

ENGINEERING DESIGN

END SEMESTER

PROJECT

SUBMITTED BY

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SUBMITTED TO

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SECTION : MI

GROCERIES LIST GENERATOR

Objective

To design a device by which the monthly grocery list can be prepared, updated and usage statistics can be seen by connecting an external device

Considerations

- Simple and easy to adapt
- Easy to install and must not hinder the daily activities in the kitchen
- An effective user manual / method of usage instructions must be given to avoid any ambiguity

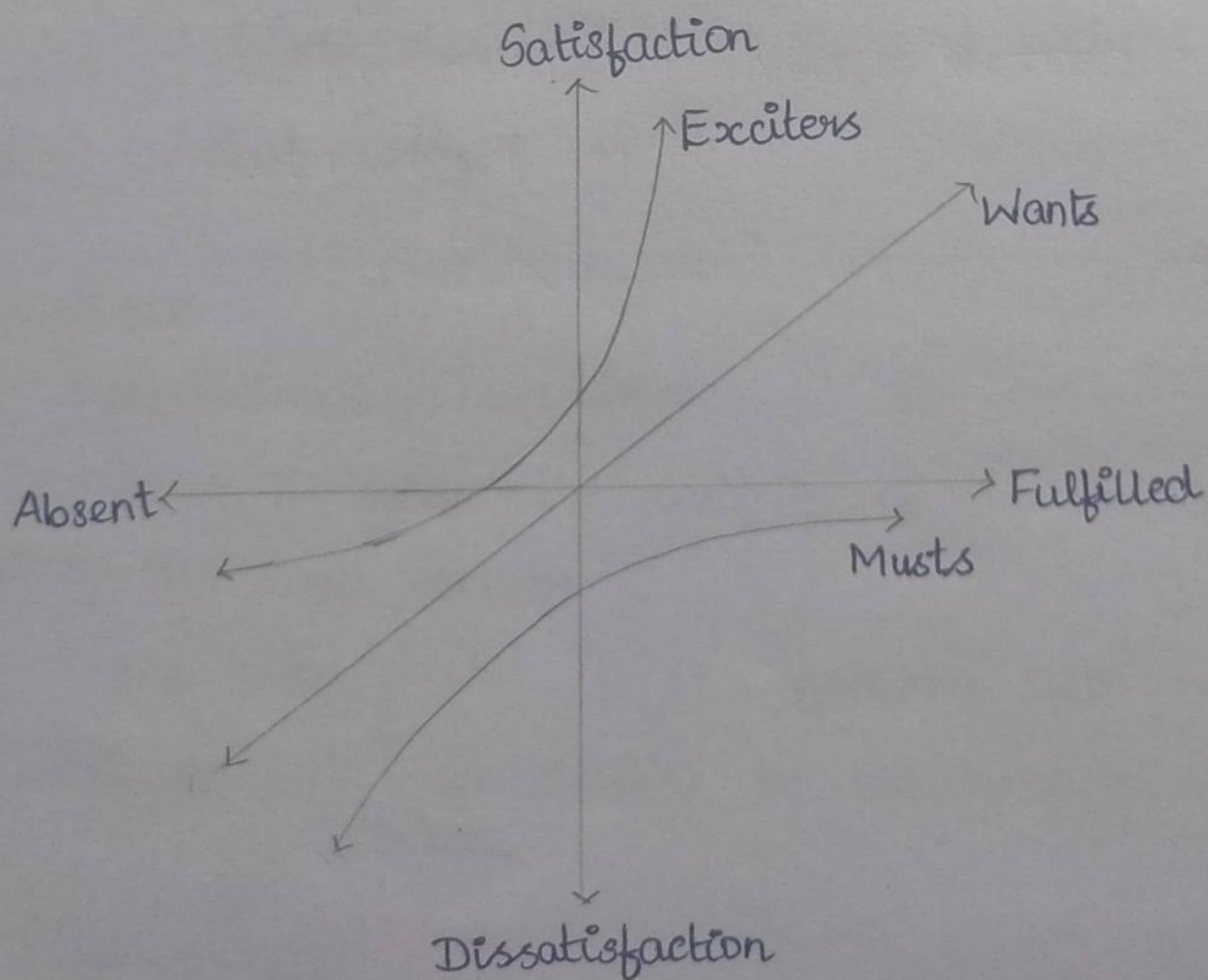
Constraints

- Budget must not exceed Rs.5000.
- System must not be too big and disturbing
- Solution covers must not be complex

