20. Teams

- Teams
- Design process

What is a team?

"A team is a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they are mutually accountable."


Building Blocks for Teams, (Website). Penn State University, http://tlt.its.psu.edu/suggestions/teams/student/index.html

Stages of Team Development

- Forming
  - The stage where team members are just becoming acquainted—the “honeymoon”

- Storming
  - Conflict begins as team members negotiate work assignments, discuss what to do

- Norming
  - Team members learn to work together—pride begins to develop

- Performing
  - Team settles down and most of the work gets done
  - Internal fragmentation: on average, each file wastes a half a block
  - To handle wear-leveling, allocate from other end

Team Leader Role

- Responsibilities:
  - Calling meetings including finding a mutually agreeable time and place
  - Setting a meeting agenda (more on this later)
  - Facilitating the meeting (more later)
  - Monitoring progress against the plan
  - Identifying problem areas that need action

- Some rules:
  - The leader is not “the boss”
  - The team needs to agree on decisions and directions
  - Compromise is essential

To handle wear-leveling, allocate from other end
### Brainstorming

- Select someone to be the recorder
- Invite everyone to give their ideas and input
- Write down all ideas without criticism or discussion
- After complete list is generated, return for discussion/analysis
- Carefully select the best approach or idea from the list

### Brainstorming-Hints for success

- Avoid being judgmental of others’ ideas
- Try to look at all sides of an idea.
- Listen attentively and treat your teammates’ opinions with respect
- Try to encourage the widest range of new ideas
- Everyone should participate
- Don’t stop the idea session too soon
- Try to remove your ego from the discussions.
- Don’t take the rejection of your ideas personally.

### Holding Effective Meetings—Tips for Success

- **Before the meeting**
  - Name someone to be the facilitator
  - Create an agenda and send it to all team members
- **Set a time limit for the meeting**
- **During the meeting, if issues emerge that are not on the agenda, the facilitator should:**
  - Ask the team if this should be discussed now, or
  - Table the issues for the end of the meeting
- **During the meeting:**
  - Keep a list of decisions and actions items
  - Keep to the time commitment
  - Create an agenda for next meeting and agree on time and place
- **After the meeting:**
  - Send out a brief summary
  - List of action items
  - Those responsible for those actions

### Gantt chart

<table>
<thead>
<tr>
<th>Task Name</th>
<th>Start</th>
<th>Finish</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mechanicals</td>
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<td></td>
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<tr>
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<td>Power</td>
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<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debugging</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Break project into little tasks
Give yourself some milestones to show success
Group Communication

- Listen attentively and respect your teammates
- Ask questions
- Give constructive feedback:
  - Present your ideas forcefully, but keep an open mind.
  - Restate the original idea to be sure it's understood
  - Critique the idea, not the person
  - Be courteous
  - Be aware of body language and tone
- Meetings don't need to be a death march
  - Use humor effectively
  - Laugh with someone, do not laugh at someone

Team Problems

- **Frustration** over the size of the project
  - Members think of an individual endeavor rather than a group endeavor
  - Break the project up into tasks
  - Engage all group members
  - Set realistic dates for each task

Team Problems: Conflict

- **Internal conflict** – An team member is experiencing a personal conflict that is interfering with his or her ability to perform
- **Individual conflict with another team member** - One team member is in conflict with another
- **Individual conflict with the entire team** - One team member is experiencing conflict with the entire team
- **Conflict between several team members** - The entire team is experiencing conflict with several other team members

Conflict Resolution

- Acknowledge that the conflict exists.
- Gain common ground.
  - Seek to understand all angles: Let each person state his or her view briefly.
  - Have neutral team members reflect on areas of agreement or disagreement.
  - Explore areas of disagreement for specific issues.
  - Have opponents suggest modifications to their points of view as well as others.
  - If consensus is blocked, ask opponents if they can accept the team's decision.
- Attack the issue, not each other.
- Develop an action plan.
Design Process

We can only optimize two of the following:
- Schedule
- Resources
- Functionality

Product
Functionality

Schedule
Resources
(Cost)

1) Analysis phase

**requirements** parameters that the system must satisfy
- Lab 7 rules

**specifications** describing how the system should work
- Frisbee
- tracks
- one 8.4V battery,
- existing motors
- 3 minute race

**constraints** limitations, within which the system must operate
- the kit+$50
- play nice with other robots
- interfaces with other instruments and test equipment,
- development schedule.

2) High-level design phase (project proposal)

**build conceptual models**
- **data flow graph**
- **block diagrams**
- **fundamental equations**
- exploit abstraction
- search for existing components
- try different control algorithms

Data flow graph

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Voltage 100Hz</th>
<th>Analog amplifier 100Hz</th>
<th>ADC 200Hz</th>
<th>Timer 200Hz</th>
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<tbody>
<tr>
<td>Power 100Hz</td>
<td>Motor 100Hz</td>
<td>Interface</td>
<td>Digital control 100Hz</td>
<td>Digital sample 200Hz</td>
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<tr>
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<td>Keypad Routines 1Hz</td>
<td>Keypad 1Hz</td>
<td>Keypad Routines 5Hz</td>
<td>Keypad Routines 1Hz</td>
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<tr>
<td>Interface</td>
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<tr>
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<tr>
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<td>Speed 100Hz</td>
<td>Speed 100Hz</td>
<td>Speed 100Hz</td>
</tr>
</tbody>
</table>

Frisbee footprint

- measured from the point of contact

- 1.25 to 1.5in measured from the point of contact
3) Engineering design phase

- Hierarchical structure
  - Call-graphs
  - Data structures
  - Flow charts
- Basic I/O interfaces
- Overall software scheme
- Direct correlation between hardware/software systems and conceptual models
- Built mock-ups of the mechanical parts (connectors, chassis, cables, etc.)
- Mock-ups user software interface

4) Implementation phase

- Concurrent implementation
- Initially implement using simulation
- Divide into modules

5) Testing phase

- Design for test
- Concurrent testing
- Control and observability (use OLED SDC)

Call graph

- I/O devices are global
  - Module
  - I/O
  - Module
  - I/O
  - Module
  - I/O

- I/O devices are local
  - Module
  - I/O
  - Module
  - I/O
  - Module
  - I/O

An Effective Team Checklist

- Define a common goal for the project.
- List tasks to be completed.
- Assign responsibility for all tasks.
- Develop a timeline and stick to it.
- Develop and post a Gantt chart for the plan.
- Document key decisions and actions from all team meetings.
- Send reminders when deadlines approach.
- Send confirmation when tasks are completed.
- Collectively review the project output for quality.