Development of a diagnostic prototype for detecting bloodstream infections: the BactInsight turbidimeter

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BACKGROUND

- Bloodstream infections (BSIs) are usually diagnosed with blood cultures
  - Liquid growth medium (nutrients) and blood
  - Incubated for several days
  - Visual or automated growth monitoring
  - Early step in antimicrobial resistance detection
- Commercial automates not always right fit in low-and middle-income countries (LMICs)
- New prototype for diagnosing BSIs: BactInsight turbidimeter
  - Designed for use in LMICs
  - Objective measurement in addition to visual inspection

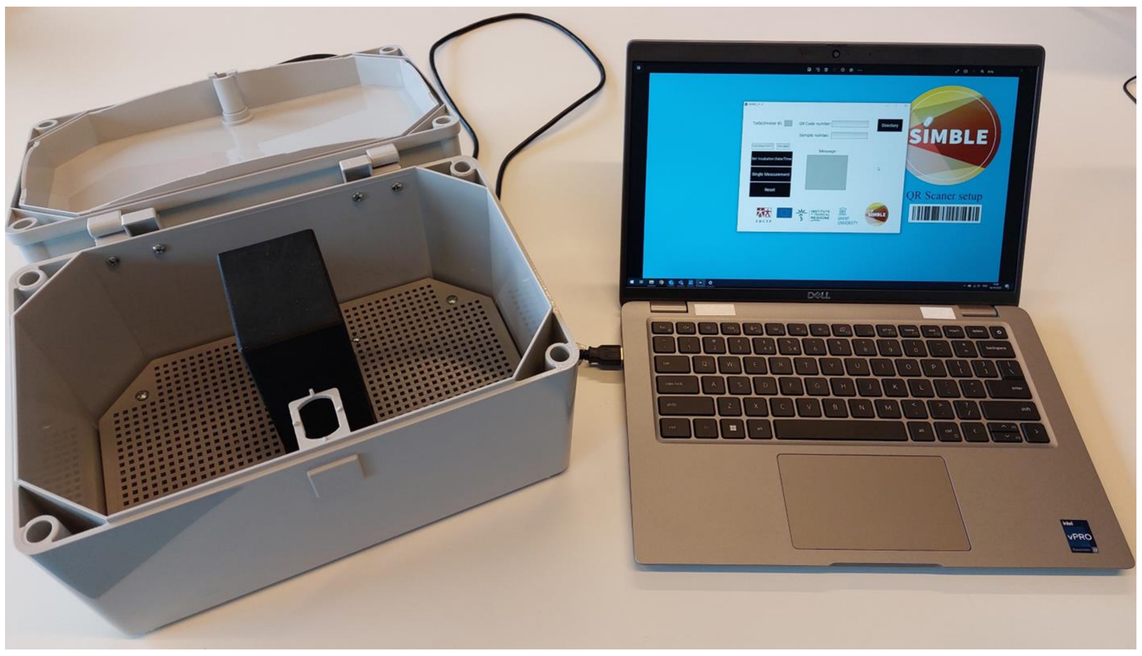
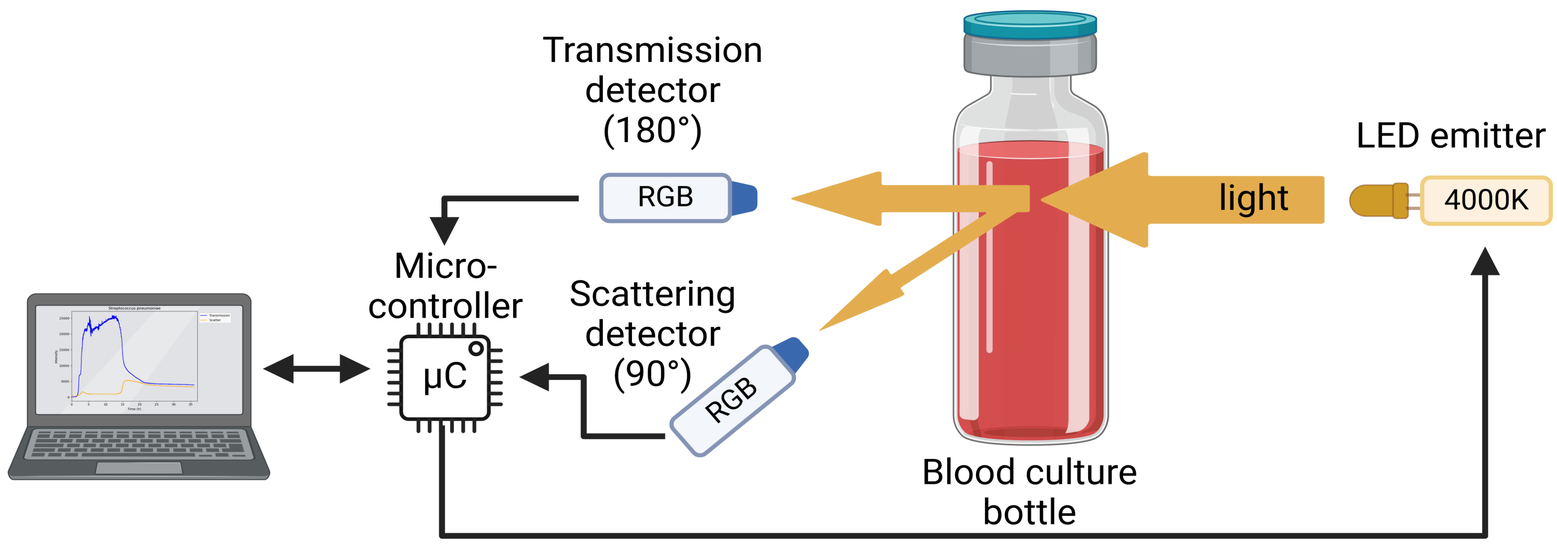
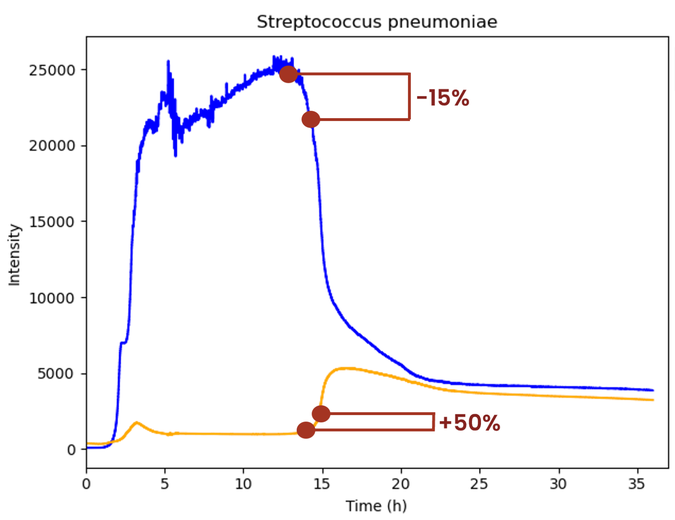


