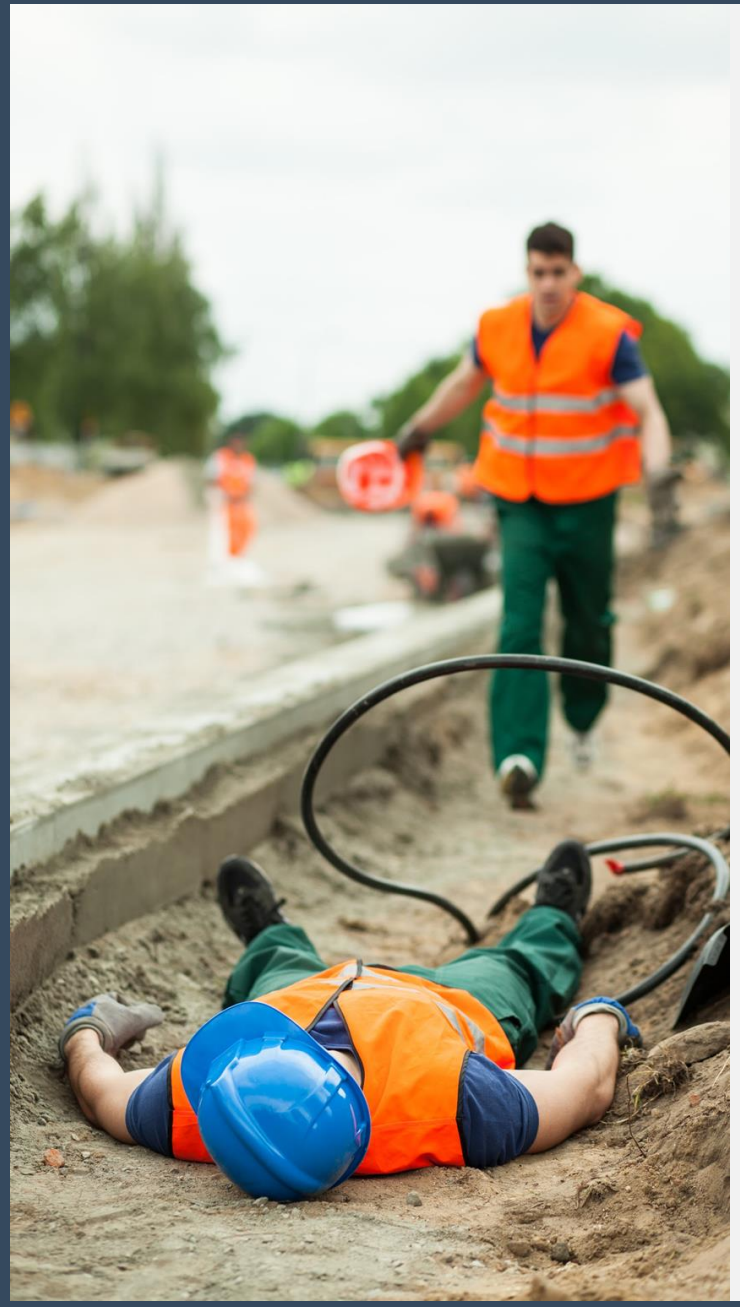
StoneThree

INDUSTRY 4.0
IN ACTION

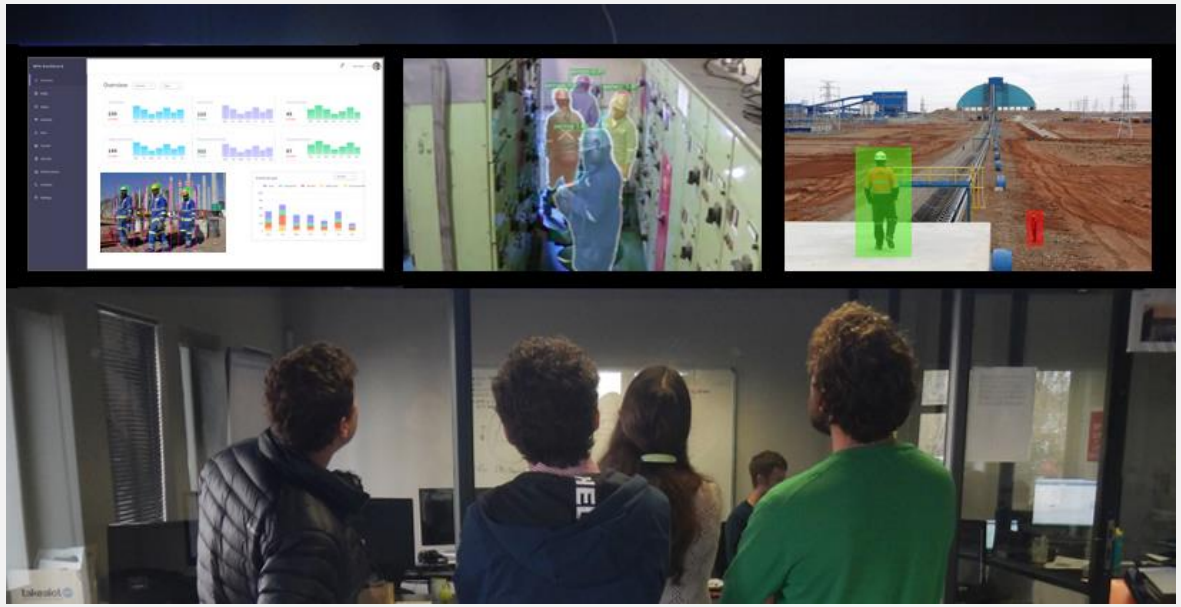
STONE THREE // Digital Workplace Safety



Challenges

- Classical safety measures are reaching a plateau in effectiveness: **changes have minor impact with diminishing returns** instead of providing big leaps forward.
- Lost production from stoppages in South African mining industry alone: $450M in 2015
- There are substantial opportunities to improve safety by **mining the vast data sources** already available on plants.
