Autonomous Flying Artists

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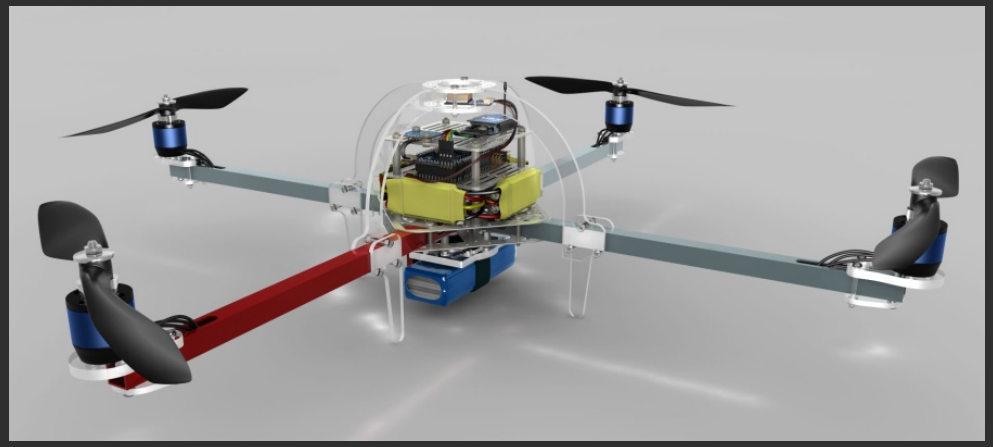
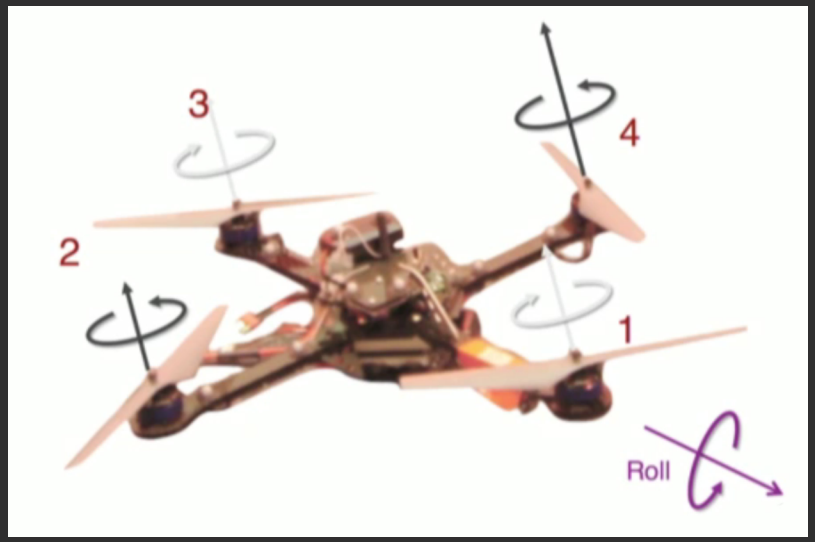
Introduction to Autonomous Agile Aerial Robots

- Designed by Vijay Kumar
- Can adapt quickly to moving surroundings
- Can react to surprises
- No GPS, no remote control
- Only 8 inches in diameter



Why Four Rotors?

- By having the rotor offset to one side, not only can it pull or push in one direction but it can also have a net effect to turn
- Regulating the speed of the four propellers produces lift at any moment



How Do They Move?

- Calculate their positions within a 12 dimensional space
  - Wide range of motion
- Uses accelerometers and sensors that detect angular rotational velocities
- Only takes a fraction of a second to calculate
- Can move through and around moving objects with incredible reaction time

How Do They Move?
Video Demo:

http://www.youtube.com/watch?v=T43BBLQ3fSY

How Do They “See” Space?

- Figures out features of the space
- Figures out where it is with respect to the features
- Estimates position 100 times per second

Video Demonstration:

http://youtu.be/sJD86wcoxLU

What Makes Them Unique?

- Completely autonomous
  - Maneuvers can not be reproduced with remote control
  - Need extraordinary precision of algorithms
  - Cannot be done through human control

How Will Their Motion be Turned into Art?

- YesYesNo + Nike *Paint with Your Feet*

YesYesNo + Nike
Paint with Your Feet

- Technology developed by YesYesNo allows runners to create artwork based on their runs
- Each runner is equipped with a GPS that tracks path, speed, and consistency
- A variation of this technology could be used to track paths of the robots

