



MMAN4020/MMAN9002
Team 2:
TfNSW Pothole Repair

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Why do we need an automated pothole repair machine...

- Potholes have always been a bane to vehicle owners.
- They cause damage to vehicles as well as accidents.
- Current designs involve safety risk and is time consuming



Our Team.

MECHANICAL



Yuewen (Fiona)



Dhanraj

Component Engineer
Model Analyser/Verification Engineer

MECHATRONICS



Isabel (Project Manager)



Tushar

Simulation Engineer
Algorithm Engineer



Existing Designs



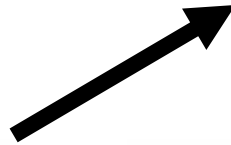
Python 5000



JCB Pothole Pro

- No automation
- No safety (airbags)
- Can't be driven on the roads normally





Sensors:

- Combination of sensors required (sensor fusion) as one sensor alone does not get the job done well.





Cleaning methods:

- **Brooming**

- A broom is spun with high speed and sweeps the debris into the dustpan
- Requires additional storage space and time for disposal

- **Blowing**

- Uses high velocity air to clean and prepare the area of defect
- Fastest method to clean a pothole and does not require additional space for debris

- **Vacuuming**

- Heavy suction is used remove fine dust and loose gravels from the ground.
- Requires more time and energy in comparison to the other two ideas.





Asphalt transfer methods:

- **Conveyor belt**

- Found in the Python 5000 machine where the asphalt is passed from the storage tank to the conveyor belt then transferred to the pothole.

- **Rubber/metal hose**

- Found in the Velocity Patching machine. By turning the valve on the hose, the machine can switch in between the options of debris removal using high velocity air and asphalt delivery.
- Nozzle needs to be controlled through manual movement.

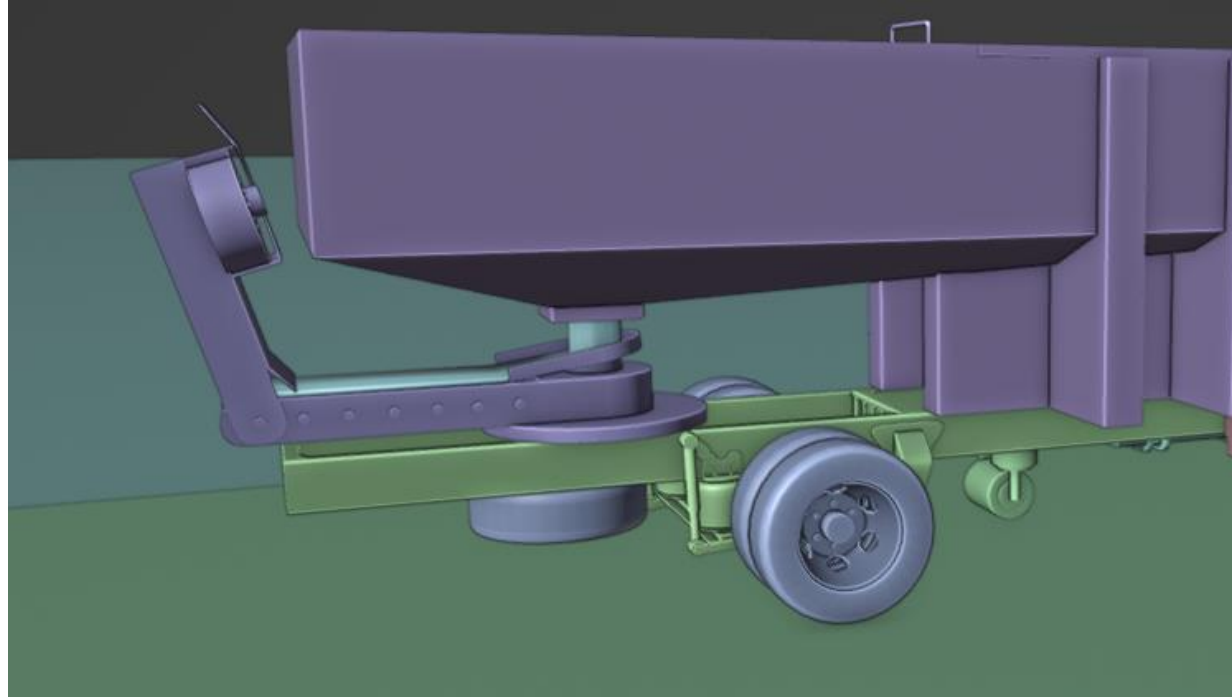




Compaction methods:

- **Roller**
 - The method uses a metal roller to roll over the newly applied asphalt surface for compaction.
- **Tamping machine**
 - Tamping machines for asphalt compression uses high pressure to compress the asphalt to the ground, so that it stays compacted within the pothole.