- But data is so abundant that it is **overwhelming**: In a typical example, after 22 minutes of continuous monitoring, a security operator can **overlook 95% of video activity**.[5]

Digital Workplace Safety Solution



1. Analyses existing CCTV camera feeds.
2. Identifies safety issues in real-time.
3. Generates appropriate notifications / responses.

Flexibility

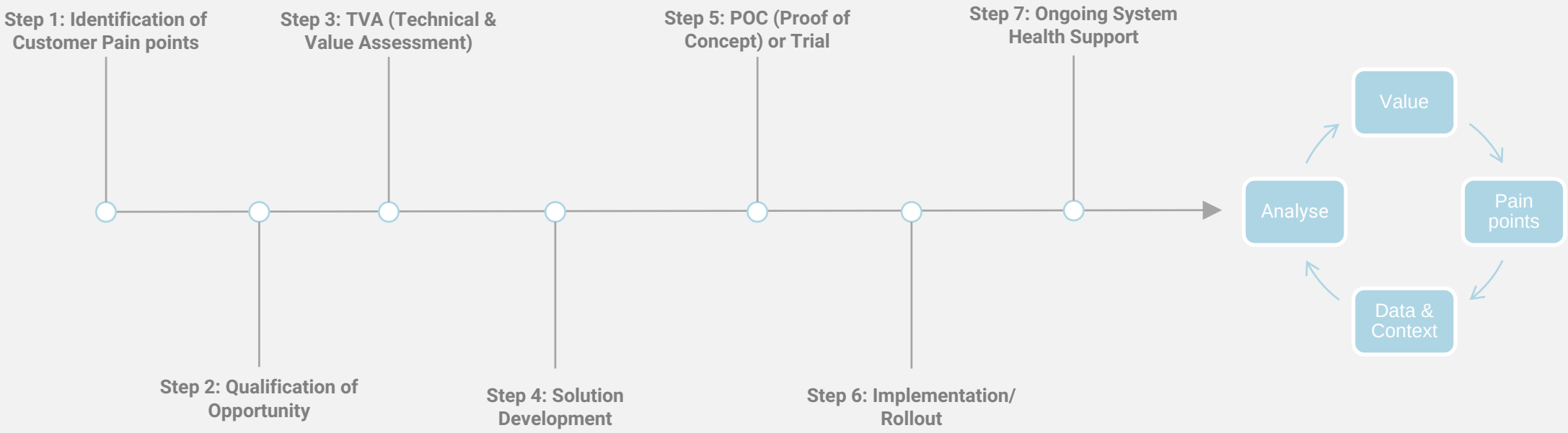
- Takes into account scenario context.
- Example: zone forbidden during high risk operations.
- Integrates into control room infrastructure.

