Use Case Research:
COVID-19 Health Management in China’s Construction Industry
Chinese construction companies utilize IoT, big data, cloud computing, and ML, along with strict protocols to ensure the health and safety of workers.
## 1. Monitoring and Management

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<tr>
<th>Use Case</th>
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<th>Complexity*</th>
<th>Solution Provided</th>
<th>Solution Snapshot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Vision Monitoring of Adherence to Mask Wearing and Mass Gathering Policies</td>
<td>Suitable for medium-large sites • Monitor workers mask-wearing status • Enforce policies regarding the number of people who can congregate in one place to prevent transmission</td>
<td>Medium-High: Machine vision hardware deployment poses challenge</td>
<td>Al-enabled video monitoring identifies workers without masks and group gatherings. <strong>Technologies:</strong> Facial recognition software using machine learning algorithms, real-time edge processing, cameras, notification application. <strong>Processes:</strong> 1. Real-time video cameras identified prohibited behavior (not wearing masks, group gatherings). 2. Alerts are sent locally to the individuals or to the central platform.</td>
<td><img src="image" alt="Solution Snapshot" /></td>
</tr>
</tbody>
</table>

**Epidemic Management and Reporting Platform**

Adopted by: China Metallurgical Group Corporation Real Estate

Suitable for medium-large sites • Enable management to remotely monitor and supervise employee health conditions • Integrate data inputs from multiple sources (IoT devices, applications, corporate policy, government regulations, etc.) | Medium: The platform must accept real-time data from a variety of data sources and output to different user groups | A unified platform provides management with a holistic overview of employee health conditions from multiple sites and over time. **Technologies:** IoT devices (data inputs), cloud-based platform, integration with existing systems, end user application. **Processes:** 1. The platform integrates temperature monitoring and other records from onsite personnel with external data such as worker travel history. 2. Dynamic indicators are displayed to inform management and regulators of potential health concerns. | ![Solution Snapshot](image) |

*Deployment complexity indicated the degree of interdependence between equipment, technologies, and systems in a given solution.
## Monitoring and Management

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<td><strong>Smart Construction Site Management Platform</strong>&lt;br&gt;Adopted by: China State Construction Engineering Corporation&lt;br&gt;<img src="image1.png" alt="Smart Construction Site Management Platform" />&lt;br&gt;<strong>Primary Industry</strong>&lt;br&gt;Construction&lt;br&gt;<strong>Use Case:</strong> IoT ONE Use Case Research: COVID-19 Health Management in China’s Construction Industry</td>
<td>Suitable for large sites&lt;br&gt;• Integrate health related data into the existing construction management platform&lt;br&gt;• Improve coordination efforts between teams and across sites&lt;br&gt;• Streamline internal communications</td>
<td>Medium-High:&lt;br&gt;The difficulty of integrating health data will depend upon the flexibility of the existing platform architecture</td>
<td>The smart construction site platform is an intelligent management system that manages the human, machine, material, process, and environmental resources to enable data-driven decision making. Leading construction companies in China integrate epidemic control systems and applications into their existing platforms to ensure the workers’ safety and health. <strong>Technologies:</strong> Data inputs (IoT devices, machine vision, etc.), big data analysis, edge computing, system integration, complex user applications. <strong>Process:</strong>&lt;br&gt;1. Data is collected from a diverse array of sensors, cameras, equipment, and manual entry points.&lt;br&gt;2. Data is transmitted via multiple communication protocols to the cloud (3G/4G/5G, WIFI, LoRAWAN, etc.).&lt;br&gt;3. A centralized cloud-based platform provides data aggregation, analysis, and utilization.&lt;br&gt;4. Applications provide management visibility into workers health status as well as other site management conditions (assets status, pollution, project management, etc.).</td>
<td><img src="image2.png" alt="Solution Snapshot" /></td>
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## 2. Health Condition Diagnosis