Methodology



The Three Main Components



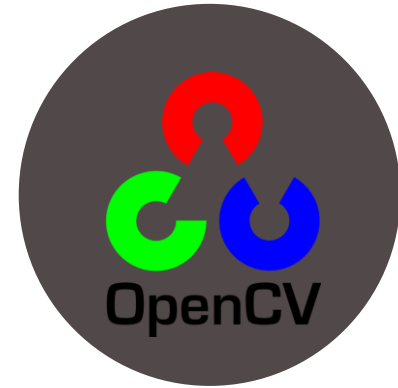
MECHANICAL DESIGN

Design of the Cad
Model using
SOLIDWORKS
including motion study



SIMULATION

Blender animation
that shows relevant
information of the
truck, pothole and
filling procedure



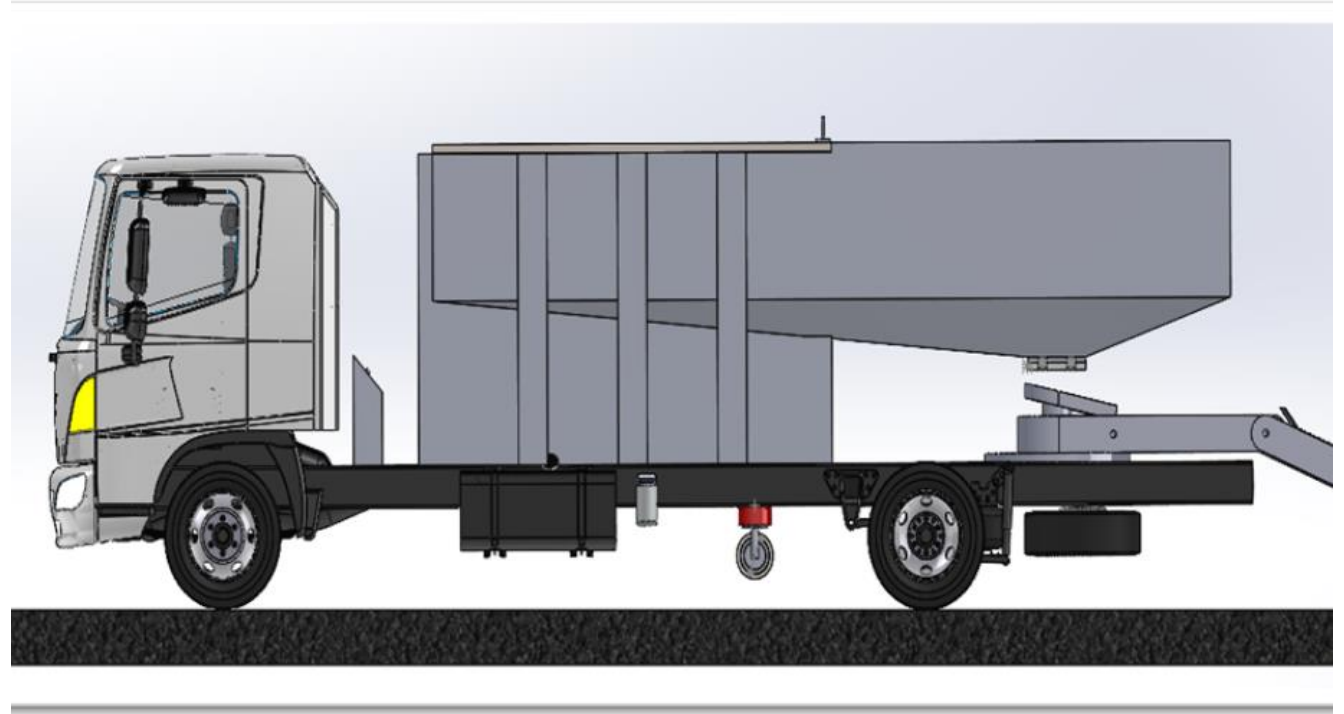
COMPUTER VISION

Using
OpenCV to
identify and
evaluate
Potholes



CAD Design

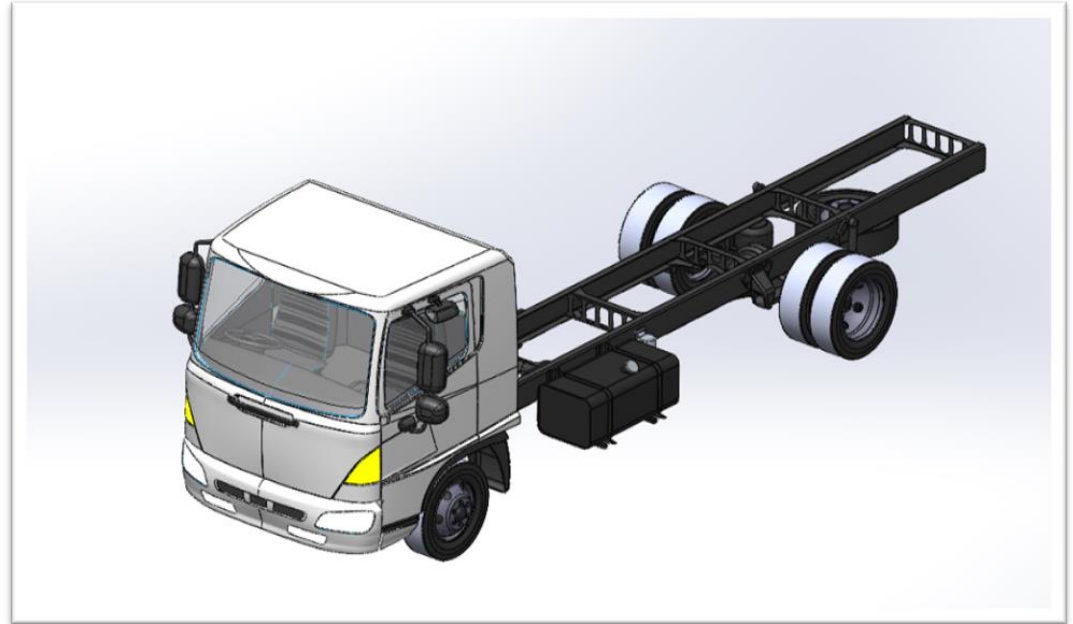
- Development of a SolidWorks model of a truck mounted pothole device.
- Modelling the individual components.
- Assembly of the components for the final model.



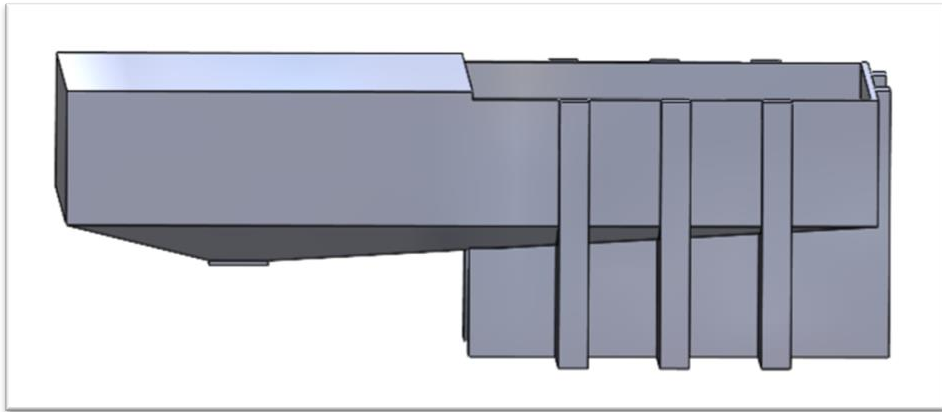
Truck Design

HINO 500 FD1126

- Twin turbo charged and intercooled 4-cylinder diesel engine.
- 260 Horsepower.
- 882nm Torque.