Benefits

- Increased safety of the workforce
- Decreased Section 54s stoppages
- Less vulnerable to human error
- Faster response times when incidents occur
- Fewer safety personnel required
- Better ROI on CCTV infrastructure
- Satisfactory safety results in Annual Reports

End to End Solution Provider

Unlocking Opportunity with Customer



Product features

Product features

Module	Feature
System Health	• Detect camera on/off • Frame rate degradation • Out of focus • Lens dirty • Tamper detection • Poor lighting during night-time operations • Obstructed view
Restricted Zone	• Detect person in restricted area based on geo-fenced area • Restrict geo-fenced area based on time shifts • Mandatory paired working
Protective Equipment	• Hard hat • Safety glasses • Overall • Safety jacket

Module	Feature
Abnormal Behaviour	• Lying down • Running • Crowd gathering • Cell phone use • Smoking
Hazardous Environment	• Smoke • Fire and flare • Access port left open (door left ajar) • Materials left in demarcated pathway • Materials blocking exit

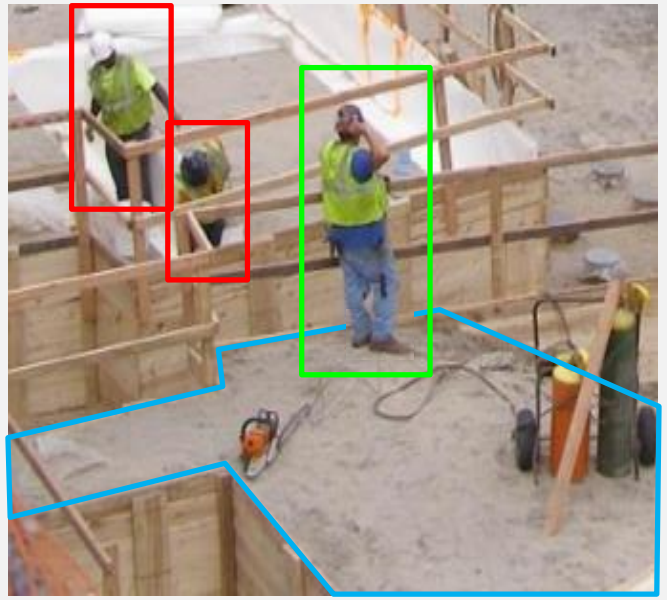
Detect people in high risk areas

- **Safe Zones:** User marks out geo-fence of dedicated pathways in camera field of view.

  System automatically alerts if a person is detected outside of the geo-fenced area.

- **Restricted / Hazardous Zones:** User marks out geo-fence of dedicated restricted area in camera field of view.

  System automatically alerts if a person is detected entering of the geo-fenced area.



- **Demarcated walkways**: More than one-third of the deaths each year attributed to forklifts are pedestrians. [1]
- **Hazardous zones**: Hydrogen sulphide is one of the leading causes of workplace gas inhalation deaths in the US. According to the Bureau of Labour Statistics (BLS), hydrogen sulphide caused 60 worker deaths between 2001 and 2010.[2]

Detect missing PPE

- System automatically detects when PPE is not worn and sends out alert.

- Relevant statistics from the US: [3]
  - > 52,000 "struck by falling object" OSHA recordable incidents each year.
  - 5% of all workplace fatalities in 2015 due to strikes by a falling object.
  - > 1mil reported injuries in the US, 80,910 were head injuries.
  - One of the main causes was noncompliance with headgear standards.
- Relevant statistics from the UK: [4]
  - 11% of work-related injuries are from being struck by an object.
  - 66,000 injuries are estimated to go unreported every year.