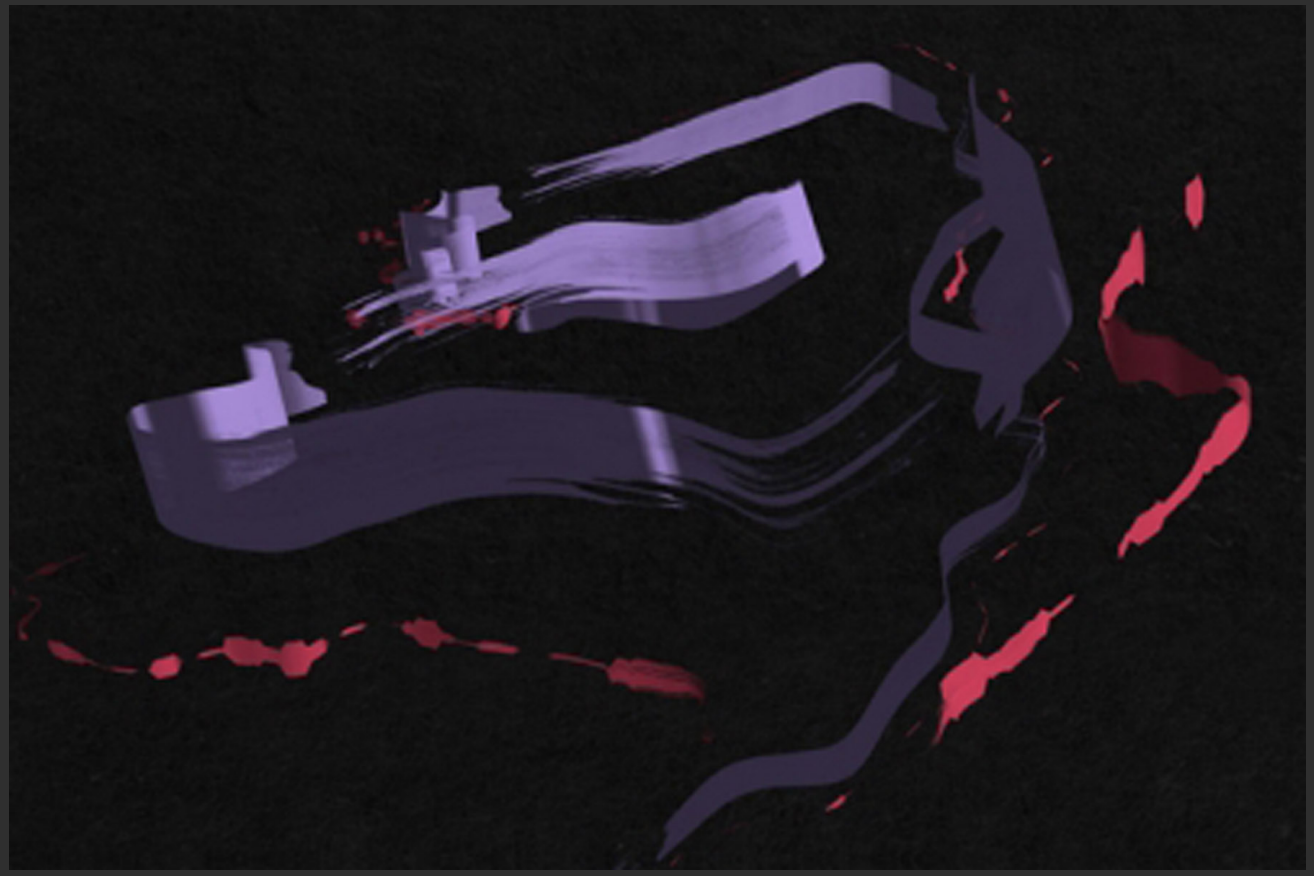
People as Obstacles in Space

- Visitors to the gallery space will be submersed in the robot's environment
- They become objects that the robots must fly around
- Although robots would be moving quickly through the space, the visitors could walk freely without having to worry about being hit
- Artwork created is the visual representation of negative space