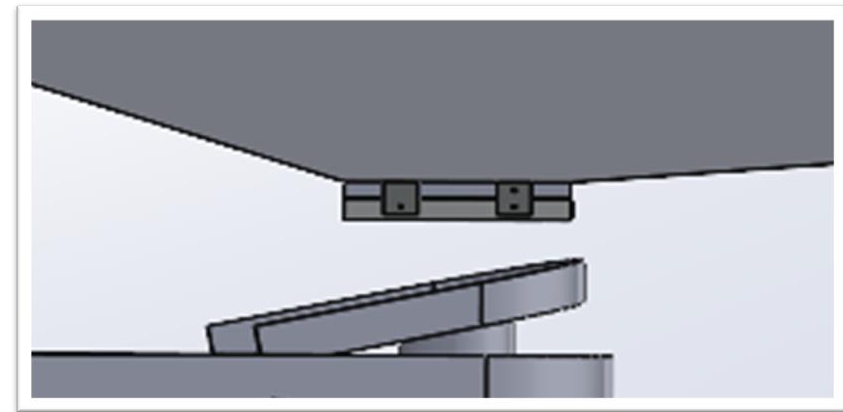


CAD Components



Tank supports

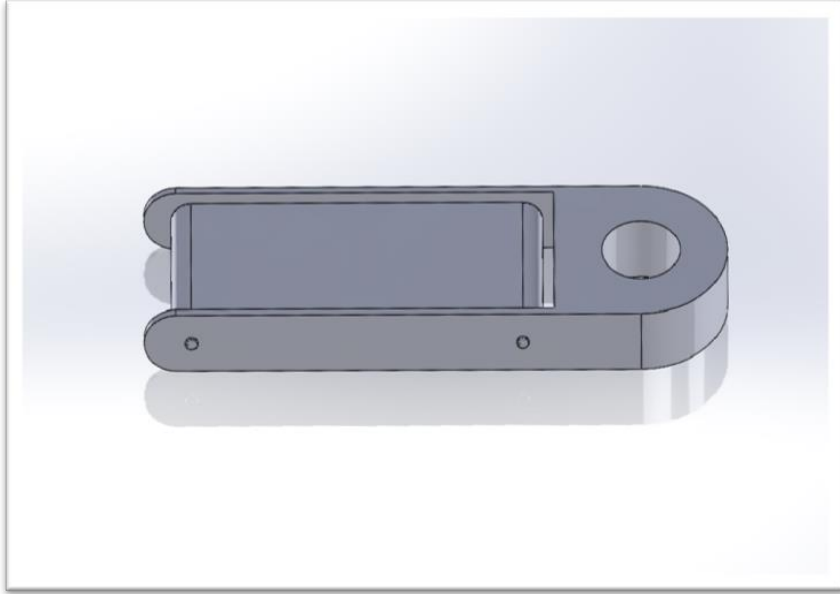
- Provides support to the tank.



Valve

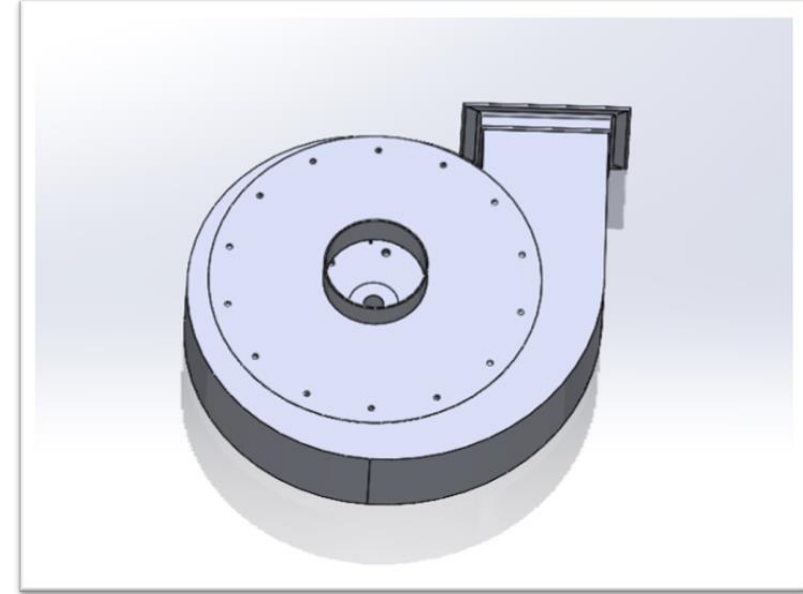
- The valve opens for the asphalt transfer





