INTEGRATED SENSORS

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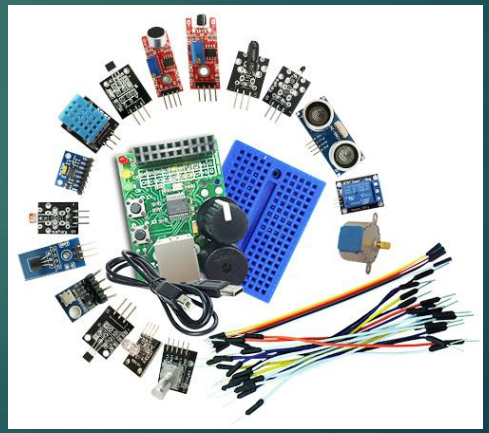
INTRODUCTION

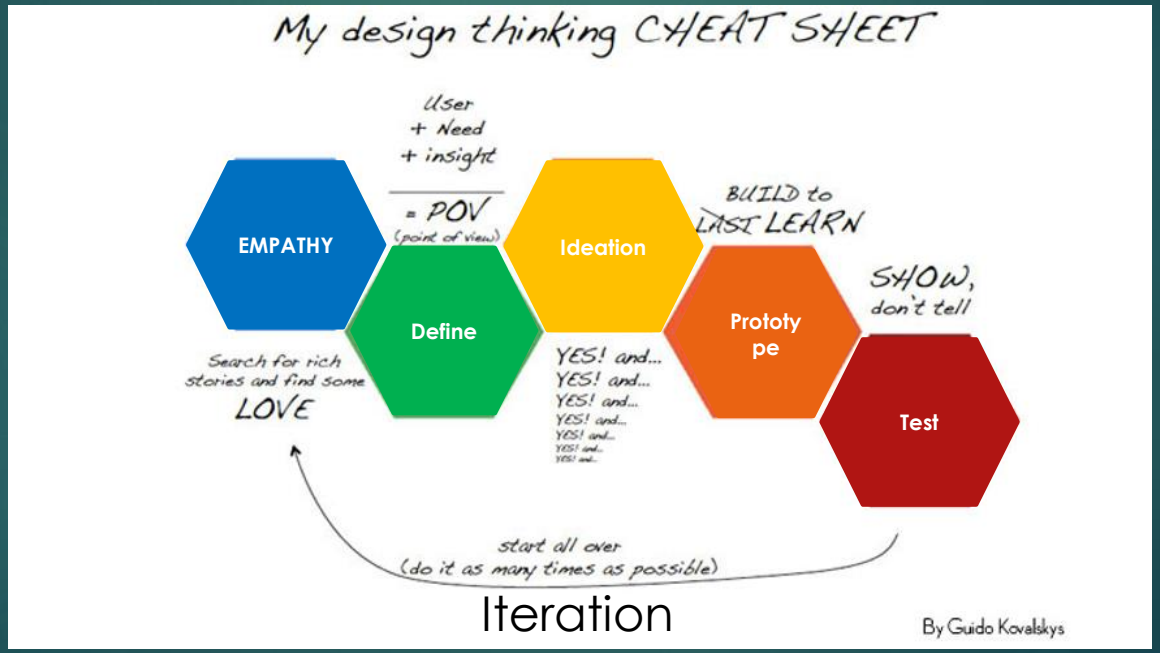
Robot

Sensors



DESIGN PROCESS

- Design thinking

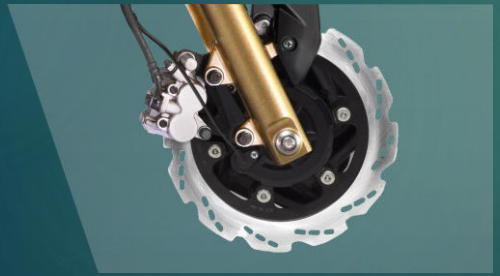


EMPATHY

- Customer Needs:
  - In-taking soft sand.
  - Wildlife monitoring & remote surveillance.
  - Working in certain weathers.
  - Brake's improvement.

