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PROJECT
PROPOSAL

SMART NAPPY

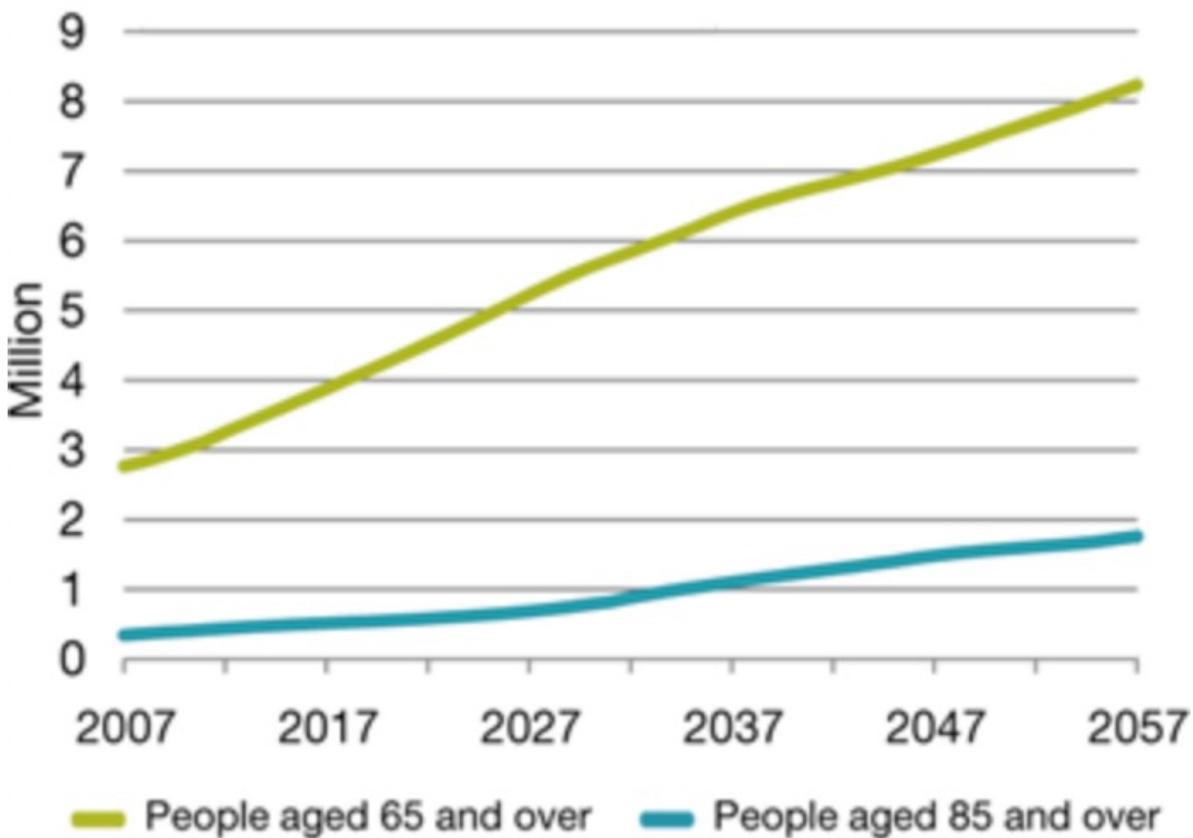
Minnie Gim

BACKGROUND

Aging

- Growing aging population
- The proportion of the Australian population aged 65 and over was 15% in 2017, and by 2057 it's estimated to be 22%, which translates to 8.8 million people.

