IPRO 310 Project Plan

Summer 2009

Devices that Assist Blind & Visually-Impaired Individuals in Swimming and Other Exercise Activities

1. Team Information

A. Team Member Roster

* Team member is consulting and is not registered for class this semester

Name	Email	Phone #
Baar, Coleman	cbaar@iit.edu	[redacted]
Dykeman, Kimberly	kdykeman@iit.edu	[redacted]
Hotz, Thomas	thotz@iit.edu	[redacted]
Kruse, Kevin	kkruse1@iit.edu	[redacted]
Kwiatkowski, Lisa	lkwiatko@iit.edu	[redacted]
Lane, Brendan	blane2@iit.edu	[redacted]
Lopez, Roman	rlopez6@iit.edu	
Reilly, Jeffrey *	jreilly2@iit.edu	[redacted]
Sarkar, Smita	ssarkar8@iit.edu	[redacted]
Sowiak, Joanna	jsowiak@iit.edu	[redacted]
Stelcel, Carl	cstelcel@iit.edu	[redacted]
Winston, Nithin	nwinston@iit.edu	[redacted]
Zhou, Raymond	rzhou1@iit.edu	[redacted]

B. Team Member Strengths, Needs, and Expectations

Team Member	Email	Major, Year	Skills/Strengths
Baar, Coleman	cbaar@iit.edu	ME, 4th Year	Experience with the physically and mentally disabled Computer Proficiency (Word, Excel, Basic C++, and Basic AutoCAD, Basic MATlab) Political Background
Dykeman, Kimberly	kdykeman@iit.edu	PSYC, 2nd Year	Proficient at Microsoft Office (Word, Powerpoint, Publisher, Excel). Basic experience with C++ and Visual Basic programming languages. Psychology experience.
Hotz, Thomas	thotz@iit.edu	ME, 4th Year	Leadership experience. Communication proficiency. Word, Excel, and PowerPoint Programming in C++.
Kruse, Kevin	kkruse1@iit.edu	BME, 4th Year	Extensive use of Microsoft Word, Excel, and PowerPoint Programming in C++, HTML, PHP, MYSQL, Actionscript 3, XML Some Spanish speaking and writing skills
Kwiatkowski, Lisa	lkwiatko@iit.edu	BME, EE, 3rd Year	Proficient at the Microsoft Office Suite, including Word, Excel, and PowerPoint. Experienced in formal scientific research and statistical analysis, Java

			programming language, and MATLAB. Leadership experience.
Lane, Brendan	blane2@iit.edu	AE, 3rd Year	Team member experience. Experienced with Matlab and proficient in MS Word and Excel, also used Maple.
Lopez, Roman	rlopez6@iit.edu	ARCH, 5th Year	10 years of restaurant management experience, basic knowledge of web design, communication and leadership skills.
Reilly, Jeffrey*	jreilly2@iit.edu	PHYS, 3rd Year	Excellent leadership and communications skills. Ability to identify and solve problems. Computer competency with proficiency in Microsoft Office Suite and Computer Programming (Language C++). Certifications in CPR and First Aid.
Sarkar, Smita	ssarkar8@iit.edu	BME, 4th Year	Leadership skills. Research experience in BME. Computer proficiency (Microsoft Office, MATlab, C++).
Sowiak, Joanna	jsowiak@iit.edu	ME, 4th Year	Polish fluent in reading and writing. Windows Vista /XP/ 2000/ Microsoft Word, Excel, PowerPoint, and Matlab
Stelcel, Carl	cstelcel@iit.edu	BME, 4th Year	Computer proficiency (Word, Excel, Powerpoint, basic C++, basic Java, some Autocad, basic PSpice, Matlab)
Winston, Nithin	nwinston@iit.edu	BME, 4th Year	MATLAB, Eclipse, MS Office (Word, Excel, PowerPoint), AutoCAD, Basic understanding of PSpice. Bilingual: English and Malayalam.
Zhou, Raymond	rzhou1@iit.edu	EE, 4th Year	Computer proficiency (Word, Excel, Powerpoint, basic C++, basic Java, some Autocad, basic PSpice, Matlab)

C. Team Identity

I. Name: Buoy

II. Logo: 

III. Motto: “A Vision for Blind Swimmers”

2. Team Purpose and Objectives

A. Our mission is to develop, test, and implement assistive technology with the community that promotes safety and improves independence of blind and visually impaired (BVI) swimmers.

B. Team Objectives

I. Design and develop a cost effective assistive technology prototype using current laser and/or electromagnetic field technology.

a. Verify the application of laser technology for underwater use.

b. Incorporate device into environment in a discrete manner.

c. Indentify ways to communicate usable information between the technology and the swimmer.

II. Include the BVI community in the design process using surveys, interviews, and BVI facility visits.

III. Modify the Buoy website so that it is accessible to the BVI community through existing screen-reader software.

IV. Create a cooperative, motivational and innovative team environment using team-building techniques.

V. Research user markets to maximize consumer benefit and marketability of potential device(s).

VI. Enhance continuity between semesters by utilizing past resources and continuing effective documentation methods.

3. Background

A. Collaborators

I. The Chicago Lighthouse for the Blind & Visually-Impaired was founded in 1960, its main mission is to serve people who are blind or visually impaired with a broad array of innovative programs designed to assist them in leading richer, more independent lives.

II. The Wisconsin Center for the Blind and Visually Impaired is a school that has been teaching BVI students, K-12, since 1999.

III. The electrical engineering design teams at the Rose-Hulman Institute of Technology.

B. Customer: The blind and visually impaired community

By the numbers:

I. 1.1 million: Estimated number of legally blind Americans

II. 54,000: Younger than 19 and blind

III. 370,000: Older than 85 and blind

IV. 121,000: People who are completely blind

V. 110,000: Blind people able to distinguish only between light and dark 609,000 children in the United States live with some degree of visual impairment and over 50,000 of them are legally blind.

C. User Problem

I. In the past, most of the IPRO groups focused on technology before obtaining feedback from the BVI community. As a result, the devices that had been created did not facilitate autonomous swimming by the users. The prototypes were often bulky, drew attention to the blind swimmers, and caused impediments in the swimmers performance.

D. Technology

I. The independent living philosophy must be employed in the development of the devices involved in this project. Consumers must be involved in the conception, design, and development of an assistive device.

II. Three technologies were tested from the previous IPRO as potential solutions to the problem of location in pool environments. These technologies are ultrasonic sensors, laser sensors and an invisible fence concept. Ultrasonic sensors are essentially a type of SONAR; last semester this was determined to not be as cost effective as laser technology or invisible fence technology. The invisible fence concept works by creating a boundary with a wire. A signal generator sends a current through the wire that can be picked up when a receiver, worn by the swimmer, nears the established perimeter. Laser sensors detect lasers given off by a transmitter and communicate to the swimmer when the beam has been broken.

