



## MS809 Enterprise Systems

### Assignment Cover Page

Group Members (Group 200)			
ID Number	First Name	Surname	Class Code
19230665	Devanshi	Thakkar	MBY
19230487	Jayakarthi	Boovendren	MBY
19230845	Karan	Mudaliar	MBY
19230063	Muthu selvi	Manikavasakam	MBY

#### Group Leader Contact Details\*:

First Name	Surname Name	Mobile Number	Email Address
Muthu selvi	Manikavasakam	0894934829	m.Manikavasakam1@nuigalway.ie

\* Occasionally it is necessary to contact individual groups. Having this information to hand greatly speeds up the process.

#### First Turnitin submission details:

Date	Time	Similarity %
31 <sup>st</sup> March 2020	15:36	14%

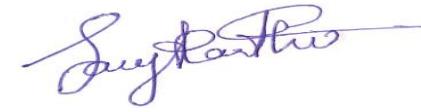
## Statement of Academic Honesty

### Notes to the Candidates:

1. No assignment will be accepted without a signed and dated copy of this declaration.
2. Complete the form below. Type all but the signature.
3. Photograph the section below.
4. Delete and replace with the photograph from step 3.
5. Failure to comply with the items above will result in no grade being awarded.

*We hereby declare that the work submitted is entirely our own, and that ideas or extracts taken from other sources are properly acknowledged and referenced. Furthermore, we acknowledge that we have read and understand the NUI Galway Code of Practice for Dealing with Plagiarism (<http://www.nuigalway.ie/plagiarism/>).*

### Complete, Photograph and Replace

Group Number: 200		Date: 31/03/2020		
ID Number	First Name	Family Name)	Class Code eg 1BC1	Signature
19230665	Devanshi	Thakkar	MBY	
19230487	Jayakarthi	Boovendren	MBY	
19230845	Karan	Mudaliar	MBY	
19230063	Muthuselvi	Manikavasakam	MBY	

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## **Part B**

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Presentation

# Title Page

27 January 2020 03:10



**NUI Galway**  
**OÉ Gaillimh**

**MS809 – Enterprise Systems**

**SMART Galway – A Technology Driven Initiative**

## **GROUP 200**

**Muthuselvi Manikavasakam : 19230063 (Team Lead)**

**Devanshi Thakkar : 19230665**

**Jayakarthi Boovendren : 19230487**

**Karan Mudaliar : 19230845**

# PROJECT CHARTER & WBS

03 February 2020 12:00

## PROJECT CHARTER

### Group 20 - Team Contract

Date: 28/01/2020

Project Name: 'Remodeling Galway' – Technology based evolution

### Project Team Members' Names and Sign-off:

Name	Student ID	Date	Signature
Muthu Selvi Manikavasakam ( <b>Group Leader</b> )	19230063	28/01/2020	Muthuselvi
Jayakarthi Boovendran	19230487	28/01/2020	Jaykarthi
Devanshi Thakkar	19230665	28/01/2020	Devanshi Thakkar
Karan Mudaliar	19230845	28/01/2020	Karan Mudaliar

Code of Conduct: We will:

- Work as a professional team with integrity in our work
- Adhere to maintain authenticity in our work and ideas by ensuring minimum plagiarism

Participation: We will:

- Act as a cohesive team and put in equal efforts in completing the project. In simple terms, tasks will be shared equally among the team based on the area of specialization of individual team member. For task allocation and tracking, will be using WBS and FreedCamp Software, where WBS contains the List of Task and Subtasks, number of hours required for completion of the task and deadlines.

Communication: We will:

- Be using Microsoft Teams for internal discussions
- Organizing team meetings, where a meeting invite will be by the Team Leader through Microsoft Teams and a face to face group meeting will occur on every Monday for 45 minutes. (Time/Place details will be shared in the calendar invite)
- Actively listen to every team member's viewpoints during the meetings
- Minutes-of-Meeting document (MOM) will be maintained by the team members on rotational basis in Microsoft OneNote. The MOM documents contain the description of the meeting, date and time, participants and information on the ideas discussed, tasks allocated and the decisions made. MOM OneNote Link: [https://nuigalwayie-my.sharepoint.com/:o/g/personal/m\\_manikavasakam1\\_nuigalway\\_ie/ErjCh1hgplxBuPyOJsGV230BD3ZhqlNtYQdF4fQIY-20g?e=NfQasw](https://nuigalwayie-my.sharepoint.com/:o/g/personal/m_manikavasakam1_nuigalway_ie/ErjCh1hgplxBuPyOJsGV230BD3ZhqlNtYQdF4fQIY-20g?e=NfQasw)
- Based on the outcome of the meeting User Stories & Task list and its respective owners & deadlines will be updated in 'Freedcamp'. Team will update the progress of the task in the below link and add necessary comments.  
[https://freedcamp.com/Group\\_20\\_a5F/Remodeling\\_Galwa\\_3WU/todos](https://freedcamp.com/Group_20_a5F/Remodeling_Galwa_3WU/todos)

**Problem Solving:** We will:

Adopt ‘Lean Problem-Solving technique’, a structured approach to resolving problems.

(<https://www.infoq.com/articles/lean-problem-solving/>, n.d.)

As Lean team members,

- The team leader prioritizes the tasks (Plan) and assigns them to the team members
- Each week, the team commit to working on the allocated task (Do)
- Once a task is completed, peer review is done (Check) and comments are provided

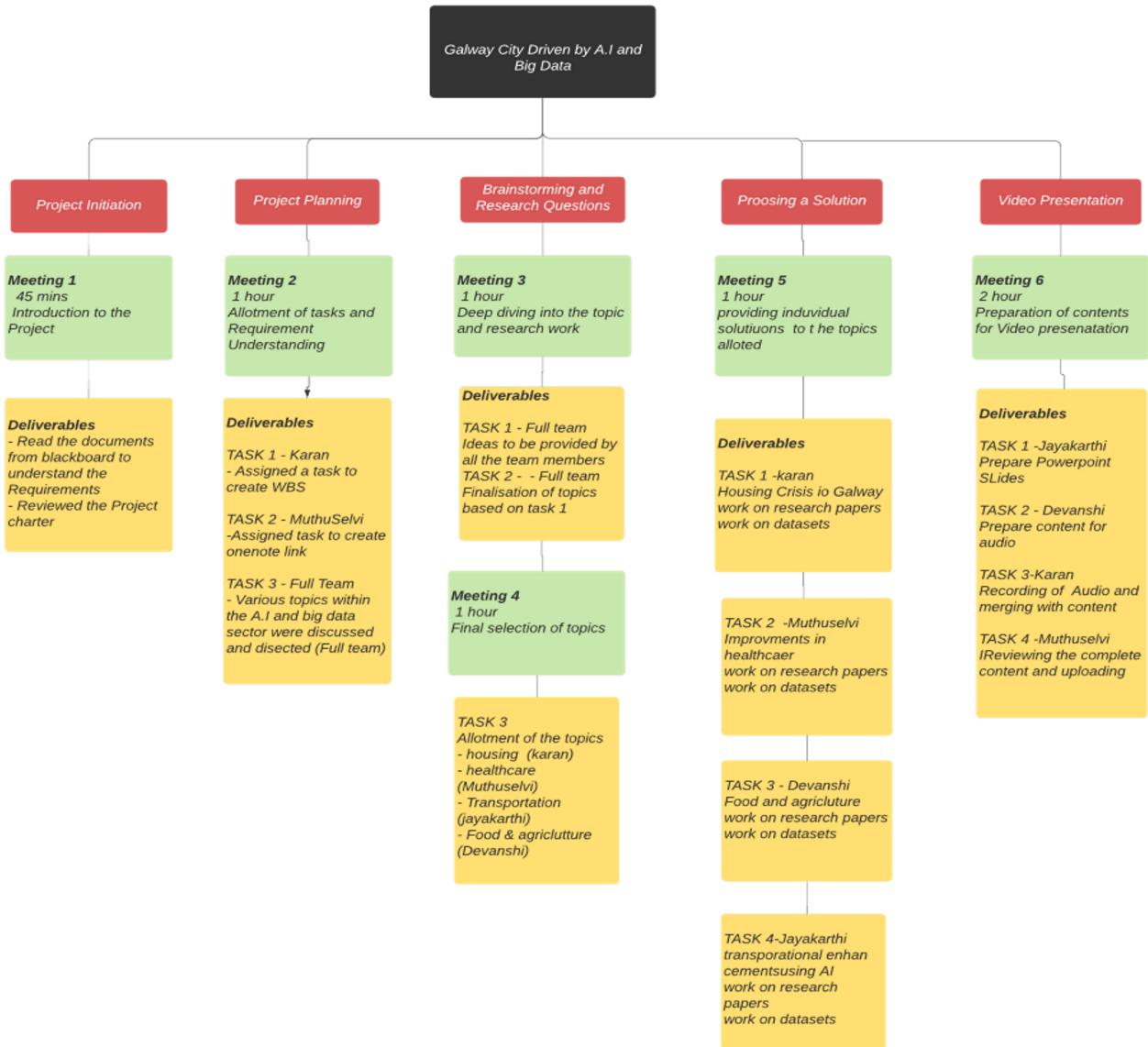
For the same, we will be using the below link,

