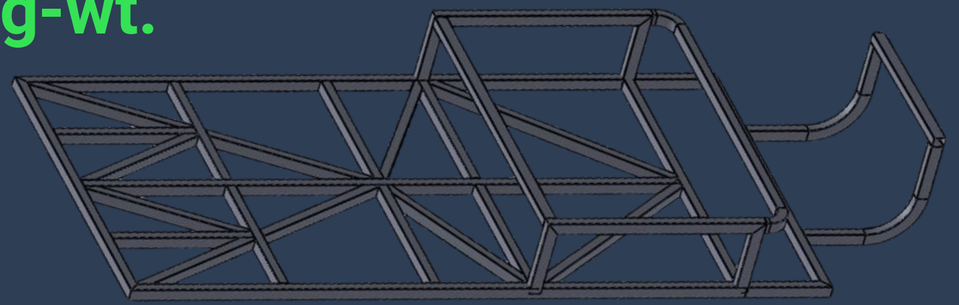


Truss Chassis

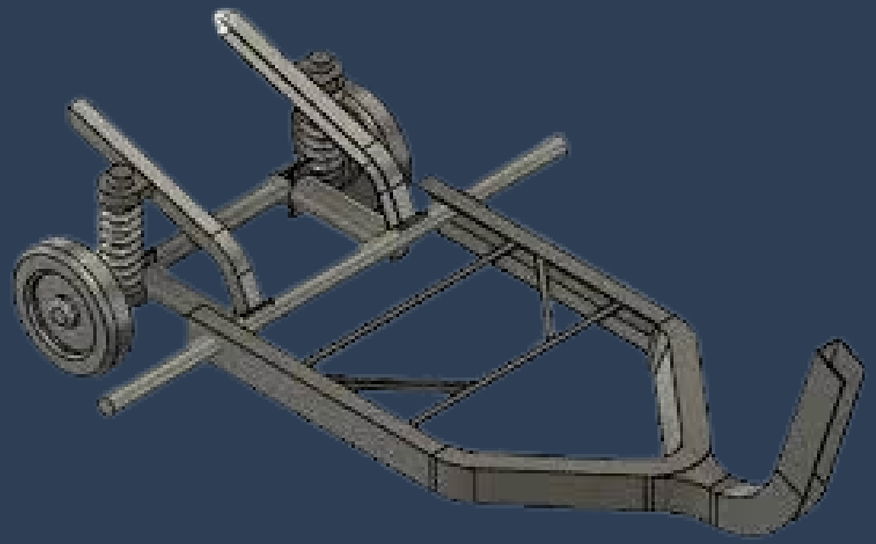
Truss structure replaces linear chassis, providing increased durability and load capacity.

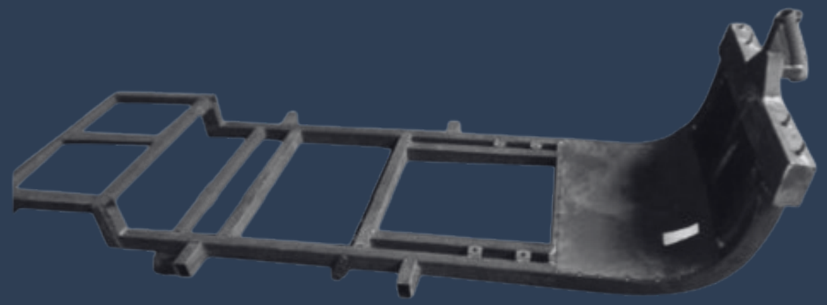
35% less weight for same weight > **Less material cost**