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| Onsite 5G Portable Health Check Station | Suitable for medium-large sites  
- Perform regular onsite health diagnosis in real time  
- Enable rapid communication of results to management or healthcare professionals | Low-Medium: The centralized system is easy to deploy and does not require sophisticated integration efforts | The 5G portable health checkup station performs exams and accurately diagnoses a range of patient conditions.  
Technologies: 5G network, health diagnoses equipment, mobile / desktop application.  
Processes:  
1. Diagnoses for physiological parameters, such as blood pressure, and ECG.  
2. Real time reporting and analysis can be displayed at the site or sent to healthcare professionals. | ![Solution Snapshot](attachment:image1) |
| Infrared Thermal Imaging Temperature Screening Robot | Suitable for small-medium sites  
- Improve compliance with temperature screening policies  
- Enable high accuracy data collection in environments with variable positioning of people | Low-Medium: Robots setup presents an installation challenge but the system is otherwise plug-and-play | The integrated infrared thermal imaging temperature screening robot provides high-speed temperature detection with a wide range of movement and visibility.  
Technologies: Multi-axis robot, thermal cameras, diagnosis software, API.  
Processes:  
1. Thermal screening robots detect infrared energy.  
2. Software constructs a heat map of exposed skin.  
3. Automatic alarms will be triggered for abnormal value.  
4. The API provides real-time data synchronization and traceability. | ![Solution Snapshot](attachment:image2) |
## 2. Health Condition Diagnosis

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| Infrared Thermal Imaging Temperature Detection Drones | Suitable for all sites  
- Remote body temperature measurement  
- Improve screening efficiency in uncontrolled environments | Low-Medium: Technology is integrated and can be deployed in as little as one unit with one operator | Temperature detection drones integrate EO/IR (optical and thermal) cameras to detect body temperature on a large scale.  
**Technologies:** Drones, optical and thermal cameras, machine vision software, operator control station, API / application.  
**Processes:**  
1. Drones with thermal cameras screen body temperatures and spot abnormal value across groups of individuals.  
2. The precise position of a person with a fever will be reported to center platforms.  
3. Facial recognition can also report IDs of relevant persons. | ![Solution Snapshot](image) |
3. Site Disinfection & Worker Sanitation

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<td><strong>Onsite Autonomous Disinfection Robots</strong>&lt;br&gt;Apted by: Beijing Urban Construction Group&lt;br&gt;<img src="image1.png" alt="BUCC" /></td>
<td>Suitable for large sites&lt;br&gt;• Increase disinfection efficiency&lt;br&gt;• Enable disinfection at night while workers are off shift&lt;br&gt;• Reduce contamination in construction sites or surrounding areas</td>
<td>Low-Medium:&lt;br&gt;Devices operate automatically and can be safely geofenced in any flat area</td>
<td>On-site disinfection robots carry out autonomous disinfection and sterilization within a geofenced perimeter.&lt;br&gt;&lt;strong&gt;Technologies:&lt;/strong&gt; Cleaning robots, built-in sprayer, omnidirectional cameras, intelligent vision algorithms, AGV software.&lt;br&gt;&lt;strong&gt;Processes:&lt;/strong&gt;&lt;br&gt;1. Robots support 360 degree disinfection coverage and autonomous navigation.&lt;br&gt;2. Disinfection management software enables calculation of the time, workflow, and amount of disinfectant required based on area size.&lt;br&gt;3. Robots automatically return to the port to be filled or charged as required.</td>
<td><img src="image2.png" alt="Disinfection Robot" /></td>
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<tr>
<td><strong>Site Entryway Automatic Disinfection Room</strong>&lt;br&gt;Apted by: Beijing Municipal Road Bridge Group&lt;br&gt;<img src="image3.png" alt="BMRC" /></td>
<td>Suitable for medium-large sites&lt;br&gt;• Disinfect workers upon entry to the site or specific buildings</td>
<td>Low:&lt;br&gt;Construction of the room requires planning but hardware is plug-and-play</td>
<td>The automatic disinfection room enables all workers to be sterilized before entering the construction site.&lt;br&gt;&lt;strong&gt;Technologies:&lt;/strong&gt; Hands-free disinfectant distribution machine, built-in sensors.&lt;br&gt;&lt;strong&gt;Processes:&lt;/strong&gt;&lt;br&gt;1. Entryways are positioned at all buildings with high traffic flows.&lt;br&gt;2. The atomized disinfection spray will be automatically activated when workers walk into the room.&lt;br&gt;3. Contactless system reduces cross-infection.</td>
<td><img src="image4.png" alt="Disinfection Room" /></td>
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## 3. Site Disinfection & Worker Sanitation

