LEVERAGING SMART TECHNOLOGIES FOR ENHANCING CONSTRUCTION SAFETY

Dr Angela Yuen

SquareDog Robotics Limited

31 July 2024

SquareDog Robotics

WORKING AT HEIGHT HAZARD

1. WORKING AT HEIGHT HAZARD

Accident Data in Hong Kong

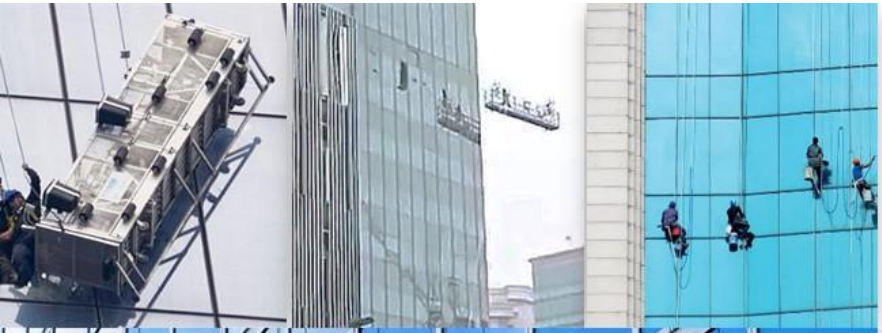
Industrial Accidents in Construction Industry in 2022 – analysed by Type of Accident

Rank	Severity	Type of accident	No. In 2022
1	Low	Slip, trip or fall on same level	946
2	Low	Injured whilst lifting or carrying	585
3	Medium	Striking against moving or stationary object	612
4	High	Fall of person from height	213
5	-	Others	2,021
		Total	**4,377**

Fall from height

- Ranked No. 4 in No. of cases with the highest severity
- 213 accidents causing 10 fatalities in 2022
- Causing 20% of total in occupational injuries in construction industry

Ref: Legislative Council Secretariat. (2024). Construction accidents in Hong Kong, Paper No.ISSH07/2024. https://app7.legco.gov.hk/rpdb/en/uploads/2024/ISSH/ISSH07_2024_20240423_en.pdf



1. WORKING AT HEIGHT HAZARD

Disturbances workers faced during façade cleaning

- Obstacles on walls and
- Swing of gondola caused by strong winds

Divert workers' attention, may cause **falling from height** accidents

1. WORKING AT HEIGHT HAZARD

Fall Accidents in Hong Kong

13 Jun 2022 SingTao Headline

兩死工傷丨吊船疑斷纜飛墮20層樓 工會震驚指意外罕見

20 Apr 2023 On.cc

渣打銀行大廈外牆吊船疑故障 兩工人一度被困半空

24 Apr 2023 HK01

北角吊船疑機件故障 工人獨自被困半空 消防高空拯救專隊戒備

3 May 2023 On.cc

中環商廈吊船疑無電 消防升雲梯營救被困工人

19 Jun 2023 MingPao

入境大樓貼海報遇吊船故障 兩工人一度被困

2 Aug 2023 on.cc

金鐘遠東金融中心疑吊船故障 兩工人被困外牆高處

1 Nov 2023 HK01

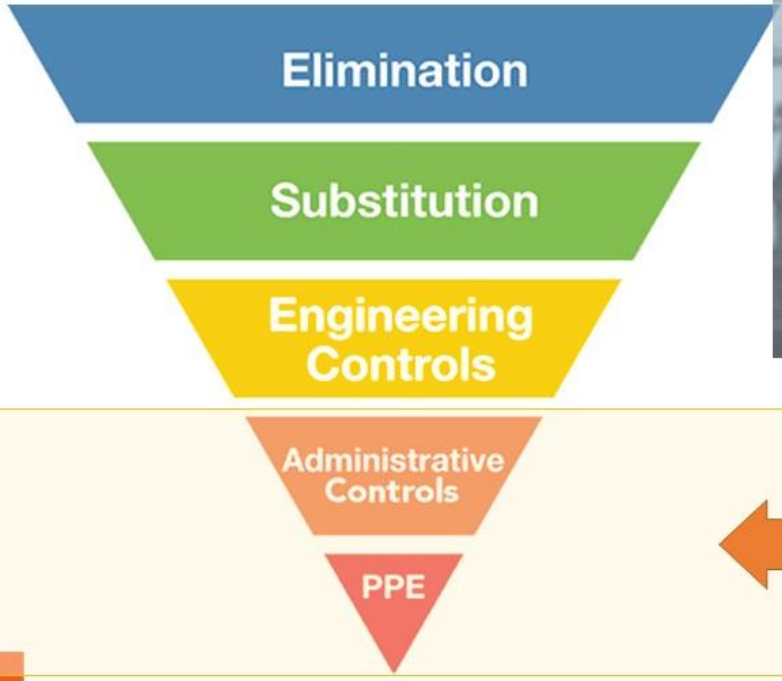
將軍澳入境處大樓地盤工人 疑未扣安全帶檢查吊船險象環生

2 Aug 2023 on.cc

信德中心吊船故障 2工人被困半空近2小時

2. REMOVE THE HAZARD AT THE SOURCE

The Hierarchy of Controls



A view of the lopsided gondola on the 15th floor of Block 199 Boon Lay Drive. (Photo: CNA/Syamil Sapari)

