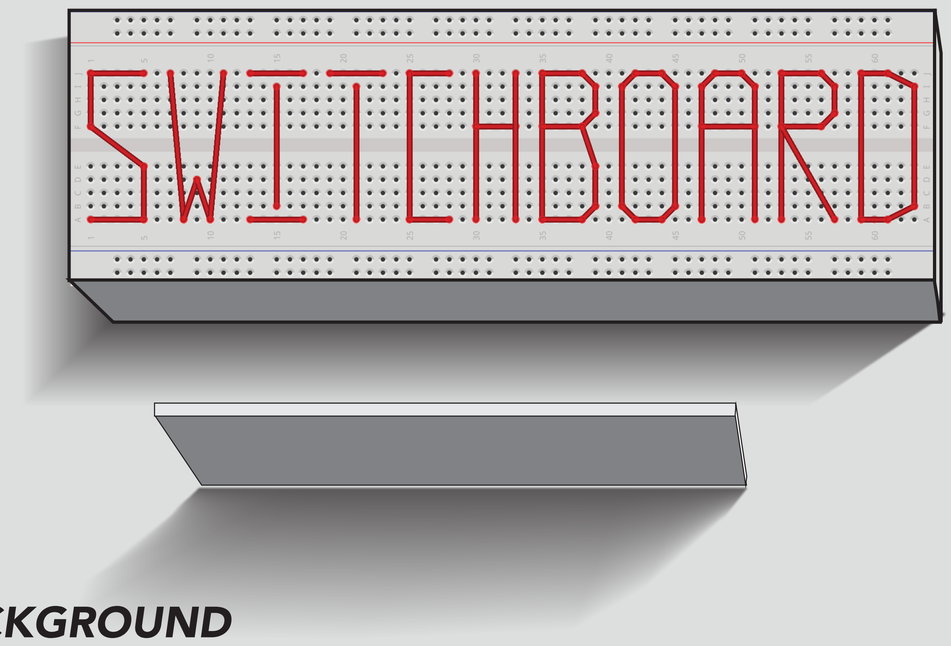
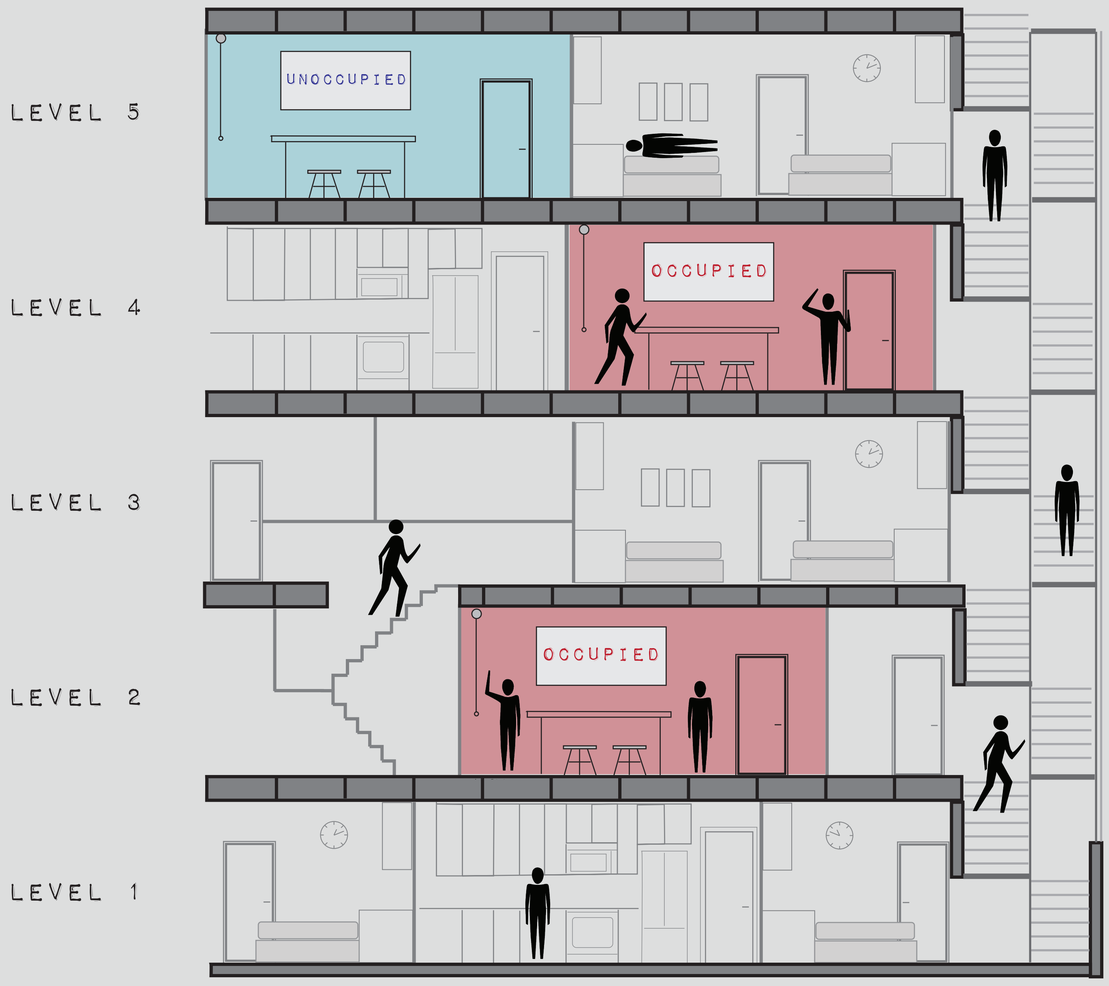