Conveyor belt

- Transfers the asphalt used for the process



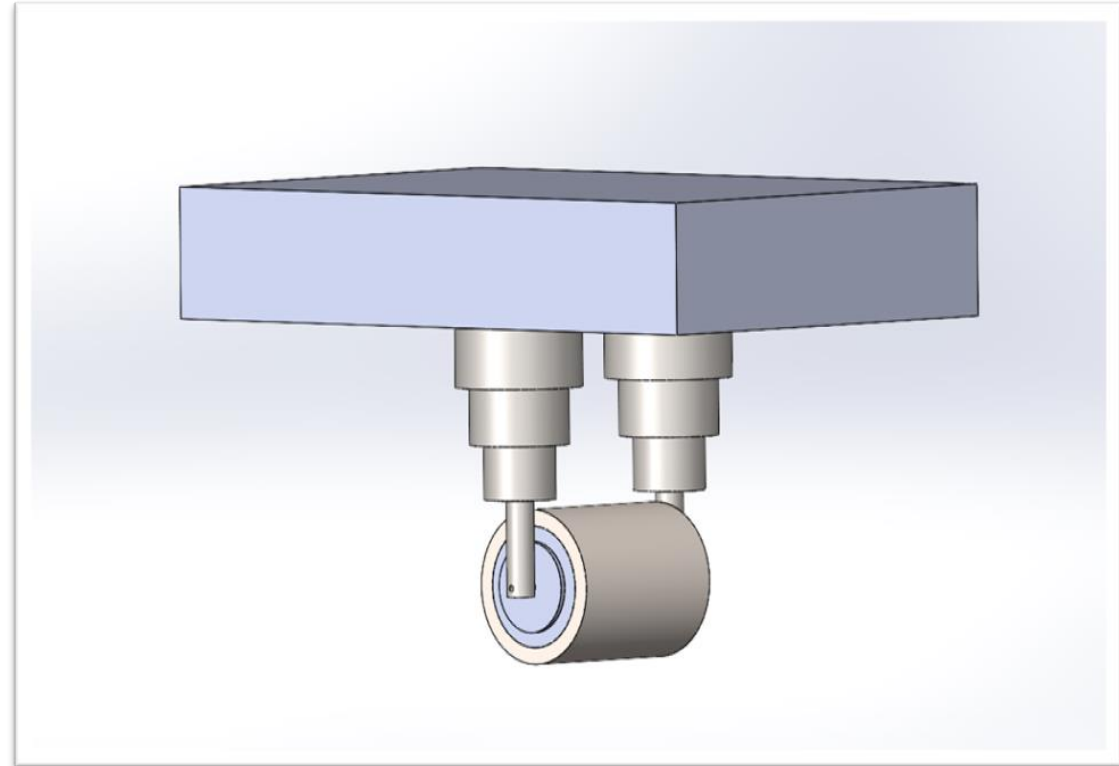
Air blower

