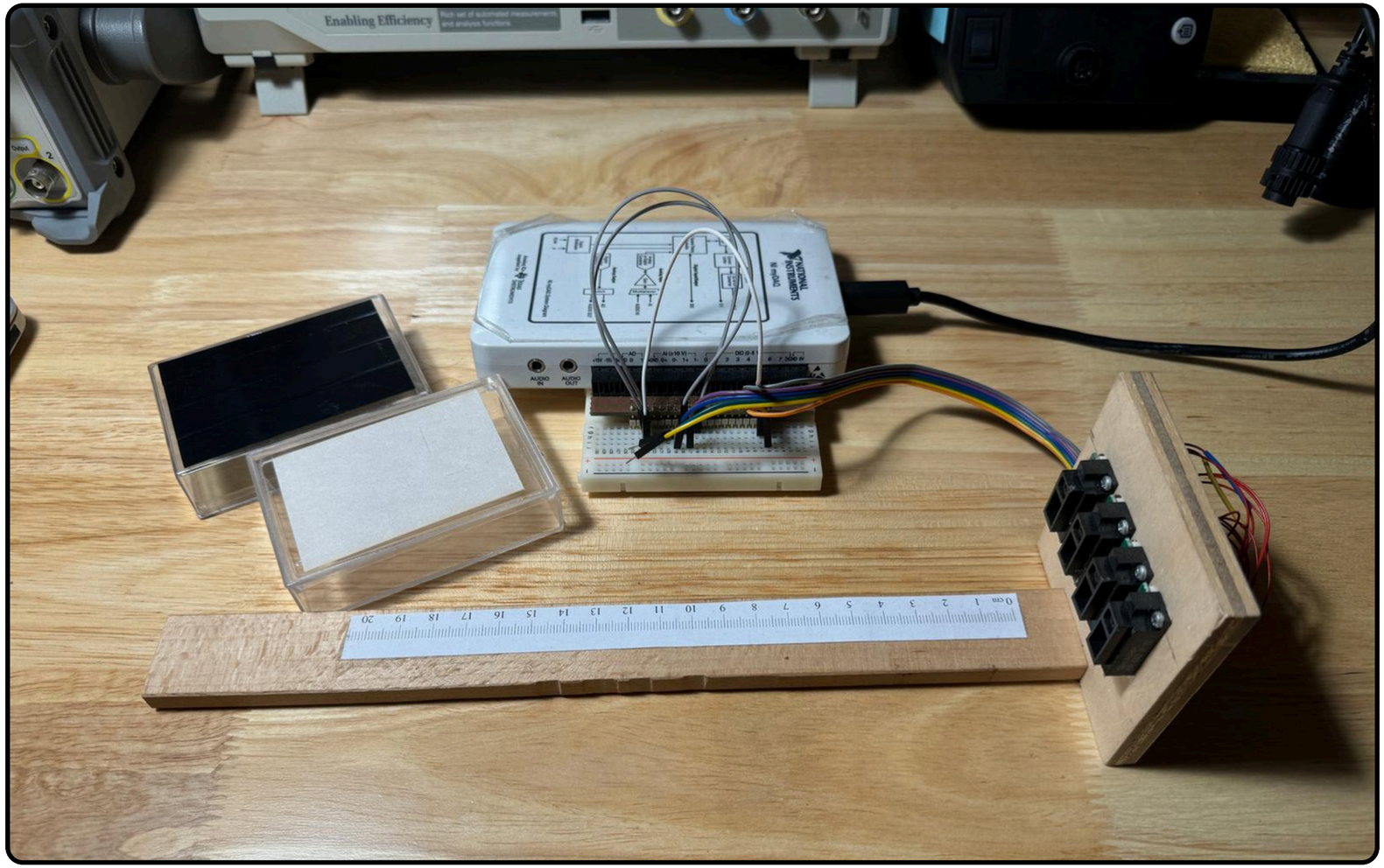
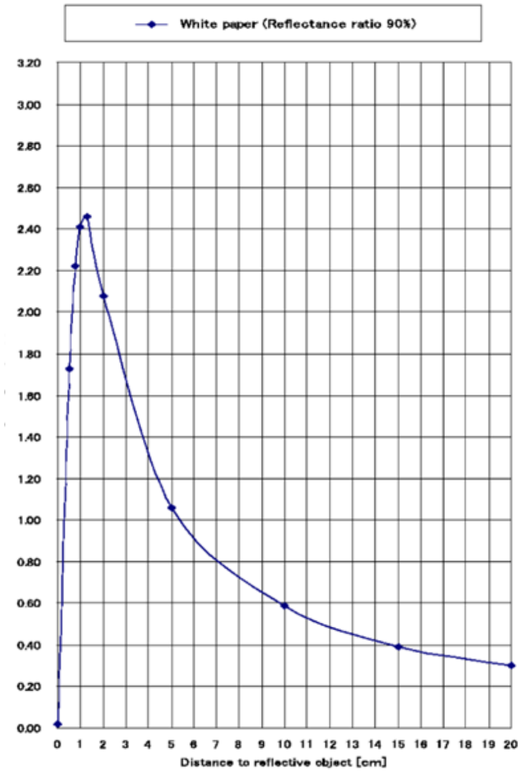
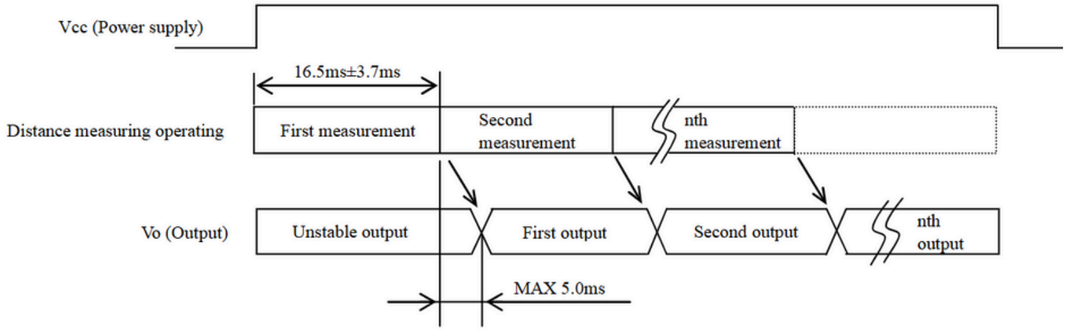
Caratterizzazione sensori di distanza



Specifiche di progetto

- Sensore di distanza analogico SHARP GP2Y0A51SK0F



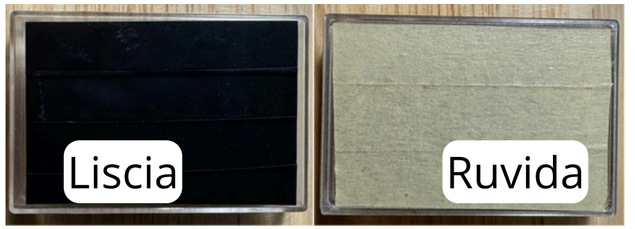


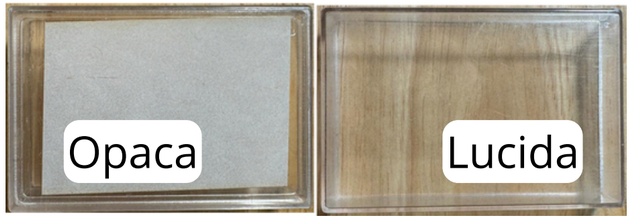
(Ta=25°C, Vcc=5V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Measuring distance range	ΔL	(Note 1)	2	-	15	cm
Output terminal voltage	Vo	L=15cm (Note 1)	0.25	0.4	0.55	V
Output voltage difference	ΔVo	Output change at L change (15cm → 2cm) (Note 1)	1.35	1.65	1.95	V
Average supply current	Icc	L=15cm (Note 1)	-	12	22	mA

