Team #19

InWhat: An Intelligent System for Wardrobe

Name	Major	Part in charge of
Shuhong Xiao	ECE	Algorithm & Software
Bo Pan	ECE	Algorithm & Software
Chuqin Zhang	ME	Hardware & Design

Introduction

Problem Statement and Proposed Solution

What to wear?

We will build ? for the person?
Our customer has a problem?
Our product solves it by?

Design Overview

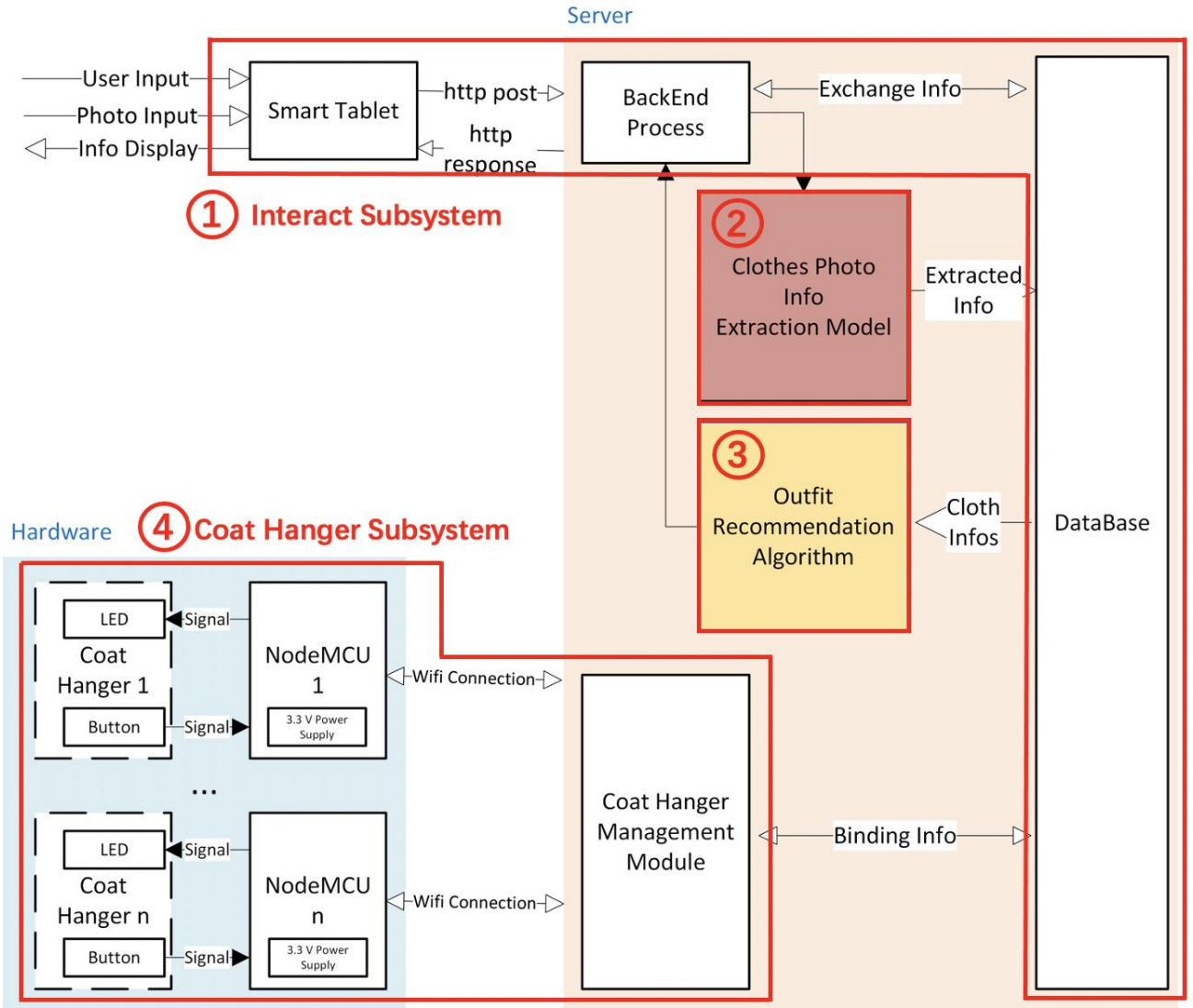
a. High-level requirements

1. Must recognize the features of the clothes put in with an acceptable accuracy
(50% accuracy for category recognition and recall 30% for attributes recognition).