- Used to clear debris from the pothole



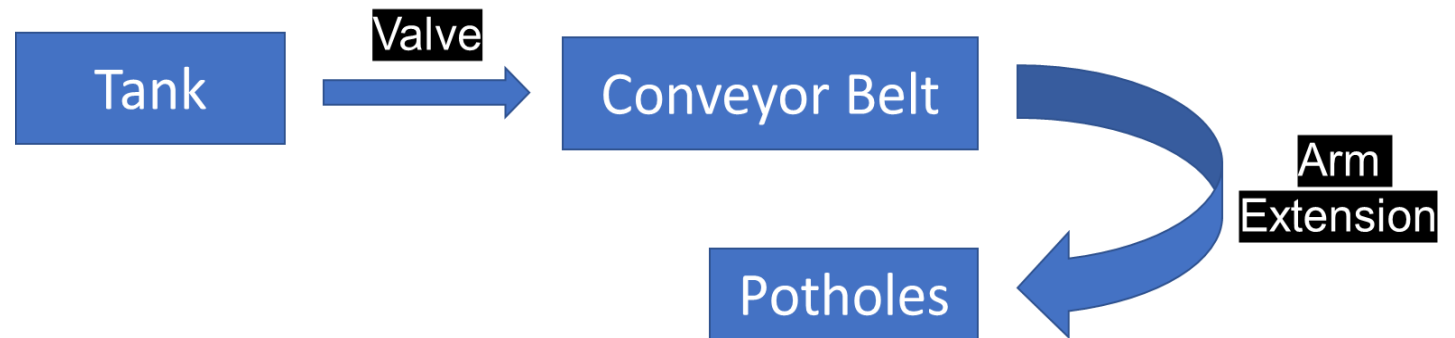
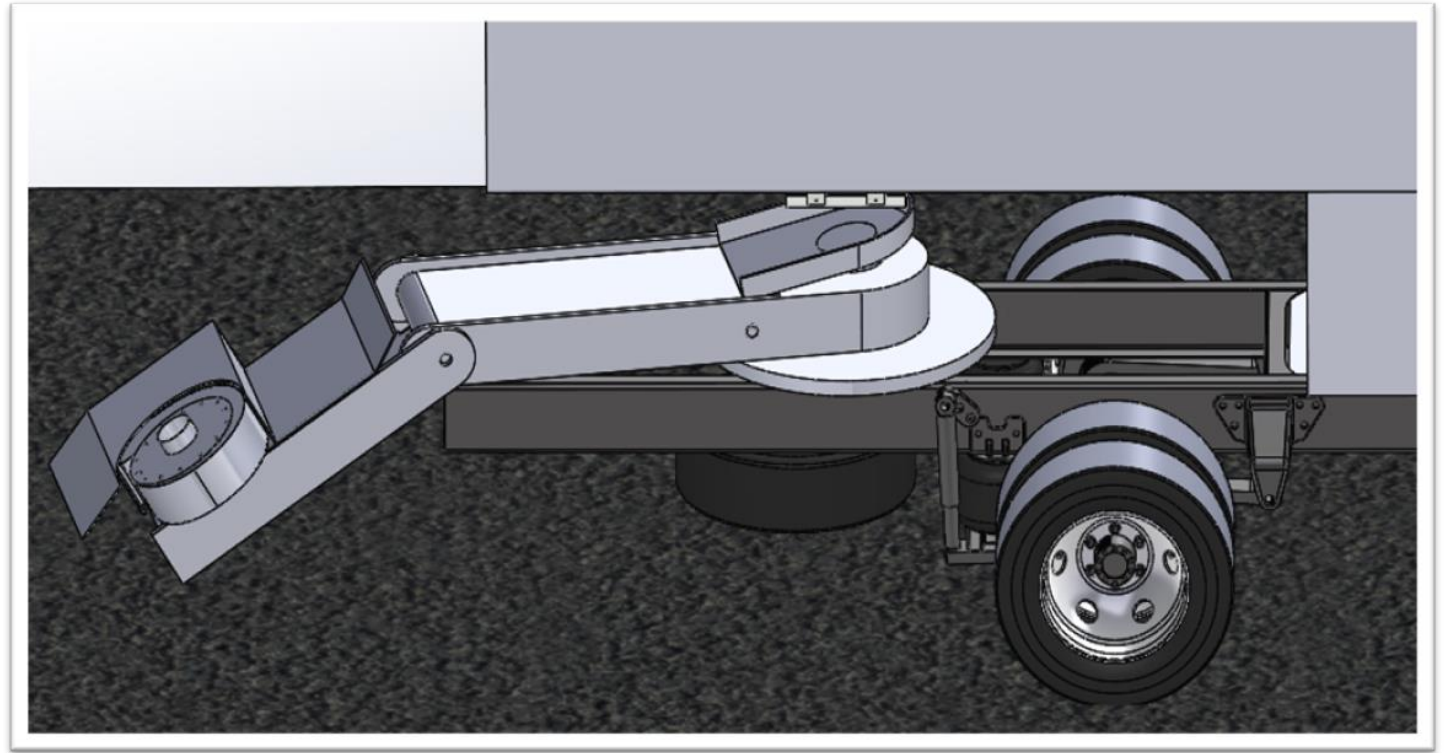
Roller