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| Automated or Remote Control Disinfectant Spraying Drone | Suitable for medium-large sites  
- Disinfect remote or difficult to reach areas of large construction sites  
- Reduce disinfection blind spots  
- Reduce the risk of health workers being exposed to the virus or disinfectant chemicals. | Low-Medium: Technology is integrated and can be deployed in as little as one unit with one operator | The disinfectant spraying drone is a highly effective alternative for disinfecting remote areas of construction sites.  
**Technologies:** Drones, optical cameras, control and refilling stations, remote control application.  
**Processes:** 1. Spraying drones are filled with disinfectants.  
2. Each drone can cover 100,000 M² in an hour.  
3. Drone flight patterns can be automated or controlled manually. | ![Image](image1.png) |
| Smart Disinfection Management and Warning Application | Suitable for all sites  
- Streamline internal sanitation compliance procedures  
- Trigger alerts when no sanitation record was submitted | Low: This standalone application provides one primary function and can be deployed quickly | The disinfection compliance monitoring application reports daily sanitation and disinfection processes and sends alerts to management or the health department.  
**Technologies:** Mobile application.  
**Processes:** 1. Site managers or designated teams report status daily.  
2. Data is consolidated and presented to management in real time.  
3. A level I warning automatically reminds project managers to check disinfection.  
4. A level IV warning sends reports to government regulatory authorities. | ![Image](image2.png) |

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# 4. Access Control

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<td><strong>Site Access Control with Facial Recognition</strong>&lt;br&gt;Adopted by: Guangxi Construction Group&lt;br&gt;<img src="image1" alt="Guangxi Construction Group" /></td>
<td>Suitable for all sites - Identification of access by persons who have been identified as at-risk of infection or who lack site access permission - Attendance management</td>
<td><strong>Medium:</strong> Integrated hardware can be installed at any access point and software comes pre-installed</td>
<td>Facial recognition functions at a distance of 3-5 meters, multi-person intelligent recognition to avoid contact infection.&lt;br&gt;<strong>Technologies:</strong> Camera system, computer screen (optional), facial recognition software, API, management application.&lt;br&gt;<strong>Processes:</strong>&lt;br&gt;1. Facial biometrics can be installed on the ceiling at access points that lack a physical barrier.&lt;br&gt;2. All people who pass within 5 meters will be scanned against control lists.&lt;br&gt;3. Automatic alarms will be triggered when unqualified personnel are identified.</td>
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<tr>
<td><strong>Temperature Screening and Access Control Gate</strong>&lt;br&gt;Adopted by: China Metallurgical Group Corporation Real Estate&lt;br&gt;<img src="image2" alt="China Metallurgical Group Corporation Real Estate" /></td>
<td>Suitable for medium-large sites - Detect body temperature at the entrance - Minimize contact by eliminating card and fingerprint access control</td>
<td><strong>Medium:</strong> Installation requires planning centralize entry/exit and ensure sufficient traffic flow but operations are simple</td>
<td>Temperature screening and access control gate provides contactless temperature detection and ID identification.&lt;br&gt;<strong>Technologies:</strong> Access gate, thermal cameras, facial recognition software, user interface, API.&lt;br&gt;<strong>Processes:</strong>&lt;br&gt;1. Facial recognition replaces card access or fingerprint identification to reduce contact transmission.&lt;br&gt;2. Automatic alarms will be triggered for unrecognized entrants or entrants who should be under quarantine.&lt;br&gt;3. Masked facial recognition is supported.</td>
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## 5. Geofencing

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<td>Site Geofencing and Intrusion Alert</td>
<td>Suitable for large sites • Identify unauthorized access to large sites when it is not possible to deploy physical barriers around the site</td>
<td>Medium: Large sites may require multiple sensor types to be integrated to provide effective coverage of all potential entry points</td>
<td>Geofencing prevents unauthorized personnel from accessing sites and introducing the virus into areas that are otherwise effectively quarantined from the outside. Technologies: Sensors (motion, vibration, displacement), cameras (radar, infrared), gateways, alarms, control application. Processes: 1. A virtual wall is deployed using a mix of sensors or cameras to detect entry. 2. Audible and visual alarms can be triggered when intruders enter the geofenced area. 3. Alarm data will be sent to the central center to inform security of the time and location of the intrusion.</td>
<td>![Solution Snapshot Image]</td>
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## 6. Worker Track and Trace