Population projections 2007 to 2057

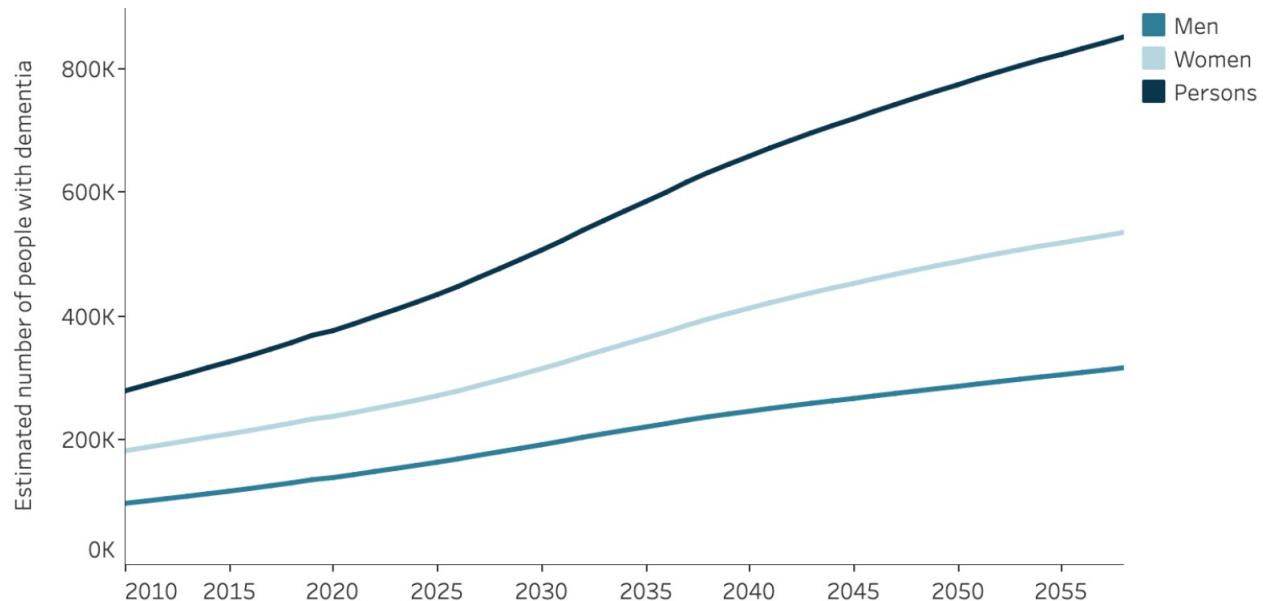


BACKGROUND

Dementia

- Dementia prevalence is increasing - it is now the second leading cause of death
- Incontinence is common in dementia
- 68% of patients in RACFs have moderate to advanced dementia
- 487,500 RACFs patients had dementia in 2022
- Expected to increase to almost 1.1 million by 2058

Figure 2.3: Australians living with dementia between 2010 and 2058: estimated number by sex and year