- Used for compaction.
- Used to spread Asphalt on the pothole.

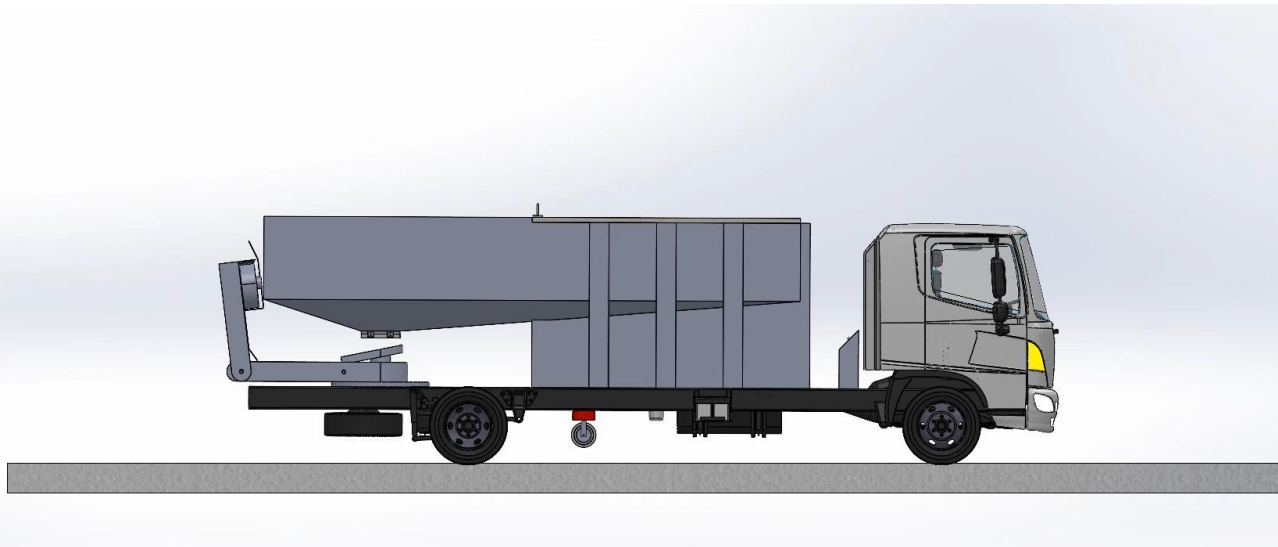


Asphalt transfer

- The combination of CAD components provide the desired result.



MOTION STUDY



- 90 degrees movements of tank door
- Sliding of tank valve
- 133 degrees vertical movement of the slider
- 180 degrees rotation of the rotating device with the conveyor belt from left to right
- Movement of asphalt under gravity
- Sliding movement of the roller
- Truck movement on the ground