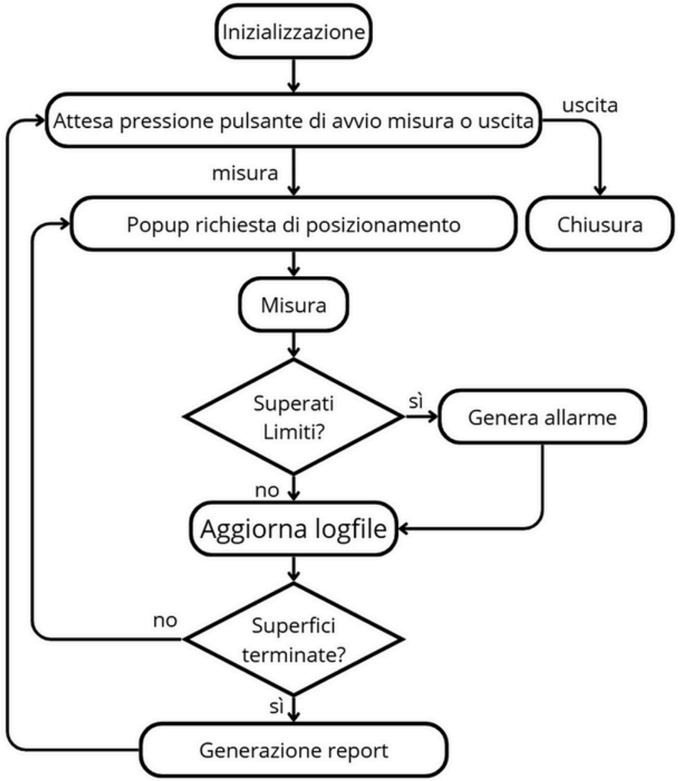
Specifiche di progetto

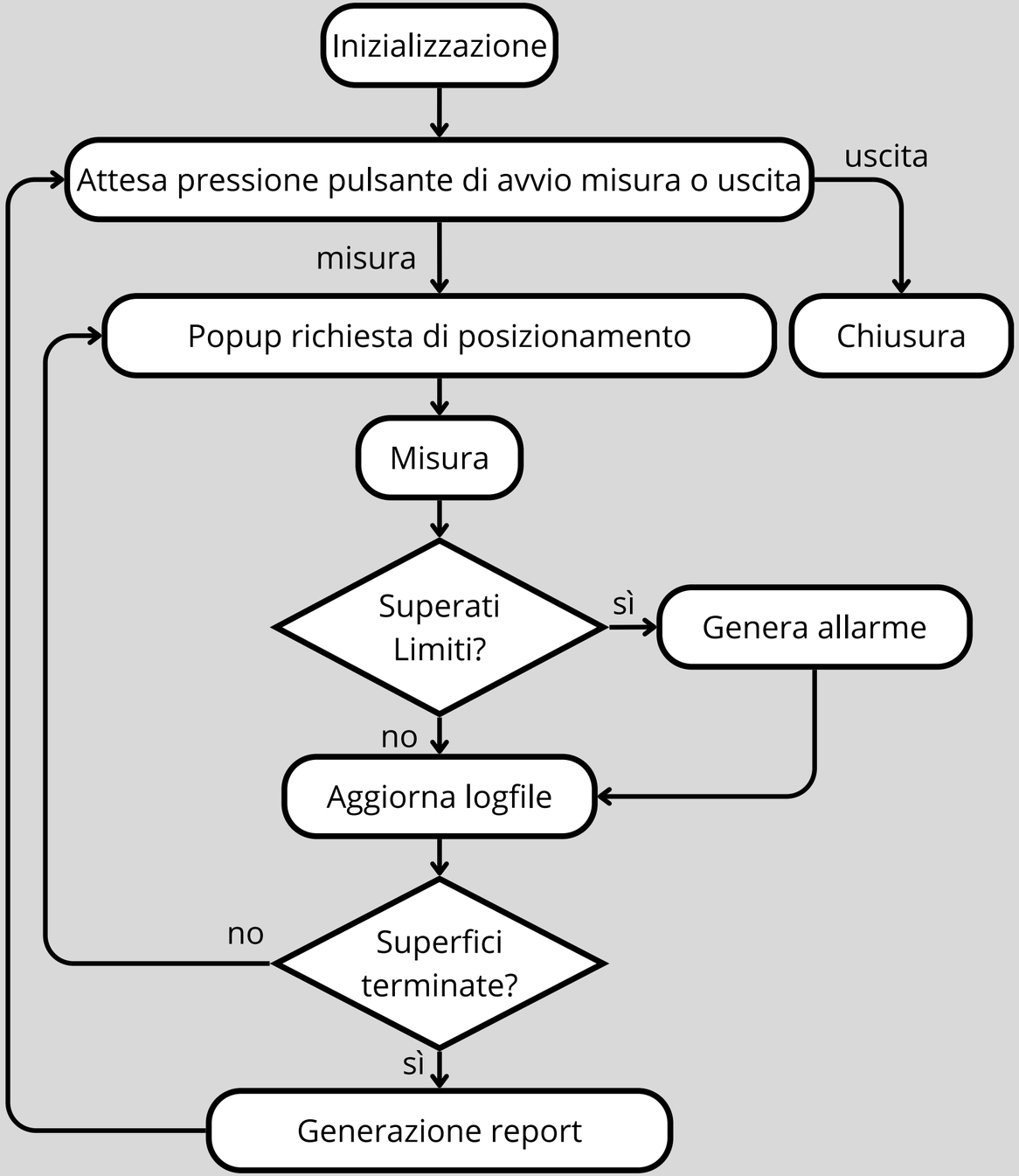
- Utilizzo di 4 superfici differenti





- Macchina a stati definita



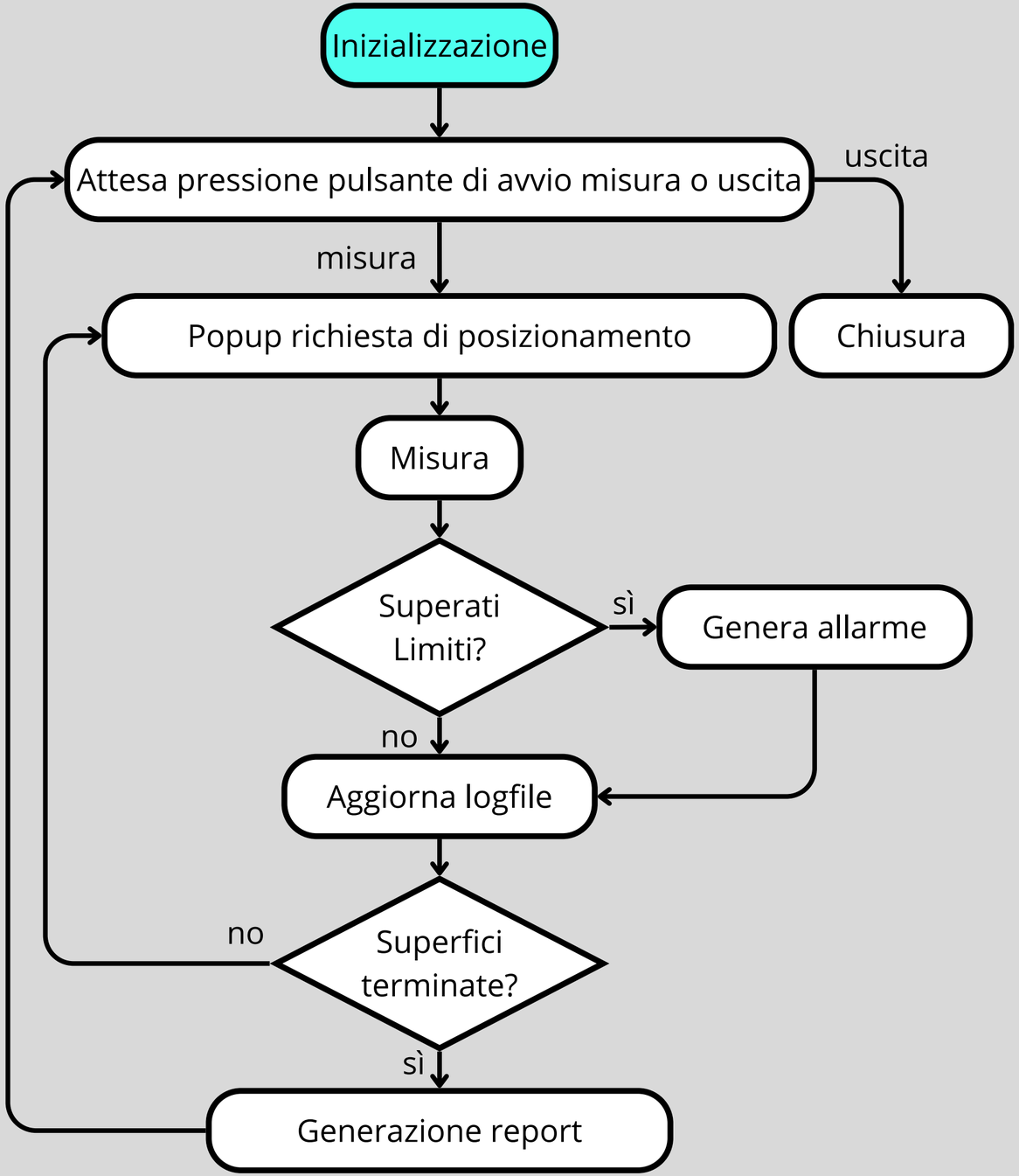


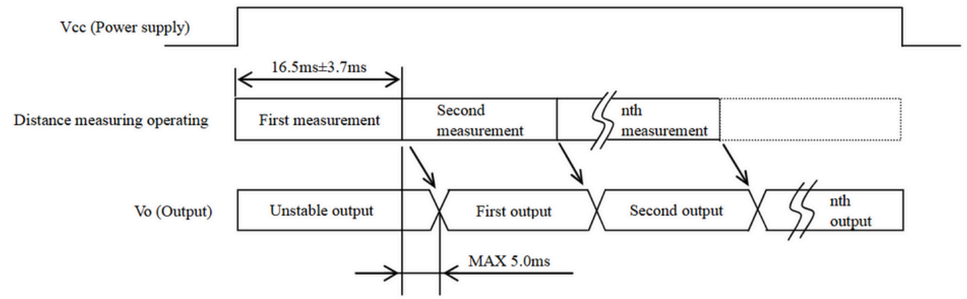
FSM

- Inizializzazione: apertura logfile, predisposizione canali di misura
- Popup richiesta di posizionamento: dialog box con indicazioni su tipologia di superficie e distanza
- Misura: acquisizione valori dei due sensori
- Genera allarme: accensione led di allarme in caso di errori
- Aggiorna logfile: aggiunta riga della misurazione sul logfile ed eventuale allarme
- Generazione report: generazione tabella di media e varianza al termine del ciclo di misura
- Chiusura: chiusura del file

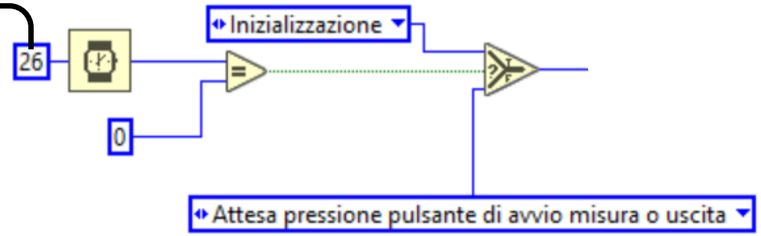
Scelte effettuate per l'implementazione

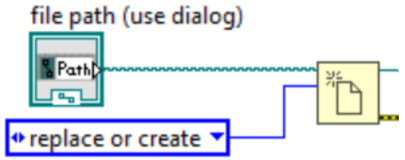
- Coerenza con le specifiche di progetto
- Leggibilità
- Semplicità e fruibilità