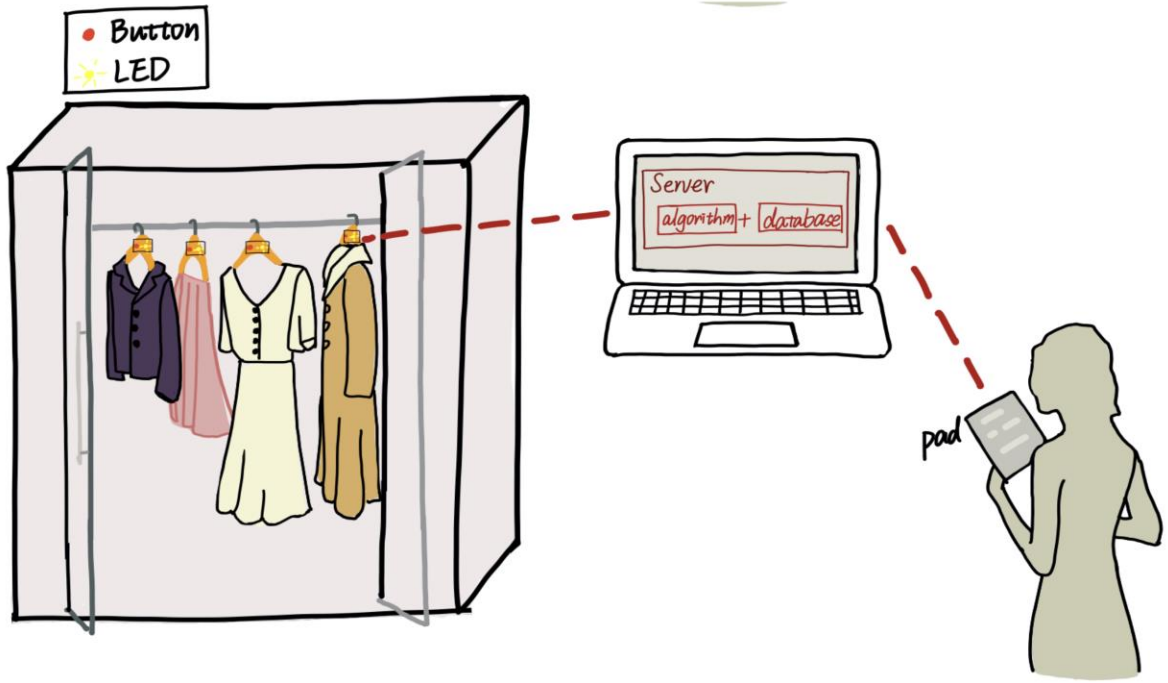
2. Must have a usable recommendation function that gives some valuable suggestions
(at least 50% of the recommendations should make sense for at least 50% test users).
Should include some randomness to make the recommendations flexible and allow the unsatisfied users a second chance.

3. Must have a user-friendly interface
(at least 80% test users should find it easy to use).
Must allow the users easily and quickly find where the chosen clothes are
(the users can find the recommended clothes within 5 seconds).