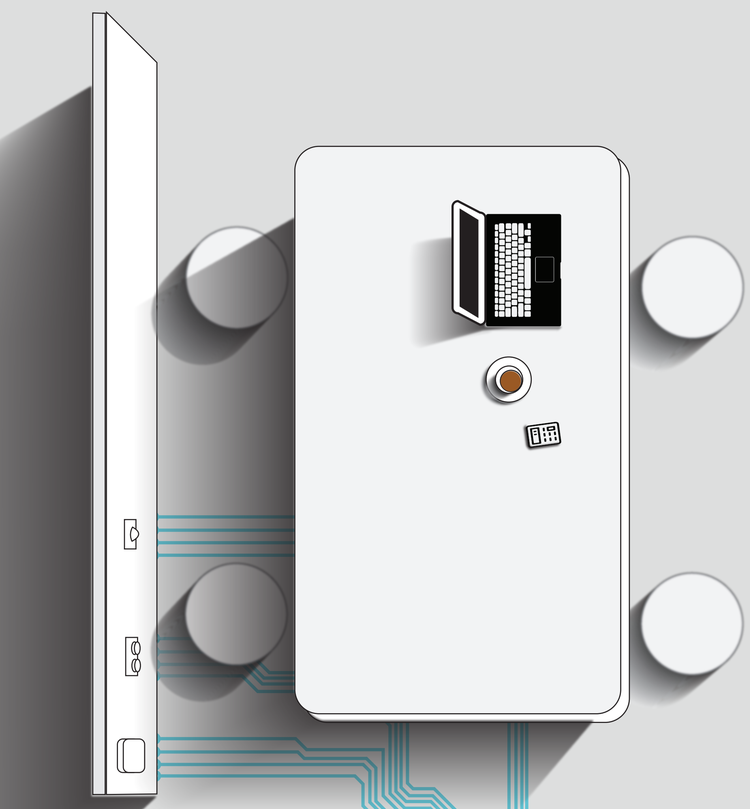
BACKGROUND

Singapore University of Technology and Design (SUTD) *is gearing towards being the heart of a Smart Nation by building a Smart Campus that utilises technology, networks and big data. In this 1D project, we aim to develop an application which informs the student population of the availability of common rooms in the hostel through the application of sensor technology.*

PROBLEM

the inability to check the availability of common rooms in SUTD Housing // *students often find searching for empty common rooms tedious as they have to manually check all the individual rooms in the hostel. Not only is it time-consuming, but often mentally draining when one has searched the entire block to no avail.*





SOLUTION

ON-SITE DEVICE INTERFACE

\\ *open the KIVY GUI to launch the application*

\\ *select the specific room user wants to check*

\\ *a page which shows the availability of the tables inside the room will be displayed*

\\ *user can change the status of the tables by pressing the button*

BEHIND THE SCENES

\\ *each RPi has a set of ultrasonic and infrared sensors, as well as an RFID reader connected to the breadboard.*

\\ *the ultrasonic sensor will be placed on the wall below each table to measure the distance to an object using ultrasonic sound waves. The sensor uses a transducer to determine the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.*

