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Learning App for Deaf and Mute People and Object Detection

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ABSTRACT: Despite advancements, most research efforts in sign language recognition still face limitations that prevent their widespread commercial use. Some studies have successfully demonstrated effective sign language recognition systems, but these often involve high costs, making commercialization challenging. Recently, there has been increased interest in developing commercially viable sign language recognition systems. Researchers are exploring various approaches, beginning with data acquisition methods, which differ due to the cost implications of high-quality devices. However, cost-effective solutions are essential for making these systems accessible on a larger scale.

The methodologies in sign language recognition development vary significantly among researchers, with each approach offering unique advantages and disadvantages. Researchers continue to experiment with diverse techniques to refine their systems, acknowledging that each method also brings distinct limitations. This paper aims to review these different approaches in sign language recognition, identifying the most effective methods used in current research. Such insights can guide future researchers to enhance and innovate upon existing systems, contributing to more accessible and efficient sign language recognition technology.

I. INTRODUCTION

Communication is a fundamental need, yet for deaf and mute individuals, traditional methods often fall short. In recent years, various applications and technologies have emerged to bridge this communication gap, focusing on both accessible learning and real-time sign language conversion. This paper reviews recent studies and innovations in the field of assistive technology for the deaf and mute, highlighting the need for adaptive, inclusive learning platforms and converters that can interpret sign language accurately for effective communication. Educational technology is now deeply embedded worldwide, with various tools developed to support students, such as courseware, e-learning, web-based learning, mobile applications, blended learning, and more. These technologies bring numerous innovations to enhance education and assess digital learning resources. Mobile applications like the Mimix app, initially developed for deaf and mute students, are now also used in regular classrooms to facilitate effective sign language learning. The Mimix app includes a database of words commonly used in daily communication, making it a useful reference source. Additionally, finger-spelling features in tutorial apps employ 3D animation to teach and spell words, illustrating how mobile apps have become central to modern learning, influenced by digital devices like smartphones.

Reports indicate that about 29 percent of students use smartphones to access the internet, reflecting how common it has become to find information online. However, further refinement is needed to ensure that these tools effectively address the unique needs of deaf and mute users. Various educational theories are important in supporting sign language learning through mobile applications. This study identifies key components in mobile-assisted teaching and learning that contribute to student success, drawing on theories such as the cognitive theory of multimedia, constructivist learning theory, learner-centered design, social learning theory, and e-learning theory. While many theories are relevant to education, these align particularly well with the objectives of using mobile apps in learning.

II. LITERATURE REVIEW

Teaching and learning through mobile apps require a structured framework to support students effectively. According to Richard E. Mayer (2014), multimedia learning involves the use of text and images. Mayer's research suggests that students process text and images through two distinct cognitive channels; however, this concept does not fully address mobile app design. Kangas and Kinnunen (2015) and Altay (2013) emphasize that app design is a critical component in

mobile-based teaching and learning, highlighting that learning occurs through both visual representation and text, which help students form a clearer understanding by combining what they see and read.

A systematic structure is essential for educational tools, as the basic concepts in mobile learning are self-directed and active learning (Moreno & Mayer, 1999). Constructivist learning theory identifies five key elements for multimedia-based teaching and learning:

communication methods, pedagogical strategies, student knowledge, teacher skills, and environment. This theory discusses how knowledge is acquired, though it does not address the significance of modules (Aldoobie, 2015; Bada & Olusegun, 2015; Jia, 2010). Soloway et al. (1996), however, highlight that modules play an essential role as structured packages that guide students through organized learning activities.

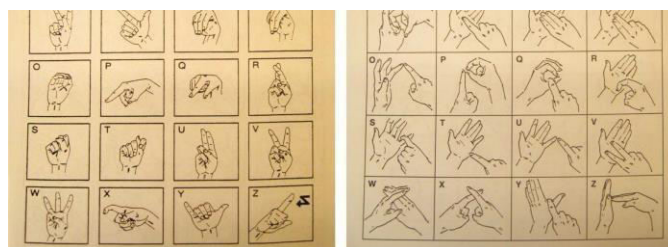
Soloway et al. (1996) further explain that additional elements, such as context—which refers to the learning goals and objectives—are also crucial in learning design. Mobile devices, including phones, tablets, and computers, serve as fundamental tools for educational activities. Altay (2013) suggests that app development should have well-defined goals and adhere to principles related to cost, user needs, and time constraints when designing for mobile devices.

