TINY REVIEW: AMBIENT INTELLIGENCE IN SMART APPLICATIONS

Abstract

Ambient intelligence (AmI) places a major focus on compelling computing to reach out to and assist people. This may appear to be an intuitive assumption from computer systems, but the fact is that people have had to devote effort to specialise themselves in order to reap the benefits of computing. Enforcing this need at the centre of the domain is projected to be a key driving factor and a turning moment in the history of computer science. The technological infrastructure appears to be constantly evolving in that direction, and there is an effective atmosphere on all sides concerned: normal users/consumers of technology, technology generators, suppliers of technology, and governmental institutions, that this paradigm change is needed and feasible. In this article, we give an overview of the technologies that form ambient intelligence as well as the applications that are significantly impacted by it. We are particularly interested in research that makes AmI technology "intelligent." We also outline ethical problems that AmI researchers will confront in several domains of applications in the next years.

Keywords: Ambient Intelligence, Artificial Intelligence, Smart environments,

Authors

Ms. J. Sangeethapriya
Assistant Professor
Department of information Technology
Saranathan College of Engineering
Trichirappalli

Ms. A. Sheelavathy
Assistant Professor
Department of information Technology
Saranathan College of Engineering
Trichirappalli

Ms. K. Muthukarupaee
Assistant Professor
Department of information Technology
Saranathan College of Engineering
Trichirappalli

Ms. G. Sathya
Assistant Professor
Department of information Technology
Saranathan College of Engineering
Trichirappalli

Ms. A. Thenmozhi
Assistant Professor
Department of information Technology
Saranathan College of Engineering
Trichirappalli

I. INTRODUCTION

IoT devices and sensors placed in the user's environment acquire contextual data, allowing AI to anticipate their needs. This is the ultimate convergence of IoT and AI. Ambient intelligence (AmI) is a pioneering method that integrates pervasive computing, AI sensors, and sensor networks into daily life, emphasising human-centricity as a result of its increased awareness of human presence [1].

Technology breakthroughs have resulted in a plethora of new devices and the widespread integration of computing power into numerous facets of our daily lives. This advancement is also changing how society views computer science. Because of the miniaturisation of electronics, embedded computing systems can now be used in jobs such as laundry, cooking, and driving. Successful implementations, such as Radio-Frequency Identification (RFID) technology [1], when paired with personal area networking protocols, have the potential to introduce ubiquitous computing to all aspects of our lives. Ongoing research advancements [2, 3] are quickly adopted by worldwide firms, as illustrated in [4], via knowledge transfer, contributing to the globalisation of technology.

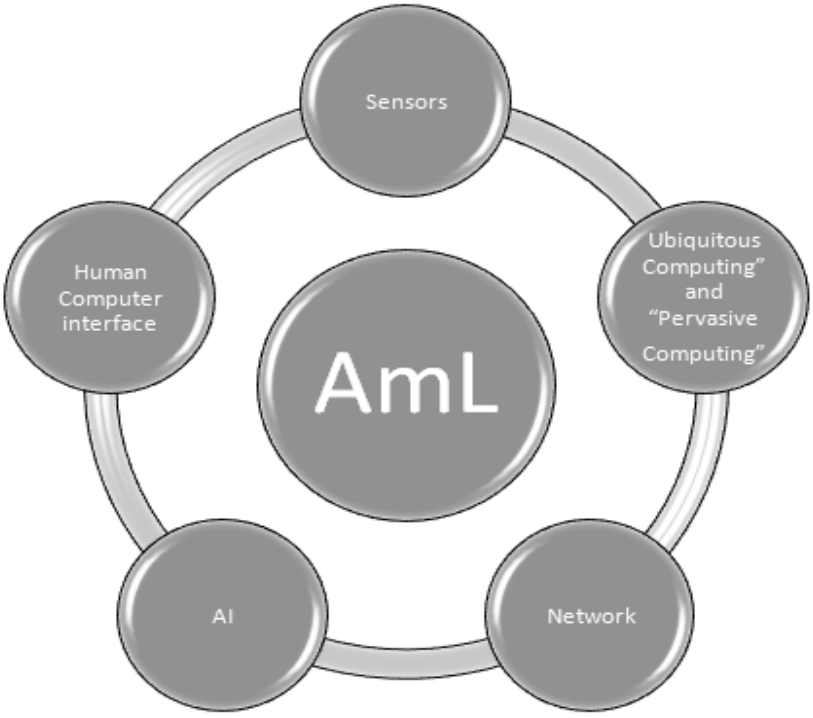

Figure 1: Correlation between Ambient intelligence and Other domains

Figure 1 explains AmI is multidisciplinary and works at the junction of multiple technologies, including Artificial Intelligence, Big Data, Internet of Things (IoT), Pervasive-Ubiquitous Computing, Networks, and Human Computer Interaction (HCI) [4], [6].

