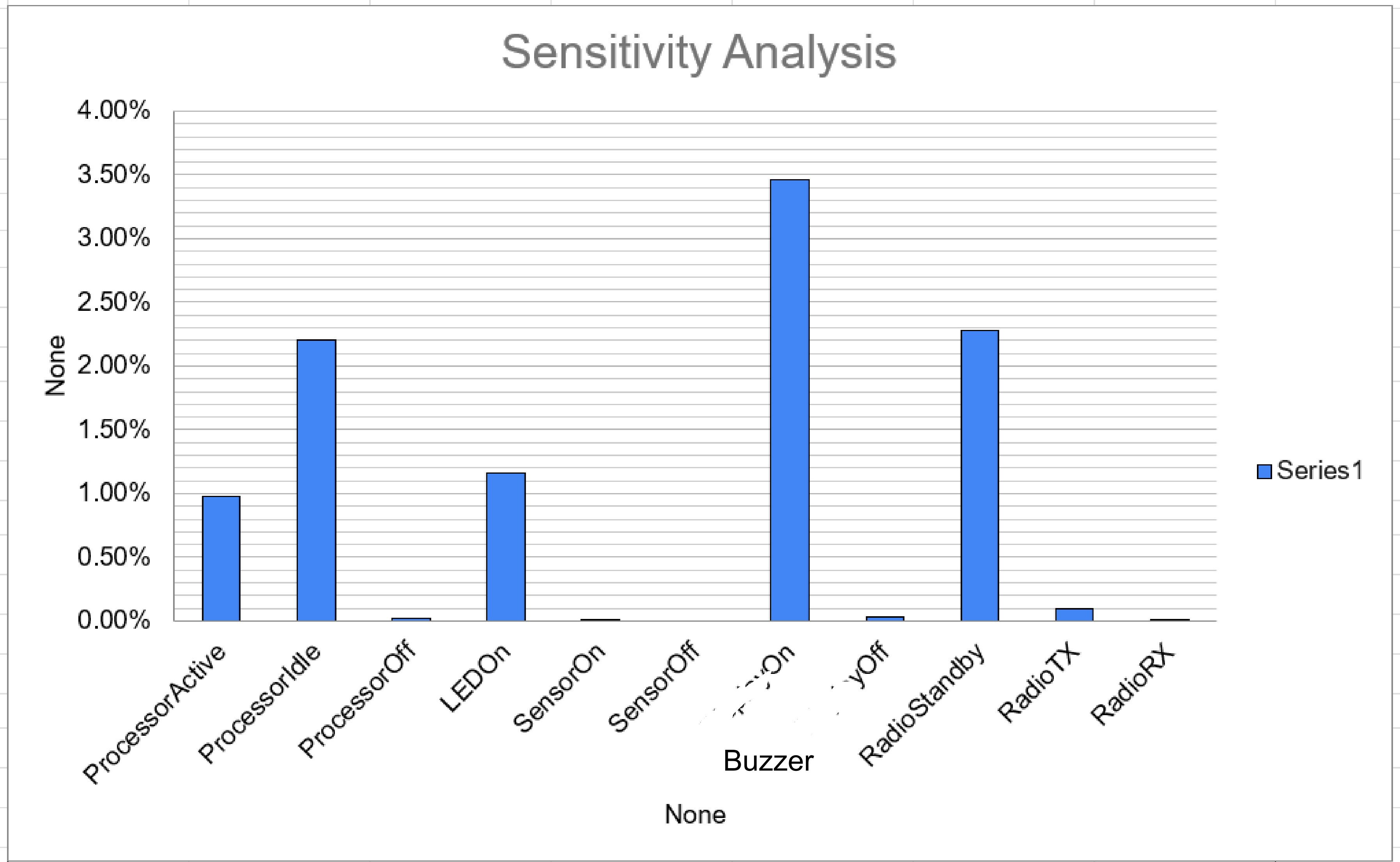
Sensor Device

System Parameters (defined by hardware)	form the datasheets		**Profiles (usage of each component mode - defined by software and usage)**		
			"off"	"sensing"	"interactive"
Processor	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/esp32-s3_datasheet.pdf				
Active	198	mW	0%	20%	50%
Idle	120	mW	0%	80%	50%
Sleep	0.6	mW	100%	0%	0%
LED	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/1498852.pdf				
On	50	mW	0%	100%	100%
Sensor	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/hx71_english.pdf				
On	7.5	mW	0%	0%	100%
Idle	0	mW	0%	0%	0%
Off	0	mW	100%	0%	0%
Buzzer	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/ef532_ps-13444.pdf				
On	150	mW	0%	100%	50%
Off (leakage)	1	mW	100%	0%	50%
Radio	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/esp32-s3_datasheet.pdf				
Data Rate	500K	bps	0%	0%	0%
Standby Power	100	mW	0%	100%	50%
TX Power	200	mW	0%	0%	40%
RX Power	100	mW	0%	0%	10%
			14	9.5	0.5 hours/day typical usage
Battery	4 * AA batteries with regulator				
Capacity	2000	mAh			
Nominal Voltage	6	V			
Regulator Efficiency	70%				

