Bi-directional visitor counter and temperature sensor to prevent the spread of Covid-19 in shops

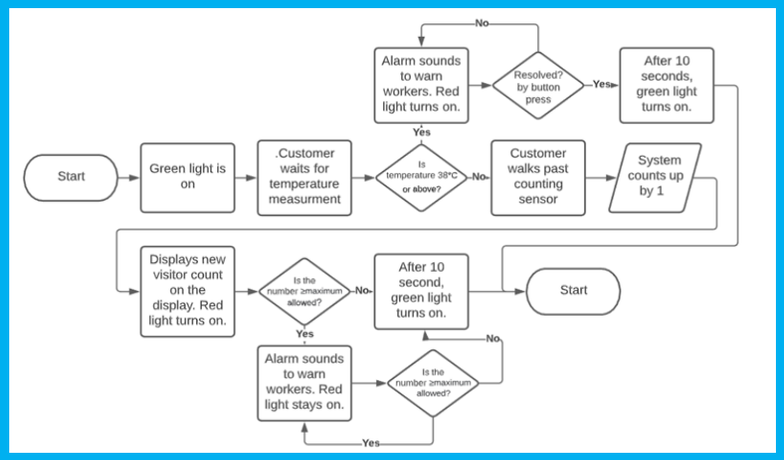
Tom McQuoid
BEng (Hons) Electronic Engineering

Background

The Covid-19 pandemic has meant shops are required to help customers follow social distancing guidelines by maintaining a maximum capacity in their shops.

These new rules and regulations made shops position employees on the shop door, causing a decrease in productivity and long queues due to the lack of staff working on tills and shop floor.

The aim of this project was to develop a prototype device for visitor counting, which combined with a temperature sensor to help with early detection of fevers, which are associated with Covid-19 .



Proposed system-flow diagram. (For customer entering premises)

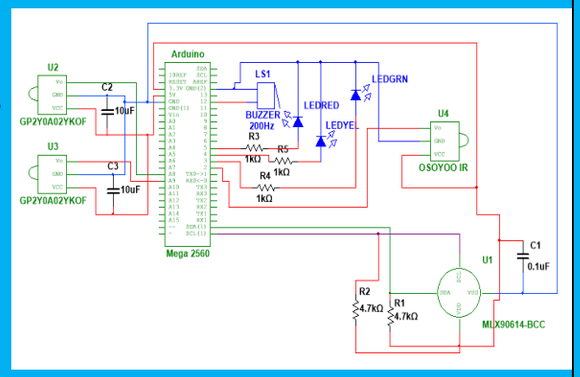
Problems

- The device needs to accurately count visitors and alarm employees when the maximum capacity has been reached.
- Be able to count quickly to avoid unnecessary queues.
- The temperature reading accuracy must be ±0.8°C or better.
- To have good usability with the capability to change both the total and current capacity.
- Many components that work together correctly and not conflict with each other.

Solution

The solution for this was to design, implement, and test a device that incorporated multiple sensors into a single device. Various components were compared and the best fit for the design were chosen. The components chosen were:

- **Arduino MEGA 2560** –Overall system controller
- **Two GP2Y0A02YKOF reflective sensors** – These sensors were placed side by side to detect visitors when they enter or exit.
- **OSOYOO IR sensor** – To detect when a customer is near the temperature sensor and start the temperature reading.
- **MLX90614-BCC** – Used to measure the body temperature of customers and staff.
- **Green, Yellow and Red LEDS** – A traffic light system used to guide customers and staff on when to enter or exit the premises or warn of a high temperature or capacity.
- **Buzzer** – To warn when maximum capacity or a high temperature has been reached.
- **DFROBOT LCD keypad shield** – To display and change the count.



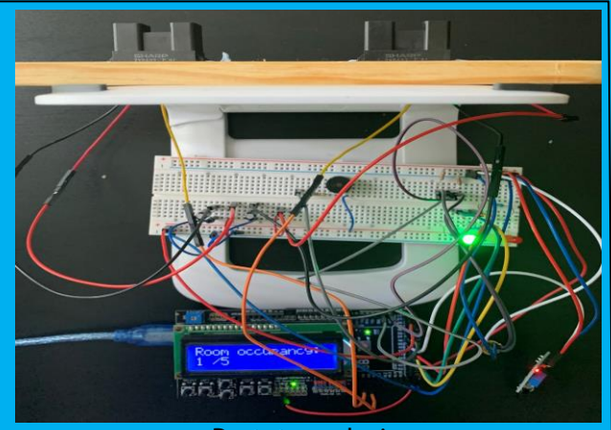
Full circuit diagram

Outcome

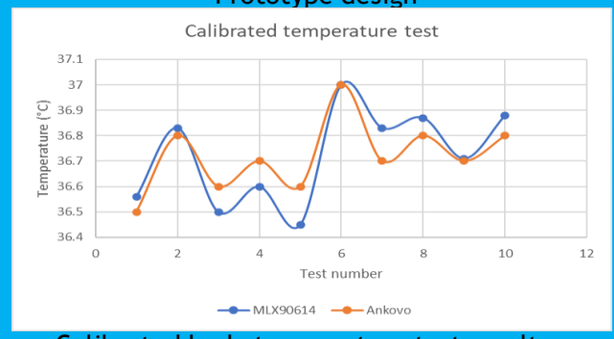
The prototype has been tested successfully against the initial project/device specification. It was able to accurately detect then increase or decrease the capacity and warn colleagues and customers when the maximum capacity had been reached.

After calibration the temperature sensor was found to have a mean temperature variation from the calibration device (Ankovo) of 0.073°C.

- **Cost** – £73.33
- **Speed** – A customer flow rate of one every two seconds (entering or exiting) was achieved.
- **Temperature accuracy** – ±0.45°C (Largest temp variance + Ankovo temp accuracy)
- **Usability** – The device is easy to use with buttons to change the capacity numbers and stop the alarm.
- **Issues** – The temperature reading will stop if someone enters or exits while in process.



Prototype design



Calibrated body temperature test results