

# The REAL Project

## Reef Experience Alternative

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### Baggrund

Verdens største koralrev er i fare. *Great Barrier Reef* i Australien er truet af forurening, overfiskeri, klimaforandringer og en voksende turistindustri. Hvis der ikke bliver grebet ind nu, risikerer vi at et unikt økosystem med en fantastisk mangfoldighed af dyre- og plantearter vil forsvinde for altid.



Alle problemer kan ikke løses på én gang. Man er nødt til at tage et skridt ad gangen. Vi har valgt at fokusere på en praktisk løsningsmodel til en bæredygtig koralrevsturisme. Vores forslag er at udvikle en helt ny form for naturoplevelse, der kombinerer robotteknologi, marinbiologi og fritidsdykning (se figur 1).

Reef Experience Alternative præsenterer en prototype til robotten REAL, der simulerer en alternativ koralrevsoplevelse. I sin endelige udformning er REAL en robot, der svømmer rundt nede ved koralerne med et 3D kamera forbundet med en modtager gennem avanceret undervandsfjernstyringsteknologi udviklet af energisektoren i forbindelse med dybhavs olie- og gasudvinding.

Alle data bliver sendt til en modtager, der svømmer under vandet tættere på kysten i et sikkert område. Modtageren har 3D briller på, der viser præcis hvad robotten filmer. Robotten styres gennem sensorer på dykkerens arme og ben. Når dykkeren for eksempel svømmer fremad, opfanger robotten bevægelsen og svømmer selv fremad. Alle bevægelser modtageren laver, kommer robotten også til at lave. På den måde skabes der et realistisk og bæredygtigt alternativ til rent faktisk at svømme ved koralerne.

#### The REAL Problem

Why The Great Barrier Reef is in Danger

**Human Intrusion**

- Inland Pollution** By using of and non-degradable resources fine particles are released into the air which then cover the corals and inhibit their sunlight. This also causes water temperatures to decrease, resulting in reduced growth rates [1]
- Coastal Development** Human populations expand in coastal areas and runoff consisting of sediment, agricultural waste and sewage pollutes the reef health.
- Fishing** The extreme growth in human population requires more food and therefore more fishing. The extreme rates of fishing by illegal high seas vessels has caused the destruction of parts of the reef backbone and living species. The more people fish, the less species of fish and corals will survive.
- Poaching** There is a great business in selling corals to tourists in need of souvenirs. However, by collecting these corals, you help destroying the reefs.

**FOCUS OF OUR PROJECT: Tourism** The Great Barrier Reef is the largest coral reef on earth and one of the world's largest tourist attractions. Each year thousands of tourists visit the reef with boats and by diving. This causes disturbance in the reef's natural environment and can thus play a big role in the growth and development. Furthermore, the visitors leave huge trails of damage to the reef, which will take many years to regenerate.

**Inevitable Changes**

- Global Climate Change** Climate change causes rising sea levels which means the corals are not able to continue photosynthesis. The temperature difference has a great impact on the health of the corals. Rise in temperature deprives the corals to decrease as well as coral bleaching which turns the corals white and kills them.
- Rising Levels of CO<sub>2</sub>** The rising of the CO<sub>2</sub> levels is one of the main factors of climate change. It is released from the factories, cars, trucks, boats and the forest fires. The amount of CO<sub>2</sub> in the atmosphere is increasing and this has a negative effect as other types of pollution by cutting off the sunlight.
- Biodiversity Loss** Up to 25% of ocean species depend on the corals for food and shelter. When the amount of corals reduce the biodiversity loss too.

#### The REAL Solution

Reef Experience Alternative

**Sustainable Tourism**

**Alternative Experience**

As our project has been decided to bring the reef experience to the tourists through robots. With a built-in camera the robot sends images to the real-time programmed cell to share the experience with you. The camera which data through Bluetooth to the tourist's smartphone in safe, located area close to the shore, but away from the coral reef themselves.

By using special goggles, the tourists can see what the robot "sees". They will also be provided with special cameras that are connected to the robot. So when they move forwards, the robot also will move forwards they turn left, the robot does the same. So basically tourists can experience an underwater alternative.

**The REAL Robot**

The REAL Robot is a sustainable form of tourism which means it is built to have minimum impact on the coral reefs. The robot has the most efficient of propeller mechanisms, blades which are built to make minimum disturbance on the reefs will collect the trash and remove them. The propeller will be made out of a white opposed to heavy black spray-paint is very little. Thus it will not have a big effect on the coral reefs.

