

AOM5456
APPLIED METHODS IN SMARTAG SYSTEMS
SECTION 1234
SPRING 2022

1. **Catalog Description:** *3 credits.* Design, analysis, and evaluation of SmartAg methods for applications in production agriculture, biological and food engineering, forestry, land, and water resources. Students will learn hardware and software concepts used in SmartAg applications with real-world examples (e.g., UAV's, irrigation, controlled environments for plant and animals, crop modeling). *Offered every other Spring semester.*
2. **Course Coordinator:** Dr. Adam Watson
 - a. Office location: 113 Frazier Rogers Hall
 - b. Telephone: 352-294-6740
 - c. E-mail address: jaw7385@ufl.edu
 - d. Course site: Canvas e-Learning
 - e. Office hours: Thursdays: 3:00PM-5:00PM

Instructors:

- a. Dr. Tom Burks
 - b. Dr. Ziwen Yu
 - c. Dr. Yiannis Ampatzidis
 - d. Dr. Sandra Guzmán
 - e. Dr. Ying Zhang
 - f. Dr. Dana Choi
- Please contact your instructors through Canvas

Teaching Assistant: Quentin Frederick

- a. Contact: e-Learning
- b. Office hours: By appointment

IMPORTANT: When contacting the instructors or the teaching assistant, please allow up to 48 hours for a response, not including weekends or holidays. In addition, your instructors want to ensure your assignments are graded in a timely manner so please allow for 3-5 school days for your assignments to be graded and returned.

3. **Meeting Times:**
 - a. Tuesdays 9:35AM – 10:25AM (3rd period)
 - b. Thursdays 9:35AM – 11:30AM (3rd & 4th periods)
4. **Meeting Location:** Frazier Rogers Hall 283
 - a. Remote access is available to students accessing the course remotely through Zoom. To access the course Zoom visit the course Canvas page and click on Zoom Conferences.
5. **Pre-requisites and Co-requisites:** None

6. Course Recommendation: Science-based graduate student. Working knowledge or basic understanding of general programming language such as Python, C, C++, Visual Basic, or MATLAB and an understanding of applied physics.

7. Course Objectives:

Students, upon completing this course, will be able to:

- a. Develop proficiency in software and programming of hardware such as microcontrollers for agricultural applications.
- b. Select appropriate unmanned aerial systems used in real-time imaging, scouting and field mapping.
- c. Apply smart agriculture technology to monitor, control and manage agricultural systems.
- d. Analyze data using statistical software packages through applied methods and techniques to solve complex problems in agriculture.
- e. Evaluate decision support tools, best management practices, and technologies used to optimize performance, yield, and profit in agricultural operations.

8. Class Schedule: Listed assigned meeting times.

Week	Date	Module	Activity	Assignment Due	
1	3-Jan	1: SmartAg Hardware			
	4-Jan				
	5-Jan		Classes begin		
	6-Jan		M1L1	EE0	
	7-Jan			EE1	
	8-Jan			EE2,Q1	
	9-Jan			EE5	
2	10-Jan				
	11-Jan		M1L2	EE3	
	12-Jan				
	13-Jan		M1L3	EE4	
	14-Jan			EE6, JS&C1	
	15-Jan			Q2	
	16-Jan			HW1	
3	17-Jan		2:Software & Programming of Microcontrollers	MLK Jr. Day	
	18-Jan			M2L1	EE10
	19-Jan				
	20-Jan	M2L2		E12	
	21-Jan			EE18&20	
	22-Jan			Q3	

	23-Jan			
4	24-Jan			
	25-Jan		M2L3	EE14
	26-Jan			
	27-Jan		M2L4	EE21
	28-Jan			JS&C2
	29-Jan			Q4
	30-Jan			HW2
	5	31-Jan	3: Data in SmartAg Applications	
1-Feb		M3L1		
2-Feb				
3-Feb		M3L2		EE22
4-Feb				
5-Feb				Q5
6-Feb				
6	7-Feb			
	8-Feb	M3L3		
	9-Feb			
	10-Feb	M3L4		EE25
	11-Feb			JS&C3
	12-Feb			Q6
7	13-Feb		HW3	
	14-Feb			
	15-Feb	M4L1		
	16-Feb			
	17-Feb	M4L2	EE28	
	18-Feb			
	19-Feb		Q7	
8	20-Feb			
	21-Feb			
	22-Feb	M4L1	EE9	
	23-Feb			
	24-Feb	M4L4	EE29	
	25-Feb		EE30, JS&C4	
	26-Feb		Q8	
	27-Feb		HW4	
9	28-Feb	5: Smart Irrigation		
	1-Mar		M5L1	
	2-Mar			
	3-Mar		M5L2	

