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August 17, 2021

Dr. James D. Fielder, Jr.
Secretary, Maryland Higher Education Commission
6 North Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder:

Prince George's Community College is requesting approval for the Internet of Things, a new certificate program in Prince George's Community College's Science, Technology, Engineering, and Mathematics Division.

The certificate is consistent with the **College's strategic goals** identified below:

Student Success: Creating and sustaining optimal conditions for students to design and achieve academic, career, and personal goals.
Regional Impact: Driving Strategic Partnerships to respond to the region's present and future priorities.
Organizational Excellence: Creating and sustaining agile, effective, and institutional synergies.

The attachments that follow display the required elements for the proposal. This letter and the proposal are being submitted electronically to acadprop.mhec@maryland.gov. A check for $250 is forthcoming per the fee schedule guidelines.

Should you have any questions or need additional information, please contact Ms. Aundrea Wheeler, Assistant Vice President for Curriculum, Programs, and Regulation at wheelead@pgcc.edu or at (301) 546-0620. I look forward to a favorable review.

Sincerely,

Clayton A. Railey, III

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MHEC
Creating a state of achievement

Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	Prince George's Community College

Each action below requires a separate proposal and cover sheet.

- ○ New Academic Program
- ○ New Area of Concentration
- ○ New Degree Level Approval
- ◉ New Stand-Alone Certificate
- ○ Off Campus Program
- ○ Substantial Change to a Degree Program
- ○ Substantial Change to an Area of Concentration
- ○ Substantial Change to a Certificate Program
- ○ Cooperative Degree Program
- ○ Offer Program at Regional Higher Education Center

Payment Submitted: ◉ Yes ○ No

Payment Type: ○ R*STARS ○ Check

Date Submitted: September 9, 2

Department Proposing Program	Science, Technology, Engineering, and Mathematics (STEM)
Degree Level and Degree Type	Certificate
Title of Proposed Program	Internet of Things
Total Number of Credits	23
Suggested Codes	HEGIS: CIP:
Program Modality	◉ On-campus ○ Distance Education (*fully online*) ○ Both
Program Resources	◉ Using Existing Resources ○ Requiring New Resources
Projected Implementation Date	○ Fall ◉ Spring ○ Summer Year: 2022
Provide Link to Most Recent Academic Catalog	URL: http://catalog.pgcc.edu/
Preferred Contact for this Proposal	Name: Aundrea D. Wheeler Title: Assistant Vice President for Curriculum, Programs, and Regulation Phone: (301) 546-0406 Email: wheelead@pgcc.edu
President/Chief Executive	Type Name: Dr. Falecia D. Williams Signature: Falecia D Williams Date: 09/09/2021
	Date of Approval/Endorsement by Governing Board:

Revised 6/13/18

INTERNET OF THINGS TECH CERTIFICATE PROGRAM

A. Centrality to Institutional and Planning Priorities:

Prince George's Community College (PGCC) serves as the region's premier center for innovations in learning, community engagement, and strategic partnerships that inspire educational, career, and personal success. PGCC delivers affordable, high-quality learning experiences for diverse populations which contribute to the economic equity and cultural vibrancy of our community. Accordingly, this proposal to offer the Internet of Things Tech Certificate is in line with the college's mission and will further promote its fulfillment.

B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan:

Maryland Ready: 2017-21 Maryland State Plan for Postsecondary Education states, the State of Maryland is among the nation's leaders of innovation in higher education, highly ranked in research and development with 72 federal laboratories. Some of the innovative industries and academic studies for the 21st century include artificial intelligence, bioinformatics, biotechnology, biopharma, cybersecurity, data mining, data analytics, entrepreneurship, informational technology, nanotechnology, modern manufacturing, and robotics–all supported by our higher education institutions.

The Internet of Things is considered one of the leading technologies rapidly growing and having a positive impact on the aforementioned industries. The Internet of Things Tech Certificate program at Prince George's Community College is in alignment with the state plan to prepare students to enter careers in the abovementioned industries.

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State:

Maryland Occupational Projections - 2018-2028 - Workforce Information and Performance site contains the following projections data for computer support related occupations:

Maryland Occupational Projections 2018 - 2028						
Occ Code	Occupational Title	Occupation level	Employment			
			2018	2028	Change	Pct. Chg
15-1152	Computer Network Support Specialists	4	6,717	7,594	877	13.1%
15-1151	Computer User Support Specialists	4	10,101	11,569	1,468	14.5%

Source: http://www.dllr.state.md.us/lmi/iandoproj/maryland.shtml

According to US Department of Labor, employment of computer and network support specialists is projected to grow 8 percent from 2019 to 2029, much faster than the average for all occupations.