Detect abnormal behaviour & hazardous environment

Man on ground / worker falling over / no longer upright:

- Exposure to toxic gas leading to loss of consciousness
- Heart Attack
- Slips and trips

Other abnormal behaviours:

- Running
- Crowding

Monitoring hazardous environments:

- Smoke Detection
- Fire Detection

System Health

The DWPS system uses machine vision and machine learning techniques to detect issues with video feeds.

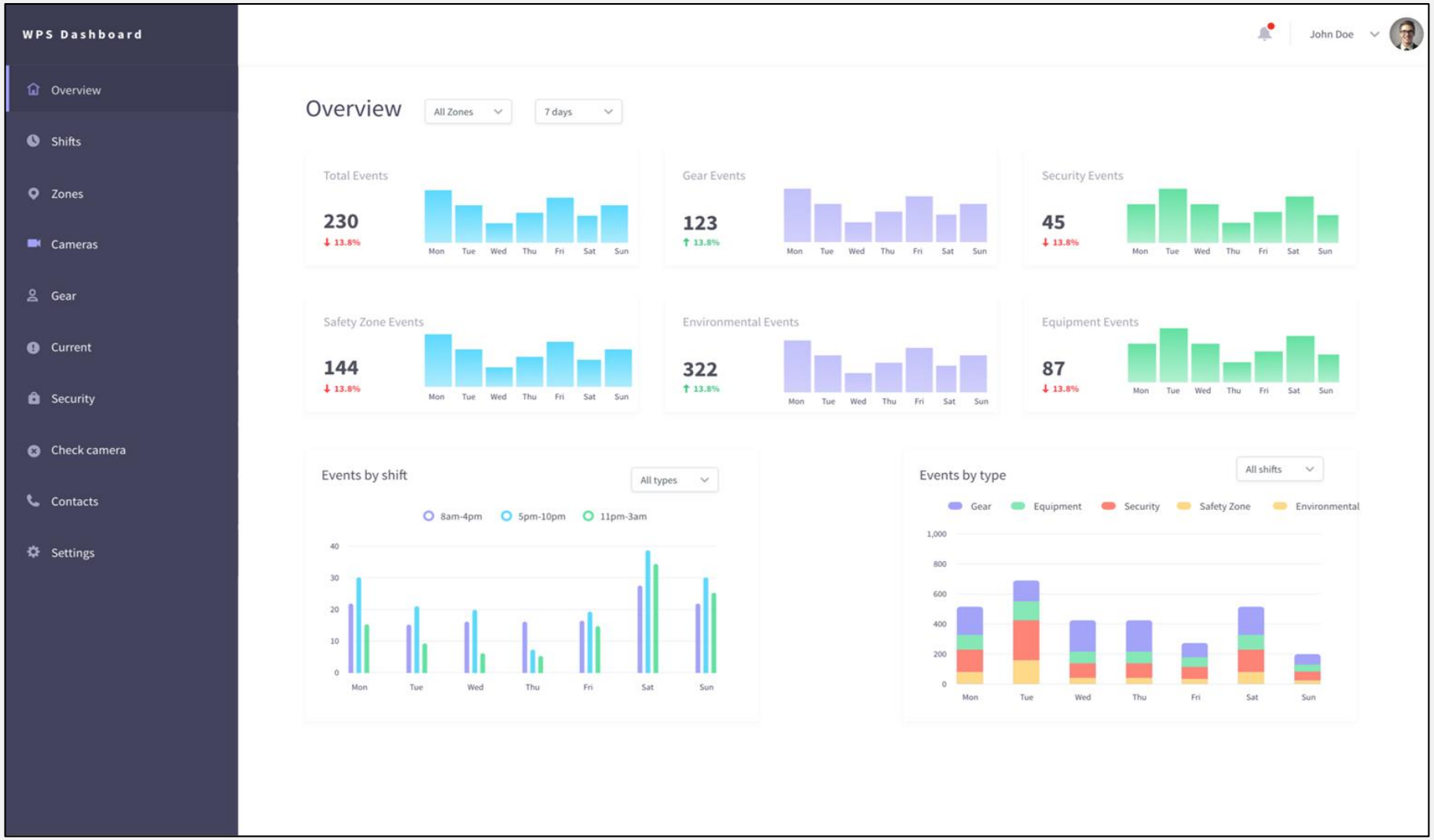
- Out of focus
- Lens dirty
- View obscured
- View shifted
- Camera operational