Initial Specifications of the design

For Microcontroller		For LOAD SENSOR	
Operating Voltage	5-10 volts DC	Rated Load	1kg, 2kg, 3kg
Digital IO pins	10-24	Rated Output	1.0V
Flash memory	8-128 KB	Recommended Operating Voltage	5V
Length	60-70mm	Maximum Operating Voltage	10V
Width	40-60mm	Material	Aluminum
Weight	< 60 g	Protection	IP65
		Cable length	atleast 180mm

Kano Model



Musts

- Able to check weight of grocery available
- Able to store the data

Wants

- Want to update the grocery list automatically if refilled
- Want a complete grocery list with weight required to be purchased

Exciters

- Generate data and provide to the user
- Prepare using statistics per grocery item over a period of time
- Bluetooth and USB connectivity to any portable device (mobile / tablets)
- Gives alarm if the grocery weight goes below critical weight limit

Functions

(i) Primary Functions

- To sense the weight of the container using the load sensor
- To check if the grocery item must be added or not, accordingly to benchmark weight

- To store the name of the grocery items in the database, if it is available below the set limit

(ii) Secondary Functions

- To make a list of all the items in the mobile phone, which is connected to the database

- To use the power supply provided for the Arduino board

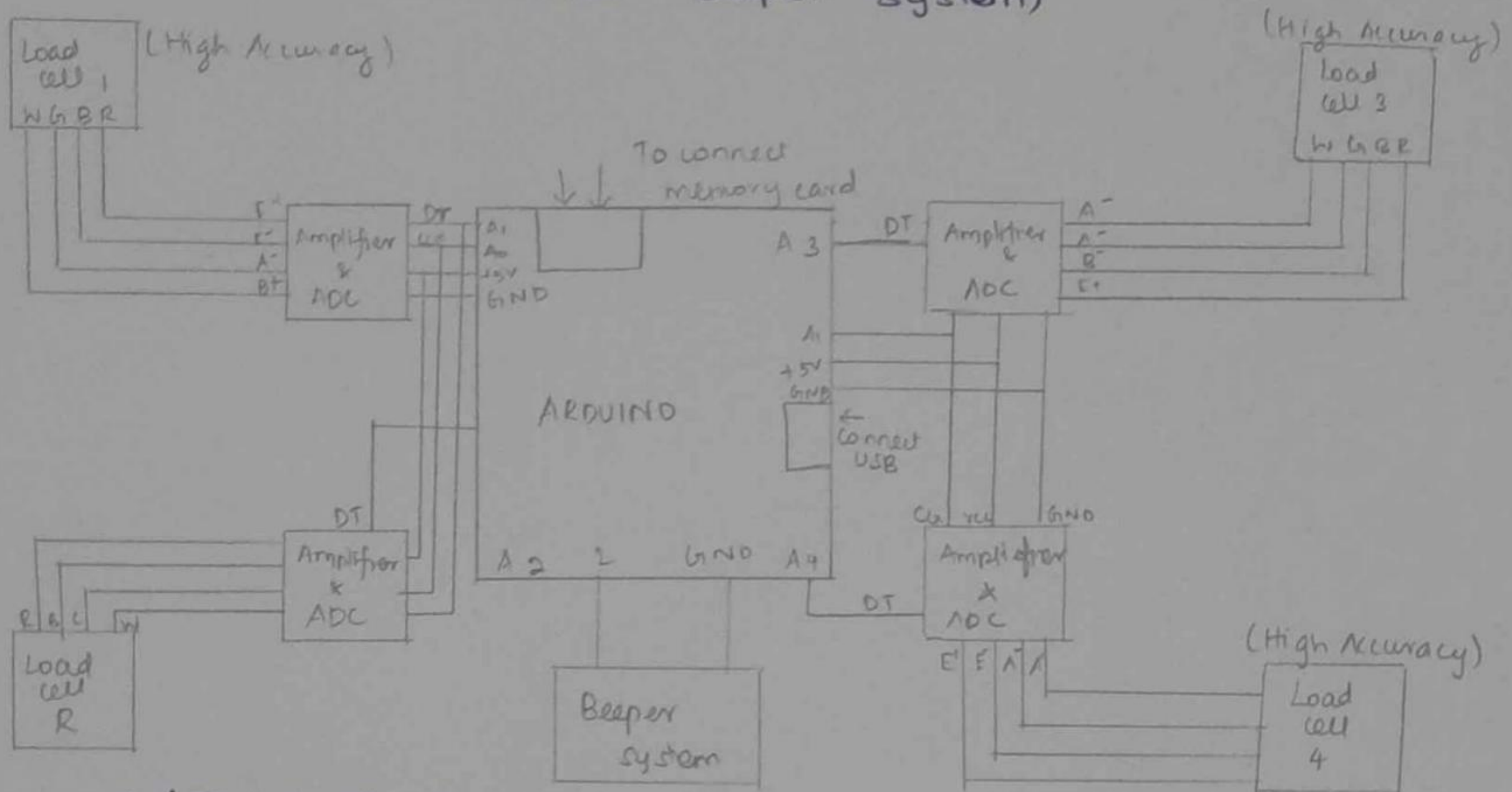
- To check the availability of groceries every 24 hours