80% more load capacity per capacity up to **700 Kg-wt.**

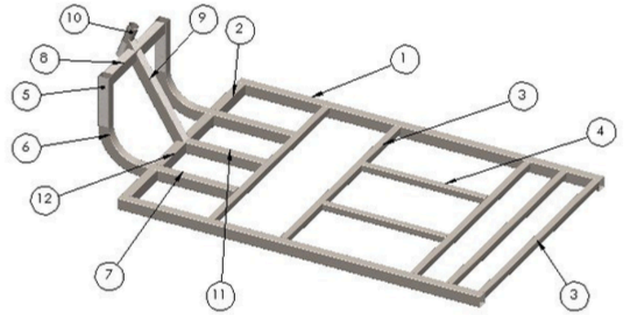


Traditional Chessis

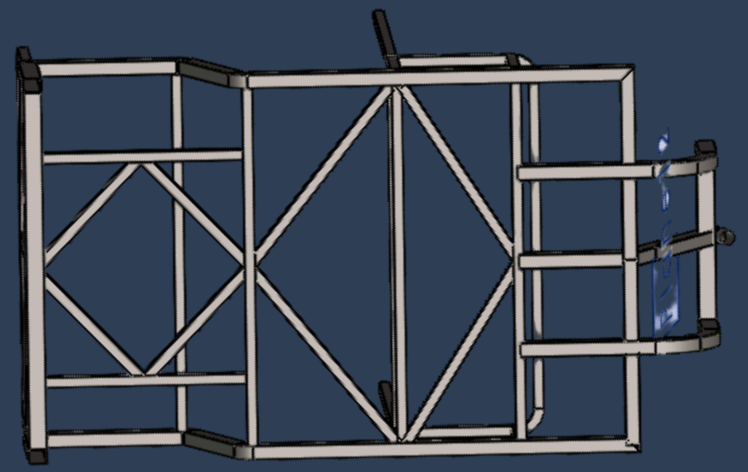




ITEM NO.	QTY.	Description	Length(m)	Mass(kg)
1	2	2.5inch x 2inch x 1.5mm square tube	2.06	5.32
2	2	2.5inch x 2inch x 1.5mm square tube	0.28	0.74
3	5	1.5inch x 1.5inch x 1.5mm square tube	1.23	2.08
4	2	1.5inch x 1.5inch x 1.5mm square tube	0.7	1.18
5	2	2.5inch x 2inch x 1.5mm square tube	0.29	0.74
6	2	2.5inch x 2inch x 1.5mm square tube	0.32	0.83
7	2	2.5inch x 2inch x 1.5mm square tube	0.54	1.40
8	1	2.5inch x 2inch x 1.5mm square tube	0.56	1.33
9	1	2.5inch x 2inch x 1.5mm square tube	0.62	1.47
10	2	2.5inch x 2inch x 1.5mm square tube	0.1	0.34
11	1	2.5inch x 2inch x 1.5mm square tube	0.44	1.13
12	1	2.5inch x 2inch x 1.5mm square tube	0.56	1.45



Our Improved Design



Electric Power Source

We chose Lithium Iron Phosphate ($LiFePO_4$) batteries over Lead-Acid and Lithium-ion batteries due to cost-effectiveness, longer lifecycle, and minimal environmental impact.

Metric	Lead acid (5×140Ah)	$LiFePO_4$ equivalent
Nominal energy	8.4 kWh	5.1 kWh
Usable energy	~4.2 kWh	~4.2 kWh
Efficiency (round-trip)	~50%	~80%
Weight	70 kg	35–40 kg
Lifespan (cycles)	300–500	3,000–5,000
Cost	~75,000 BDT	~130,000 BDT
Charging time	~9 h	~3–4 h

Mechanical Structure & Versatility

Origami Designed Hood

A foldable, origami-inspired hood built with **six 0.5-inch MS bars** and waterproof polyurethane tarpaulin enables conversion of the vehicle from ambulance to cargo van.

Cabin Accomodation

A 2.5 × 6.5 ft stretcher platform with a double-parallelogram mechanism, cabin accommodates three attendant seats, including one for a nurse and one for a paramedic caregiver.

Medical Equipments

- Oxygen Cylinder
- Emergency Medicine Box
- 3 Caregiver seating arrangements
- Convertible to Medical Cargo
- Well ventilation, Cooling fan instead of AC
- The hood reflects sunlight making the compartment cooler
- Electric Outlet for electric appliances and fridge
- Oximeter, Blood Pressure Meter

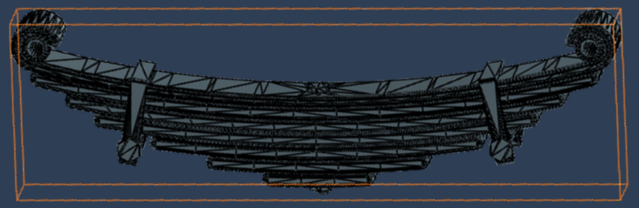
This service can also be crucial for public medical emergencies during a national crisis. For example, in **July 2024**, **Milestone tragedy**, **COVID-19 lock down.**

