ISEIC'2024 Proposal Template

A. Proposal Information

Project title	An IoT System for Intensive Care Units (ICUs)
Project Challenge Area	Health
School / College / University	Luxor University
Department/Faculty (for University)	Faculty of Computers and Information
Industrial partner (if any)	

B. Advisor Information

Advisor Name	Hammam Abdelaal
Title	Lecturer
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Brief summary of expertise	Computer Engineer at Operation, Maintenance and Repair of Computer Systems at Armed Forces. Computer Engineer at Silicon Expert Technologies Company. Computer Engineer at Arrow Company that related Silicon Expert Technologies Company. Demonstrator at the Higher Institute for Specific Studies, Giza. Oracle and Java Developer at Space Program of Egyptian (NARSS)

	Lecturer at the Higher Institute for Administrative Sciences & Computer, New Cairo, Cairo Lecturer at the Higher Institute for Administrative Sciences & Computer, New Cairo, Cairo Engineer at Operating safety Dept. Nuclear Safety Research Center, Nuclear and Radiological Regulatory Authority, Cairo Lecturer at faculty of Computers and information, Luxor university

C. Project Members Information

#	Full Name	year grade	Strengths (special skills and capabilities)	Mobile number	Email
1	Shahd Mahmoud Mohammed	4 IT	Embedded Developer	01202468259	shahdmahmoud111.t@gmail.com
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3	Rawan Essam El-deen	4 IT	Embedded Developer	01123067335	rawanessam464@gmail.com
4	Mennatullah Osman	4 IT	Flutter Developer	01114355821	menna.osman160@gmail.com
	Sarah Sayed	4 IT	Embedded Developer	01029982635	sm0144535@gmail.com

5	Arwa Hassaan	4 IT	Flutter Developer	01124092761	arwahassann1911@gmail.com

* Please note that the first name will be referred to as the main **CONTACT PERSON** for the whole group.

D. Project Description

Applicants shall provide a brief description of their project. This description should include the following **according to the distribution of scores**:

1. Overview	(20 point)

i) Problem Definition

The healthcare system in our country faces critical problems regarding patients that may negatively affect patients' health or even lead them to death.

1. The ICU monitor is a large, wired device and in case of emergencies, unless a healthcare professional is in the room, the patient wouldn't be noticed.

2. The ICU monitor typically doesn't contain a patient history. It provides real-time data but doesn't give insights so we can't foresee any further critical conditions.

ii) Approach and Tools/Techniques

The proposed system addresses some critical issues in the healthcare system by leveraging sensors, a gateway, cloud infrastructure, an AI module, and a web application. This integrated approach aims to provide real-time monitoring of patients' health and environmental conditions, timely alerts, and improved data analysis for healthcare professionals.

A. Sensors

Sensors are the main actors in our system. sensors capture patients' vital data and rooms' environmental conditions. sensors send their data in real-time which is most suitable and what is needed in our case.

B. Gateway

The gateway collects sensor data and does some preprocessing and can take actions if needed. it then sends the data to the cloud