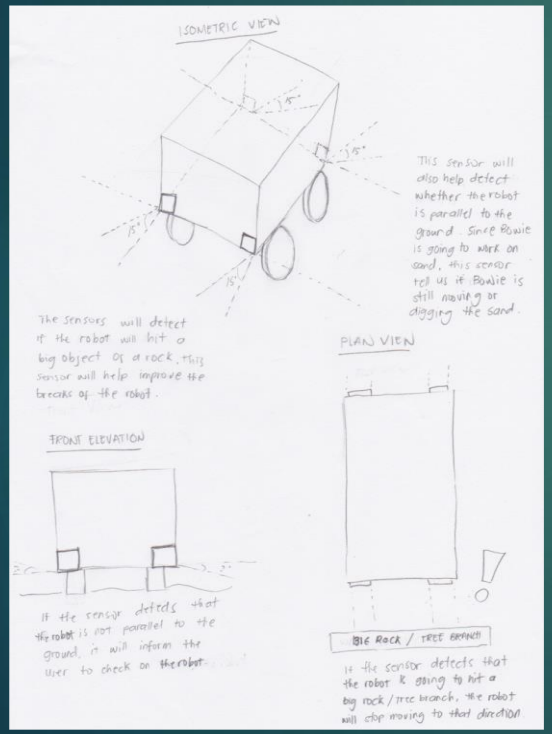
Define

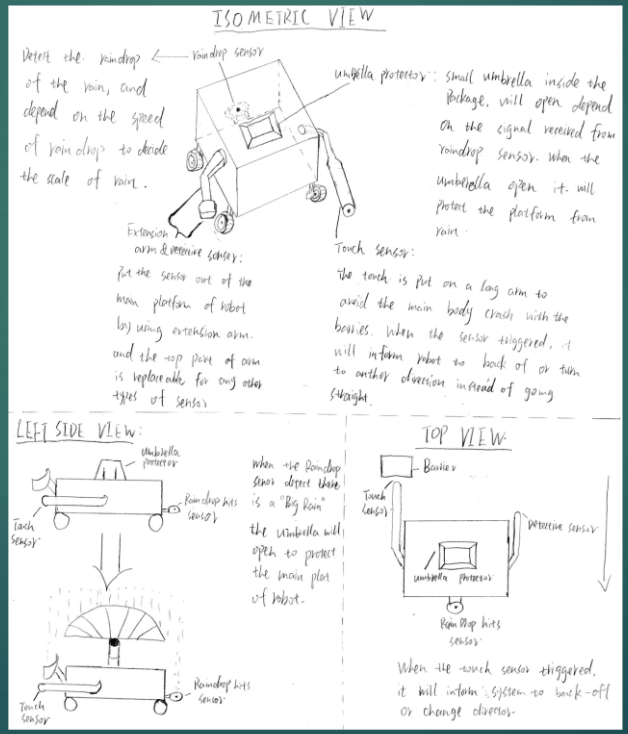
- Improve the functionalities and efficiency of Bowie robot for environmental restoration by create several types of ***sensors*** to improve its ***braking system***, ***wildlife*** and ***environmental monitoring.***

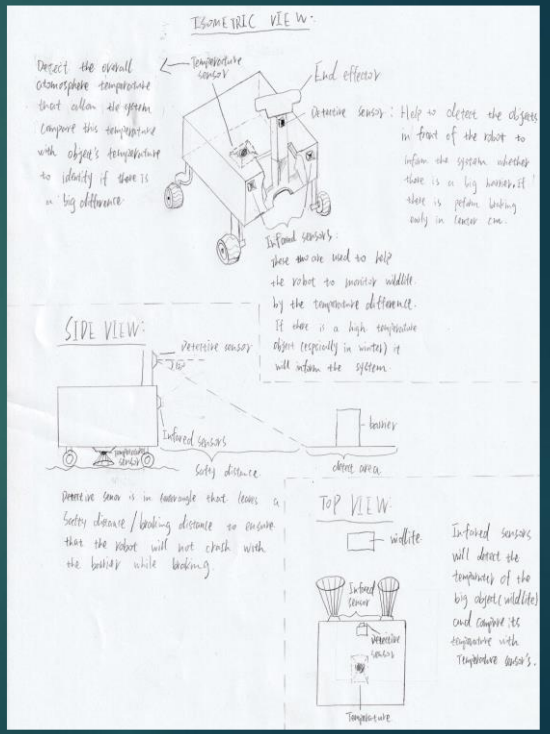


sensors

Ideation


ISOMETRIC VIEW
This sensor will also help detect whether the robot is parallel to the ground. Since Bowie is going to work on sand, this sensor tell us if Bowie is still moving or digging the sand.
The sensors will detect if the robot will hit a big object or a rock. This sensor will help improve the lifecycle of the robot.
PLAN VIEW
FRONT ELEVATION
If the sensor detects that the robot is not parallel to the ground, it will inform the user to check on the robot.
BIG ROCK / TREE BRANCH
If the sensor detects that the robot is going to hit a big rock / tree branch, the robot will stop moving to that direction.


