

# artikel

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# INNOVATION OF ADAPTIF TECHNOLOGY BASED ON INTERNET OF THINGS FOR INCLUSIVE STUDENT

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**Abstract.** This paper discusses the learning system of inclusive students by adapting adaptive technology. The learning process is carried out by adjusting the curriculum and educational infrastructure. Students at the PGRI Argopuro Jember University College have 45-50 inclusion students with each batch of 2018-2020. Inclusive students (blind, deaf) experience negative stigma, mentality, difficulty understanding lessons, task completion, and communication. Inastec adaptive technology innovation based on internet of things is proposed to improve the inclusive student learning system. Learning utilizes application algorithms and hardware design schemes for the Raspberry Pi 3 B+. The results of applying Inastec's adaptive technology based on the internet of things can help inclusive students in understanding theory, completing assignments, and communicating with the Inastec platform tool with text output and voice feedback on sound speakers.

*Keywords : Adaptive technology, Internet of things, In Aztec, Raspberry Pi.*

## 1. INTRODUCTION

The education of inclusive student makes adjustments to the curriculum, infrastructure, and education system that can help the needs of students [1]. Inclusive education such as elementary, junior high, high school, vocational school called Special School (SLB) with slow disabilities and learning difficulties [2],[3]. The colleges for inclusive students have special needs in physical, intellectual, social, emotional, linguistic, and learning processes [4]. The success factor of the inclusive education learning process is to provide tutoring [5].

The teaching and learning process of inclusive education can be supported by appropriate technology in solving problems. The technological advances are accompanied by an effective and efficient learning system [6]. However, the process of inclusive student education is still a problem with the negative stigma and mentality of the community [7]. This is influenced by four factors namely. First, the learning system is not right in higher education. Second, students cannot receive environmental treatment. Third, technological innovation cannot match the needs of students. Fourth, the implementation of teaching staff cannot adapt to adaptive technological innovations to facilitate inclusive student learning [8].

The application of adaptive technology as a learning medium can help the learning process by paying attention to students to evaluate the shortcomings of the teaching and learning system. Adaptive technology provides easy access for inclusive students (blind and deaf) Special Education Study Program at PGRI Argopuro Jember University with computer media. So that lecturers can provide a more effective and efficient learning process with methods that are easily understood by students.

Therefore, inastec adaptive technology innovation (inclusive assistive technology) based on the internet of things is proposed in the learning system for inclusive students. [9],[10]. Inastec adaptive technology utilizes structured programming language algorithms. Each argument will result in interaction without the help of human labor in doing its work. The working principle of inastec adaptive technology uses an internet network that is connected to a hardware system. Teaching staff can monitor students in the learning process, assigning assignments, and completing assignments.

2. METHODS

The method used in Inastec's adaptive technology innovation based on the internet of things using Google's cloud platform and Raspberry Pi 3 B+ [11]. Technological design is divided into two, namely, the application of algorithms and hardware schemes [12]. The application algorithm is similar to the google cloud platform which is used as a storage for communication services with the internet network as a Raspberry Pi server [13]. Raspberry Pi provides google text to speech API, core, SQL, and owncloud database services [14]. Voice input in the form of google text to speech API is stored as a database, and RPI Monitor is a monitoring server on a rest-full API. The stored database is sent via a fronted interface with the Raspberry IP Address web browser, then the text is converted into sound that is displayed on the Inastec platform.

Hardware schematic is designed with microphone and audio splitter as voice input on google assistant [15], [16]. The Raspberry Pi B+ is equipped with a sound card to store sound, then a small computer is connected to keep the operating system safe while running [17]. Voice input displayed on the monitor screen in the form of text connected to a computer and LED Projector as a learning medium for deaf students [18]. The monitor speakers are controlled using a power amplifier for feedback as sound for blind students [19]. Inastec's adaptive technology method based on internet of things is described in Figure 1.