E. History

I. The passive device developed at Notre Dame University and modified at IIT showed signs of success by helping swimmers correct their direction if they were off track; however it did so at the cost of requiring a large, bulky device that stands out from conventional methods of swimming.

II. A vibration belt was attempted. This device was also large and stood out. It did not eliminate the need for an assistant to be outside the pool warning the swimmer when they were nearing walls or lane lines.

III. A snorkel device was created. This stood out in the pool because most swimmers do not use snorkels when swimming laps and the mouthpiece was rather large. Additionally, it required an assistant to be outside the pool giving directions.

IV. SONAR was used before as well, however in previous attempts the groups tried to mount the sonar source on the wall instead of on the swimmer. Mounting it on the wall lead to a lot of noise and false signals getting picked up and misleading the swimmer.

V. Devices I, II, and III failed to achieve independence of the swimmer due to the need of an assistant. IV failed by not correctly "mapping" the environment.

VI. Last semester laser technology and invisible fence technology worked both in and out of the water, showing promise for a future prototype.

F. Ethical Issues

I. Beneficence: the action that is done for the benefit of others. Beneficent actions can be taken to help prevent or remove harms or to simply improve the situation of others.

a. Developing assistive technology to aide BVI swimmers

b. Training the BVI community with the device

II. Non-malfeasance: to "do no harm." Refrain from providing ineffective treatments or acting with malice toward subjects. The pertinent ethical issue is whether the benefits outweigh the burdens.

a. Quality and safety of the prototypes

b. Include precautionary information for when using the device

III. Autonomy: the "personal rule of the self that is free from both controlling interferences by others and from personal limitations that prevent meaningful choice." Autonomy is used to help individuals act intentionally, with understanding, and without controlling influences.

a. Informed consent of participants

b. Discrete appearance of device in order to raise positive self-image

c. Increasing independence, while decreasing dependence on other people by providing useful device feedback

IV. Justice: the quality of being fair and reasonable

a. Price that fits the intended market

b. Patent and copyright

c. Overall availability and serviceability of the device to the BVI community

V. Fidelity: faithfulness to a person, cause, or belief, demonstrated by continuing loyalty and faith.

a. Maintaining past contacts, as well as developing repoires with new contacts and facilities

b. Receiving input from the BVI community

c. Providing demonstrations of the technology to the BVI community

d. Continued involvement with the BVI community Business/Societal Costs

G. Business and societal costs

I. BVI persons unable to exercise on their own safely and independently causing health problems in many BVI individuals.

II. Lack of accessible pools for BVI swimmers

H. Practical Solutions

I. Our team will arrange to visit the Chicago Light House and conduct surveys and interviews with BVI individuals.

II. Two active device teams created: Invisible Fence and laser device.

III. Prototype utilizing one or both technologies will be created.

I. Similar Solutions

I. Some underwater swimming devices that are used by the swimmers: Life Buoyancy Device, Swimming Aid, Sonar Lifeguard and Easy Float.

II. Devices that can be used underwater but not for swimming purposes; these devices may be adapted to our design: Underwater phone, Underwater iPod and Underwater headphone.

III. Devices using either sonar or ultrasound to guide the blind but they cannot be used underwater: Tongue Sensor and Electrode.

IV. Several of the devices stated above are already being sold while the few others are only in the patent phase.

4. Team Values Statement

Behavior	How to address?
Punctuality and absences	Publish attendance chart for peer reviews. Any member who plans to miss a class session will provide the team leader with 24 hours notice.
Conflict resolution	Team leader encourages antagonists to discuss the problem face to face.
	If the problem is related to the direction of the IPRO and the F2F method fails, the issue will be brought up during a class session and open for discussion. A vote (simple majority rule) is then taken for a final decision. The vote ensures that the issue is closed and the teams can move forward with their work. We want to ensure that conflict/issues will not impede the progress of the IPRO.
	If the problem is of a personal nature and the F2F method fails, the class advisors will be consulted.
Communication	Break the ice by conducting team building activities and encourage team members to express ideas and suggestions.
	Major teams and Minor teams will each decide among themselves the best method and times to meet and announce meeting times to the class.
	Host regular meetings that promote an open dialogue and allow team members to share their findings or problems directly.
	All communication between Bouy and the community will be done by the Survey sub-team in coordination with the team leader

	Team members can share documents and obtain contact information on iGroups.
Motivation	Team building to improve team spirit.
Fair Distribution of work	Two major teams and three minor teams.
	Leaders of each major and minor team ensure members have fair workload.
	Volunteers for non-categorized work.
Documentation	One member of Documentation Team in charge of recording meeting minutes during each class and uploading to iGroup.
	Agendas are decided on by the team leader and discussed with professor before class to ensure our work is on track.
	Documentation team ensures group in on-track with deliverables.
	Timesheets record each member's time contribution in this project.
	iGroup houses all documentation ensuring organization and visibility to entire team.

5. Methodology

A. Existing assistive technology does not allow BVI swimmers to swim as independently as they would like according to survey data from previous semesters.

B. Our team will:

   I. Team members will be divided into two development teams geared towards utilizing specific technology in the development of a prototype device.

   II. Team members will be further broken down into sub teams that will focus on such tasks as: media, research/surveys, and documentation.

   III. It is reasonable to expect that by the end of the semester we will have researched and developed a prototype device based on one or two of the technologies we have chosen to use. We will have made contact with the BVI community and completed multiple surveys to aid in the design process. We will have a completed prototype with initial testing. We will also have detailed documentation that will be easy to follow by future IPRO's.

C. Potential solutions will be tested by the major teams and the volunteering participants

   I. There will be three phases of testing:

      a. Phase one will consist of only Buoy members

      b. Phase two will consist of Buoy members and BVI swimmers

      c. Phase three will consist primarily of BVI swimmers and a few control tests with Sighted swimmers

   II. Tasks include: acquisition of facilities and participants, user-feedback and ensuring complete safety of all involved. Subtasks will include acquiring external testing locations and identifying all legal and financial issues with testing locations and participants.

D. Results of research and testing will be documented as follows:

I. The Survey sub-team will work to develop an appropriate sample of testing methods, surveys, and interviewing processes. Upon approval of the entire team, the Survey team will administer the testing methods and the surveys.

II. The Survey team will also be responsible for creating reports summarizing the findings, which will be documented and presented to the class to aid in the design process.

III. The Documentation Team will be responsible for recording minutes during these presentations and posting all relevant documents to the team website and iGroups and oversee the posting of the raw data by the Survey team.