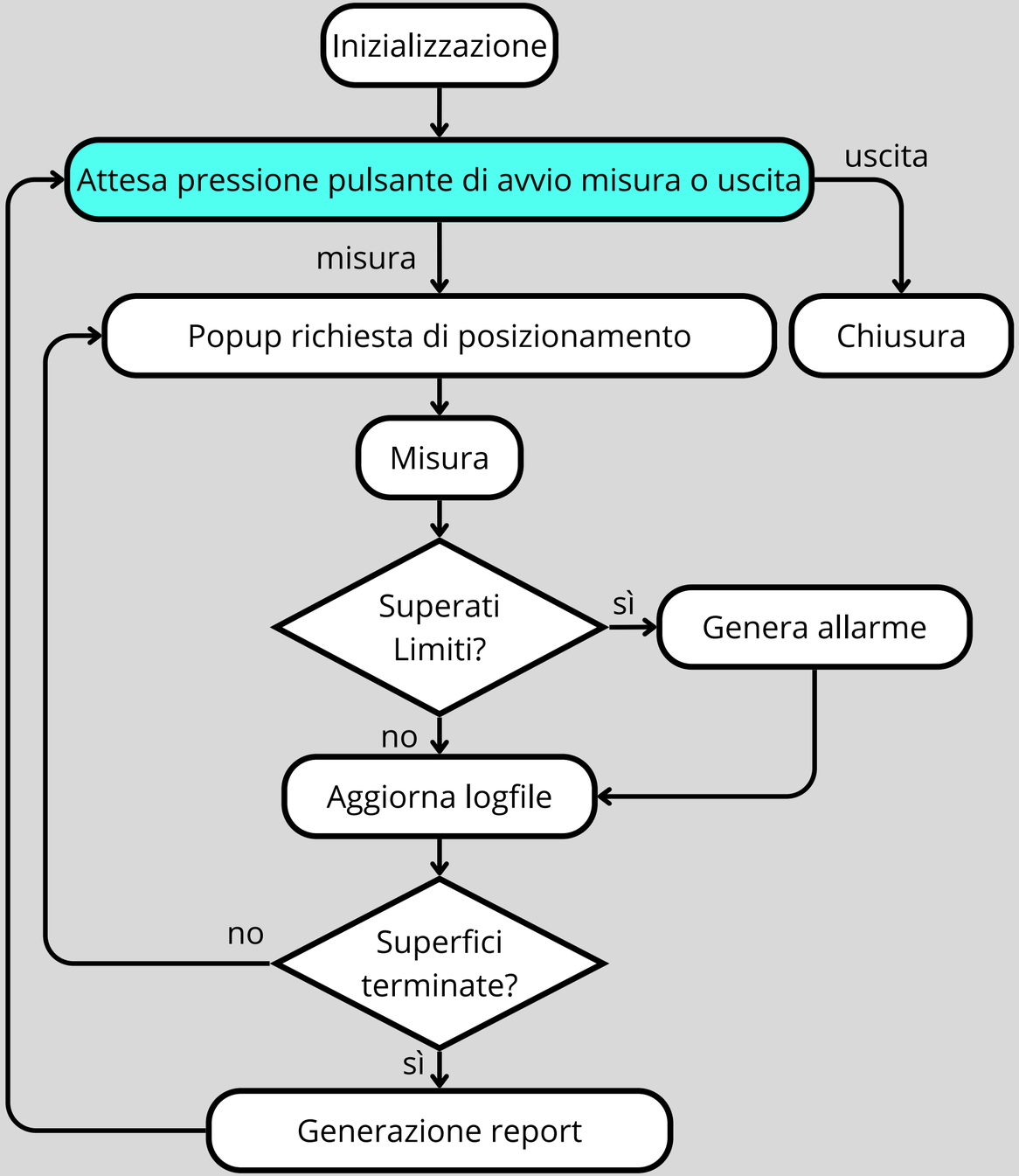


Attesa tempo di startup dei sensori

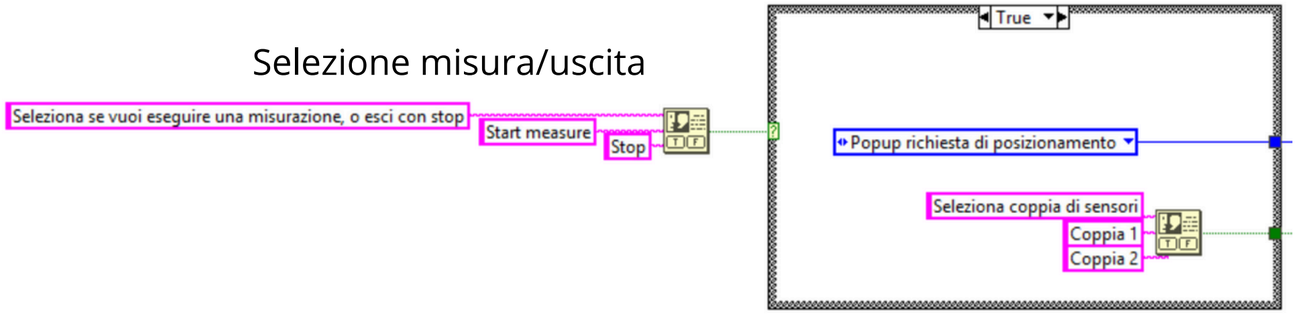




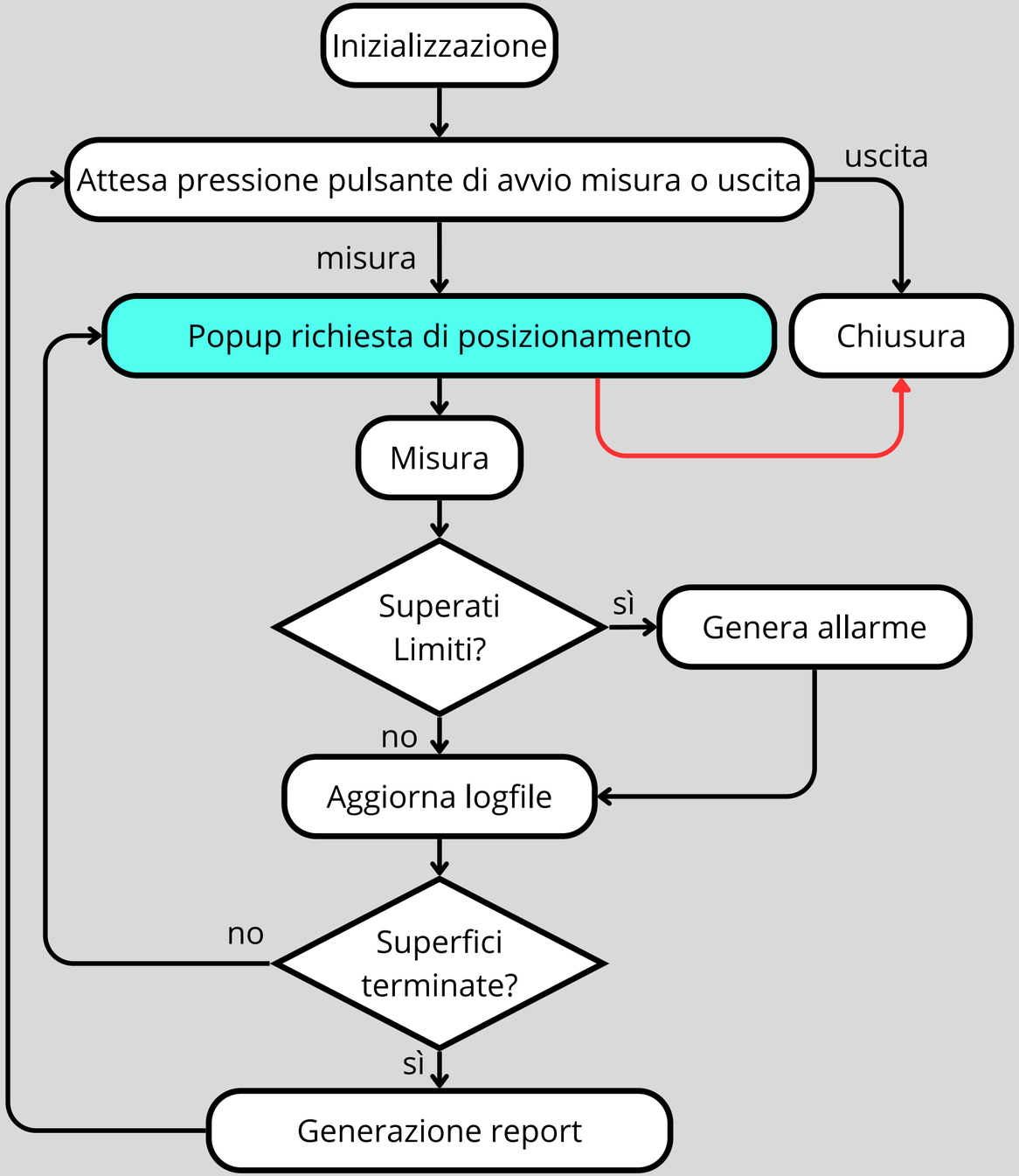
Apertura logfile

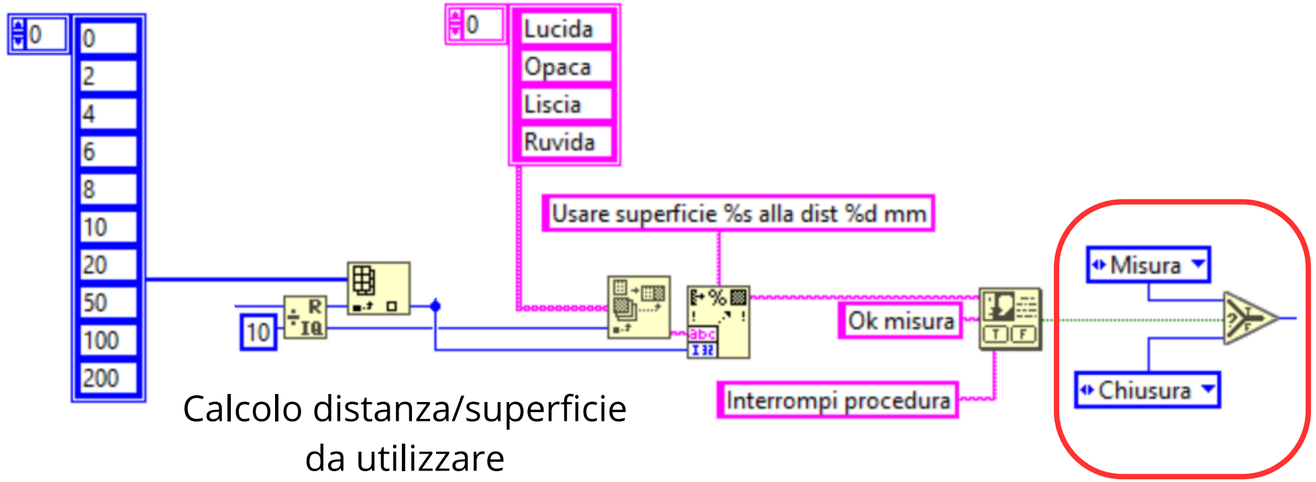