	4-Mar			
	5-Mar			Q9
	6-Mar			
10	7-Mar	Spring Break		
	8-Mar		No Class	
	9-Mar			
	10-Mar			
	11-Mar		No Class	
	12-Mar			
	13-Mar			
11	14-Mar	5: Smart Irrigation		
	15-Mar		M5L3	Project Dscrip Due
	16-Mar			
	17-Mar		M5L4	
	18-Mar			JS&C5
	19-Mar			Q10
	20-Mar			HW5
12	21-Mar	6: SmartAg Applications in Controlled Environments		
	22-Mar		M6L1	
	23-Mar			
	24-Mar		M6L2	
	25-Mar			
	26-Mar			Q11
	27-Mar			
13	28-Mar			
	29-Mar		M6L3	
	30-Mar			
	31-Mar		M6L4	
	1-Apr			JS&C6
	2-Apr			Q12
14	3-Apr	7: Internet of Things and Decision Support Tools for Agriculture		
	4-Apr			
	5-Apr		M7L1	
	6-Apr			
	7-Apr		M7L2	
	8-Apr			
	9-Apr			Q13
10-Apr				
15	11-Apr			

	12-Apr		M7L3	
	13-Apr			
	14-Apr		M7L4	
	15-Apr			JS&C7
	16-Apr			Q14
	17-Apr			HW7
16	18-Apr	Student Presentations		
	19-Apr		Student Presentations	
	20-Apr			JS&C8
	21-Apr		Reading Day	
	22-Apr		Reading Day	
	23-Apr			
24-Apr				
17	25-Apr	Student Presentations		
	26-Apr		Student Presentations	Project Report
	27-Apr			
	28-Apr			
	29-Apr			

Key: M (Module); L (Lecture), EE (Experiment Exercise); JS&C (Journal Summary and Critique); Q (Quiz) ; HW (Homework).

- 9. Material and Supply Fees:** Students are required to purchase an Arduino starter kit, available through Amazon.com which costs approximately \$60 plus tax and shipping. https://smile.amazon.com/EL-KIT-008-Project-Complete-Ultimate-TUTORIAL/dp/B01EWN0UUA/ref=sr_1_2_sspa?dchild=1&keywords=vilros+arduino+kit&qid=1597338743&sr=8-2-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEFFMFVXTE0xMIJEVFEmZW5jcnlwdGVkSWQ9QTA0ODE5MTYzSFBFUDhaSUIwOVpUJmVuY3J5cHRlZEFkSWQ9QTAyODAxODhQR1BSSk5VVVRDOFEmd2lkZ2V0TmFtZT1zcF9hdGYmYWN0aW9uPWNsaWNRUmVkaXJlY3QmZG9Ob3Rmb2dDbGljaz10cnVl

10. Textbook, Course pack, Technology and Software:

Required Textbook

- No required textbook. Module handouts available from faculty in Canvas.
- Arduino programming notebook, free e-book

Course Pack

- No required course pack

Technology and Software

- Arduino programming notebook, free e-book

Graduate Student Reading List

- 1 Sushanth, G., & Sujatha, S. (2018). IOT Based Smart Agriculture System. In *2018 International Conference on Wireless Communications, Signal Processing and Networking, WiSPNET 2018*. Institute of Electrical and Electronics Engineers Inc. <https://doi.org/10.1109/WiSPNET.2018.8538702>
- 2 Mat, I., Mohd Kassim, M. R., Harun, A. N., & Yusoff, I. M. (2019). Smart agriculture using internet of things. In *2018 IEEE Conference on Open Systems, ICOS 2018* (pp. 54–59). Institute of Electrical and Electronics Engineers Inc. <https://doi.org/10.1109/ICOS.2018.8632817>
- 3 Roy, S., Ray, R., Roy, A., Sinha, S., Mukherjee, G., Pyne, S., ... Hazra, S. (2017). IoT, big data science & analytics, cloud computing and mobile app based hybrid system for smart agriculture. In *2017 8th Industrial Automation and Electromechanical Engineering Conference, IEMECON 2017* (pp. 303–304). Institute of Electrical and Electronics Engineers Inc. <https://doi.org/10.1109/IEMECON.2017.8079610>
- 4 Nageswara Rao, R., & Sridhar, B. (2018). IoT based smart crop-field monitoring and automation irrigation system. *Proceedings of the 2nd International Conference on Inventive Systems and Control, ICISC 2018*, (Icisc), 478–483. <https://doi.org/10.1109/ICISC.2018.8399118>
- 5 Shamshiri, R. R., Kalantari, F., Ting, K. C., Thorp, K. R., Hameed, I. A., Weltzien, C., ... Shad, Z. (2018). Advances in greenhouse automation and controlled environment agriculture: A transition to plant factories and urban agriculture. *International Journal of Agricultural and Biological Engineering*, 11(1), 1–22. <https://doi.org/10.25165/j.ijabe.20181101.3210>
- 6 Gutiérrez, F., Htun, N. N., Schlenz, F., Kasimati, A., & Verbert, K. (2019, August 1). A review of visualisations in agricultural decision support systems: An HCI perspective. *Computers and Electronics in Agriculture*. Elsevier B.V. <https://doi.org/10.1016/j.compag.2019.05.053>
- 7 Caria, M., Schudrowitz, J., Jukan, A., & Kemper, N. (2017). Smart farm computing systems for animal welfare monitoring. *2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2017 - Proceedings*, 152–157. <https://doi.org/10.23919/MIPRO.2017.7973408>
- 8 Kim, J., Kim, S., Ju, C., & Son, H. Il. (2019). Unmanned aerial vehicles in agriculture: A review of perspective of platform, control, and applications. *IEEE Access*, 7, 105100–105115. <https://doi.org/10.1109/ACCESS.2019.2932119>