E. The Survey team will be responsible for analysis of the data, which will then be presented to the class for discussion and uploaded to iGroups for further viewing. The raw data will be analyzed using charts, graphs, and other analysis tools to design the prototype devices.

F. The Documentation sub-team will be responsible for the written deliverables due during the semester. Their rough drafts of the deliverables will be presented to the entire group and a final draft will be developed through class feedback.

G. The Media sub-team will be responsible for the presentation deliverables due during the semester as well as maintaining and organizing the iGroups site. They will also be responsible for maintaining and improving the Buoy website created by the previous IPRO and to make sure it is compatible with existing software used by the BVI community. All deliverables need to be approved by the entire team prior to submission.

H. Contact List

I. The Chicago Lighthouse
1850 West Roosevelt Road
Chicago, Il 60608-1298
Tel: (312) 666-1331
Fax: (312) 243-8539
www.thechicagolighthouse.org

II. Wisconsin Center For Blind and Visually Impaired
Dan Wenzel, Center director
1700 W. State St. JanesVille, WI 53546
Tel: 608-758-6100
www.wcbvi.k12.us

III. Illinois School for the Visually Impaired
658 East State St.
Jacksonville IL 62650
Tel: 1-800-919-5617
Fax: 217-479-4479
www.isvi.net

IV. Indiana School for the Blind and Visually Impaired
7725 North College Ave.
Indianapolis Indiana 46240
Tel: 317-253-1481
Fax: 317-251-6511

http://intra.isbrockets.org/public/

V. Rose-Hulman Institute of Technology ECE department
Tel: 812-877-8228
http://ece-1.rose-hulman.edu/ece/

6. Expected Results

A. Expected Activities during the project:

I. Each of the major groups will be involved in researching, designing, and building a prototype device using information obtained from the survey and interview data.

II. The survey team will create various surveys and administer them at the Chicago Lighthouse. They will compile and analyze the data and present their findings to Buoy members to aid the design process.

III. The media team will update the Buoy website and verify that it is accessible to the BVI community through existing assistive software.

IV. The documentation team will create and deliver all required deliverables for the project, take minutes during all group meetings, and document all the progress made on the project so that the next semester will be able to continue the project without backtracking.

B. The expected data will be obtained from surveys and interviews the BVI community, as well as research and testing done by the group. The data we hope to obtain will tell us the current problems with our device and where it needs improvement, as well as design characteristics from the BVI community that will be incorporated into developing the prototype.

C. We expect to have developed a prototype device that will most suit the community through extensive surveying and interviewing with the BVI community. We will also provide information about testing and research to future semesters so that they can improve the device to even better suit the community.

D. We expect to utilize the research done last semester to design and develop a prototype assistive technology device. The media team will make the Buoy website accessible by the BVI community.

E. The objective of this semester is to develop a working prototype device using either laser or invisible fence technology. We will have analyzed data obtained from the BVI community to give to next semester for future use. We will also have documented all our research, as well as the designs to recreate the prototype.

F. A major challenge is to be able to utilize the technology we have into a usable device, and to be able to communicate the necessary information to the user of the device. There are challenges and risks associated with testing, surveying, and interviewing, such as IRB approval and creating a safe and secure testing environment. We will have to change assumptions we have about the design of the device after we get more information from the BVI community about what kind of device they would like.

G. Buoy will document and incorporate all results into a final proposal, with all results being based on extensive research and testing in coalition with the BVI community.

7. Project Budget

Category	Requested	Approved	Explanation	Status
Supplies	$100 2/6/09	Awaiting	Wires, building materials, solder, and other miscellaneous items for modifying equipment	Pending
Equipment	$385 2/6/09	Awaiting	$75 5 Green Laser pointers $100 2 End switches $40 FM Transmitter $20 FM Headset $150 Innotek replacement receivers	Pending
Services	$25 2/6/09	Awaiting	Printing etc.	Pending
Travel	$100 2/6/09	Awaiting	Trips to stores for equipment and facilities to administer surveys, interviews and product testing.	Pending
Participant Support	$25 2/6/09	Awaiting	Used for pool test participants if needed.	Pending
Team Building	$100 2/6/09	Awaiting	Used for team building exercises to be determined	Pending
TOTAL	**$735**	**$0**		