Selezione misura/uscita

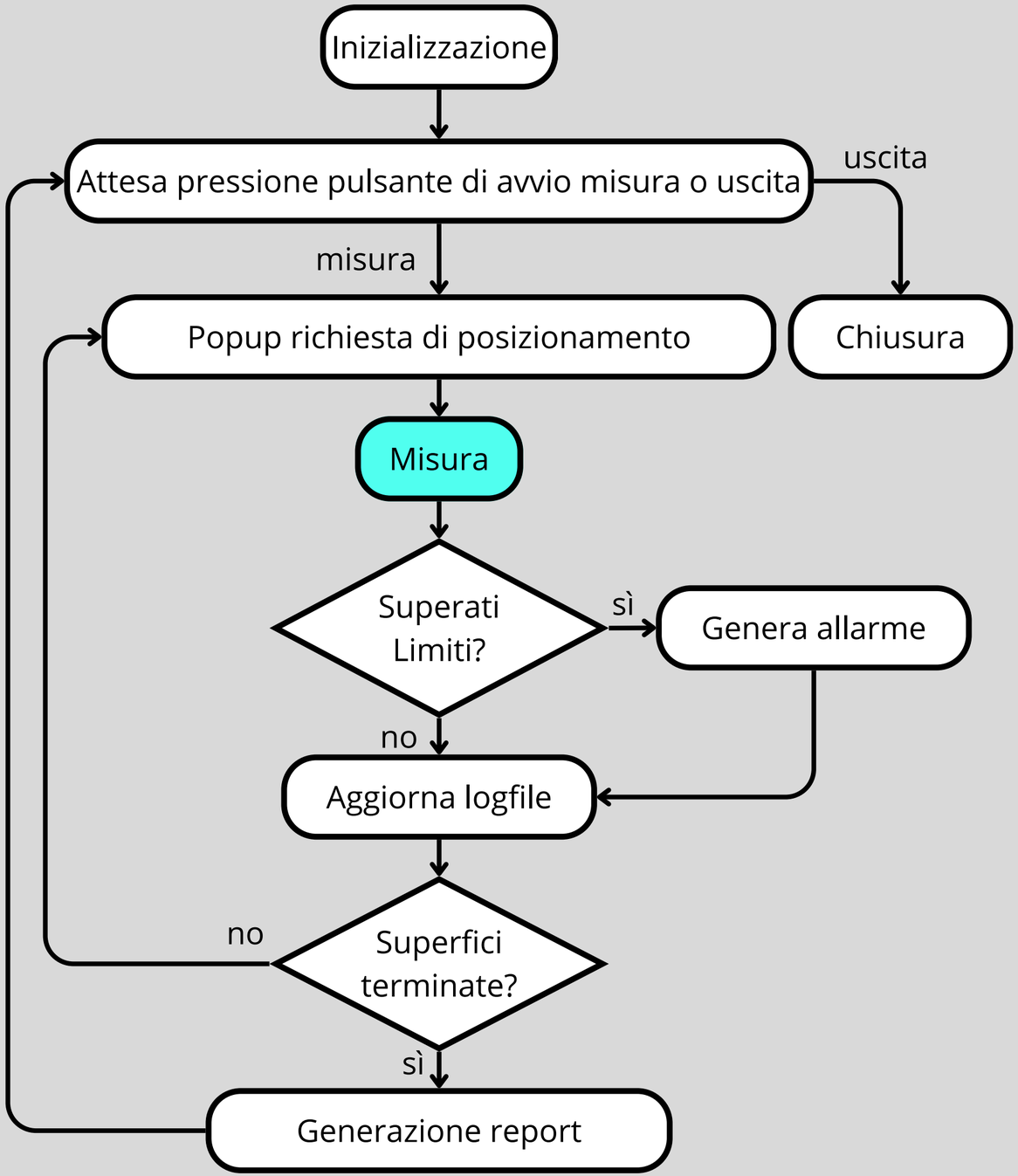


Selezione coppia di sensori

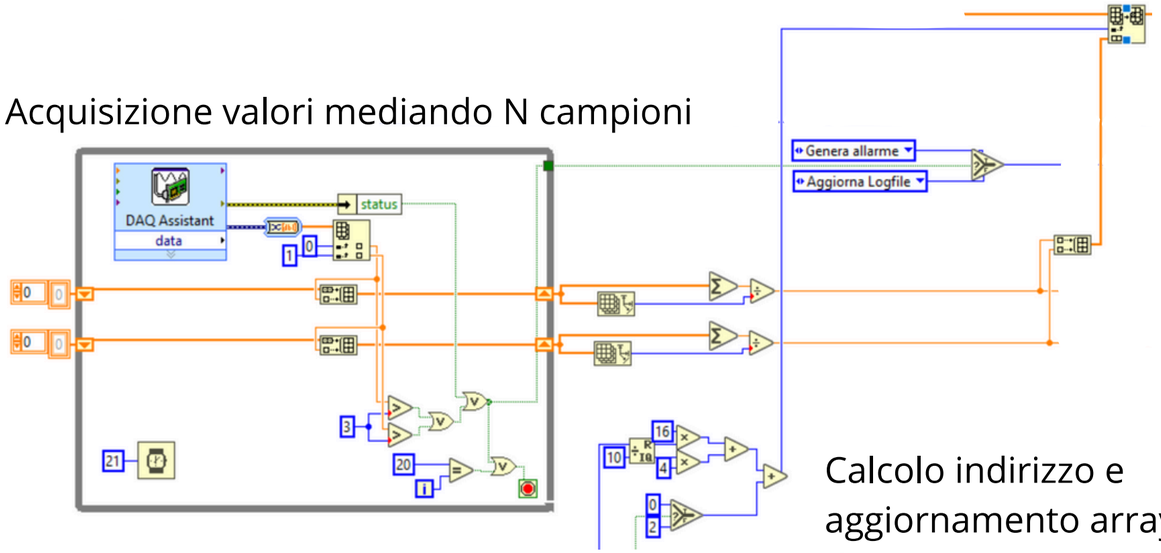




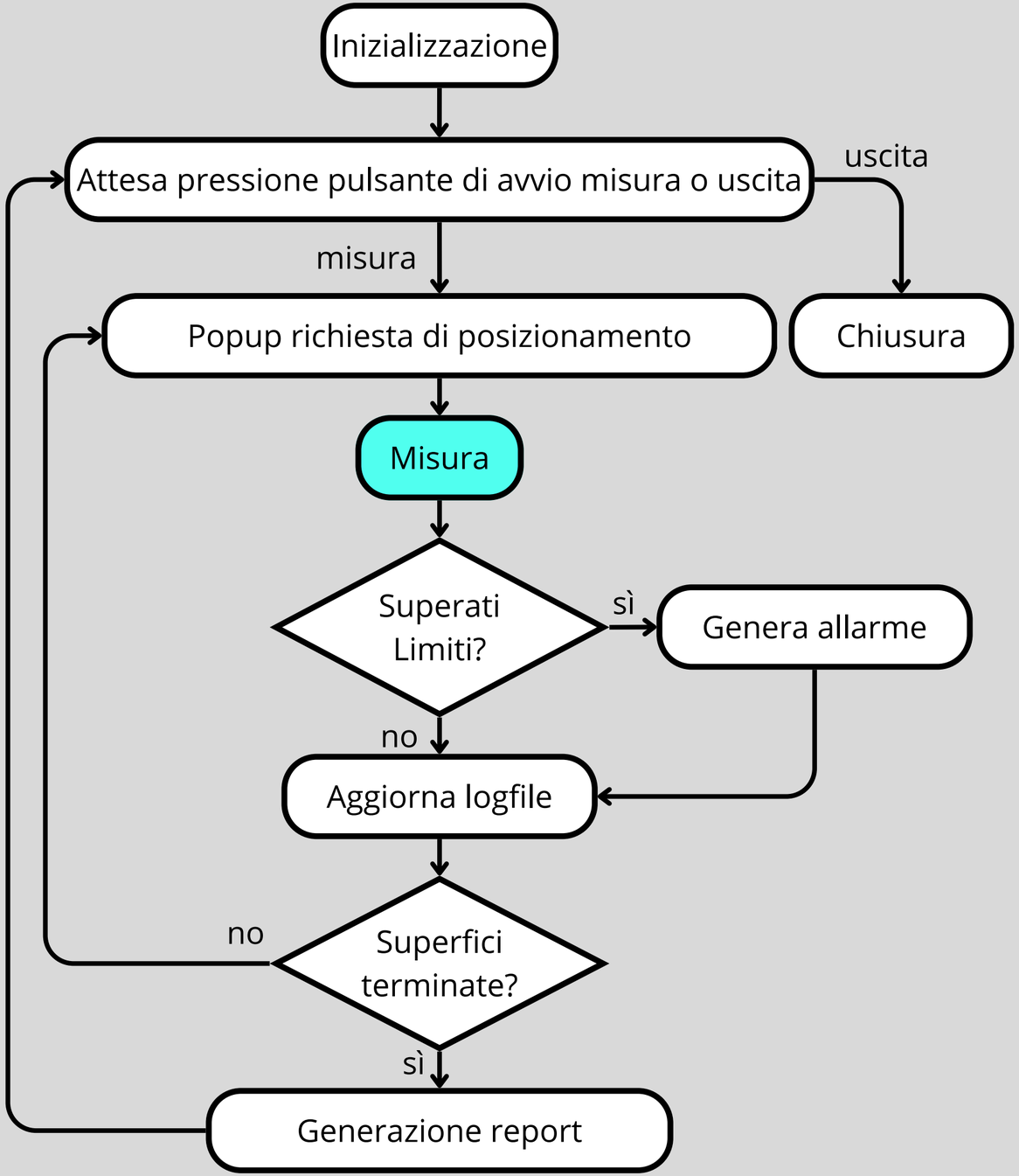
Calcolo distanza/superficie da utilizzare