[https://freedcamp.com/manage\\_combined/view?groupid=1084976&projectid=2597568](https://freedcamp.com/manage_combined/view?groupid=1084976&projectid=2597568)

**Meeting Guidelines:** We will:

- Create and send a proper calendar invite for every meeting using Google Calendar. The invite will clearly state the description of the meeting, venue, timings and participants. Furthermore, a Google Meet link is embedded in the invite for video conferencing, in case public holidays or if any of participants can't physically attend the meeting at the university.
- A structured agenda for meeting is shared through OneNote drive prior to the meeting day and the shareable link of the agenda is also included in the meeting invite
- Share the current progress of the tasks assigned and decide on the tasks that need to be completed before the next meeting. For this purpose, we will be using ‘Freedcamp’ – a project management collaboration tool.

## Work Breakdown Structure



# MEETING 1 - Initial Meeting

14 February 2020 06:28

Minutes of Meeting:

Duration - 60 mins (from 12.00 to 1.00 pm)

Participation - Entire Group

Location - J.E Cairnes

Outcome:

- Discussed about MS809 Enterprise system Group Assignment related documents available under Blackboard and understood the project requirements.
- Discussed about different type of issues currently available in Galway.
- Everybody agreed that compared to other cities, Galway is a small town which lacks technological advancement. And using technology we can make people life easier thus making Galway a SMART city.
- Karan proposed that finding a Apartment or House is really a problem in Galway.
- Devanshi quoted that she feels because of the climate in Galway there will be lot of problems in Agriculture sector.
- Karthik proposed that we need to explore different technologies like Big Data, Artificial Intelligence, IOT & Blockchain technologies which can definitely help to shape up Galway as a smart city.
- For the next meeting, everyone should come up with issues that are currently available in Galway.

The image shows two calendar interfaces side-by-side. The left calendar is a standard light gray design, showing the month of January 2020 and the beginning of February 2020. The right calendar is a dark-themed design, showing the same period. In the dark-themed calendar, the 14th of February is highlighted in blue and labeled '14'. A green box on the right calendar contains the following text:  
**Enterprise Systems Meeting**  
J.E Cairnes School of Business  
Manikavasakam, Muthu Selvi

# MEETING 2 - Brainstorming

17 February 2020 18:02

## Minutes of Meeting:

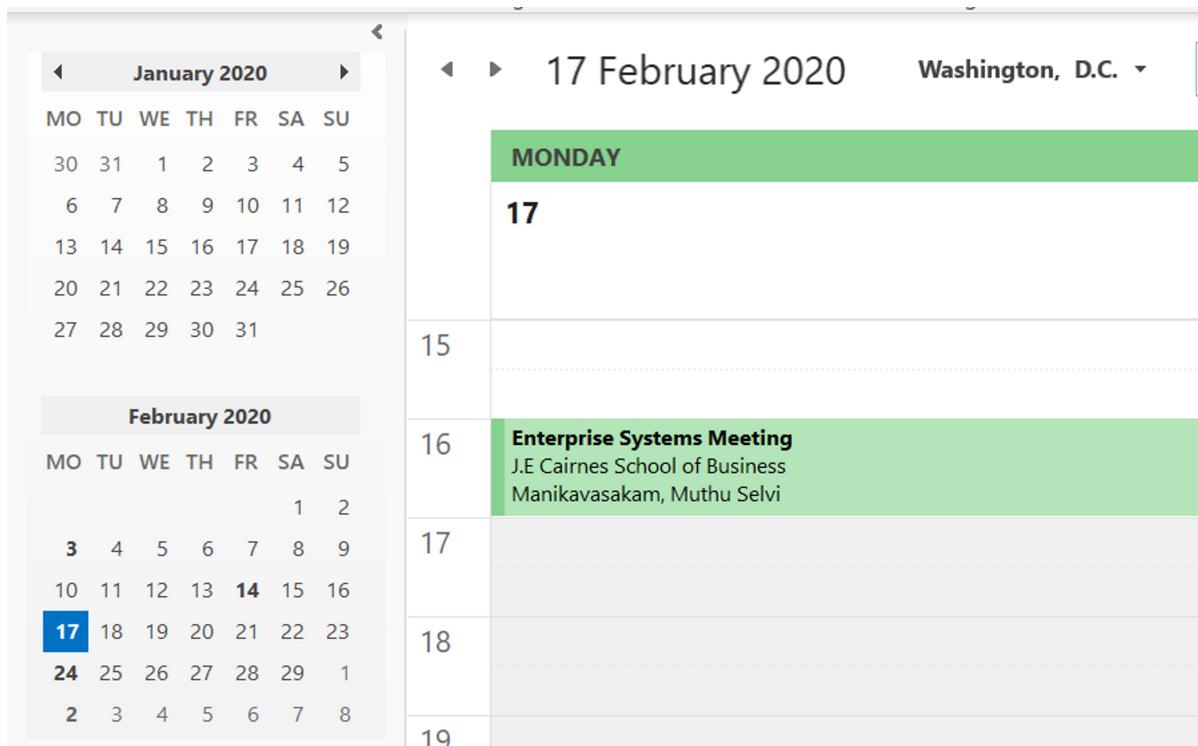
Duration - 60 mins (from 4.00 to 5.00 pm)

Participation - Entire Group

Location - Microsoft Teams

## Outcome:

- Karan proposed a research question on "How to help International Students with their accommodation in Galway". Team debated what type of technology we can use to achieve this and to what extent it will really help the students.
- Muthu stated few facts about current Health care system in Galway and how they really lack advanced technology compared to other cities.
- Devanshi researched about agriculture in Galway and stated using technology we can increase the production of crops, vegetable, fruits etc.
- Karthik proposed that currently because of Galway population existing transport systems looks fine. But if the population is increased every year a new advance transport system should be needed.
- We discussed about IOT and its current impact in the society.
- Finally, we agreed that we would look further into other areas and come up with interesting questions in the upcoming meetings.