Service Levels

Software Updates	Software Updates
	Software configuration backups
	Operating System update compatibility
Help Desk	Log support ticket via Email, Telephone or Internet
	Attending to support ticket & determining suitable plan of action
	Responding to client with regards to support ticket via email or telephone
	Attending to System operator queries
System Health	Continues remote monitoring of system health
	Scheduled sensor login & health verification
	Remote Sensor configuration
	Fault detection & Troubleshooting of Sensor and Software
	Ensure Edge and Cloud clusters are operational with high uptime
	Deploy software update and ML Models
	Edge Cluster monitoring and maintenance

Camera health & Tamper detection	Missing camera feed detection
	Camera lens dirty detection
	Camera redirection detection
Human Assisted AI	Monitor and filter incident notifications to remove false positives that may occur
	Escalate valid incident notifications to client
Safety & Compliance Expert Services	Ongoing monitoring
	Expert recommendation for WPS improvements
	Value tracking
	Case management
	Reporting
	Change management

Remote Monitoring & Diagnostics

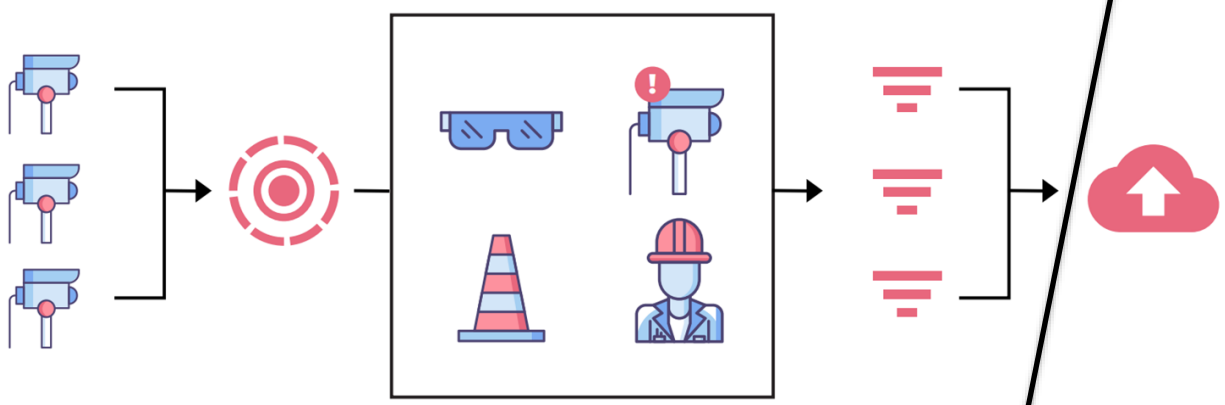


System Architecture

Existing Camera Infrastructure

Custom Built Neural Net Modules

Intelligent Filters



Alarms

Notifications

Web portals

Device management

ML model management

On premises

On cloud

Microsoft Azure

Infrastructure built on Microsoft Azure

Differentiation

Broad range of integration options:

- Integrates with majority of off-the-shelf CCTV cameras
- Integrates into risk management systems
- Fusion with sensor data (wearables, asset trackers, equipment sensors)

Stone Three Proprietary database and industry domain knowledge

- Custom model capability
- Adapts to operational context
- Abnormal behavior, conditions and mood detection

- Ability to scale

- Range of services levels (people, processes, tech)

Next Step: TVA

- Technical and Value Assessment (TVA)
  - Capture client requirements; understand client pain points
  - Assess current infrastructure and gap analysis
  - Stakeholder Analyssis
  - Compile Business Case
  - Generate proposal & costing for first implementation