ISOMETRIC VIEW
Detect the raindrop of the rain, and depend on the speed of rain drop to decide the scale of rain.
Raindrop sensor
Umbrella protector: small umbrella inside the Package, will open depend on the signal received from raindrop sensor. When the umbrella open it will protect the platform from rain.
Extension arm & detective sensor: Put the sensor out of the main platform of robot by using extension arm. and the top part of arm is replaceable for any other types of sensor
Touch sensor: the touch is put on a long arm to avoid the main body crash with the barrier. When the sensor triggered, it will inform robot to back off or turn to another direction instead of going straight.
LEFT SIDE VIEW:
Umbrella protector
Raindrop hits sensor
Touch sensor
When the Raindrop sensor detect there is a "Big Rain" the umbrella will open to protect the main plat of robot.
Raindrop hits sensor
Touch sensor
TOP VIEW
Barrier
Touch sensor
Detective sensor
Umbrella protector
Raindrop hits sensor
When the touch sensor triggered, it will inform system to back-off or change direction.


ISOMETRIC VIEW
Detect the overall atmosphere temperature that allow the system compare this temperature with object's temperature to identify if there is a big difference.
Temperature sensor
End effector
Detective sensor: Help to detect the objects in front of the robot to inform the system whether there is a big barrier, if there is return looking only in certain zone.
Infrared sensor's: these two are used to help the robot to monitor wildlife by the temperature differences. If there is a high temperature object (especially in winter) it will inform the system.
SIDE VIEW:
Detective sensor
Barriers
Infrared sensors
Temperature sensor
Safety distance
detect area
Detective sensor is in rectangle shape, means a safety distance / looking distance to ensure that the robot will not crash with the barrier while looking.
TOP VIEW
wildlife
Infrared sensor
Detective sensor
Temperature
Infrared sensors will detect the temperatures of the big objects (wildlife) and compare its temperature with Temperature sensor's.

Ideation: Prioritize

Functional Requirement:

#	Conceptual Design / Specifications	Imp (Weight)	First design	Second design	Third design
1	Shaking frequency for storage tank	3	1	1	1
2	Charging voltage for robot	3	3	3	2
3	Breaking/stopping distance	5	2	3	3
4	Time of detect and response	5	2	2	3
5	GPS & GPRS	2	1	1	1
6	Breaking Speed for breaks/sensor	4	2	2	3
7	Sensor Angle	5	3	3	2
8	Sensor Current	5	3	3	2
9	Sensor detective distance	5	2	3	3
10	Sensor voltage	5	3	3	3
	Total		97	102	103

