Maxis Graduate Programme- Software Engineer Case Study

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1. Identify the Problem Statement

   As the rising of Internet of Things (IoT), one of Maxis's big retail client would like to invest and innovate their shop with Internet of Things. The main concern of client is they would like to understand foot traffic of shoppers in their stores across the nation. By applying IoT, it can be assumed that the client would like to know number of shoppers that have visited their shop on a particular day. Thus, they can make a deduction on factors that affecting their business such as weather, date or any special occasion happened.

2. Propose and justify the solution.

   The proposed idea is to use Passive Infrared (PIR) Sensor on entrance of client's shop. PIR Sensor is an electronic sensor that could measure infrared light radiating from objects within it range of view. PIR Sensor can detect human or animal movement that come across its range of detection. PIR Sensor have two slots in it, when the sensor in idle, both slots detect the same amount of infrared. When a warm human body entered sensor's detecting area, it will intercept the first slot which causes a positive differential change. When warm human body leaves the detecting area, it will intercept the second slot which causes a negative differential change as shown in Figure 1. The number of customers can be counted as they walk through this sensor when entering client's shop and it can be monitored by connecting the sensor to computer or cloud.
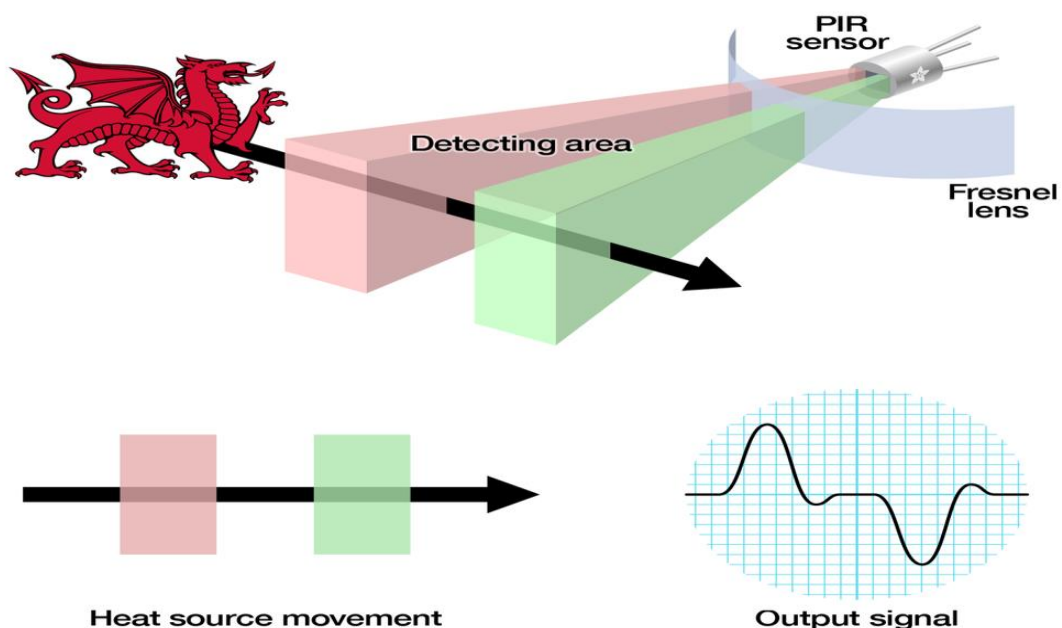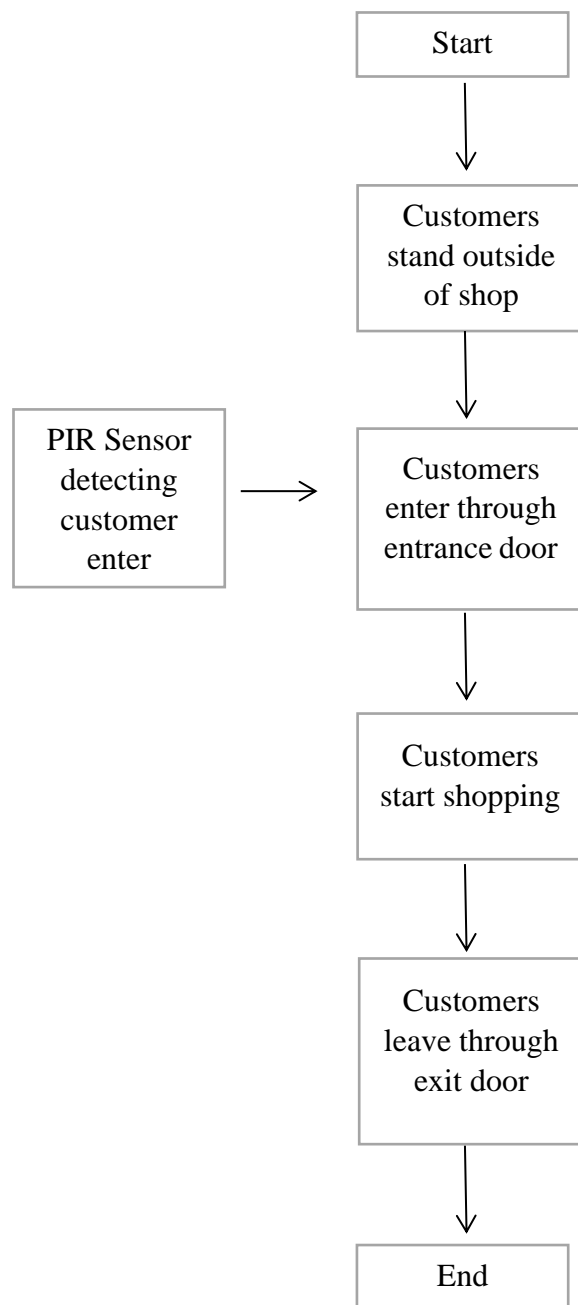

