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Simultaneous Localization and Mapping Using sick LMS and DVS128

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ABSTRACT

To estimate the position of the object placed in a given environment and estimate the distance between them. The flooring scheme is used where the distance between the object is determined using the co-ordinates of the floor. The proposed system analyses the position of an object using the sensor (SICK LMS) and the object can be tracked and the distance between them can be measured by projecting the infrared light. The light is projected in the surrounding which track the vehicles and hence calculate distance between them so as to avoid the collision. This method is more precise in the indoor environment as limited area is to be scanned therefore the intensity of infrared can be strong which will be weaker in outdoor environment. The accuracy is higher in the indoor environment and hence it is very effective. This can be implemented in the area where GPS facilities are out of hand.

KEY WORDS: LMS, GPS.

1. INTRODUCTION

The LMS 291 Laser Measurement Systems are non-contact measurement systems (NCSDs) in stand-alone operation for industrial applications. The systems scan their surroundings two-dimensionally with a radial field of vision using infra-red laser beams (laser radar). The systems require either reflectors or position marks.

The SICK LMS 291 relies on a spinning mirror and laser diode to perform time-of-flight distance calculations. In a tear-down of the laser rangefinder, one can clearly see the main components, such as the spinning mirror mechanism, laser diodes, etc. It also become fixtures on many robots -- for both SLAM applications (below left) and as a "sweeping" sensors for safety and perception (below right).

The Virtual Robot Experimentation Platform or simply V-REP simulator is the result of an effort trying to council all requirements into a versatile and scalable simulation framework. V-REP allows the user to choose among various programming techniques simultaneously. V-REP is designed around a versatile architecture. There is no main or central functionality in V-REP. Rather, V-REP has various relatively various functionality which can be enabled or disabled as per our requirement.

Lua is commonly described as a "multi-paradigm" language, providing a small set of general features that can be extended to fit different problem types, rather than providing a more complex and rigid specification to match a single paradigm. Lua strives to provide flexible meta-features that can be extended as needed, rather than supply a feature set applicable to one paradigm. Lua is a dynamically typed language intended for use as an extension or scripting language, and is compact enough to fit on a variety of host platforms. It supports only a small boolean values, numbers and strings. Other data set can be represented using LUAs native set.

2. MATERIALS AND METHODS

System Design: A robot is placed in the environment where it has to determine the position of various object present in the environment and thus to avoid collision between them. The robot is armed with the DVS 198 sensor along with the sick LMS sensor. The Dynamic Vision Sensor (DVS) uses patented technology that works like your own retina. Instead of wastefully sending entire images at fixed frame rates, only the local pixel-level changes caused by movement in a scene are transmitted at the time they occur. The result is a stream of events at microsecond time resolution, equivalent to or better than conventional high-speed vision sensors running at thousands of frames per second. Power, data storage and computational requirements are also drastically reduced, and sensor dynamic range is increased by orders of magnitude due to the local processing it is connected to the sensor and it’s also connected to camera. A vehicle is placed in the environment and sensor which is placed on the arm of the robot sense the vehicles and detect its position. The position of the vehicles shown in the is play of the system (PC)

The robot is programmed using the LUA language which programs each object placed in the environment according to the requirement. The object can be tracked and measure the distance by TIME OF FLIGHT. The advantage of the proposed system is more accurate, sensor can be used under water to track the object and it requires approximately 20 Watts of power, operating off on a 24VDC supply.

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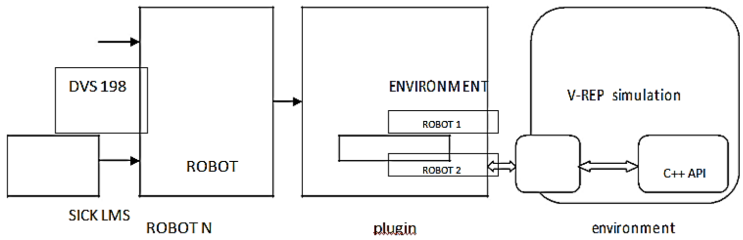


Figure.1. System Architecture

The time graph is plotted between the moving robot and the object placed in the environment. Thereby resisting the collision between the objects. It also determine the position of all the object placed in the environment based on the inter-distance between the object

The system (PC) which consists of two displays camera and sensor display both interfaced by using GUI. Lms291 which is fixed in the robot arm reads the object using time of flight. Both the DVS and LMS sensor readings are correlated with each other. After fixed interval of time the readings are updated in the system. The above steps are repeated for given frame of time. MRPT localization is used to locate the correct position of the vehicles. Thus by following the steps it can estimate the position of a moving object.

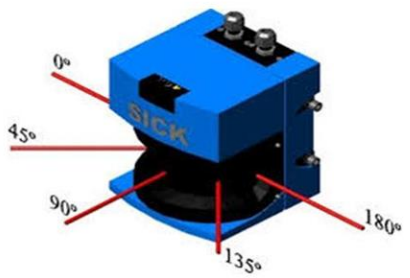
Area Monitoring and Tracking of a Moving Vehicles: The LMS291 measurement data (internally processed from the raw measurement data) is used for object measurement and determining position. These measurement data correspond to the surrounding contour scanned by the LMS291 and are output in binary format via the RS 232/RS 422 data interface. The telegram listing required is supplied with the device (PDF file on CD-ROM). The MST200 Measurement Software Tool provides further support for software connection to the LMS291. External evaluation (software) can take place at a PC or PLC. Fundamentally, the distance value per individual impulse (spot) is evaluated. This means that a distance value is provided every 0.25°, 0.5° or 1°, depending on the angular resolution of the LMS291.