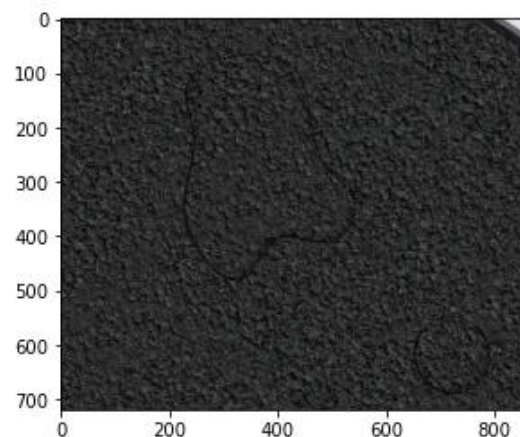


BLENDER ANIMATION

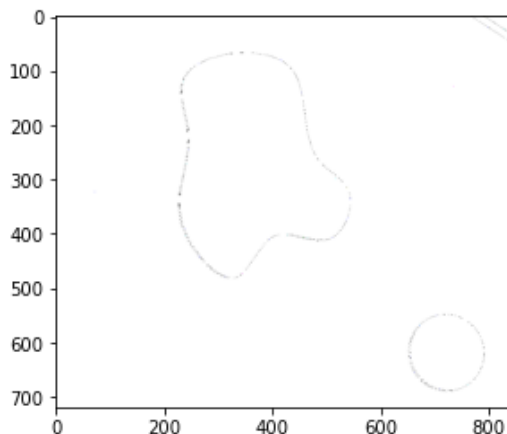


Pothole Detection with Simulated Environment

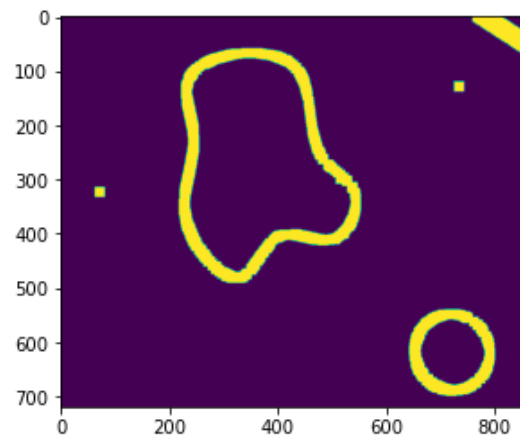
ORIGINAL IMAGE



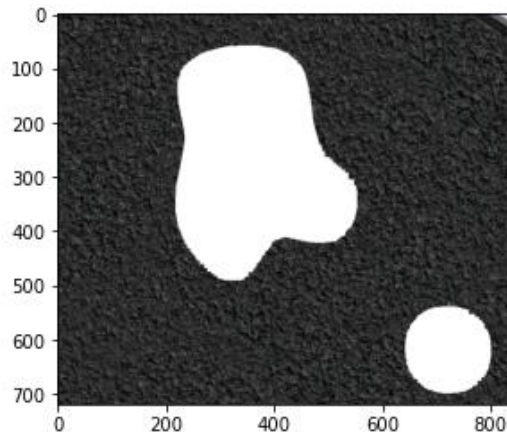
THRESHOLDING



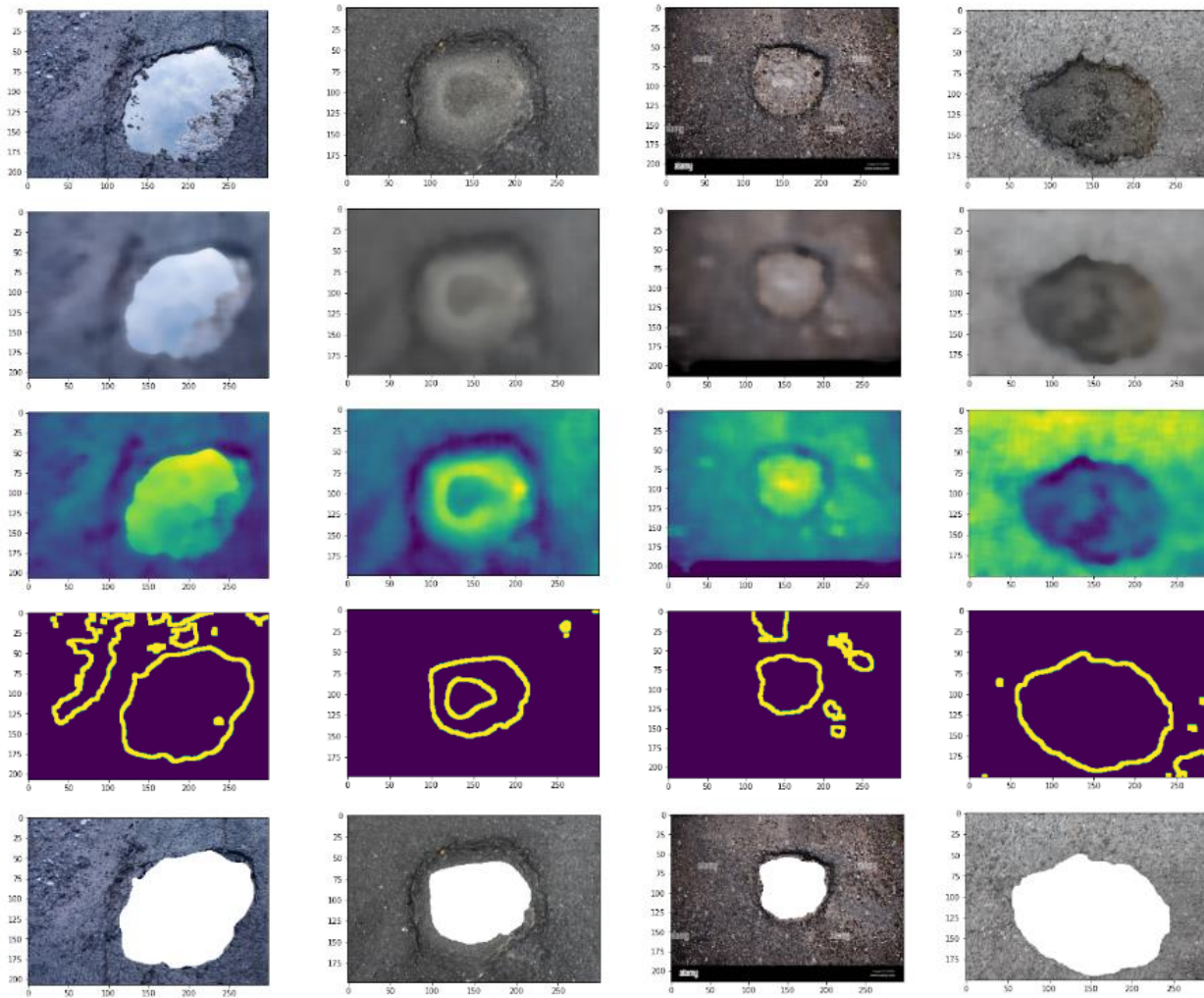
**CANNY METHOD
(EDGE DETECTION
ALGORITHM)**



**FINAL DETECTED
AREA VS. ORIGINAL
POTHOLE IMAGE**