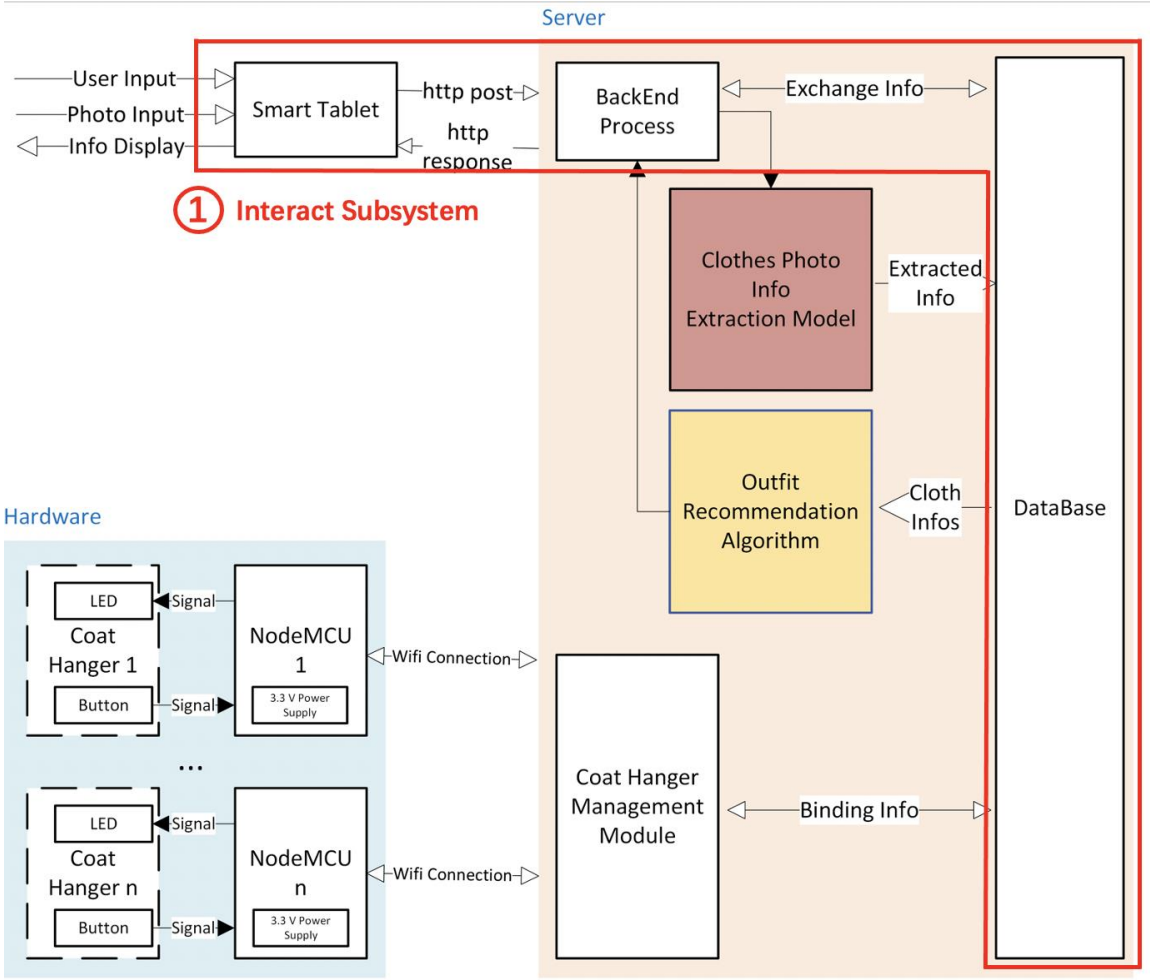
b. Block Diagram



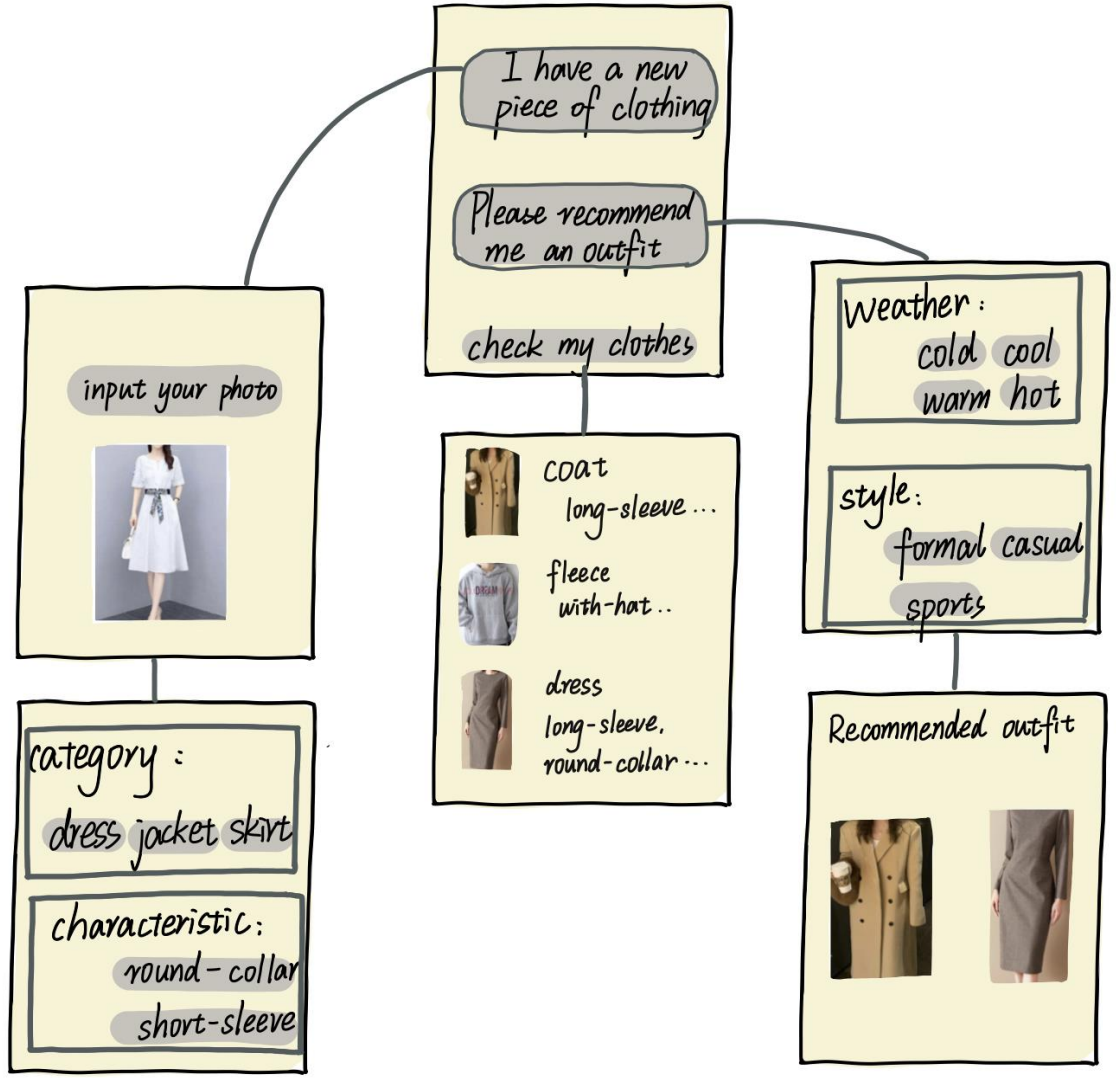
c. Physical Design



1. Interact Subsystem



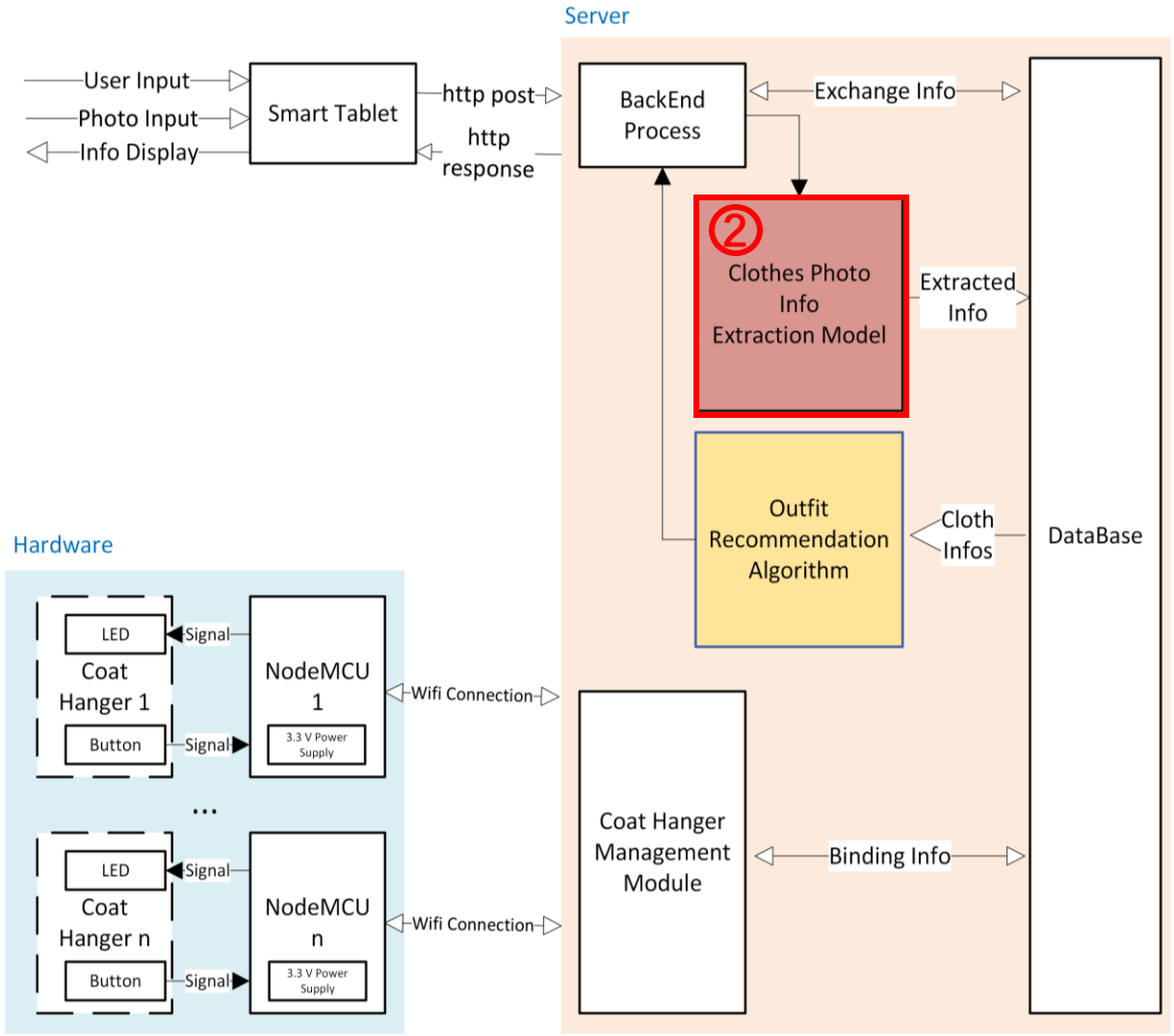
Interact Subsystem Block Diagram



Interact with Users

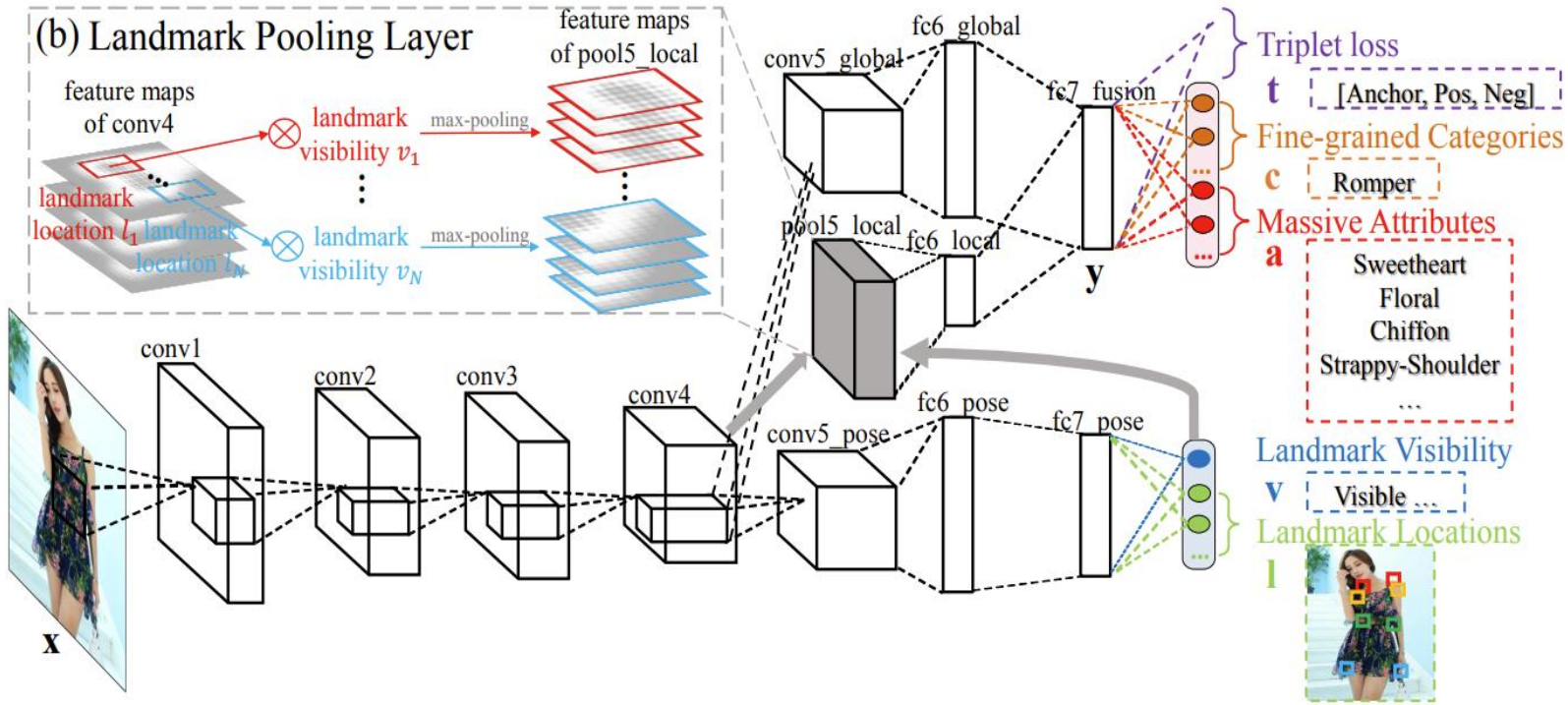
Requirements	Verification
1. The web tool should be user-friendly and our users can quickly learn how to use it in 15 minutes. 2. The web and database should be stable and not easy to break.	1. Find a group of volunteers, test whether they can get familiar with both registering and recommending without any instruction. 2. For web tool, test its stability using scripting tools, either detect the script and deny the access or sustain 100 visits per second; for database, test it by writing illegal data into each table, if all requests are denied, we can prove that database is also stable.

