

# AtomQuest 2023

## TEAM MIRAGE



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- **Past Team Experiences:**
  - **Winners:** Techfest 2022 ( Games of Code )
  - **Winners:** Techfest 2019 ( RoboVR )

# INTRODUCTORY

- **Product Name:**
  - **System for Parcel Detection [ SPADES ]**
- **Objectives:**
  - To create an anti-theft system for parcels delivered to the household.
- **Beneficiaries:**
  - Consumers of the e-commerce website.
- **Value of results:**
  - The Project's value is found in increased operational effectiveness and greater security via precise threat detection, which benefits both public safety and enterprises.

## PROBLEM ADDRESSED

→ In metropolitan cities, delivery man usually leaves our packages on the doorstep making them vulnerable to theft.

→ In suburbs and rural areas, some thieves follow delivery trucks and grab packages immediately after they are delivered.

### Package theft

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From Wikipedia, the free encyclopedia

**Package theft** or **cargo theft** is the theft of a package or parcel. It can occur anywhere in the distribution channel. One major type is **porch piracy** which has been defined as, "Taking possession of a package or its contents, outside of a residence or business, where it has been commercially delivered or has been left for commercial pickup, with intent to deprive the rightful owner of the contents or even try to sell the contents."<sup>[1]</sup>

#### Distribution channel [\[ edit \]](#)

Packages, pallet loads, and full truck loads are subject to theft. This can take place anywhere from the shipper, carrier, or consignee. It can involve individuals with an opportunity to take a package or can involved organized crime. Security systems involving surveillance systems, tracking systems, and broader corporate security are needed to resist the theft of material. Estimates of cargo loss and theft range from two to thirty billion dollars a year.<sup>[2][3]</sup>

Some theft involves [package pilferage](#) where all or part of the contents are taken from the package. Sometimes a weight or object is placed into the pilfered package, the package is resealed, and then sent on its way through the remainder of the distribution system. [Package tracking](#) continues but the contents of the package could be gone.



Several packages left unattended on a porch, a typical target for package thieves

**source:** [https://en.wikipedia.org/wiki/Package\\_theft](https://en.wikipedia.org/wiki/Package_theft)

→ Since doorstep deliveries are now common due to the rise in popularity of online shopping, packages are more susceptible to theft. Opportunistic persons who seize unattended parcels left outside of homes are involved in this behaviour, putting unwitting consumers at risk of suffering severe losses.

→ Not only does package theft put a financial strain on victims, but it also erodes their sense of security and confidence in the society. Thus we have decided to solve this problem.

## RESEARCH

→ There hasn't been a **proper solution** to this issue like that up until now.

→ **Spades** offers a **singular response** to this growing problem.

→ By **utilising advanced computer vision** algorithms and artificial intelligence, the system can **accurately detect** and track suspicious activities related to package theft in real-time.

→ Furthermore, We can **incorporate** a comprehensive range of features, including **motion sensors, tamper-proof packaging**, which collectively make it an all-encompassing solution.

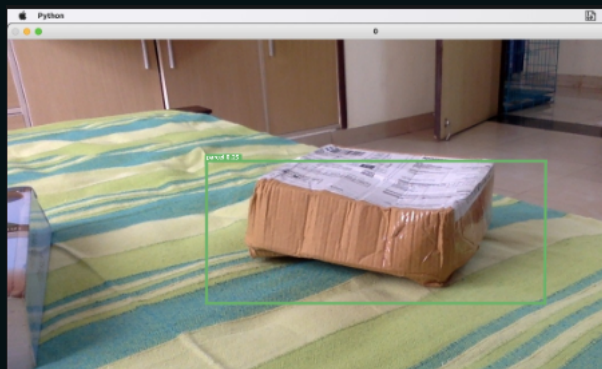
## PROPOSED SOLUTION

→ After putting in numerous efforts we have finally designed **spades** as a **solution** to this challenge.