8. Schedule of Tasks and Milestone Events

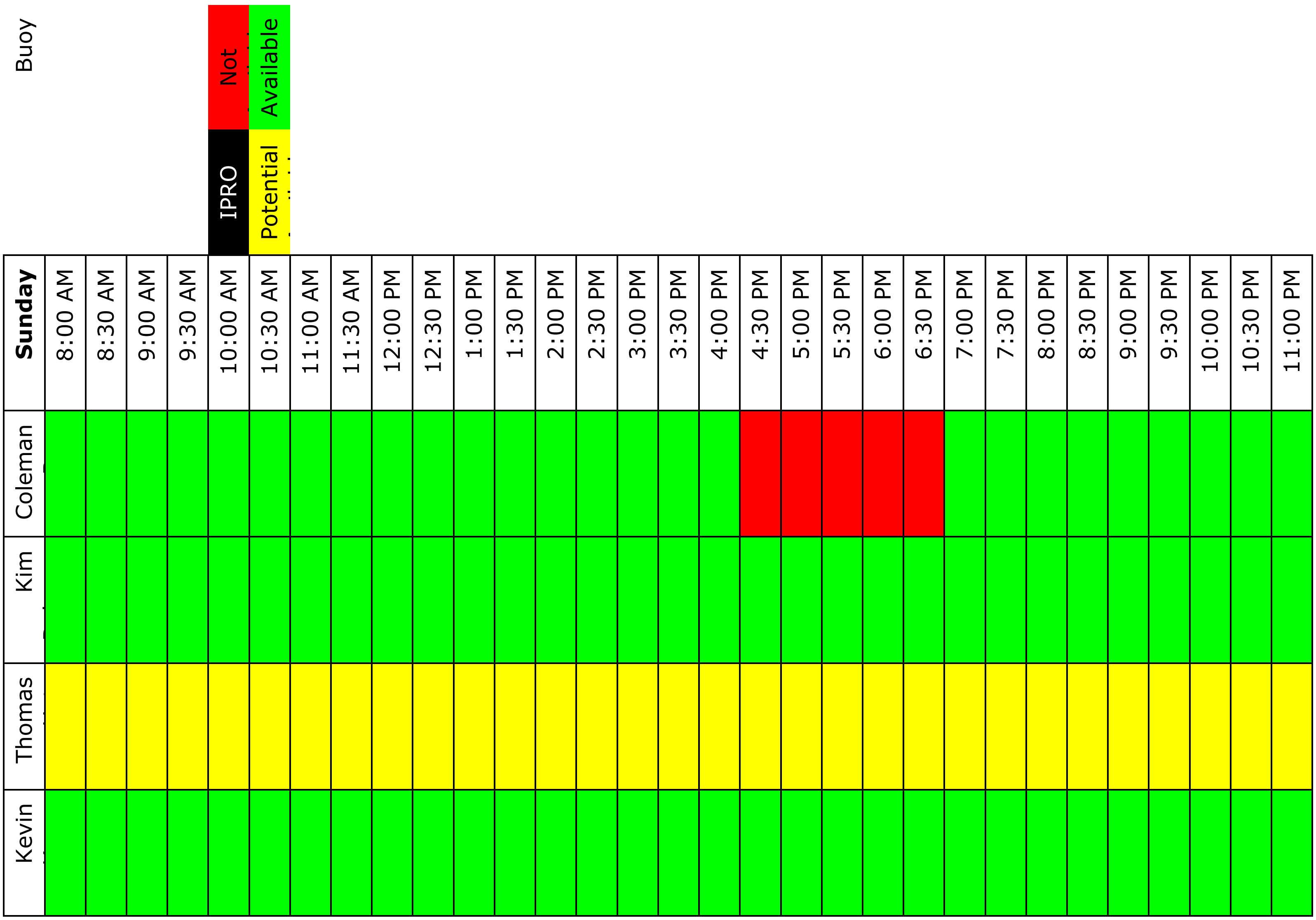
A. Tasks and events calendar

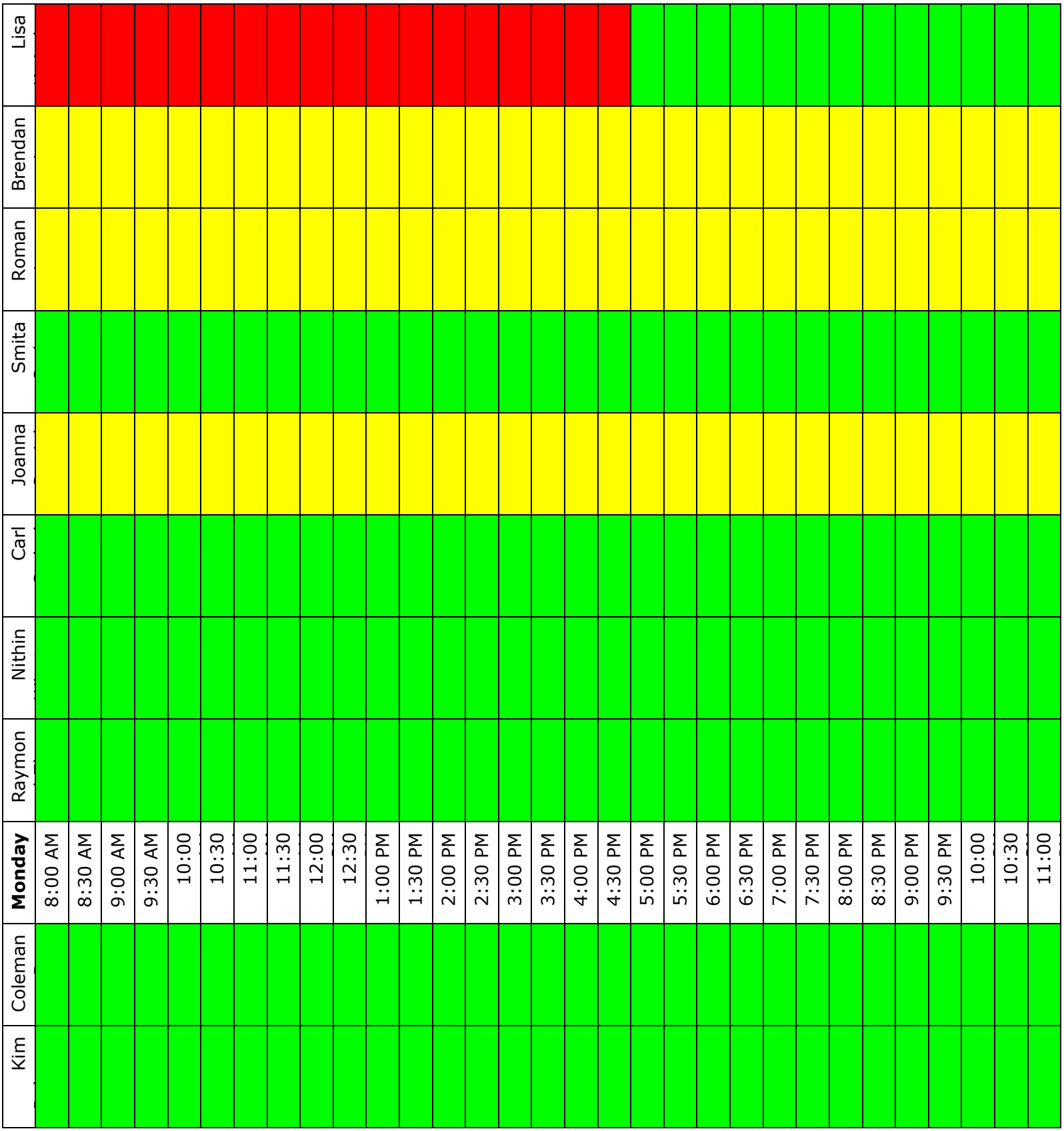
	June 1 to 6	June 7 to 13	June 14 to 20	June 21 to 27	June 28 to July 4	July 5 to 11	July 12 to 18	July 19 to 25
IPRO overview	X							
Defining the Problem	X	X	X					
Research/Surveys		X	X	X	X	X		
Identifying possible Solutions		X	X					
Teambuilding session				X				
IPRO Team Meeting Minutes	X	X	X	X	X	X	X	X
Project Plan (6/16)	X	X	X					
Ethics Framework Module		X						
Design/Build prototype			X	X	X	X	X	
Mid-term prep			X	X	X			
Mid-term reviews (6/30)					X			
Midterm peer evaluation					X			
Testing			X	X	X	X	X	
Communication Experience & IPRO Day preparation						X	X	
IIT course evaluation								X
Exhibit/Poster						X	X	X
Abstract/Brochure						X	X	X
Presentation (7/23)						X	X	X
IPRO Projects Day (7/24)								X
Final Report								X
Team Work Product								X
IPRO Stuff Hand-Off								X
Final peer evaluation								X
Individual team								X

member project analysis report								
IPRO Project closure								X
Website development			X	X	X	X	X	X
Time Sheets	X	X	X	X	X	X	X	X