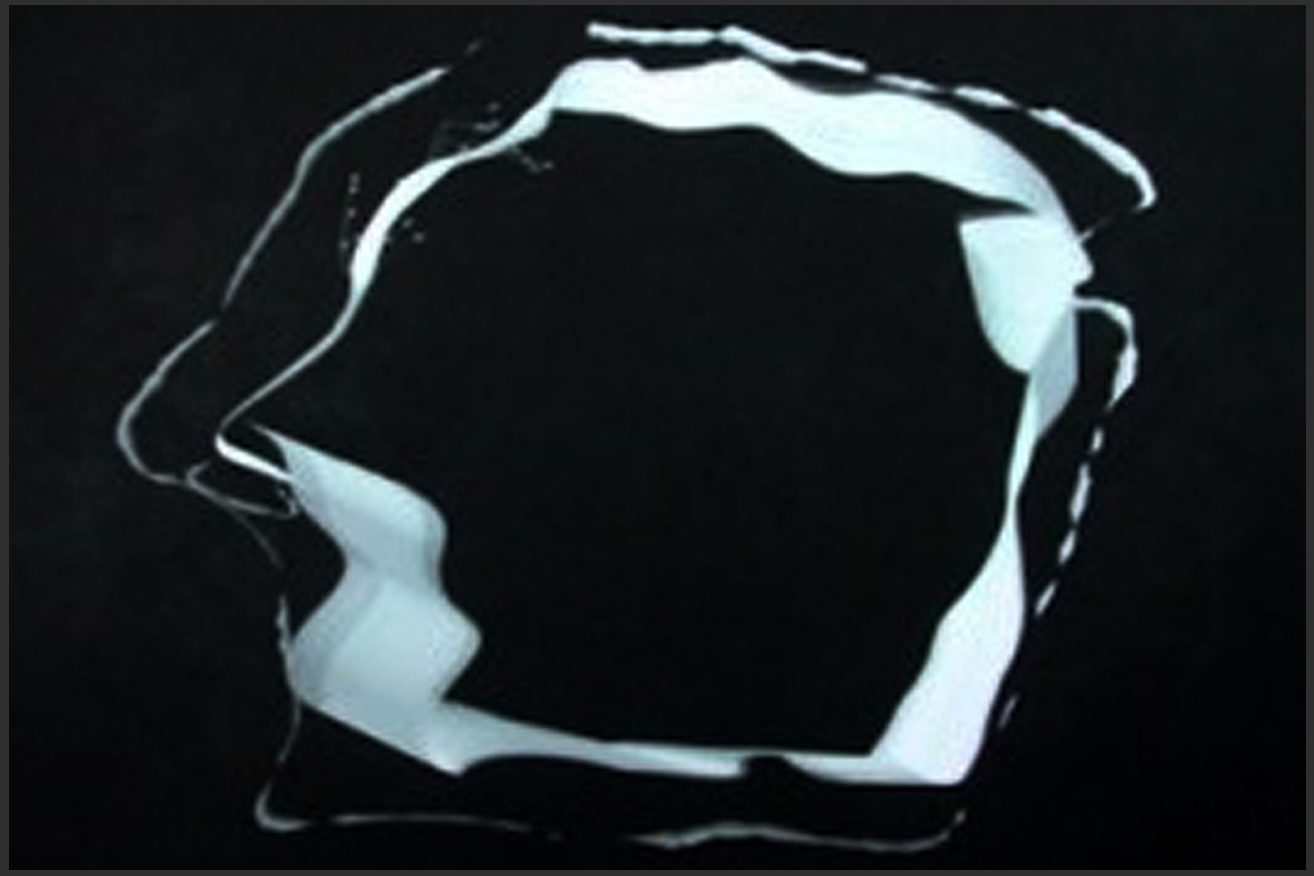
People as Obstacles in Space

- More people in the gallery
  - More complicated maneuvering
  - less consistent, more intricate path
- Less people in the gallery
  - More direct path
  - smoother, more consistent recording of negative space

What a Crowded Gallery Might Look Like:



What an Empty Gallery Might Look Like:



Gallery Space:

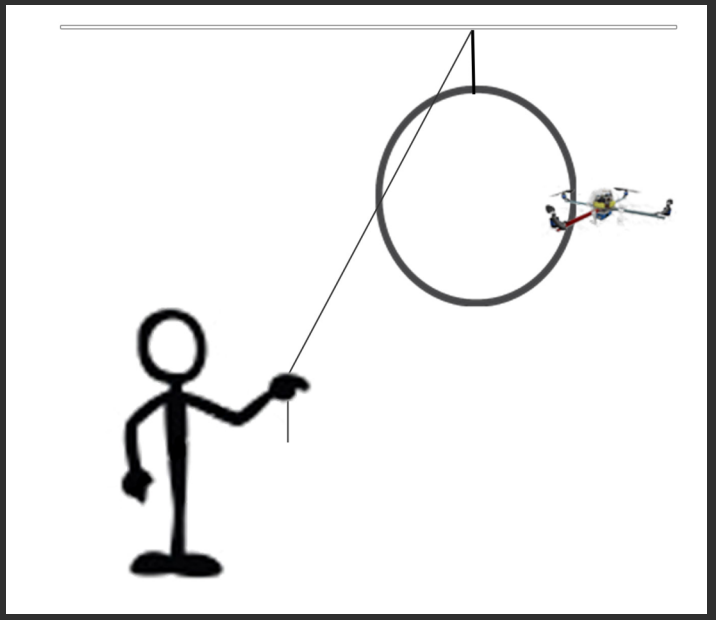
Gallery Space:

- Open room
- Blank walls onto which images are projected
- Each flying robot would have a GPS
  - Each robot's individual pathway would correspond to a projector
- Images do not move, but they change every three minutes to show changes in gallery space

Props:

- In addition to people, there would also be a selection of objects in the room that people can use to interact with the robots if they choose
  - Hoops, panels, etc

Props:



Conclusion

- Autonomous Flying Artists are able to interact with humans without interfering
- With the help of a GPS and a variation of *Paint with Your Feet*, these robots are able to create unique pieces of art based on the negative space in which they fly

Sources

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