# MEETING 3 - Brainstorming

24 February 2020 12:02

## Minutes of Meeting:

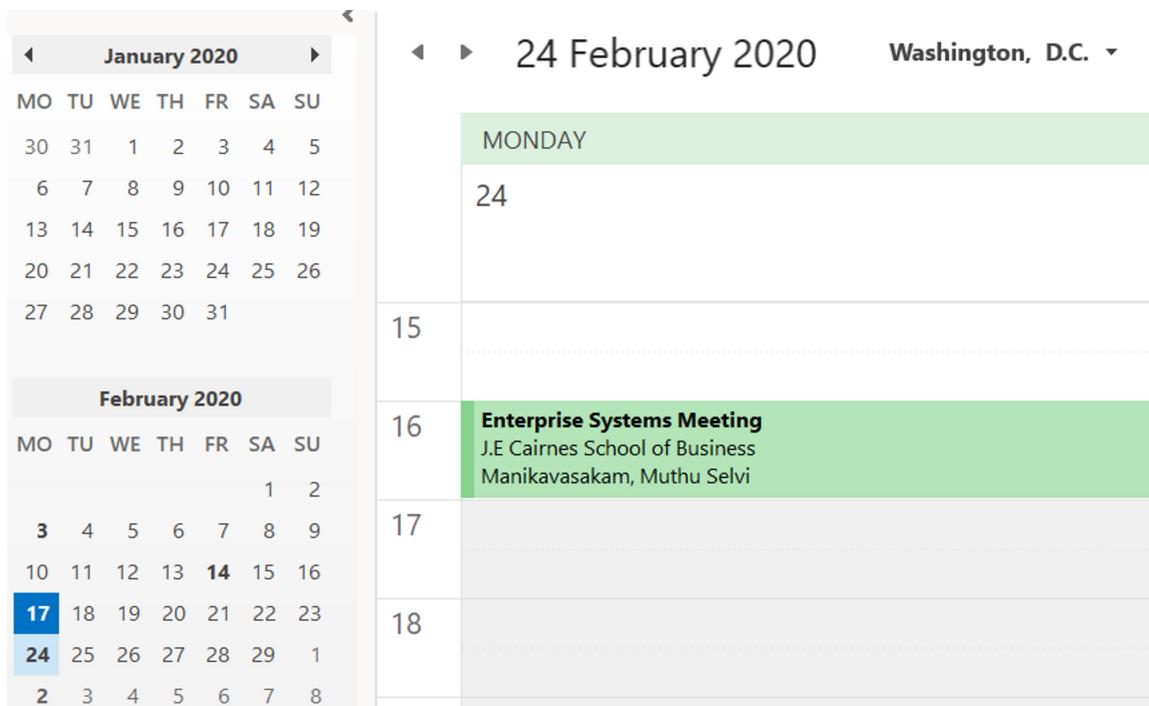
Duration - 60 mins (from 4.00 to 5.00 pm)

Participation - Entire Group

Location - J.E Cairnes

## Outcome:

- Karan & Muthu started the meeting by present their research idea.
- Karan explained how implementing a database to store student's location details in a database can help to find new apartment for students.
- Muthu stated that Galway hospital lacks advanced devices/interfaces which can be created using Artificial Intelligence.
- Karthik wants to explore the opportunities of Big Data on Galway Transportation and depict how Big data optimizes existing transport system.
- Devanshi proposed that agricultural sector can be more improvised by predicting the future production of food and crops by collecting data from the type of land, quality of seeds, pH level of soil and also by analyzing data fetched from various sensor based devices use in farming such as tractor etc.
- Finally, we agreed that we will come up with research question in the next meeting.



# ANNOTATED BIBLIOGRAPHY

01 March 2020 04:00

## BIG DATA IN HOUSING :

- ANNOTATED BIBLIOGRAPHY FOR RESEARCH QUESTION

Cunningham, E., Cunningham, E., Cunningham, E. and Farragher, F., 2020. Galway TD: 'Worst Housing Crisis For 40 Years'. [online] Connachttribune.ie. Available at: <<https://connachttribune.ie/worst-housing-crisis-for-40-years-990/>> [Accessed 25th February 2020].

*In this article the author provides us with the state of affairs of the current situation of Housing in Galway. Galway is one of the Prime destinations for quality education with in Ireland as there are multiple institutes within this small city. The National University of Ireland in Galway which is amongst the top 1% of the universities in the world and is a hotbed for students across the world. The population of the city stands at 80,000, while NUIG itself is home to about 19,070 students (as given in the university student report 2018-19). Though only a part of this is counted in the population census, but the sheer number itself indicates that Galway is a student city. As sourced from an article written by Andrew Hamilton for the Irish Times, according to Andrew's analysis Galway lacks by 3000 houses and there are at least 4,500 families on the waiting list. To add to this list is every growing student population. This led to the curiosity to build a possible solution to this crisis.*

- ANNOTATED BIBLIOGRAPHY FOR PROPOSED PLAN (2 ab)

Higher Education Authority, 2020. Student Accommodation Development Activity September 2019. [online] Construction Information services. Available at: <<https://www.education.ie/en/Publications/Policy-Reports/national-student-accommodation-strategy-progress-report-q3-2019.pdf>> [Accessed 25 February 2020].

*As understood from the article posted for the third quarter of 2019 by the government of Ireland, A different plan was constructed. A bottom-up approach can yield better results i.e. The accommodation's office can take up a pro-active modus operandi rather than having a post-active approach to helps students to find accommodation. By maintaining a database of – Current students, their addresses, details of owners. The data that can be used to create valuable insights are - Students, location of houses, lease term, Landlord details etc. By maintaining this data and using an optimized and Equitable distribution, NUIG will be ready, in advance, for at least 700-1000 international students coming in next term.*

## **BIG DATA AND AI IN HEALTH:**

- **ANNOTATED BIBLIOGRAPHY FOR RESEARCH QUESTION**

Mason, J., Morrison, A. and Visintini, S., 2018. An Overview of Clinical Applications of Artificial Intelligence. *CADTH ISSUES IN EMERGING HEALTH TECHNOLOGIES*, [online] (174). Available at: <[https://www.cadth.ca/sites/default/files/pdf/eh0070\\_overview\\_clinical\\_applications\\_of\\_AI.pdf](https://www.cadth.ca/sites/default/files/pdf/eh0070_overview_clinical_applications_of_AI.pdf)> [Accessed 24 February 2020].

*In this journal, authors talk about Artificial Intelligence, its emergence and how Artificial Intelligence is applied in the Health Sector. It explains in details about the various application of AI in clinical specialties and how AI have the potential to resolve numerous clinical problems with accuracy. Also this journal explains how AI is applied in Non-clinical but Health related applications such as research, drug discovery etc. Finally the journal concludes by stating that AI going to create huge impact on future Health care systems & delivery.*

- **Pollack, M., 2005. The Use of AI to Assist Elders with Cognitive Impairment. AI Magazine, [online] (26). Available at: <<https://www.aaai.org/ojs/index.php/aimagazine/article/view/1810/1708>> [Accessed 25 February 2020].**

*In this magazine, the authors particularly talks about how AI can help elderly people in different ways. Author categorizes the uses of AI for elderly into different categories such as Assurance systems, Compensation systems, Schedule Management & Assessment Systems. Each systems uses different AI techniques/devices and provides advanced care to the elderly. Finally author concludes to support aging population AI technology & techniques should be implemented and it is going to play an integral part in the future.*

- **ANNOTATED BIBLIOGRAPHY FOR PROPOSED PLAN**

Saolta University Health Care Group, 2018. Saolta University Health Care Group Operational Plan 2018. [online] Available at: <<https://www.hse.ie/eng/services/publications/serviceplans/service-plan-2018/operational-plans-2018/saolta-university-health-care-group-operational-plan-2018.pdf>> [Accessed 18 February 2020].

*This report provided by Saolta University Health Care group lists the their strategic developments for the year 2018-2023 and implementation of their new projects/ideas. Currently Saolta University Health Care Group have six hospitals under them and this report analyzes many factors suchs as census, finance, workforce to build a better Health care service for the people.*

## **BIG DATA IN FOOD AND AGRICULTURE:**

- **ANNOTATED BIBLIOGRAPHY FOR RESEARCH QUESTION**

Warner, J., 2020. *AGRICULTURE IS THE NEW BEE FOR BIG DATA ANALYTICS!*. [online] [irishtechnews.ie](http://irishtechnews.ie).