B. Master team schedule

I. See iGroups for original file

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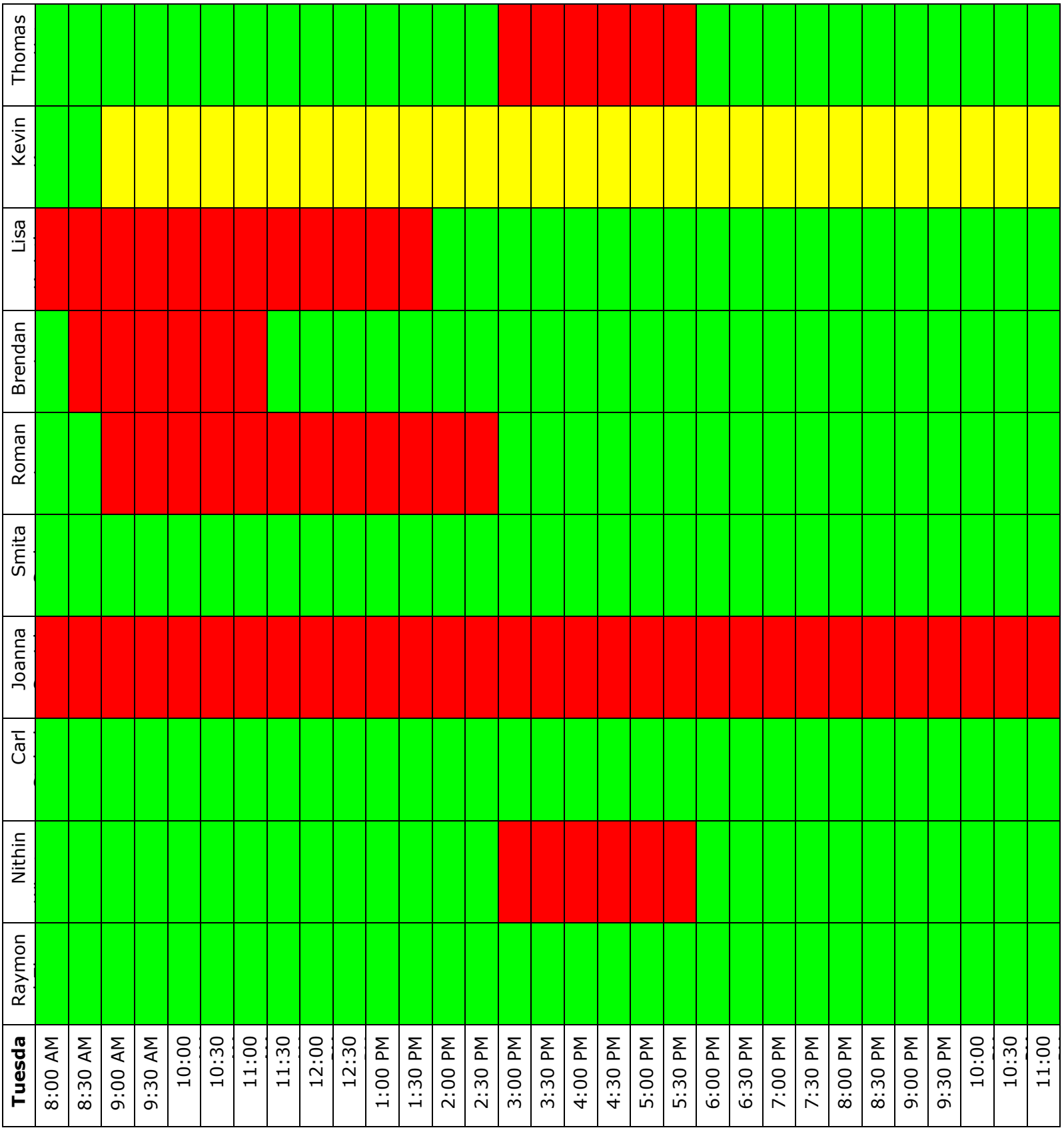
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