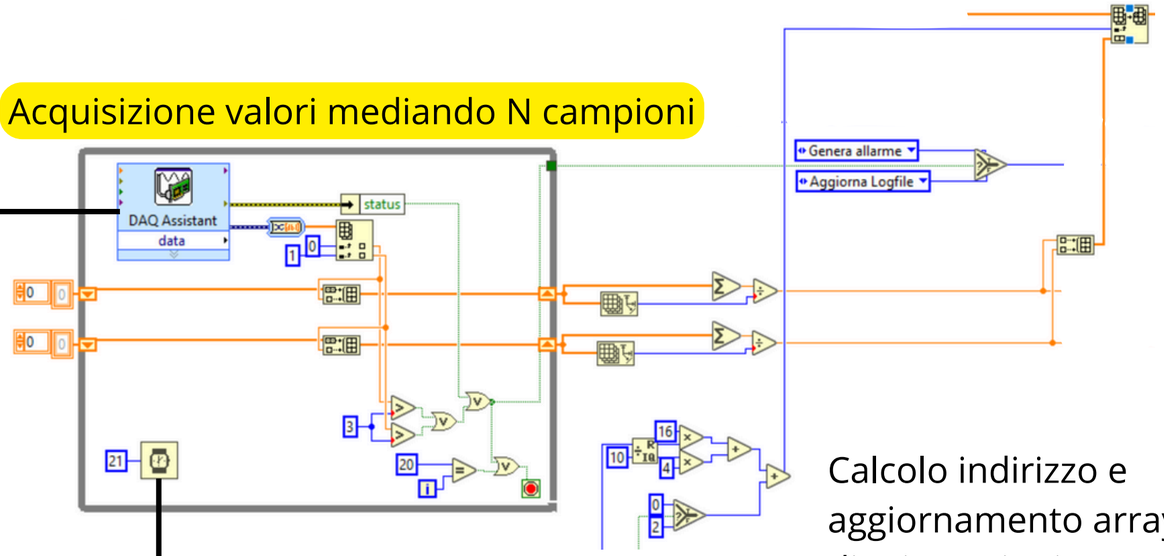
Acquisizione valori mediando N campioni



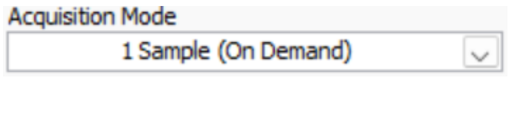
Calcolo indirizzo e aggiornamento array di misurazioni

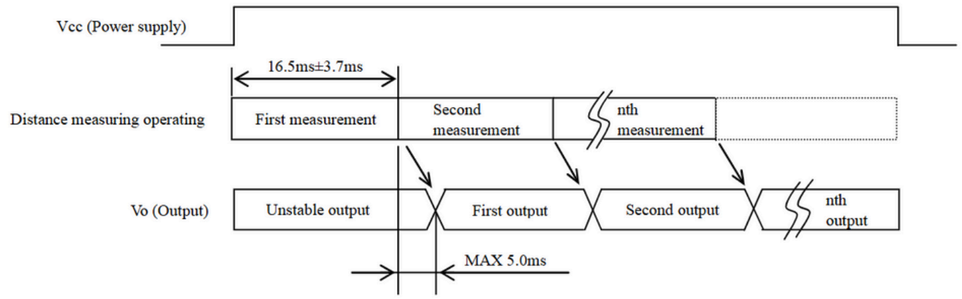


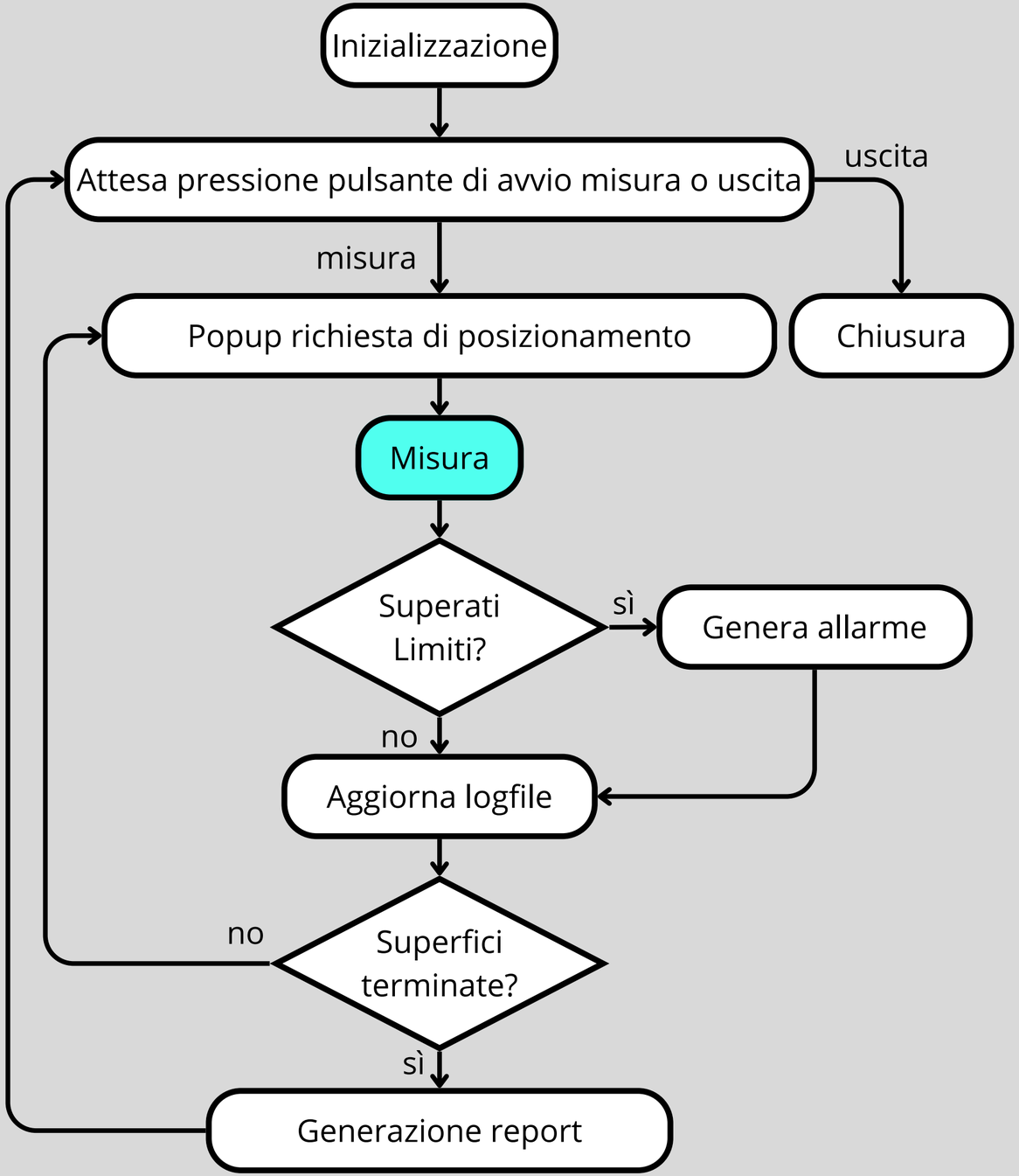
Acquisizione valori mediando N campioni



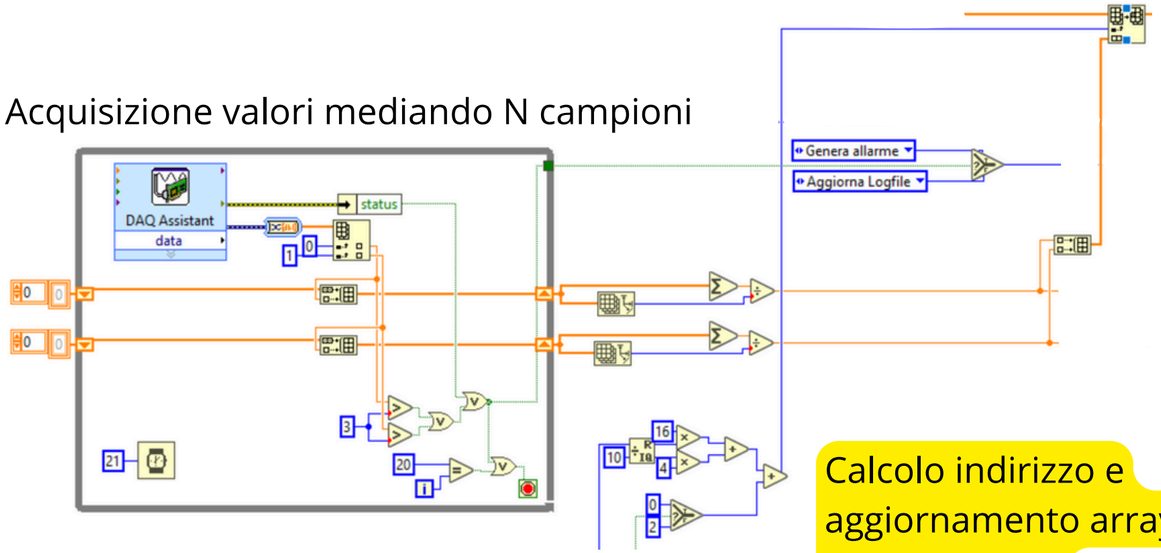
Calcolo indirizzo e aggiornamento array di misurazioni