Conventional Practice

Using Gondola and performing "Spiderman" for high-rise work

→LOW level of control

→threaten workers' precious lives

https://www.safetyandhealthmagazine.com/articles/16790-the-hierarchy-of-controls

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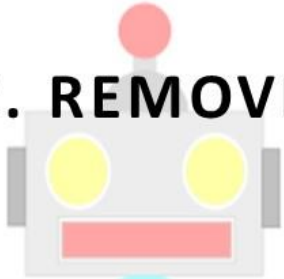
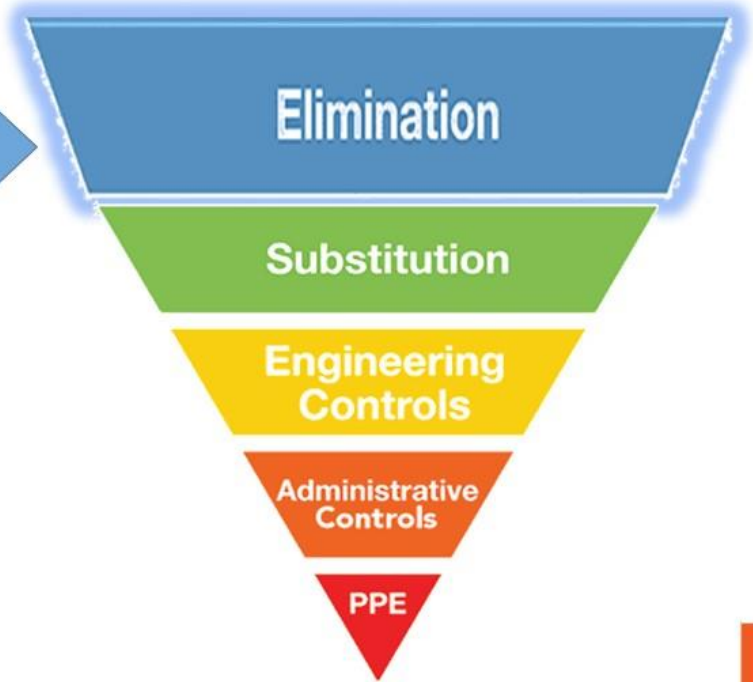


Use of Robot

Gondola-free, minimize the workers to be engaged in working at height to **eliminate** hazard at the source

The Hierarchy of Controls



https://www.safetyandhealthmagazine.com/articles/16790-the-hierarchy-of-controls

3. WHY ARE ROBOTS NOT WIDELY ADOPTED BEFORE?

- Most robots are required to operate without plugged into a power socket, they need to carry their own energy source, e.g. battery pack or gas tank

- There would be many restrictions when using drones in urban areas
- Drones are easily be affected by electronic devices

5. HOW SQD ROBOT WORKS?

CORE TECHNOLOGY

Robota6th

Sensing
Data Collection and Database

Intelligence
Artificial Intelligence

Execution
Robotic Control

Developed since 2016, SquareDog Robotics' proprietary Adaptive Robotic Control (ARC) technology, Robota6th has been a game-changing innovation to help realise our vision in construction automation and is one of SquareDog's patented pioneering technologies.

Robota6th senses collected data from database input and uses a Smart Intelligence Algorithm to aid the worker in executing and performing high quality works with miniscule tolerance for irregularity and error. Likened to an App on your mobile device, the versatile technology can be applied to any machinery to instantly make it smartly operational and easy to program.

