

SECTION 28 31 21.20

LIDAR PERCEPTION SOFTWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Section includes a LIDAR detection mechanism incorporating continuous laser scanning in a 3D 360° field of view.

1.2 RELATED SECTIONS

- A. Section 28 31 21.19 LiDAR Area Sensor Perimeter Security

[Specifier Notes]: Remove sections not required under project scope of work.

- B. Section 28 05 11 Cyber Security Requirements for Electronic Safety and Security
- C. Section 28 06 30 Schedules for Security Detection, Alarm, and Monitoring
- D. Section 28 16 13 Access Control Interfaces to Intrusion Detection
- E. Section 26 31 31 Intrusion Detection Interfaces
- F. Section 28 47 21.15 Notification Interfaces to Security Detection, Alarm and Monitoring
- G. Section 28 51 51.15 Information Interfaces to Security Detection, Alarm and Monitoring

1.3 REFERENCES

- A. Abbreviations
  1. LIDAR: Light Detection and Ranging
  2. DTC: Detect, Tracking, and Identification
  3. 3D: Three Dimensional
  4. PoE+: Power over Ethernet Plus
  5. PTZ: Pan, Tilt, Zoom
  6. FOV: Field of View
  7. IEEE: The Institute of Electrical and Electronics Engineers
  8. FDA: The United States Food and Drug Administration
  9. FCC: Federal Communications Commission
  10. ETSI: European Telecommunications Standards Institute
  11. ROHS: Restriction of Hazardous Substances
  12. IEC: International Electrotechnical Commission
  13. WEEE: Waste from Electrical and Electronic Equipment
  14. ASTM: American Society for Testing and Materials
- B. Reference Standards
  1. IEEE 802.3 - Ethernet Standards
  2. Laser Safety a. FDA Class 1 - Laser Safety
  3. Enclosure Ingress Protection Rating IP67

1.4 ADMINISTRATIVE REQUIREMENTS

[Project Number][Project Name]  
[Date][Project Location]

- A. Coordination:
  - 1. Coordinate with Owner or Owner's representative regarding camera network configuration and estimated bandwidth utilization prior to performing network connections.
- B. Sequencing / Scheduling: Provide to Owner or Owner's representative a schedule and list of participants required to attend coordination and progress update meetings.

[Specifier Notes] – Retain only those individuals required to be in attendance for progress meetings. Delete the entire following sub-paragraph if not required.

- 1. Owner representative(s) for Facilities Management, Information Technology (IT) Services, and Security Management.
- 2. General Contractor.
- 3. Project Manager.
- 4. Manufacturer's Representative.
- 5. Project Architect.
- 6. Project Engineer.
- 7. Security Consultant.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's product information and data sheets for each product specified in this section, including:
  - 1. Substrate preparation instructions and recommendations
  - 2. Installation means and methods.
  - 3. Recommendations and requirements for proper storage and handling.
- C. Shop Drawings:
  - 1. Submit Manufacturer's approved shop drawings detailing the section and elevation views of each product to be installed.
  - 2. Coordinate with locations listed on Contract Drawings.
- D. Warranty Information:
  - 1. Submit confirmation and details of manufacturer's warranty, extended warranty, and replacement policies.
- E. System Support Resources:
  - 1. Submit a list of available manufacturers providing fee based professional services available to the Contractor or Owner, including but not limited to the following:
    - a. Training.
    - b. Installation.
    - c. Commissioning.
    - d. Remote diagnostics and integration with 3rd party software and hardware systems.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Supply licensing and registration information for all software, hardware, firmware, operational, and administrative licenses.
- B. Supply network configuration backup files, restoration application and instructions.

#### 1.7 MAINTENANCE SUBMITTALS

[Project Number][Project Name]  
[Date][Project Location]

- A. Spare Parts: All Spare Parts must be delivered to the owner in their original sealed packaging. Clearly label with "SPARE: DO NOT REMOVE", and include manufacturer part numbers, and date of delivery to Owner. Store all spare parts in an environment and condition recommended by the manufacturer.

[Specifier Notes] – Retain one of the next two paragraphs based upon project requirements for spare components.

- 1. One spare for each \_\_\_\_\_ devices.
- 2. Provide spare components as noted in the coordinating schedule for work listed in this section.