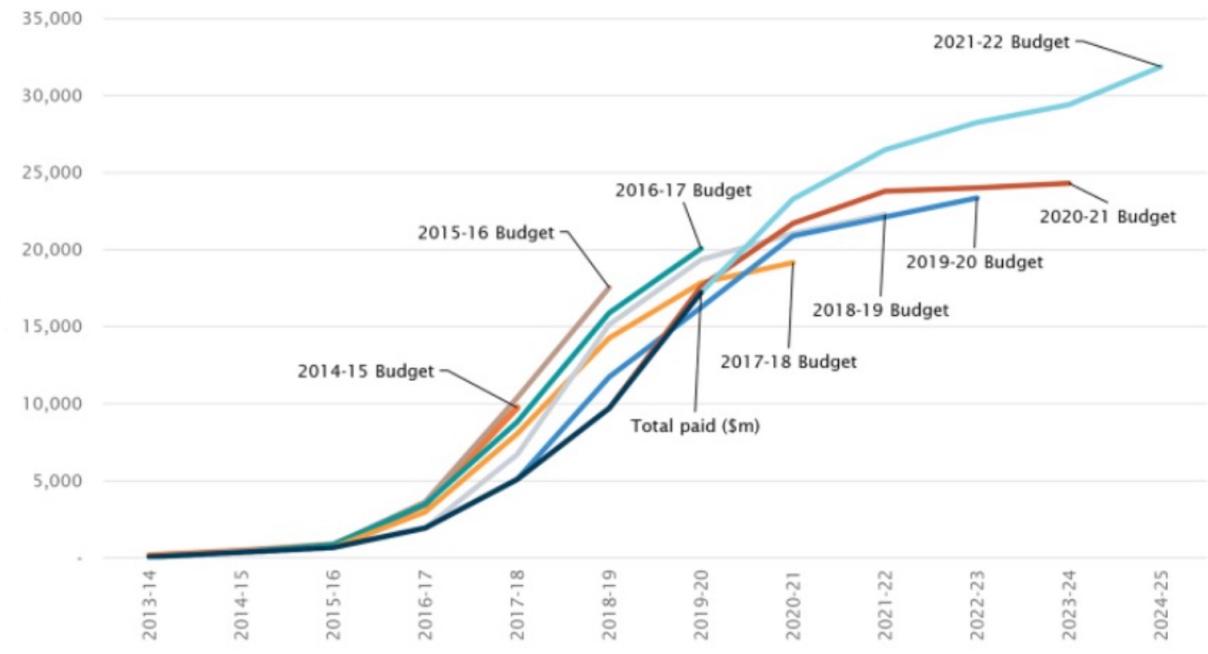
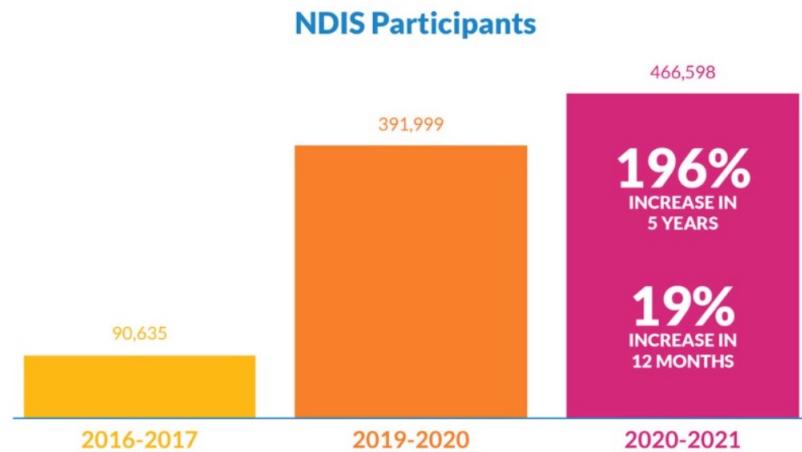


Source: The AIHW estimates were derived using prevalence rates from the 2015 World Alzheimer report and
Withall et al. 2014, and the ABS Series B population projections.
<http://aihw.gov.au>

BACKGROUND

Disability

- 4.3 million Australians are living with disability.
 - 1 in 8 people with disability : as a result of MVAs
 - Those group always need help for toileting, self care, and mobility.



CURRENT PROBLEM

- Increasing bladder and bowel incontinence issues among elderly people
- By 2030, 6.2 million Australians will be living with incontinence
- High risk of infection and pressure sores due to failure to remove a wet nappy in a timely manner
- Loss of dignity
- Upset relatives
- Cause physical and verbal aggression
- Damage nappy that leads to replace nappy unnecessarily
- Increasing risk of accreditation failure which suspend government subsidy

MARKET OPPORTUNITIES

- Growing aged care and disability care industries
- Increasing numbers of patients with incontinence
- Australian government spent **\$ 67 billion** on continence aids subsidy in 2010
 - excludes personal expenses on continence aids
 - Excludes hospital expenses on continence aids
- Not only for the elderly and people with disability but also babies

INSPIRATION



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Low-cost “smart” diaper can notify caregiver when it’s wet

Design combines a common diaper material with RFID technology.