Pothole Detection with Real Environment



ORIGINAL IMAGE

BLURRED IMAGE

HIGH CONTRAST

CANNY METHOD (EDGE DETECTION)

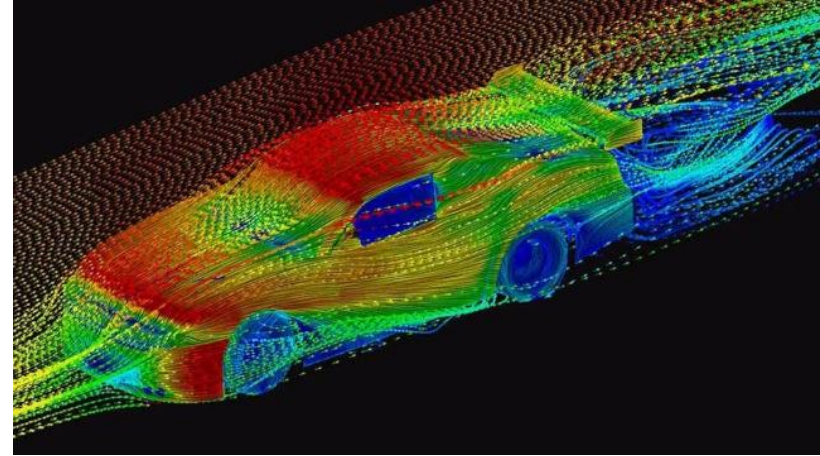
**FINAL DETECTED AREA VS.
ORIGINAL POTHOLE IMAGE**



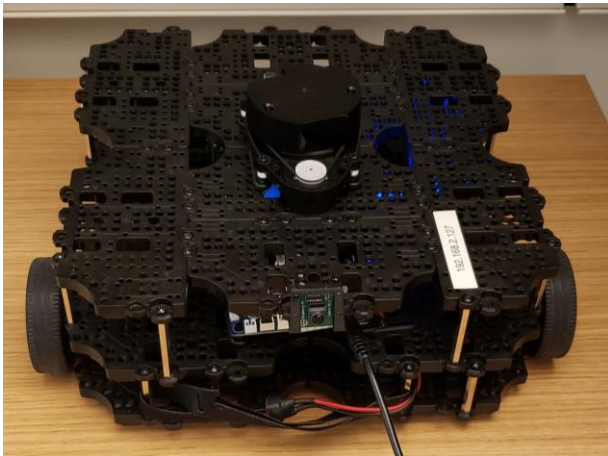
Future work



Better computational power



CFD



ROS



Prototyping



Final Design



- Truck-mounted
- Safety
- Easy to move to a new location



Q&A Time!

