CENG 6533 Robotics

Homework 3 Spring 2015

Dr. T. L. Harman: 281 283-3774 Office D104 Due Feb 16, 2015

Do the homework in HW3 . Questions are from Klafter Chapter 1 and Chapter 2.
First set are review questions. Second set considers architecture and controllers for robotics.

Write the answers in detail by references to the WEB or other sources but the final product should use your own works. Be complete

If you copy paragraphs from the WEB or other sources – enclose them in "Quotes" and give the reference.

NOTE: List all references - the web URL, books, etc. Also, please list the DATE of the reference and a brief summary of the reference.

6533 HW 3

I

1.11 REVIEW QUESTIONS

KLAFTER CH 1
PICK 5 OF THE 10

50

Due to the fairly descriptive nature of this chapter, the problems that will be included at the end of subsequent chapters are replaced here by review questions. The purpose of these is to help the reader clarify the mostly nontechnical ideas presented in this introduction to robots.

1.1 Discuss the major differences between servo-controlled and non-servo-controlled robots.

1.2 Define the following terms:
- a. Work envelope
- b. Work cell
- c. Tip speed
- d. Coordinated motion
- e. Return on investment

1.3 Discuss the roles that the major and minor axes of a robot play in positioning a part in space.

1.4 Discuss the differences between fixed and flexible automation.

1.5 Discuss at least five robotic applications in terms of the type of robot that is best suited for the job, the level of external sensory information required, and the repeatability of the manipulator demanded by the task.

1.6 Discuss three methods of "teaching" a robot.

1.7 The end effector is the single component that "personalizes" the robot to a particular task. Explain this statement.

1.8 Describe the function of the four basic components of a robot.

1.9 Why is the NASA *Space Shuttle* robotic arm not a true robot? IS THE ROBONAUT ?

1.10 Discuss the need for certain robots to perform straight-line motion and provide several applications where this feature is absolutely necessary.

PICK TWO OF THE THREE

2.7 PROBLEMS

50

2.1 Investigate the architecture of some commercial robots and their controllers. Compare the functionality of the commercial units to the general subsystems shown in Figure 2.2.2. PBB COMPUTER + ARM + CAMERA

2.2 Investigate the actual implementations of some commercial robots and their controllers. Discuss the advantages and disadvantages in these implementations (and architecture) if one wanted to implement features (such as those listed in Section 2.4) that are currently missing.

2.3 Investigate the various methods used by commercial robot manufacturers to program their controllers. Consider software structure, languages or menu systems, dedicated controls, and so on. Based on the list of the general features given in Section 2.4, define what commands are used to implement these features for one or two commercial units. For example, how does one command a PUMA robot to move in a straight line, or how does one command a particular output line to be energized?