*Available At :* [Article Link](#)

*This artice emphasis on how Big Data innovation is a challenge and how Agriculture sector is not left behind either. Though the field of agriculture is less affected by any technological development, Big Data and AI are such powerful forces that can turn the agricultural domain. Farmers have relied mainly on a variety of different techniques to gather data on how to find the best crop to grow and how to grow it in the most efficient way. They walk their fields, pick a small portion of the soil to examine the moisture content and, after closely observing the plant leaves, they attempt to evaluate their health. However, for farmers to understand and appreciate technology, it is extremely important to collect crop information more rapidly and methodically, in greater amounts, for the sole purpose of transforming it into useful data.*

- **ANNOTATED BIBLIOGRAPHY FOR PROPOSED PLAN**

Ribarics, Pal. (2016). Big Data and its impact on agriculture. *Ecocycles*. 2. 33-34.  
10.19040/ecocycles.v2i1.54.

Available at: [Article Link](#)

*The viewpoint of this paper is to discuss the key roles that Big Data phenomenon play in agriculture, food processing with respect to environment, food quality and other similar issues. An increasing world population, evolving eating habits and unpredictable weather – just to name a few – are impacting today's and future agricultural growth. Rising production and maintaining food quality for nearly 10 billion people by 2050 will be a huge challenge. The Big Data trend will answer those questions. The author, Pal Ribarics has contributed to Oracle's strategic White Paper on the scope of Big Data in agriculture, and he outlines some of its core elements in this paper.*

Bronson, Kelly & Knezevic, Irena. (2016). Big Data in food and agriculture. *Big Data & Society*. 3.  
10.1177/2053951716648174.

Available at: [Article Link](#)

*In this paper the author has highlighted to that even small-scale farmers passively collect information from precision agricultural equipment and many farmers use information from large datasets and precision analytics to make on-farm decisions. The data obtained from tractors with sensors that stream soil and crop conditions data and the company invites farmers to subscribe (and charge) for information that can help them to with precision analysis. The information on tractors and tools are proprietary, and the data they collect is not freely available to farmers. The use of broad data sets and digital resources to collect, aggregate and analyze them – collectively referred to as big data – has the potential to wade into long-standing relationships between food and agriculture players (e.g., between farmers and agricultural firms)*

#### **BIG DATA IN TRANSPORTATION:**

- **ANNOTATED BIBLIOGRAPHY FOR RESEARCH QUESTION**

Hevin Özmen and Kim Hee. (2018). Leveraging Big Data for Managing Transport Operations [Online].

Available at: [Article Link](#)

*The article is about a LeMO research project that focuses primarily on understanding and mapping big data technologies in the transport sector. The author states that one of the critical factors for economic development in EU countries is to upgrade the existing transportation infrastructure. The paper proposes several opportunities and challenges of big data in transportation, by using: numerous subject matter expert interviews, applied case studies, and a literature review. Furthermore, the study aims to develop a large-scale sustainable transport system with affordable planning, control and evaluation costs.*

- **ANNOTATED BIBLIOGRAPHY FOR PROPOSED RESEARCH PLAN**

**Wolfram, M. (2004) Expert Working Group on Sustainable Urban Transport Plans, Deliverable D4, Cologne: Rupprecht Consult [Online].**

Available at: [Article Link](#)

*The research project, funded by the European Commission, revolves around various plans for sustainable urban transport development in the EU countries. The study focused on transport planning at different levels in 12 EU countries. Furthermore, the research incorporates the desired qualities for sustainable transportation alongside the drivers and factors that impact the development.*

**Transforming Transport (2020) [Online]**

Available at: [Article Link](#)

*Transforming Transport is an EU-funded project that serves as a secure connection between 48 leading transport, logistics and information technology stakeholders in Europe. The goal is to achieve mobility and logistics by leveraging big data using real-time, measurable and verifiable transport data.*

# RESEARCH QUESTION

08 March 2020 06:00

# SMART Galway – A Technology driven initiative

The research questions for four major Galway sectors that will be covered in the report and are as follows :

## BIG DATA IN HOUSING:

### ISSUES

- Student come to Galway with an average stay of **4-5 days** in a hostel, With the assumption that a house will be surely be found in the lovely city of Galway. But that is not the case to be. Finding a house in Galway during the month of August and September is arduous task.
- With more and more International students flocking into Ireland as their prime destination to pursue higher education, More so NUI Galway. The task becomes twice as more difficult
- Students mostly depend on word of mouth, whatsApp groups or facebook groups to sort things out of themselves. By this means an introvert would be left homeless or would have to pay an exorbitant amount of money to get a roof over his head. All the above-mentioned mediums have helped people find housing, past and present, but is that the most-optimized solution that we have at hand? Is a question to be asked.
- “The first impression is the best impression”, this phrase implies to institutions as well. The institution is equally responsible to make an international student feel at home as much as the student himself.

### PROBLEM STATEMENT

- How might we try to find a way to optimize the allotment of Housing for the students in order to provide them with better facilities by saving their time, money spent on finding a housing and rather help them focus on more important things such as education.

### CHALLENGES

- GDPR based issues
- Coordination of the Landlords
- Authenticity of the landlords (to avoid scams)
- Smooth transfer of money from student to owners

## **BIG DATA AND AI IN HEALTH:**

### **ISSUES**

- Senior Population ( age >65 years) in Ireland is expected to increase 23% by 2023. In Galway the elderly population (age > 65 years) has increased by 20% since 2011.
- If this percentage continues to grow then it will be difficult to provide health services to senior population. Currently there are 17 hospitals in Galway for 80,000 people and the total population is expected to increase to 1,00,000 by end of 2020.
- There is not enough facilities/hospital to provide specific care to the senior population in Galway.

### **PROBLEM STATEMENT**

- How to provide a Age specific Health care system for every person who is above 65 years in Galway?

### **CHALLENGES**

- Government Policies with respect to current Healthcare System
- Coordination between Hospitals, Senior Population and new health care system
- Proposed solution requires huge funding to implement in real time.

## **BIG DATA IN FOOD AND AGRICULTURE:**

### **ISSUES**

- A increasing world population, evolving eating habits and unpredictable weather – just to name a few – are impacting today's and future agricultural growth.
- To help manage supply chains, many agribusinesses are looking for ways to boost production methods and yields and boost forecasting.
- Gaining new insight through knowledge is vital for holding or rising product market share.
- With agribusinesses increasing in size and complexity, the rising volumes of data that need to be handled are also becoming more complex. And gaining new knowledge through this information is crucial with rising product market share.

### **PROBLEM STATEMENT**

- How will we improve production and achieve food and farming security by 2050 for what is going to be close to 10 billion people? How can we help the plants survive in ever changing weather? How can we help the farmers, from small farms to large-scale farms? And how do we ensure that the customer only gets high-quality, organic and healthy food?

### **CHALLENGES**

- Will have chunks of data related to soil, seeds climatic conditions, land type. Merging them together to form 1 concrete structure will be an issue.
- Farmers need to understand and appreciate technology to collect crop information more rapidly and methodically, in greater amounts, solely for the purpose of making it valuable.
- Identifying correlations between the farm type and the environment and producing data for efficient irrigation, fertilization, crop processing and efficient livestock feeding and marketing.
- Authenticity of the Data to avoid unnecessary predictions which may even rise to food quality degradation and loss of economy and crops.

## **BIG DATA IN TRANSPORTATION:**

### **ISSUES**

- Value for money, punctuality, length of time the journey taken and overall satisfaction with the journey are major issues in Galway affecting quality of life and impacting on the functionality of the City
- One of Galway's broadest problem is with the timeliness of the public transportation service.
- This concern is intertwined with the overall issues surrounding regular traffic congestion faced by city residents.
- There is limited public transport in Ireland, mainly in the country's major urban centres. Dublin, Limerick, Cork, Galway cities these all have their own commuter rail networks — Galway Commuter Rail has only one rail line linking Galway and the satellite cities of Oranmore and Athenry, and the bus transportation is the main mode of public transportation in all cities and major regional cities throughout the country.
- Galway has a transport problem because of its reliance on private vehicles, which were affected by the current public transport network, restricted cycling facilities, a wide rural hinterland and the main gateway to and from Connemara

### **PROBLEM STATEMENT**

- How can data analytics be applied to the contemporary transportation system in Galway to provide more amplified services to the public and promote economic growth while diminishing the limitations in the transport sector?

