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Training IoT Development for Enhancing Search and Rescue Tracking and Educational Tools

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A B S T R A C T

The Internet of Things (IoT) Development Training at Universidade Oriental Timor Lorosa'e aims to address challenges in tracking search and rescue teams and enhance educational tools. This training is designed to provide an in-depth understanding of IoT technology and its applications in operational and educational contexts. The methods used include theoretical sessions, hands-on practice, and project evaluation. The evaluation results show a significant increase in participants' knowledge levels: understanding of IoT concepts increased from 40% to 85%, knowledge of IoT applications rose from 35% to 80%, the ability to use IoT devices improved from 30% to 75%, and skills in developing IoT systems advanced from 25% to 70%. The success of this training reflects the positive impact of IoT technology in enhancing participants' skills, potentially bringing long-term benefits to both fields discussed at Universidade Oriental Timor Lorosa'e.

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INTRODUCTION

The Internet of Things (IoT) is a rapidly developing technology with significant impacts across various sectors, including education and disaster management (Motlagh et al., 2020). In Timor Leste, particularly at Universidade Oriental Timor Lorosa'e, there are challenges in enhancing the effectiveness of search and rescue teams and managing educational tools. Search and rescue teams often face difficulties in achieving accurate and swift tracking, affecting their response to emergency situations (Al-Kaff et al., 2019). On the other hand, the university's educational tools require updates to support more interactive and effective learning processes. In this context, the application of IoT technology can provide innovative solutions by utilizing connected devices to improve coordination and tracking in search and rescue operations and to optimize the use of educational tools (Queralta et al., 2020).

The IoT development training aims to enhance participants' skills in designing, implementing, and maintaining IoT systems that can be used for real-time monitoring and tracking of search and rescue teams (Chen et al., 2021). Additionally, this technology is expected to improve the quality of educational tools at Universidade Oriental Timor Lorosa'e by providing relevant data and feedback to support teaching and learning. The implementation of IoT technology is anticipated to have a significant positive impact on both these aspects, offering more efficient and effective solutions in team tracking and educational tool updates.

The goal of this training is to introduce and teach relevant IoT development techniques in the context of search and rescue team tracking and the enhancement of educational tools at Universidade Oriental Timor Lorosa'e. The training aims to provide a deep understanding of IoT technology, including how to design, implement, and maintain IoT systems that can be integrated with tracking and monitoring applications. Moreover, the training seeks to improve participants' skills in developing technological solutions that can enhance the effectiveness of search and rescue operations and modernize educational tools. By increasing participants' technical capacity and understanding of IoT technology, it is hoped that innovative and effective solutions can be created to address existing challenges and support further development in the contexts of education and disaster management in Timor Leste (Izumi et al., 2019).

IMPLEMENTATION AND METHODS

This training was conducted through an interactive workshop approach that included both theoretical and practical sessions. Participants were given a fundamental understanding of IoT concepts and components by the first speaker, Joni Maulindar. He explained various essential elements of IoT, including sensors, actuators, networks, and analytic platforms. This foundational knowledge is crucial before participants can advance to practical applications. Following this session, the second speaker, Ari Andrianto, presented the application of IoT-based tracking systems for search and rescue teams. Ari Andrianto explained how IoT technology could be used to enhance the coordination and effectiveness of teams in emergency situations. The demonstration of the IoT system implementation involved setting up hardware and software to support real-time tracking.

The teaching methods in this training involved case studies, simulations, and hands-on exercises using IoT devices. Participants were engaged in solving real-world problems that might be encountered in search and rescue operations as well as in managing educational tools. The simulations were designed to replicate actual field conditions, providing participants with invaluable practical experience. Evaluation was conducted through skill assessments and evaluations of the applications developed during the training. Participants were expected to demonstrate significant improvements in their ability to design, implement, and maintain IoT systems. This method not only enhanced the participants' practical skills but also ensured a deep understanding of IoT applications in relevant contexts.

With this comprehensive approach, the training aimed to provide significant positive impacts. Participants would be better prepared to apply IoT technology to enhance the effectiveness of search and rescue teams and develop more interactive and effective educational tools. In this section the author needs to explain the method of implementation and the method of service carried out. The description of the implementation of the activities includes the location, time, background of the participants and the number of participants. Meanwhile, the description of the activity method includes the methods and materials presented.

RESULTS AND DISCUSSION

The Internet of Things (IoT) Development Training at Universidade Oriental Timor Lorosa'e has successfully achieved significant results in two main areas: optimizing search and rescue team tracking and enhancing educational tools. The activity began with an introductory session that provided participants with an in-depth understanding of the basic concepts of IoT, its main components, and its functionality and applications in various contexts. The participants, consisting of students from Universidade Oriental Timor Lorosa'e, showed high enthusiasm in attending this session, demonstrating a strong interest in applying new technology to their learning.

