

Customer Insights & Needs		
User Insights	User Needs	Specification
"I can't feel my arms after scanning", "Quite heavy and uncomfortable" User comfort matters	The module can scan without much manual maneuvering and handling	Vertical Field-of-view (VFOV) of a single scan frame
	The module can be comfortably operated for extended periods without fatigue	LiDAR system weight
	The module can operate silently	Decibel during operation
"Jerky motion ruins mapping quality"	The module can maintain high LiDAR point accuracy over a specified scanning distance for reliable de-skewing and mapping	LiDAR point accuracy at specified distance
	The module is easy to operate with minimal training required	Familiarization time
Disassembly and reassembly took a bit of time. System should be reliable and efficient	The module can transfer LiDAR data stably to the compute unit	Data throughput rate
	The module supports modular upgradeability and serviceability	Proportion of replaceable/serviceable parts
	The module can integrate seamlessly into dConstruct's handheld ecosystem	Percentage of mechanical and electrical parts modified to accommodate module.
	The module does not significantly affect battery life of the scanner	Average current consumption

User Needs & Metrics						
User Needs	Specification	Importance (1-5)*	Measurement Unit	Marginal Value (Acceptable)	Ideal Value (Target)	Competitor Reference / Benchmark / Justification
The module can scan <b>without much manual maneuvering and handling</b>	<b>Vertical Field-of-view (VFOV)</b> of a single scan frame	5	Degrees (°)	180°	≥ 270°	Typical handheld scanners: 30-270° Single LiDAR scanner: ~30° Leica BLK2GO: 270°
The module can be comfortably operated for <b>extended periods without fatigue</b>	LiDAR system <b>weight</b>	5	Kilograms (kg)	1.2kg	1.0 kg	Typical LiDAR scanner weights ~0.8kg (Hesai XT32). Marginal ~1.5x, Ideal ~1.2x
The module can maintain <b>high LiDAR point accuracy</b> over a specified scanning distance for reliable de-skewing and mapping	<b>LiDAR point accuracy</b> at specified distance	5	Millimeters (mm @ specified distance)	±30 mm @ 80 m	±20 mm @ 80 m	Match LiDAR scanner unit. Ouster OS1-64: ~25 mm @ 80 m; Hesai XT32: ~20 mm @ 80 m
The module can transfer LiDAR data stably to the compute unit	Data throughput rate	1	Mbps	80 Mbps	100 Mbps	Hesai XT32: 100 Mbps standard
The module is <b>easy to operate</b> with <b>minimal training</b> required	<b>Familiarization</b> time	3	Minutes	60	30	Current training average: 1-2 hrs
The module can operate silently	Decibel during operation	1	dB	60	30	65 dB ~ Human speech 30 dB ~ Typical LiDAR scanner operation
The module supports modular upgradeability and serviceability	Proportion of replaceable/serviceable parts	1	Percent (%)	40	60	
The module can integrate seamlessly into dConstruct's handheld ecosystem	Percentage of mechanical and electrical parts modified to accommodate module.	2	Percent (%)	40	10	Existing ecosystem requirement
The module does not significantly affect <b>battery life</b> of the scanner	Average <b>current consumption</b>	3	Amperes (A)	1.2 A	1.0 A	Typical standalone LiDAR scanner unit current draw at 12V = 0.8A. Marginal ~1.5x, Ideal ~1.2x

\*Based on House of Quality Needs-Metrics Matrix

House of Quality									
	Vertical Field-of-view (VFOV) of a single scan frame	LIDAR system weight	LIDAR point accuracy at specified distance	Data throughput rate	Familiarization time	Decibel during operation	Proportion of replaceable/serviceable parts	Percentage of mechanical and electrical parts modified to accommodate module.	Average current consumption
The module can scan without much manual maneuvering and handling	9	8	6		8				
The module can be comfortably operated for extended periods without fatigue	2	9				5			4
The module can maintain high positional accuracy over scanning distance for reliable de-skewing and mapping	8		9	2					5
LIDAR point accuracy at specified distance			7	9				5	
The module is easy to operate with minimal training required	9	9			9				2
The module can operate silently						9			
The module supports modular upgradeability and serviceability		1					9	6	
The module can integrate seamlessly into dConstruct's handheld ecosystem			8	3	4		4	9	2
The module does not significantly affect battery life of the scanner	2	4		2					9
Intermediate Steps	30	31	30	16	21	14	13	20	22
	15.2284264	15.73604061	15.2284264	8.121827411	10.65989848	7.106598985	6.598984772	10.15228426	11.16751269
Relative Importance (1-5)	5	5	5	1	3	1	1	2	3

Concept Screening					
	<u>A</u> Single LiDAR (Benchmark)	<u>B</u> Dual LiDAR	<u>C</u> Dual-axis Scanner	<u>D</u> Actuated LiDAR	<u>E</u> Hemispherical LiDAR
Selection Criteria					
Vertical Field-of-view (VFOV) of a single scan frame	0	+	++	++	+
LiDAR system weight	0	--	-	-	0
Positional accuracy over distance	0	0	0	0	--
Familiarization time	0	0	++	++	0
Average current consumption	0	--	-	-	0
Sum +'s	0	1	4	4	1
Sum 0's	4	2	1	1	3
Sum -'s	0	4	2	2	2
Net Score	0	-3	2	2	-1
Rank	3	5	1	1	4
Continue?	No	No	No (Not commercially available)	Yes	Monitor for Development

Concept Selection					
		A	B	C	D
Selection Criteria	Weight	Simplest Mechanical Integration	Reciprocating Test Platform	IMU Test Platform	Integrated Option
Vertical Field-of-view (VFOV) improvement	30%	5	4	5	5
Total system weight	25%	3	1	2	4
Angle measurement accuracy	25%	4	5	2	3
Ease of use	13%	5	2	5	5
Estimated power use	13%	3	1	2	3
Net Score		4.25	3.075	3.375	4.25
Rank		1	3	4	1
Continue?		Yes	No	No	Yes