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SIT123: Data Capture Technologies

Lab Report Week 4: Ethical issues

In this task you will investigate ethical concerns in a given a case study.

Task 1 - Objective

Read the case studies given below and consider their ethical concerns.

Case study 1:
Consider your GPS data collected and mapped in Lab report 6. Now imagine your GPS traces were collected for a period of 30 days, and shared publicly with your name without your knowledge.

Case study 2:
Refer to the context of the data provided in Lab work of last week. Here, data was collected from a motion sensor installed in a user's (John Doe) bathroom. John Doe is an elderly gentleman between 65-75 years, and he lives by himself in his own home.

The data was part of John's smart home system, which has motion sensors installed in every room. All the sensor data being collected from John's house, including his bathroom is uploaded to a cloud server. The company who built the smart home system has access to John's collected sensor data in the cloud, and their artificial intelligent algorithms use the collected data to learn about John's behaviours and feed the learned patterns back to John's smart home. John's smart home uses these learned patterns to make various decisions such as automating lights, heating and if John is well (based on his activity). All of John's data includes his name and address.

John himself does not have access to his data in the cloud.

Task 1- Submission Details

There are 5 questions in this task. Answer all of them in this word document itself and submit to unit site.

Q1: In case study 1, what should have been explained and obtained prior to sharing your GPS traces publicly? Why?

The program should have asked the users' permission to display their GPS traces along with their name as well as ask them if they are ok with sharing it publicly.

Q2: What are some ethical concerns in case study 1?

The program collecting GPS data, mapping it and sharing it publicly did not ask for permission from users to display their data to others. This would cause everybody to be able to know where somebody resides and also know their movement activities from the past 30 days.

Q3: What are some ethical concerns in case study 2?

The company that built John Doe's smart home system presumably did not make John aware of which data was being collected by the sensors in his house, nor did they tell him where that data is being sent and that it is being used to analyse and learn about his patterns and behaviours in the house. He also does not know that they collected his name and address, nor did they give him access to the sensor data in the cloud.

Q4: What adverse effects may arise as a result of the aforementioned ethical concern/s? Explain using examples.

John has no control over what sensor data is sent to the company's servers as a result of not having access to it in the cloud. For example, he may not wish for the company to know about his activity in the bathroom in any way but since he does not have access to cloud, he cannot turn off any sensors found in the bathroom.

If the smart home system is poorly designed or there are malfunctioning sensors, this can cause the system to behave undesirably. For instance, if John has medical issues that require immediate attention if something goes wrong, there is a chance that the sensors will not detect this and therefore, will not call emergency services or a caretaker.

Q5: Explain how one of the ethical concerns you mentioned can be addressed.

The company can give John some login information to give him access to his data as well as settings that control which data the smart home system collects.

Task 2 - Objective

Read the project ideas given below and consider their requirements

Scenario 1:
John has two plants on the balcony of his house. These plants require constant attention and caring. He has to water them when they require and make sure the soil moisture is kept at optimum levels. Otherwise the plants will not be in good shape and may not survive. John has become very busy these days and with his age it is hard for him to keep record and remember when to water the plants. He is looking for a smart solution to notify him when the plants need to be watered. Such a solution needs to provide a notification using an LED light connected to the pot to indicate when the soil moisture is below and over a certain limit. In addition, John also wants to find out if both plants require the same amount of water, or if he should be watering them different levels.
Note: Assume that both plants are planted in identical pots, using identical potting mix.

Scenario 2:
Jane, Megan and Kim are university students who enjoy cycling. Since they live in different suburbs, they usually cycle on their own, and not together. They think that it will be interesting to compare where they've been cycling. They want to see if they can find out some common areas and times to cycle together, based on things like distance, elevation, day of the week and times of the day.

Task 2 - Submission Details

There are 8 questions in this task. Answer all of them in this word document itself and submit to unit site.

Q1: Propose a solution to the problem given in Scenario 1, using the Sense-Think-Act paradigm. Give an overview of your proposed solution, and outline its Sense-Think-Act requirements.