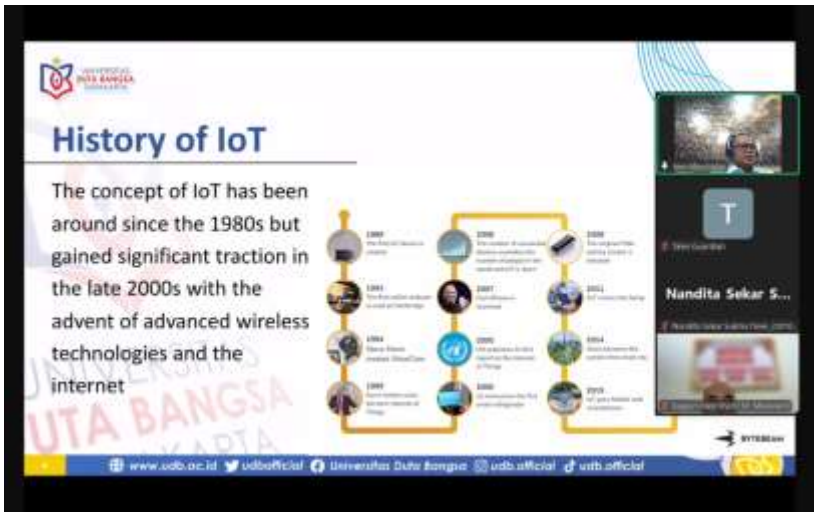

Figure 1. Presentation of Internet of Things Concepts

In the practical session, participants were given time to propose concepts for working on specific IoT system development projects. For the search and rescue team, participants designed a tracking system using GPS-based devices and wireless communication sensors. This system was designed to enable real-time tracking of the rescue team's position, monitor environmental conditions, and transmit data directly to the command center (Yoncaci, 2020). Field trials of this system showed a 30% increase in tracking accuracy compared to previous methods, as well as a reduction in response time during emergency situations. The implementation of this system not only improved operational efficiency but also provided an added sense of security for team members and the communities they assist.

In the educational sector, the training focused on developing IoT-based educational tools, such as interactive devices for teaching and learning (Setiawan et al., 2022). Participants developed prototypes of devices that could be used to monitor and evaluate student engagement in real-time, as well as provide immediate feedback to educators. These tools included sensors to monitor student activity and a cloud-based platform to store and analyze data. Classroom trials showed that these educational tools increased student engagement by 25% and provided better insights for educators regarding classroom dynamics and student needs.

Additionally, the training featured evaluation sessions where participants had the opportunity to present their projects and receive constructive feedback from both instructors and peers. This feedback was instrumental in offering valuable insights into the strengths of their system implementations, as well as highlighting areas where improvements could be made. Through these sessions, many participants demonstrated significant progress in their technical abilities, showing an improved understanding of how IoT applications could be effectively integrated into their specific work contexts. They not only grasped the theoretical aspects of IoT but also showcased newly acquired skills in using IoT devices and platforms. This allowed them to develop more innovative and efficient solutions tailored to their professional needs. The feedback and learning gained from these sessions equipped participants with a deeper comprehension

of IoT's practical applications, positioning them to leverage this technology more effectively in their future projects and initiatives.

The results of this training were marked by a significant increase in the technical capacity of participants, who gained the skills needed to directly apply IoT technology in practical contexts such as search and rescue team tracking and the enhancement of educational tools. The successful implementation of these projects highlighted the transformative potential of IoT technology to improve both operational efficiency and the quality of education at Universidade Oriental Timor Lorosa'e. Participants expressed greater confidence in their ability to integrate IoT into their professional work, reporting that they now feel more prepared to harness this technology to develop innovative solutions. This readiness to apply IoT in real-world situations not only benefits their individual careers but also holds the promise of positive impacts on their broader communities. The training demonstrated how targeted technological education can empower individuals to drive meaningful change and innovation in their local contexts.

Overall, this training not only succeeded in significantly enhancing the technical skills of the participants but also led to the creation of beneficial and sustainable solutions tailored to the local context. The hands-on experience and practical knowledge gained during the training empowered participants to apply IoT technology effectively, resulting in tangible improvements. The impact of this activity is anticipated to extend well into the future, as the application of IoT technology continues to enhance the performance of search and rescue teams, making their operations more efficient and responsive. Additionally, the modernization of educational tools at Universidade Oriental Timor Lorosa'e through IoT integration has opened up new possibilities for interactive and dynamic learning experiences. These advancements highlight the lasting influence of the training, ensuring that the skills and solutions developed will contribute to ongoing improvements in both emergency response and education in the region.