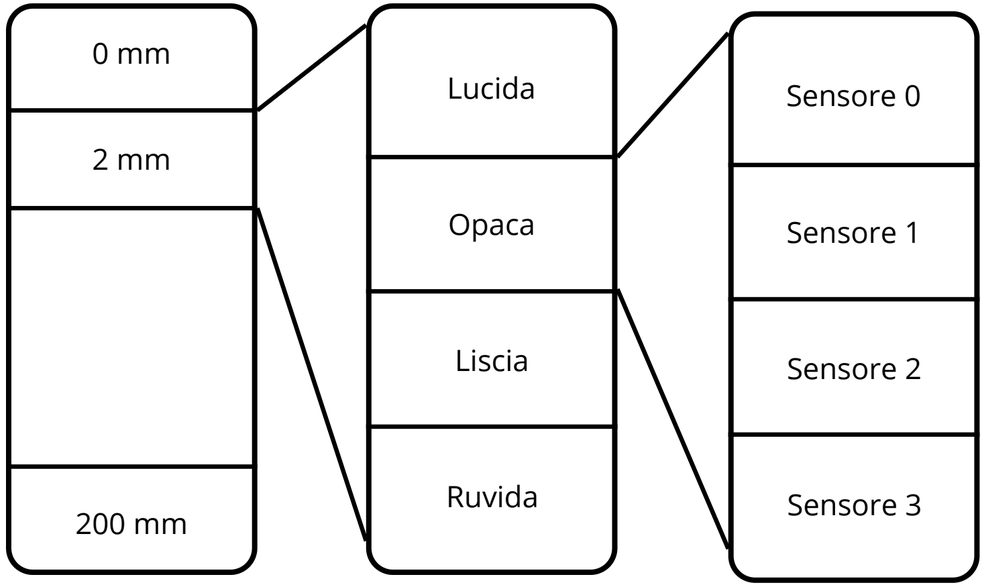


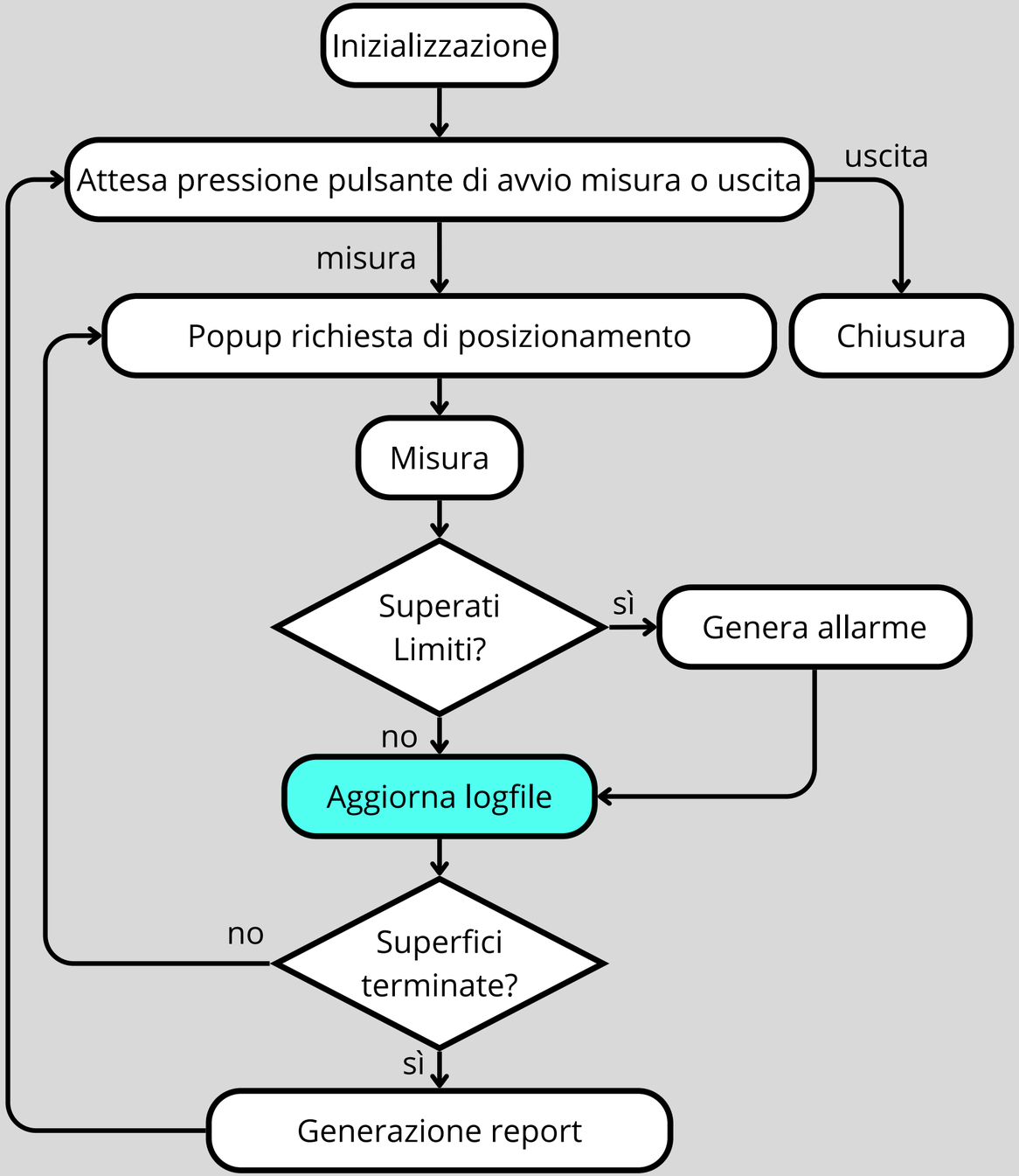


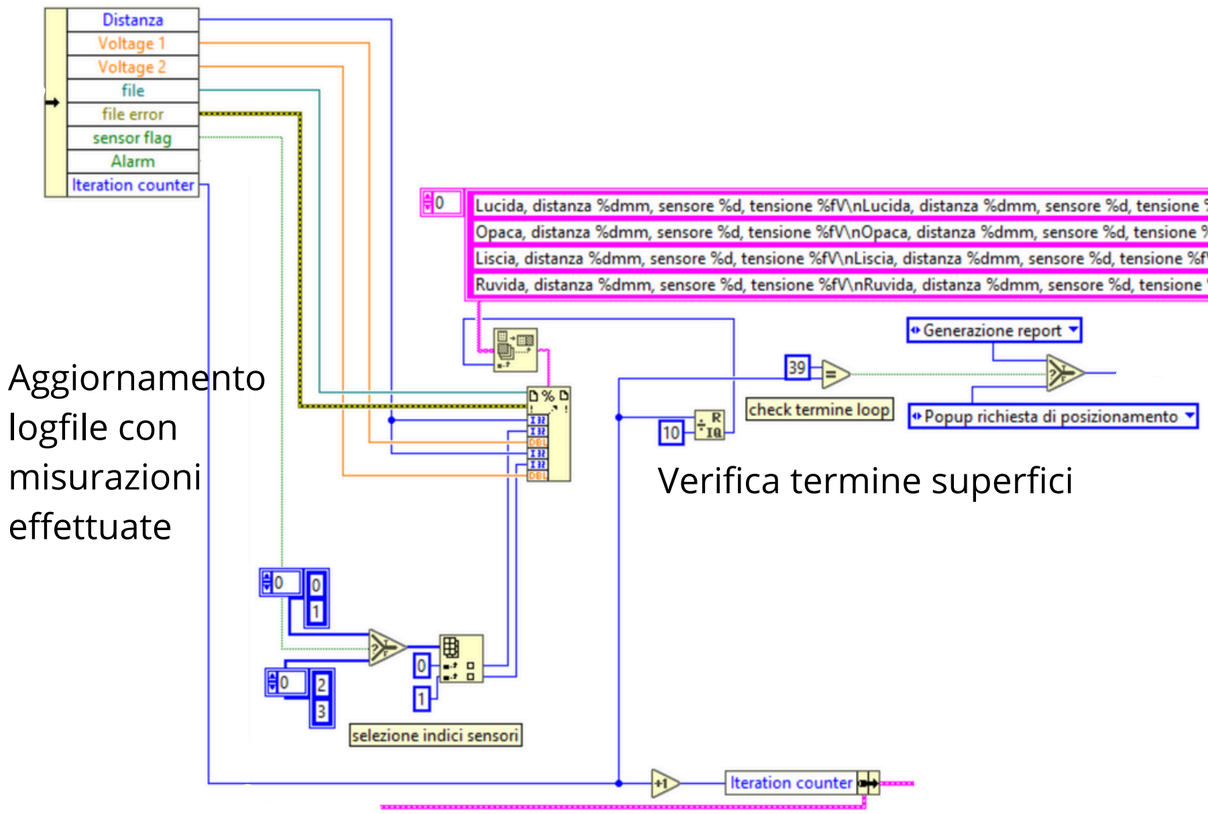
Acquisizione valori mediando N campioni

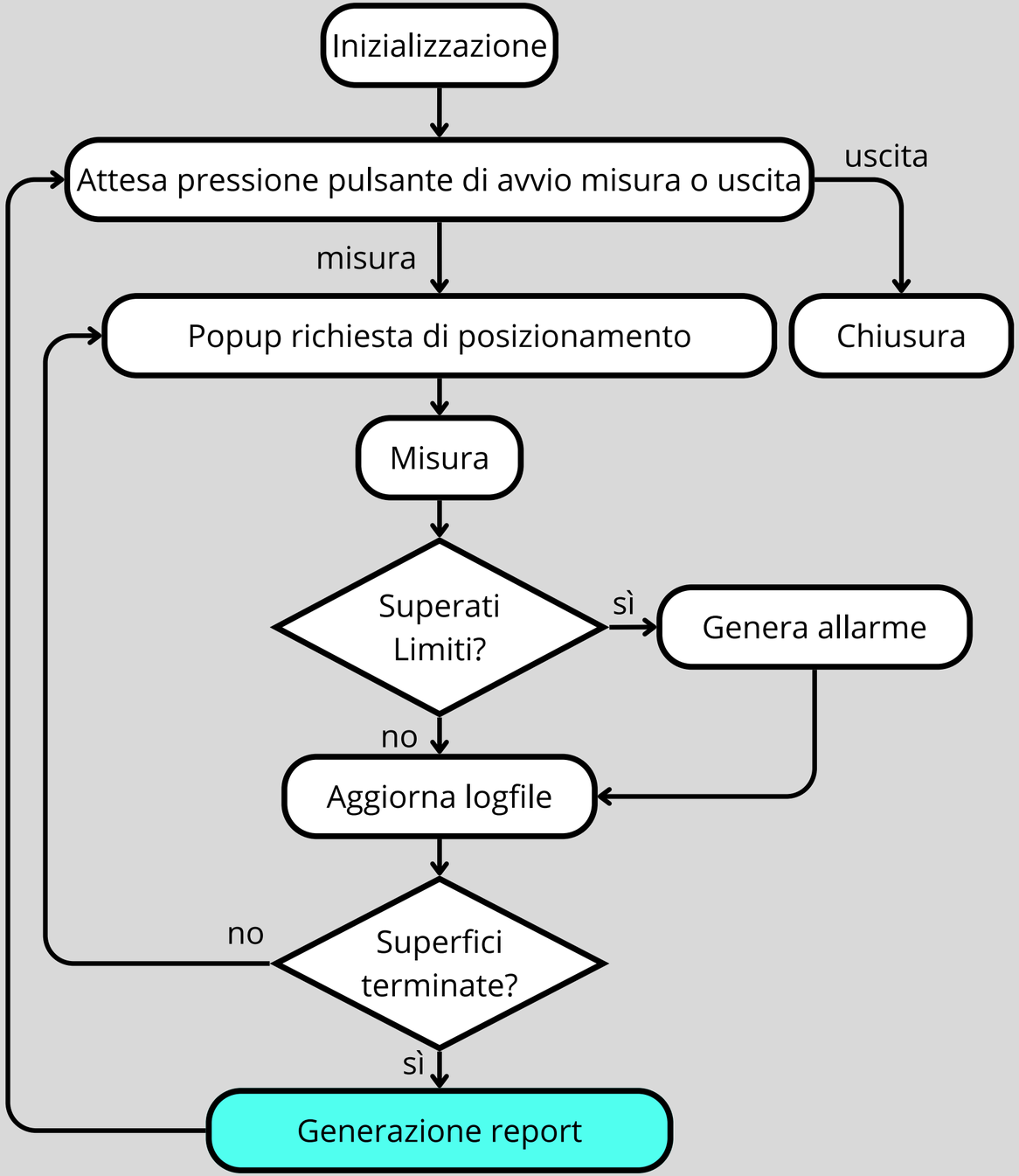


Calcolo indirizzo e aggiornamento array di misurazioni

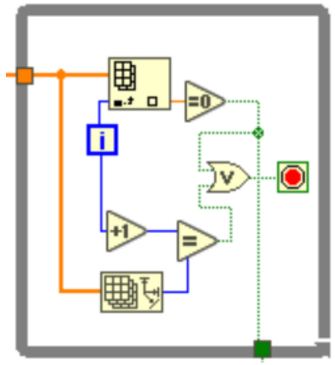


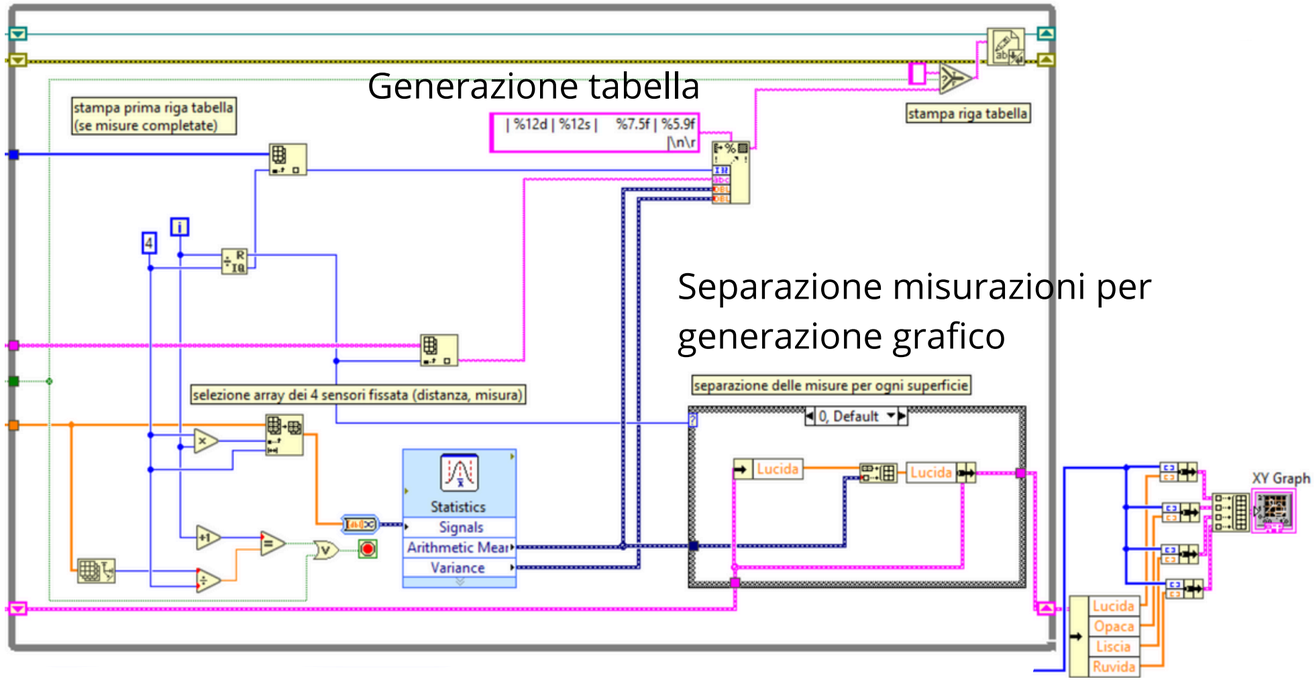

Inizializzazione
Attesa pressione pulsante di avvio misura o uscita
uscita
misura
Popup richiesta di posizionamento
Chiusura
Misura
Superati Limiti?
sì
Genera allarme
no
Aggiorna logfile
Superfici terminate?
no
sì
Generazione report


Distanza
Voltage 1
Voltage 2
file
file error
sensor flag
Alarm
Iteration counter
Lucida, distanza %dmm, sensore %d, tensione %fV\nLucida, distanza %dmm, sensore %d, tensione %fV\n
Opaca, distanza %dmm, sensore %d, tensione %fV\nOpaca, distanza %dmm, sensore %d, tensione %fV\n
Liscia, distanza %dmm, sensore %d, tensione %fV\nLiscia, distanza %dmm, sensore %d, tensione %fV\n
Ruvida, distanza %dmm, sensore %d, tensione %fV\nRuvida, distanza %dmm, sensore %d, tensione %fV\n
Aggiornamento logfile con misurazioni effettuate
Verifica termine superfici
Generazione report
Popup richiesta di posizionamento
check termine loop
selezione indici sensori
Iteration counter