Suspension and Braking System

Suspension System

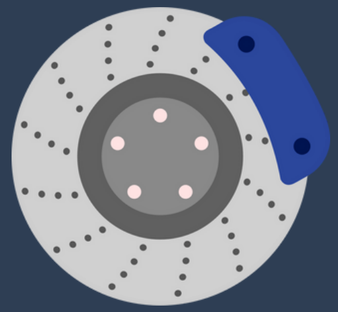
Two MacPherson strut on front wheel

Two Leaf Spring on rear wheels



Braking System

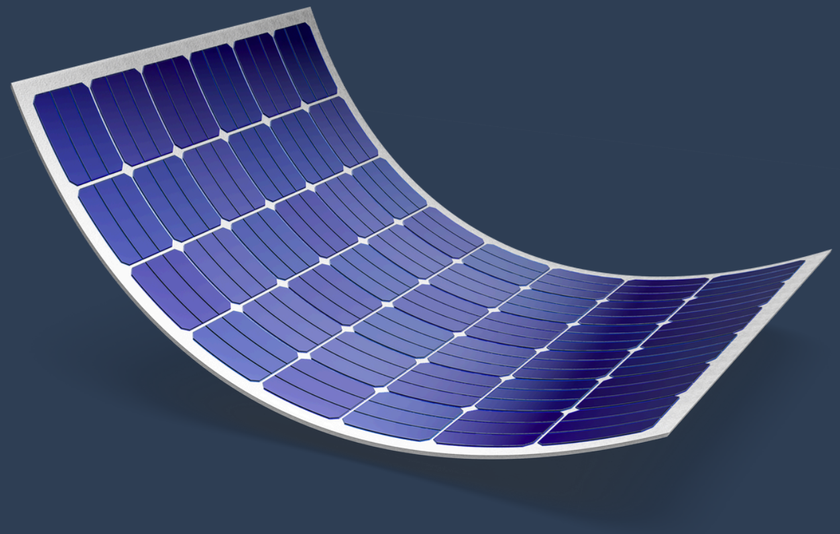
Hydraulic Disk Brake on three wheels.

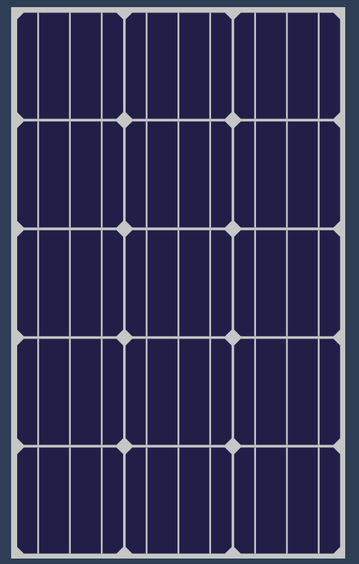


Designed and visualized in SolidWorks

Simulated and iterated in Ansys

Solar Panel Integration





2 × 150W (12 V) solar panels ~300W total; Costing 30,000 BDT extra

6 peak sun-hours/day ~1.5-2 kWh/day.
Generating 15% of total energy needed for Trambulance.
That will be used for emergency medical equipment power.