- Cost of TVA

  $5,000 - $10,000

- Duration of TVA

  ±2 weeks

TVA Process

Pre work

- Outline Objectives of the Analysis
- Execution Time line
- Understanding of the process
- Check lists (tags, Interview)
- Onsite requirements
- Identification of Onsite assistance
- Allocate roles and responsibilities
- Outlining Clients pain points
- Establish key focus areas
- Requirement of IT infrastructure
- Obtain plant layout, camera specifications, sample footage

Execution of TVA

- Evaluation of IT structure
- Align onsite schedule with plant personnel
- Conduct interviews and document pain points / opportunities
- Record contact information of all known plant resources
- Plant walk through
- Touch base with champion/onsite support
- Documentation of processes / findings / interviews answers
- Stakeholder analysis
- Business Case

Reporting / Client Feedback

- Detailed documentation of procedures/ outcomes of TVA
- Results of processed client sample footage
- LTOT presentation on Results & benefit presentation
- Development of Costing structure
- Proposal development
- Proposal presentation

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Thank you

Information sources

[1] https://www.ehstoday.com/forklift-safety/forklifts-and-pedestrians-do-not-mix-infographic

[2] https://www.osha.gov/SLTC/hydrogensulfide/index.html

[3] https://www.constructionbusinessowner.com/news/ansi-approves-publication-dropped-object-prevention-standard

[4] http://www.hse.gov.uk/statistics/industry/construction/

[5] T. Ainsworth, “Buyer beware,” Security Oz, vol. 19, pp. 18–26, 2002.http://www.securityworldmag.com/wsr/wsr_view.asp?idx=1362&part_code=01&page=2

Elaboration slides

Over 20 years of field experience

- Enterprise Software Engineering, Machine Vision, Machine Learning and Software Defined Radio solutions.
- Vertical focus: Heavy Industries, Healthcare and Marine Telecoms.
- Application Lifecycle experience, leveraging processes and systems.
- Inter-disciplinary staff of 65+ professionals: experienced software, electronic and process engineers and product designers.
- Project Management and Systems Engineering using Scaled Agile software development processes.
- Support Capabilities: Experienced support team of 200 systems deployed on 50 sites in 10 countries.

Partners & Clients

- First Quantum Minerals
- Anglo American
- FLSmidth
- Gem Diamonds
- Asanko Gold
- Mediclinic
- Glencore
- JKTech
- Boliden
- SASOL
- Exxaro
- Rusal
- ARM
- ABB
- TSA
- GE

Clients & partners

230 sensors, 40 clients and 60 sites across 10 countries.

AngloAmerican
Sibanye we are one
ARM African Rainbow Minerals
ASSMANG
NKOMATI We Care We Grow We Excel
NORILSK NICKEL
LONMIN
SASOL
FIRESTONE DIAMONDS
GEM DIAMONDS Botswana
Lucara Diamond
ASANKOGOLD
ANGLOGOLD ASHANTI
MULTOTEC
FLSmidth
RUSAL
FIRST QUANTUM MINERALS LTD.
NEW BOLIDEN
exxaro POWERING POSSIBILITY
JKtech SMI Technology Transfer
NEWMONT
ROYAL BAFOKENG PLATINUM MORE THAN MINING
VALE
FREEPORT-McMoRan
GLENCORE
vedanta
SGS
Outotec
RioTinto
fm FIRST MAJESTIC SILVER CORP.

Spec sheet

- Detection scenarios: refer to slides 8 and 9
- RM&D service provided by Stone Three: refer to slide 10
- Monitoring center decision support.
- Stone Three proprietary large database of industrial scenarios for machine learning
- Default framerate of one frame per second per camera
- Onsite GPUs required to run machine learning models
- Seamless LAN camera integration
- Camera protocols supported:
  - H264
  - MJPEG
  - Arbitrary image resolutions
- Leverages Microsoft Azure
  - Edge Processing
  - Events send to Azure Cloud (CosmosDB)
  -PowerBI dashboards
- Archived footage of incidents
- Intellisenzo / PowerBI dashboards
  - Safety KPI monitoring
  - Incident footage
- Scalable to a large number of cameras (1000s per site)