Conceptual Design	First design	Second design	Third design
Score	171	172	153

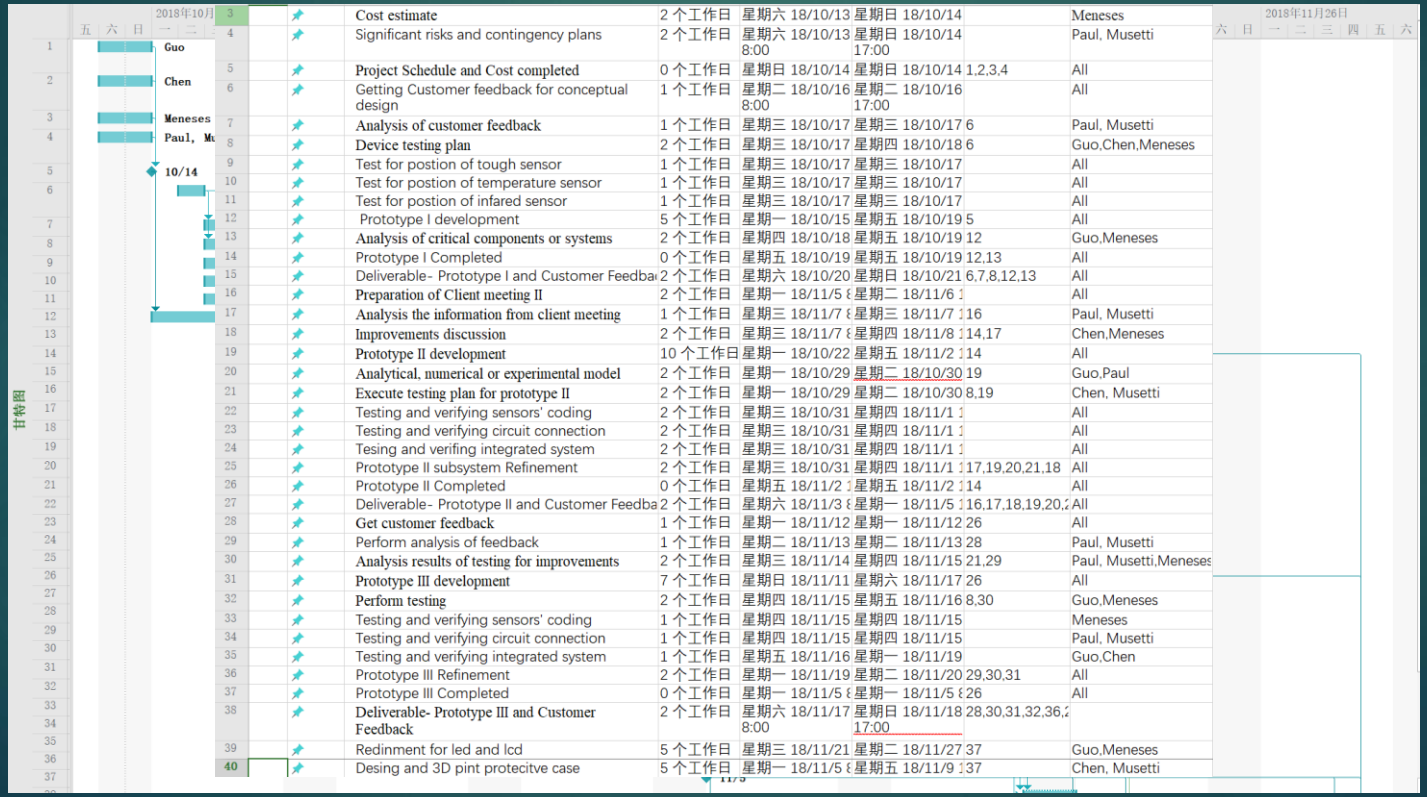
Non-functional Requirement:

#	Conceptual Design / Specifications	Imp (Weight)	First design	Second design	Third design
1	Weight	3	3	3	1
2	Motor capacity	4	3	3	1
3	Size of storage tank	3	1	1	1
4	Specialized outfits size for different weather (Platform)	3	1	1	3
5	Operation Temperature	4	2	3	2
6	Battery Capacity	4	3	2	1
7	Cost of sensors and other related accessories	2	3	2	1
8	Maximum Payload	2	3	3	1
	Total		59	57	35

Constraints:

#	Conceptual Design / Specifications	Imp	First design	Second design	Third design
1	Number of cameras & sensors	2	3	3	3
2	Aesthetics	1	1	1	1
3	Product life	2	3	2	3
	Total		15	13	15