2. Clothes Photo Info Extraction Subsystem



Category: Tee
Attributes: short-sleeve, graphic, chiffion, summer

Upper-cloth (9)	Blazer, Blouse, Coat, Hoodie, Jacket, Parka, Sweater, Tank, Tee
Lower-cloth (9)	Chinos, Culottes, Cutoffs, Jeans, Jeggings, Joggers, Shorts, Skirt
Full-cloth (2)	Dress, Romper (Jumpsuit)



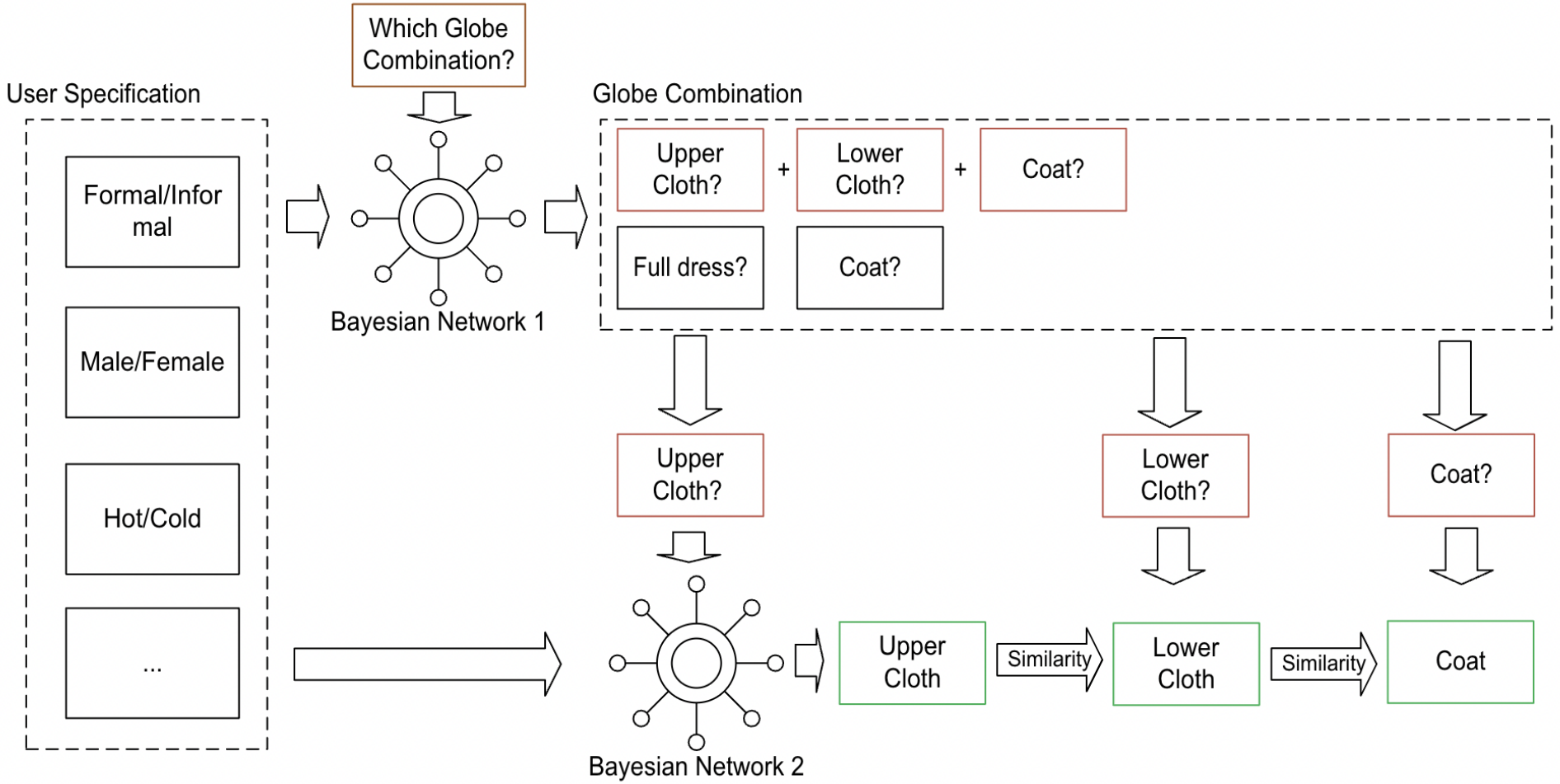
$$L_{category} = \frac{1}{D}\sum_{j=1}^{D}(-\log p_i)$$