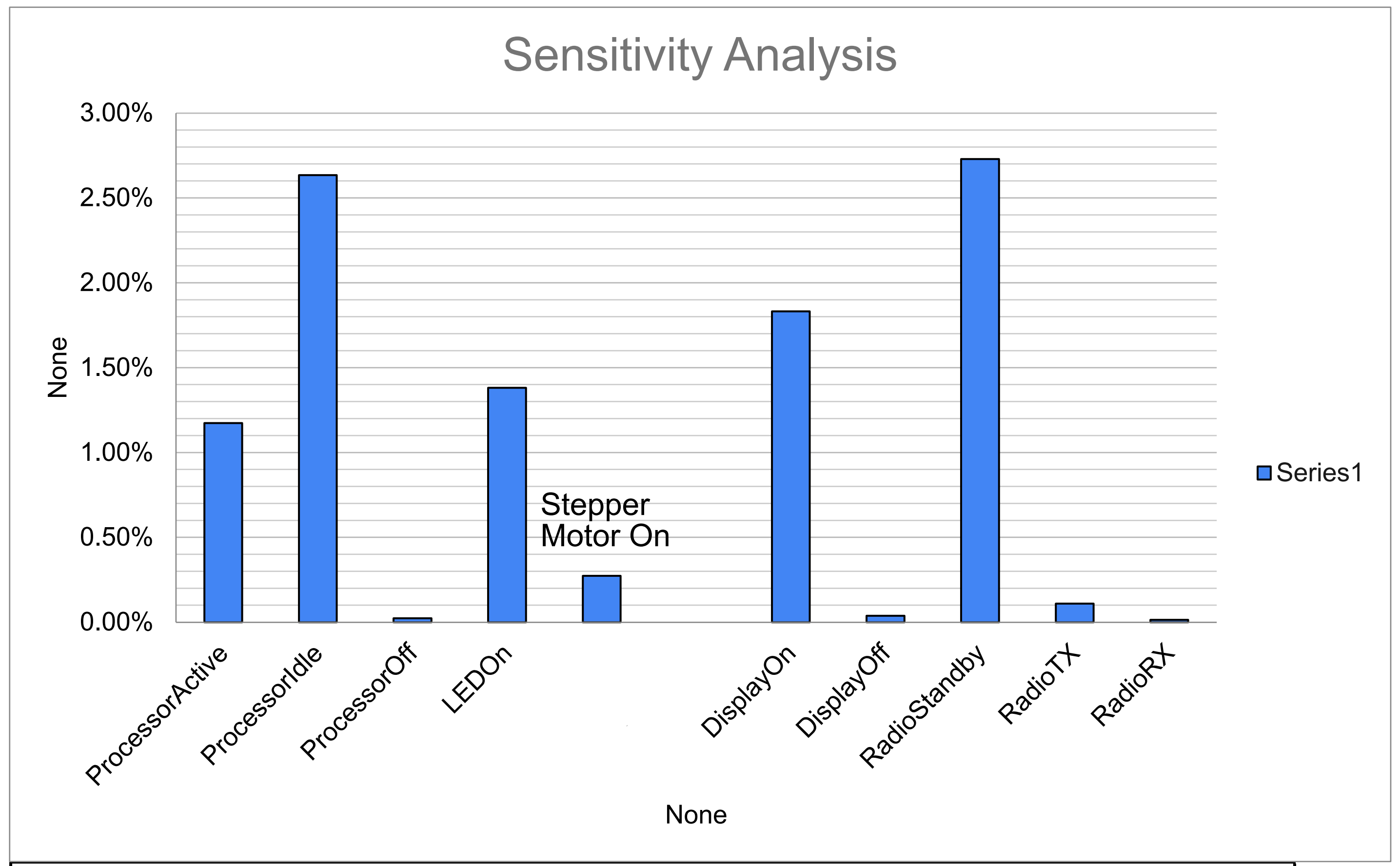


Total power in profile (mw)			Maximum Time	
"off"	1.6	mW	5250.0	hours
"sensing"	435.6	mW	19.3	hours
"interactive"	432	mW	19.4	hours
Effective Battery Capacity				
	8400	mW*h		
Days of Use	**1.92**	**days**		
Hours of Use	**46.06**	**hours**		

Github Link：https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/Sensor_Power_Model.xlsx

Display Device

System Parameters (defined by hardware)			Profiles (usage of each component mode - defined by software and usage)		
	form the datasheets				
			"off"	"sensing"	"interactive"
Processor	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/esp32-s3_datasheet.pdf				
Active	198	mW	0%	20%	50%
Idle	120	mW	0%	80%	50%
Sleep	0.6	mW	100%	0%	0%
LED	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/1498852.pdf				
On	50	mW	0%	100%	100%
Stepper Motor	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/Stepper-motor2424.pdf				
On	200	mW	0%	0%	100%
Idle	0	mW	0%	0%	0%
Off	0	mW	100%	0%	0%
Display	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/SSD1306.pdf				
On	66	mW	0%	100%	100%
Off (leakage)	1	mW	100%	0%	0%
Radio	https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/esp32-s3_datasheet.pdf				
Data Rate	500K	bps	0%	0%	0%
Standby Power	100	mW	0%	100%	50%
TX Power	200	mW	0%	0%	40%
RX Power	100	mW	0%	0%	10%
			14	9.5	0.5 hours/day typical usage
Battery	4 * AA batteries with regulator				
Capacity	2000	mAh			
Nominal Voltage	6	V			
Regulator Efficiency	70%				



Total power in profile (mw)			Maximum Time	
"off"	1.6	mW	5250.0	hours
"sensing"	351.6	mW	23.9	hours
"interactive"	615	mW	13.7	hours

Effective Battery Capacity
8400 mW*h

Days of Use	**2.29**	**days**
Hours of Use	**54.93**	**hours**

Days of Use Metric:
The "days of use" metric was determined by calculating the effective battery capacity, considering the regulator efficiency, and then dividing by the total power consumption per day for the usage profile defined. With a regulator efficiency of 70% and a battery capacity of 2000 mAh at 6V, the effective battery capacity is 8400 mW*h. By comparing this against the total power consumed in different profiles, it can estimate the number of days and hours the device can operate before the battery needs recharging or replacing.

Optimum Size for the Battery:
Given the device's current configuration and usage, the 4 * AA batteries with a capacity of 2000 mAh seem to be a reasonable choice, providing over 2 days of continuous use in the most demanding 'interactive' profile and significantly longer in the 'off' or 'sensing' modes.

Hardware/Software/Cost/Effort Trade-offs:
Hardware: Using a more energy-efficient OLED screen or a stepper motor with lower power consumption could extend battery life. Another hardware consideration could be integrating an energy harvesting component, like a solar cell, to extend battery life or even eliminate the need for batteries in some environments.
Software: Implementing a more aggressive sleep mode management in the software could reduce power consumption when the device is idle. For example, reducing the frequency of updates or implementing a motion-activated wake-up could minimize energy use without significantly impacting user experience.
Cost: While higher-capacity batteries or more energy-efficient components might increase the cost, they could also improve the user experience by requiring less frequent charging. Additionally, software optimizations typically do not increase the hardware cost and can be a cost-effective way to improve power management.
Effort: Investing in software development for intelligent power management could be less resource-intensive than hardware changes. For instance, creating a low-power communication protocol between the sensor device and the display could reduce the energy required for data transmission.

Github Link：https://github.com/Jingyii800/Hydration-Companion/blob/main/data_sheets/Simple_Power_Model.xlsx