



### BACKGROUND

Parking lots are difficult to manage for both the user of the parking lot and the manager of the parking lot. For the users, parking spots are difficult to find and are therefore time-consuming. For parking lot managers, it can be difficult to determine the data regarding the parking lot (i.e., busiest times, favorite parking spots, etc.) they manage. Our software and hardware package solution provide data to parking lot owners and helps parking lot users find free spaces.

Drivers waste time navigating parking lots for free space and may end up leaving. Therefore, parking lot owners miss out on potential parking lot space income from the drivers who left. It is also difficult for parking lot managers to understand the intricacies of the parking behaviors of customers.

- In congested US cities 30% of traffic is caused by drivers looking for parking.
- We all circle city blocks looking for parking spaces which wastes gas and promotes pollution.
- An average American spends about 17 hours per year looking for empty parking spaces.
- The potential solution can maximize parking lot space utilization.

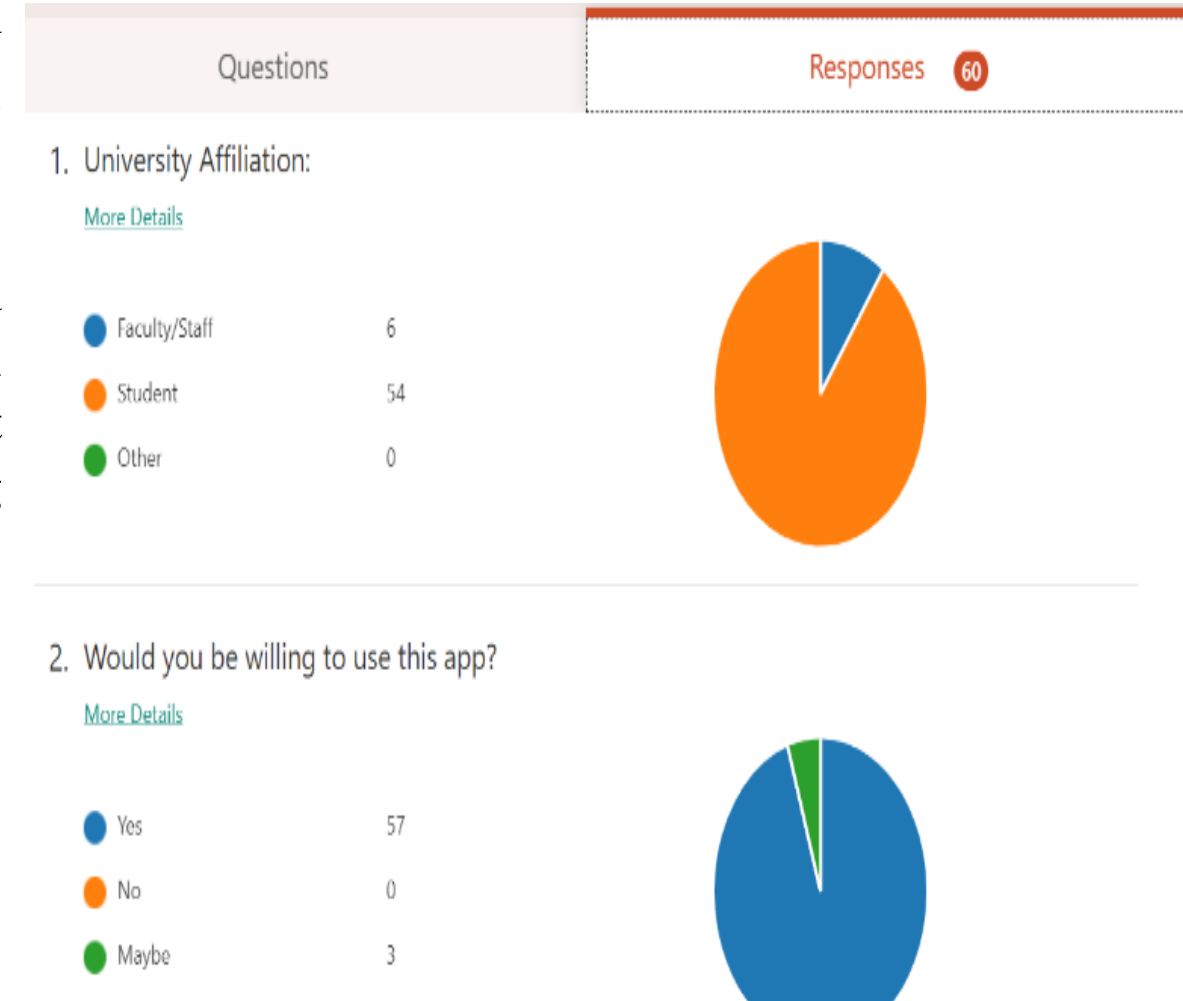


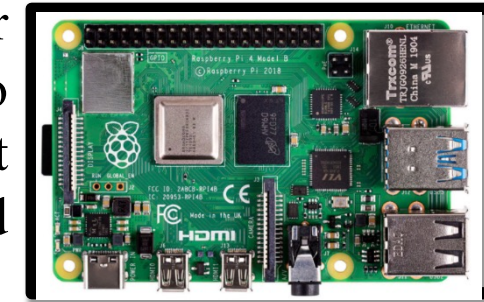
Figure 1. Application Need Survey

### SYSTEM DESIGN



Figure 3. Raspberry Pi and Sensor Connection

**Raspberry PI**  
Raspberry PI provides computing power enough to host a server while also allowing us to use its GPIO port to input and output voltages of highs (3.3V) and lows (0V).



**Apache Server**  
Apache provides an easy to setup server on RASPBIAN, the raspberry PI's operating system. The apache server is a locally hosted website that can receive HTTP POST and GET methods.