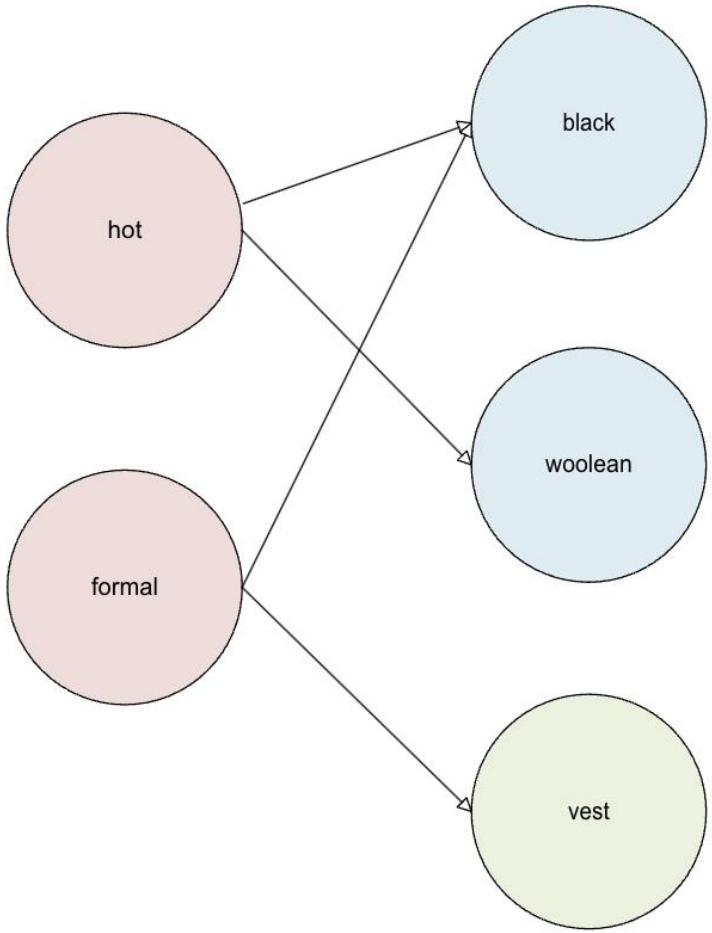
$$L_{landmarks} = \sum_{j=1}^{|D|} \|\boldsymbol{v}_j \cdot (\hat{l}_j - l_j)\|_2^2$$

$$L_{attributes} = \sum_{j=1}^{|D|}(w_{pos} \cdot \boldsymbol{a}_j log p(\boldsymbol{a}_j|\boldsymbol{x}_j) + w_{neg} \cdot (1-\boldsymbol{a}_j) log(1 - p(\boldsymbol{a}_j|\boldsymbol{x}_j)))$$

Requirements	Verification
1. The prediction of top 5 category accuracy should reach 50%. 2. The prediction of top 5 Attributes recall should reach 30%.	1. Test the category prediction use our test set, for every one sample in our test set, if the true category label appear in the top 5 prediction, we consider the prediction as successful, otherwise failed. 2. Test the attributes prediction use our test set, the top 5 recall here define as $\frac{TP}{5}$.

