

## **Monitoring beach usage on Gold Coast beaches: Is it beneficial?**

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### **ABSTRACT**

People primarily use beaches for fun and recreation. Monitoring beach usage is important for providing data to help predict future beach needs. CoastalCOMS, an automated observation system for coastal monitoring, can measure the extent of beach usage by counting how many people are on the beach at any given time.

Another important aspect of beach usage monitoring is to determine what people are using the beach for. For example, are they walking on the beach, sunbathing, or entering the water? The information obtained about how people are using the Gold Coast beaches will provide valuable data to coastal councils and coastal management authorities to help future beach planning and management. It will also be useful for surf lifesaving organisations and local lifeguards.

This paper will review CoastalCOMS, its uses and benefits, and how it can be used by local councils, coastal management groups, and surf lifesavers to help improve the management of Queensland beaches.

### **INTRODUCTION**

The Coastal Conditions Monitoring System (CoastalCOMS) is an automated observation system for coastal monitoring. The system is comprised of a shore-mounted video camera network and sophisticated image processing routines for analysis and display of coastal environment information.

CoastalCOMS provides comprehensive real-time and predictive information about beach and surf conditions. The real-time data includes offshore wave height, nearshore wave height, wind direction and strength, surf quality, beach state, beach usage and shoreline position. Combined with data from other sources, such as tide predictions and expert observations, the collected data is stored and used to train predictive algorithms for short term forecasting of nearshore wave height and surf quality, beach state changes, and beach user risk.

CoastalCOMS offers seven modules of information relating to beach conditions. These are vision, wave height, beach state, beach risk, surf quality, beach usage, and shoreline position. The information provided in each module is often related to, and dependant upon, the information in the other modules. Each module may consist of display elements derived directly from video, raw data from climatic and other physical processes, and processed information (including predictive information) derived from this raw data.

This paper will review CoastalCOMS, its uses and benefits, and how it can be used by local councils, coastal management groups, and surf lifesavers to help improve the management of our Gold Coast beaches in regards to beach usage.

Beaches are used primarily for recreation and fun. Monitoring beach usage is important for providing data to help predict future beach needs. The CoastalCOMS

can measure the extent of beach usage by counting the number of people using the beach at any given time. Figure 1 shows an image captured from a CoastalCOMS camera.



Figure 1. Image showing areas (rectangles) that have been classified as a “person object”. (Source: CoastalWatch, 2007)

Information gained from CoastalCOMS is important for use in future beach planning and beach safety management. This shows the importance of beach monitoring and being able to ascertain what people are doing on the beach, for example: Is the person walking on the beach, sunbathing or entering the surf?

## **METHODOLOGY**

The technique used to automatically count the number of people on the beach is a simple approach to counting objects. An algorithm converts the image to greyscale and performs a technique, known as ‘thresholding’, on the video. This converts dark colours to black and light colours to white, thus creating a black and white image. This also has the effect of making foreground objects white and background objects black. The rest of the algorithm counts the number of detected foreground objects in each frame of the video and averages the number of people out over the length of the video.

While this technique is not practical in complex environments, on a beach environment there are very few incorrect classifications as there are few objects aside from people on the beach. The misclassified objects are insignificant compared to the number of people on the beach. Accuracy rates of up to 90% have been achieved by manipulating camera direction and zoom. By breaking the beach up into 3 or more sections (figure 2), we can obtain an accurate count on both wide beaches and beaches where the camera is a significant distance from the target.

There are some limitations to the system. These include the inability of the technique to work in adverse weather conditions and poor lighting. Generally speaking, 9am – 4pm in summer and 10am – 3pm in winter provide sufficient lighting conditions for an accurate count. Outside these times, accuracy rates can drop significantly, and additional parameters are required to obtain reasonably accurate results.