GIVE REFERENCES ! PICK A MODERN ROBOT

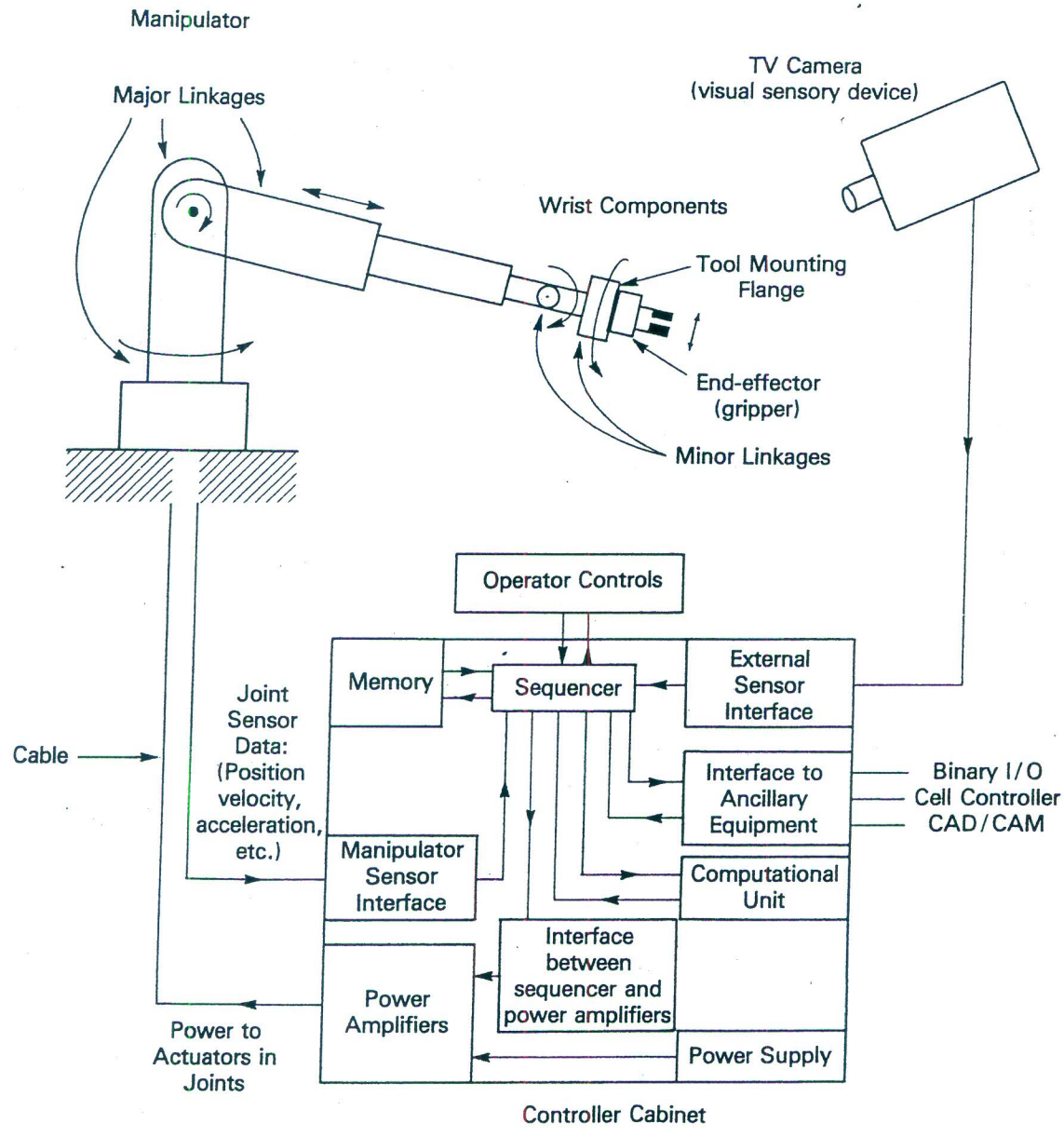

Figure 2.2.2. Subsystems of robot components.

The real-time clock is used to implement delays and to synchronize information transfer among the various devices connected to the bus. It may generate interrupts so that the servo controllers always sample the joint positions and generate new set points at the same instant, thus ensuring a uniform sample rate. These concepts are discussed further in Chapter 7.

From Figures 2.2.1 and 2.2.2 we can infer another way to organize and describe the components of a robot system. That is:

- Manipulator
- Connecting cable
- Controller cabinet

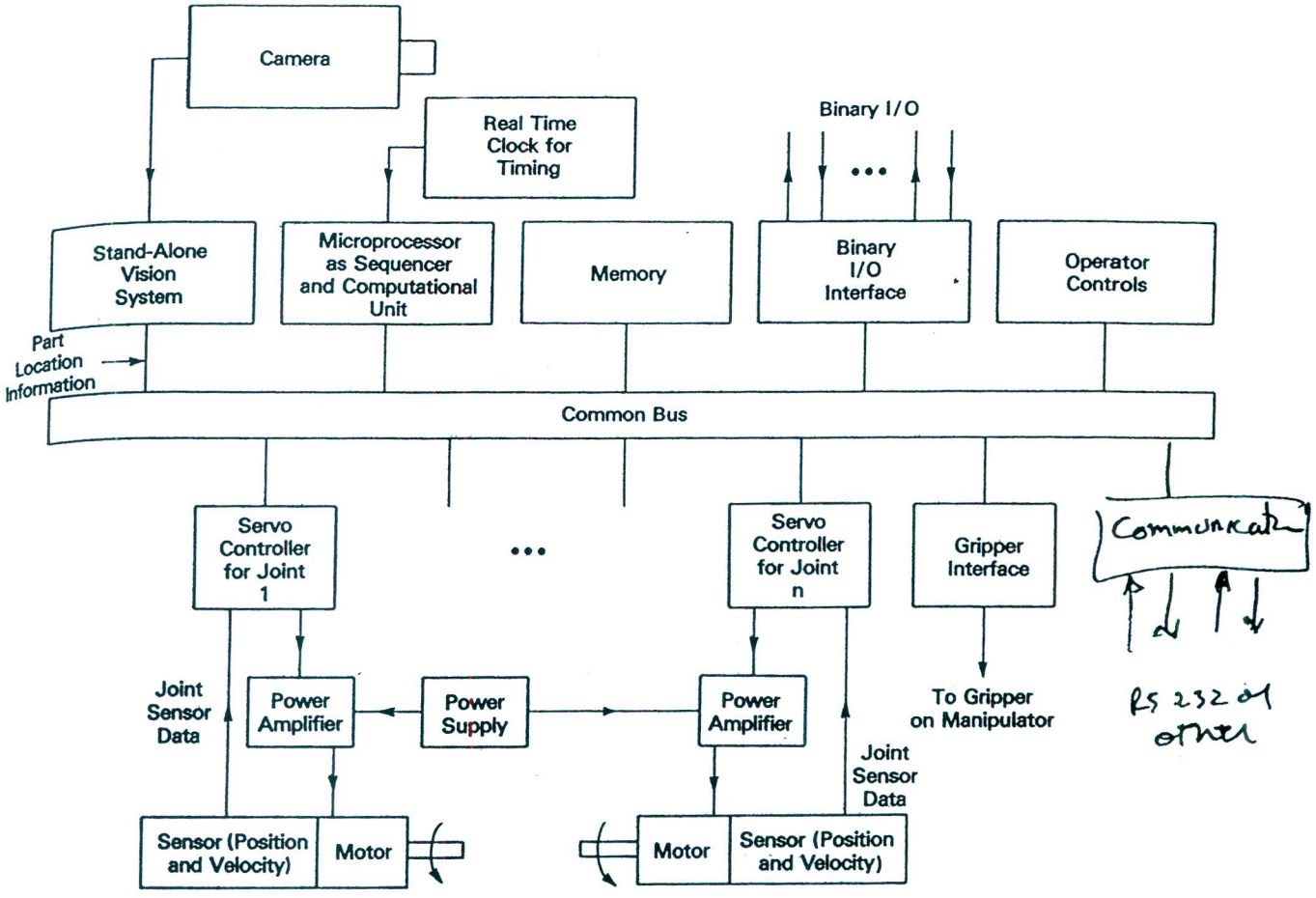

Figure 2.2.3. Possible implementation of a robot controller.

As opposed to the functionality approach just described, this organization is based on the physical packaging of the components and as a matter of fact, most industrial robots are packaged this way. Clearly, such a description is not as meaningful to the user in terms of the functionality of each subunit. However, it has the advantage of corresponding directly to the actual pieces of hardware.

2.3 THE ROBOT SYSTEM IN AN APPLICATION

By itself, a robot system has limited utility. Normally, it must be integrated with other components so that it can be programmed or trained to do some useful task. The term "workcell" is used to describe a collection of automated equipment and controls dedicated to performing one or more specific tasks. The workcell may contain several robots in addition to fixed automation devices (e.g., part feeders and conveyors), control devices (e.g., computers or programmable controllers), or