3. Outfit Recommendation Subsystem





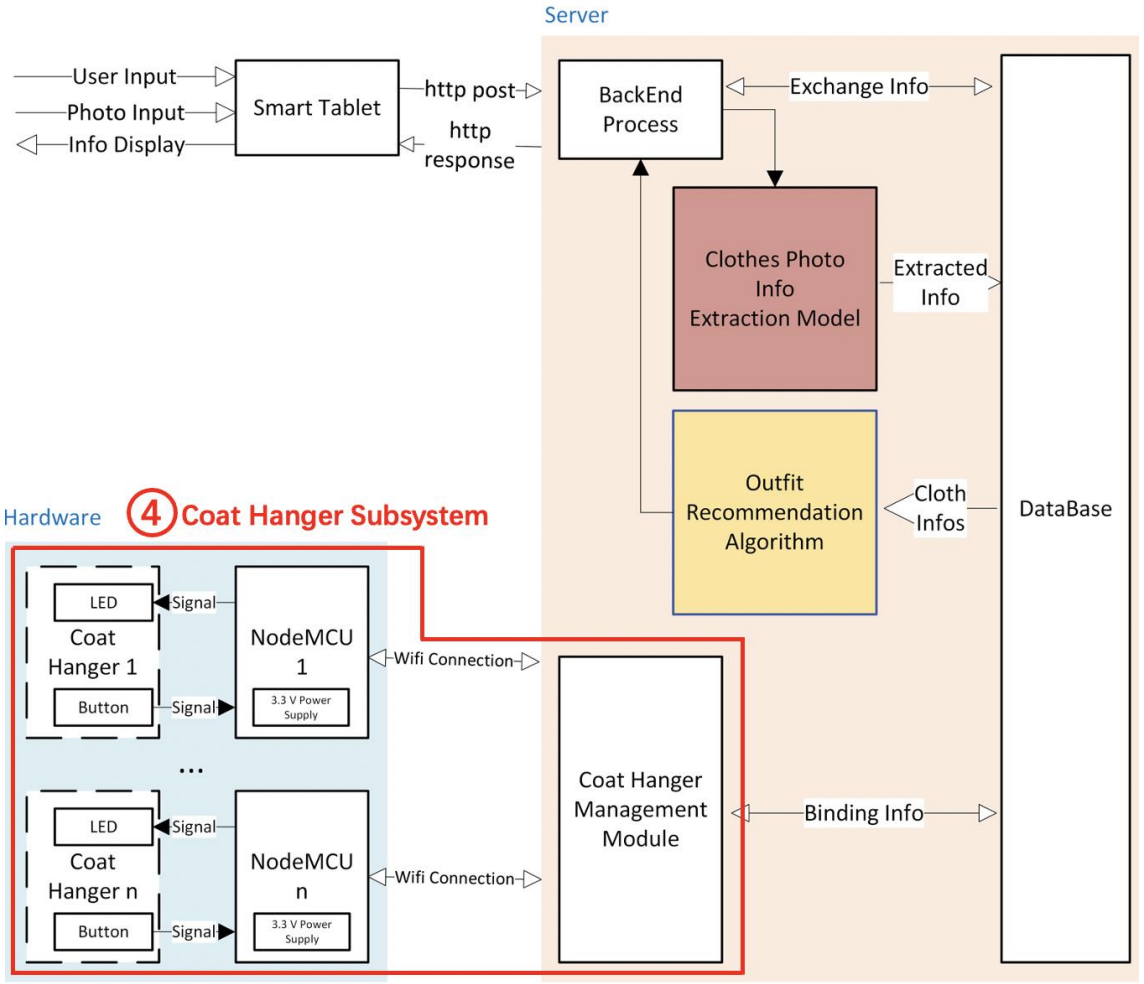
User Input

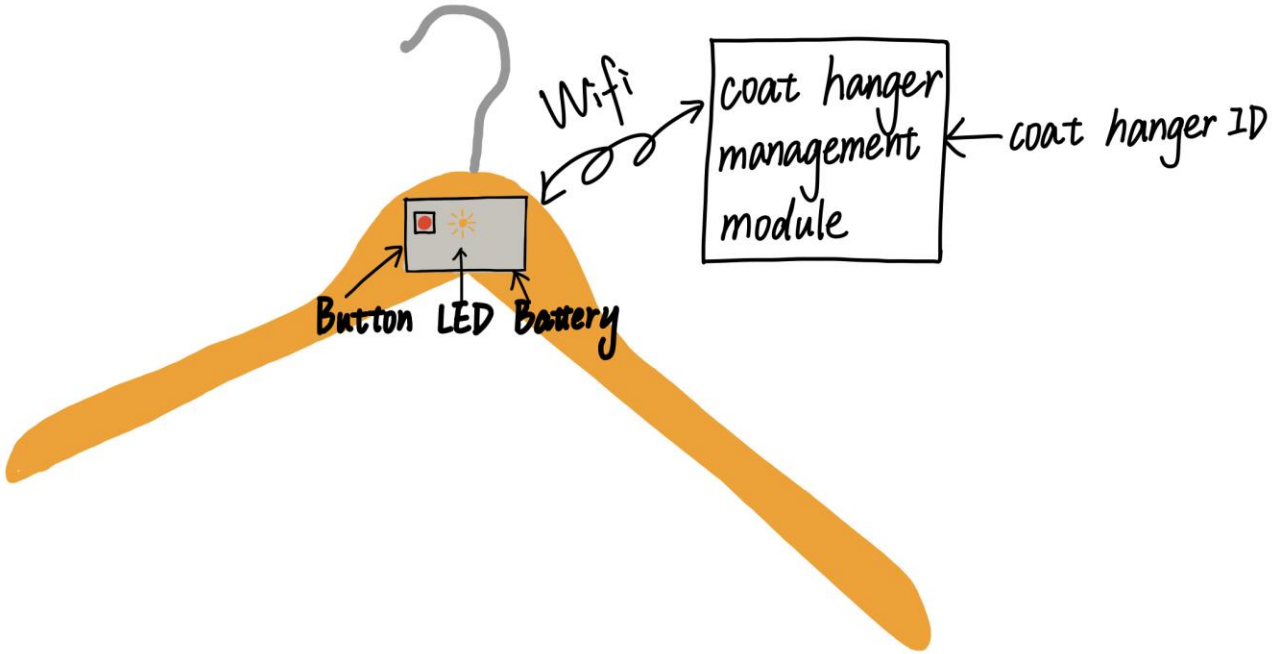
Cloth Attribute

Cloth Category

Requirements	Verification
1. At least 50% of the test user should be satisfied with the recommendation result.	1. Find a group of volunteers, teach them how to use the system, then let them imagine a scenario (e.g. today is hot, you will need to go to an interview). Ask the volunteers to input their specification to the system through the user interface. Record if they find the result they want (they can ask the system to regenerate the result until they get tired with that). If more than 50% the user are satisfied with the result in the end, we regard this subsystem as a successful implementation.