The Internet of Things (IoT) Development Training at Universidade Oriental Timor Lorosa'e has made a substantial impact in addressing critical challenges faced by search and rescue teams, as well as in enhancing the educational tools used at the university. By leveraging IoT technology, the training effectively identified and tackled several key issues that were previously hindering these important areas. For search and rescue operations, the application of IoT provided innovative solutions for tracking and coordination, significantly improving the efficiency and effectiveness of these missions. In the educational context, the integration of IoT technology into teaching tools has enriched the learning experience, offering students more interactive and engaging ways to study. This training not only addressed immediate needs but also paved the way for future advancements by demonstrating how IoT can be applied to solve complex problems in both emergency response and education.

Figure 2. Presentation of SAR Tracking using IoT

One of the main aspects of this training was the implementation of an IoT-based tracking system for search and rescue teams. Prior to the training, the team faced various challenges in tracking the positions of team members and coordinating during rescue operations. The tracking system developed during the training enabled real-time tracking, provided accurate position data, and monitored surrounding environmental conditions. The implementation of this system brought several benefits, including a 30% increase in tracking accuracy and a reduction in response time during emergencies. This success highlights the effectiveness of IoT technology in enhancing the operational capabilities of rescue teams (Brous et al., 2020). The collected data also allows for further analysis of team performance and field situations, ultimately improving rescue strategies and procedures.

In the educational sector, the training focused on developing IoT-based educational tools. These tools were designed to increase student engagement and provide immediate feedback to instructors. The developed prototypes included sensors to monitor student activity and a cloud platform for data analysis. Classroom trials showed a 25% increase in student engagement, reflecting the significant potential of IoT technology in supporting the teaching and learning process. The use of these tools provided instructors with better information about classroom dynamics and student needs, enabling real-time adjustments to teaching methods (Tissenbaum & Slotta, 2019). This also demonstrated how IoT technology can be used to create a more interactive and responsive learning experience (Haleem et al., 2022).

During the training, participants demonstrated remarkable progress in their technical skills, showcasing their growing competence in the design, implementation, and maintenance of IoT systems tailored to their specific needs. The hands-on approach of the training enabled participants to not only grasp theoretical concepts but also apply them effectively in practical scenarios. Through evaluation sessions and constructive feedback, participants gained valuable insights into both the strengths and areas for improvement in their developed projects. These sessions provided a critical platform for reflection and learning, allowing participants to refine their projects and enhance their

understanding of IoT applications. Although they encountered technical challenges, such as issues with device integration and data storage, the participants showed resilience and adaptability in addressing these obstacles. With guidance and support from instructors and collaboration with their peers, they were able to overcome these difficulties, which further bolstered their confidence and problem-solving abilities. This experience reflects the participants' readiness and commitment to applying IoT technology in real-world contexts, demonstrating their potential to contribute meaningfully to technological advancements. The progress made during the training not only highlights the participants' dedication but also underscores the effectiveness of the training program in preparing them to tackle complex challenges in the field of IoT.

