

## REQUIREMENTS ANALYSIS – EXECUTIVE SUMMARY

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Tracking animals with GNSS and other sensors has become an important tool for a wide variety of applications in science, nature management, livestock husbandry, animal rehabilitation, pet training and other disciplines. The way from the specific question one wants to answer or deal with by GNSS tracking until the successfully completed study or application is very complex and problems may arise where not expected.

In this report on a stakeholder analysis and requirements specifications, we relate project goals to outcomes of (i) an overview of the interests of different stakeholders on animal behaviour tracking and E-Track as a system, (ii) an analysis of the responses of a large number of users to a survey on animal tracking requirements and satisfaction, (iii) present detailed use cases obtained by interviews with users and (iv) deduct from the thus acquired insights how E-Track can position itself as an important player for the tracking of animals with GNSS.

Summarising the goals of E-Track, we emphasize our focus on improving position accuracy of GPS positions with EGNOS and EDAS. Such data will enable us to improve the understanding of small-scale movement, social interactions between individual animals and the process of disease spread. Additionally, we aim to develop an innovative software package that includes tools for general movement track visualisation and analysis, but also behavioural detection. Finally, hardware and software components are designed to interact automatically, preventing data loss or the need for reformatting.

In our stakeholder analysis we list five groups that are important to consider for the E-Track project: system developers, hardware and software providers, a group influencing system acceptance, funding agencies and the large group of users. The interests of most of them are positive towards the E-Track system as we envisage it, as it will enable scientists to receive better data and to get more out of them. Users are discussed to have one of the strongest interests in E-Track, but are often restricted by funding possibilities.

The user survey that we performed specifies the requirements on the E-Track system to improve the work of different user groups. Most responses are from wildlife scientists, but some also from livestock farmers. However, requirements overlap often. The greatest shortcomings of animal GPS tracking, as indicated by the survey respondents, are battery life and tag prices. Those limitations affect possible sample sizes that can hamper the conclusiveness of results of scientific studies and management questions. Additionally, a large proportion of survey respondents would like to improve positions accuracy with differential augmentation methods as EGNOS, but many were not aware of its availability.

In terms of software requirements, needs are still dominated by simple visualisations, overlay with environmental information, movement statistics and home range analysis. However, also the automatic detection of behavioural states of the tracked animals was met with some enthusiasm. Often the availability of additional accelerometer data was stressed as interesting. Additionally, data loss and reformatting requirements were mentioned as shortcomings, emphasizing the necessity of an end-to-end hardware-software system, where the two components interact remotely.



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Use cases also reflect the above mentioned issues, however often system specific problems become limiting. These are, for example, tag attachment, reliability of battery life time and the compatibility of hardware and software systems. Also the need for additional sensor data, like depth or acceleration has been pointed out. This underlines how flexible animal tracking systems need to be, in terms of tag as well as software development.

The requirements and limitations are finally summarised in a requirements specification analysis and in terms of a MoSCoW framework the E-Track system is specified. Requirements that must be fulfilled are, for example, reliable position determination with accuracy augmentation, maximal battery life, highly informative visualisation, standard movement statistics and home range analysis, behaviour detection tools and ease of use with a hardware-software interface. Out of the scope of this project are however the inclusion of additional sensors, like for heart rate, proximity or hormone measurements. The inclusion of other components might be ruled out by price considerations, as costs that users find acceptable for GPS tags and analysis software were specified rather low.

Finally, we discuss the variability of different stakeholder positions and user requirements, define limitations and conclude with different aspects of feasibility and applicability of E-Track.