Morphological Matrix

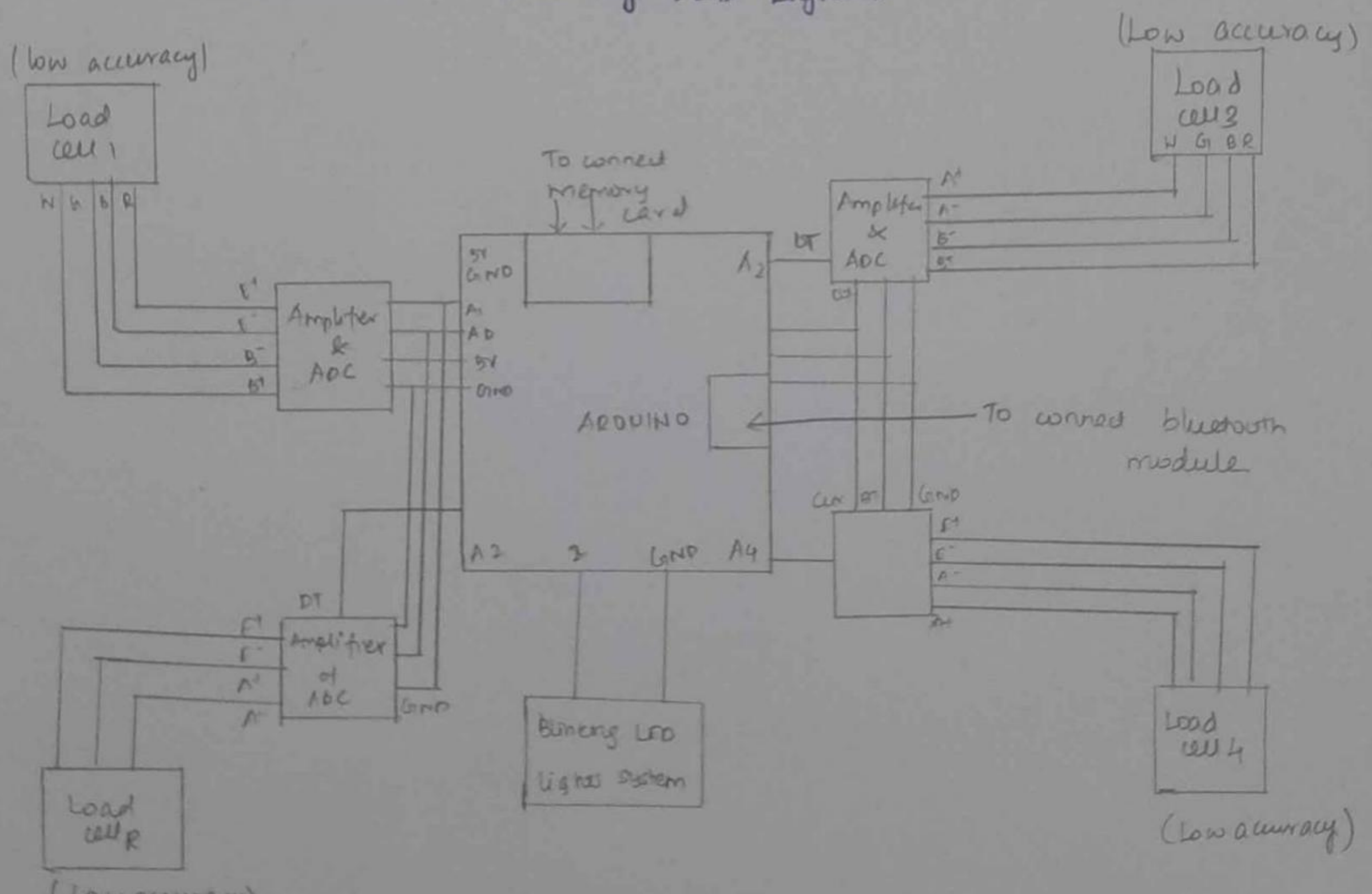
Functions	MEANS			
	Means 1	Means 2	Means 3	Means 4
Storage	Internal memory	External memory		
Weight	Load sensor with high accuracy	Load sensor with low accuracy	Piezo resistive sensors	
For output	Arduino	Raspberry PI	Node MCU	MSP 430
For sharing data	Removable MMC	USB	Bluetooth	
To indicate	Blinking LED lights	Small beeper system	Mobil message notification	

