**POST PROJECT SUMMARY**

Rationale:

There is an increasing need for an inexpensive and portable alternative to the challenge of property safekeeping, in a city state where the number of SMEs and independent shop owners is only set to increase over the next few years. Existing security systems often face restrictions when it comes to affordability and portability, limitations that are potentially deal-breakers for business operators restrained by a tight budget. This project aims to present an alternative method of engineering a safekeeping system – using capacitive sensing – that can be as reliable as it is affordable, setting a new standard for existing security systems around. It will also benefit shop owners immensely as it not only helps prevent theft, but also give them greater piece of mind knowing that their business premises are guarded and secure.

Research Question:

* What are some of the ways we can increase the *Sensitivity*, *Consistency*, *Adaptability* and/or *Reliability (SCAR)* of a capacitive sensor which uses human touch detection as its input?

Hypotheses:

* **Hypothesis #1:** Using the relative difference between readings received from the capacitive sensor as the alarm trigger will improve *SCAR* as opposed to using a fixed threshold value.
* **Hypothesis #2:** The lower the trigger value used, the higher the *Sensitivity* & the lower the *Consistency, Adaptability* and *Reliability* achieved.

Engineering Goals:

* To design an inexpensive yet reliable safekeeping system.
* To maximise the capabilities of our self-constructed capacitive sensor by manipulating the Arduino sketch on which it runs on, thereby achieving the optimal *SCAR* balance*.*

Expected Outcomes:

* A trade-off between *Sensitivity* and *Adaptability* will have to be struck – the value that best suits one criteria may not best suit the other.
* *Consistency* and *Reliability* should both be as high as possible for our safekeeping system to be trustworthy and useful, lending credibility to any alarm sounded.

Procedures:

Separate sketches were written for the various methods proposed and each were put through a

series of tests that evaluated their *Sensitivity, Consistency, Reliability,* and *Adaptability* (*SCAR*).

* *Sensitivity*: receptiveness of the sensor. Assessed by two factors: furthest possible distance between the hand and the sensor and how fast the sensor can respond to an approaching hand
* *Consistency*: how consistent the results gathered from the *Sensitivity* test are. Variation in *Sensitivity* should have been negligible to score high in this test.
* *Reliability*: percentage of false alarms – alarms that are triggered spontaneously when they are not intended or supposed to.
* *Adaptability*: how adept a sensor is to changing environments and situations. The sensor will be put through a variety of environments and situations and the results from each will be compared and compiled to give a final score.

Risk & Safety:

* **Photosensitive epilepsy** **warning**: flashing lights are heavily involved in this project.
* Avoid staring directly into the LED or placing your ear too close to the speaker.

Data Analysis:

* The results from Hypothesis #1 will be tabulated on two bar graphs and their individual *SCAR* scores will be compared to evaluate the better alarm trigger method.
* Results from Hypothesis #2 will be plotted across line graphs for the identification of an overall general trend across the trigger values in terms of S, C, A & R.

Results Discussion & Conclusions:

* Using relative difference is better than a threshold value as it makes the sensor more consistent, reliable and adaptable while being slightly less sensitive as a minor trade-off.
* *Sensitivity* decreases as the trigger value increases, and approaches a plateau as the trigger value increases beyond 30. The initial *Reliability* scores were noticeably sub-par at the start but quickly rose to peak at 10. No overall general trend was observed with *Consistency*. *Adaptability*witnessed the most interesting trend. Peaking at 18, it formed a bell curve with relatively steep gradients, the right side being steeper than the left.
* A trade-off between *Sensitivity* and *Reliability* is imperative to achieving optimal *Adaptability*, and 18 seems to offer this ideal combination. Lower values increase *Sensitivity.*

Bibliography:

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