11. Recommended Reading:

None

12. Course Outline:

1. SmartAg Hardware (Burks)
2. Software & Programming of Microcontrollers (Yu)
3. Data in SmartAg Applications (Yu)
4. Unmanned Aerial Systems Applications in Agriculture (Ampatzidis)
5. Smart Irrigation (Guzman)
6. SmartAg Applications in Controlled Environments (Zhang)
7. Internet of Things and Decision Support Tools for Agriculture (TBD)

13. Grading:

Assignment	Points	Percentage of Total Grade
Homework Sets (7 @ 50 pts. each)	350	35.0%
Quizzes (14 @ 15 pts. each)	210	21.0%
Journal Article Summary & Critique (8 @ 20 pts. each)	160	16.0%
Arduino Program and Experiment Exercises (18 @ 10 pts. each)	180	18.0%
Term Project Paper & Demonstration (1 @ 100 pts.)	100	10.0%
TOTAL	1000	100.0%

Students who have questions about their grades should contact their professor by e-mail. Do NOT contact the TA about grades assigned.

14. Grades and Grade Points:

Percent	Grade	Grade Points
100.00 – 93.00	A	4.00
92.99 – 90.00	A-	3.67
89.99 – 87.00	B+	3.33
86.99 – 83.00	B	3.00
82.99 – 80.00	B-	2.67
79.99 – 77.00	C+	2.33
76.99 – 73.00	C	2.00
72.99 – 70.00	C-	1.67
69.99 – 67.00	D+	1.33
66.99 – 63.00	D	1.00
62.99 – 60.00	D-	0.67
59.99 – 0.00	E	0.00

Assignments will be marked down for a sloppy presentation and, if excessive, they may be returned un-graded. All assignments must be typed and are due by the dates listed in Canvas by 11:59 PM of the due date unless otherwise specified by the instructor.

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>.

15. Attendance and Make-Up Work:

To be successful in this course, students are expected to attend all class meetings. Students who are summoned for jury duty, subpoenaed as a witness, sick or have illness, or who are participating in college-sanctioned activities are excused from class(es) during those events with proper documentation (e.g., doctor's note, jury summons/court appearance, instructor letter, etc.). It is the student's responsibility to contact the instructor(s) in advance of any planned absences, and to make arrangements to complete assignments and make-up tests.

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>.

COVID Response Statement:

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are required to wear approved face coverings at all times during class and within buildings. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.
- This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations.
- Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- Follow your instructor's guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.
- If you are experiencing COVID-19 symptoms ([Click here for guidance from the CDC on symptoms of coronavirus](#)), please use the UF Health screening system and follow the instructions on whether you are able to attend class. [Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms.](#)

- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. [Find more information in the university attendance policies.](#)

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

16. Online Course Evaluation Process: Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to

provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email, they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at: <https://gatorevals.aa.ufl.edu/public-results/>.

- 17. Academic Honesty:** As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

- 18. Software Use and Technology Assistance:** All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

If you are having issues with technology and software including the Canvas site, please contact the [UF Help Desk](#) to resolve any matters. Additional information and resources about technology assistance and technical help can be found in the Canvas site on the page titled Technical Help.

- 19. Services for Students with Disabilities:** The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of

Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu/>

20. Campus Helping Services: Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu*
Counseling Services
Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu/
- *Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>.*

Student Complaints:

- Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>.
- Online Course: <http://www.distance.ufl.edu/student-complaint-process>

Additional information

Instructors may choose to clarify in their syllabus their teaching philosophy, expectations for classroom behavior, utilization of e-learning, and other information that will help students succeed in the course.