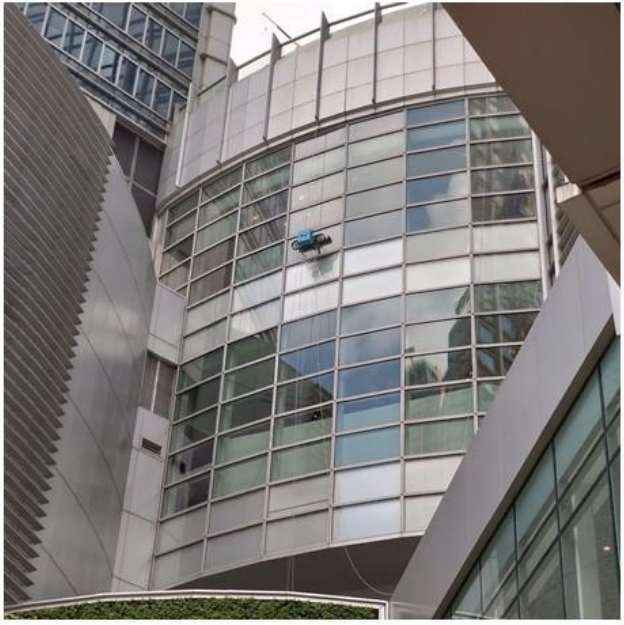
Without needing prolonged training, any user can set up the ARC system within a matter of minutes — a true breakthrough in the world of construction automation.

5. HOW SQD ROBOT WORKS?

For high-rise building automation

High-Rise Auto Cable Technology

- Multi-line Algorithm for Cable Robot
- Advance Cable Control
- Precision Numerical Traction Winch System
- Automatic Self-balancing
- Work-at-height Stabilization



Allows robot to stably travel across large areas on high-rise buildings up to 200m in height

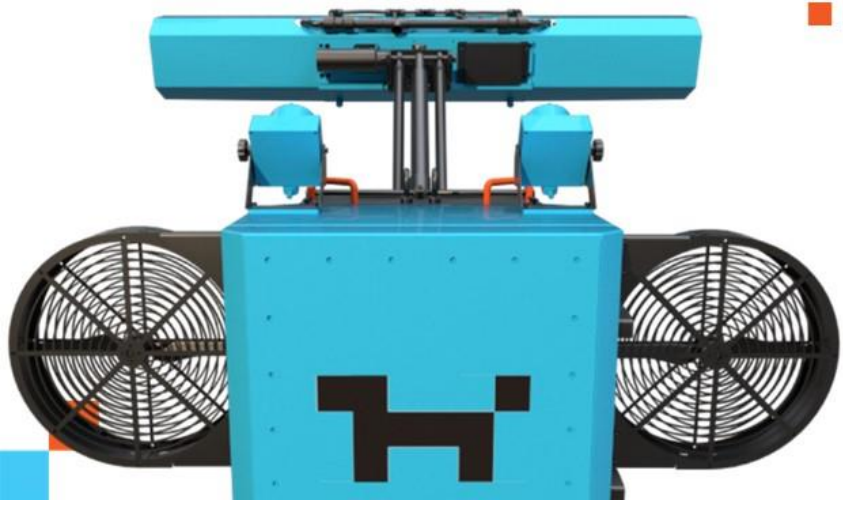
5. HOW SQD ROBOT WORKS?

SQD-SKY ROBOT

The **FIRST** successfully **commercialized** high-rise exterior robot

2021-22 香港工商業獎 HONG KONG AWARDS FOR INDUSTRIES
設備及機械設計獎 EQUIPMENT AND MACHINERY DESIGN AWARD

E&M InnoPortal



- **Safe**
  - Safest operational alternative from traditional gondola
- **Cost Saving**
  - Save max 50% on cost*
- **Quick**
  - Quick, one-time installation in half days*
- **All-in-one**
  - For various inspection tests, from detecting water leakage to surface and water pipe defects

5. JOB REFERENCES

Sky Robot (Cleaning)

Nina Tower

MEGA Gateway, Ma Kwok Street

New Tech Plaza

Tuen Mun Town Plaza

5. JOB REFERENCES

Sky Robot (WTT)

CLP Kai Tak Headquarter

11 Skies, Skycity

VILLA GARDA (LP11)

Grand Victoria

The recommendation letter from the Client for Sky Inspectors adoption in March 2024

G&M Engineering Company Limited
信越工程有限公司
(member of G & M Holdings Limited)

Date: 14 March 2024

To whom it may concern,

I am writing this letter to have the opportunity to collaborate closely with SquareDog Robotics (SQD) by utilizing technology innovation (SQD-Sky Robot) in water leaking test with at CLP site in January 2024.

From the initial planning to final execution of the project, SQD's a group of highly skilled individuals actively engaged with our team to develop innovative strategies and solutions to address project requirements and allow the project team to overcome various challenges and obstacles. Our project was run smoothly with detail and meticulous approach, all deliverables were completed with the utmost precision and quality.

In addition to their technical expertise, SQD team prioritized proactive and responsive communication to ensure our team kept informed every step of the way. Apart from providing regular progress updates during project period, SQD team consistently offered necessity support to applying government funding (Construction Innovation and Technology Fund (CITF)) for adopting SQD-Sky Robot in our project.