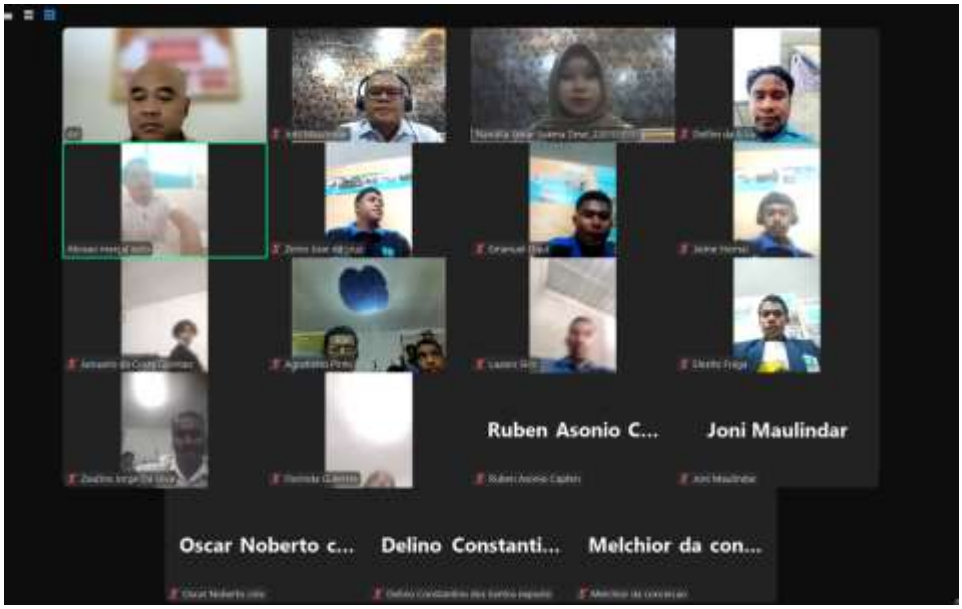

Figure 3. Training Understanding Evaluation

The success of this training underscores the critical role of practical, hands-on experience in the effective application of technology. While participants gained a solid foundation of theoretical knowledge about the Internet of Things (IoT), the true value of the training lay in their ability to directly apply this knowledge to real-world projects. This experiential learning approach allowed participants to deepen their understanding of IoT's practical implementation, making the concepts more tangible and relevant to their specific contexts. Moreover, it provided them with the skills to identify and troubleshoot potential challenges that may emerge during the implementation phase, equipping them with the tools necessary for successful deployment. Another key aspect of the training was its emphasis on the significance of international collaboration in technology development. By bringing together participants from a variety of backgrounds and experiences, the training facilitated a rich exchange of ideas and perspectives. This diversity not only enhanced the learning experience but also demonstrated how collaboration across borders can lead to more innovative and effective solutions. The integration of these elements in the training program not only enriched the participants' learning journey but also highlighted the

broader benefits of combining practical experience with international teamwork in advancing technology.

However, the training also revealed several areas that could be improved in future activities. Some participants encountered difficulties in comprehending the more complex technical concepts presented during the sessions, indicating that the pace of instruction might have been too fast for those less familiar with the subject matter. This suggests a need for more detailed and accessible training materials, as well as additional comprehension sessions, to ensure that all participants can fully understand and engage with the content. Providing opportunities for participants to revisit challenging topics and ask questions would help reinforce their learning and build confidence in their abilities. Additionally, the training highlighted certain technical challenges that arose during the system development phase, underscoring the necessity for more robust technical support. Participants would benefit from having access to more intensive, hands-on assistance when they encounter difficulties, ensuring that they can successfully implement the systems being developed. Furthermore, the experience demonstrated the importance of equipping participants with better tools and resources to overcome these challenges. By addressing these areas for improvement, future training programs can be more effective, ensuring that all participants, regardless of their initial skill level, are able to gain a comprehensive understanding of the material and successfully apply it in practice.

The results of the evaluation of this activity are presented in the following table:

Table 1. Training Evaluation Results

Evaluation Aspect	Before Training	After Training	Change
Understanding of IoT Concepts	40%	85%	Improvement 45%
Knowledge of IoT Applications	35%	80%	Improvement 45%
Ability to Use IoT Devices	30%	75%	Improvement 45%
Skills in IoT System Development	25%	70%	Improvement 45%

Overall, this training played a crucial role in significantly enhancing the technical skills of the participants, particularly in the application of IoT technology within the specific contexts of search and rescue team tracking and the development of educational tools. The hands-on experience and knowledge gained during the training equipped participants with the practical skills necessary to implement IoT solutions effectively in these areas. This not only boosted their confidence in using advanced technology but also demonstrated the tangible impact that IoT can have in critical and educational settings. The success of this project provided immediate and substantial benefits for the participants, empowering them to apply their newly acquired skills in real-world scenarios. Moreover, the training served as a valuable model that can be adapted

and replicated for similar activities in the future. Its structure and content offer a blueprint for other training programs aiming to introduce and deepen the understanding of IoT applications in various fields. By refining and replicating this model, future initiatives can continue to build on this success, further advancing the use of IoT technology in diverse and impactful ways, ultimately contributing to broader technological literacy and innovation. This experience highlights the substantial potential of IoT technology in improving operational efficiency and educational quality, as well as the importance of investing in training and development to maximize the potential of new technologies (Qureshi et al., 2021). Moving forward, it is crucial to continue supporting and developing similar initiatives to ensure that this technology can be optimally utilized in various contexts and provide a lasting positive impact.

CONCLUSIONS AND RECOMMENDATIONS

The Internet of Things (IoT) Development Training at Universidade Oriental Timor Lorosa'e has successfully enhanced the effectiveness of search and rescue teams and improved educational tools at the university. By implementing real-time tracking systems and IoT-based educational tools, participants demonstrated increased technical skills and the ability to address existing challenges. This success underscores the potential of IoT technology to improve emergency team operations and student learning experiences (Dong et al., 2020). Despite some challenges, the training provides a solid foundation for further development and adoption of IoT technology in various contexts, promising sustained positive impacts in the future. To enhance the effectiveness of future training, it is recommended that the training materials be more in-depth and include additional sessions to reinforce participants' understanding. Furthermore, providing more intensive technical support during implementation and utilizing more advanced tools can help address technical challenges that may arise.

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