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| Worker Positioning and Status Tracking by Helmet Sensor | Suitable for medium-large sites  
- Identify the location of workers in real time  
- Detect congregations that exceed the number of people allowed in close contact  
- Detect temperature periodically without a central check point | Low-Medium: Independent deployment of the solution is simple, complexity arises from integration with other systems | Track the location of each worker to identify mass gatherings and illness indications. Technologies: Connected helmets, GPS, temperature sensor, cameras, lights, intercom, heart rate monitor, application. | ![Helmet sensor diagram](image) |
| Adopted by: China Railway Group              |                                                                                               |                | Processes:                                                                                                 |                                                                                  |
| ![China Railway Group logo]                  |                                                                                               |                | 1. Track worker health condition.                                                                          |                                                                                  |
| ![Helmet sensor image]                       |                                                                                               |                | 2. GPS tracks location to identify who was in contact with an ill co-worker.                               |                                                                                  |
| ![Helmet sensor image]                       |                                                                                               |                | 3. Audio and video intercom enable remote communicate to reduce contact.                                   |                                                                                  |
| ![Helmet sensor image]                       |                                                                                               |                | 4. Abnormal values can be sent automatically to the control center.                                        |                                                                                  |

| Worker Positioning and Status Tracking by Smartwatch | Suitable for medium-large sites  
- Identify the location of workers in real time  
- Detect congregations that exceed the number of people allowed in close contact  
- Detect temperature periodically without a central check point  
- Contactless payment | Low-Medium: Independent deployment of the solution is simple, complexity arises from integration with other systems | Smartwatches monitor workers health conditions and can be connected to a platform to provide real-time insights to management level. Technologies: Smart watches, biometric sensors, GPS, application. | ![Smartwatch diagram](image) |
| Adopted by: China Railway Group              |                                                                                               |                | Processes:                                                                                                 |                                                                                  |
| ![China Railway Group logo]                  |                                                                                               |                | 1. Smartwatches monitor body temperature, blood pressure, oxygen levels, and pulse.                        |                                                                                  |
| ![Smartwatch image]                          |                                                                                               |                | 2. GPS tracks location to identify who was in contact with an ill co-worker.                               |                                                                                  |
| ![Smartwatch image]                          |                                                                                               |                | 3. Contactless payment for canteens, stores, and transportation reduces the chance of cross-infections.    |                                                                                  |
6. Worker Track and Trace

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<td>Digital Quarantine Tracking System</td>
<td>Suitable for all sites • Track quarantine status in a centralized database to determine when a person may access the site</td>
<td>Low-Medium: Application complexity is low but ensuring proper adoption required understanding user behavior and potential workarounds</td>
<td>QR codes linked to a users ID are scanned at checkpoints to assess and track travel histories between cities and quarantine status. <strong>Technologies:</strong> QR code, smart phone, cloud-based application. <strong>Processes:</strong> 1. The mini-app is embedded in Alipay or WeChat (could also be independent). 2. The app assigns three colors to people — green, yellow, red — on the basis of their travel and medical histories. 3. Scanning can record entry to a site.</td>
<td>![QR codes and color codes for tracking quarantine status]</td>
</tr>
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Adopted by: China Communications Construction Company

**Use Case Identification**

- Green: Free to access
- Yellow: 7 days quarantine
- Red: 14 days quarantine

**IoT ONE Use Case Research: COVID-19 Health Management in China’s Construction Industry**
7. Alerts and Education

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| Automated Alerts and Worker Education by Drone with Machine Vision | Suitable for large sites  
  • Educate and raise the awareness of epidemic prevention among onsite workers  
  • Monitor social distancing among workers with insufficient health protection | Low-Medium: Remote control systems can be rapidly deployed while automated systems require careful planning to guarantee safety and effectiveness | Drones with broadcast and monitoring functionalities are deployed in large construction site to educate and supervise workers remotely.  
**Technologies:** Drones, thermal cameras, loudspeakers, control stations, application.  
**Processes:**  
1. The control center can spot identify high risk behavior such as violation of social distancing practices.  
2. Drones broadcast recorded messages to workers immediately to request that they increase distance to reduce the chance of cross-infection.  
3. The machine can also plays audio loops periodically to remind workers to wear face masks, wash their hands to take other precautions. | ![Solution Snapshot Diagram]
## 8. Materials Management

### Use Case

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| Health and Safety Materials Management Application | Suitable for all sites  
• Track the availability and location of medical and transmission prevention goods  
• Improve forecasting accuracy | Medium-High: Basic platform setup is simple but ensuring data accuracy across multiple sites required effective processes and system integration | Epidemic control materials management applications record the usage of materials and predicts the available consumable days to formulate procurement plans. Technologies: RFID, data analytics, management application. Processes:  
1. The platform records the usage of the materials by manual inputs or RFID for thermometers, masks, and disinfectant fluid, etc.  
2. The availability and location are accessible remotely to aid planning across multiple sites  
3. Based on the usage plan combined with the current inventory, the consumable days for the remaining stock is predicted to formulate the procurement plan. |

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We look forward to supporting your success!