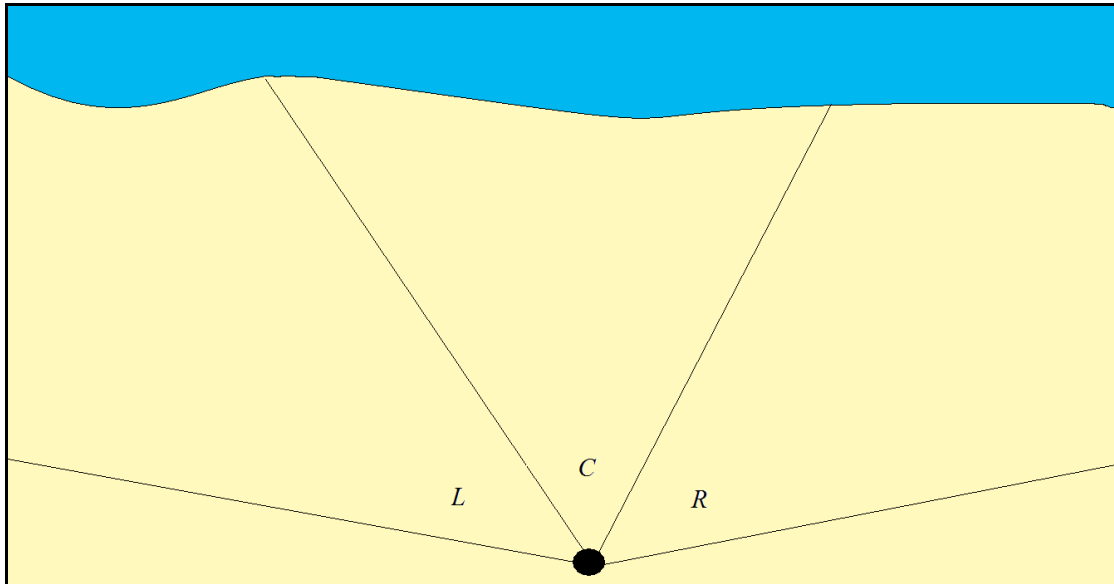


Figure 2. Breaking the beach up into 3 sections for counting the number of people. (Source: CoastalWatch, 2007)

## CASE STUDY

### Surfers Paradise vs. Kurrawa, Gold Coast, Australia

Surfers Paradise beach is Queensland's best known beach and the most popular beach on the Gold Coast. It is the heart of the Gold Coast tourism industry and is visited by millions of tourists each year – 10 million visitors in 2005/2006 (GCCC, 2007). The 2 km strip of beach is backed by a fenced foredune, with several access tracks. The Esplanade is the most highly developed section of the Australian coast (Short, 2000).

Kurrawa is approximately 3.5 km south of Surfers Paradise and has the most extensive beach reserve. The wide reserve runs for 1.5 km and incorporates the Kurrawa SLSC and many other public facilities (Short, 2000). The area is more frequented by local residents with a local market held in the park on weekends.

Data collected over a week in January 2007 (figure 3) using the CoastalCOMS software, shows that Kurrawa was more popular and used more extensively on that particular weekend than the more famous Surfers Paradise beach. Results show that especially on the Sunday, Kurrawa had nearly twice as many people attending the beach than Surfers Paradise. Nippers and Bronze medallion events are run on weekends at Kurrawa as well as the weekend markets making it a popular place for local residents and families. This shows the unquestionable need for weekend lifeguards services at Kurrawa and the management of resources and facilities for the safety and use of the local residents and tourists visiting the beach.

Surfers Paradise is more of a tourist beach and was therefore more popular during that week than Kurrawa, with visitor numbers nearly double that of Kurrawa. This shows that lifeguard numbers could be increased during the weekday periods to cater for the tourist numbers. Local markets are held on a weeknight along the Esplanade and Nippers are held at Surfers Paradise on a Sunday morning, however, the people count numbers for that week do not show much of an increase in beach usage around these times.

This data is but a snapshot and an example of the potential information and results that can be gathered from using the CoastalCOMS software. Further analysis of long-term data would provide specific information in regards to demand on specific days.

Results gained from CoastalCOMS can help to prioritise management and planning strategies to target certain beach areas along the Gold Coast. In the case of Surfers Paradise and Kurrawa, results may indicate that beach patrols are more important on the weekends at Kurrawa and during the week at Surfers Paradise. With the number of activities being held at Kurrawa it shows that facilities and amenities in the area, such as parking spaces and park and bbq facilities, have to be properly managed to meet the demand. This demand can be clearly established and analysed using the CoastalCOMS software.