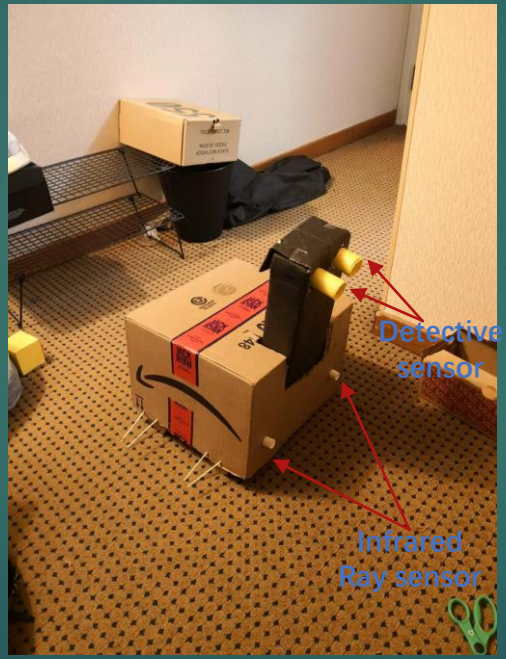
PROJECT PLANNING



甘特图

3		Cost estimate	2 个工作日	星期六 8:00	18/10/13	星期日 17:00	18/10/14	Meneses
4		Significant risks and contingency plans	2 个工作日	星期六 8:00	18/10/13	星期日 17:00	18/10/14	Paul, Musetti
5		Project Schedule and Cost completed	0 个工作日	星期日	18/10/14	星期日	18/10/14	1,2,3,4 All
6		Getting Customer feedback for conceptual design	1 个工作日	星期二 8:00	18/10/16	星期二 17:00	18/10/16	All
7		Analysis of customer feedback	1 个工作日	星期三	18/10/17	星期三	18/10/17	6 Paul, Musetti
8		Device testing plan	2 个工作日	星期三	18/10/17	星期四	18/10/18	6 Guo,Chen,Meneses
9		Test for postion of tough sensor	1 个工作日	星期三	18/10/17	星期三	18/10/17	All
10		Test for postion of temperature sensor	1 个工作日	星期三	18/10/17	星期三	18/10/17	All
11		Test for postion of infared sensor	1 个工作日	星期三	18/10/17	星期三	18/10/17	All
12		Prototype I development	5 个工作日	星期一	18/10/15	星期五	18/10/19	5 All
13		Analysis of critical components or systems	2 个工作日	星期四	18/10/18	星期五	18/10/19	12 Guo,Meneses
14		Prototype I Completed	0 个工作日	星期五	18/10/19	星期五	18/10/19	12,13 All
15		Deliverable- Prototype I and Customer Feedba	2 个工作日	星期六	18/10/20	星期日	18/10/21	6,7,8,12,13 All
16		Preparation of Client meeting II	2 个工作日	星期一	18/11/5 8	星期二	18/11/6 1	All
17		Analysis the information from client meeting	1 个工作日	星期三	18/11/7 8	星期三	18/11/7 1	16 Paul, Musetti
18		Improvements discussion	2 个工作日	星期三	18/11/7 8	星期四	18/11/8 1	14,17 Chen,Meneses
19		Prototype II development	10 个工作日	星期一	18/10/22	星期五	18/11/2 1	14 All
20		Analytical, numerical or experimental model	2 个工作日	星期一	18/10/29	星期二	18/10/30	19 Guo,Paul
21		Execute testing plan for prototype II	2 个工作日	星期一	18/10/29	星期二	18/10/30	8,19 Chen, Musetti
22		Testing and verifying sensors' coding	2 个工作日	星期三	18/10/31	星期四	18/11/1 1	All
23		Testing and verifying circuit connection	2 个工作日	星期三	18/10/31	星期四	18/11/1 1	All
24		Tesing and verifing integrated system	2 个工作日	星期三	18/10/31	星期四	18/11/1 1	All
25		Prototype II subsystem Refinement	2 个工作日	星期三	18/10/31	星期四	18/11/1 1	17,19,20,21,18 All
26		Prototype II Completed	0 个工作日	星期五	18/11/2 1	星期五	18/11/2 1	14 All
27		Deliverable- Prototype II and Customer Feedba	2 个工作日	星期六	18/11/3 8	星期一	18/11/5 1	16,17,18,19,20,2 All
28		Get customer feedback	1 个工作日	星期一	18/11/12	星期一	18/11/12	26 All
29		Perform analysis of feedback	1 个工作日	星期二	18/11/13	星期二	18/11/13	28 Paul, Musetti
30		Analysis results of testing for improvements	2 个工作日	星期三	18/11/14	星期四	18/11/15	21,29 Paul, Musetti,Meneses
31		Prototype III development	7 个工作日	星期日	18/11/11	星期六	18/11/17	26 All
32		Perform testing	2 个工作日	星期四	18/11/15	星期五	18/11/16	8,30 Guo,Meneses
33		Testing and verifying sensors' coding	1 个工作日	星期四	18/11/15	星期四	18/11/15	Meneses
34		Testing and verifying circuit connection	1 个工作日	星期四	18/11/15	星期四	18/11/15	Paul, Musetti
35		Testing and verifying integrated system	1 个工作日	星期五	18/11/16	星期一	18/11/19	Guo,Chen
36		Prototype III Refinement	2 个工作日	星期一	18/11/19	星期二	18/11/20	29,30,31 All
37		Prototype III Completed	0 个工作日	星期一	18/11/5 8	星期一	18/11/5 8	26 All
38		Deliverable- Prototype III and Customer Feedback	2 个工作日	星期六 8:00	18/11/17	星期日 17:00	18/11/18	28,30,31,32,36,2
39		Redinment for led and lcd	5 个工作日	星期三	18/11/21	星期二	18/11/27	37 Guo,Meneses
40		Desing and 3D pint protecitve case	5 个工作日	星期一	18/11/5 8	星期五	18/11/9 1	37 Chen, Musetti