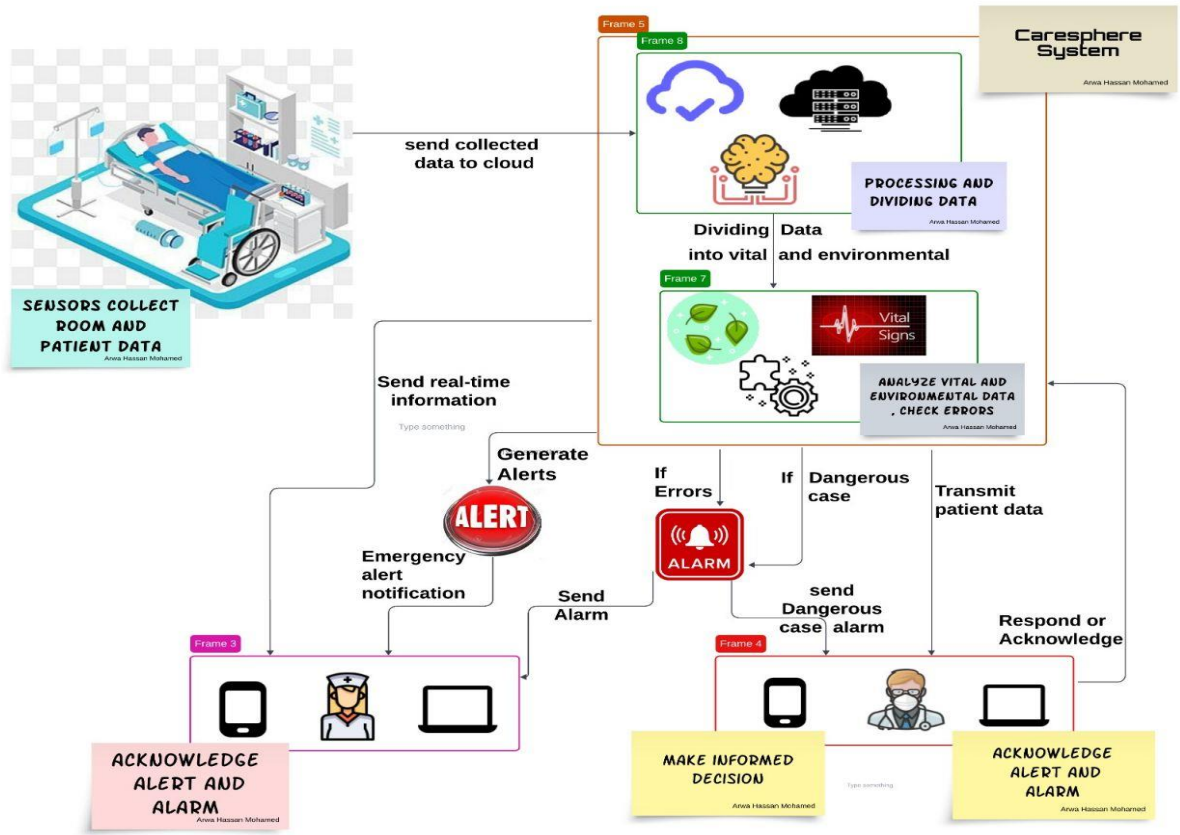
C. Cloud & AI Module

cloud is the storage we will be using for its scalability, reliability, and security. when data is sent to the cloud, the AI module analyzes and separates it into two categories: vital and environmental data. Vital data are sent to doctors and nurses while environmental data are sent to nurses. then, generates alarms when needed and sends them to the application.

D. Web Application

The application is the interface for nurses and doctors to keep track of patients' records. The application shows patients' vital data and room conditions in real time. it also provides insights, graphs, and charts to provide a better view for healthcare professionals. In critical conditions, alerts are sent to nurses, and in emergencies, alarms are sent to doctors. It's recorded if the alarms are acknowledged or not. There's role-based access control to ensure that only authorized personnel can access sensitive information.

iii) Overview of System Modules


Frame 5
Frame 8
Caresphere System
Arwa Hassan Mohamed
send collected data to cloud
PROCESSING AND DIVIDING DATA
Arwa Hassan Mohamed
Dividing Data into vital and environmental
Frame 7
Vital Signs
ANALYZE VITAL AND ENVIRONMENTAL DATA , CHECK ERRORS
Arwa Hassan Mohamed
SENSORS COLLECT ROOM AND PATIENT DATA
Arwa Hassan Mohamed
Send real-time information
Type something
Generate Alerts
ALERT
Emergency alert notification
If Errors
If Dangerous case
ALARM
Transmit patient data
Send Alarm
send Dangerous case alarm
Respond or Acknowledge
Frame 3
Frame 4
ACKNOWLEDGE ALERT AND ALARM
Arwa Hassan Mohamed
MAKE INFORMED DECISION
Arwa Hassan Mohamed
Type something
ACKNOWLEDGE ALERT AND ALARM
Arwa Hassan Mohamed

2. Impact	(20 point)

Why do you consider this project? What is its impact on community/market/end user/**sustainable development of Egypt 2030…?**

This project has tremendous potential to have a positive impact on various fronts, particularly in its influence on society, the market, end-users, and the achievement of Sustainable Development Goals outlined in Egypt's Vision 2030. Here are some points that highlight the impact and strengthen the project:

Community Impact:

Enhanced Healthcare Accessibility:
- Continuous monitoring and early detection contribute to improved healthcare accessibility, particularly benefiting communities with limited access to medical facilities.

Public Health Improvement:
- Early detection and preventive measures lead to a reduction in critical conditions, contributing to an overall improvement in public health within the community.

Resource Optimization:
- Efficient resource utilization results in better allocation of medical staff and facilities, optimizing healthcare resources for the community's benefit.

Emergency Response and Lives Saved:
- Rapid response to emergencies through real-time monitoring and alert generation can potentially save lives, positively impacting the community's well-being.

Market Impact:

Attracting Investments in the Healthcare Sector:
- The project is seen as attractive for investment in the healthcare sector. Due to its advanced technologies and innovative solutions, the project may draw the interest of investors looking to invest in healthcare-related ventures. This fosters economic activity in the healthcare market, contributing to the growth of investments in this sector and enhancing market development.

End-User Impact:

Empowering Healthcare Professionals:
- Real-time insights empower healthcare professionals to make informed decisions promptly, leading to improved patient care and healthcare outcomes.

