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MEASURING IRRADIANCE ON A PRINT BED

HP INC

Measuring Irradiance on a Print Bed

Some background

Some 3D printing technology is based on selective powder material fusion. In terms of temperature, this fusing process is developed in two different stages.

In a first stage a subsystem called top heating is responsible for maintaining a homogeneous temperature over the whole print bed, this temperature is close to the powder material fusing temperature. On this stage current implementations use infrared sensor cameras to provide feedback to the lamp controller trying to meet required irradiance level.

In a second stage a subsystem called fusing lamps attached to the printing carriage rise temperature to the melting point on printed areas. On current implementations for this second stage there is not feedback during fusing process. Lamps are previously calibrated using external tools and complex processes; and there is no option on printer to adjust irradiation after calibration process.

Why not improving feedback mechanism?

A new idea could be to include in the printer a reliable irradiance measure mechanism which could be used to improve current top heating and fusing mechanism providing the possibility to calibrate both systems top heating and fusing system while necessary even before any print job. This new mechanism could also perform a direct lamp irradiation measurement at a voxel level instead of measuring lamp effect on big print bed areas.

How could we implement it?

An actual printer implementation could include three different elements working together to have a reliable irradiance measurement in the print bed area at a voxel level (understanding voxel level as the maximum printing resolution)

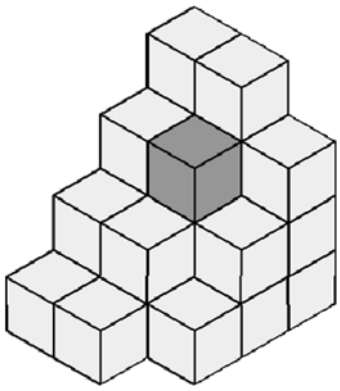

Figure 1 (Voxel grid)

The first element is a simple irradiance sensor together with some focusing lenses sensor to implement a single irradiance area measurement. This element would be able to provide reliable irradiance measures on specific areas.

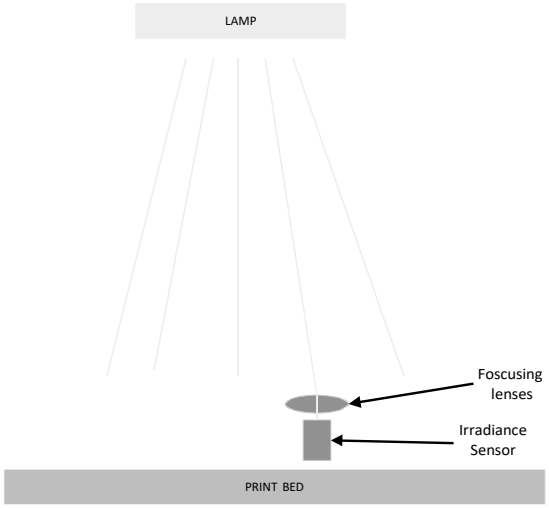

Figure 2 (Irradiance sensor)

The second element required to make possible not only a standalone area measure, but a complete linear area measure is a periscope mechanism.

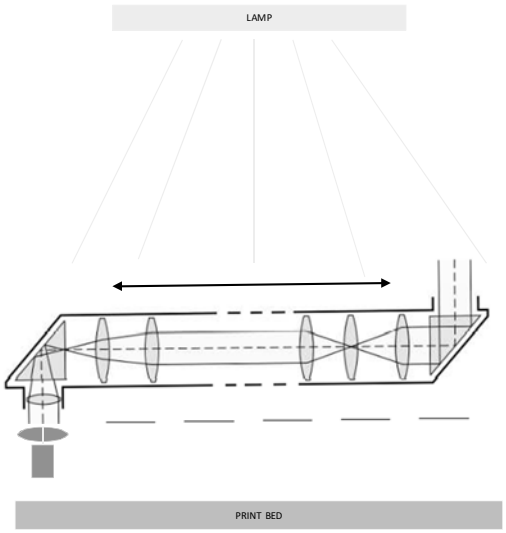

Figure 3 (Periscope mechanism)

The use of a periscope structure makes possible to scan a complete axis instead of a single point.

Periscope structure guide the light from required measurement area to irradiance sensors which now can rest on a fix position.

Finally, the last element or concept consist on attaching both previous elements to moving element over the printer scan axis, providing periscope-sensor assembly the capability to measure on any point over the print bed area.

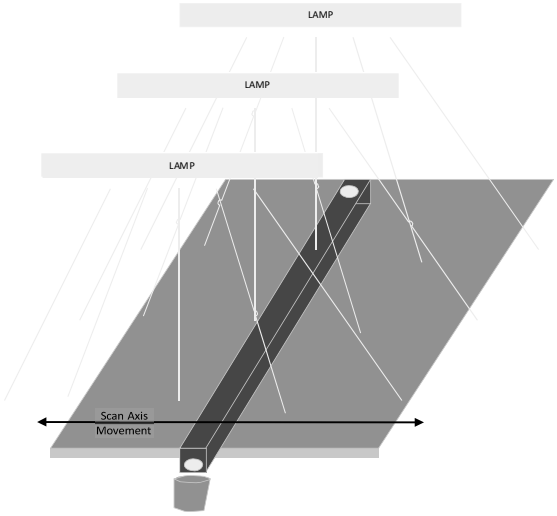

Figure 4 (Scan Axis)

As an example, next figure shows composite movement involving scan axis movement and periscope functionality. The figure shows how the combination of both mechanism makes possible to implement an irradiance measurement wherever in the print bed area:

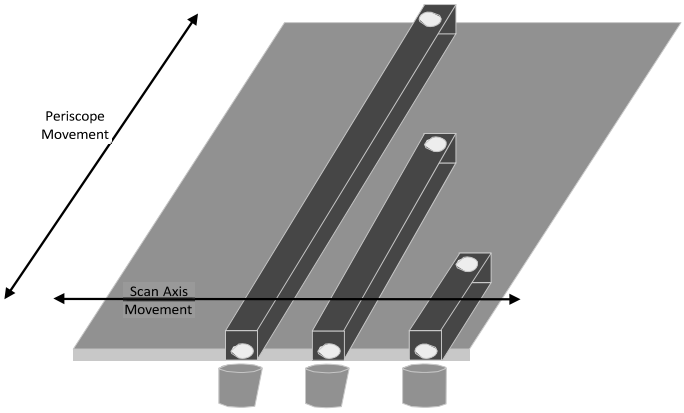

Figure 5 (Print bed area measure)

Some advantages

This new approximation to the required irradiance measurement over the print bed provide some interesting advantages: Makes possible direct measurements over the whole print bed area, facilitates irradiance automatic non-assisted calibration mechanism suitable for any print job improving printed part quality, it is a simple solution based on known technologies, makes possible to use a single high reliable irradiance sensor avoiding exposing it to high temperatures simplifying sensor integration.

Disclosed by Juan Manuel Zamorano, David Soriano and Mayid Shawi, HP Inc.