Jennifer Chu | MIT News Office

February 13, 2020

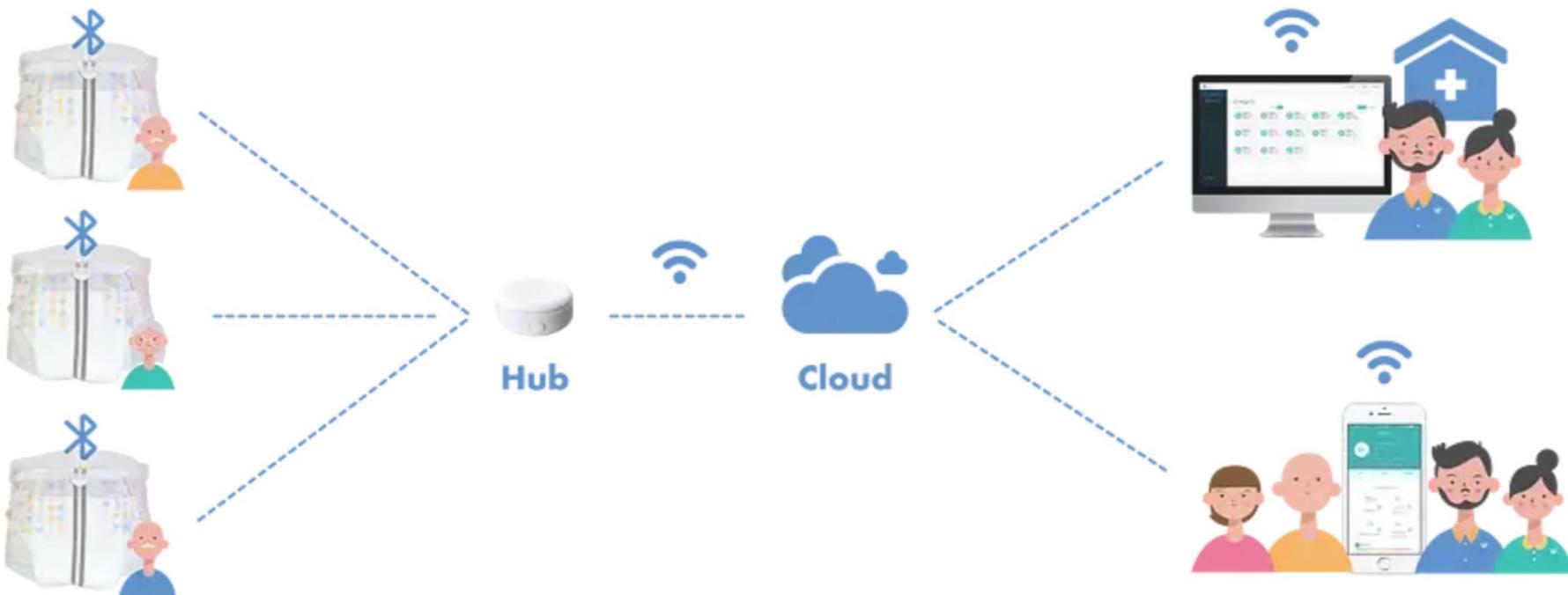
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A new disposable, affordable “smart” diaper embedded with an RFID tag is designed by MIT researchers to sense and communicate wetness to a nearby RFID reader, which in turn can wirelessly send a notification to a caregiver that it’s time for a change.