I firmly believe that SQD team's professionalism, expertise, and dedication make them an excellent choice for any organization seeking reliable and exceptional robotic solutions. I would also like to take this opportunity to express my appreciation SQD Chief Corporate Development Officer, Dr Angela Yuen, for her dedication and unfailing support, to contribute to the overall success of the project.

Thank you for your kind attention.

Yours faithfully,

For and on behalf of

G&M Engineering Co. Ltd.

Thank you

This is a clip from the 31 July 2024 recording of the

Hong Kong Housing Authority

"Safety Forum 2024 for Works and Property Management Services"

The speaker on stage is Dr Angela Yuen

Chief Corporate Development Officer, SquareDog Robotics Limited

Her topic is

"Leveraging Smart Technologies For Enhancing Construction Safety"

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(00:24)
First of all, thank you everyone

Thanks to the Housing Department, OSHC and CIC

for giving us this chance to introduce our product

Like other high-tech companies

we aim to use technology to minimise danger

This is what we hope to achieve

In recent years, despite various changes and improvements in construction

working at height remains the highest-risk activity

On many construction sites in Hong Kong

as the chairman and other speakers mentioned

there are many dangers associated with working at heights

Not just on construction sites, but also in property management

Often the use of suspended working platforms poses similar risks

It is because when working at height outdoors

many unpredictable situations can arise

Hong Kong has made progress in this area

as suspended working platform are widely used here

But in other countries, even advanced ones like Singapore

they still often use "Spiderman"

When I worked in Singapore I saw many “Spiderman” at work

Watching them, you can not help but feel anxious

So we hope to use robots

to eliminate risks directly at the source

The most important point

is not relying on safety harnesses or any safety measures

but to directly keep workers on the ground to work

Since this is so important

everyone wants to know

why it has not been implemented earlier

This risk has not just appeared overnight

For many years, construction companies or construction projects

or property management have faced similar situation

So why has not it been implemented

When we tried to put it into practice

we encountered many challenges

What are the challenges?

It is about how to place robots in a moving environment

and ensure they can work stably

It is actually not easy at all

Additionally, our design is quite special

We often encounter obstacles

or some architectural decorative components

So figuring out how to avoid these barriers

while continuing to work

is something we need to consider

Additionally, if we set up a robot to work

but still need an engineer to operate it

then that does not align with cost-effectiveness

No one wants a robot that requires an engineer to function

Therefore, we need to simplify complex control situations so that

even regular workers can manage them

That would be a success

In simple terms

We hope our technology is straightforward

We analyse

our tasks in detail

using extensive artificial intelligence calculations

and then implement them easily

An ordinary worker

with just one to two weeks of training

should be able to do the job

This is our biggest advantage and our goal

What is special about our robot?

Actually, it is not very special

The most special aspect is using a suspended working platform alike set up

with two lifting points for control

However, the suspended working platform can only move vertically

whereas our robot can also move horizontally

What is the benefit of horizontal movement?

A vertical suspended working platform usually only covers a two-meter range

but our robot can traverse 20 meters

by setting up just two lifting points

This effectively solves the problem

So the whole operation becomes simpler

Also, a suspended working platform weighs around one tonne

but our robot weighs less than 100 kilograms

which is about the weight of an adult male

making it easy to transport

If used for property maintenance and repair projects

It is much easier

The biggest advantage is that

with the robot we do not require workers to work at height

Let's take a look at this video

Thank you to the developers, contractors, landlords

and subcontractors

for giving us so many opportunities

Here we're cleaning building facades

These are real-life cases

We are grateful for these opportunities

We are collecting a lot of data while handling these real cases

We hope to use this data to improve our programme

At the same time, the feedback from our clients

has also helped us improve our backend tools

Besides facade cleaning and assisting property management

we also help buildings with pre-inspection works

Here are some of the sites

including the recently completed CLP headquarters

and some private residential and commercial buildings for water leakage testing

What is special about that?

Usually water testing is done by a worker

sitting inside a suspended working platform

But some landlords

used both suspended working platform and our robot at the same time

and found that our robot could detect problems faster

So this helps landlords identify issues earlier

After identifying the issues

we can resolve these leaking problems before handing over the building

Finally, we have received

recommendation letters from our clients

because they have actually used our robots

and found they met their needs

without major issues

Lastly, thanks to CIC and the Development Bureau for their policies

As a local company

we are able to receive 80% of the subsidy from CIC

If you're interested in our robots

or other products

please visit our booth behind

Thank you everyone

Thank you for watching

(06:04)