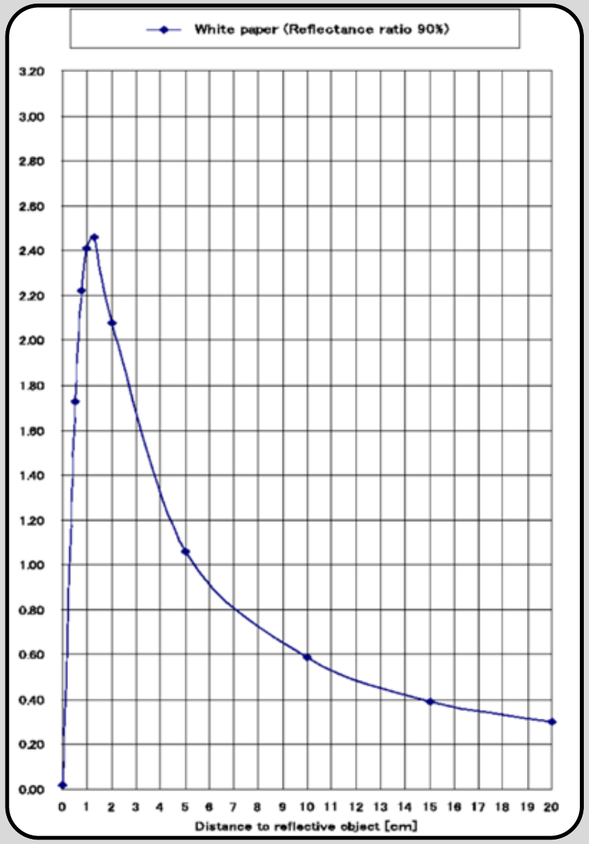


Valutazione di completamento misurazioni con tutti i sensori

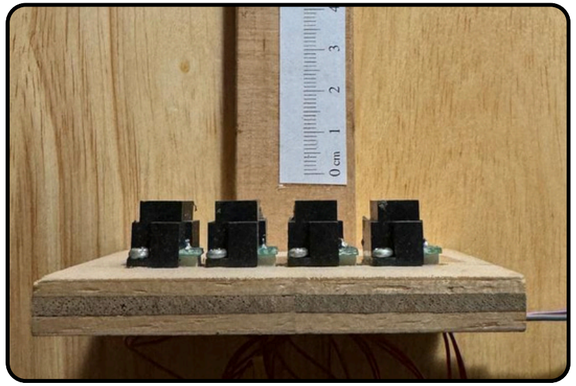


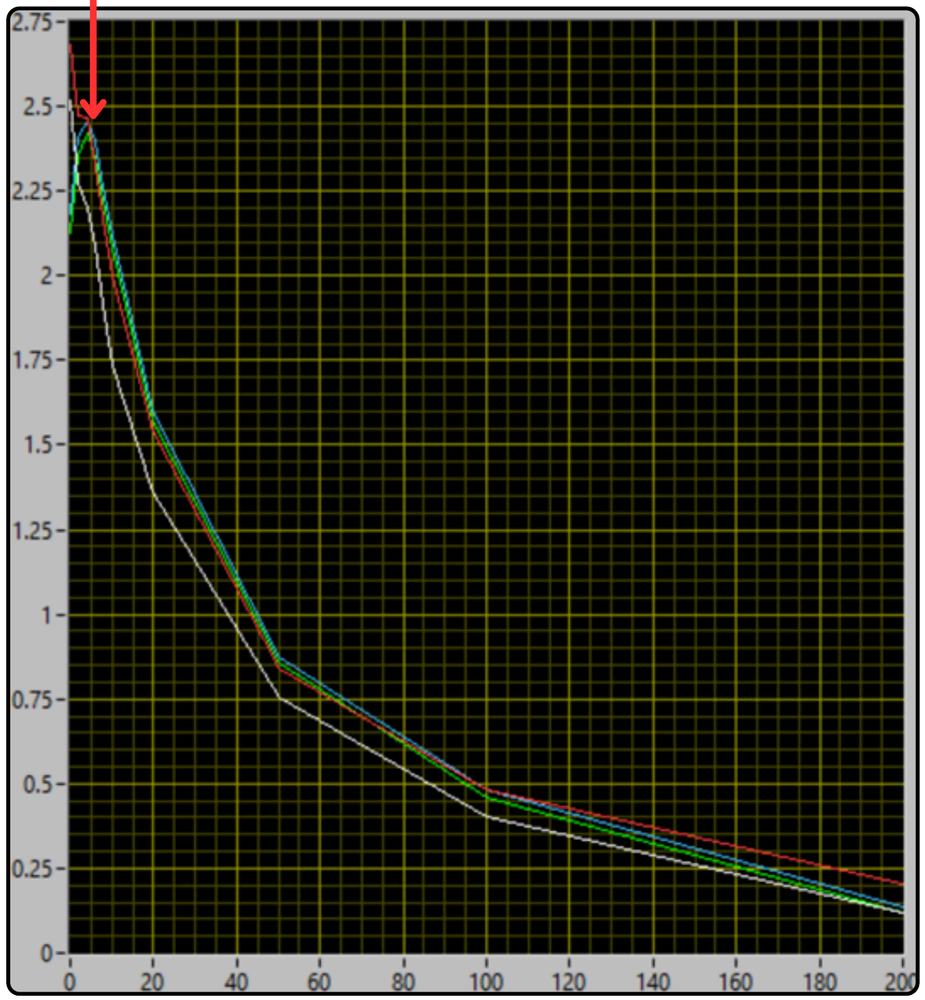


Risultati sperimentali

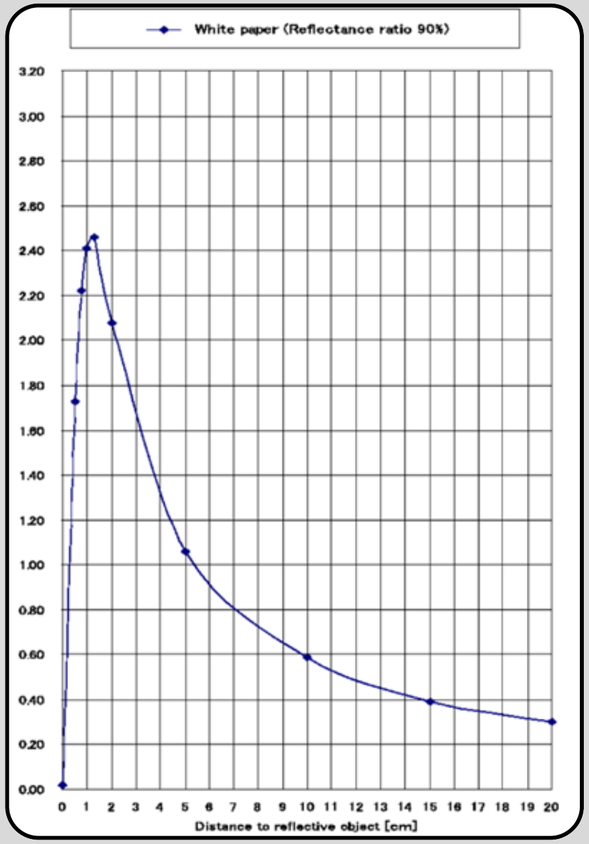


- Superficie **Opaca**, **Ruvida**: picco misurazioni intorno ai 4 mm

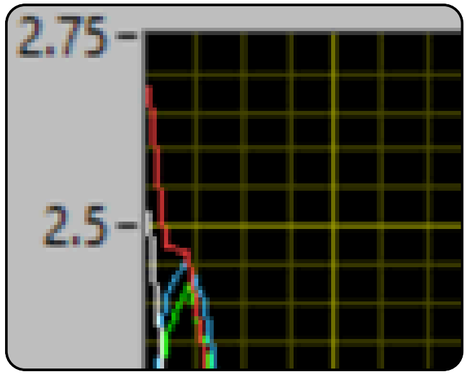


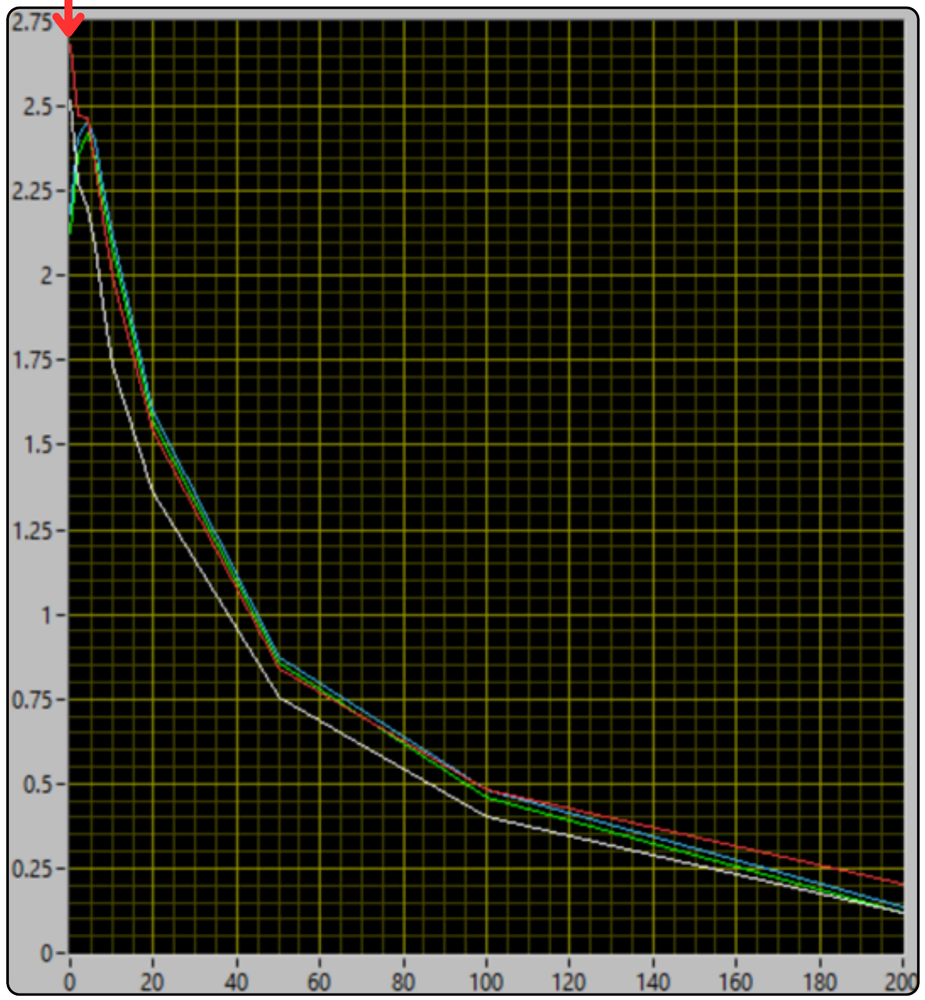


Risultati sperimentali

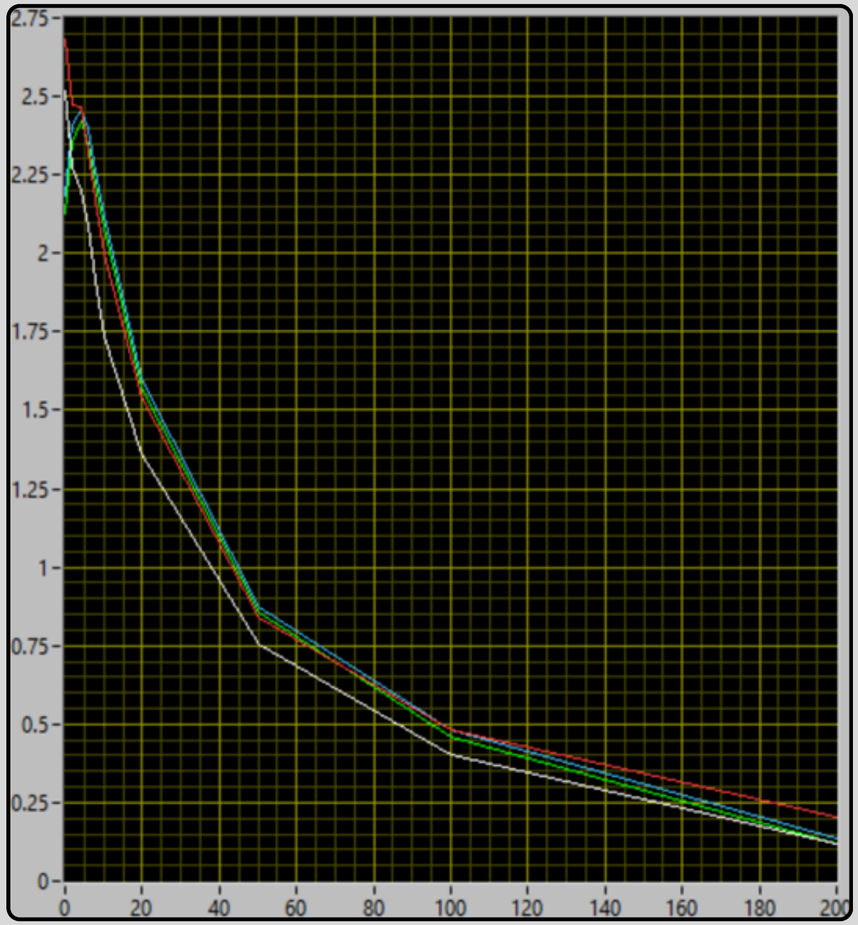


- Superficie **Lucida**, **Liscia**: andamento anomalo





Risultati sperimentali



	Varianza sui 4 sensori **(E-2)**			
Distanza (mm)	**Lucida**	**Liscia**	**Opaca**	**Ruvida**
0	0,4038408	0,0901377	0,5629859	0,3250390
2	0,0766196	0,2577998	0,5591988	0,0981543
4	0,1475025	0,3870833	0,1832123	0,1494924
6	0,4949315	0,2687210	0,4099933	0,2475959
8	0,7856214	0,3830274	0,2776534	0,2879699
10	0,4652597	0,6840736	0,5226121	0,1622398
20	0,3543921	**1,0080748**	0,3161767	0,1651000
50	0,4161374	0,3493794	0,2295391	0,1486012
100	0,1306746	0,1076963	0,1003408	0,0898861
200	0,0595967	0,0561440	0,0440848	0,0280693

Conclusioni

- Risultati coerenti per superfici poco riflettenti / rifrangenti (opaca, ruvida)
- Offset legato all’errore di misura
- Fenomeni di riflessione / rifrazione e interferenze con la luminosità ambientale più rilevanti per superfici riflettenti / rifrangenti (liscia, lucida)
- Differenze ragionevolmente basse tra i sensori

Possibili miglioramenti

- Circuito di preprocessing per matchare dinamica del segnale a DR dell’ADC
- Migliore sistema di misura (illuminazione controllata, struttura di misura più precisa)