**MPMC Project – LiDAR Scanner Prototype**

# **Literature Survey**

Research Papers

Research Gate :

* Chiang, Chih-Wei & Das, Subrata & Chiang, Hui-Wan & Nee, Jan & Sun, Shu-Huang & Chen, S.-W & Lin, P.-H & Chu, J.-C & Su, C.-S & Su, L.-S. (2015). A new mobile and portable scanning lidar for profiling the lower troposphere. Geoscientific Instrumentation, Methods and Data Systems. 4. 10.5194/gi-4-35-2015.
* Sidharta, Hanugra & Sidharta, Sidharta & Sari, Wina. (2019). 2D Mapping and boundary detection using 2D LIDAR sensor for prototyping Autonomous PETIS (Programable Vehicle with Integrated Sensor). Kinetik: Game Technology, Information System, Computer Network, Computing, Electronics, and Control. 4. 10.22219/kinetik.v4i2.731.

Optica :

* Maccarone, K. Drummond, A. McCarthy, U. K. Steinlehner, J. Tachella, D. A. Garcia, A. Pawlikowska, R. A. Lamb, R. K. Henderson, S. McLaughlin, Y. Altmann, G. S. Buller, “Submerged single-photon LiDAR imaging sensor used for real-time 3D scene reconstruction in scattering underwater environments,” *Opt. Express* Vol. 31, Issue 10, pp. 16690-16708 (2023).
* G. Kim, J. Eom, S. Hur, and Y. Park, "Prototype design of 3D scanning LIDAR based on direct-sequence optical code division multiple access," in Advanced Photonics 2018 (BGPP, IPR, NP, NOMA, Sensors, Networks, SPPCom, SOF), OSA Technical Digest (online) (Optica Publishing Group, 2018), paper JTu2A.69.
* S. Cwalina, C. Kottke, N. Laske, V. Jungnickel, and R. Freund, "Coherent LiDAR Prototype Based on 2D MEMS Mirror Scanning," in Optical Fiber Communication Conference (OFC) 2023, Technical Digest Series (Optica Publishing Group, 2023), paper M3F.6.
* Y. Budisusanto, M. N. Cahyadi, I. W. Farid, M. R. Ubaidillah and D. W. Imani, "Low Cost LiDAR Prototype Design for 3D Mapping," 2021 International Conference on Advanced Mechatronics, Intelligent Manufacture and Industrial Automation (ICAMIMIA), Surabaya, Indonesia, 2021, pp. 13-17, doi: 10.1109/ICAMIMIA54022.2021.9808695. keywords: {Laser radar;Costs;Three-dimensional displays;Moon;Prototypes;Distance measurement;Laser beams;LiDAR;Low Cost},

Harvard.edu :

* [1]Hartsell, D., LaRocque, P. E., and Tripp, J., “Rapid 2-axis scanning lidar prototype”, in <i>Electro-Optical Remote Sensing X</i>, 2016, vol. 9988, Art. no. 99880D. doi:10.1117/12.2241433.

IEEE :

* S. Cwalina, C. Kottke, N. Laske, V. Jungnickel and R. Freund, "Coherent LiDAR Prototype Based on 2D MEMS Mirror Scanning," *2023 Optical Fiber Communications Conference and Exhibition (OFC)*, San Diego, CA, USA, 2023, pp. 1-3, doi: 10.1364/OFC.2023.M3F.6.  
  keywords: {Micromechanical devices;Laser radar;Prototypes;Optical fiber communication;Optical transmitters;Mirrors},

MDPI :

* Baek J. Two-Dimensional LiDAR Sensor-Based Three-Dimensional Point Cloud Modeling Method for Identification of Anomalies inside Tube Structures for Future Hypersonic Transportation. *Sensors*. 2020; 20(24):7235. <https://doi.org/10.3390/s20247235>
* Raj, Thinal, Fazida Hanim Hashim, Aqilah Baseri Huddin, Mohd Faisal Ibrahim, and Aini Hussain. 2020. "A Survey on LiDAR Scanning Mechanisms" *Electronics* 9, no. 5: 741. https://doi.org/10.3390/electronics9050741

Science Direct :

* Mohd Yusuf, Aman Zaidi, Abid Haleem, Shashi Bahl, Mohd Javaid, Sonu Bala Garg, Jatinder Garg, IoT-based low-cost 3D mapping using 2D Lidar for different materials, Materials Today: Proceedings, Volume 57, Part 2, 2022, Pages 942-947, ISSN 2214-7853, <https://doi.org/10.1016/j.matpr.2022.03.161>. (https://www.sciencedirect.com/science/article/pii/S2214785322014857) Keywords: 3D mapping; Lidar; Internet of Things; Cost-effective

IOPScience :

* @article{Tai\_2023, doi = {10.1088/1361-6439/ac9e62}, url = {https://dx.doi.org/10.1088/1361-6439/ac9e62}, year = {2022}, month = {nov}, publisher = {IOP Publishing}, volume = {33}, number = {12}, pages = {125001}, author = {Trevor S Tai and Siyuan He and Behrad Ghazinouri}, title = {2D FPCB micromirror for scanning LIDAR}, journal = {Journal of Micromechanics and Microengineering},

