**RESEARCH PROPOSAL FORM**

*(also referred to as the ‘Statement of Intent Form’, or SOI)*

***To be submitted by the researcher to the Institute Research Sub-Committee (IRC)***

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| **Research Title:**  Research on Remote Sensing Applications in Malta | |
| **Institute name**  Institute of Information & Communication Technology | |
| **Course / Programme:**  B.Sc. Software Development (Hons.) | |
| **Level and year of study**  Level 6 Year 3 | |
| **Main area of study being proposed:**  By using existing satellite data publicly available, this research aims to find different methods of monitoring and analyzing different scenarios relevant to the Maltese islands by looking through the unique perspective that remote sensing has to offer. This study will also look into combining the technology and instruments of other satellite/s in order to provide a wide and reliable range of methods and readings depending on the situation required at hand. | |
| **Name of Researcher:**  Massimo Darmanin | **Researcher’s I.D. Number:**  0277596M |
| **Signature of Researcher** | **Date of submission of Form**  07/06/2021 |
| **Name of Tutor (or Recommended Tutor):**  Frankie Inguanez | |

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| **Personal Motivation for the Choice of Research Theme.** |
| This research aims to provide an answer to the problem by providing evidence and use case scenarios of how remote sensing is of benefit to this island. Prior to the Sentinel Missions, publicly available remote sensing satellites where not accurate and precise enough to be considered a viable standalone option for Malta due to its very limited size. |

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| **Outline of Key Literature and Theoretical Framework or Propositions.** |
| High Resolution land cover is an important key data required by policy makers around the world to better understand existing development while protecting natural resources in countries, cities and towns. Until now, Malta has used very limited methods in order to cater for this problem.  A research conducted by G. Kuc and J. Chormanski (2019), showed an example of a high-resolution image of a built up area in a part of the city of Warsaw. This image was mapped by combining specific bands available from Sentinel-2 called NDVI (Normalized Difference Vegetation Index). The NDVI ratio was calculated by combining the visible wavelengths and near-infra-red wavelengths. It is cited that NDVI can be altered further to produce a cleared mapping of built-up areas. This was achieved by using the Normalized Difference Build-up Index or NDBI as it highlights urban areas with a higher reflectance in the shortwave-infrared spectral range (SWIR).  An article by S. B. KV, A. Roy, and R. Aggarwal (2018) at the United Nations University Institute for the Advanced Study of Sustainability shows that, NDVI can be modified even further. Variants of NDVI were used in order to map the severity of the burned area over Uttarakhand districts. The variants used in this study were the Differenced Normalized Burn Ratio (dNBR) and Relativized Burn Ratio (RBR) which were then calculated and cross referenced with active fire points. NBR index varies from -1 to +1, with healthy vegetation showing high reflectance in NIR regions while burnt areas show low reflectance. By contrast, areas that are burnt will show a higher reflectance in the SWIR region while health vegetation will show lower reflectance.  Studies from the University of Debrecen in Hungary by S. Szabo, Z. Gacsi, and B. Balazs (2016), determined that NDVI could also be used to map water bodies efficiently. In this research, the index was split into two sub indices, NDWI(Normalized Difference Water Index) and MNDWI (Modification of Normalized Difference Water Index). It was noted that all three indices more or less behaved similarly. However, NDVI and MNDWI was better at mapping visually water bodies and dense vegetation than NDWI. MNDWI however, was found that it enhanced water features such as ponds and rivers, which justified visual observations. |

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| **Significance of the Study.** |
| This research aims to explore new and existing techniques of remote sensing to document and monitor the Maltese islands by looking at different real life scenarios which are relevant to Malta, providing valuable insightful data which conventional methods lack. This study may also further promote future space research of the Maltese islands. |

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| **Hypotheses and/or Research Question/s** |
| While Remote sensing has come a long way from its infancy, there are still some major hurdles one can face when monitoring a small island compared to vast lands and features commonly found elsewhere in the world. However, certain techniques and features can still be resourceful such as monitoring and assessing fires in forested areas, monitoring urban development and keeping tabs on water bodies in the Maltese islands.   * Is remote sensing a viable option for Malta? * What are the applications of remote sensing best suited for Malta? * Are these options reliable? |

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| **Target Participants and Research Methods for Data Collection and Analysis** |
| Public satellite image data will be collected as a data set. This dataset shall only feature images of the Maltese islands. A cloud coverage mask will be used to help filter out cloudy images which will result in a cleaner dataset. In order to reduce the size of the data, any other land or sea areas will be removed. Each study area will be mapped using QGIS, an open-source geographic information application, which automatically assigns geospatial data into a geojson file. This geospatial data is used to focus on a specific area of the previously downloaded data.  By creating custom classes, using python and its open source libraries, the dataset will be computed according to the scenario and generate visual representations of the data. Each scenario will feature an RGB image which shall be compared with their respective scenario visualization method.  Data computed from the dataset shall be used in order to complement the scenario at hand by providing insights of the possibilities the technology can achieve. |

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| **Anticipated Contributions of the Study.** |
| * Provide new and/or alternative methods to document and monitor the Maltese islands depending on the scenario. * Shed light on new insightful data previously overlooked which might be useful in certain situations. * Improve Maltese space research. |