According to social learning theory by Wood and Bandura (1989), learning occurs through observation of others' behaviors, attitudes, and the outcomes of their actions. While Altay (2013) does not discuss behavior directly, he emphasizes the influence of attitude on success, as attitude shapes students' actions. Bandura (2002) identifies four key components in social learning: observation, retention, response, and motivation. Learning is understood to occur through students' observations, where attitudes and behaviors witnessed in others remain in students' memory, prompting a response and motivating them toward similar actions.

Moreno and Mayer (1999) identify two principles in elearning: the principles of mobility and coherence, both of which aim to reduce students' cognitive load. Richard E. Mayer (2003) further outlines three key components for effective digital learning: evidence from previous studies, theoretical frameworks, and application-based principles. In mobile learning contexts, the modality principle suggests that audio may be more effective than text. However, for deaf and mute students, text remains the primary medium for communication. The presence of graphics and video advertisements can increase cognitive load, making it important to apply coherence principles to help students stay focused.

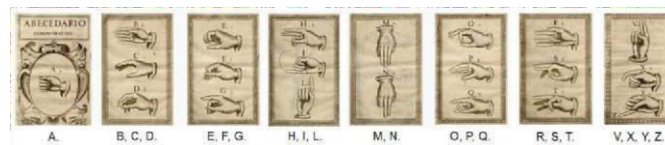
III. SIGN LANGUAGE

Sign languages are diverse and widespread, with nearly every spoken language having its own corresponding sign language—over 200 in total. Some commonly used sign languages include American, British, German, French, Italian, and Turkish Sign Language. American Sign Language (ASL) is one of the most well-known and extensively studied sign languages worldwide. Its grammatical structure has influenced other sign languages, such as British Sign Language (BSL), although ASL and BSL are not closely related and have distinct differences, as illustrated in Figure 1. This section will not delve into the specifics of individual sign languages, as each has its unique rules. Instead, the following section will provide an overview of the shared characteristics among different sign languages, including aspects like origin, phonology, and syntax. Developing a sign language translator is a complex task due to these variations.



IV. ORIGIN OF SIGN LANGUAGE

Deaf individuals rely on sign language to communicate with each other as well as with other members of the deaf community. Additionally, some ethnic groups with distinct phonological systems, such as the Plains Indian Sign Language and Plateau Sign Language, have historically used sign languages to interact with other cultural groups. The origins of sign language trace back to early history. A significant work in this field is Juan Pablo Bonet's book, *Reduccion de las letras y Arte para enseñar a hablar los Mudos* (Reduction of Letters and Art for Teaching Mute People



to Speak), published in Madrid in 1620. This text is regarded as the first modern treatise on phonetics and introduced a method for educating deaf individuals through the use of manual signs, including a manual alphabet (illustrated in Figure 2), to facilitate communication. Although this manual alphabet had limitations, it served as an early approach to enable interaction among the deaf.

The first significant research into sign languages began in the 1960s. In 1960, Dr. William C. Stokoe published a monograph titled *Sign Language Structure* [2], marking a pivotal moment in the study of sign languages. He collaborated with deaf students from Gallaudet University to develop and document signs. Later, he published the first American Sign Language (ASL) dictionary [3], categorizing signs based on handshape, location, and movement, rather than focusing on their English equivalents. This work was groundbreaking and laid the foundation for further research into the linguistics of sign language.

Phonology:

The phonology refers to the study of physical sounds present in human speech. The phonology of sign language can be defined. Instead of sounds, the phonemes are considered as the different signs present in a row of hand signs.

They are taking into account the following parameters:

1. Configuration: Hand shape when doing the sign.
2. Orientation of the hand: Where the palm is pointing to.
3. Position: Where the sign is completed.
4. Motion: Movement of the hand when doing the sign (straight, swaying, circularly) [2].
5. Contact point: Which part of the hand touch the body.
6. Plane: The sign is depending on the distance to the body.
7. Non-manual components: Information provided by the body. For example, when the body leans front, it expresses future tense.

Morphology:

Spoken languages have inflectional morphology and also derivational morphology. The inflectional morphology refers to the modification of words. The derivational morphology is the process of forming a new word on the basis of an existing word.

Sign languages have only derivational morphology because there are no injections for tense, number or person. The most important parameters regarding morphology are represented as:

1. Degree: Mouthing.
2. Reduplication: Repeating the same sign several times.
3. Compounds: Fusion of two different words.
4. Verbal Aspect: Expressing verbs in different ways. Several of these involve reduplication [2].
5. Verbal number: To express plural or singular verbs. Reduplication is also used to express it.