An Arduino board can be set up with an LED connected one port and a soil moisture sensor connected to the other (Sense). The Arduino controls LED in that it switches it on and off (Act) based on the moisture level being detected by the sensor (Think).

Q2: Propose a solution to the problem given in Scenario 2, using the Sense-Think-Act paradigm. Give an overview of your proposed solution, and outline its Sense-Think-Act requirements.

The GPS tracker (Sense) can be attached to the bike or the person or the person can just use their phone's GPS tracking capabilities. The tracker can store the data in an SD card (Think) which can then be passed into a software that reads GPS information (Act).

Q3: What kinds of hardware do you think can be used to solve the problem in scenario 1?

A soil moisture sensor and an LED are required for this problem.

Q4: What kinds of hardware do you think can be used to solve the problem in scenario 2?

A GPS tracker attached to the bike or person would be essential for this scenario.

Q5: Think of a data collection approach to be used in Scenario 1.

a) What things can result in 'dirty data' in this case?
   Null values, values not properly formatted, blank data values

b) What can you do to clean the data?
   In Microsoft Excel, you can hide this invalid data by filtering it or removing it.

Q6: Think of a data collection approach to be used in Scenario 2.

a) What things can result in 'dirty data' in this case?
   Incorrect geocoordinate values, null geocoordinate values, incorrect elevation and times of day values. Incorrect formatting of data values.

b) What can you do to clean the data?
   Filter out the incorrect data or remove it.

Q7: Propose some ways to extend your proposed solution for scenario 1.

A buzzer of some sort can be connected to the board to make a sound as well as have the LED turn on and off. The LED should change colour based on how moist the soil is so that he can water it just enough so that it is at the correct moisture level.

Q8: Propose some ways to extend your proposed solution for scenario 2.

The GPS software can take in multiple sources of GPS information and compare them to find its commonalities such as the locations of where the bike riders go in common and at what times.

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Lab Report Week 5: Test Motion Sensors for Range and FoV

Today, there are many cheap sensors available on the market, such as passive Infra-Red (PIR) motion sensors. However, a drawback of these sensors is the inconsistency of their output depending on the manufacturer, and also how they perform differently under various environmental conditions.

Hardware Required

Arduino Board

USB cable

HCSR505 PIR (Passive Infra Red) Motion Detector
Bring your laptop with Arduino IDE installed
A measuring tape
A protractor