**IR distance sensor (Adafruit)**  
This IR distance sensor is compatible with the raspberry PI and requires 5V to operate. The sense line of the Sensor can be connected to an input GPIO Pin on the Raspberry PI to sense cars.



**Refresh Button**  
The Refresh button allows the software application user to refresh the status of the parking spot indicators to check for parking spots. The button will send an HTTP request for the Apache server.

**Parking spot indicator**  
The parking spot indicators parse an array received from the Apache server and light up green if the array position value is "1" or red if the array position value is "0".



Figure 4. Provider Application

### PROPOSED SOLUTION

Our project will provide a parking lot space management package for parking lot owners and a software navigator for drivers to navigate the parking lot. Each parking space will be equipped with a sensor that can determine if a car is present within that space. The sensor will then communicate to a web server where all the data will be stored.

The software application will communicate with the web server to output a graphical navigator for parking lot users to download from the app store. The parking lot owners can access the data mined from the sensors and stored in the web server.

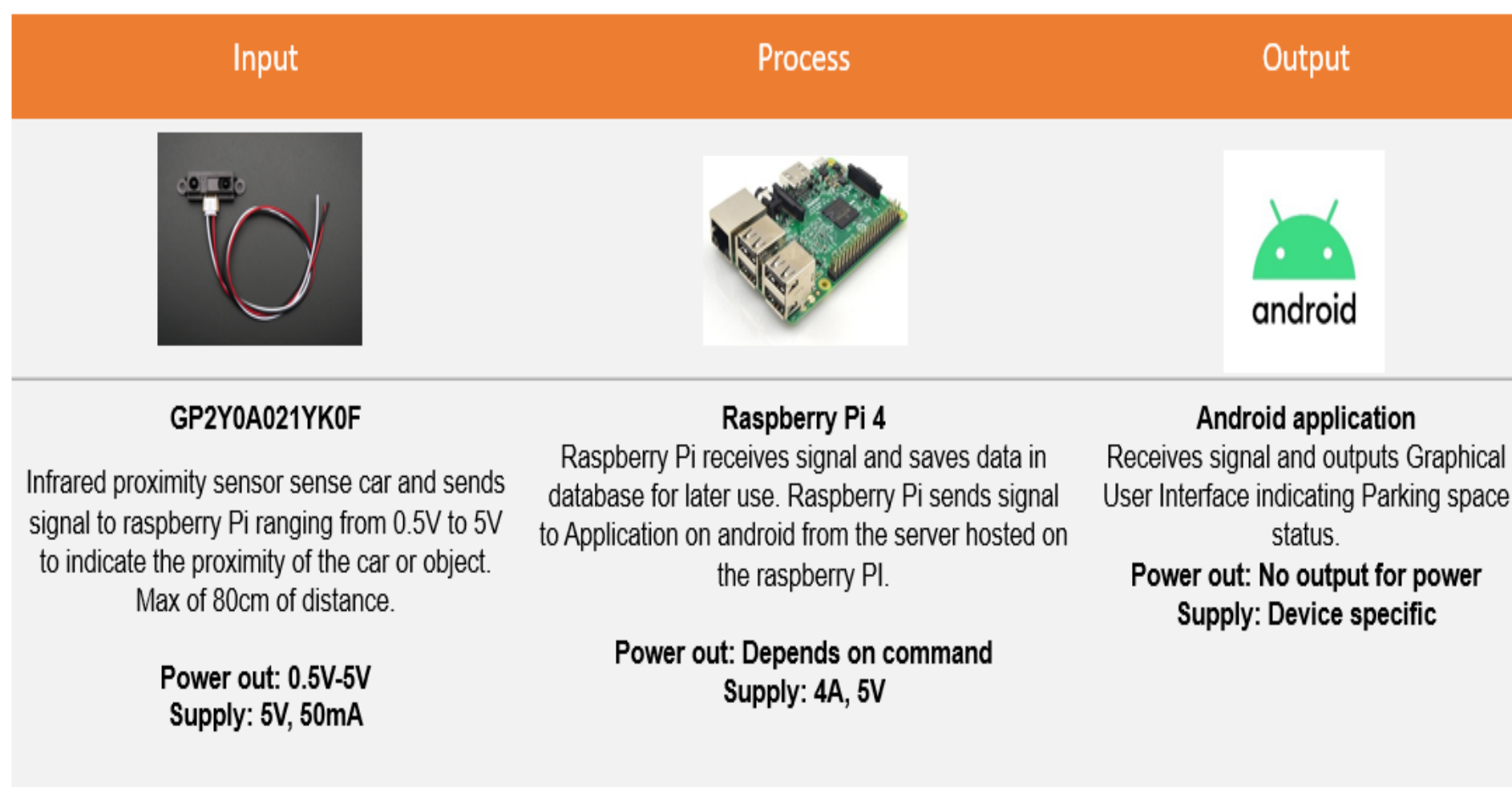


Figure 2. Block Diagram

### FUTURE DIRECTION

- Artificial intelligence with Camera
- Cloud service (Amazon web services, Google Cloud, etc.)
- Personalized data visualization (Business Intelligence)
- Financial services
- Parking Reservations

### REFERENCES

1. Shoup, D. (2019, February). Articles - Is 30 Percent of Traffic Cruising for Parking? Retrieved November 19, 2020, from <https://www.parkingtoday.com/article/details.php?id=2624>
2. McCoy, K. (2017, July 13). Drivers spend an average of 17 hours a year searching for parking spots. Retrieved November 19, 2020, from <https://www.usatoday.com/story/money/2017/07/12/parking-pain-causes-financial-and-personal-strain/467637001/>

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