Syntax:

It is primarily brought through a combination of word order and non-manual features. It is described by:

1. Word order: A full structure as [topic] [subject] [verb] [object] [subject-pronoun-tag].
2. Topic and main clauses: Background information sets.
3. Negation: Negated clauses can be mentioned by shaking the head during the entire clause.
4. Questions: The questions are mentioned by lowering the eyebrows.
5. Conjunctions: Separate sign in ASL is a short pause.

Concepts of Sign Languages:

Briefly the basic knowledge about sign languages has been represented. The main linguistic characteristics used by the system are part of the Phonology section. The following parameters are considered: International Journal of Computer Science & Engineering Survey (IJCSSES) Vol.6, No.4, August 201542

1. Position: The position that the sign is occurred.
 2. Motion: Movement of the hand when doing the sign (straight, swaying, circularly).
 3. Plane: The distance with respect to the body. The different basic signs from the ASL dictionary have been taken and the parameters assigned to these characteristics as respect to the position, motion and plane. equipped with sign language recognition, AI-driven interpreters, and machine learning techniques are prominent. For example:
- Image and Video Recognition for Sign Language: One approach uses video recognition algorithms to capture and translate sign language in real time. International Journal elaborates on using machine learning models to identify and interpret hand gestures, an essential component of sign language.
 - Gesture Recognition with Wearable Devices: Some solutions utilize wearable technology to detect gestures based on muscle movement and positioning. This method, covered in International Research Journal, demonstrates how wearable tech can be integrated into a learning app for more personalized interaction.
 - Text-to-Sign and Sign-to-Text Translation Models: Platforms that convert spoken language into sign language and vice versa allow for bi- directional communication. For example, Procedia Computer Science discusses an integrated approach combining image recognition and natural language processing to achieve accurate translations.

V. CHALLENGES

Despite advancements, there are notable challenges in creating effective learning and communication platforms for the deaf and mute:

- Variability in Sign Language: Different regions have unique dialects or versions of sign language, making it challenging to design a universal application.
- Complex Gestures and Real-Time Processing: Sign languages rely not only on hand gestures but also on facial expressions and body posture, which current recognition technologies sometimes struggle to capture in real time, as discussed in Software Based Sign Language.
- User Accessibility and Device Compatibility: Ensuring that learning apps are accessible across different devices, particularly those used by individuals from diverse socioeconomic backgrounds, remains a challenge. Tse Gu discusses compatibility issues and the need for cost-effective solutions.

VI. PROPOSED SOLUTIONS AND INNOVATIONS**CURRENT TECHNOLOGIES AND SOLUTIONS**

Several technological solutions have been developed to facilitate communication for the deaf and mute. Studies indicate that the studies reviewed suggest multiple strategies to address these challenges:

- Deep Learning Models for Better Accuracy: Employing deep learning models, particularly convolutional neural networks (CNNs), can enhance gesture and expression recognition. International Journal shows promise in improving translation accuracy with such models.
- Augmented Reality (AR) for Interactive Learning: AR can be a powerful tool in a learning app, making lessons

more interactive and visually engaging. Tse Gua proposes using AR to teach sign language basics interactively, helping users practice and understand signs better.

- Cloud-Based Solutions for Real-Time Updates: As discussed in Unit Penerbitan Ui, a cloud-based infrastructure could provide real-time updates, enabling users to access the latest versions of sign language data, dialectal variations, and new signs, making the app dynamic and adaptive.

VII. CONCLUSION

The reviewed papers highlight significant progress toward creating effective learning applications and sign language converters for the deaf and mute. Future directions may include integrating artificial intelligence with user-specific adaptations, enabling the app to learn and adjust to each user's unique signing style. Enhanced machine learning models focusing on multi-lingual sign language support and lowercost devices would also be beneficial, expanding the app's reach. The potential for such technologies to foster inclusivity and independence for the deaf and mute community is substantial, yet ongoing research and development are crucial.

REFERENCES

1. Article by Mat Redhuan Samsudin and his colleagues
2. Article by Taner Arsan and Oguz UlgenI..
3. Article by Keerthi S Warriar and Himadri Halder.
4. Article by Suharjito, Ricky Anderson, Fanny Wiryana and Gede putra Kusum
5. MatRedhuanSamsudin&rushanasulaiman



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