The robot is provided with a 3D camera sending data to the customer with the special goggles. The cost will be able to move according to the tourists movements.

**Take only photographs, leave only footprints**

Many World Heritage sites are being damaged by the great number of tourists visiting and collecting. For our future generations to experience these sites, we need to protect them and do so by many environmentalists. "Take only photographs, leave only footprints."

#### The REAL Project

Building a REAL Model for Demonstration

**Modeling the REAL experience**

**Our Robot**

The work involves a minimum version of a coral reef to demonstrate our project idea. This construction resembles the REAL robot by being able to move around the coral reef and through it. The robot will control the data through Bluetooth to a computer where you can see what the camera records and hereby navigate around the model coral reef.

**The Model Coral Reef**

Our coral reef is a box measuring roughly 100x50x70 cm where we have created corals and animals for the robot to explore. The box and platform will be completed in seven weeks. It is designed to give an alternative experience of seeing a coral reef.

**Next Step**

The next step in our project is to create a prototype of the REAL Robot which is able to transfer and receive data through Bluetooth. Furthermore, we need to work on body sensors that will enable controlling the robot through movements to be able to get the remote control to work. This will then need to be combined with a 3D camera to control the REAL Experience Alternative. Building a prototype in the able to function underwater in the next few days.

**Team Members**

- Josephine Guldhammer
- Freja Rønne
- Victoria Kjærgaard

FIGUR 1: REAL posters til projektpresentation

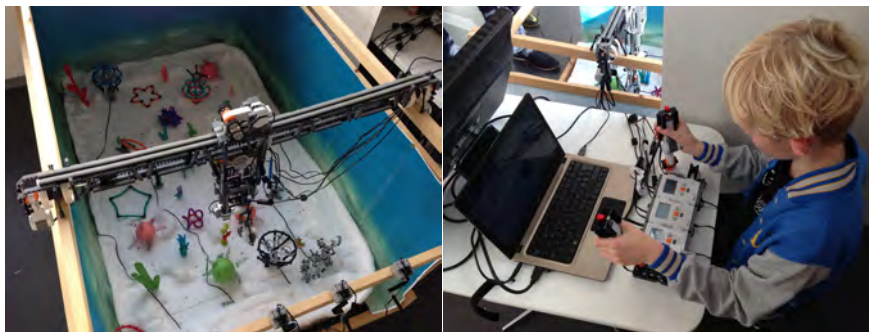
## Planlægning og ambition

Med vores projekt har vi ønsket at lave en REAL prototype til simulering af en alternativ koralrevsoplevelse (se figur 2). Vi ville undersøge 1) hvilke elementer, der kræves for at gå til næste niveau med konstruktion af en fjernstyret funktionsdygtig undervandsrobot og 2) hvordan brugere ville reagere på ideen.



*FIGUR 2: REAL prototype af LEGO MINDSTORMS i laboratoriet*

For at undersøge 1) har vi bygget en LEGO MINDSTORMS robot med kamera, der kan bevæge sig i tre dimensioner på en skinnekonstruktion i et modelkoralrev. Robottens bevægelser er frem, tilbage, op, ned, vippe og dreje rundt. Den styres af en controller bygget op af tre NXT'er og to joysticks forbundet til en bærbar computer, som kameraet leverer et live feed til (se figur 3). Koralmodellen er på ca 2 m<sup>2</sup>, konstrueret af flamenco på en træramme med koraller af gips og LEGO, enkelte med fjernstyrede bevægelser for at simulere et levende rev.



*FIGUR 3: REAL prototype i koralmodel og bruger der fjernstyrer robotten*

For at undersøge 2) havde vi brugere til at prøve at fjernstyre REAL prototypen gennem en hel dag til WRO på Aarhus Universitet i efteråret 2013. Vi fik meget positiv respons.

## Konklusion og perspektivering

Vi fik vores hypoteser bekræftet: 1) en LEGO MINDSTORM prototype robot kan bruges til at undersøge hvad der kræves af en 2. generations prototype, der skal fungere rigtigt under vand og ikke i et modelrev, og 2) at brugere er positivt indstillede for at teste REAL. Næste skridt er at udvikle en vandtæt, fjernstyret robot, der efter aftale skal testes i et bassin med levende dyr i Randers Regnskov.