### **CHALLENGES**

- The performance and effectiveness of the transport sector relies significantly on the data that are primarily sensor-generated, flight schedules, weather data, GPS or traffic information.
- Proper computer algorithms architecture should be designed to avoid unnecessary havoc
- Privacy barriers like data privacy constraints (GDPR) — Employing Data anonymization techniques like Differential Privacy allows to obtain and share insights without compromising the privacy of the data
- Big data challenges as known as the 4V – Attention to details is essential in analyzing the size and type of data, type of storage and processing required.
- Lack of skilled professionals

# RESEARCH PLAN

09 March 2020 07:02

## **BIG DATA & HOUSING (provided by Karan Mudaliar)**

### **INTRODUCTION**

Galway is one of the Prime destinations for quality education within Ireland as there are multiple institutes within this small city. The National University of Ireland in Galway which is amongst the top 1% of the universities in the world and is a hotbed for students across the world. The population of the city stands at 80,000, while NUIG itself is home to about 19,070 students (as given in the university student report 2018-19). Though only a part of this is counted in the population census, but the sheer number itself indicates that Galway is a student city. As sourced from an article written by Andrew Hamilton for the Irish Times, according to Andrew's analysis Galway lacks by 3000 houses and there are at least 4,500 families on the waiting list. To add to this list is every growing student population. A proposed solution is given below

### **TARGET AUDIENCE**

- College (NUIG)
- Students, Families
- Landlords
- Brokers / middlemen

### **BASIC BUSINESS MODEL CANVAS**

#### ***Value proposition***

- A first of its kind model offered by any educational institute
- Value generation amongst students
- Precious time will be saved by students
- Precious Money will be saved by students
- A database that help maintain the location of students thus helping to create a virtual demographic map of where most students of the NUIG are located

#### ***Key activities***

- To allot housing to new incoming students
- To form an cohesive partnership with landowners so as to ease the allotment of housing Y-o-Y

#### ***Channels***

- College website
- University application
- Social media platforms (Facebook, Instagram, LinkedIn)
- Separate signups on websites for students and owners

#### ***Tech Used to build the proposal***

- Database setup ( MongoDB)
- A CRM tool – Eg:- Salesforce can be used to establish active communication between university-students and university -house owners
- Complete separate section has to be build within the university websites to facilitate the above given ideas (CSS and Javascript)
- Use of Microsoft azure

## **Approach**

There are '3 main elements' to finding a solution to this accommodation conundrum

- Students (Irish / international coming into Galway), Landlords (owners), NUIG
- NUIG is the fulcrum that holds onto the student-landlord equation
- Without NUIG there wouldn't have been students (plenty of them), without them the landlords (well they wouldn't be landlords)
- NUIG has an amazing 'accommodations support office', Our aim is to make it even better
- The college has a top down approach in terms of accommodations- problem solving I.e. The students try to find accommodation >> fails to find one >> comes to the accommodation's office for help
- A bottom-up approach can yield better results I.e. The accommodation's office pro-actively helps students to find accommodation
- There is volunteering available for over 100+ activities, but there isn't one for accommodations. Many of the activities are leisurely whereas accommodation is a real issue

## **CONCLUSION**

By taking a proactive approach rather than a post-active one, by building a database of students and dividing them on the basis of location

## **ARTIFICIAL INTELLIGENCE IN HEALTH (provided by Muthuselvi Manikavasakam)**

### **INTRODUCTION**

A Health Care Management system subdivided into below categories which are collectively implemented as Galway Senior Health Care Management System.

- Personal assistance
- Physical Interfaces
- Assurance Systems
- Schedule Management
- AI clinical applications

### **TECHNOLOGY**

The objective of Artificial Intelligence (AI) for Health care is to mimic human cognitive processes. AI techniques such as planning, knowledge acquisition and machine learning bring a radical shift to healthcare, driven by an increase in the healthcare data and technological advancements in analytical techniques and below are some of the main AI techniques which is used in the proposed new healthcare system for elderly.

#### **Machine Learning:**

To predict or detect diseases, trends & insights based on available data

#### **Neural Networks:**

An artificial neural network is a process of imitating the way the human brain learns using a computer model.

#### **Deep Learning:**

This technique analyzes complex data to predict the presence or absence of a disease accurately.

#### **Natural Language Processing:**

It is a process of understanding and interpreting human language, which is used to analyze a patients response and EMR data.

## **SOLUTION - Implementation of Galway Senior Health Care Management**

### **Personal Assistance:**

In this category, autonomous AI Robots are positioned in every Senior's House and this Robot can play three different roles such as **Assistive, Companion & Service robots**. These robots are programmed to respond to a set of pre-written questions/phrases, and the entire conversation can be stored in the cloud. Then using Case-Based Reasoning (solve new problems by reusing or adapting solutions) improved responses or useful insights is derived. It should also incorporate natural language processor, visual tracking, facial recognition and other AI-based behaviors which can help on day-to-day activities. (Broekens, Heerink and Rosendal, 2009)

### **Physical Devices/Interfaces for elderly users:**

Many people above 65 years may suffer from physical disabilities related to hearing, learning, mobility, mental health or cognition. AI technique helps to design products for every individual ensuring technology helps everyone.

**Visually impaired** - Driverless car which works with google map and AI was surrounding data collected by many sensors and cameras manipulated around the vehicle. Kapten Plus Personal Navigation System which speaks directions to the user.

**Mobility** – Electric wheelchairs built by capturing various signals (EMG, EOG & electroencephalographic) generated by muscles, eyes & brain and detect the type of command person is trying to think and use them as input command to the wheelchair. In other words, wheelchair operated based on facial expressions.

**Patient Monitoring** – Using sensors/biosensors patient's activity and current emotional state can be captured.

(Creed, 2016)

### **Assurance Systems:**

Assurance systems for the elderly may be necessary notifications to automated controlled networks. These include Lighting controls, Retrofit automatic door opening systems, Automatic curtains and blinds, Wireless socket control systems, Powered cupboards & Entry control systems.

(Hassan and Mumtaz, 2020)

### **Schedule Management:**

Schedule management systems remind people when to take their medicine when to eat meals when to take care of personal hygiene, and so on. It uses AI technologies and Reinforcement Learning to update and provide reminder according to user needs. It should be implemented as a PDA (personal digital assistant).

### **AI clinical Applications:**

#### **Radiology and Imaging**

The primary focus of AI in radiology is to assist imaging professionals in the reading and explanation of images. AI make predictions when interpreting images at a competence level similar to that of a physician. Deep learning tools that automate the extraction and categorization of imaging characteristics with power and speed that assists in diagnosing stroke using CT and MRI neuroimaging.

#### **Oncology**

AI is improving its participation in oncology, particularly in cancer-based cognitive computational systems. Cognitive computational mimics the functioning of the human brain by enforcing machine learning algorithms to realistically simulate thought processes using data mining, pattern recognition and natural language processing.

## **Genetics and Genomics**

Machine learning is widely used to identify patterns in DNA combinations that can accurately predict a patient's chance of developing a disease and recognize root causes to facilitate the development of targeted therapies.

## **Neurology**

In the field of stroke, the incorporation of AI algorithms that identify early signs of heart attack using motion sensor devices which can discriminate between normal resting and heart attack-related paralysis which is used for early stroke prediction.

## **Diabetes Care**

A screening tool using AI can be developed using AI, which will consider older people's family history, waist circumference & physical activity and predict Diabetes. Diabetes comes under active machine learning research complication concerning Diabetes from person to person can be identified at an early stage.