Occupational Title	SOC Code	Employment, 2020	Projected Employment, 2029	Change, 2019-29 Percent	Change, 2019-29 Numeric
Computer support specialists	15-1230	882,300	949,600	8	67,300
Computer network support specialists	15-1231	195,100	207,700	6	12,600
Computer user support specialists	15-1232	687,200	741,900	8	54,800
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program					

Source: https://www.bls.gov/ooh/computer-and-information-technology/computer-support-specialists.htm#tab-6

According to the US Bureau of Labor Statistics, Occupational Employment and Wages (May 2019) for 15-1232 Computer User Support Specialists is as follows: Employment estimate and mean wage estimates for this occupation:

Employment (1)	Employment RSE (3)	Mean hourly wage	Mean annual wage (2)	Wage RSE (3)
647,330	0.8 %	$27.19	$56,550	0.4 %

Percentile wage estimates for this occupation:

Percentile	10%	25%	50% (Median)	75%	90%
Hourly Wage	$15.54	$19.39	$25.13	$32.72	$42.53
Annual Wage (2)	$32,330	$40,340	$52,270	$68,060	$88,470

According to the US Bureau of Labor Statistics, May 2019 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates for Washington-Arlington-Alexandria, DC-VA-MD-WV are as follows:
Source: https://www.bls.gov/oes/current/oes_47900.htm#15-0000

Occupation Code	Occupation title	Employment	Employment RSE	Employment per 1,000 jobs	Mean hourly wage	Annual mean wage
15-1231	Computer Network Support Specialists	7,300	4.60%	2.295	$37.86	$78,750
15-1232	Computer User Support Specialists	18,970	7.00%	5.966	$31.40	$65,320
15-1241	Computer Network Architects	8,920	6.10%	2.807	$62.70	$130,410
15-1244	Network and Computer Systems Administrators	19,890	4.40%	6.257	$48.80	$101,510
17-2061	Computer Hardware Engineers	3,060	5.70%	0.963	$61.29	$127,480

D. Reasonableness of Program Duplication:

According to the MHEC's Academic Program Inventory, the only program found in the area of the Internet of Things (IOT) is the University of Maryland's (College Park), Embedded Systems and Internet of Things Bachelor's Degree program. There are no IOT programs leading to certifications at community colleges in the state of Maryland. Thus, there is no education program duplication at nearby institutions related to IOT.

E. Relevance to High-demand Programs at Historically Black Institutions (HBIs)

Since there are no IOT certificate programs at any Historically Black Institutions (HBIs) in Maryland, it is does not impact on the implementation or maintenance of high-demand programs at HBI's.

F. Relevance to the identity of Historically Black Institutions (HBIs)

The proposed IOT certificate program will not have an impact on the uniqueness and institutional identities and missions of HBIs.

G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes

The proposed IOT Tech Certificate Program was established to enrich the curriculum of the Computer Engineering Technology Program with the latest advances in smart devices and applications that have an impact on every segment of our society. The program will be led by the coordinator of the Computer Engineering Technology Program in the Technology, Engineering and Construction (TEC) department within the STEM division at PGCC.

Program outcomes to be included in the course description section of the catalog

Graduates of the Internet of Things Tech Certificate program will be able to:

- Identify characteristics and features of widely used Internet of Things (IoT) applications
- Describe the functions of the main hardware components and technologies used in IoT devices
- Explain how the main IoT communication protocols are used in IoT applications
- Describe the operations of the various sensor and actuator technologies utilized in IoT applications

- Identify types of IoT sensors used capture and transmit data under software control
- Identify key features and functions of IoT software present in commonly used IoT applications
- Explain how software controls and manages IoT devices
- Explain how data is generated/gathered, transmitted, stored and analyzed by IoT applications
- Install, test, monitor, maintain and secure IoT hardware and software components
- Troubleshoot and resolve problems found in IoT devices

Sequence of Study – Internet of Things Tech Certificate Program

Total number of credit hours for the certificate program is 23

Required Courses (in expected order)