→ In order to **detect theft**, our solution proposes a **parcel detecting** system that uses modern AI systems.

→ A notification will be sent to the owner when the package is delivered and an alert will be sent when any type of **abnormality is detected** on the door.

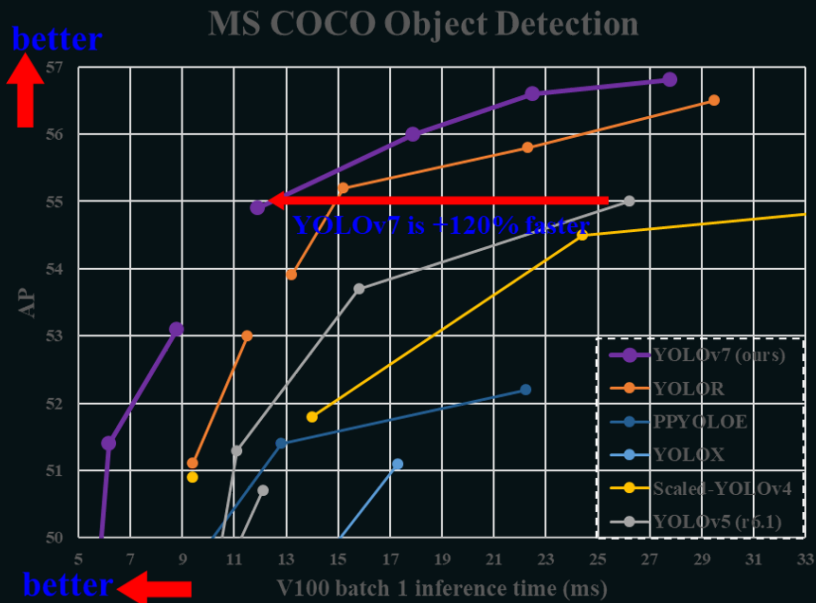
→ If the owner want, they may access the camera and perform a self-inspection, if anything appears suspicious, the programme will **notify the guard**. [if used in a **township**].



Live example of software working on webcam

# TECHINCAL REPORT

→ **Spades** uses a highly trained open source Object Detection Framework known as **Yolov7**.



**source:** <https://github.com/WongKinYiu/yolov7>

→ Users will have to install a security camera in front of the main door integrated with **raspberry pi** which will be running our detection code.



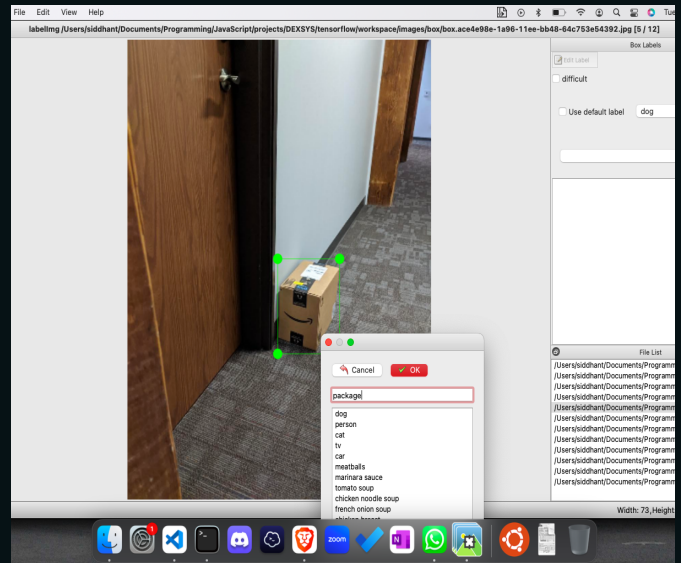
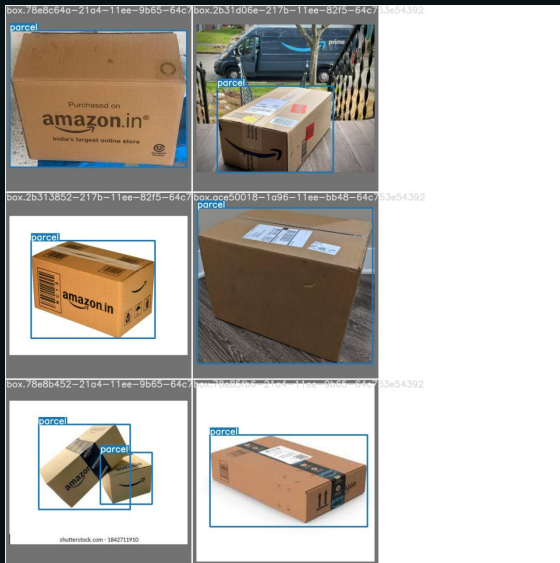
→ **Spades** is trained using a **large number of images** and training **attributes**, resulting in an accurate and error-free detector.

