µScribe

Presented by

Group 10

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Overview

- Problem Statement
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- Project Plan
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Problem Statement

- To use Firebird V Hexapod to scribe letters and shapes with reasonable legibility
- The program for scribing a letter or shape is preprogrammed into the Hexapod
- The complication lies in the fact that there are 18 motors = 18 Degrees Of Freedom (DOF)!

Task Specification

- To program smooth motion of Hexapod
- To program simple natural movements
  - Rotation by any given angle, movement in any given direction
- To program simple in-place movements
  - Jerking, swaying
- To program elementary scribing movements
  - Drawing stroke, curve
- To translate shapes to a series of strokes that Hexapod can sequentially scribe

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Project Plan

- Timeline
  - 27 Sept – 1 Oct: Basic Motion
  - 4 Oct – 8 Oct: Strokes and Curves
  - 11 Oct – 15 Oct: Mono-scribing
  - 18 Oct – 22 Oct: Testing and Documentation
- Task Division
  - Alphabet Scribing Module
  - Number Scribing Module
  - Shape Scribing Module

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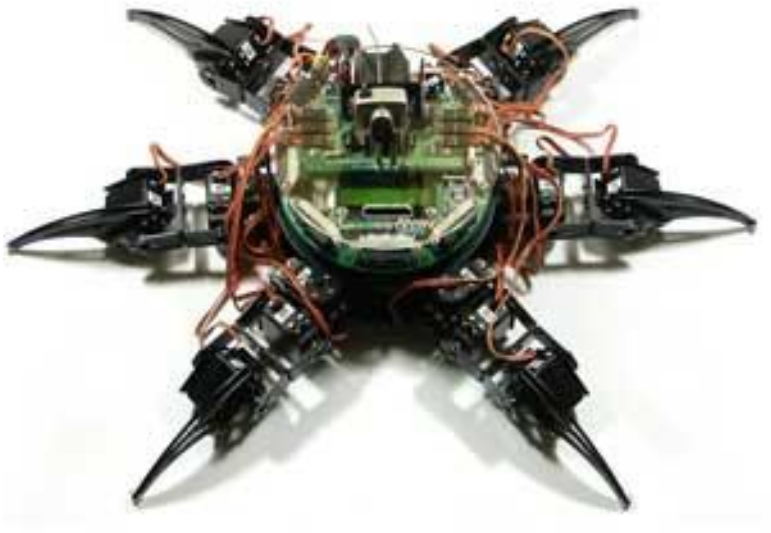
Innovation and Challenges



- 18 Motors = 18 DOF!
- Intolerance to imprecision
- Sensitive to manufacturing asymmetries

Completed Tasks

Task	Timeline	Person
Project Setup and understanding Header Files for Basic Functions	27 Sept – 1 Oct	AM
Rectilinear Motion	4 Oct – 8 Oct	AM, LR, YK
Rotational Motion	11 Oct – 15 Oct	AM, LR, YK
Noise Cancellation Hardware Maintenance	18 Oct – 22 Oct	LR, YK
Pen Attachment	18 Oct – 22 Oct	AM, LR
Letter Writing Functions	25 Oct – 29 Oct	LR, YK
Documentation	1 Nov – 5 Nov	AM, LR, YK

Test Cases (1/2)

- Circle Scribing
- Hexapod was programmed to draw a circle
- Circle was approximated as a series of strokes
- Legible scribing of the shape achieved
- Character Scribing: Hexapod was programmed to draw the letter L

Test Cases (2/2)

- Number Scribing: Hexapod was programmed to draw the number 1
- Successively writing H,E,X with fair precision.
- Scribing is jerky and comes as a series of dots
- Can be improved by adding a robotic pen with a spring for minimizing the effect of motion on the scribing

Reusability Features

- Separation of platform-specific code into hexapod_firebirdv.h
- Ease of portability to future versions of Firebird by separation of hardware specific code involving timers, ports, etc.
- Each atomic step programmed as a separate function
- Modular programming by having platform-dependent and platform-independent header files which enclose functions used by main()

Future Enhancements

- Dynamic specification of message to be scribed
- Application of AI techniques like fuzzy logic, HMM to simplify coding of intelligent behaviour
- Esterel: Developing Esterel coding platform for the Hexapod
- Variety of movement like staircase climbing

References

- Firebird V ATmega2560 Robotic Research Platform Hardware Manual. IIT Bombay & NEX Robotics Pvt. Ltd.
- Firebird V ATmega2560 Hexapod Robotic Research Platform User Guide. IIT Bombay & NEX Robotics Pvt. Ltd.
- Firebird V ATmega2560 Robotic Research Platform Software Manual. IIT Bombay & NEX Robotics Pvt. Ltd.

End

- Questions?
- Comments!
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