Figure 1: Turbidimeter in a protective box next to a laptop running control software

WORKING PRINCIPLE





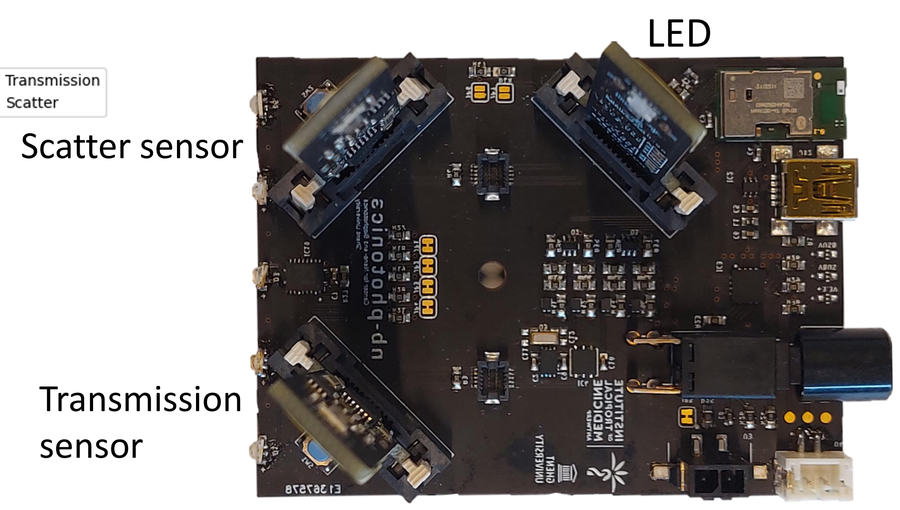


Figure 2: Working principle turbidimeter

- Off-the-shelf components
- BOM-cost: ~€50

- Turbidity based detection
- White LED illuminates the sample
- Two colour sensors monitor light
  - Transmitted light (straight)
  - Scattered light (90° angle)
- Results communicated to laptop running detection algorithm

Growth when either:

- Transmitted light drops ≥ 15%
- Scattered light increases ≥ 50%

METHODS

- Simulated blood cultures spiked with one of 15 clinically-relevant bacterial species
- Incubated for 20-96 hours at 35°C
- 342 runs were performed
- Each run consisted of 5 BCBs inoculated from same spiked blood:
  - 2 bottles were inspected visually (3x/day)
  - 2 bottles were measured with a turbidimeter every 30s
  - 1 BacT/ALERT PF Plus bottle was used as a reference
- The BactInsight system consisted of the two visually inspected bottles in combination with the two bottles monitored by the turbidimeter. If one of the BactInsight bottles was labelled positive, the result of the system was also considered positive.

RESULTS

Yield (diagnostic sensitivity):

- BactInsight (turbidimeter + visual inspection): 100% (342/342)
- Turbidimeter only: 94% (321/342)
- Reference: 100% (342/342)

CONCLUSION

The turbidimeter was able to detect growth in most of the simulated blood cultures.

Field studies in Benin and Burkina Faso to evaluate the BactInsight system are ongoing.

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EDCTP
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