Patient-Centric Approach:
- Continuous monitoring ensures a patient-centric approach, providing personalized and timely healthcare services tailored to individual needs.

Improved Doctor-Patient Communication:
- Transmission of comprehensive patient data to doctors enhances communication, allowing for more informed medical consultations and personalized treatment plans.

Enhanced Quality of Care:
- The project contributes to an enhanced quality of care by leveraging technology for efficient data analysis, resulting in better-informed medical decisions.

Positive Shift in Healthcare Perception:
- The project represents a positive shift in the perception of healthcare, integrating technology for a more holistic and proactive approach to individual health.

By considering these impacts across community, market, and end-user perspectives, the project demonstrates its potential to bring about positive changes on multiple levels.

3. Novelty and Features	(20 point)

Explain (i) novelty (ii) features, and (iii) related products, if any.

Novelty and Implementation:

- Caresphere, our innovative project, introduces a cutting-edge approach to healthcare monitoring relying on IoT by seamlessly integrating advanced sensor technology into a dedicated room environment. The implementation of this project involves deploying a network of sensors, including air quality and light sensors, within the room. The bed within the same space is equipped with specialized sensors - a temperature sensor, a bed pressure sensor, and a motion sensor. These sensors work cohesively to continuously monitor and assess the vital signs of the patient during their rest.

  This novel implementation ensures a comprehensive analysis of environmental changes and the patient's well-being. The seamless integration of sensor data collection during the patient's rest period is a distinctive feature of Caresphere. The project utilizes state-of-the-art technology to gather real-time data, providing a holistic view of the patient's health status and the surrounding environment. Our innovative system significantly reduces the time required for a physician to assess a patient, facilitating prompt medical decision-making. This expedited process ensures timely interventions, minimizing the risk of sudden emergency situations. By maintaining comprehensive awareness of the patient's health condition, our system promotes not only rapid medical responses but also enhances patient comfort and safety, mitigating the potential for life-threatening situations and contributing to overall survival outcomes.

Features:

- ***Environmental Monitoring:*** Caresphere employs air quality and light sensors to monitor and analyze changes in the room environment, ensuring a conducive and safe atmosphere for the patient.
- ***Vital Signs Assessment:*** The bed-integrated sensors, including temperature, bed pressure, and motion sensors, offer a detailed evaluation of the patient's vital signs, contributing to a more thorough understanding of their health condition.
- ***Real-time Data Transmission:*** Collected data from the sensors are promptly transmitted to the centralized Caresphere system for immediate analysis, enabling timely decision-making and intervention.
- ***Hazard Detection***: Caresphere excels in identifying potentially dangerous situations through advanced data analytics, triggering immediate alerts in critical conditions.
- ***Predictive Analytics:*** The IoT integration allows Caresphere to employ predictive analytics, foreseeing potential health issues based on historical data trends. This proactive approach enables healthcare providers to intervene and mitigate risks before they escalate.

Related products:

- Caresphere, with its IoT foundation, sets the stage for potential collaborations with other IoT-enabled healthcare technologies. The modular design allows for seamless integration with wearable devices, electronic health records (EHR) systems, and smart medical equipment. This adaptability positions Caresphere as a cornerstone in a broader healthcare IoT ecosystem.

  As we embrace the IoT era in healthcare, Caresphere stands at the forefront, showcasing the transformative power of interconnected devices in enhancing patient care. The project not only redefines the monitoring landscape but also lays the groundwork for a more interconnected and intelligent healthcare infrastructure.

4. Deliverables

What is the project final outcome (HW device, SW package, simulation ...)? Do you foresee any potential marketing or customers? **(20 point)**

This healthcare system for monitoring intensive care patients utilizes sensors to collect patient and environmental data, transmitting it to the cloud. An AI module analyzes the data, separates vital and environmental signs, generates alarms for abnormalities, and sends patient data to doctors. In critical situations, the system alerts doctors about dangerous signs, facilitating prompt intervention in intensive care scenarios. The project, which focuses on using sensor technology, cloud computing and AI to monitor care patients, has great potential, in various markets and for different types of customers. Those some of markets and customer:

1. Hospitals and Healthcare Facilities:

One primary market segment is hospitals and healthcare facilities. By implementing this system patient care can be significantly enhanced through monitoring and early detection of conditions. This would ultimately lead to improved patient outcomes.

2. HealthTech Companies:

Health technology companies can benefit from integrating this system into their product offerings. They might be interested in providing solutions for patient monitoring enabling healthcare providers to deliver more personalized and proactive care.