Figure 1- PIR Sensor detecting human/animal

3. Present the solution that is easily understandable by a larger non-technical audience.

```
                    ┌─────────────┐
                    │    Start    │
                    └──────┬──────┘
                           │
                           ▼
                    ┌─────────────┐
                    │  Customers  │
                    │ stand outside│
                    │   of shop   │
                    └──────┬──────┘
                           │
                           ▼
┌─────────────┐     ┌─────────────┐
│  PIR Sensor │     │  Customers  │
│  detecting  │────▶│ enter through│
│  customer   │     │ entrance door│
│   enter     │     └──────┬──────┘
└─────────────┘            │
                           ▼
                    ┌─────────────┐
                    │  Customers  │
                    │start shopping│
                    └──────┬──────┘
                           │
                           ▼
                    ┌─────────────┐
                    │  Customers  │
                    │leave through│
                    │  exit door  │
                    └──────┬──────┘
                           │
                           ▼
                    ┌─────────────┐
                    │     End     │
                    └─────────────┘
```

4. Provide a working coding sample on how this might work.

To provide some insight for the client on how PIR Sensor can be implemented in their shop for foot traffic detection, setup of the prototype can be done using PIR Sensor and Arduino Uno. Firstly, V_{cc} of PIR Sensor pin is connected to 5v port of Arduino board. Secondly, the ground of PIR Sensor pin is connected to ground port of Arduino board. Lastly, the output pin of PIR Sensor is connected to any of the digital port of Arduino board for this diagram it is connected to digital port number 2. The foot traffic detection prototype can be seen in Figure 2.
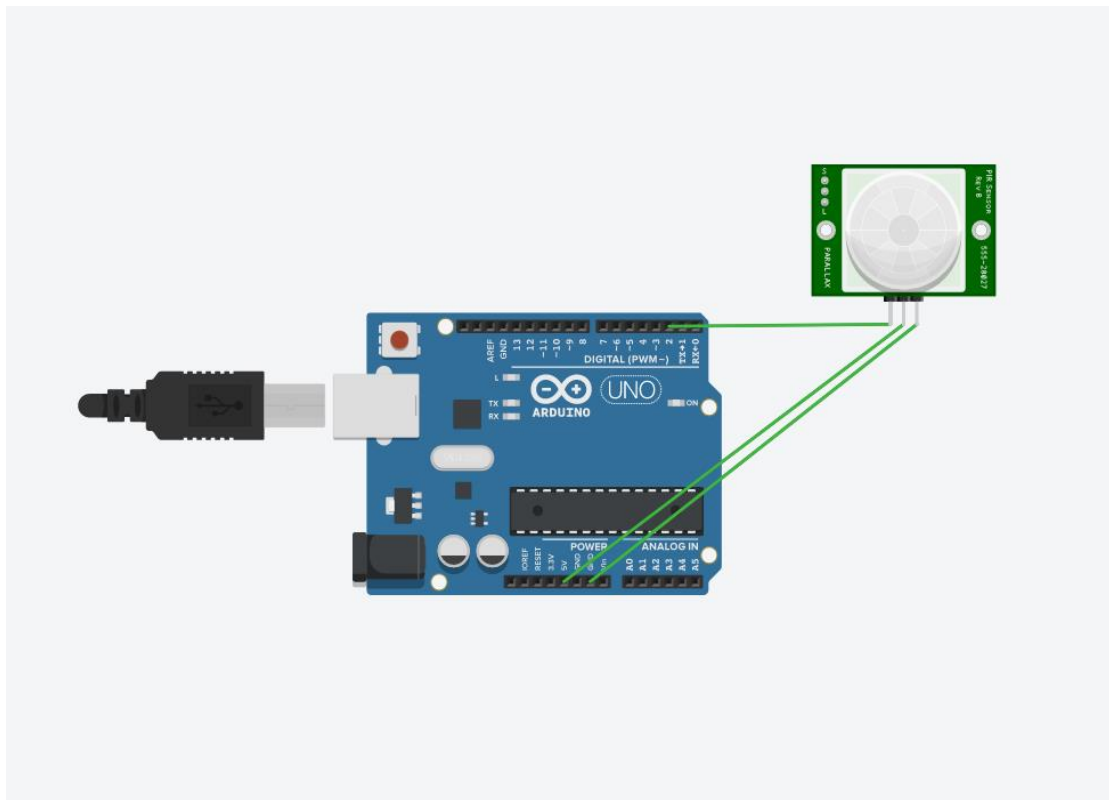