## **Eye Care**

Deep learning to distinguish stable eyes from eyes with age-related macular degeneration and foresee heart disease from retinal fundus images, and the use of neural networks to automate age-related rheumatoid arthritis, glaucoma screening and cataract diagnosis.

## **CONCLUSION**

Ireland's Government Agency, Health Service Executive should create a new policy for Elderly care & fund this new Health Care System. This initially should be implemented for selective crowd and based on the feedback & results this can be built to cover entire Senior Population in Galway. Also, a dedicated team of AI & Analytical can be formed to implement this solution.

## **REFERENCES**

1. Broekens, J., Heerink, M. and Rosendal, H., 2009. *Assistive social robots in elderly care: a review*. *Gerontechnology*, 8(2).
2. Creed, C., 2016. *Assistive tools for disability arts: collaborative experiences in working with disabled artists and stakeholders*. *Journal of Assistive Technologies*, 10(2), pp.121-129.
3. Hassan, M. and Mumtaz, N., 2020. *AI in Assisting the Elderly and People with Disabilities*. *IJRE*, 03(08).

## **BIG DATA IN FOOD & AGRICULTURE (Provided by Devanshi Thakkar)**

### **INTRODUCTION**

Data is a growing part of our lives. The massive amount of data is being produced, and their use is becoming increasingly widespread. The ability to access, evaluate, and handle vast quantities of data is increasingly critical to lead agribusinesses' effective activities. Many agribusinesses are looking for ways to boost production methods and yields. Gaining new insight through data is vital for holding or rising product market share. With agribusinesses increasing in size and complexity, the rising volumes of data that need to be handled are also becoming more complex.

Big Data analytics is about searching for and rectifying the smallest of errors in these large complex datasets, so the technology helps farmers and many agribusinesses to take the crop quality and quantity to a new height!

## **Data Sources**

Data used for the analytical process in farming and agriculture can be collected from various sources as listed below.

- Farm devices sensor data (e.g. tractor having a sensor to check the quality of soils, seeds etc.)
- Agriculture land data (e.g., location, sunlight, humidity)
- The livestock that feeds on these crops data (e.g., soil worms, mice)
- Historical Harvested crop data
- Commodities trade data
- Financial And Market trend data
- Weather And Climatic data
- Animal and plant research data
- Consumers trend data

## **TARGET AUDIENCE**

- Farmers
- Agribusiness owners
- Wholesale Marketers
- Consumers

## **TECHNOLOGY**

### **Machine Learning**

To keep a track and predict the data related to soil, seeds, fertilizers over a while and provide real-time alerts

### **Centralized Data System**

All the data collected with respect to the fertilizers, soils and climatic conditions needed to cultivate high consumer crops must be integrated into a single master data source. They can be accessible to all farmers anywhere in the world.

### **Visualizations / Graphics**

Visualizations and graphics tools can provide trend visuals of the quality of crops over the coming years based on the future climatic conditions etc. which will integrate production and business performance data for improved decision making

### **Impact :**

Below 3 are the ways through which big data technology can transform the food and agriculture industry :-

#### **Optimum Crop Forecast:**

The farmers spend a great deal of their time thinking about how the crops turn out to be. Over the years, crop forecasts have to be accurate. Using high-end and useful computer algorithms to study the decades and at times stretches of weather and crop knowledge, today's farmers should be able to predict the yields with absolute precision, even without Big data analytics expertise allows farmers to implement and harvest their crops at the right time, and this helps optimize the harvests. It will provide real-time decisions and alerts based on these data. Farmers are often obliged to spend a great deal of time thinking about their harvest. But accurate crop forecasting is saving them from the burden of sometimes worrying about their harvest.

### **Precision farming:**

The new way to grow crops is through precision agriculture or automated farming. Nevertheless, there is no question that farmers have used several different methods over the years to automate and keep track of a variety of farming procedures. And, now, big data analytics tools too shall split the commercial farmers from the pack altogether. Recent advances in Big Data have led to AI, internet, drone technology to reach a new stage of agricultural automation! Even drones with cutting-edge sensors can now be used by farmers to survey crops, keep their data updated and warn them about areas that need improvement. The technology is growing rapidly and is expected to switch from measuring to even planting and harvesting.

### **High-quality seeds and minimized hunger:**

Recently, it has been reported in some reports that increasing foreign population along with rising temperatures has led to an enormous famine in Africa that has threatened starvation for 20 million people. Throughout the planet, philanthropic teams have trained to assist as best as they can, but the resolution could be in big data. For decades, researchers and agricultural scientists have been looking into plant data in the hopes of growing crops that can be grown in any climate. Thanks to recent developments, we can grow plants faster, bigger and healthier than ever before. Chemically engineered seeds that are nurtured with big data that sound terrible, but the seeds generated with data analytics have the power to end global hunger.

### **Ethics Of Big Data In Agriculture**

Farmers constantly have to disclose their most intimate farm details to gain access to the advantages of technology. At the same time, those who turn the data into valuable knowledge say little or nothing about the back-end processes or whether or where the knowledge will be stored or used. With wireless sensors on tractors tracking or dictating any decision a farmer makes, large agri-businesses can now collect vast amounts of previously proprietary farming data, allowing for a privileged position with specific field-by-field insights. This power asymmetry must be rebalanced for use in the public domain utilizing open-sourced data and publicly funded data analytics tools of equal sophistication and creativity.

### **CONCLUSION**

Big data analytics has made a notable impact in the field of agriculture, but it is difficult to pin down all its implications and still hard to predict what more change it might bring. But Big Data's Effect on farming would be exciting and beneficial to farmers. It's just that farmers need to implement new Big Data-enabled technologies to use Big Data analytics to the full. And, for this is also a requirement to make farmers aware of Big Data's power planning seed inland and in what capacity it can help them grow better crops! It is an era for a new Agricultural Revolution. Building on the initial achievements of the first Green Revolution of the 1960s, what is desperately needed is a significant and sustainable increase in worldwide agricultural production. We face the challenge of feeding 10 billion people by 2050, while already exceeding our planet's ecological limits today. We need innovative, sustainable solutions that reduce the agricultural footprint on the climate. All of these can be Big Data analytics.

### **Smart Galway Transportation (provided by Jayakarthi Boovendren)**

#### **Introduction**

Advancements in the field of Information Communication and Technology have facilitated the transportation sector to generate, collect and process enormous quantities of data. These data are primarily sensor-generated, flight schedules, weather data, GPS or traffic information. The performance and effectiveness of the transport sector relies significantly on these data. Employing data analytics in the transport sector offers new opportunities to improve the existing transport infrastructure, observing traffic patterns and enforcing new government policies. Therefore, the primary objective of the research project is to provide an in-depth analysis of the potential of big data in upgrading the transport sector in Galway.

## **Target Audience**

The potential target audiences of the proposed study are,

- The public of Galway
- Transport industry
- Government policy-makers
- Relevant technology companies
- Big Data practitioners

## **Research Plan:**

### **Sustainable Transport**

A recent increase in Galway's population has spurred the need for a sustainable transport system.