Image: MIT News

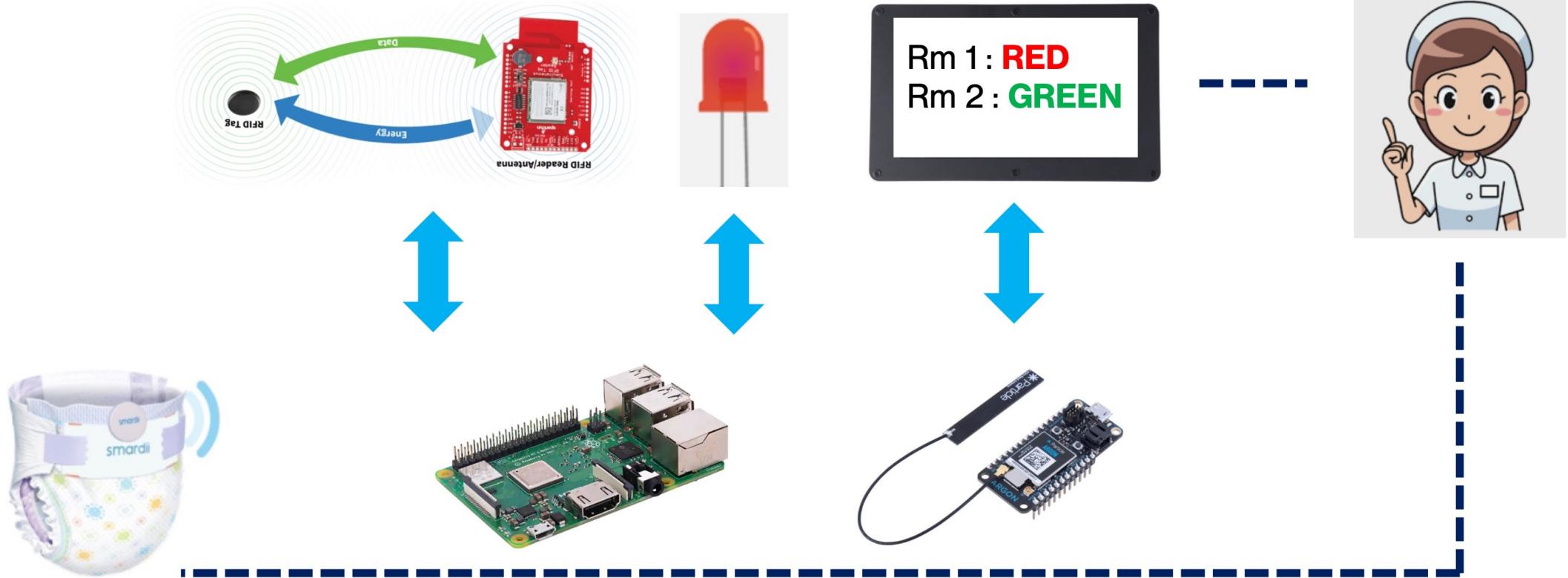
IDEA



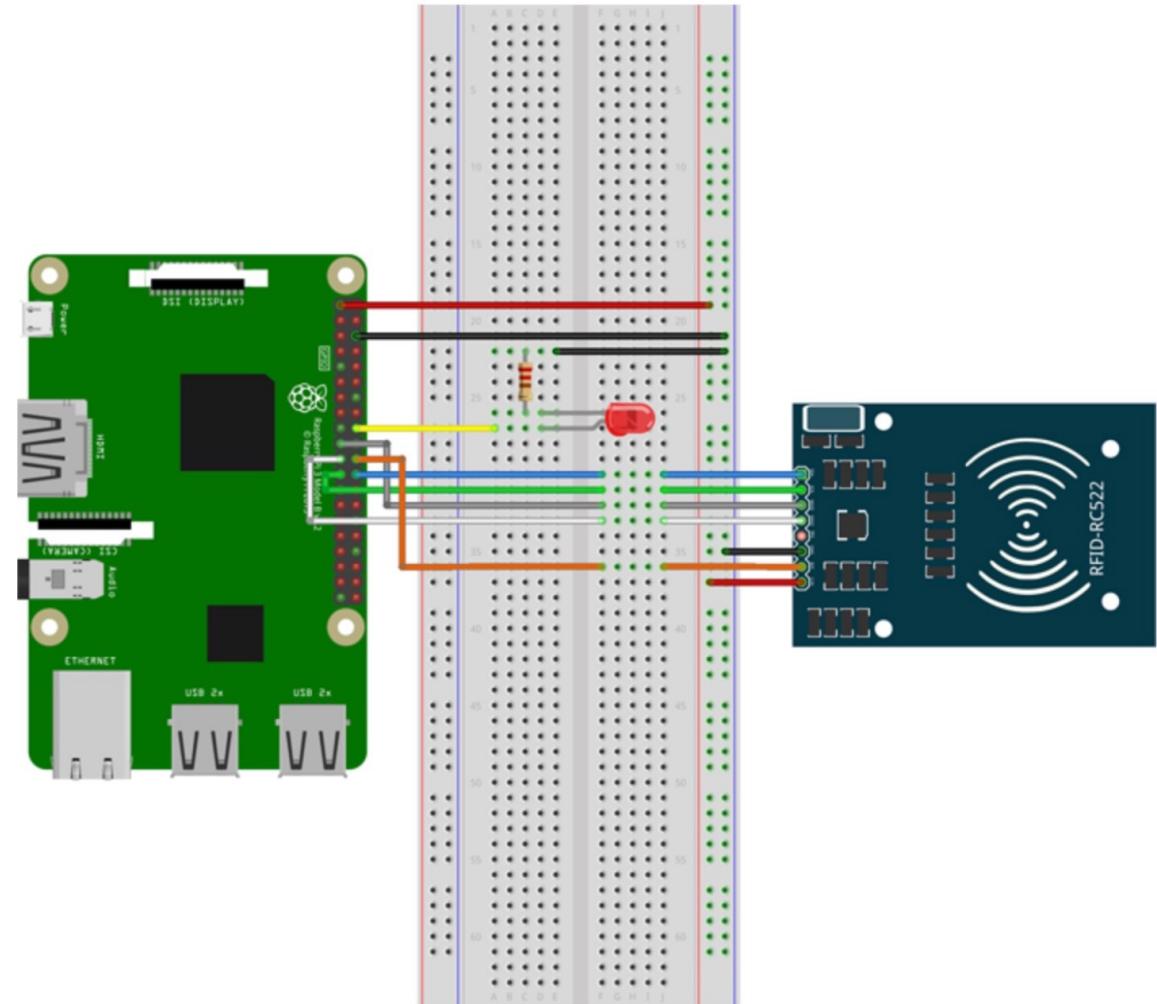
TRIAL 1 REQUIREMENTS

Item	Link
Raspberry Pi 3	Link for Raspberry Pi
RC522 RFID Module	Link for RFID Module
HDMI Cable	Link for HDMI Cable
LED	Link for LEDs from Adafruit
Mouse + Keyboard	Amazon Link for Keyboard/Mouse
Monitor/TV	Any TV or monitor with HDMI
Jumper Wires	Amazon Link for Jumper Wires
Micro USB Cable	Amazon Link for Micro USB Cable
Breadboard	Amazon Link for Breadboard

PLAN (PROJECT TRIAL 1)



TRIAL 1 CIRCUIT DIAGRAM



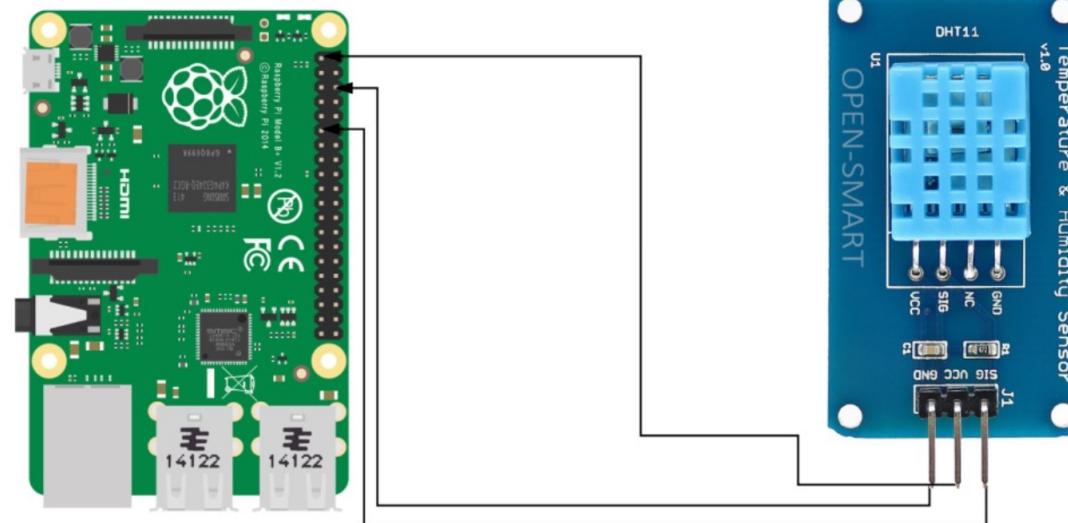
Project.py code

```
53
54     ##WIDGETS
55     ledButtonred=Button(win, text='WET', font=myFont, command=ledToggle)
56     ledButtonred.grid(row=0, column=1)
57
58     exitButton=Button(win, text='COMPLETED', font=myFont, command=close)
59     exitButton.grid(row=3, column=1)
60
61     win.protocol("WM_DELETE_WINDOW", close)
62
63     win.mainloop()
64
65 else:
66     GPIO.output(LED, GPIO.LOW)
67     GPIO.output(BUZZER, GPIO.LOW)
```

```
1  import RPi.GPIO as GPIO
2  import Adafruit_DHT
3  from tkinter import *
4  import tkinter.font
5  from gpiozero import LED
6
7  RPi.GPIO.setmode(RPi.GPIO.BCM)