## 1.8 QUALITY ASSURANCE

### A. Qualifications - Installers:

- 1. Installer must be licensed to install LiDAR equipment, video surveillance and security equipment as required by authority having jurisdiction.
- 2. Installer must be capable of providing more than 2 references that will attest to successful completion of projects of similar scope as the work noted in this section.
- 3. Installer must be certified by the manufacturer prior to the bid date and be up to date with all training required to maintain good standing.

## 1.9 WARRANTY

### A. Manufacturer Warranty: Provide manufacturer's warranty covering parts and labor costs to repair or replace part that fail to perform.

- 1. Warranty Period: Parts and labor warranty for 24 months from date of Substantial Completion or date of purchase, whichever comes first.
- 2. Service During Warranty: Provide direct support to Owner via phone and email, including access to training and education in the form of documents, videos and other materials via the internet.

END OF SECTION

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

[Specifier Notes] – Retain the following Paragraph if this document is a PROPRIETARY Specification, with Quanergy's products listed as the Basis of Design. Delete if not required.

- A. Basis of Design Manufacturer: Quanergy Solutions, Inc.
  - 1. Address: 128 Baytech Drive, San Jose, California, 95134, USA.
  - 2. Phone: (498) 245-9500.
  - 3. Website: [www.quanergy.com](http://www.quanergy.com).

[Specifier Notes] – Retain the following Paragraph if this document is written as a PERFORMANCE specification, without listing a manufacturer as a basis of design. Insert manufacturers that sell products comparable to those specified in this section. Delete if not required.

- B. Manufacturer List:
  - 1. Manufacturer: Quanergy Solutions. Inc  
Address: 128 Baytech Drive, San Jose, California, 95134, USA.  
Phone: (498) 245-9500.  
Website: [www.quanergy.com](http://www.quanergy.com)

## 2.2 GENERAL DESCRIPTION

- A. The LiDAR-based perception software shall use data intelligence to provide three-dimensional perception and volumetric sensing for the detection, tracking, and classification (DTC) of objects as people or vehicles, as well as types of sub-vehicles.
- B. The DTC solution shall leverage a user-friendly, software-based toolkit for the discovery, management, and calibration of related LiDAR sensors.
- C. The DTC solution shall comprise of several components: LiDAR's, license(s), server software on user-preferred host computer, and client software on user-preferred host computer.
- D. The DTC solution shall steer and alarm (slew to cue) PTZ cameras.
- E. The system architecture shall deploy in a simple distributed scenario where all DTC solution components connect to the installation site's Ethernet local area network (LAN) via Transmission Control Protocol/Internet Protocol (TCP/IP) using industry-standard equipment.
- F. The DTC Server and DTC Client shall connect to the same LAN in order to access the visualization and alert system and to provide output to any third-party applications that consume the Server's output.
- G. The DTC Server shall receive input from multiple LiDAR's that have been calibrated through the toolkit.
- H. The DTC Server shall produce output (object, zone event, and point cloud information) to the customer's own network infrastructure, including Video Management Systems (VMS).
- I. The DTC solution shall allow combining individual results from multiple DTC servers into a single output. The object IDs shall be consistent across the servers (that is, an object traveling from one server area to another server area shall preserve its object ID). Duplicate objects shall be suppressed.
- J. The DTC Server shall support user authentication using the HTTP Digest authentication protocol and shall support data encryption (object list, zone list, state list, etc) using AES-256 encryption.

## 2.3 TOOLKIT

- A. The toolkit shall be a separate software package that can be leveraged to provide necessary information to be consumed by the DTC solution.
- B. The toolkit shall be packaged as a sophisticated Graphical User Interface (GUI) in an eye-soothing color palette with intuitive tabs, menus, tooltips, and dialog boxes for easy use via mouse and keyboard.
- C. The toolkit shall include an automatic LiDAR sensor discovery engine that shall disclose specific data about the network, the LiDAR Sensors on it, and their performance.