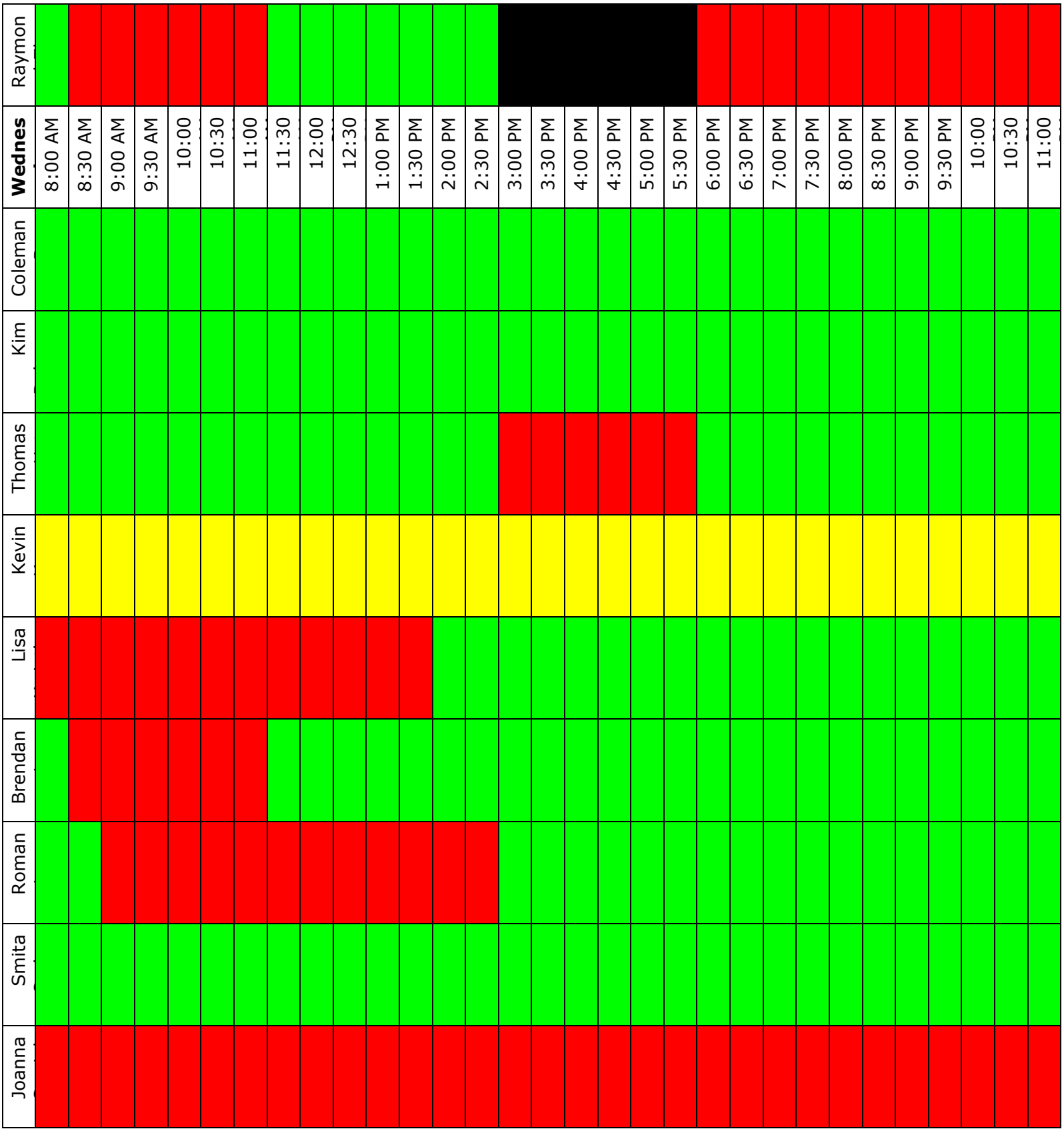
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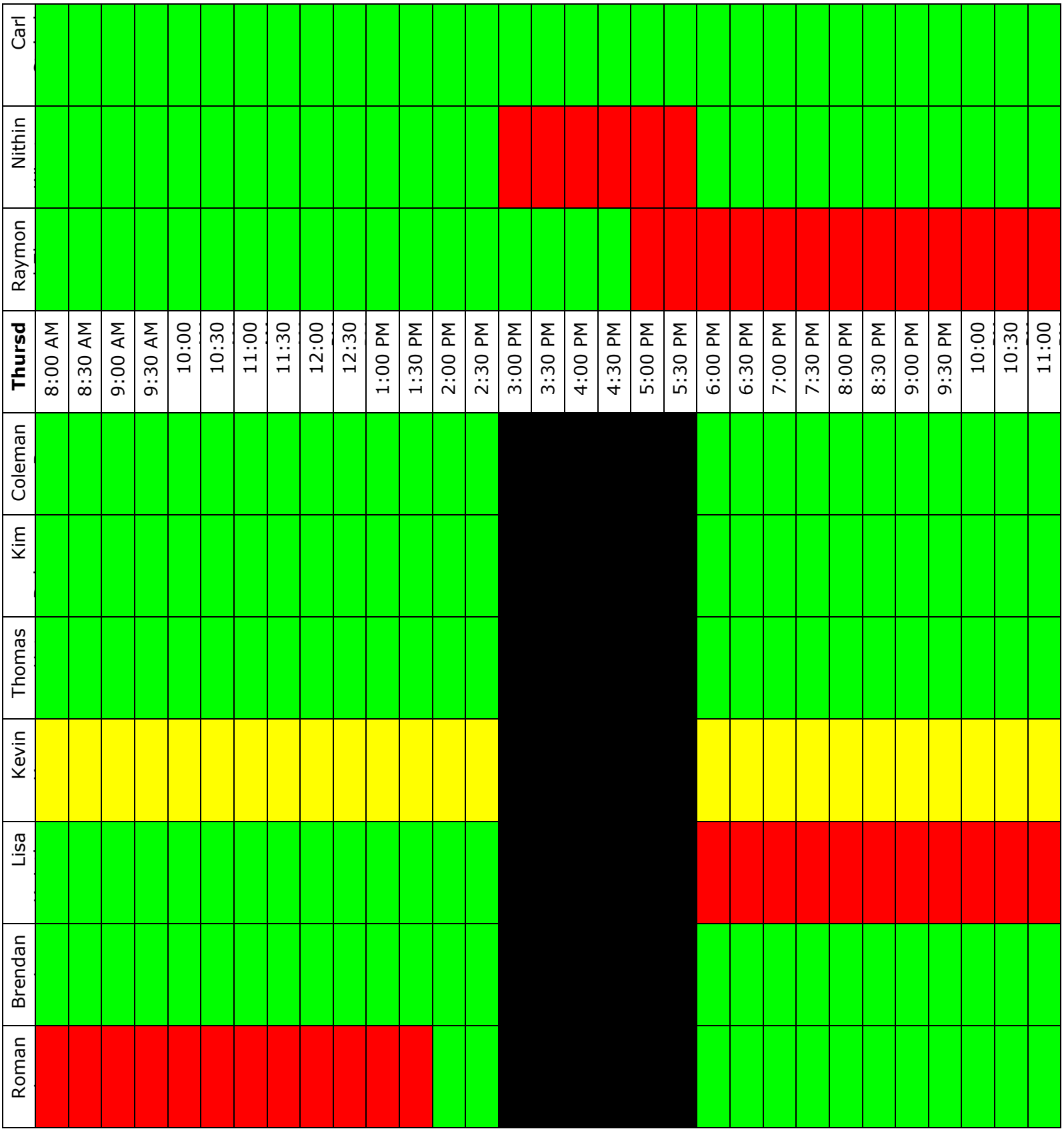
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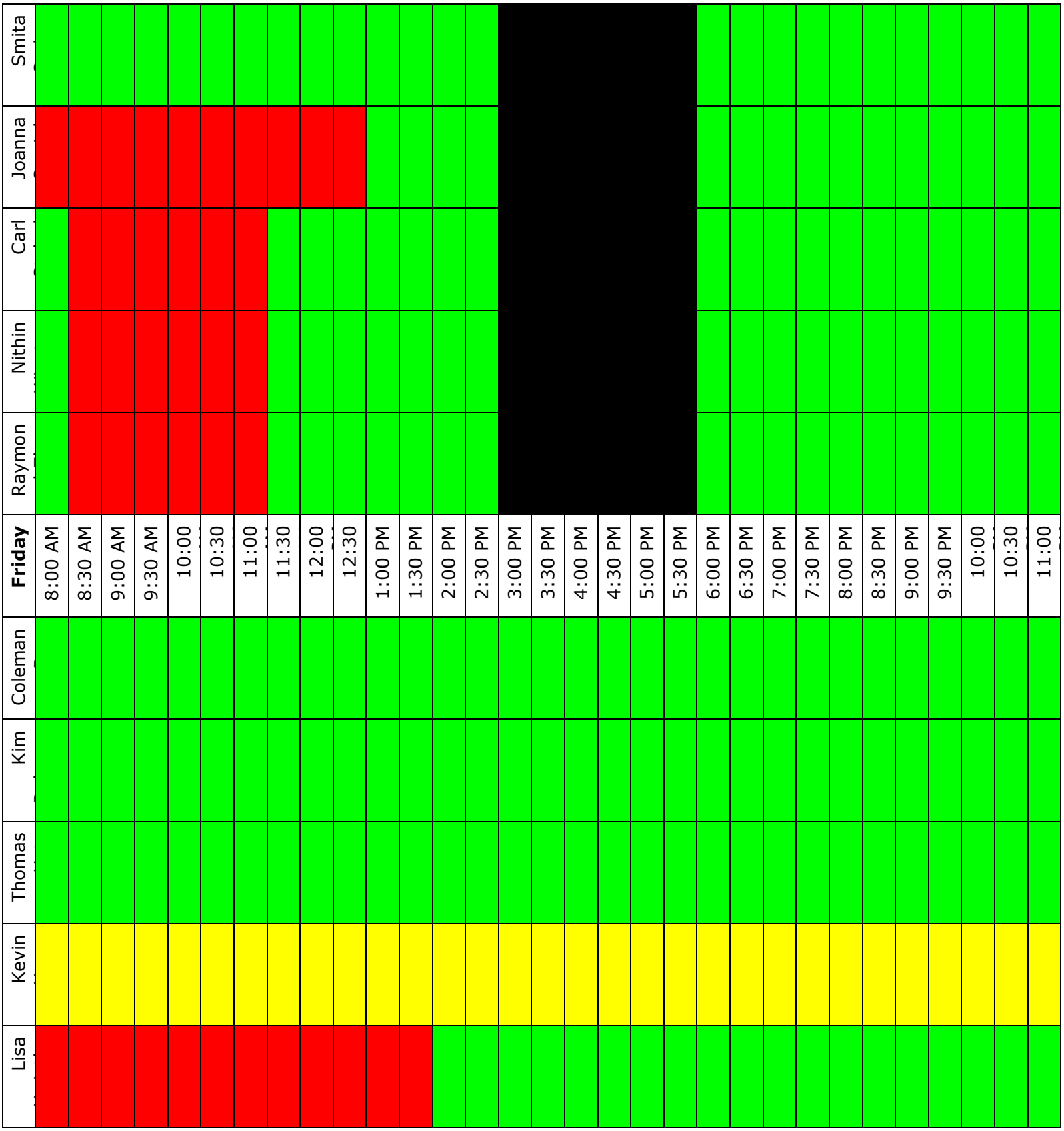