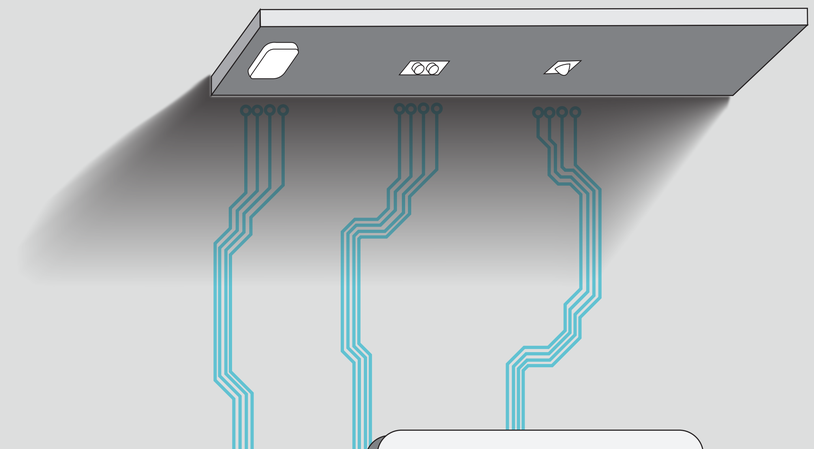
\\ *passive IR (PIR) sensors use a pair of pyroelectric sensors to detect heat energy in the surrounding environment. These two sensors sit beside each other, and when the signal differential between the two sensors changes, the sensor will engage. IR radiation focuses on each of the two pyroelectric sensors using a series of lenses constructed as the sensor's housing to widen sensing area.*

\\ *both sensors will send the waves continuously and the readings will be collated in the RPi. When the distance reading of the US sensor decreases below 10cm, it reveals the existence of an obstruction in the path of the US waves, which may be caused by objects on the floor or human legs. If the IR sensor is triggered, it detects a change in heat energy, revealing a moving human passing the sensors. Subsequently, if both sensors' distance readings remain low and register movements, it translates to "occupied" for that particular table, otherwise "empty". The data is updated to a Firebase database in real time.*

\\ *another RPi fetches the data from Firebase, determines the occupancy status, and maintains the occupied status for set intervals which will be extended if the room remains occupied.*

\\ *RFID reader allows one of the table users to tap his identity card on the scanner such that his name will be registered in the Firebase under the particular table's availability info. It helps inform other people that the table is being occupied by him.*

\\ *the information in Firebase will be displayed on the Kivy GUI that users can interact with to check room availability.*



BENEFITS

\\ *Ultrasound and PIR is reliable in any lighting environment (bright or dark)*

\\ *Ultrasonic sensors are reliable range of 2cm – 4m and cost-effective ($1/each)*

\\ *PIR sensors have a detection range between 5m and 12m, and are cost-effective ($3/each)*

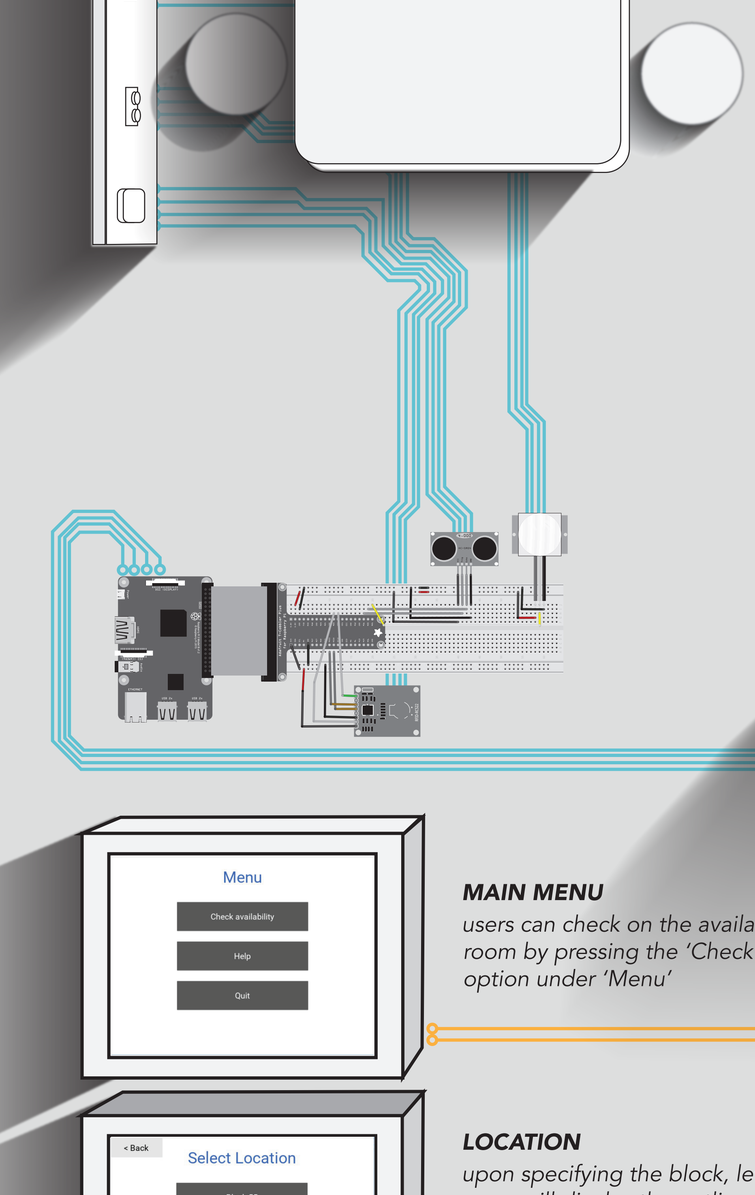
\\ *PIR has low power draw of only 0.8-1 W*