According to (Wolfram, 2004), the chief qualities for sustainable transport systems are:

- Allow fundamental access to the needs of the society
- Affordable and offer a variety of transport modes
- Limits emission and wastes by the use of renewable resources

### **Opportunities for Big Data in the Transport Sector**

It is essential to identify appropriate opportunities for employing Big Data in the transport sector. The subject matter experts' interview directed by (Hevin Özmen and Kim Hee, 2018), proposed numerous initiatives relating to the use of big data technologies in the transport sector. The proposed research plan centers around these initiatives. A few are,

- Applications focusing on Automated driving and parking
- Internet of Things (IoT) enabled vehicles and road infrastructures
- Object detection, spatiotemporal track association
- Public behavior analysis and plan prediction

### **Smart Highways**

Galway is renowned for its major highway routes like the M4 and M6, with top speed limits of 120Km/h; also, the M6 Galway-Dublin route is the third-longest motorway in the Republic of Ireland. According to (Transforming Transport, 2020), highways generate almost 1GB of data every day. The data include traffic information, meteorology information, historical traffic data, OCR (Optical Character Recognition) data, car sensor data, and social network streams. Analysis of which may serve the following purposes,

- Identify and understand mobility patterns and route choices
- forecast traffic flow concerning weather and events
- optimize highway efficiency (scheduling and maintenance of highway infrastructures)
- Improve safety by preventing and lessening the number of accidents

### **Smart Cabs**

In Galway, public transportation facilities are limited during late nights and weekends; which is when the use of cabs comes into the picture. According to myTaxi (*Ireland had the busiest taxi drop-off point in Europe last year, according to mytaxi, 2020*), Ireland had the most popular destination for myTaxi passengers across the whole of Europe. Furthermore, Eyre Square in Galway was the most popular drop-off locations across the nation outside Dublin in 2018. It is not always that easy to get a cab instantly, especially during festive seasons. In such scenarios, a prediction model built on historical travel data might help. One such real-time example is the HubCab (*HubCab / MIT Senseable City Lab, 2020*). The project provided a visualization of 170 million taxi trips in NYC, showing the time and mode of taxi pick-up and drop-off. This analysis helped in identifying the zones with concentrated pick-up and drop-off activities, frequently travelled destinations, route patterns as well as the analysis of taxi share-ability.

## **Vehicle Data Analysis**

According to (Transforming Transport, 2020), about 2,500 GB of data are generated by vehicles annually. The data are vehicle info, position, speed, brake, black ice sensor, ABS, ESP, fuel level, emergency button, engine status, engine revolutions, tire pressure, and temperature. Deploying big data infrastructure with descriptive and predictive analytics capabilities may allow detection of traffic jams, reduce emissions and monitoring maintenance.

## **Intelligent Ports**

Galway is home to one of the oldest ports in Ireland, ‘The port of Galway’. It has a history dating back to the 10th century. Ports play a critical role in the trade and economic growth of a nation. Employing big data technologies at ports helps in predictive decision making; improve efficiency in crane movements; apply predictive maintenance models to cranes’ spreaders. For the same, information like, import and export data, cargo data, traffic management data, logistic chains data and video streams of trains and trucks from the different check posts are considered. It is also technically feasible to do automated delivery of goods. Roboat project, a real-time project based in Amsterdam provides design and test of autonomous boats that can transport goods and people. (Roboat project, 2020)

## **Smart Public Transportation**

Increase in the population often results in Congestion. Global Mobility Index is an initiative aimed at resolving Congestion issues through public transportation and cab-sharing. The project illustrates the movement of people in nearly 100 cities around the world. The visualization focuses on three aspects of urban mobility (1) congestion levels for real-time traffic-monitoring data, (2) commuting time and (3) estimated the percentage of trips that could be shared if citizens were to wait to share a trip. This initiative could benefit Galway. (*Global Mobility Index :: MIT Senseable City Lab, 2020*)

## **Inter-County Transportation**

Travelling between different counties is not always comfortable. For instance, there are several ways to travel from Co. Galway to Co. Waterford, and this often involves multi-modal transportation and causes longer waiting times between stops. A big data platform that integrates multi-modal and multi-system transportation between famous counties may promote economic growth in those counties.

OneTransport is an initiative that integrates multi-modal transportation from four contiguous counties of UK. (*oneTRANSPORT, 2020*)

## **References:**

1. *Breaking News*. 2020. *Ireland Had The Busiest Taxi Drop-Off Point In Europe Last Year, According To Mytaxi*. [online] Available at: <<https://www.breakingnews.ie/business/ireland-had-the-busiest-taxi-drop-off-point-in-europe-last-year-according-to-mytaxi-896255.html>> [Accessed 5 March 2020].
2. *Hubcab.org*. 2020. *Hubcab / MIT Senseable City Lab*. [online] Available at: <<http://hubcab.org/#13.00/40.7219/-73.9484>> [Accessed 6 March 2020].
3. *roboat.org*. 2020. *Roboat Project*. [online] Available at: <<http://roboat.org/>> [Accessed 9 March 2020].
4. *Senseable.mit.edu*. 2020. *Global Mobility Index :: MIT Senseable City Lab*. [online] Available at: <<http://senseable.mit.edu/global-mobility-index/>> [Accessed 15 March 2020].
5. *Service.onetransport.io*. 2020. *Onetransport*. [online] Available at: <<https://service.onetransport.io/>> [Accessed 18 March 2020].

# Presentation Link

31 March 2020 14:19

**Presentation link - [Click here to view the presentation](#)**

## Presentation Screenshots



**MS809- Enterprise Systems**

*Group Assignment*

**Group No: 200**

### **Team Members:**

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- 19230665- Devanshi Takkar
- 19230063- Muthuselvi Manikavasakam

*\*Project done under the guidance of Mr Michael Kelly*





A dramatic increase in Galway's population, coupled with the lack of efficiency in the contemporary city infrastructures, is inducing severe societal and business challenges in various sectors of the Galway City.

This research study concentrates primarily on **smart city initiatives** powered by **big data technologies** in the following sectors.

- Housing
- Health & Medicine
- Food & Agriculture
- Transportation

## Galway Housing Crisis- A Student's Perspective

Galway is one of the Prime destinations for quality education within the Republic of Ireland. The **National University of Ireland, Galway** is amongst the top 1% of the universities in the world and is a hotbed for students across the globe.



The population of the city stands at 80,000, while NUIG itself is home to about **19,070 students**. To be more precise, Galway is a Student City; however, there aren't enough houses for them to stay. In an article written by Andrew Hamilton for the Irish Times,

stated that Galway **lacks by 3000 houses** and there are at least 4,500 families on the waiting list. To add to this list is every growing student population.

### Issues with the Current Housing System

- Students come to Galway with an average stay of **4-5 days in a hostel**, With the assumption that a house will be surely be found in the lovely city of Galway. But that is not the case to be. Finding a house in Galway during the month of August and September is an arduous task.

### Research Question

How might we try to find a way to optimize the allotment of Housing for the students in a more efficient manner?

### Approach

- There are '**3 main elements**' to finding a solution to this accommodation conundrum- **Students** (Irish / international coming into Galway), **Landlords** (owners), **NUIG**

## Approach

- There are '**3 main elements**' to finding a solution to this accommodation conundrum- **Students** (Irish / international coming into Galway), **Landlords** (owners), **NUIG**
- NUIG has an amazing 'accommodations support office', Our aim is to make it even better
- With the help of **Big data** and **AI, algorithms** can be created in providing allotment to students based on their demographics
- The college has a top-down approach in terms of accommodations- problem-solving I.e. **The students try to find accommodation >> fails to find one >> comes to the accommodation's office for help**
- A bottom-up approach can yield better results I.e. The accommodation's office proactively helps students to find accommodation

## Galway Healthcare

Senior Population (>65 years) in Galway is expected to increase 23% by 2023 and there are not enough facilities/hospital to provide specific care to the them.

### Research Question

How to provide a Age specific Health care system for every person who is above 65 years in Galway?

## Technology Solution:

### Solution

Create a new Galway Senior Health Care Management System and it's based on Artificial Intelligence as the core technology.

### Technologies:

Artificial Intelligence – Machine Learning, Neural Networks, Deep Learning, Natural Language Processing & AI Robotics.

### **Implementation:**

A Health Care Management system subdivided into below categories which are collectively implemented as Galway Senior Health Care Management System.

- **Personal assistance** – Assistive, Companion & Service Robots
- **Physical Devices/Interfaces** – Visually impaired, Mobility & Patient Monitoring
- **Assurance Systems** - Lighting controls, Retrofit automatic door opening systems, Automatic curtains and blinds, Wireless socket control systems, Powered cupboards & Entry control systems
- **Schedule Management** – PDA's which remind people when to take their medicine when to eat meals when to take care of personal hygiene, and so on
- **AI clinical applications** - Radiology and Imaging, Oncology, Genetics and Genomics, Neurology, Diabetes Care & Eye Care

## Galway Food and Agriculture

### Research Question:

How will we improve production and achieve food and farming security by 2050 for what is going to be close to 10 billion people? How can we help the farmers, from small farms to large-scale farms? And how do we ensure that the customer only gets high-quality, organic and healthy food?

