ENHANCED SMOKE WIRE TECHNIQUE IN SMALL SCALED QUASI-ATMOSPHERIC BOUNDARY LAYER WIND TUNNEL

INVENTOR : DR. NURIZZATUL ATIKHA BINTI RAHMAT,
MUJAHID HUSAIMI BIN CHE HASSAN,
MOHAMMAD ROZAKI BIN RAMLI
FACULTY : FACULTY OF MECHANICAL AND AUTOMOTIVE ENGINEERING TECHNOLOGY
UNIVERSITY: UNIVERSITI MALAYSIA PAHANG
Email : izzatulatikha@ump.edu.my

Product Background

- For decades, **wind tunnel** is widely used for studying the response of aircrafts and, vehicles [Witkowski et al., 1989, Flanagan et al., 2007, and Cheli et al., 2010].
- Nevertheless, wind tunnel is heavily employed over the last half century to examine the flow natures around various shapes of buildings and rigid bodies [Lin et al., 2005, Iqbal and Chan, 2016, Aristodemou et al., 2018, and Liu et al., 2019], to investigate wind pressure acting on building walls [Lou et al., 2012] which deeply related to the flow separation and vortex shedding [Rahmat et al., 2018], and to understand the strong wind effects on super tall buildings [Li et al., 2019] and high density residential area [Rahmat et al., 2016].

Applicability

- Flow pattern and behavior behind and around rigid bodies or buildings can be observed and analyzed by **qualitative measurement**, i.e., flow visualization experiments.
- Provide a qualitative macroscopic picture of the overall flow field.

Environmental Impact

- Environmental friendly
- Drip solution made from Propylene Glycol water-based.

Marketability & Commercialisation

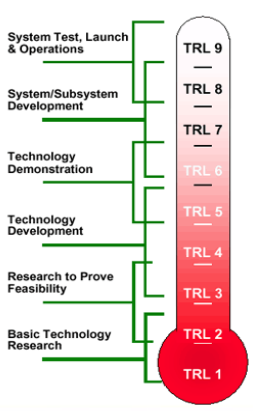
- Simple and easy set up design will increase the marketability.

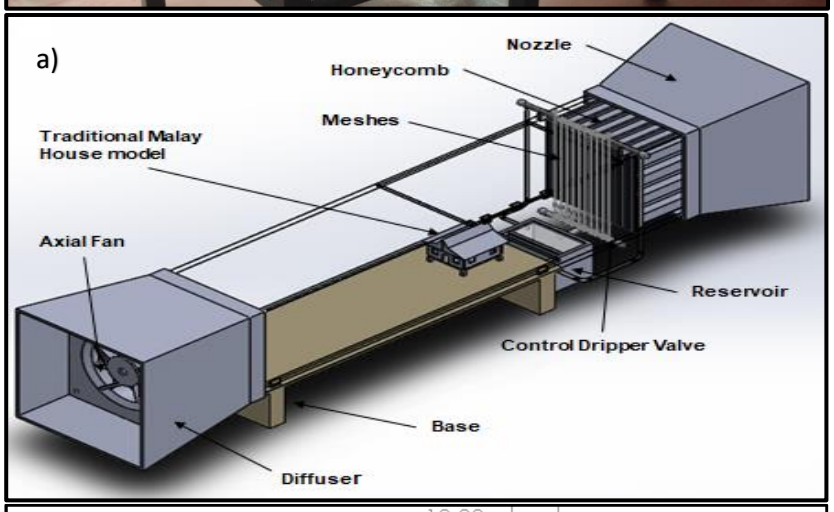
Cost Analysis

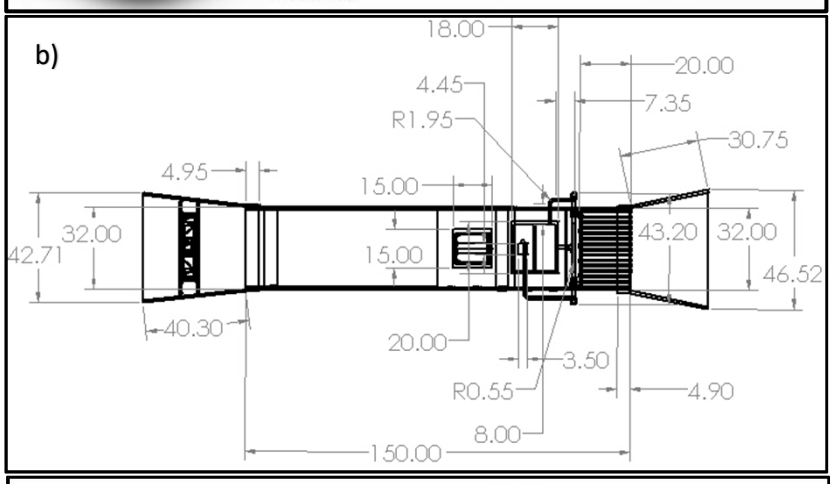
- Many methods available for flow visualization technique namely, Particle Image Velocimetry (PIV) and Laser Doppler Anemometer (LDA), the most cost-effective and adaptable method is **Smoke Wire Technique**.