[illegible]

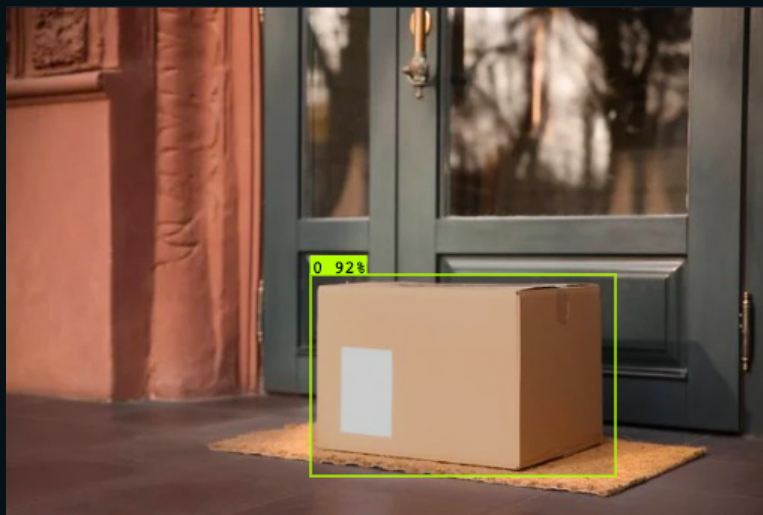
```
python3 train.py --workers 1 --device cpu --batch-size 3 --epochs 100 --img --python3
```

Epoch	gpu_mem	box	obj	cls	total	labels	img_size
11/99	0G	0.07196	0.02802	0	0.09259	R	640: 100%
	Class	Images	Labels		P	R	mAP@.5 mAP@.5:
	all	2	3	0.999	0.333	0.364	0.
108							
Epoch	gpu_mem	box	obj	cls	total	labels	img_size
12/99	0G	0.07296	0.02116	0	0.09412	R	640: 100%
	Class	Images	Labels		P	R	mAP@.5 mAP@.5:
	all	2	3	0.996	0.333	0.379	0.
114							
Epoch	gpu_mem	box	obj	cls	total	labels	img_size
13/99	0G	0.05941	0.02001	0	0.07941	R	640: 100%
	Class	Images	Labels		P	R	mAP@.5 mAP@.5:
	all	2	3	0.991	0.333	0.411	0.
127							
Epoch	gpu_mem	box	obj	cls	total	labels	img_size
14/99	0G	0.07178	0.02826	0	0.09204	R	640: 100%
	Class	Images	Labels		P	R	mAP@.5 mAP@.5:
	all	2	3	0.946	0.333	0.372	0.
112							
Epoch	gpu_mem	box	obj	cls	total	labels	img_size
OK						0/3 [00:00<7, 7it/s]	

→ **Spades** intends to provide **error free** experience to the user.



→ When a package is **delivered**, the **Spades**, which is installed at the front door will **detect it** and transmit a **low-level alert** to your integrated device.