- INT-1111 Programming Logic and Design 3 Credits (Program Requirement)
- ENT-1730 DC and AC Circuit Analysis 3 Credits (Program Requirement)
- ENT-1810 Internet of Things Fundamentals 3 Credits (Program Requirement)
- INT-1540 Computer Hardware I: A+ Preparation 4 Credits (Program Requirement)
- INT-1550 Introduction to Networks: Network+ Preparation 3 Credits (Program Requirement)
- INT-2719 AWS Cloud Computing Architecture 4 Credits (Program Requirement)
- ENT-2820 Internet of Things Devices and Technologies 3 Credits (Program Requirement)

H. Adequacy of Articulation

Not applicable

I. Adequacy of Faculty Resources

Name	Terminal Degree/Field	Rank	Courses Taught
Ali, Mohammed N.	EdD, Higher Education - Community College Leadership	Professor (Full-time)	INT 1111 - Programming Logic and Design INT 2719 - AWS Cloud Computing Architecture

Choudhury, Joy S.	MA Public Administration	Associate Professor (Full-time)	INT 1111 - Programming Logic and Design INT 2721 - Linux Operating System I
Chukwuma, Godson	PhD Electrical Engineering	Professor (Full-time)	INT 1620 - Security Plus Preparation INT 1550 - Network+ Preparation
Elebute, Kunle	PhD Information Technology	Professor (Full-time)	INT 1111 - Programming Logic and Design INT 1540 - Computer Hardware I: A+ Preparation
Haptemariam, Zewdu	MS Communications Engineering	Associate Professor (Full-time)	ENT 1730 - DC and AC Circuit Analysis ENT 1810 - Internet of Things Fundamentals ENT 2820 - Internet of Things Devices and Technologies
Koumadi, Koudjo	PhD Communications Engineering	Professor (Full-time)	INT 1550 - Computer Hardware I A+ Preparation INT 1620 - Security Plus Preparation

Faculty have been trained and are required to take ongoing professional development courses related to pedagogy, enhanced Blackboard training, and training for remote and online instruction.

J. Adequacy of Library Resources

PGCC library has on-site holdings and online resources, including reference materials, to support the Internet of Things Certificate program. In addition, the library continuously procures literature and technical materials to support the needs of students and graduates. The library maintains online accessible and extensive databases, journals, and E-texts. Students may request holdings and inter-library loans either by E-mail or in person. Additionally, the library will provide journals and publications specifically related to the various Information Technology professions. The PGCC library has extensive online resources available to students:

Computer & Information Technology Databases

Computer Science (Gale OneFile)

Computing Database

Safari Books Online

General Databases

ProQuest Academic OneFile Credo Reference

General OneFile

E-books

EBook Central

EBSCO Host Academic E-book Collection Gale Virtual Reference Library

Streaming Video Films on Demand VAST Academic Video Collection

Furthermore, the library has ready access to:

a. Interlibrary loan services compliant to and in support of the Library of Congress and its Bibliographic Utilities.

b. The holdings of the Prince George's County Memorial Library System.

c. The holdings of the University of Maryland System.

d. If faculty requests the librarians to review Books-In-Print for materials to enhance students' academic understanding of the discipline, the College library will use its budget to acquire those books them. The librarians will provide a subject strength analysis of the proposed titles to assure compatibility with course content.

K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment

Prince George's Community College has sufficient classroom and office space to accommodate the program. The Center for Advanced Technology (CAT) will provide an educational environment that will allow the college to enhance and grow its curriculum. The venue will include the following:

25 classrooms with computer labs to include the following specialized instruction labs (average seating capacity 26):

Engineering Technology Lab

Engineering Lab

A+ Troubleshooting Lab

Computer Graphics / Multimedia Lab

4 classrooms without lab (average seating capacity 24)

2 open computer labs with various types of workstations and collaboration spaces (35 computers each)

2 study labs (average seating capacity 10)

27 faculty work spaces

2 conference rooms

1 certification testing center

L. Adequacy of Financial Resources with Documentation

The proposed program is expected to generate revenue in excess of expenses. The proposed program will be housed within the Center for Advanced Technology (CAT). The proposed program will be utilizing revenue generated by the use of the CAT by internal and external stakeholders to augment the costs concerning equipment, and facilities maintenance to support the efforts of the Internet of Things Tech Certificate Program.