Prototype I

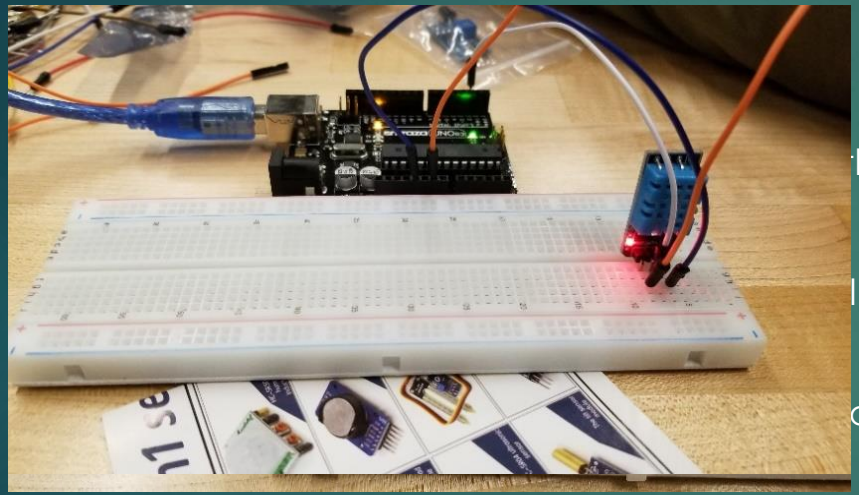


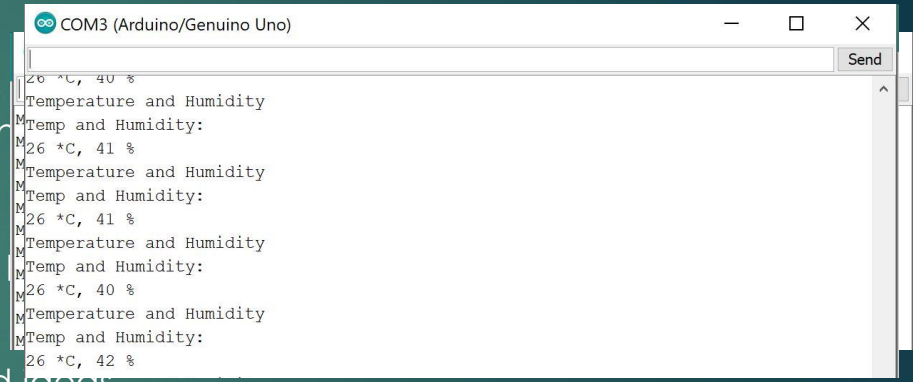
- Objectives:
  - Verifying the ***position*** of multiple
  - As a tool for ***communication***
  - Explore for different ***new ideas***

BILL OF MATERALS

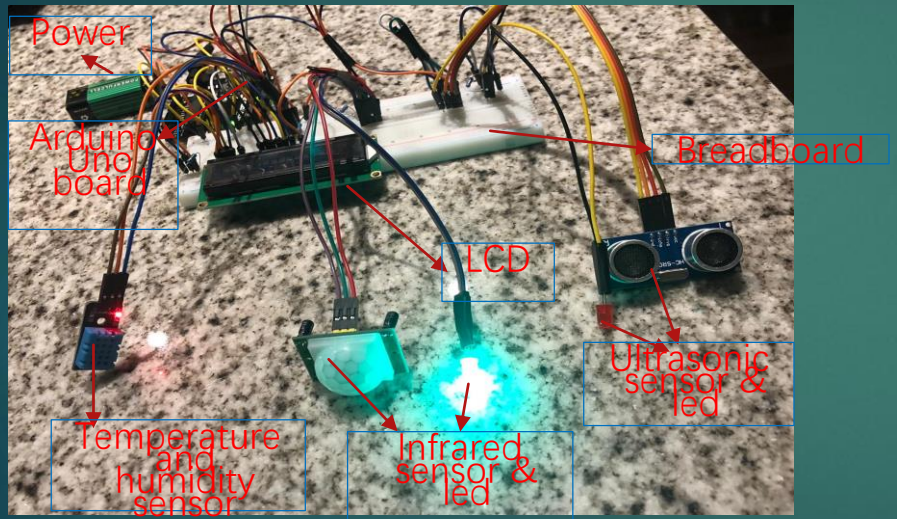
Material	Cost (CAD)
Detective sensors	$ 12.54
Temperature sensor & Infrared sensor	$ 39.99
Arduino board & other accessories	$ 38.99
Discounts	$ 9.25
Total	$82.27