Products:

1. **KEYENCE**

<https://www.generationrobots.com/en/262-hokuyo-lidar?srsltid=AfmBOoo3gaSMap3k6QZ9JAuepAjXwqe14TI2aGExsC1czP0VWAtNTObA>

1. **YDLIDAR G4 360° 2D LiDAR Sensor**

SKU: 1415429

* Product: YDLIDAR G4 360° 2D LiDAR Sensor
* Input Voltage Range: 4.8-5.2
* Startup current (mA): 1000
* Working current (mA): 350
* Ranging frequency (Hz): 9000

**Price - ₹ 29,949.00 (Incl. GST)**

**Features:**

* 360 degrees scan ranging
* High accuracy, stable performance
* Wide measuring range
* Strong resistance to ambient light interference
* Industrial grade brushless motor drive, stable performance  
  Class I eye safety
* 360 degrees omnidirectional scanning and 5-12Hz frequency
* Using optical and magnetic fusion technology to realize wireless communication and wireless power supply
* High-speed ranging, up to 9000Hz frequency

|  |  |
| --- | --- |
| **Input Voltage (V)** | 4.8-5.2 |
| **Startup current (mA)** | 1000 |
| **Working current (mA)** | 350 |
| **Ranging frequency (Hz)** | 9000 |
| **Motor frequency (Hz)** | 5-7 |
| **Shipping Weight** | 0.214 kg |
| **Shipping Dimensions** | 7 × 7 × 4 cm |

1. **YDLIDAR G2 360° 2D LiDAR Sensor**

SKU: 1294327

* Model: G2
* Ranging Distance: 12m
* Supply Voltage: 5.2 V
* Working current: 500mA
* Field of view: 360°
* Ranging Frequency: 5000 times per second
* Motor Frequency: 12 Hz

**Price - ₹ 13,511.00 (Incl. GST)**

**Features:**

* 360 degrees scan ranging
* Stable performance and high accuracy
* Wide measuring range
* Strong resistance to ambient light interference
* Industrial-grade brushless motor drive, stable performance
* Laser power meets Class I laser safety standards
* 360 degrees omnidirectional scanning and 5-12Hz frequency
* Using optical and magnetic fusion technology to realize wireless communication and wireless power supply
* High-speed ranging, up to 5000Hz frequency

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| --- | --- |
| **Product Type** | LiDAR |
| **Model** | G2 |
| **Brand** | YDLIDAR |
| **Maximum Supply Voltage (V)** | 5.2 V |
| **Operating Current (A):** | 500mA |
| **Field of View** | 360° |
| **Ranging Distance** | 12m |
| **Ranging Frequency** | 5000 times per second |
| **Angle Resolution** | 0.864 (Frequency-12Hz) |
| **Operating Temperature** | 50 ℃ |
| **Shipping Weight** | 0.404 kg |
| **Shipping Dimensions** | 13 × 10 × 8 cm |

1. **YDLIDAR X2 360 Degree ROS Scanner for Navigation, Collision Avoidance – 8M**

SKU: 887613

* High Accurracy,Low power consumption
* Scanning Frequency: 7Hz
* Ranging Frequency: 3000Hz
* Distance Range: 0.1-8m based on the Based on reflectivity of objects.

**Price - ₹ 5,848.00**

**Features:**

* 360 degrees scan ranging
* High accuracy, stable performance
* Wide measuring range
* Strong resistance to ambient light interference
* Low power consumption, small size, stable performance and long service life
* Class I eye safety
* Motor speed adjustable, the proposed speed is 6Hz
* Ranging frequency up to 3kHz
* Scan Fequency : 5-8Hz
* Range Distance : 0.12-8m
* Angle Resolution : 0.6°-0.96°
* Dimension : 60.5mm x 50.3mm x 96mm

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| **Scan Angle** | 360° |
| **Resolution** | 0.82°-0.86° |
| **Scan Frequency (Hz)** | 7 |
| **Length (mm):** | 60 |
| **Width (mm):** | 47 |
| **Height (mm):** | 96 |
| **Shipping Weight** | 0.2 kg |
| **Shipping Dimensions** | 10 × 7 × 6 cm |

1. **SLAMTEC RPLiDAR S2E 360 Degree Laser Range Scanner – 30M Range, 2D point cloud map, 80000 lux light resistance, IP65, high safety for human eye**

SKU: 1507765

* Product: RPLiDAR S2E 360 Degree Laser Range Scanner – 30M Range, 2D point cloud map, 80000 lux light resistance, IP65, high safety for human eye
* Sampling Frequency: 32K
* Rotational Speed: 10Hz
* Angular Resolution: 0.12°

**Price - ₹ 42,999.00 (Incl. GST)**

**Features:**

* 360 Degree DToF Laser Ranging Scanner: Generate 2D point cloud map information up to 30m radius, within 30mm precision
* Stunning Sampling Capability: Up to 32KHz measurement frequency, 10Hz rotational speed, resist up to 80000 lux light
* Prolong Operation Life: Apply OPTMAG light magnetic fusion technology for support up to five years of reliable running
* Suitable for Anywhere: IP65 high ingress protection, small and compact, capable of every indoor and outdoor deployment
* Certified Output Laser Power: Safe as IEC-60825 Class One eye safety rating