TABLE 1: PROGRAM RESOURCES for the Internet of Things Tech Certificate Program					
Resource Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1.Reallocated Funds	$0	$0	$0	$0	$0
2.Tuition/Fee Revenue (c + g below)	$77,488	$77,488	$94,436	$94,436	$111,384
a. Number of F/T Students	8	8	10	10	12
b. Annual Tuition/Fee Rate	$6,050	$6,050	$6,050	$6,050	$6,050
c. Total F/T Revenue (a x b)	$48,400	$48,400	$60,500	$60,500	$72,600
d. Number of P/T Students	12	12	14	14	16
e. Credit Hour Rate	$202	$202	$202	$202	$202
f. Annual Credit Hour Rate	12	12	12	12	12
g. Total P/T Revenue (d x e x f)	$29,088	$29,088	$33,936	$33,936	$38,784
3. Grants, Contracts & Other External Sources	$0	$0	$0	$0	$0
4. Other Sources	$0	$0	$0	$0	$0
TOTAL (Add 1 – 4)	$77,488	$77,488	$94,436	$94,436	$111,384

TABLE 1: PROGRAM EXPENDITURES for the Internet of Things Tech Certificate Program					
Expenditure Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Faculty (b + c below)	$ 0	$ 0	$74,063	$74,063	$74,063
a. Number of FTE	0	0	1	1	1
b. Total Salary	$ 0	$ 0	$55,000	$55,000	$55,000
c. Total Benefits	$ 0	$ 0	$19,063	$19,063	$19,063

2. Admin. Staff (b + c below)	$0	$0	$0	$0	$0
a. Number of FTE	0	0	0	0	0
b. Total Salary	$0	$0	$0	$0	$0
c. Total Benefits	$0	$0	$0	$0	$0
3. Support Staff (b + c below)	$0	$0	$0	$0	$0
a. Number of FTE	0	0	0	0	0
b. Total Salary	$0	$0	$0	$0	$0
c. Total Benefits	$0	$0	$0	$0	$0
4.Technical Support and Equipment	$0	$0	$0	$0	$0
5.Library	$0	$0	$0	$0	$0
6.New or Renovated Space	$0	$0	$0	$0	$0
7.Other Expenses	$0	$0	$0	$0	$0
TOTAL (Add 1 – 7)	$ 0	$ 0	$78,063	$78,063	$78,063

M. Adequacy of Provisions for Evaluation of Program

The College has a rigorous course and program assessment process. Course assessment takes place by using embedded tests and assignments that address specific course outcomes. Data from these course-embedded assessments are collected and analyzed to improve courses and to ensure program-learning outcomes are met.

Complete program assessment takes place every five years, with progress toward achievement of improvement plans being evaluated every two years. Data regarding enrollment, retention, and graduation is collected and analyzed against program outcomes, courses offered, and other variables. Each program must have an advisory board consisting of professionals in the field assist in the construction and analysis of program review data.

Students and administrators evaluate non-tenured faculty members yearly. Each year, non-tenured faculty members have their course material and student evaluations assessed by their department chairs and deans, with final verification of the assessment conducted by the Executive Vice President and Provost for Teaching, Learning and Student Success. In order to receive high evaluations, faculty members must demonstrate effective teaching above all, but professional development in the discipline and participation in departmental, divisional, and college-wide activities is also assessed. The same criteria for evaluation are carried out for tenured members of the faculty, but once every three years. The above

assessment process also provides administrators the opportunity to set out action plans for faculty improvement in teaching, professional development, and/or college service in order for each or any of those facets of the faculty member's career to be enhanced.

Prince George's Community College (PGCC) has developed a comprehensive system to assess student learning that is organized, well documented, and has continued to improve since spring 2012. The system is founded on the existence of clear statements defining the skills, knowledge, and values that students are expected to acquire in their educational experiences at the College. These statements or learning outcomes, which are publicized in the College Catalog and in master course syllabi, establish well-defined, shared expectations for faculty, students, and the community. In doing so, the learning outcomes ensure consistency across the diversity of educational experiences offered at the College. They also provide the basis for measuring the quality of program and course offerings, as well as for developing targeted interventions for continuous improvement. Prince George's Community College has identified three sets of learning outcomes for its students: course, program, and institutional learning outcomes. Course outcomes define the skills, knowledge, and values that students are expected to acquire upon completion of a course. Program outcomes specify the skills, knowledge, and values that students are expected to acquire upon completion of a program of study. The institutional learning outcomes encapsulate the foundational skills, knowledge, and values that every graduate of the certificate program is expected to achieve.