Limited Accessibility

33%

Deaths are from Time Sensitive Emergencies

1%

Population has Access to formal Ambulance Service

10%

Roads can be accessed by Van Ambulances

2.8

Per 100,000

inhabitants of Dhaka

24%

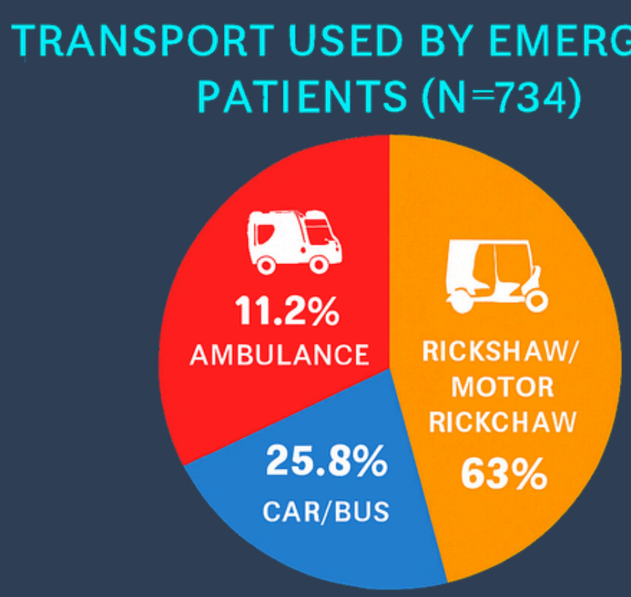
Call Requests are fulfilled rests were denied

56%

Patients reach hospital after 2 hours

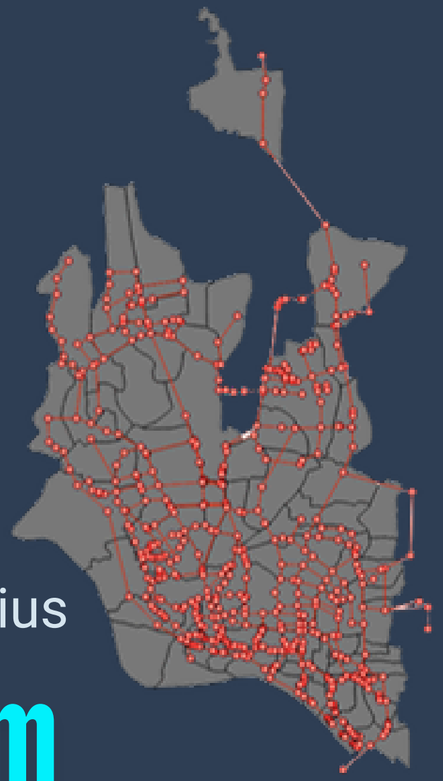
[4]

EMR (Emergency Medical Response) Access Improvement by Nimble Trambulance Fleet



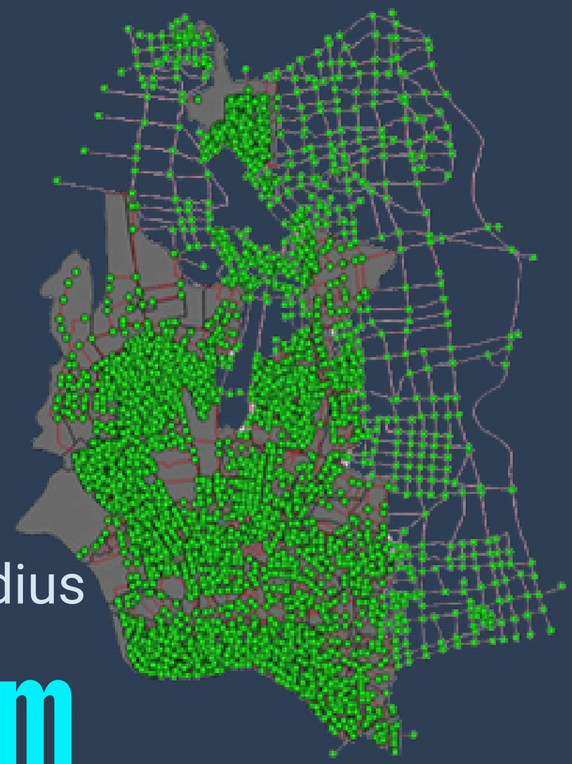
If Turning Radius

6m



If Turning Radius

2m



Lack of EMR (Emergency Medical Response)
EMP (Emergency Medical Personnel)

A 2014 study shows 14 thousand deaths revealed critical deficiencies in EMR, with **45.9% of fatalities** attributed to road traffic incidents. To minimize response delays, researchers are emphasizing the use of nimble, small vehicle fleets instead of traditional van ambulances. [4]

Lack of EMP (Emergency Medical Personnel)

25% Reduction of fatal cases

Trambulance Solution

Governments and NGOs can collaborate to establish short-term paramedic training programs for CPR, bleeding control, and oxygen administration to existing drivers.

Our Vision

A Lifeline for Bangladesh and Beyond

Affordable

Breaking the financial barrier to life-saving transportation.