## SPADES CONTROL CENTER

Automation Alert

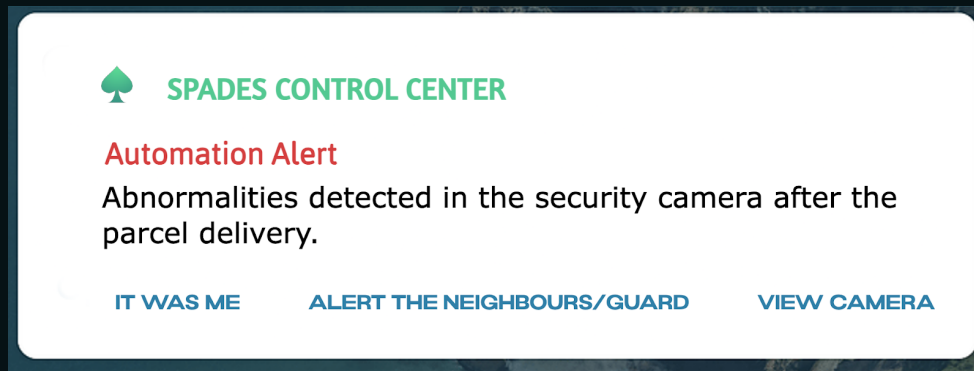
Your Parcel containing ... has arrived



DISMISS

INFORM THE NEIGHBOURS

→ Any **irregularity** in the environment, for example if **Spades spots a person** after the package is detected and the package being **undetected for over 20 seconds** will be reported to the owner.



→ With the use of a button, the owner will be able to **notify their neighbour** or the **community guard**.

→ The user will also have the option to **examine the camera** and make their own judgements.

## FINANCIAL LOSSES DUE TO PROBLEM

→ The problem exists worldwide, peaking in developed nations.

- Nationally, 49 million Americans have had at least one package stolen in the past 12 months.
- The prevalence of victims ranged from a high of 29 percent in Alaska to a low of 12 percent in Maine.
- The median value of stolen merchandise was \$50, with state-specific averages varying from \$30 (Arizona) to \$80 (Alaska).
- The incident rates and average loss captured in our research reflect more than \$2.4 billion in stolen goods over the past 12 months.

**source:** <https://www.security.org/package-theft/annual-report/>

→ Package theft is a problem that concerns people. Doorstep delivery has emerged as a practical method of shopping as e-commerce expands across many nations.

→ But as a result, there have been more instances of parcel theft. Opportunistic people steal abandoned packages.

→ The results are part of the world's first global parcel theft survey which found that close to one in ten people had at least one parcel lost or stolen from May 2021 to April 2022. This amounts to a staggering 1.009 billion packages globally, at a total cost of \$38.81 billion.



**source:**

<https://www.prnewswire.com/news-releases/penn-elcom-more-than-42-million-packages-lost-or-stolen-in-the-us-in-just-12-months-with-one-in-ten-people-being-affected-301649458.html>

## FINANCIAL REPORT

→ Costs of hardware elements of the system:

- Raspberry Pi: INR 3500
- Camera: INR 2000

→ **Spades** will be simplified enough for the user to self install or he can contact specialists to install.

## MARKET REPORT

→ Globally, there is a growing issue with package theft. Everyday, **this issue affects a large number of people**. The solution to this difficult issue, in our opinion, **may be found in our model**.

→ People purchase anti-theft systems for parcels to **safeguard valuable shipments** from theft, ensuring secure delivery. **Spades detects theft** and protect valuable items awaiting pickup.

→ It serves a **wide spectrum of consumers** and covers a **variety of contexts**, including residential regions, apartment buildings, and commercial places.

→ This concept has **tremendous potential** to reduce package theft and guarantee the secure delivery of shipments, especially given the **ever-increasing reliance on e-commerce**.