Software Required

Arduino IDE

Pre-requisites: You must do the following before this task

1. **Attend Class (Lecture)**
2. **Read this sheet from top to bottom**

Task Overview

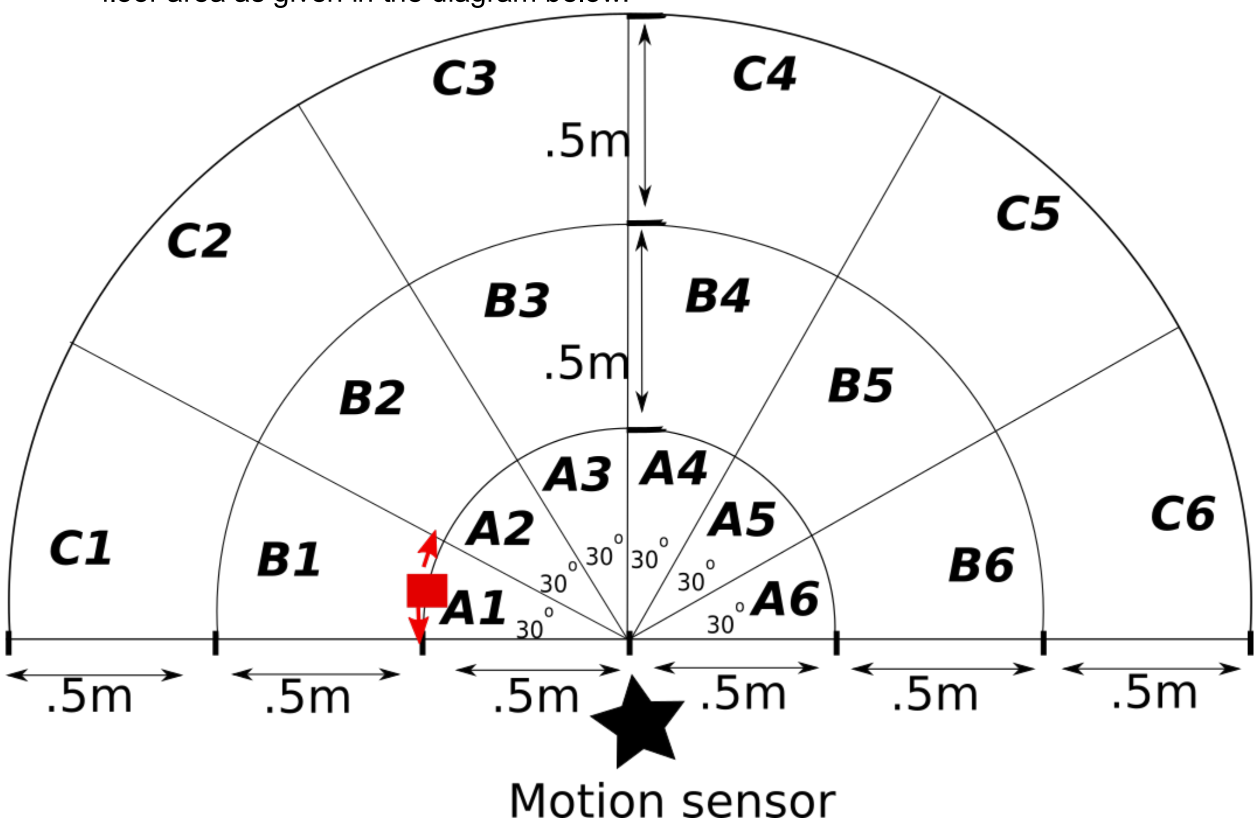
In this task, you will test the PIR Motion sensor for range and FOV (field of view) and calculate its TPR (true positive rate).

Task Submission Details

There are 6 questions in this task. Answer all of them in this word document itself and submit to unit site.

Steps:

1. Find some open floor space indoors (around 3 m wide and 1.5 m in height) and mark the floor area as given in the diagram below:



2. Attach the motion sensor to your Arduino board. You can refer to the Task 2.2P instructions on how to do this.
3. Place the motion sensor connected to your computer at the centre as indicated in the diagram.

Q1. Recording Active/Inactive States

We want to find out if the motion sensor can detect movement in each section A1 to A6, B1 to B6 and C1-C6.

- Open the code for motion sensor used in Task 2.2P in your Arduino IDE.
- Ask a friend to step into the edge of section A1 (the red square in the given image) and step sideways bit (look at the red arrows), being careful to stay within the boundaries of A1.

- Check the Serial monitor to see if ‘Active’ states are being recorded. If you can see Active states, mark that in the table below, and then ask your friend to move the next section A2.
- If you can see ‘active’ states when they move to A2, ask your friend to be still for a few seconds until you start seeing ‘Inactive’ states again on the serial monitor, and then ask the friend to step forwards and backwards a bit, being careful to stay within the boundaries of A2. Mark what you see in the table below.
- Repeat this for sections A1 to A6, B1 to B6 and C1-C6.

	A	B	C
1	Active	Active	Active
2	Active	Active	Active
3	Active	Active	Active
4	Active	Active	Active
5	Active	Active	Active
6	Active	Active	Active

Q2. Calculate the True Positive Rate at .5 m Range

a) Enter the motion data you recorded from A1 to A6 in shared file https://docs.google.com/spreadsheets/d/1e3n6oo4L-dc3kydQDnt3OX8wOU6hed8v_XALm0Xo3LI/edit?usp=sharing
If you did the data collection as a group, only enter one reading per group, with all of your names in the relevant cell. Copy the table from the shared file and include here, once there are results from at least 8 groups.

