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Active Fire Hazard Monitoring Device

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Problem description

Can we reduce the number of fire incidents at home and office in the Pacific region using an affordable technological solution?

Figure 1: A recent property fire incident in Suva

Property fire incidents in the Pacific Island Countries (PICs), especially in Fijian households, are a disturbingly common occurrence. According to the National Fire Authority (NFA) of Fiji, there were over 1800 fire incidents in just 2009 in Fiji alone [1]. Of these, over 200 were property fires.

While these numbers have reduced over the years, they still hover in the double to triple digits annually. One only needs to pick up a few days' worth of newspapers to realize the severity of the issue whereby local people have had the misfortune of losing their homes, their personal belongings and even their life.

Fire hazards and accidental fires are a serious concern in the Fijian communities and in the pacific nations in general, especially due to a lack of monitoring equipment and awareness.

Proposed Solution

Design and implement a monitoring device that is mounted on the ceiling of the house e.g. in the kitchen, that will detect the presence of flammable gases (LPG) & smoke, and monitor ambient temperature levels, in real time. Once it senses levels of the gas or smoke above a certain threshold, it will perform the following three operations in order:

1. sound a local alarm via an on-board speaker,
2. send SMS messages to all members of the family, and
3. ring the mobile phone of one person (selected by the user)

The device is similar to common smoke detectors in that it sounds a local alarm upon detection of smoke particulate in the air. However, the similarities end there. Our monitoring device is able to detect the presence of a gas leak and **take action *before* there is an actual fire**. Also, it is able to notify concerned people such as family members via SMS message over the cellular network and call a single person. This helps in case owners are not at home when the fire hazard is introduced or a fire starts, thus allowing them to react and take preventative measures to avoid a potential fire incident. Furthermore, the local alarm will be able to wake people up from sleep in case the incident occurs during sleeping hours.

The **main objective of this idea is to make a relatively low-cost, reliable, easily-adoptable monitoring device that serves to reduce the rate of life-threatening fire incidents** in homes, and buildings in general, in the Pacific region.

The monitoring device will consist of the following main parts:

a) **Gas + smoke sensor**

An off-the-shelf MQ-2 sensor that can detect 300 to 10 000 ppm concentrations of flammable gas [2].

Figure 2: MQ2 sensor

b) Piezo transducer - **buzzer**

The buzzer is used to play a loud high frequency sound when the microcontroller decides to sound the alarm [3].

Figure 3: Speaker

c) **Temperature sensor**

A sensor to measure the ambient temperature [4]. Coupled with the smoke detector, this will assist in determining whether a fire incident is underway.

Figure 4: **Temperature sensor**

d) **GSM** shield for Arduino

This will provide the microcontroller with cellular capabilities. It will be responsible for communicating with the family members in the form of SMS messages and calling [5].
If design goes into production, its cost can be significantly reduced by using special purpose GSM chips instead of this expensive shield.

Figure 5: **GSM Shield for Arduino**

e) **Microcontroller**: Arduino UNO R3

Figure 6: **Arduino Uno – microcontroller**

The 'brains' of the device, it will be used to monitor the levels of gas and smoke in the surrounding air – as reported by the MQ-2 sensor – and take the necessary actions once levels surpass a certain threshold [6].

Similar to the GSM shield above, cost saving can be achieved with this component by using cheaper, simpler and smaller microcontrollers in production.