Accessible

Reaching patients where traditional ambulances cannot.

Safe & Comfortable

Providing a stable, medically-equipped environment for patients.

Widely Available

Creating a scalable, data-driven national ambulance system.

TRAMBULANCE

750 KG Capacity

6 Persons

2.5 Lakh BDT

SAFE BRAKE

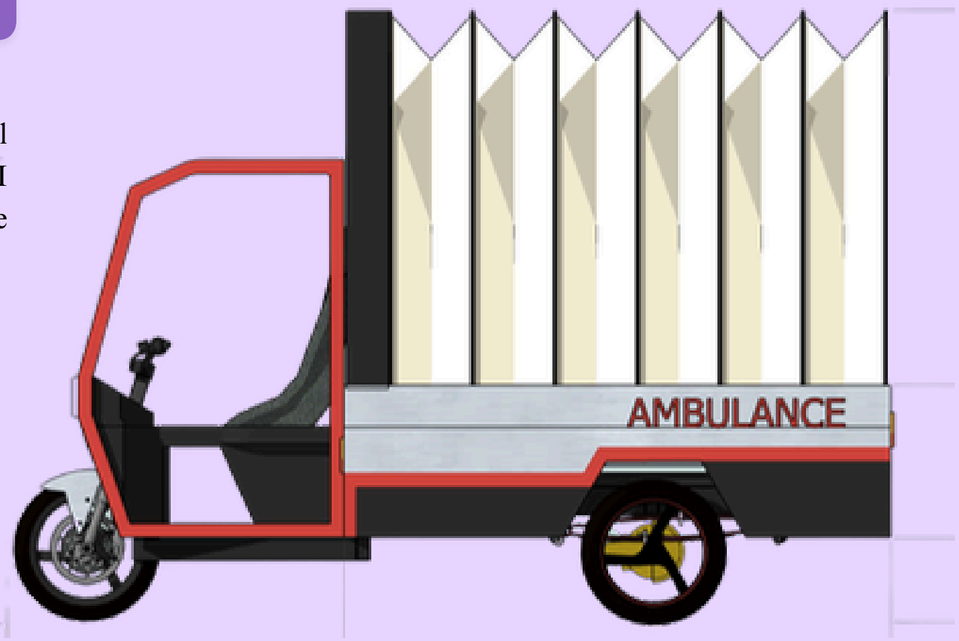
Hydraulic Disk brake and Hand Brake

OUR OWN APP & AI MAP

An Uber like app that will locate real time location and optimized route. AI based decentralized post where it can be found.

LOW COST

Government can make it accessible in Upazila Health Complex with just 10% money for van ambulance



STRONGER CHESSIS

Completely new and improved Truss Chessis and Origami hood
Build by SolidWorks, Sketchup
Simulated by Ansys

SUPERIOR SUSPENSION

Industry grade MacPherson and Leaf Spring

SPEED

65 Kmh

SKILEED TEAM

Dr. Ehsan with skill of BUET-BEPRC & 8 BUET alumni funded and directed

SOLID R&D

Trade licensed & Patent holder Start-up collaborated with Different companies.

RANGE

150 Km

References and Research Papers

(1) Razzak, J. A.; Kellermann, A. L. **Emergency Medical Care in Developing Countries:** Is It Worthwhile? Policy Pract.

(2) Meilinda F.N. Maghfiroh, Moinul Hossain & Shinya Hanaoka Minimising Emergency Response Time of Ambulances through Pre-Positioning in Dhaka City Bangladesh.

(3) Shahen, A.; Islam, R.; Ahmed, R. Challenges for Health Care Services in Bangladesh: An Overview.

(4) Tasnim, Z.; Tune, S. N. B. K.; Islam, B. Z.; Naher, N.; Ahmed, S. M. Ambulance Services for Road Traffic Injury (RTI) Victims in Bangladesh: A Cross-Sectional Study on the Ground Realities and the Way Forward. Inj. Prev. 2025, ip–2024–045302. https://doi.org/10.1136/ip-2024-045302.

(5) Boutilier, J. J.; Chan, T. C. Y. Ambulance Emergency Response Optimization in Developing Countries. Oper. Res. 2020, 68 (5), 1315–1334.

Thank You

Institution of MECHANICAL ENGINEERS

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