Evidence of student learning is collected through embedded assessments that students have to complete as part of their regular coursework. These assessments, which are used in the calculation of student grades, are designed to provide direct demonstrations of students' skills, knowledge, and values. Frequently used assessments include multiple-choice exams, written assignments, artistic artifacts or performances, and clinical demonstrations. With the exception of multiple-choice exams, assessments are evaluated and scored with the aid of rubrics. All sections of the same course are required to use either the same assessment or variations of the same assessment. Data collected in the classroom are aggregated across sections and used to simultaneously measure student achievement of course outcomes, program outcomes, and the Student Core Competencies. These data are stored in an assessment management system, called Tk20, which provides multiple data reports easily accessible to faculty and administrators.

Program Assessment

Prince George's Community College has a five-year cycle for completing the assessment of every program outcome and every Student Core Competency. Prior to the beginning of each cycle, the faculty design an assessment plan for every program of study offered by their department. The assessment plan indicates which program outcome(s) will be assessed each semester along with the list of courses where those outcomes are addressed. Departments are expected to assess all

courses in their assessment plan(s) during the five-year cycle. For each course included in an assessment plan, faculty adhere to the following sequence:

1. Prior to assessing a course, faculty create assessment materials to measure student achievement of course outcomes and submit these materials for review to the Assessment Coaches and the Teaching Learning and Assessment Committee (TLAC)

2. The Assessment Coaches and the TLAC examine the materials to ensure that they are appropriately rigorous and reflect best practices for the assessment

3. Once the assessments are approved, faculty implement the assessment in the following semester. Data are then collected and entered into Tk20, allowing the College to store, track, analyze, and disseminate data to all stakeholders.

4. The semester following data collection, The Office of Research, Assessment, and Effectiveness (RAE) analyzes the data and releases a 188 report of its findings.

5. Faculty discuss the findings and use preset performance criteria or benchmarks to determine whether an Action Plan needs to be developed to address any areas of concern.

6. When an Action Plan is needed, changes are implemented in the following semesters and the course is later reassessed.

The assessment data are publicly distributed every semester in the Student Learning Outcomes Assessment Report (SLOAR). An additional report showing student achievement of the Student Core Competencies is published every year. Assessment data are discussed within each department for course and program improvement, leading to changes in individual courses and in the content and structure of the curriculum. The College relies on a plethora of training guides, regular face-to-face training sessions, and a series of online assessment modules to ensure that all faculty are equipped with the knowledge and skills they need to engage in the discussion and use of assessment findings.

Course Assessment and Evaluation

Each semester, the RAE office reports the results of every Action Plan implemented to improve student learning the previous semester. Results are published in a document called the Action Plan Success Report, which allows faculty to see if the changes introduced in their courses following the initial assessment produced the desired impact. The report is available to the entire PGCC community on the College’s intranet.

Although these Action Plans are focused on improving performance in the classroom, the clear alignment of course outcomes to program outcomes and to the

Student Core Competencies mean that changes implemented at the course level can have a significantly broader impact. Beyond measuring student achievement every semester, the assessment system is aimed at capturing students' skill development over time and building a better understanding of how small changes in each course can lead to larger aggregate changes in learning at the program and institutional levels.

N. Consistency with the State's Minority Student Achievement Goals

The proposed program addresses minority student access and success, and the institution's cultural diversity goals and initiatives by remaining committed to the College's mission, which states "PGCC exists to educate, train, and serve diverse populations through accessible, affordable, and rigorous learning experiences." PGCC's minority student enrollment is comparable to its service population, with the percent of nonwhite credit enrollment (95.9%) and minority full-time administrative and professional staff (78.9%) exceeding the College's fall 2020 benchmarks.

Trends in PGCC's student population reflect the demographic patterns of its primary service area, Prince George's County, with 70.7% of credit students enrolled in fall 2018 identifying as Black/African-American. The percentage of Hispanic/Latino students rose from 10.5% of the credit student population in fall 2015 to 12.4% in fall 2018. PGCC continues to attract students in English for Speakers of Other Languages courses (5,854 students) as well as first-generation college students, 51.7% of credit students in spring 2018. PGCC is an institution of higher learning that has been approved and has been offering distance education in accordance with all applicable regulations.

O. Relationship to Low Productivity Programs Identified by the Commission:
There are no low productivity programs related to this program.