0	1	0	1	1	0	1	1
1	1	0	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1
1	1	0	1	1	0	1	1

b) Use the results from at least 8 groups to calculate the true positive rates for the FoVs given in the table below. You must show the steps of your calculations in the table.

FoV True positive rate

180° $\frac{41}{48} = 0.854 = 85.4\%$

120° $\frac{30}{32} = 0.9375 = 93.75\%$

60° $\frac{16}{16} = 1 = 100\%$

Q3. Calculate the True Positive Rate at 1 m Range

a) Enter the motion data you recorded from B1 to B6 in shared file https://docs.google.com/spreadsheets/d/1e3n6oo4L-dc3kydQDnt3OX8wOU6hed8v_XALm0Xo3LI/edit?usp=sharing
If you did the data collection as a group, only enter one reading per group, with all of your names in the relevant cell. Copy the table from the shared file and include here once there are results from at least 8 groups.

1	0	0	1	0	1	1	1
1	0	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1
1	0	0	1	1	1	1	0
Ninny Cooke(2020/8/12)	Nathan Johansen (12/08/20)	Harvey Zuccon	John Pouk(12/08/20	Beau Williams (12/08/20)	Lael Newton + Ben Marriner (12/08/2020)	Matthew Hall (12/08/2020)	Lachlan Burgess (12/08/20)

b) Use the results from at least 8 groups to calculate the true positive rates for the FoVs given in the table below. You must show the steps of your calculations in the table.

FoV True positive rate

180° $\frac{40}{48} = 0.8333 = 83.33\%$

120° $\frac{30}{32} = 0.9375 = 93.75\%$

60° $\frac{16}{16} = 1 = 100\%$

Q4. Calculate the True Positive Rate at 1.5 m Range

a) Enter the motion data you recorded from C1 to C6 in shared file https://docs.google.com/spreadsheets/d/1e3n6oo4L-dc3kydQDnt3OX8wOU6hed8v_XALm0Xo3LI/edit?usp=sharing
If you did the data collection as a group, only enter one reading per group, with all of your names in the relevant cell. Copy the table from the shared file and include here once there are results from at least 8 groups.

0	0	1	0	0	1	0	1
1	0	1	1	0	1	0	1
1	0	1	1	1	1	1	1
1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1
1	0	1	0	0	1	0	0
Harvey Zuccon	Nathan Johansen (12/08/20)	Ninny Cooke(2020/8/12)	John Pouk(12/08/20	Beau Williams (12/08/20)	Lael Newton + Ben Marriner (18/08/2020)	Matthew Hall (12/08/2020)	Lachlan Burgess (12/08/20)

b) Use the results from at least 8 groups to calculate the true positive rates for the FoVs given in the table below. You must show the steps of your calculations in the table.

FoV True positive rate

180° $\frac{33}{48} = 0.6875 = 68.75\%$

120° $\frac{27}{32} = 0.8438 = 84.38\%$

60° $\frac{15}{16} = 0.9375 = 93.75\%$

Q5. Based on the above, what can you say about the range and FoV of the motion sensor tested? Justify your answer, giving reasons.

Two out of the eight motion sensors have no blind spots at all while the remainder do. This could be due to how the sensor was positioned or if the dials that control the sensitivity and timing were shifted. If the sensitivity dial was adjusted then it may have affected the distance at which movement could be detected. In addition to this, the sensors were better at detecting movement from a narrower range than they were from a wider range and were also the best at detecting movement when the movement was <=50cm away.

Q6. Propose an experiment to find the True Negative Rate (TNR) of this sensor.

Have the sensor placed in an area of the same length and width where there is absolutely nothing that is prone to moving. Have the Arduino record whether there is movement or not every second for 2 minutes. If the sensor detects no movement in the two minutes, the TNR rate would be 100%. If the TNR rate is <100% then either something moved in the area or the sensor has a problem.