DESIGNS:

1. (External Memory + Load Sensor With High Accuracy + Arduino + USB + Small Beeper System)



2. (External Memory + Load Sensors with Low Accuracy + Arduino + Bluetooth + Blinking LED Lights)



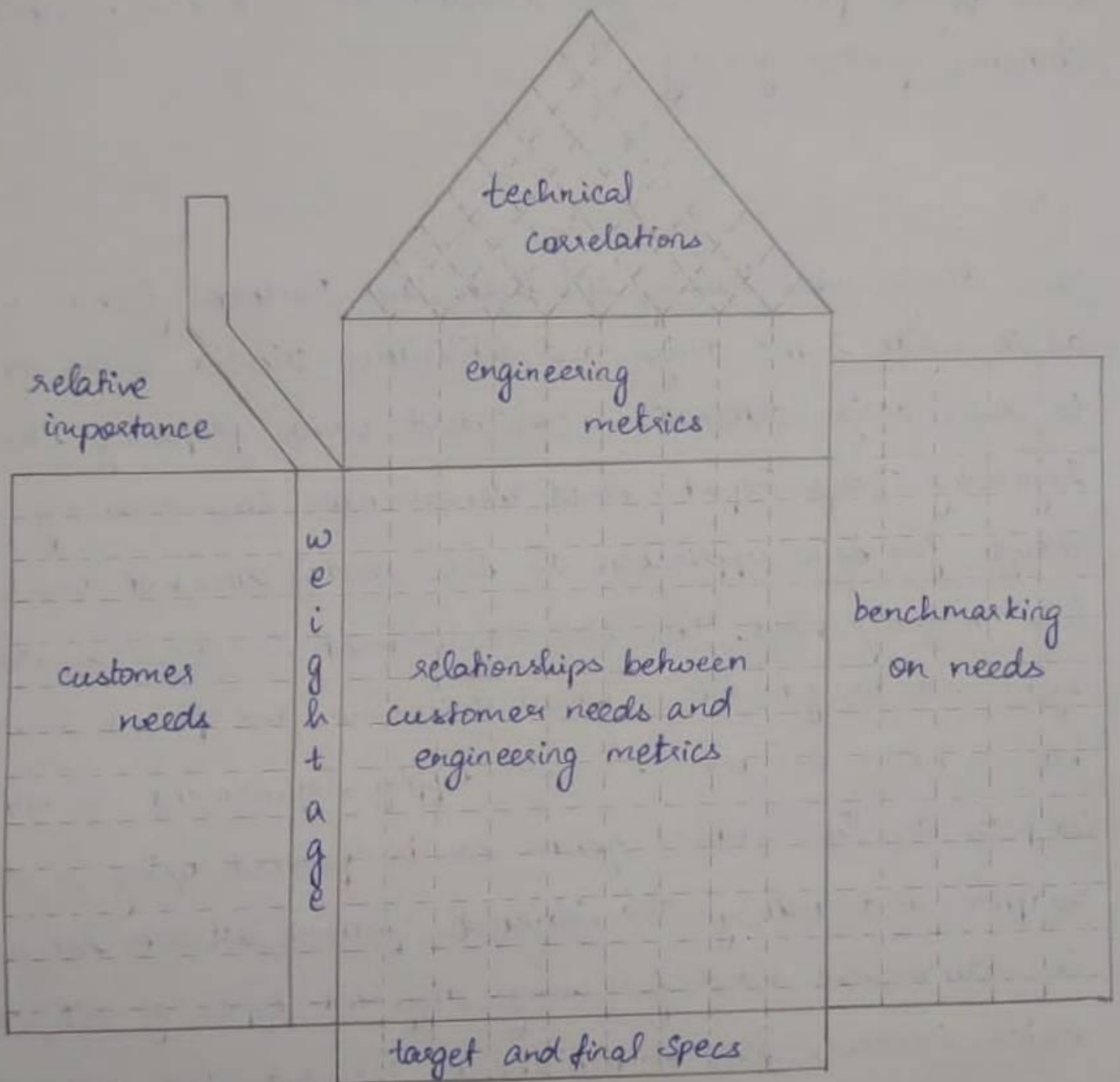
List of Criteria For Selecting The Concept Design