Prototype II

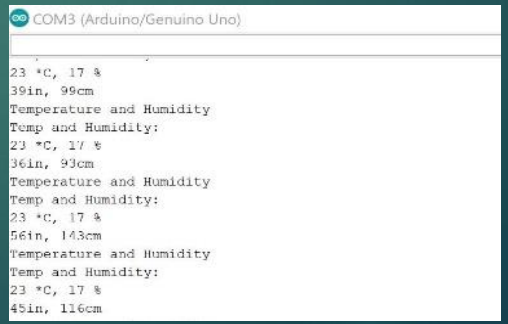




Prototype III

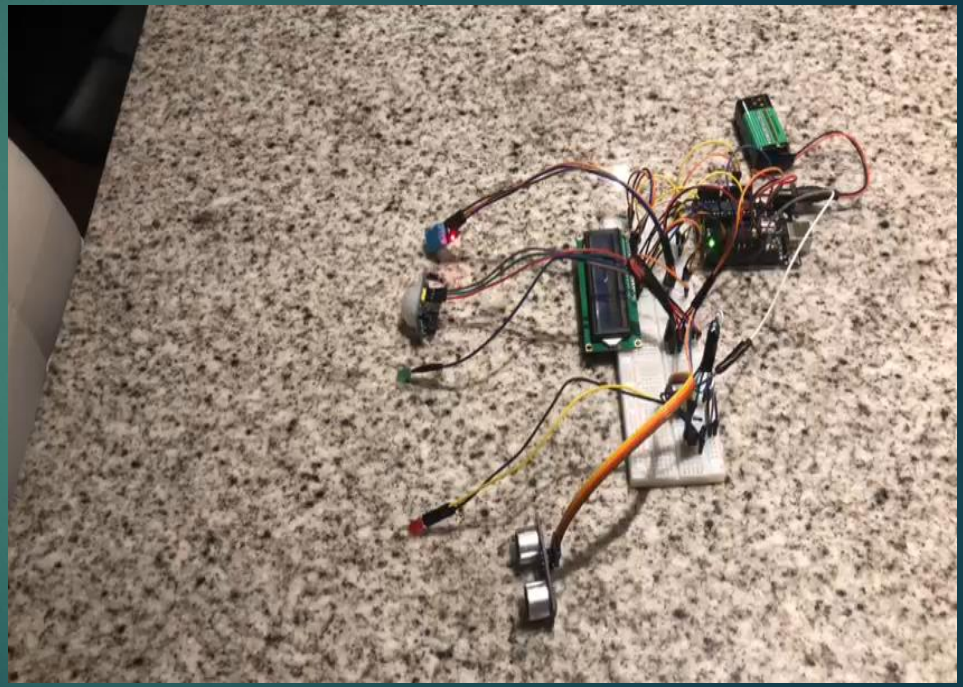


- Objectives:
  - New ideas about improvements final product.
  - Verifying the feasibility of integrated Arduino coding & circuit connections.
  - Analyze the potential problems, uncertainty, and risk of integrated system.



ANALYSIS OF CRITICAL COMPONENTS & SYSTEMS

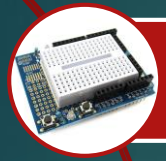
- Risks and problems:
  - Anything left lying around
  - Circuit changes
  - Overloading a pin
  - Exceeds of board's current limit
  - Arduino Board heating up
  - Syntax errors in the coding



Lesson Learned

- The importance of team work.
- How to apply the knowledge learned
- Useful Skills:
  - Soldering
  - Arduino
  - Project planning

Future Works



Integrate into extension board

Improve LCD

Modify the system for bowie

Design a better protective case

QUESTIONS?

THANKS FOR WATCHING