- D. A manual search mode shall enable the discovery of a particular LiDAR on the network.
- E. The toolkit shall enable connectivity to the LiDAR with a single click of a mouse button.
- F. Connected LiDAR sensors shall report their model, IP address, serial number, and device number.
- G. The toolkit shall provide intuitive click-through buttons and dialogs for visualizing the collected LiDAR data.
- H. The toolkit shall enable and control simultaneous recordings of data collected by multiple LiDAR sensors.
- I. Pairs of connected LiDAR sensors (or LiDAR sensors whose data was previously recorded) may be selected, aligned, and calibrated to each other when the user responds to a series of simple prompts via mouse and keyboard.
- J. The toolkit shall calibrate multiple LiDAR sensors, pair by pair, until all are aligned to each other to produce a fused single view of the area of interest.
- K. The toolkit shall aid the calibration process by helping snap together the two views of the LiDAR sensor pair, but the user shall fine-tune that alignment with mouse clicks of arrow buttons until the view is adequately fused.
- L. Upon completion, the toolkit shall report "Calibration is done," create a calibration map, and save it in a file, to be consumed by the DTC Server.

#### 2.4 DTC SERVER SOFTWARE ON HOST COMPUTER

- A. The DTC Server shall be supported on either Linux/Ubuntu 20.4 or Windows 10/11.
- B. The DTC Server shall provide the backend system that shall accomplish three primary tasks: provide essential functionality, process data, and publish output.
- C. To provide essential functionality the DTC Server shall:
- D. (After initial bootup/login) restart automatically as needed to provide persistent service.
- E. Connect to multiple LiDAR sensors by individual IP addresses. While the DTC software shall have no limit on the number of sensors, in practice the physical limit shall depend on the current processor speed and available memory of the server.
- F. Accept commands and parameters (if any) from the remote Client via a shared interface.
- G. The DTC Server settings shall be configurable through a Configuration API.
- H. To process data collected by the LiDAR sensors, the DTC Server's artificial intelligence (AI) algorithms shall via configurable parameters and in real time:
  1. Collect, timestamp, unify, and format all point cloud data from each LiDAR.
  2. Cluster and group the points into trackable objects.
  3. Detect objects of various sizes and shapes up to 70 meters away.
  4. Track each unique object's historical movements through space and time up to 70 meters away.
  5. Measure the sizes and velocities of objects in the surveillance area.
  6. Classify objects up to as human or unknown based on motion, size, and velocity dependant on sensor distance abilities.

7. Detect if any active objects are in zones of interest.
8. Include a Motion Threshold Filter as well as an Occlusion Filter as noise reducing mechanisms.
9. Detect, track, and classify up to 600 simultaneous objects (depending on hardware processing platform and number of sensors).
10. To make output from its processing action usable, the DTC Server shall:
11. Publish streams of object, zone event, and point cloud data in a serialized format on the local Ethernet network. The streamed object data shall include XYZ coordinates, dimensions, direction, velocity, classification, and subclassification for all objects in the LiDAR sensors field of view (except for those in exclusion zones).
12. Allow the DTC Client software and any number of potential third-party listening applications to consume and subscribe to these published data stream outputs for surveillance or visualization.
13. Allow its output to serve as the basis for further action, including the notification of external alarm systems via TCP and HTTP GET. By measuring and providing exact 3D coordinates of humans, DTC Server shall reduce or eliminate false positive threats.

## 2.5 DTC CLIENT SOFTWARE ON HOST COMPUTER

- A. The DTC Client shall be supported on either Linux/Ubuntu 20.4 or Windows 10/11.
- B. The DTC Client shall connect to the same Ethernet subnet LAN as the DTC Server.
- C. The DTC Client shall be a standalone application that consumes and visualizes the streams of data published by the DTC Server as a three-dimensional representation of the object, zone, and point cloud published by the Server.
- D. The DTC Client GUI shall include menus, tooltips, and dialog boxes for easy use via mouse and keyboard, in an eye-soothing color palette.
- E. The DTC Client shall be responsible for posting command and data messages that control the Server's behavior, including messages that define event and inclusion zones (to heed) and exclusion zones (to ignore), and messages for when to start or stop recording.
- F. The DTC Client shall allow configuration of rules to trigger point cloud recordings, network actions and/or automatically control PTZ camera movement to follow selected objects through a built-in *Rules Engine*.
- G. The DTC Client visualizer shall enable the user to employ a mouse to draw three types of zones:
  1. *Event zones* may be defined for areas of heightened interest that are critically important to protect. If desired, the user shall click through the *Rules Engine* menu (described above in section 4d) and apply rules to Event Zones for the software and optional PTZ cameras to track particular objects and call attention to suspicious activities before problems occur. Rules may also be assigned for highlighting tracked objects in the visualizer or turning devices (lights, alarms, and so on) on and off through a typed HTTP GET network command.
  2. *Exclusion zones* may be defined for zero-interest areas that pose no threat, but are visually noisy with flapping flags and vegetation, for example. To preserve resources, the software shall not monitor, collect, visualize, or output points within these zones.
  3. *Inclusion zones* may be defined to limit the DTC processing area so that everything outside of the Inclusion is ignored. If no Inclusions zones are drawn, the DTC server should process the entire area covered by the sensors except for Exclusion zone areas. If 1 or more Inclusion zones are drawn, the DTC server should only process the point