AmI detects the environment and user context by utilising numerous IoT sensors and devices installed in our homes or workplaces. Following then, the data acquired from these systems is processed by the AmI system. The AmI system interprets data after it has been processed and analysed in order to comprehend user proximity, state, intent, and behaviour. It

then intuits based on current data insights, prior learnings, and pattern recognition. It then decides on the next best action and reacts to the user via a smart device's elegantly built natural interface [3], [4].

According to the AmIS idea, it should include the following distinguishing features [5]:

- Many networked devices have been implanted into the environment;
- These technologies are context aware in the sense that they can recognise the situational context.
- AmIS can be customised to meet the demands of individuals;
- AmIS can adjust their behaviour and interfaces in response to human demands and situational context.

1. **Ambient Intelligence Technologies:** Ambient intelligence settings can be enabled through a variety of technologies [11], [15], including radio frequency identification **(RFID)** and **microchip** implants.

   RFID employs non-contact wireless technologies to transport data from tags affixed to objects, allowing for automated identification and tracking. Some tags do not require batteries and instead broadcast radio waves, but others require a nearby power source.

   Microchip implants, which provide a unique ID number connected to external databases, can be inserted in tracked items.

   Sensors are converters that measure physical quantities and turn them into signals for use in electrical devices or for observation. Software agents are intelligent, autonomous, distributed, multi-agent systems, and mobile agents that operate on behalf of users or programmes.

   The study and development of systems and devices that recognise, interpret, process, and imitate human feelings is known as **affective computing**.

   Affective computing is an interdisciplinary area that includes computer science, psychology, and cognitive science. Passive sensors capture data about the user's physical condition or behaviour without interpreting the input in order to detect and recognise emotional information. To recognise emotional information, machine learning techniques must be used to identify meaningful patterns from data. Emotion in machines is another subfield of affective computing that involves creating computer devices that have natural emotional capabilities or can simulate emotions.

   Nanotechnology is a broad area that focuses on molecular self-assembly, materials, and direct atomic-scale control of matter. It finds use in medicine, electronics, biomaterials, and energy generation. Biometrics is the identification of persons based on their features or qualities, which is used in computer science for identification and access control, as well as in groups that are being monitored.

2. **AmI Applications and its Ethical Issues:** Ambient Intelligence (AmI) is predicted to undergo a dramatic transition over the next decade as these technologies make their way

into our homes, markets, workplaces, healthcare facilities, and transportation networks. AmI's notable uses span a wide range of industries:

3. **Education:** Technological advancements have transformed the teacher-student relationship, resulting in a shift away from face-to-face encounters and towards online forums and text-based arguments, which can impede good communication.

    - **Ethical issues:** Biases, security, autonomy, independence, openness, explainability, and responsibility are among the ethical concerns raised by AI integration in education. AI systems have the potential to perpetuate biases, impair learning processes, innovation, and analytical thinking, and obstruct informed choices and control. Addressing these concerns demands a holistic approach that takes into account all stakeholders' perspectives and assures an ethical application of AI in education [8].

4. **Robotics:** The long-awaited combination of artificial intelligence and robotics as personal helpers is reshaping research and technical growth.

    - **Ethical Issues:** Here addresses an ethical considerations with the use of AI and robotics systems by humans, taking into account their autonomy and design. It emphasises the importance of responsible design rather than assuming which ethical techniques are best suited to tackling these difficulties. The emphasis on usage does not presume which ethical approach is best suited, and the debate does not address whether AI systems have intellect or mental qualities [10] .

5. **Health:** The healthcare industry is at the forefront of technological adoption, with efforts such as home healthcare services and hospital assistance making considerable strides. Hospitals can improve service efficiency by monitoring patients' health and progress through automated analysis of activity in their rooms. They can also improve safety and reduce infection spread by, for example, limiting access to specified areas and devices to authorised employees and patients.

    - **Ethical Issues:** The ethical concerns with intelligent technology in healthcare are around security and monitoring, prejudice and discrimination, and the role of human judgement. There is always the potential of inaccuracy and data leaks whenever there is technology, and failures in healthcare can have terrible implications for people. Because there are no clearly defined rules on the ethical and legal issues connected to artificial intelligence and its role in healthcare, this is a critical topic that has to be investigated [7].

6. **Transportation:** Ambient intelligence has the potential to improve travel experiences through technology-enabled cars and data-driven system improvements.

    - **Ethical Issues:** Overloading vehicles, drunk driving, theft, illegal activities, and transportation expenses contribute to vehicle damage, road accidents, and loss of public funds. Factors like manipulation of trip records and excessive expenses also contribute to these issues. 3PLs exploit these issues [11].

All necessary steps must be taken to reap the benefits of the industry's current growth stage. Autonomous cars have the potential to be exploited for malicious purposes, such as in the context of a terrorist strike. Furthermore, there are concerns that criminals may utilise these cars to flee the scene of an assault or to smuggle illegal drugs.

7. **Workplace:** By continuously monitoring the environment and warning management or personnel of safety breaches, ambient intelligence has a chance to prevent workplace accidents.