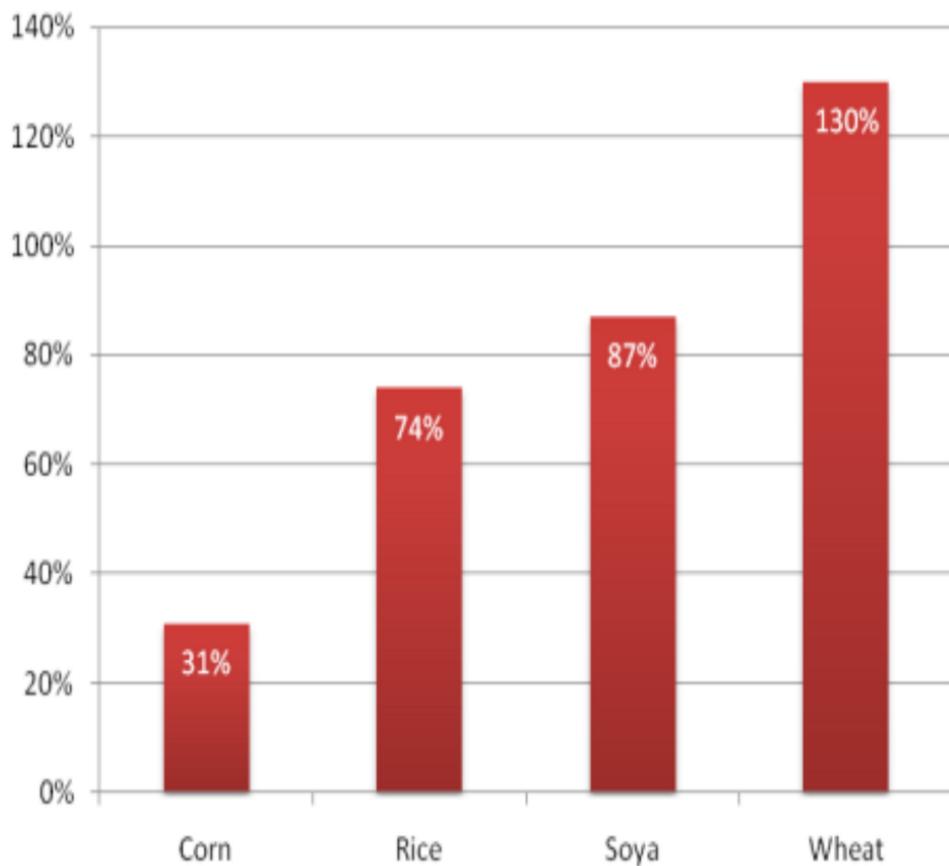
### Technology Solution:

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The 3 ways through which big data can transform the food and agriculture industry :

- Optimum Crop Forecast
- Precision farming
- High-quality seeds and minimized hunger

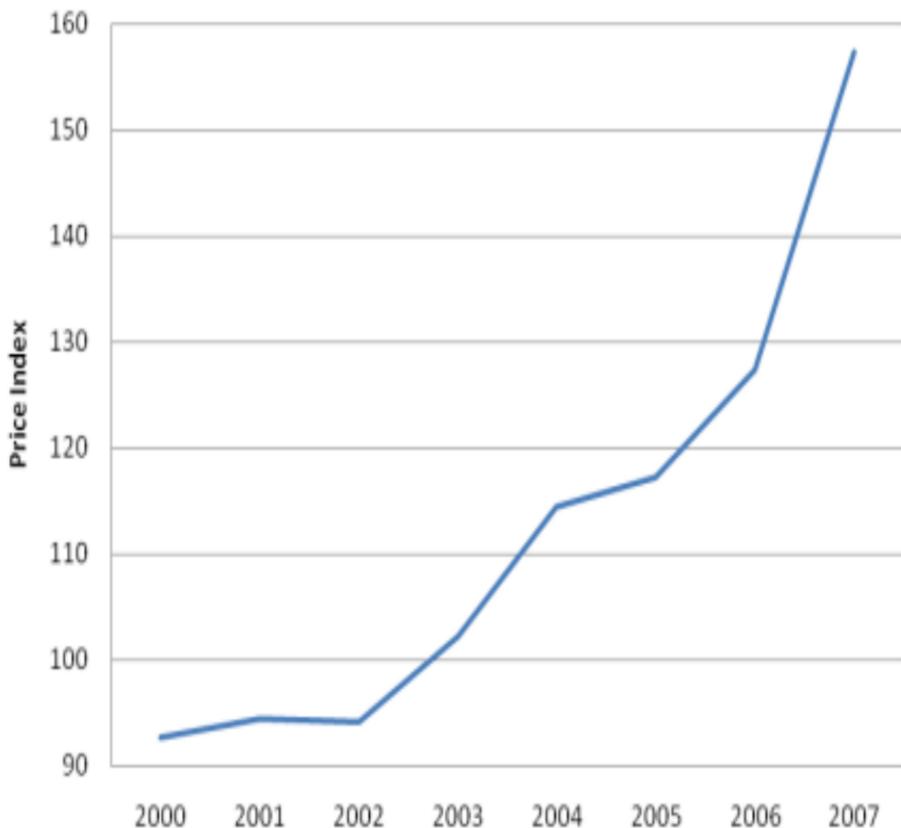
## Price rises in % in a single year, March 2007 - March 2008



Source: BBC, Bloomberg, Food and Agriculture Organisation of the UN

Average food price index, 2000-2007

## Average food price index, 2000-2007



Source: Food and Agriculture Organisation of the UN

## Sources:

- Farm equipment sensor data (e.g. tractor having a sensor to check the quality of soils, seeds etc.) of Galway
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- Historical Harvested crops data of Galway
- Financial and Commodities trend data of Galway
- Weather And Climatic data of Galway
- Animal and plant research data of Galway
- Consumers trend data OF Galway

## Smart Galway Transportation

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### Research Question:

How can data analytics be applied to the contemporary transportation system in Galway to provide more amplified services to the public and promote economic growth while diminishing the limitations in the transport sector?

## Big Data Opportunities in the Transport Sector

- Applications focusing on Automated driving and parking
- Internet of Things (IoT) enabled vehicles and road infrastructures
- Object detection, spatiotemporal track association
- Public behaviour analysis and plan prediction

## Applied Case Studies

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### Smart Highway

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-longest motorway in the Republic of Ireland.

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In such scenarios, a **prediction model** built on historical travel data might help. One such real-time example is the **HubCab(2014)**. The project provided a **visualization of 170 million taxi trips in NYC**, showing the time and mode of taxi pick-up and drop-off. This analysis helped in identifying the zones with **concentrated pick-up and drop-off** activities, frequently travelled destinations, **route patterns** as well as the analysis of **taxi share-ability**.



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Galway is home to one of the oldest ports in Ireland, ‘The port of Galway’. Ports play a critical role in the trade and economic growth of a nation. Employing big data technologies at ports helps in **predictive decision making**. For the same, information like, **import and export data, cargo data**, traffic management data, logistic chains data and video streams of trains and trucks from the different check posts are considered.

It is also technically feasible to do automated delivery of goods. **Roboat (2016)**, a real-time project based in Amsterdam provides design and test of **autonomous boats** that can transport goods and people.



## Vehicle Sensor Data Analysis

The data like vehicle info, position, speed, brake, black ice sensor, ABS, ESP, fuel level, emergency button, engine status, engine revolutions, tire pressure, and temperature. Deploying big data infrastructure with descriptive and

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Thank You!

# Video Link

23 March 2020 04:14

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