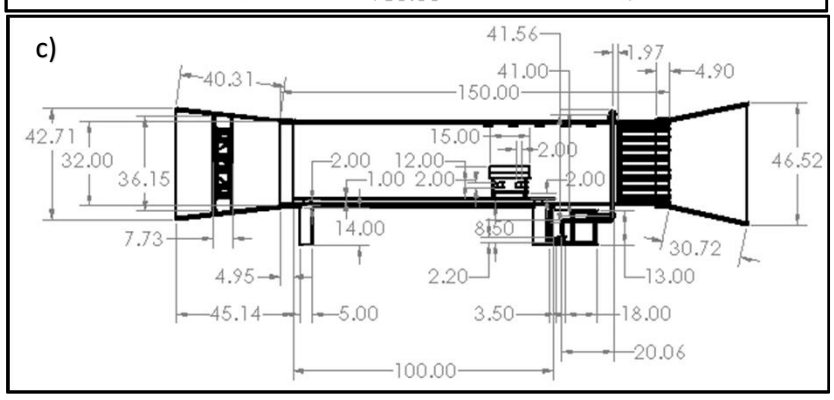
Status of Innovation

- Products undergo Sub-system Development.
- TRL Level 6.
- Finished product ready for technology demonstration.
- Functionality: Optimum







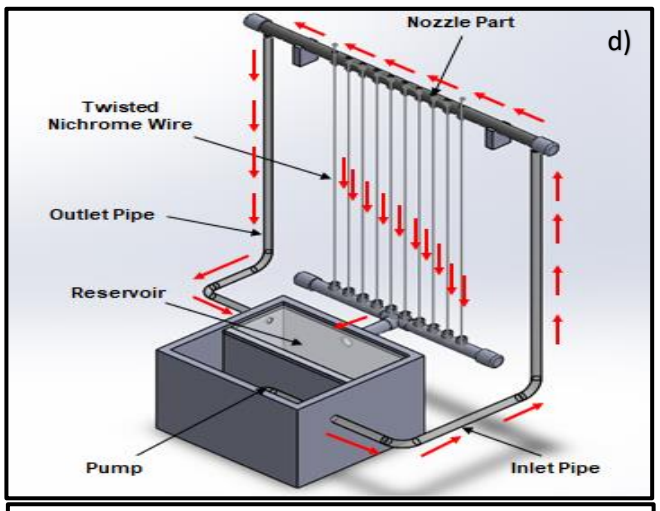


Inventiveness

WIND TUNNEL		
PARTS		SPECIFICATION
Smoke wire		Twisted nichrome wire (26gauge, 0.404mm)
Air velocity		0.92 m/s ~ 1.30m/s , adjusted using speed controller (from spindle 4 to 6)
Settling chamber	Honeycomb	To reduce the turbulence (mean velocity) and straighten the flow (diminished non uni-formities of inflow condition) in axial direction.
	Meshes (Smaller open area ratio, β nearer to test section, β>0.57). [Mehta and Bradshaw, 1985]	
Drip solution		Propylene Glycol water-based, to be drip on the nichrome wire to produce smoke once heated.

WIND TUNNEL ENHANCEMENT		
PARTS	EXISTING	ENHANCED
Test section	1m	1.5m
Base (to give stability to the wind tunnel)	Without base	With base

SMOKE WIRE TECHNIQUE ENHANCEMENT		
PARTS	EXISTING	ENHANCED
Control dripping valve	No	Yes
Smoke fluid reservoir	No	Yes
Pump	No	Yes
Twisted nichrome wire	Yes (3)	Yes (10)



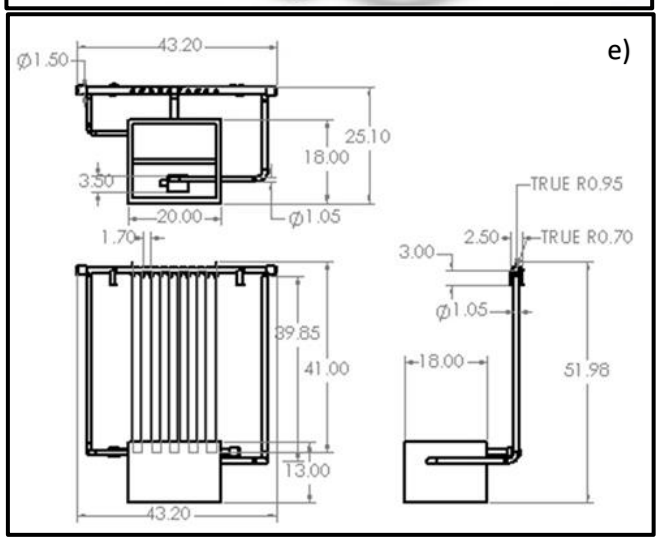


Figure 1 (a) Isometric drawing of extended quasi-atmospheric boundary layer wind tunnel with control dripping valve and traditional Malay house, schematic drawing of the wind tunnel for (b) top, (c) side views with dimension, control dripping valve system (d) and (e) schematic figure dimensions of control dripper valve with pump and smoke fluid reservoir.

Results