- **Ethical Issues**: One of the key ethical issues about AI in the workplace is the possibility of labour displacement. While AI has the potential to enhance productivity and cut costs, it may also result in job losses for employees who have been substituted by robots [12].

II. RECENT ADVANCEMENTS OF AMI IN SMART ENVIRONMENTS (AMISE)

1. Ambient human-to-human communication involves terminal-centered interaction, similar to traditional telephone and video conference systems. This type of communication has social characteristics similar to face-to-face meetings. There are various interaction modes available when people are physically together, with different social or interpersonal distances. Ambient communication technology focuses on natural interaction between people who are physically present.
2. Recent developments in occupancy sensing and services in smart environments, including houses, offices, and urban spaces. Sensor equipment, tools, algorithms, and data mining techniques are used to process and apply occupancy information, enabling services for both ordinary and professional users.
3. Smart offices and decision rooms are critical for effective decision-making in a variety of scenarios, including conference rooms and distant learning.
4. The Smart Decision Room initiative seeks to assist meeting room participants by merging intellectual and emotional factors.
5. The Smart Classroom project integrates ubiquitous computer technology into traditional distant learning, therefore improving the traditional classroom-based learning experience. Multiple sensors, multimodal interfaces, and context-aware applications are key technologies. The specialized programme "Same View" provides a complete range of functionalities for teachers, local students, and distant students to conduct real-time, collaborative distance learning experiences.
6. The software infrastructure of the Smart Platform supports multiple data transmission modalities and quality of service (QoS) levels. The use of ambient intelligence in the metropolis solves urban planning deficiencies by concentrating on incorporating ubiquitous sensing difficulties into urban planning in order to mediate between both public and private objectives [13], [14].

III. AMI DATASETS

Dataset	Source URL
Gesture, body Gesture dataset	https://archive.is/k0g1k https://archive.is/nwNUH

Gesture (Kinect)	https://archive.ph/T92ky
Speech corpus TIMIT (UPenn)	https://archive.ph/3j4QC
Human activities	ed.ac.uk
Behaviour ontologies Survey paper	https://archive.ph/ZgFvb http://doi.org/10.1145/2523819
Home dataset MIT	https://archive.is/TZM3P
Inpatient Mortality rates	https://data.world/chhs/05fee607-cea9-4bf1-8b53-20ca584748a3
Smart grid	https://data.world/datasets/ami

IV. CONCLUSION

Ambient the field of computing, ambient cognitive ability, ubiquitous computing, persistent computing, or calm technology are terms used to describe directed evolution in our daily life. This includes hardware, software, experience for users, and human-machine interaction. We've seen advancements hinting at a future full of this type of technology, but we won't be besieged and troubled by personal devices in the future. Instead, ambient computing will fade and mix all technology into the background, where we will not notice it operating. It will quietly and unobtrusively assist us in our daily lives. Ambient computing will usher in a new era in the smart world, not only the future of smart homes. Ambient computing is the technological future, and it's an exciting one.

REFERENCES

[1] https://www.sciencedirect.com/science/article/abs/pii/S157411920900025X
[2] Cook, D. J., Augusto, J. C., &Jakkula, V. R. (2009). Ambient intelligence: Technologies, applications, and opportunities. Pervasive and Mobile Computing, 5(4), 277–298. doi:10.1016/j.pmcj.2009.04.001
[3] AMBIENT INTELLIGENCE:BASIC CONCEPTS AND APPLICATIONS
[4] (Keynote Lecture) ,Conference Paper · September 2006 DOI: 10.1007/978-3-540-70621-2_2 ·
[5] Ambient Intelligence: Concepts and Applications
[6] Juan Carlos Augusto and Paul McCullagh https://www.infosys.com/insights/ai-automation/ambient-intelligence.html
[7] Data Collection Technology for Ambient Intelligence
[8] Systems in Internet of ThingsAlexander Vodyaho 1, VasiliyOsipov2 , Nataly Zhukova 2,* and Vladimir Chernokulsky https://www.immerse.education/study-tips/ethical-issues-with-artificial-intelligence-and-healthcare/ https://taxila.in/blog/the-ethics-of-ai-in-education/ https://plato.stanford.edu/entries/ethics-ai/
[9] https://content.iospress.com/articles/journal-of-ambient-intelligence-and-smart-environments/ais180507
[10] https://www.oecd-ilibrary.org/docserver/840a2d9f en.pdf?expires=1690831418&id=id&accname=guest&checksum=000BA6AA9F24C78C898A0E4846987086 https://ijrcs.org/wp-content/uploads/IJRCS202002011.pdf
[11] Ambient Intelligence and Smart Environments: A State of the Art
[12] Juan Carlos Augusto, Hideyuki Nakashima, Hamid Aghajan
[13] H. Nakashima et al. (eds.), Handbook of Ambient Intelligence and Smart Environments, DOI 10.1007/978-0-387-93808-0_1, © Springer Science+Business Media, LLC 2010
[14] A Survey of Ambient Intelligence, Article in ACM Computing Surveys · April 2021DOI: 10.1145/3447242

