Development Phase for Automated Refueling System ARFS

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Development System Model : Introduction

Problem Statement:

Automate the refueling of a compact transport vehicle:

The General Idea:

Shell Oil's Smart Pump Elk Grove, California

Development System Model : Outline

How: Our Approach

Develop an Intelligent Vision Guided Robotic Arm

Key Points

Intelligent:

- The movement of the robot arm will be require no human operator
- System will monitor its workspace to maintain a high margin of safety
- System will be adaptive to lend itself for other applications

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Development System Model : Outline

Key Points (cont.)

Vision Guided:

- Our system will use information attained from a set of sensors to performs its task, no database of vehicles will be required
- No initial information about the vehicle needs to be know*, as long as the the location of the fuel cap is approximately 1m from the ground and within the workspace of the robotic arm

Robotic:

- Our system will employ a universal* robot arm to perform its task

* some limitations may need to be placed on the fuel cap depending on the range of styles

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Development System Model :Why Development

Final Model: Full Scale Implementation

Development Model: Scaled Implementation to allow development in the lab environment

Development of the Automated Refueling System (A.R.F.S.) needs to begin on a reduced physical scale. The reduced physical scale will allow the development of the A.R.F.S. to proceed faster and more economically. The development work can be performed in a laboratory environment, such as the Computer Vision and Image Processing Lab (C.V.I.P lab) of the University of Louisville, where components of the A.R.F.S. system can be accurately developed.

Development System Model :Why Development

Development Model:

- Determine the Visual System Requirements
- Redesign of Vision Tools for this Specific Application
- Determine the necessary computation for the Vision System
- Determine the necessary characteristics of Robotic Arm
- Develop algorithms for Robot Arm positioning and control
- Design the interface between Vision System and the Robot Arm
- Show functional system design before a large financial investment is made into a full-scale model