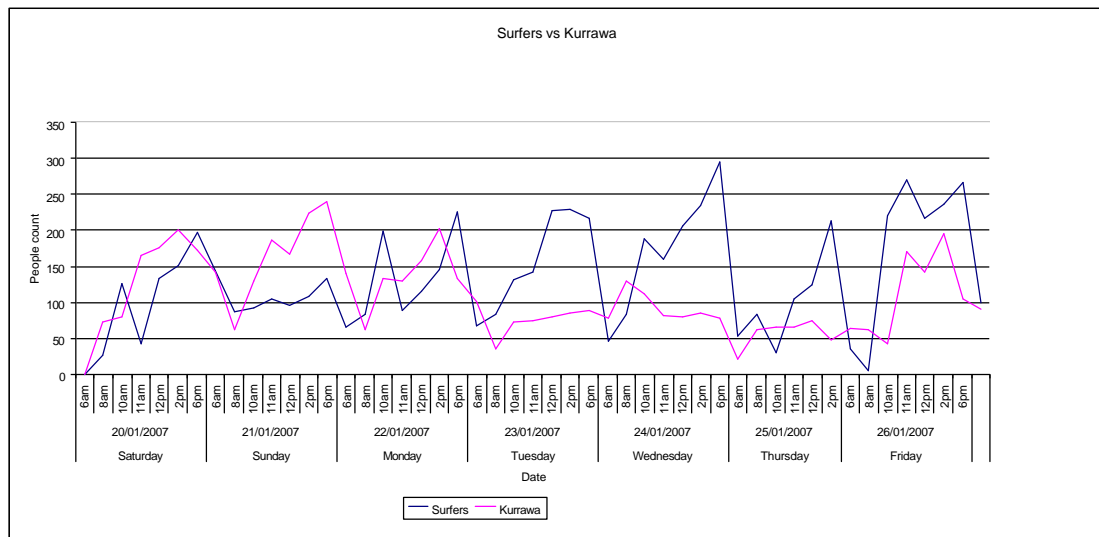


Figure 3. Surfers Paradise vs. Kurrawa: Beach usage numbers

This data will aid local Gold Coast lifeguards as they will be able to access vital information on the numbers of people currently on their particular beach and exactly what it is they are using it for. They can then better assess any associated risks and the current beach conditions in regards to the beach usage data and better plan for any potential dangers which may arise. Consequently, the beaches are better managed with proper distribution of lifeguards and other resources. With the popularity of these two beaches, this technology will be of particular importance during the summer seasons when the number of people using these beaches is at its peak.

## BENEFITS

With CoastalCOMS providing comprehensive real-time and predictive information about beach and surf conditions, the system has many benefits not only to local councils and surf life saving but also to the local community. This includes beach health, beach safety, and better local planning and management techniques.

With the growth of Queensland's general population along with the number of tourists rising each year, the amount of people visiting the beaches is increasing. This is resulting in more beaches being used, more of the time by an increasing number people, many of whom are unfamiliar with beaches and their associated risks. Many beaches along the coast have no surf life saving clubs or patrols. There is now, more

than ever, a greater need to maintain public safety on beaches. More recently, on Gold Coast beaches, there has been an increased need for lifeguards to extend their patrol hours during the peak summer months due to the increased number of people using the beach outside 9am – 5pm hours. The CoastalCOMS technology could provide an analysis of swimmers using the beach during these hours and assess the need for lifeguards after 5pm or before 9am on certain beaches along the Queensland coast. It can also help determine information on each beach's general characteristics, suitability for swimming and other recreational activities, beach health and access, and the need for certain lifeguards resources. It is an important tool for beach safety and future planning issues for the coast.

The CoastalCOMS data allows local councils and surf life saving clubs to access information on the number of people using a particular beach and what they are using the beach for as well as the potential hazards of that beach. As stated above, this aids lifeguards as they can access information on the number of people currently on their beach and the general activities they are undertaking. The lifeguards can then better assess any associated risks as well as the current beach conditions. Beaches are then able to be better managed with a proper distribution of lifeguards and other resources and facilities.

This technology could be used in conjunction with the beach hazard rating system (Short, 2000) which refers to the scaling of a beach according to the physical hazards associated with its beach type together with any local physical hazards.

The system can also benefit local councils in their local area planning and coastal management strategies, with the system being able to determine the number of people using the area and what they are using the area for. This will help local councils plan for parking, infrastructure and other amenities which may be required in the area. This can either be used to increase parking and amenities in an area of high demand, in order to help combat problems caused by high usage, or increase parking and amenities in an area of low demand.

In terms of coastal management, it can look at current coastal management techniques used by local councils, such as beach nourishment and dune revegetation, and determine whether they are of any benefit to the area and the people using that area. It can also determine whether that management technique is actually needed elsewhere instead. For example, local councils can focus funding on beaches that are directly impacted on by an increased number of people using them, ensuring that the beaches can meet the expectation of the tourist and local community. It is a local council's responsibility to ensure the provision of a healthy beach system, otherwise it could impact on the local community's lifestyle and the tourism dollar.

All of these benefits can help manage current local council spending and ensure that funding is being distributed within areas with the highest needs. Better management and planning of a particular area will have a positive effect on local businesses and the local economy. Improved use of local council funding can then be used to address community concerns regarding beach amenity and safety.

## **CONCLUSION**

CoastalCOMS addresses a need for readily accessible real-time and predictive information on beach usage and surf conditions. It is easily installed and provides coverage over wide areas of coastline while conveniently displaying the information at a single location.

Effective coastal management recognises the need to manage and plan for the long-term impacts of natural and human activities to protect coastal resources for future generations. Coastal management authorities require adequate and timely access to information on the health of the beach system in order to effectively manage the distribution of resources and to address community concerns regarding beach amenity and safety. A system, which combines the wide array of ever-changing environmental parameters in one graphical display, enables efficient communication of information to stakeholders and the public.

The benefits of CoastalCOMS, as demonstrated in the case of the two Gold Coast beaches, are varied and can be applied to any beach area along the Queensland coast or Australia coast. The information provided by CoastalCOMS is especially useful for coastal councils and their lifeguards, coastal management authorities and surf life saving organisations.

## **ACKNOWLEDGEMENTS**

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