Angular resolution is set using the LMSIBS Configuration Software or a command (telegram). As the individual values are given out in sequence, particular angular positions can be allocated on the basis of the values" position in the data string. Note that the LMS291 laser beam turns towards the left.

From each individual spot in each scan, and a separate counter being started for each spot. Erroneous measurements can be filtered out by repeatedly examining the reported spot (multiple reading whose number depends on the setting selected). Pixel-oriented evaluation should be included in the corresponding evaluation software when external data processing is undertaken. Blanking is used for suppressing an object that is not to be detected, e.g. a steel cable that is located within the monitored field. The object size to be filtered depends on the distance.

Area Monitoring/Detection: In this application, the LMS291 is responsible for automatically reporting that an area (freely definable field form) is "clear". This means that an infringement of a field by a moved or resting object (e.g. human or subject) leads to a switching signal at the associated output.

Pixel-oriented evaluation is used to suppress raindrops and snowflakes or other particles, and thus makes the LMS291 less sensitive to environmental factors during outdoor operation. This involves saving the sequential messages (measured values) in the environment where a moving robot armed with sensor tracks the position and distance of the object.



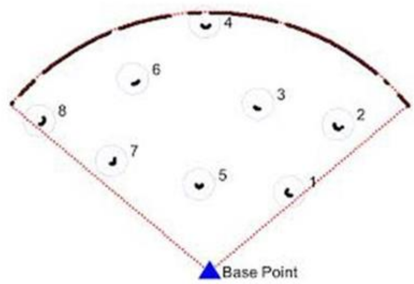


Figure.2.Angular Resolution of LMS 291 **Figure.3.Area Monitoring And Detecting**

3. EXPERIMENTAL RESULTS

The infrared of an object is represented in red color. In fig 5 it gives the status of the object. It can be used to visualize the data and to set an initial pose. In fig 6 the graph is shown which determines the position and the distance of the object in the given environment. In fig 8 we can determine the collision status of the object by determining the co-ordinates of the system, and hence determine the distance between the moving robot and the scanned object.

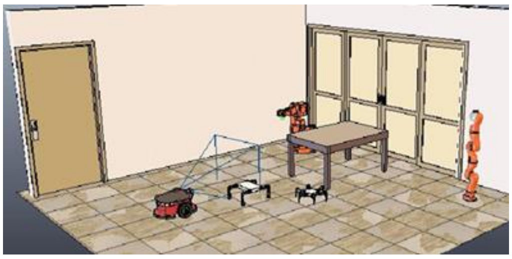


Figure.4. Environmental Setup

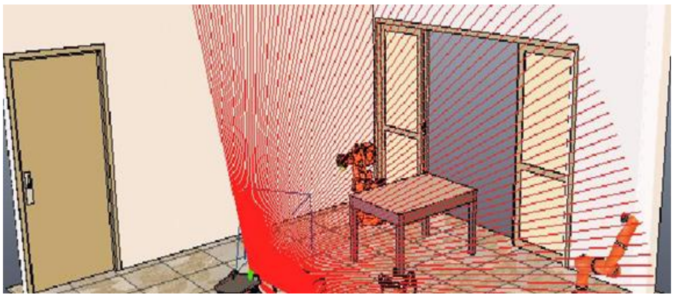


Figure.5.Tracking Object

Figure.6.Illustrate The Position and distance of vehicles around 180 Degree

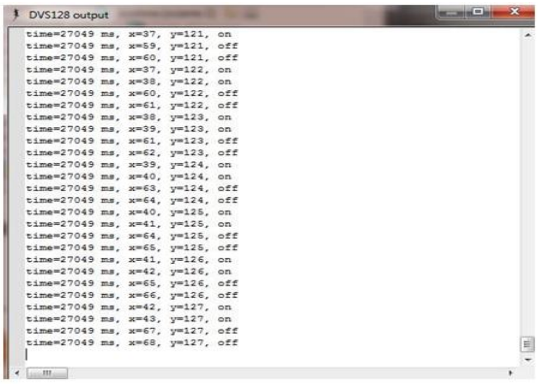


Figure.7. Collision status of the object

4. CONCLUSION

Thus, the position of a moving is determined by the robot which is dynamic. It will detect the vehicle using sensor SICK LMS.V-REP is used effectively to form the environment according to our requirement and thus carry on the simulation effectively before practical establishment. LUA is used to program the robot and design the environment. The main advantage in using this language is that it is quite simple and can be effectively use for various range of problem and hence make it very easy to determine the position and hence calculate the distance of the object effectively. Each vehicle position will be tracked and measured by using sick LMS. The sensor measure around 180 degree of an environment and it is very useful for military applications and for under water surveillance.

This paper presented an approach capable of locating the position and hence determining the distance between them effectively using the floor scheme method. Experimental results have shown that our system can successfully perform the tracking of the object effectively hence calculating the distance effectively. This system is highly effective in indoor environment as the intensity of infrared is strong in limited environment.

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