4. Coat Hanger Subsystem





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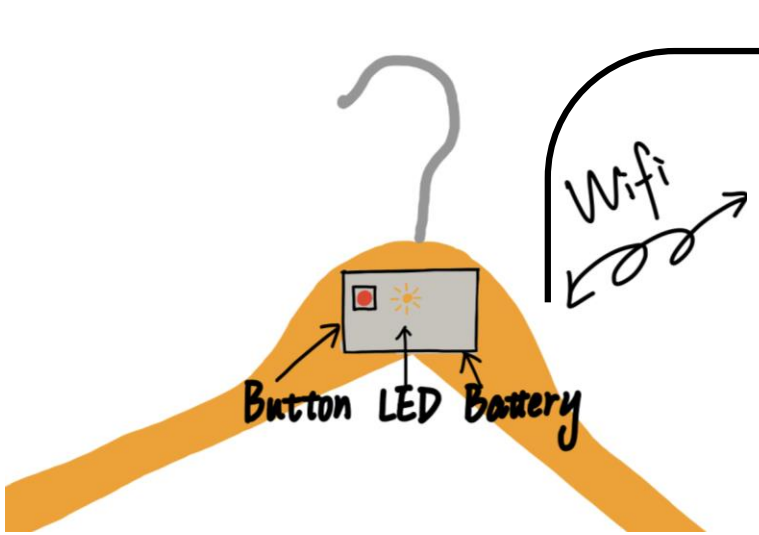

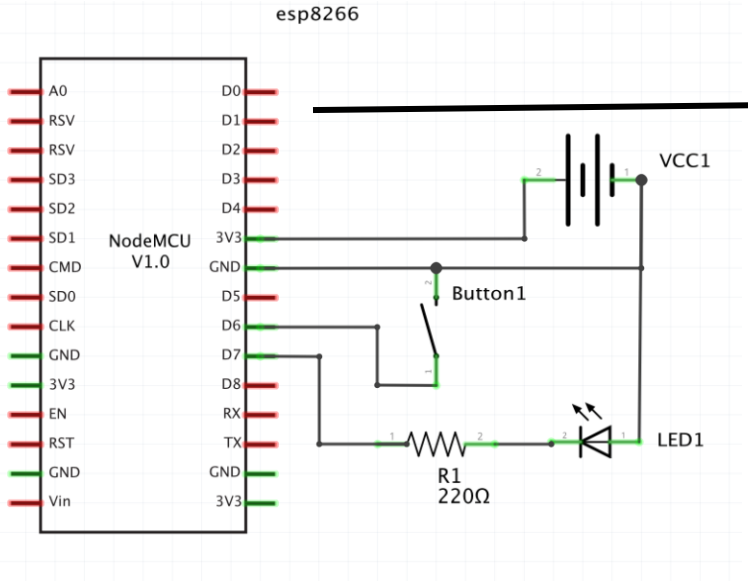

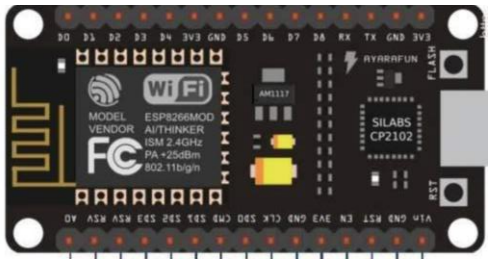

ModeMCU with ESP8266

	Modem-sleep	Light-sleep	Deep-sleep
Wi-Fi Connection	on	on	off
RTC	on	on	on
CPU	on	pause	off
Substrate Current	15mA	0.4mA	~20 μA

Three Sleep Patterns Comparison from Espressif Inc. (ESP8266 Producer)

4. Coat Hanger Subsystem

Requirements	Verifications
Implement reliable communication between coats hangers and server (control delay within 2s and achieve above 95% accuracy).	Within 3 minutes, sent about 10 messages. Measure the delay time and see if the LED lit up accurately. The above tests may be carried out several times, and the delay time and accuracy should be recorded.

Schedule

week	Bo pan	Chuqin Zhang	Shuhong Xiao
3/21	Derive bayesian model used in recommendation subsystem. Produce design document.	Read manual and try some demo on ESP8266. Produce design document.	Process data set, fix some bugs for training code for extraction subsystem. Produce design document.
3/28	Analysis attributes in data set, reduce the quantity.	Django, HTML, CSS learning.	label new attributes special for our system.
4/4	Train extraction model on GPU.	Set up database and tables.	Train extraction model on GPU.
4/11	Write code for bayesian network.	Establish hardware communication.	Test and tune recommendation result.
4/18	Begin with web design.	Produce and assemble coat hangers.	Begin with web design
4/25	Continue with web design.	Write management code in server for coat hanger, demo it.	Continue with web design.
5/2	Finish web design.	Coat hanger test.	Test the individual function of each subsystem.
5/9	Combine all the subsystem, debug.	Prepare for demo and presentation.	Prepare for demo and presentation.
5/16	Conduct environmental testing.	Begin writing final report.	Begin writing final report.
5/23	Finish writing final report.	Finish writing final report.	Finish writing final report.

Cost

- *The average salary of an CompE student is $99,145/year and for ME student, the average salary is $79,117/year. With average person works 2080 hours/year.*

$$\$99,145/2080 \times 2 + \$79,117/2080 = \$133.37/\text{hour}$$

$$\rightarrow 3 \times \$133.37/\text{hours} \times 10\text{weeks} \times 10\text{hours/week} = \$40010$$

Part	Cost
ESP8266 Wi-Fi microchip	$1.83
5mm LED	$0.05
DS-211/213 button	$0.16
2.8AH Li-ion battery $\times 2(AAPortablePower; Nanfu)$	$0.47
raw coat hanger	$1.57
Total	$4.08

$$\rightarrow \rightarrow \rightarrow \$40,010 + 3 \times \$4.08 = \mathbf{\$40022.24}$$

Thanks for listening!