Development System Model : Subsystems

Our System: Brake Down

Vision System

- Capture Data
- Manage Sensors*
- Position of Sensors*

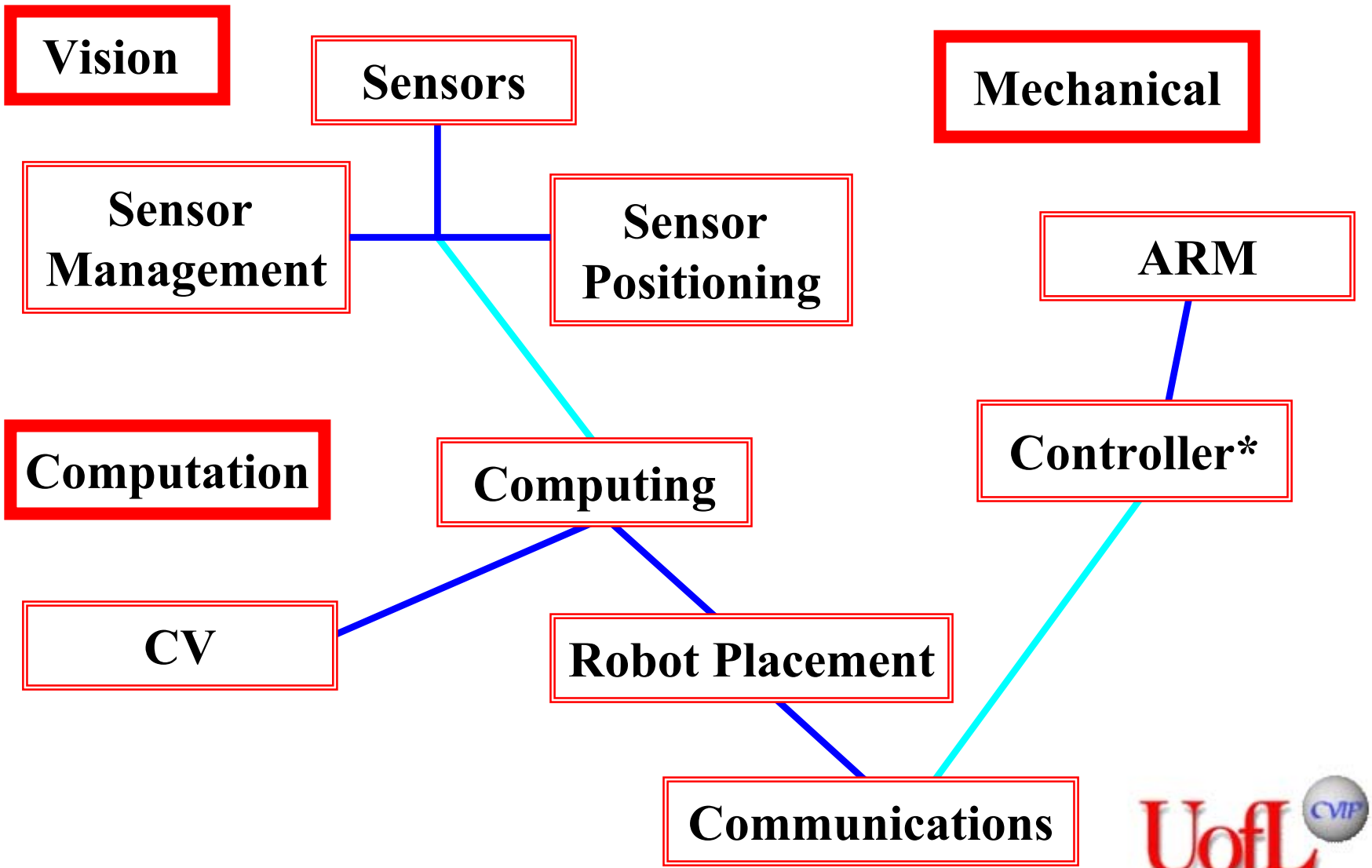
Intelligence System

- Acquiring data from Vision System
- Interpretation data
- Controlling Robot Arm*
- Communication with world and the other subsystems

Robot System

- Opening of Fuel Cap
- Fuel Fill-Up
- Replacement of Fuel Cap
- Other*

Development System Model : Subsystems



Development System Model : What We Already Have

Hardware:

- CardEye: test-bed for active vision system
- KingTut: ability to perform fast computation on large sets of data

Software:

- Tools for Computer Vision with Intensity Images
- Tools for Sensor Planning

Development System Model : What We Still Need

Hardware:

- Robot Arm with Controller
- Appropriate Robot Attachment(s)
- Dedicated Vision Platform
- Model(scale) Props

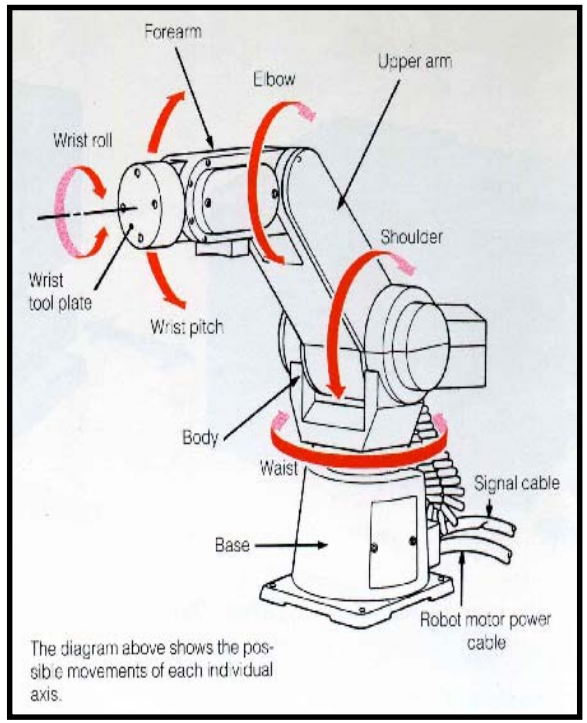
Software:

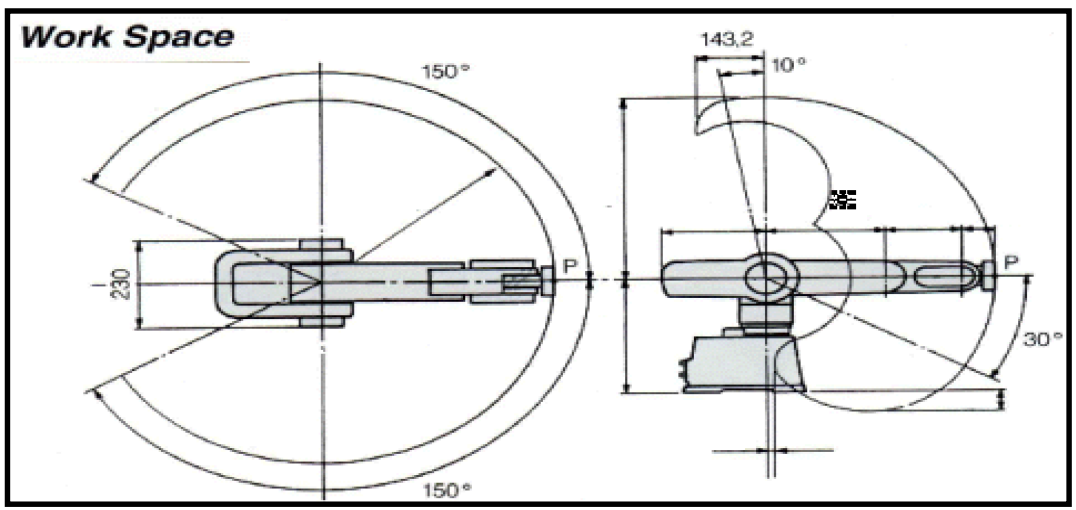
- Vision tools for Range Images*
- Vision tools for Intensity Images specific to this application
- Robot Controller*
- Robot Planning tools based Image data

Development System Model : Step 1

Purchase Robot Arm:

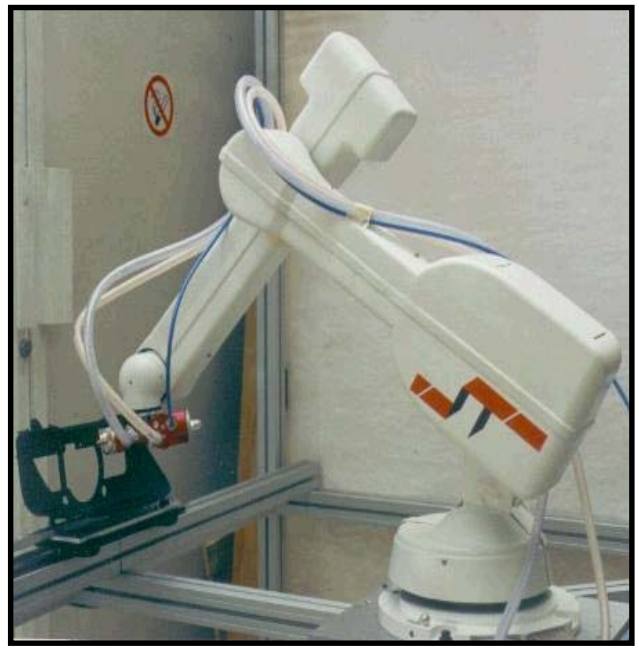
- Flexible with 5-6 degrees of freedom
- Cost effective for lab use
- Available attachment for our needs
- Workspace limited to confines of the lab
- Controller which will easily except input from computational components





Development System Model : Step 2

Setup Robot Arm:



- Learn to control Robot Arm
- Based on Robot Arms limitations demonstrate the ability to guide robot to a desired position in 3-D space
- Design interface from robot arm to KingTut
- Develop algorithms or controller to guide robot arm to a position in 3-D space

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Development System Model :Road Trip

Parameters:

- Avoid Class times
  - MTWR 11-12:15
  - MWF 1:1:50
- Avoid Friday
- Convenient time for Antene Research (call today)

Suggestion:

- T or R 1:00 PM
- Either take University Van or Rent a Van