Robotics and embedded systems Tob31

1.

a) An autonomous robot using computer vision/slam be used to detect and map the crop field, Ai/machine learning could then be used to Identify areas of the crop field that require fertilizer. A flying robot would be used to hover over the crop field giving greater visibility/line of site to the lidars sensors used. Flying locomotion would give the robot greater mobility and speed at accessing the areas that need to be treated. Flying locomotion would however be at a disadvantage when in extreme weather conditions for example strong winds and torrential rain (storms). The fertilizer would be in a payload type system on the belly of the robot so that it could deliver the fertilizer to the detected areas effectively by sprinkling in the areas, not just dumping it all at once. The flying aspect of the robot would however not be able to keep the robot static in the air which could lead to smaller areas that do not need fertilizing being hit. Multiple air born robot could be used which could be linked together wirelessly to increase efficiency. An autonomous hybrid system could be used with a deliberative system working as the whole brain and the reactive system below working to help the individual robot move and react quickly to changes in the environment.

b)

When using a flying robot system, it must be made sure that it its area of mobility is only in the land its working for, there may be some ethical concerns if it flies into residential private land or sensitive areas like airports/military locations which is illegal.

The flight of the robot should not disrupt animal behavior of flying animal's which may hunt in close proximity to the working area/crop fields.

The movement of the robot should not harm humans/wildlife by flying and hitting them it should try to detect and avoid them.

The actual fertilizer delivered from the robot should not be harmful in any way to wildlife or humans on direct contact.

The robot should be secured in a safe location and can only be activated and accessed to by the authorized people since it could be miss used, perhaps using rfid cards. These to authorized people should also be the only ones who can possibly remote control the robot.

c)

The lidars on the robot could be used to detect wild life by finding its distance/location and 3-d mapping it, The Ai/Machine learning would then be used to identify the wildlife as something that needs to be avoided so it can't fly into them but around and it can't drop the fertilizer on the animal, should it be on an area that needs fertilizing then it should continue in a different area and comeback and/or wait for it to move.

Access to the Robot should only be given to people who are authorized otherwise it could be miss used, when remote controlling the robot, the individual should be given a secure login, and when accessing the robot physically the individual could be given an rfid tag that they scan to open doors/ secure areas its kept.

2.

a)

vehicle 2, is just 2 of the vehicles 1's together as one, so one sensor and a motor that are directly linked so that when the sensor detects light it gets faster moving towards it.

Vehicle 2 a has uncrossed connections between the sensors and motor so when one side of the vehicle detects light that sides motor increases the speed.

Vehicle 2 b has crossed connections, so the right sensor is connected to the left wheel and the left sensor is connected to the right wheel.

Vehicle 2 a will move away from the light if it on the side but if its directly Infront it will speed up and move towards it.

Vehicle 2 b will however move towards the light source when by its side, because of the crossed connection. then it will speed up moving towards it head on.

b)

An autonomous robot clearing a minefield should be given a hybrid control strategy, a hybrid system has a deliberative system sitting on top of a reactive system. The reason why I would suggest a hybrid system over a deliberative system is because, with the reactive system element you can achieve a quicker reaction to problems that may occur in the environment which would be very common and needed in a minefield, this is because of the reactive element behaviors being in parallel. The deliberative element would always be needed since an intelligent world model of the minefield would be needed so that it could avoid the mines. A reactive system by itself would not be a good use since it would most likely only avoid the mines when it comes into contact with one possibly setting it off. However the quick nature of the reactive system is needed for other problems like wildlife or dynamic terrain from exploding mines.

c)

Sticky bot it biologically inspired robot which was created to demonstrate a robots potentially ability to vertically climb up walls by sticking to them. This robot was based off gecko's since they can easily climb up vertical surfaces with ease using their feet which have small hairs allowing it to stick to a surface by increasing and decreases resistant friction when presser is applied using the feet with hairs. The robots' microscopic feet hairs were created using a plastic polymer and worked the same way. The robot also featured a tail which like the real gecko's tail could be used to help balance the robot. The synthetic feet created a strong force that was able to keep the robot fully attracted to the wall. In the future this technology could be used for larger heavier more complex robots if smaller hairs could be created and a larger surface area for contact with the wall made.

3.

a)

i)

The Wheel encoders on the robot can produce a better result because they can count the rotation of the wheel for a given distance and multiply that by the circumference of the wheel to accurately

calculate distance travelled by the wheel robot. All four of the wheels encoders should produce the same result however should they be slightly different because of the ground type interferes, an average of the 4 wheels could be taken (sum of the total value/4)

ii)

The wheels themselves could have slightly different sizes or shapes due to poor production or long-term use. Also, should the robot not travel in a straight line, and turn or nudge/ veer off. Different wheels would be turning faster than others which would increase the distance on one side and not the other creating possibility for less accurate results, however when an average is taken from the 4 wheels it could even out. The terrain the robot travels on could also affect the result since rough terrain would require the bot to make more wheel rotations (moving more), however mapping roads/track as the crow flies would not change the distance map/noted because of the terrain.

b)

i)

A Lidar sensor could be used to 3-d map the change in ground terrain and the distances from different point to determine the transitions from one ground type to another. It could also detect when there will be a ground type change assuming it one the front of the robot. Calibration could also determine which ground type It will encounter

An infrared sensor could be used to detect the change in ground type when the values from the infrared sensor change because of the ground physical pattern and colour. With calibration it could possibly primitively detect what ground time it is currently on. For example, in the robotics assignment project. The robots line sensors would display a different value when on the practical room floor carpets compared to a white surface.

ii)

A tire pressure monitoring systems could be used to determine the tires air pressure and then calculate the possible dimensions of the tires, since a higher tire pressure is proportional to a larger tire. However, for physical hard changes that have developed over time this would be impossible without possible hard recalibration. However, you could monitor the speed at which the wheels term to then determine the possible size since a smaller deflated wheel would turn faster than a full larger wheel. Initial calibration could be used to find the normal size of the wheel when fully inflated and then when the turn speed of one wheel increases could calculate the dimension of the wheel based on its newly calculated size.