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| **Dissertation Project Plan.** |
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| **Ethical Considerations.**  **Refer to *guidance points below. You are also additionally required to read MCAST Document 074 ‘Research Ethics Policy and Procedure’ that is available on the College website via link*** [***http://www.mcast.edu.mt/179***](http://www.mcast.edu.mt/179)  *Research shall be conducted in such a manner so as to avoid any psychological and physical harm to humans and animals and financial damage to organizations:*   1. *Only the supervisor and examiners will have access to any data gathered.* 2. *Participants will remain free to withdraw from the study at any time without having to provide any reason. In the case of withdrawal, all the records and information collection will be deleted.* 3. *The participant, who is the sole proprietor of the data provided, is granting that such data would be processed for this study purposes only.* 4. *The data collection process will be a transparent process.* 5. *All transcriptions and/or electronic recordings reflecting the data collected, once exhausted, are to be deleted* 6. *Confidentiality, anonymity and data protection procedures are to be ethically abided by.* 7. *The researcher would provide a soft copy of the study to the participant, if required.* |
| *Enter details here regarding possibility of issues regarding confidential personal data:*  There will be no personal data as risk since the data being used in this research is public image data. Therefore no qualitative or quantitative forms of research shall take place. |
| Enter details here regarding possibility of physical harm:  Since this study will be fully operated by a computer, there are no hazards present. This section is not applicable. |
| *Enter details here regarding possibility of moral harm:*  No moral harm will be caused as this research is only focusing on image processing of public data. |
| *Enter details here regarding possibility of business harm:*  Since the image data processed will be only limited to the land itself of Malta, gathered from public domain, there shall be no possibility of business harm. However it could provide valuable insight on how to plan our future and dictate certain policies related to the scenarios provided. |

**List of Key References:**

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| 1. G. Kuc and J. Chorma ́nski, “Sentinel-2 imagery for mapping andmonitoring imperviousness in urban areas,”International Archives ofthe Photogrammetry, Remote Sensing and Spatial Information Sciences,vol. 42, no. 1/W2, 2019.  2. S. B. KV, A. Roy, and R. Aggarwal, “Mapping of forest fire burnedseverity using the sentinel datasets,”International Archives of the Pho-togrammetry, Remote Sensing and Spatial Information Sciences, vol. 42,p. 5, 2018.  3. S. Szabo, Z. G ́acsi, and B. Balazs, “Specific features of ndvi, ndwi andmndwi as reflected in land cover categories,”Landscape & Environment,vol. 10, no. 3-4, pp. 194–202, 2016. |

***This section is to be filled in by the representative of the Institute Research Sub-Committee (IRC) prior to forwarding of this Form to the ‘MCAST Research Ethics Committee’ for final ethics approval:***

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| ***Nature of Ethical Consideration*** | ***Outcome (Tick)*** | ***Comments/Advice*** |
| All ethical issues have been adequately tackled. |  |  |
| Possibility of issues regarding misuse of data or some form of harm. |  |  |

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| **Details of Representative to the Institute Research Sub-Committee.** | |
| Name | Signature |
| Designation | Date |

**Annex 1: Participant Information Letter**

***Sample: ***

**Title of Research: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

You are being invited to take part in a research study. Before you decide to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

**What is the purpose of the study?**

This research is being undertaken on…

**Why have I been chosen?**

You have been chosen because…

**Do I have to take part?**

It is up to you to decide whether or not your take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a corresponding consent form.

**What will happen to me if I take part?**

You will then be given a questionnaire on.../your data will be used…/your image will be used…

**What are the possible disadvantages and risks of taking part?**

There are no disadvantages or risks foreseen in taking part in the study.

**What are the possible benefits of taking part?**

By taking part you will be contributing to the development of a set of recommendations for…

**What if something goes wrong?**

If you wish to complain or have any concerns about any aspect of the way in which you have been approached or treated during the course of this study, please contact…(researcher is to give his/her MCAST email as a contact)

**Will my details be kept confidential?**

All information which is collected about you during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information and will not be shared with any other individuals. Participants should note that data/images collected from this project may be retained and published in an anonymized form. By agreeing to participate in this project, you are consenting to the retention and publication of data.

**What will happen to the results of the research study?**

The results will be written up into a dissertation for my final project of my Bachelor…

**Who is organizing the research?**

The research is conducted as part of a degree in …

**Who may I contact for further information?**

If you would like more information about the research before you decide…(researcher is to give his/her MCAST email as a contact)

*Thank you for your interest in this research…*

**Annex 2: Participant (or Guardian) Consent Form**

***Sample: ***

**Title of Research: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Name of Researcher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

# Please initial box

1. I confirm that I have read and understand the Information Letter

for the above study and have had the opportunity to ask questions.

1. I understand that my/my charge’s participation is voluntary and that I/my charge am/are free to withdraw at any time without giving any reason.

3. I agree to allow my daughter/son/charge to take part in the above study.

*(Statement 3 is to be included only when guardians/parents are involved in giving consent)*

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Name of Participant/

Guardian Date Signature

Researcher Date Signature

*1 for participant; 1 for researcher*