cloud in the Inclusion zones. Event zones and Exclusion zones should be able to overlap Inclusion zones.

- H. The DTC Client shall consume the calibration file produced through the toolkit, and shall then align the overlapping vision of multiple LiDAR sensors into an enriched fused view of the same space. As a result of this distributed vision, the visualization may detect points from one LiDAR's point of view that are blocked from another LiDAR's view.
- I. The DTC Client visualizer shall display in real time the movement and trail of human-sized objects (appearing as bounded boxes) over time, persisting through blockages and crowd gaps.

## 2.6 VMS CLIENT PLUG-IN

- A. As an alternative to the DTC Client, users may integrate a VMS solution seamlessly with the DTC solution.
- B. The DTC solution shall boost the surveillance effectiveness when integrated with major Video Management Systems (VMS) solutions.
- C. The manufacturer of the DTC solution shall offer VMS Client plug-ins to easily integrate with existing customer security platforms and enhance object tracking and PTZ camera control. These clients must be at least:
  - 1. Milestone
  - 2. Genetec
  - 3. Hanwha
  - 4. Other VMS Manufacturers.
- D. If compatible, LiDAR sensors that integrate into an existing VMS solution may leverage its existing power and communication infrastructure.
- E. Camera compatibility requirements shall be determined by the particular VMS solution.

## 2.7 CAMERA INTEGRATION

- A. Users can have cameras steered either directly by QORTEX DTC or through a VMS Client plug-in.
- B. The DTC solution shall control optionally provided PTZ cameras that are compliant with the global standards set by the Open Network Video Interface Forum (ONVIF), Profile S (for "streaming video"). Such compliance ensures the effective interoperability of security products operating under the Internet Protocol (IP).
- C. The DTC solution shall be a client of ONVIF services and shall support Web Services Security (WSS) digest authentication.
- D. The DTC solution output of an object's XYZ coordinates, dimensions, direction, and velocity shall inform cameras and enable them to:
  - 1. Focus attention on an area of interest.
  - 2. Track and zoom to specific objects observed in the surveillance area or in special event zones.
  - 3. Lock to the track of one specific object, and stay with it until it is lost.
  - 4. Use VMS systems, such as Genetec or Milestone, for camera integration.
  - 5. DTC Client software shall provide menus that enable users to control camera-to-object behavior:

[Project Number][Project Name]  
[Date][Project Location]

- E. The DTC Plug-in shall allow the operator to:
  - 1. Click and drag a mouse to draw event or exclusion zones.
  - 2. Click GUI menu options to enable camera following and to reset camera positioning.
  - 3. Control the camera manually by clicking a track to lock a camera's attention on an object.
  - 4. Set up menu-driven rules for when and how long a camera shall focus on an object.

END OF SECTION

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Do not begin installation until substrates have been properly prepared.
- B. Evaluation and Assessment: If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Surface Preparation: Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install all products in this section following the product manufacturer's published installation and application manuals and guidelines.

### 3.4 CLOSEOUT

- A. Demonstration:
  - 1. Demonstrate administration and operation of devices described by this section.
  - 2. Demonstrate how to authorize users and applications to operate and configure installed devices.
  - 3. Demonstrate how an authorized user can gain access to and make changes to configuration.
  - 4. Demonstrate how to operate functionality configured for this project as defined by configuration punch list.

END OF SECTION