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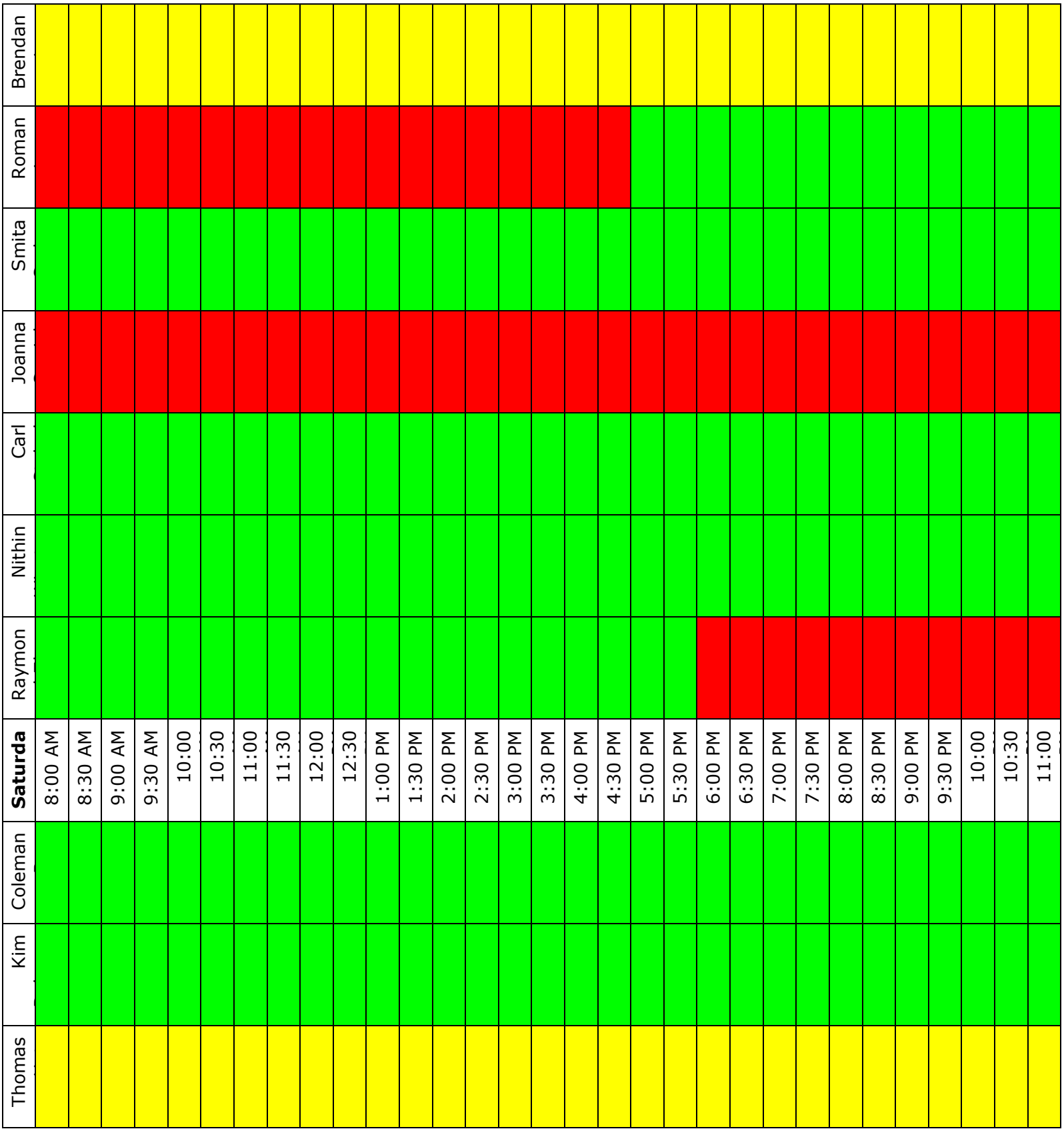
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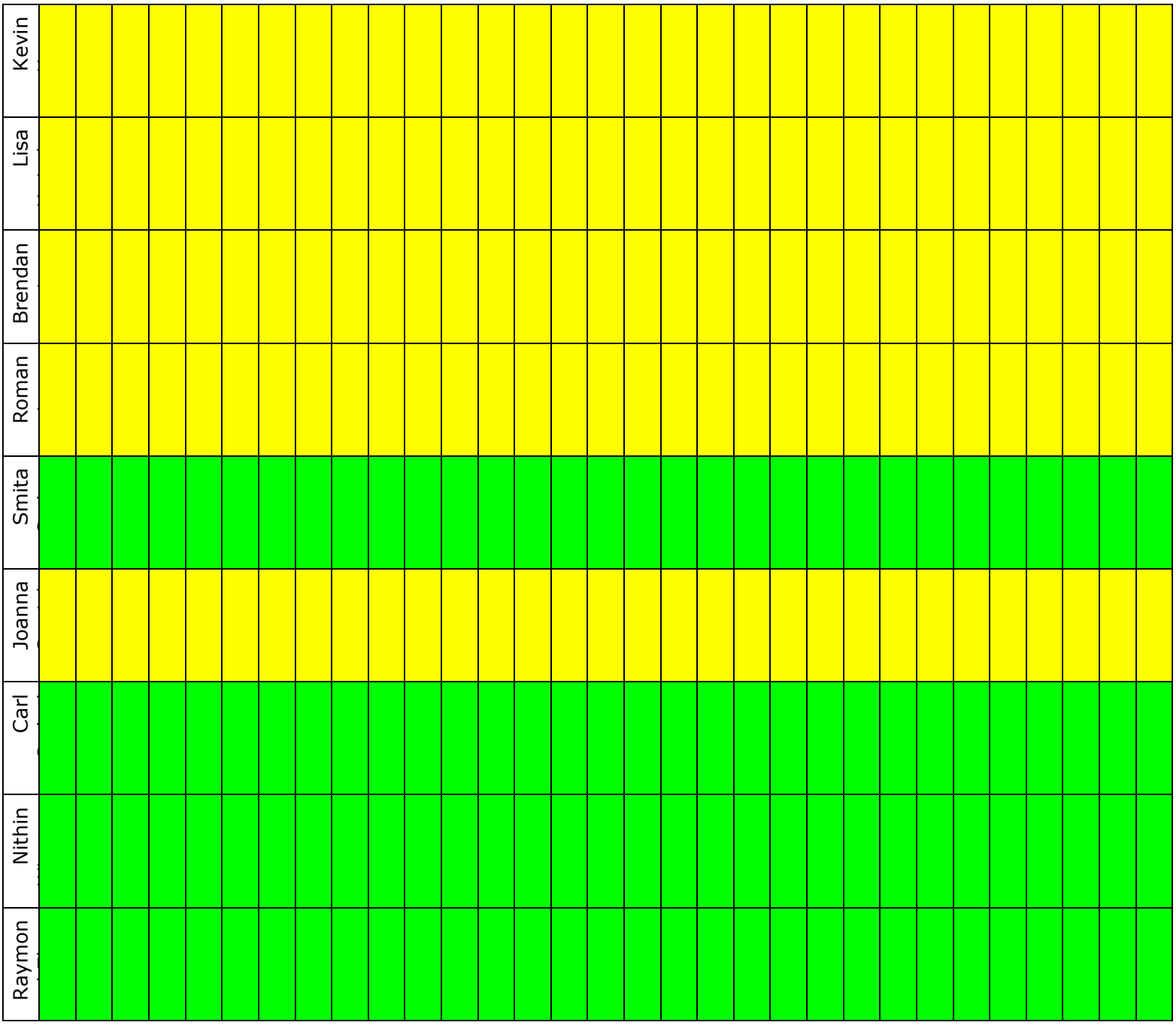