3. Medical Device Manufacturers:

Companies that manufacture devices could find value in incorporating this system into their product portfolio. The integration of monitoring capabilities would make their devices more competitive and appealing to healthcare providers.

4.Health Insurance Providers:

Health insurance companies may be interested in promoting the adoption of this system as a preventive measure. Early detection of health issues can lead to reduced hospitalizations, potentially lowering overall healthcare costs.

5.Government Health Agencies:

Collaboration with government health agencies for public health initiatives, especially during emergencies or pandemics, could be explored. The system can contribute to early detection and containment efforts.

5. Role of the Industrial Partner (if any)	(20 point)
What is the type of support to be provided by the industrial partner (technical, financial, access…)?	
No one	

6. Estimated Expenses							(20 point)
An estimate of the itemized costs: Equipment & tools; printing							
Item	**Type (Hardware/ Software/ Other)**	**Specifications (brief description)**	**Justification (why is this item needed?)**	**Vendor/Source**	**Unit Cost**	**No. of Items**	**Total Cost of Items**
1	ThermoPro TP50 Digital Hygrometer Indoor Thermometer Room Thermometer and Humidity Gauge with Temperature Monitor	Monitors room temperature and humidity to ensure a comfortable environment for the patient.	Essential for maintaining a comfortable and stable temperature&humidity in the hospital room, ensuring the well-being of the patient	amazon	2,604 EG	1	2,604 EG
2	Raspberry Pi 4 Model B 2GB	Suitable for smart home projects, edge computing, and applications with average memory demands.	Connect all sensors with each ather. cost-effectiveness, suitability for moderate workloads, optimal resource utilization, energy efficiency, and balanced	Amazon	2460.02 EG	1	2460.02EG

			performance.				
3	Occupancy Sensor 360 Degree PIR Motion Light Switch Ceiling Recessed 1200W Max	Detects the presence of individuals in the room. Useful for energy efficiency and security.	Enables energy-efficient management of room resources and ensures the safety of the patient by monitoring room occupancy.	amazon	250.00 EG	1	250.00 EG
4	Air Quality Sensor MQ135 (Analog/Digital)	Measures air pollutants and ensures the quality of air in the room is suitable for patients.	Monitors air quality, detecting pollutants that could impact the health of patients, particularly those with respiratory conditions.	Amazon	290.00 EG	1	290.00 EG

5	Aegon X1805 Fingertip Pulse Oximeter	Monitors oxygen saturation levels in a patient's blood	Measures oxygen levels in the blood, providing critical information for patients with respiratory or cardiovascular issues.	amazon	267.00 EG	1	267.00 EG
6	RP-C7.6-LT-LF2 Thin Film Pressure Sensor	Monitors pressure changes, useful for patients at risk of developing pressure ulcers.	Monitors pressure changes, particularly relevant for patients at risk of developing pressure ulcers, allowing for preventive measures.	amazon	144 EG	1	144 EG
Total Cost of project							6015 EG

رقم المشروع	اسم المشروع	اسم المشرف	أسماء الفريق (5)	الجامعة / الكلية / المدرسة	كيف يمكن الاستفادة من المشروع في المجالات المختلفة (زراعة / صناعة / طبية /عسكرية/.....)
1043	نظام انترنت الاشياء لوحدات العناية المركزة	د.همام عبدالعال	شهد محمود محمد روان عصام الدين مصطفي اروي حسان محمد منة الله عثمان عبداللاهي سارة سييد عبدالرحيم عبدالرحمن رمضان سليمان	جامعة الاقصر	يواجه نظام الرعاية الصحية في بلدنا مشاكل حرجة فيما يتعلق بالمرضى قد تؤثر سلبًا على صحة المرضى أو حتى تؤدي بهم إلى الموت. شاشة وحدة العناية المركزة هي جهاز سلكي كبير وفي حالة الطوارئ، ما لم يكن أخصائي الرعاية الصحية في الغرفة، فلن يتم ملاحظة المريض. لا تحتوي شاشة وحدة العناية المركزة عادةً على تاريخ المريض, الجهاز يوفر بيانات في الوقت الفعلي ولكنه لا يعطي رؤى لذلك لا يمكننا توقع أي ظروف حرجة أخرى. يعالج النظام المقترح بعض

					المشكلات الحاسمة في نظام الرعاية الصحية من خلال الاستفادة من أجهزة الاستشعار والبوابة والبنية التحتية السحابية ووحدة الذكاء الاصطناعي وتطبيق الويب. يهدف هذا النهج المتكامل إلى توفير مراقبة في الوقت الفعلي للظروف الصحية والبيئية للمرضى، والتنبيهات في الوقت المناسب، وتحسين تحليل البيانات لمتخصصي الرعاية الصحية.

بيانات المشروع باللغة العربية