8
9
10 DHTSensor = Adafruit_DHT.DHT11
11 DHTPin = 23
12 LED = 16
13 BUZZER = 21
14
15 print ("Rm2 Nappy Monitoring")
16 GPIO.setwarnings(False)
17 GPIO.setmode(GPIO.BCM)
18 GPIO.setup(BUZZER, GPIO.OUT)
19 GPIO.setup(LED, GPIO.OUT)
20
21 while True:
22     humidity, temperature = Adafruit_DHT.read_retry(DHTSensor, DHTPin)
23     if humidity is not None and temperature is not None:
24         print("Temperature={0:0.1f}*C Humidity={1:0.1f}%".format(temperature,humidity))
25
26     if(temperature > 37) or (humidity > 90):
27         print("Rm2 Wet")
28         GPIO.output(LED, GPIO.HIGH)
29         GPIO.output(BUZZER, GPIO.HIGH)
30
31     ##GUI Definitions
32     win = Tk()
33     win.title("Rm2 Monitor")
34     myFont = tkinter.font.Font(family = 'Helvetica', size = 12, weight = "bold")
35
36     ##EVENT FUNCTIONS
37     def ledToggled():
38         if LED.is_lit:
39             LED.off()
40             ledButtonred["text"] = "Turn red LED on"
41             #GPIO.output(LED, GPIO.OUT)
42             #GPIO.output(BUZZER, GPIO.LOW)
43
44         else:
45             LED.on()
46             ledButtonred["text"] = "Turn red LED off"
47
48     def close():
49
```