C. Task Breakdown

I. Identifying the Problem/ Solutions: The entire class will participate in brainstorming sessions to identify potential problems and solutions for prototype design. No special skills or education is needed.

II. Project Plan: Interested members formed a committee to create the project plan. Necessary skills include, previous experience with ipro, organizational skills, and proficiency with Microsoft Office.

III. Midterm Review: Selected members and volunteers will participate in the midterm review. Skills for this task include presentation skills, general knowledge of all technologies, comprehension of ethical issues related to this project, and proficiency in power point.

IV. IPRO Day/ Deliverables: Selected Members will present the ipro day presentation and run the booth at ipro day. Skills for this task include management experience, presentation skills, a general understanding of technology and ethical issues. Members of the media team and documentation team will design Deliverables. Skills include general understanding of the technology and ethical issues related to this project, computer skills in Microsoft Office, and basic web design.

9. **Individual Team Member Assignments**

A. BUOY Overall Team Leader: Coleman Baar

B. Major teams

I. Active Team 1: Electromagnetic field technology

a. Thomas Hotz (ME) (Continuing with Buoy in fall 2009) TEAM LEAD

b. Coleman Baar (ME)

c. Kim Dykeman (PSYC)

d. Roman Lopez (ARCH)

e. Smita Sarkar (BME)

f. Nithin Winston (BME)

II. Active Team 2: Laser technology

a. Kevin Kruse (BME) (Worked on laser in Spring 2009) TEAM LEAD

b. Lisa Kwiatkowski (BME/EE)

c. Brendan Lane (AE)

d. Joanna Sowiak (BME)

e. Carl Stelcel (BME)

f. Raymond Zhou (EE)

C. Minor Teams

I. Media Team

a. Smita Sarkar (Team 1) (Interested in web design) TEAM LEAD

b. Roman Lopez (Team 1)

c. Carl Stelcel (Team 2)

d. Raymond Zhou (Team 2)

II. Media Team Responsibilities

a. Website

b. Brochure/Abstract

c. Poster
d. PowerPoint Presentations
e. Deliverables CD
f. iGroups
g. Informal group pictures

III. Survey Team
a. Kim Dykeman (Team 1) (PSYC) (IRB experience) TEAM LEAD
b. Thomas Hotz (Team 1)
c. Kevin Kruse (Team 2)
d. Brendan Lane (Team 2)

IV. Survey Team Responsibilities
a. Survey development, administration, and results reporting
b. IRB approval
c. Contact lists
d. Community coordination

V. Documentation Team
a. Lisa Kwiatkowski (Team 2) (Management experience) TEAM LEAD
b. Coleman Baar (Team 1)
c. Joanna Sowiak (Team 2)
d. Nithin Winston (Team 1)

VI. Documentation Team Responsibilities
a. Midterm/Final report
b. Agendas
c. Meeting minutes
d. Budget Management
e. Timesheets
f. Compiling engineering designs
g. Pictures of events, pool tests, designs, etc.
h. Weekly status reports

D. The major teams are organized based on member skills and field of expertise to ensure equal distribution of talent. The minor teams are organized to include two members from each major team to ensure that both major teams have equal influence over the minor team's respective responsibilities and deliverables.

E. Every sub-team member is responsible for the tasks indicated in section 9.C as delegated by the respective team leader.

10. Designation of Roles

I. Master Schedule Maker: Coleman Baar
II. Weekly Timesheet Collector/Summarizer: Documentation Team
III. Minute Taker: Documentation Team
IV. iGroups Facilitator: Media Team
V. Website Creator and Facilitator: Media Team
VI. Agenda Maker: Documentation Team
VII. Timekeeper: Joanna Sowiak