Figure 2- Foot Traffic System Prototype Design

The simulation for foot traffic detection can be done using Tinkercad. Tinkercad can be used to compile the code and upload it to the Arduino board. The Serial Monitor in Tinkercad will display the output of the code along with the sensor reaction towards any movement. If there is motion detected by the PIR Sensor, the counter will increase its value as shown in Figure 3. In conclusion, PIR Sensor work exactly as expected for foot traffic detection system. PIR Sensor can be used for the client to monitor foot traffic in all their shop across the nation. This foot traffic system can be connected to the

computer or cloud to provide real-time data to the client which is why it is consider as Internet of Things innovation.
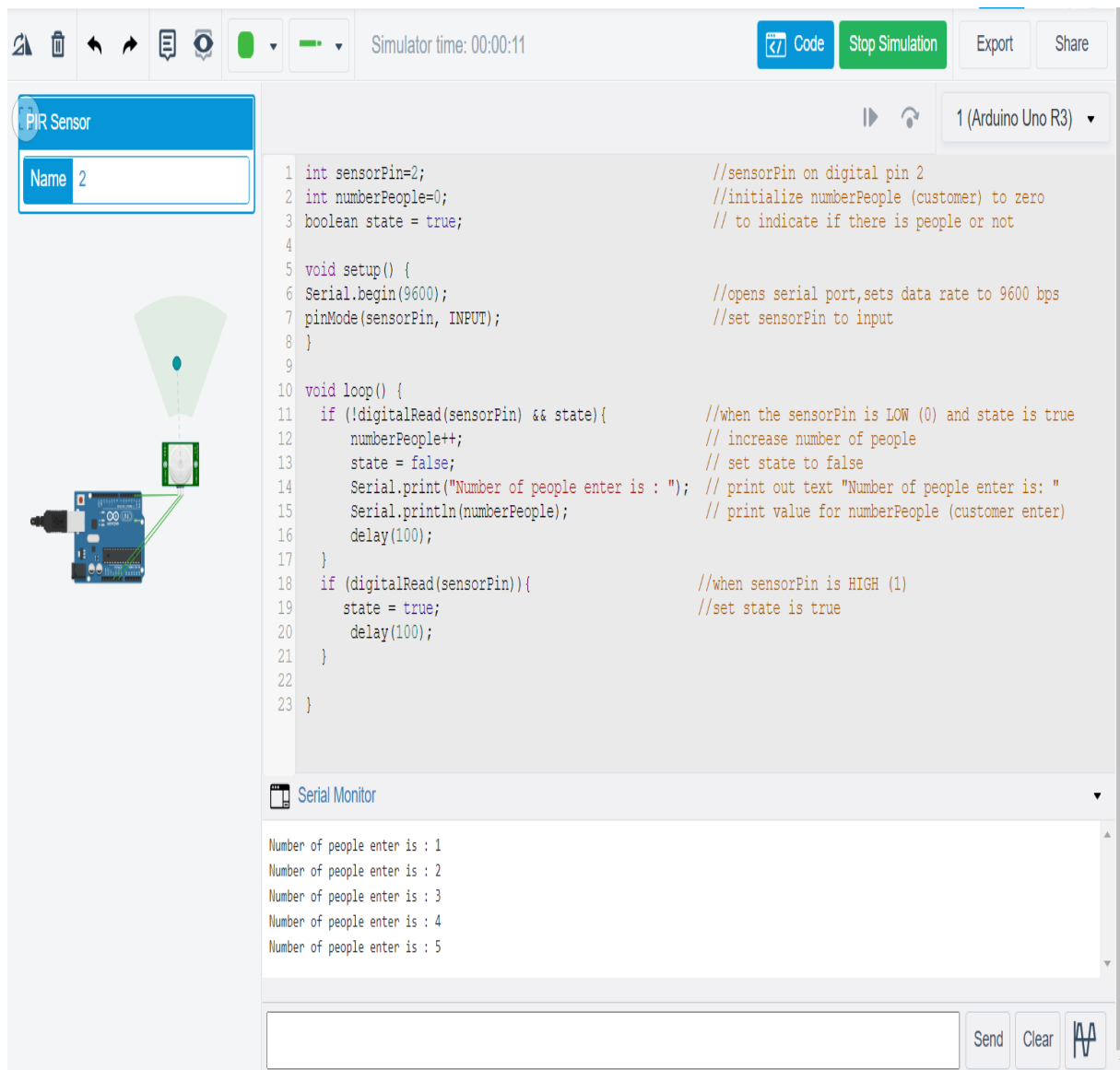

Figure 3- Foot Traffic System Code and Simulation

5. Conclusion

In conclusion, the solution for client to innovate their shops using Internet of Things have been provided. The client will be able to implement foot traffic system on their shop's entrance across the nation using solution provided. The foot traffic system can be monitored through computer or access remotely through cloud.