1. External storage - As internal storage may not be sufficient to hold both the program and the grocery data.
2. Load sensor with low accuracy - because this is not a critical application and does not require high accuracy/costly alternatives.
3. Arduino - it is open source and a cost-effective solution for our requirement.
4. Bluetooth - it will be compatible with different portable devices (mobiles/tablets) as ~~the~~ USB connectors may vary.
5. Blinking LED light - user can be reminded to extract data/refill the groceries accordingly. Small beeper system may not be user friendly as it might sound like an alarm in the middle of the night causing disturbances.

Decision Matrix:

Function	Means	weightage	Cost	Portability	User Friendliness	Score
To store data	Internal memory	5	4	5	2	11
	<u>External memory</u>	<u>5</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>12</u>
To weigh	Load sensor with high accuracy	5	2	4	4	10
	<u>Load sensor with low accuracy</u>	<u>5</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>12</u>
	Prezo resistive sensors	5	1	3	4	8
To generate report	<u>Arduino</u>	<u>5</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>12</u>
	Raspberry Pi	5	1	4	3	8
	Node MCU	5	2	4	3	9
	MSP 430	5	3	4	3	10
To share data	Removable MMC	5	3	3	3	9
	USB	<u>5</u>	3	3	4	10
	<u>Bluetooth</u>	<u>5</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>12</u>
To alert user	<u>Blinking LED lights</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>4</u>	<u>10</u>
	Small beeper system	5	3	3	4	10
	Mobile message notification	5	2	4	3	9

Quality Function Deployment (House of Quality)



DESIGNER FEATURE CORRELATION MATRIX

Relative importance (%) →

← Technical correlation

Customers Needs		<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="text-align: right;">→ Engineering matrix</div> </div>						Importance
		material	Loss Type	choosing parts	PIC choosing parts	Pattern material	display	
Safety	26.8	✓✓	✓	✓	✓	x	✓	5
Weights	20.4	✓✓	x	0	0	x	x	4
Cost	21.05	x	x	✓✓	✓✓	0	✓✓	4
Easy repair	15.7	0	✓✓	x	✓	0	✓	2
User friendly	10.57	✓✓	✓	x	x	x	✓	1
Use of renewable energy	5.2	✓✓	x	x	x	✓	✓	1
		95	98	80	75	30	50	

KEY:

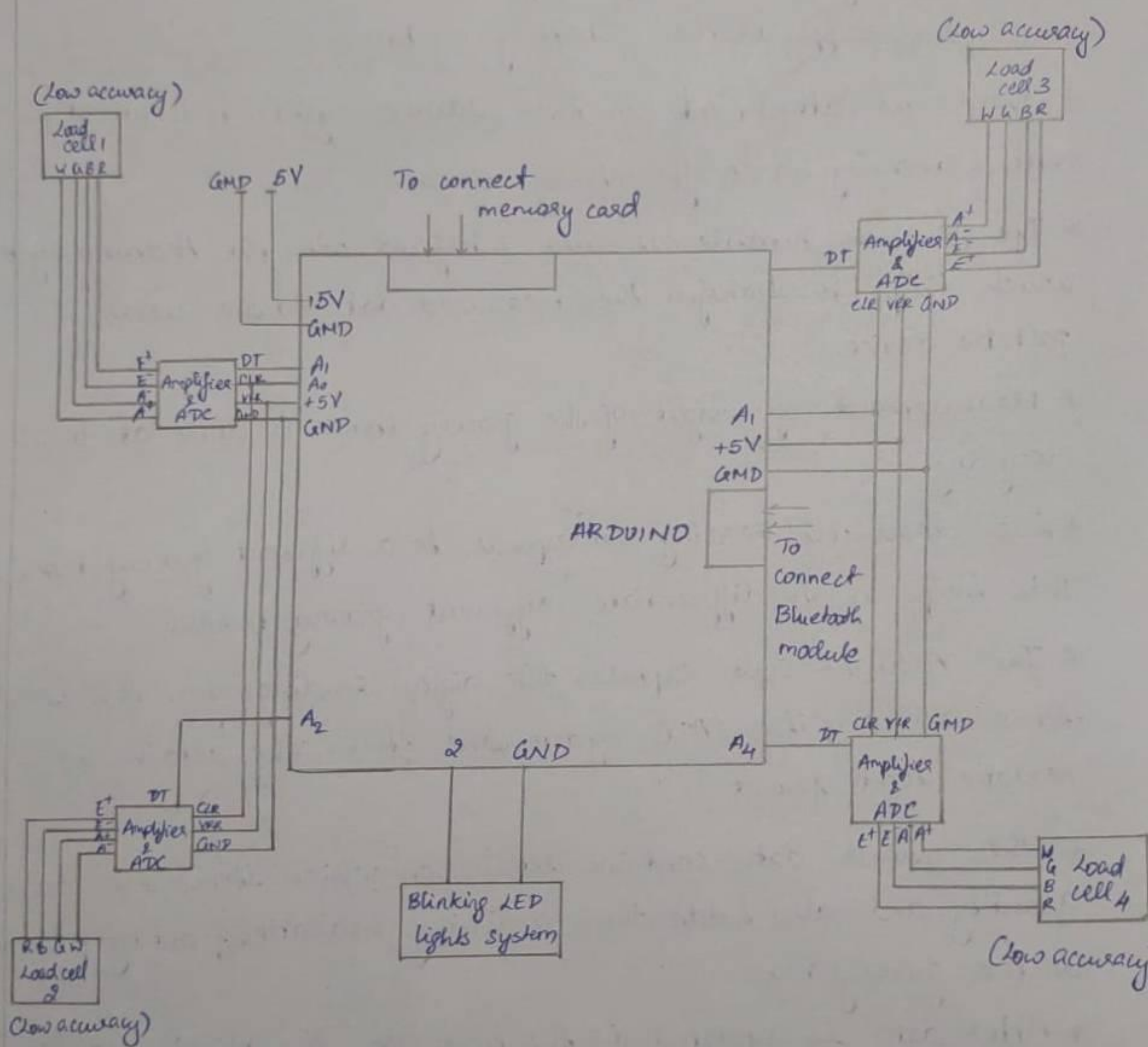
- ✓✓ - very good
- ✓ - good
- x - poor
- 0 - very poor

Relationship:-

- ++ - strong positive
- +
- 0 - no relation

Importance Scale: 1 2 3 4 5.

Design 2: External Memory + Load Sensor with low accuracy + Arduino + Bluetooth + Blinking LED lights.



Design Features of the Selected Design :

* Load sensors with low accuracy are used since cost-effectiveness.

- * Multiple load sensors are interfaced with the amplifier and ADC before connecting to the Arduino system.
- * Arduino system uses V supply which can be supplied via a small power supply unit or a battery system.
- * There are attachments in the Arduino system to connect external memory cards for storage of data.
- * The Bluetooth module is also interfaced with the Arduino system which helps to transfer the measured data to the users' portable device.
- * Measurement of weight of the grocery items is done at 00:00 every day.
- * Each load cell reading corresponds to a different grocery box. This helps us to differentiate different grocery boxes.
- * The Arduino code captures the digital readings from the load sensor and amplifier / ADC system and stores the details in readable text format.
- * The stored data contains details on which items are less in quantity and also holds the remaining available quantity present in the grocery box.
- * After data is updated in the text file, the blinking LED lights systems starts to blink indicating to the user that there is a new addition in the text file which indirectly relates to the less availability of groceries.
- * This measurement is done once everyday.
- * The user can connect the portable devices to this system via the Bluetooth module. Program is available to synchronize the data between the storage available in the system.

portable device.

- * If the groceries are refilled by the user, the data in the text file gets automatically updated when the next reading is taken (00:00 the next day).
- * The program provision is also available to track the monthly usage statistics of each grocery.

Conclusion:

The design with Blinking LED lights and Bluetooth feature is selected as it holds better design and utilization criteria when compared to other design alternatives considered while preparing this Engineering Design Report. Load sensor with low accuracy is enough for this application as this model does not warrant a high accuracy need. The size requirement is small as the entire system can be fit into a small enclosure and placed in the kitchen under the boxes. Power supply requirement is not that complex as this entire system can be powered using a small DC adapter or a battery. The Bluetooth feature attracts the user as it reduces the need for using different types of USB cables, which increases the portability of the suggested design.