MAE 163B / 263B – Dynamics of Robotic System

Project No. 1

Market and Industry Analysis & Qualitataive Robotics System Design

MAE 163B (Undergraduate Class) – Solve Problem 1

MAE 263B (Graduate Class) – Solve Problem 2

Note: The following two assignments are described as “open questions” meaning there is no right or wrong way to address them. As an engineer and/or a scientist who would lead R&D group, one makes the best attempt to gather and address these questions the best way possible given the current knowledge. These analyses aim to inform the stakeholders, decision makers, and design engineering the best initial starting points of the design process. Feel free to add more information that is not specifically outlined below.

1. **Problem No. 1 - Market & Industry Analysis** - As a lead engineering analyst in a consulting company conduct a **Market & Industry Analysis** of the robotics industry
    a. Market Research - Identify reputable sources of information including IEEE, governing bodies, federal agencies, privet firms, academia etc. and formulate your reference list
    b. Review the information available and identified the most recent information available for each topics
    c. Prepare a PowerPoint presentation and address the following topics.
        i. **Key market segments / applications** (disciplines) e.g. Manufacturing, Healthcare, Aerospace& Defense, Media & Entertainment, Logistics, Service,
        ii. **Companies and market share** in various applications
        iii. **Analysis of Leading Companies** (“Key Players”) in two selected submarkets address the following
            1. Company snapshot
            2. Operating business segments
            3. Product portfolio
            4. Business performance
            5. Key strategic moves and developments

            Example of submarkets

            - Manufacturing (e.g. ABB, Denso, Fanuc, Kawasaki, Kuka, Mitsubishi, Omron, Seiko Epson, Staubli, Yaskawa).
            - Healthcare / Medical (e.g. Intuitive Surgical, Verb)
            - Service
            - Aerospace& Defense
            - Media & Entertainment
            - Logistics
        iv. **Future Prediction** – Challenges & Visions
            1. What are the challenges of the field of robotics?

2. What are the visions of the field of robotics?
3. What is the expected market growth?

2. **Problem No. 2 - Robotic System Design** - As a lead scientist in a startup company you are asked to design a new surgical robotic platform preforming the surgical task autonomously. Chose one of the following medical applications:
    - **Dental Robotic System** – The robotic system is aimed to perform perpetration of a tooth for a crown
    - **Ophthalmological Robotic System –** The robotic system is aimed to perform a cataract procedure

    Presentation - Prepare a Power Point Presentation including an engineering analysis addressing the following topics

    a. **Literature Survey** - Overview of existing surgical robotic systems
    b. **Clinical Procedure** – Provide an overview of the surgical procedure broken down to steps aiming to accomplish the clinical outcome.
    c. **Clinical Requirements** – Describe the clinical requirements in order to accomplish the standard of care
    d. **Technical Requirement** - Defined the technical requirements of the surgical robotic system by addressing the following topics
        - External Loads
        - Time (speed / cycle-time)
        - Environment (Sterility)
        - Cost
        - No. of DOF (Task/Robot)
        - Workspace
        - Kinematics configuration
        - Dynamics properties
        - Actuation
        - Sensors
        - Accuracy
        - Reputability
    e. **Analysis** – Describe how each one of the following analytical methods will be conduct and what will be their contribution
        - Kinematics
        - Link length optimization
        - Singularities
        - Dynamics
        - Actuation optimization
        - Trajectory Analysis
        - Modal Analysis
        - Cost Analysis
        - Control
        - Low level (servo)
        - High level (sensor fusion)