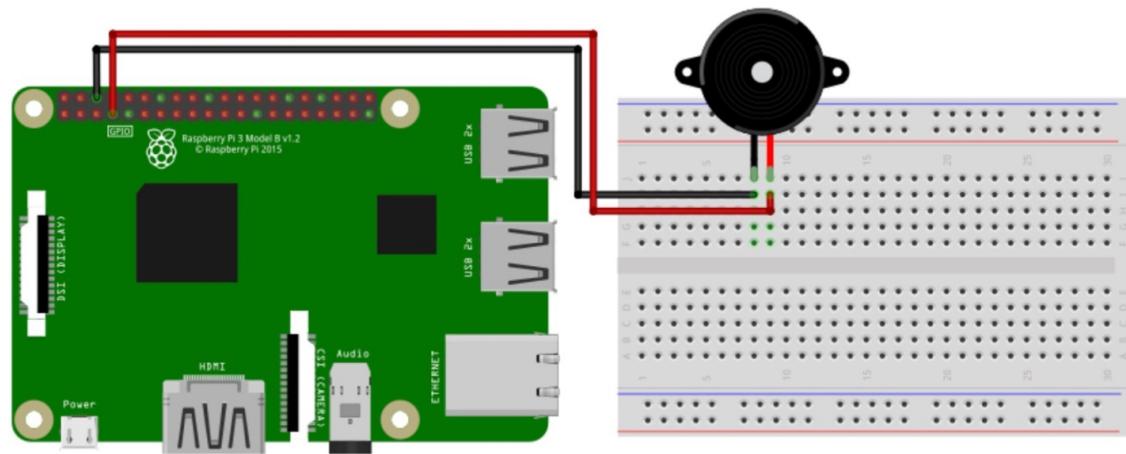
DHT11 SENSOR

- DHT11 sensor was inserted into the nappy.
- Set up: if the temperature > 37 or humidity > 95 %, the buzzer and LED will be on.
- VCC -> 3V3 power (1)
- GND -> Ground (6)
- DATA -> GPIO 23