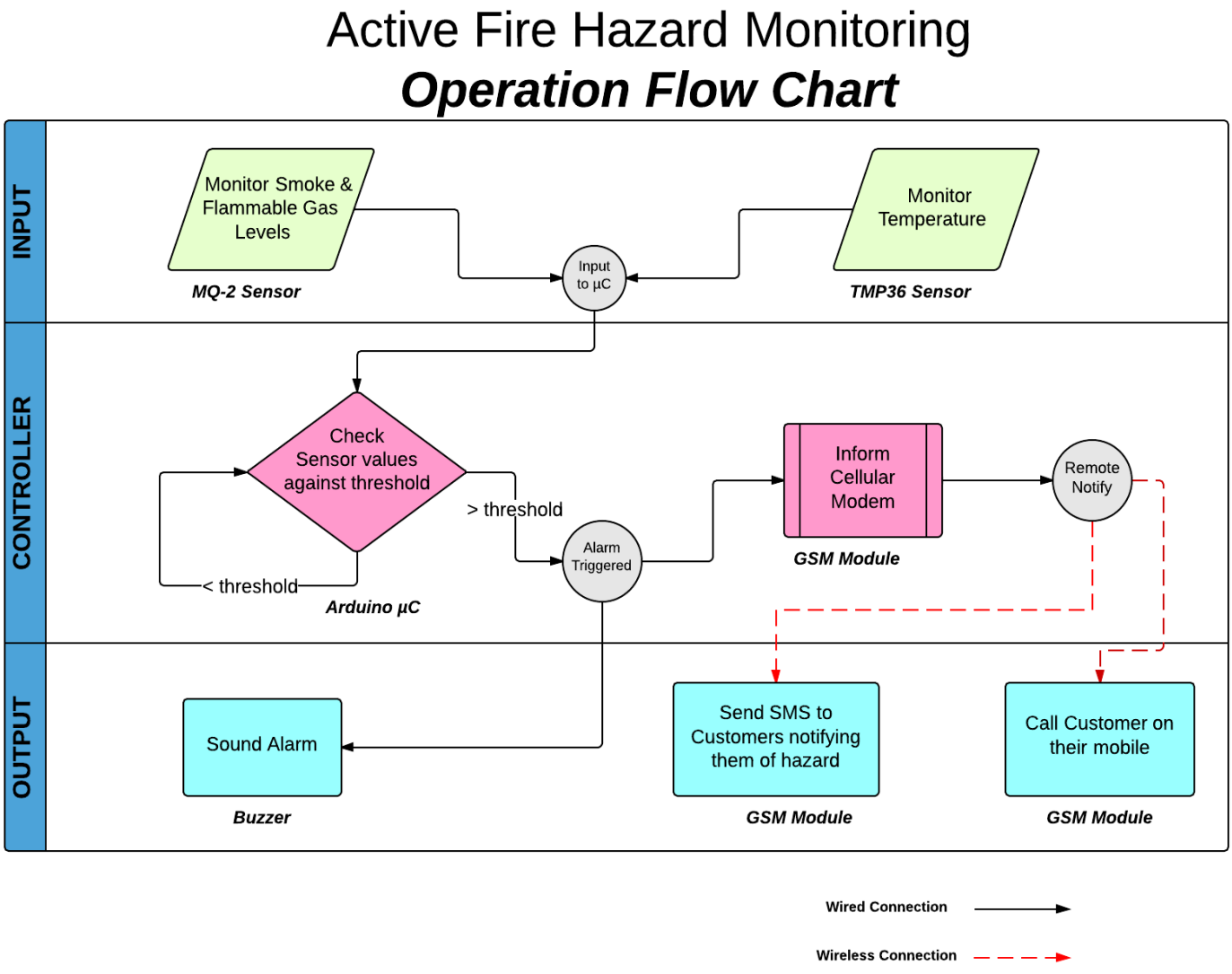

Figure 7: Flowchart and block diagram of monitoring device

Impact on community

Mobile phone penetration in Fiji is approximately 85% [7] i.e. approximately 85 out of every 100 people in Fiji own a mobile phone. Given such high connectivity levels for a small developing country like Fiji, mobile phone is a feasible, and perhaps the best, means of delivering information to people on short notice. With our Active Fire Hazard Monitoring Device keeping watch for potential fire hazards & fire incidents and relaying this information in real-time, the users of this device will have peace of heart in knowing their homes and offices are safer than before.

The monitoring device will enable local communities to reduce the number of structural fires that result from negligence and ones that could have been easily prevented by attending to gas leaks in time.

References

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