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| **Sampling Frequency** | 32K |
| **Rotational Speed** | 10Hz |
| **Angular Resolution** | 0.12° |
| **Motor** | Brushless |
| **Dimensions** | 77 x 77 x 38.5 mm |
| **Weight** | 190g |
| **Connect** | Ethernet UDP |
| **System Voltage** | 12V |
| **System Current** | 200mA |
| **Power Consumption** | ＞ 2W |
| **Temperature Range** | -10℃ – 50℃ |
| **Angular Range** | 360° |
| **Scan Field Flatness** | ±1.5° |
| **Range Resolution** | 13mm |
| **Accuracy** | ≤30mm |
| **Shipping Weight** | 0.19 kg |
| **Shipping Dimensions** | 77 × 77 × 38 cm |

1. **Slamtec RPLIDAR A1M8 2D 360 Degree 12 Meters LIDAR Sensor for Robot Navigation and Obstacle Avoidance**

**Price - ₹ 11,764.85 (Incl. GST)**

**Features:**

* 12 meter range radius for obstacle avoidance and navigation
* 5V power supply with M2.5 mounting holes
* Configurable scan rate from 2-10Hz, plug and play
* 8000 times sample rate, ideal for robot navigation
* Application scenarios include home service robot navigation, 3D modeling, and SLAM
* Measures distance data in more than 8000 times/s
* 360 Degree Omnidirectional Lidar Range Scanning
* 8000 times sample rate, the highest in the current economical LIDAR industry
* OPTMAG Original Design, prolong the life-span Configurable Scan Rate from 2-10Hz

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| Product Dimensions | 5.1 x 3.9 x 3.1 inches (13 x 9.9 x 7.9 cm) |
| Item Weight | 11.2 ounces (317.52 grams) |
| Item model number | RPLIDAR A1M8 |
| Is Discontinued By Manufacturer | No |
| Date First Available | June 25, 2019 |
| Manufacturer | Slamtec |
| Country of Origin | China |
| Brand | Slamtec |
| CPU Socket | BGA |
| Memory Clock Speed | 5.5 GHz |
| Platform | Linux |
| Model Name | RPLIDAR A1M8 |
| Main Power Connector Type | DC power connector |
| Graphics Card Interface | PCI Express |
| Number of USB 2 Ports | 1 |
| Package Weight | 1 Pound |

1. **DFR0315** [**DFROBOT**](https://www.tme.com/in/en/katalog/p,dfrobot_1215/)

Sensor: 2D scanner; laser; 5VDC; USB-UART; 0.15÷12m; 360°; SLAM

Manufacturer part number:

DFR0315

TME Symbol:DF-DFR0315

Supply voltage - 5V DC

Gross weight - 251.3 g

**Price - ₹ 11,166.48 (Incl. GST)**

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| --- | --- | --- |
| Manufacturer | [**DFROBOT**](https://www.tme.com/in/en/linecard/p,dfrobot_1215/) |  |
| Type of sensor | [**2D scanner**](https://www.tme.com/in/en/katalog/sensor-modules_113690/?params=2193:1936478) |  |
| Kind of sensor | **laser** |  |
| Interface | **USB - UART** |  |
| Distance measurement range | **0.15...12m** |  |
| Measurement frequency | **2Hz/5.5Hz/10Hz** |  |
| Viewing angle | **360°** |  |
| Resolution | **1°** |  |
| Information | **product is not a working device, but only component** |  |
| Application | **SLAM** |  |

1. **Unitree 4D 3D LiDAR L1 360 Degree TOF Lidar Scanner AI Robot ROS AGV SLAM (L1 PM)**

Item #: 75232361

**Price - ₹ 56,510.00 (Incl.GST)**

**Features & Benefits**

* Ultra Wide Angle for large omnidirectional FOV
* Compact size (75x75x65mm) and lightweight (230g) for flexible installation
* Can detect under complex lighting conditions
* Effective resistance to indoor ambient light and outdoor glare interference
* Stable ranging and high accuracy map building under 100Klux outdoor light
* Scanning effect differs under different angles and radar parameter configurations

1. **RPLIDAR A2M12 - 360 Degree LiDAR Laser Range Scanner (12m)**

Mfr. No: DFR0445

Mfr: DFRobot

Distance Sensor Development Tool RPLIDAR A2M12 - 360 Degree LiDAR Laser Range Scanner (12m)

**Price - ₹ 25,103.84 (Incl. GST)**

**Specification:**

* Model: RPLDIAR-A2M8
* Distance Range: 0.15 - 12 m
* Angular Range: 0-360 degree
* Distance Resolution:    Angular Resolution: 0.9degree
* Sample Duration: 0.25 millisecond
* Sample Frequency: ≥ 4000Hz
* Scan Rate: 10Hz
* Weight: 190g