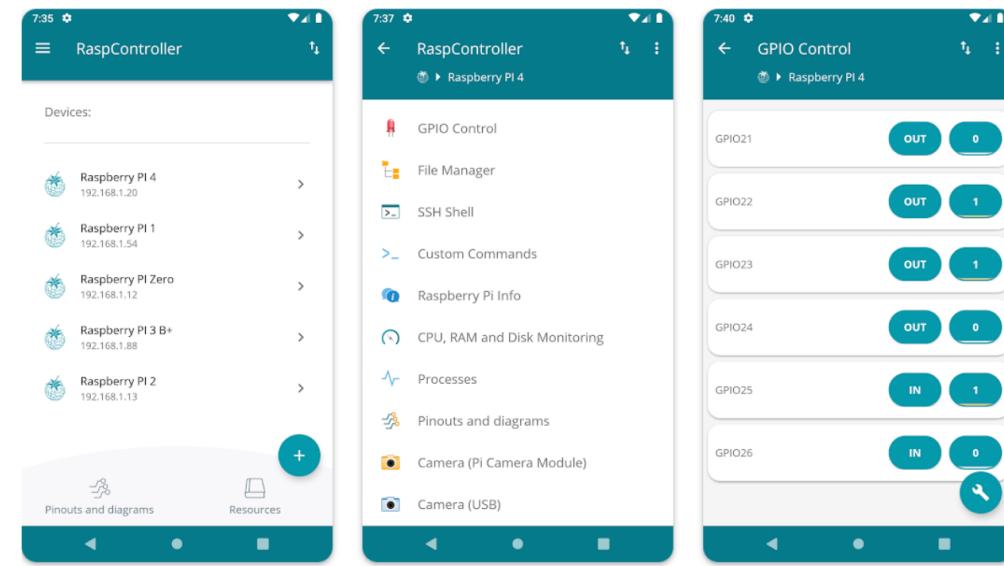
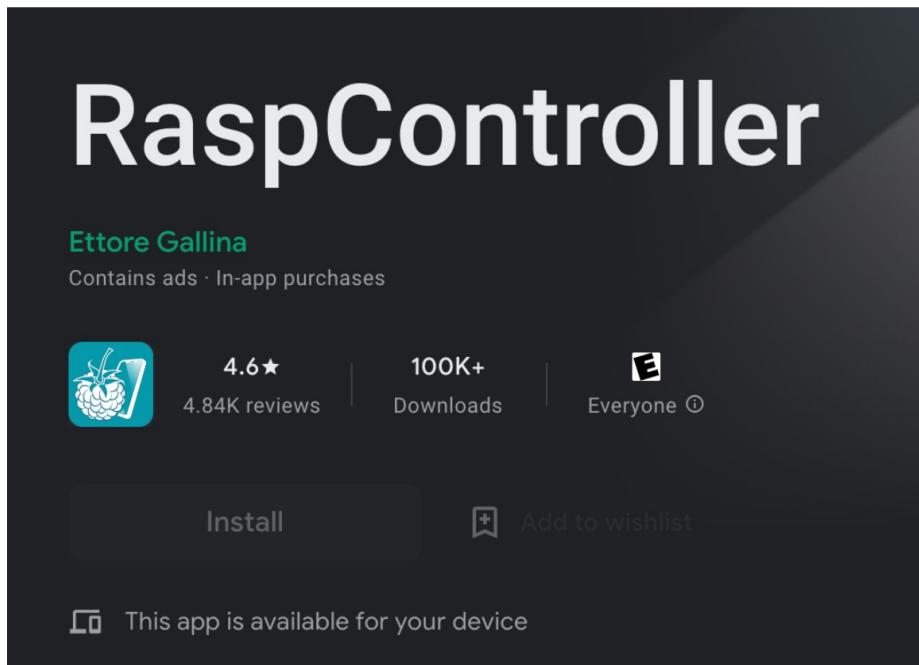
BUZZER

- Buzzer on: when the temperature > 37 or humidity > 95%
- Buzzer off: when staff change the nappy and press the “Completed” button on the screen



RaspController

- Mobile App
- Can control sensors (LED off)
- Can monitor data on the cell phone



CONCLUSION

- I enjoyed the research and process of IoT. I am considering it as a career in the future.
- I read the MIT news a while ago and have been thinking about it since then. To find the RFID sensor that can detect moisture safely was the most difficult part of this project. There are not many companies selling RFID sensors to a student.
- If I have another chance, I might change the topic to transforming wheelchair. This will be my own project.