\\ *Our solution combines the data from both sensors to offset each other's limitations and optimise the accuracy of the readings.*

\\ *It allows convenient and fast identification of available rooms without having to laboriously check individual rooms.*

\\ *Increases productivity of students as it reduces time spent on searching free common rooms.*

\\ *Easy to implement and cost-friendly (<$20 for 2 tables in a room)*



MAIN MENU

users can check on the availability of a certain room by pressing the 'Check Availability' option under 'Menu'

LOCATION

upon specifying the block, level and room, a page will display the outline of the room of choice and the availability of each table in the room.

OCCUPANCY STATUS

the occupancy status indicator is highlighted in green if empty, and red if it is occupied. Users can select on the 'occupied' button to change it to 'empty' when they leave the room.

INSTRUCTIONS

the application is user-friendly as there is a button under the 'Menu' page titled 'Help' that displays an instructions page on how to use the application.

TELEGRAM BOT

users can check on the availability of a certain room by querying the Telegram Bot with the following commands

/alltables

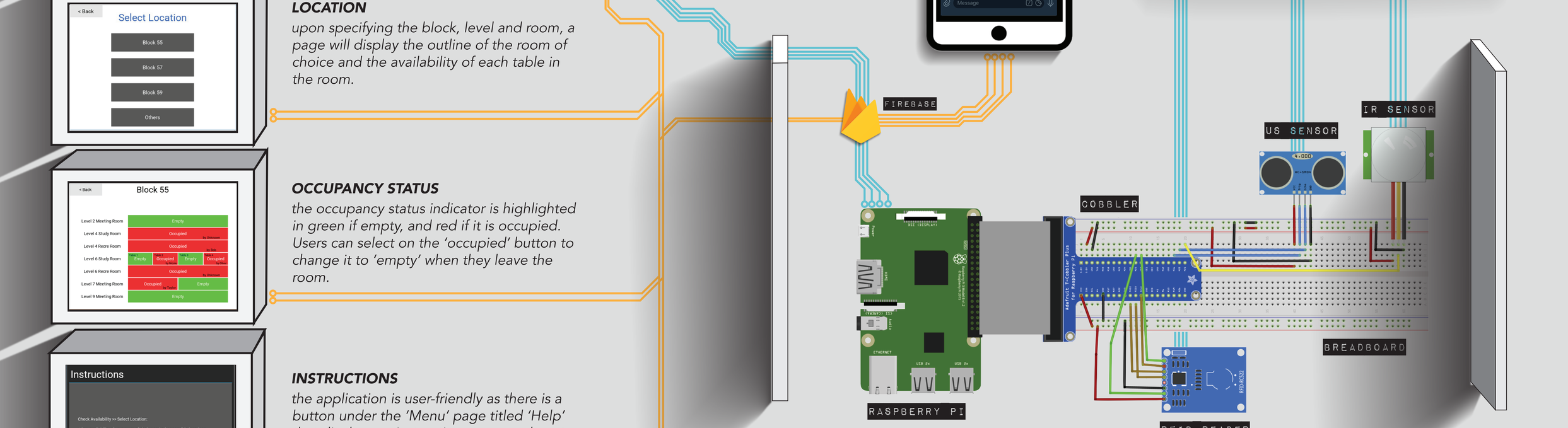
fetches the overall status

/table1 or /table2

fetches a specfic location status

DATA ANALYSIS

The Firebase data regarding the status of the room is also reflected on a Google spreadsheet so that the data collected can be used for further analysis. This data can be used by SUTD Housing to determine the timings when the rooms are in greatest demand and implement measures to alleviate this. In addition it can be used to justify the creation of more rooms if needed.



KEITH GOH **1003334** ONG JIA EN **1003860** DIONETTA YOUNG **1003735** CAO BINGQUAN **1003881** MATTHEW TSOU **1003545**

credits: *noun project // fritzing // pinterest*