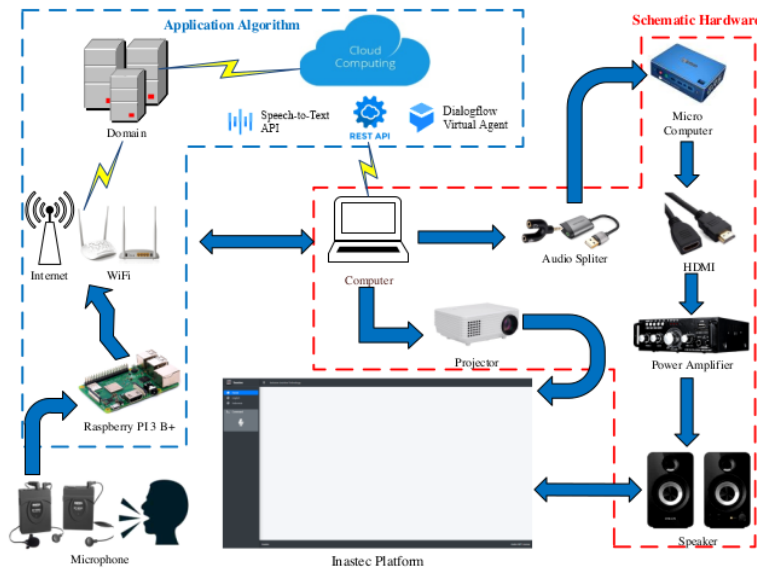


Figure 1. Inastec Platform

The purpose of the Inastec assistive technology model is as a tool for inclusion of blind and deaf students. The microphone voice input will be used as network communication that is connected to wireless using a static IP and client server. The static IP and client server take advantage of the dynamic domain name system (DDNS) to provide port forwarding on the Raspberry Pi with internet network access. Then the Raspberry Pi is connected to the Inastec interface to display sound output in the form of text, and feedback text as output on the sound speaker. Inastec products function as a platform for technology-based learning media. So that inclusive students can learn effectively by adapting internet of things-based technology. The benefits of inastec products are that students can easily understand the material, complete assignments and communicate.

3. RESULTS AND DISCUSSION

3.1 The Learning of Monitoring Using Inastec

An inastec assistive technology is internet of things based with Raspberry Pi and bluetooth integration. So that Inastec assistive technology can be controlled remotely using a smartphone or laptop. Users of this technology are not only used as learning media, but can monitor student learning systems effectively with one device. The Raspberry Pi can be connected to various sensors, then the data obtained by the sensor is then forwarded back to the Raspberry Pi via the internet. The Raspberry Pi will continue the message to give orders to control and monitor blind and deaf students at PGRI Agropuro University Jember. Learning Monitoring Using Inastec is described in Figure 2.

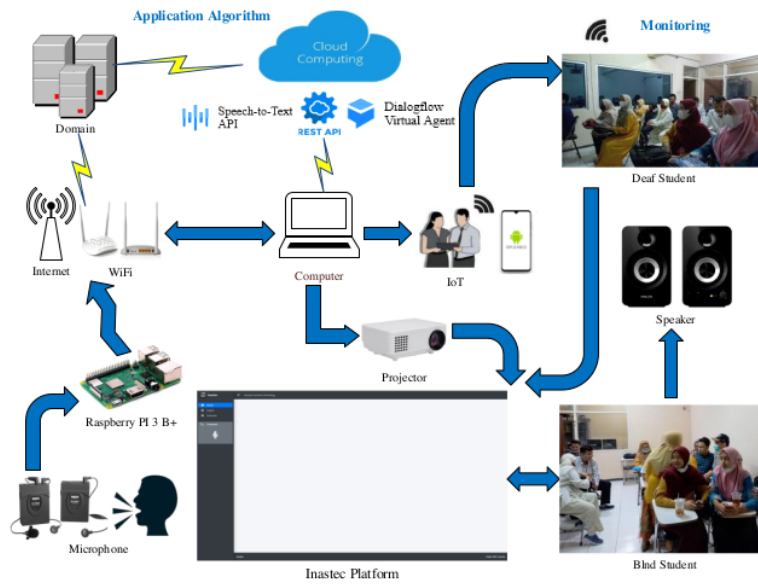


Figure 2. The Learning of Monitoring Using Inastec

### 3.2. Inastec Programs

The Inastec program consists of `inv`, `bower`, `htts`, `index`, and `packages` programs. Each program provides arguments on the Raspberry Pi B+. RESTful API uses the PHP programming language and the phpMQTT library found on the Server [20]. This RESTful API is a service that serves to bridge the gap between IFTTT and MQTT Broker. phpMQTT is a simple php class used to connect, subscribe and publish to MQTT Broker [21]. The HTTP RESTful API source code uses PHP programming and the phpMQTT library.

```

46
47 # database.test.hostname = localhost
48 # database.test.database = ctt
49 # database.test.username = root
50 # database.test.password = root
51 # database.test.charset = utf8mb4
52 # database.test.collation = utf8mb4_0900_ai_ci
53
54
55 # CONTENT SECURITY POLICY
56
57
58 # contentSecurityPolicy.reportOnly = false
59 # contentSecurityPolicy.defaultSrc = 'self'
60 # contentSecurityPolicy.scriptSrc = 'self'
61 # contentSecurityPolicy.styleSrc = 'self'
62 # contentSecurityPolicy.imgSrc = 'self'
63 # contentSecurityPolicy.baseUri = null
64 # contentSecurityPolicy.childSrc = null
65 # contentSecurityPolicy.connectSrc = 'self'
66 # contentSecurityPolicy.fontSrc = null
67 # contentSecurityPolicy.frameAction = null
68 # contentSecurityPolicy.frameAncestors = null
69 # contentSecurityPolicy.frameSrc = null
70 # contentSecurityPolicy.mediaSrc = null
71 # contentSecurityPolicy.objectSrc = null
72 # contentSecurityPolicy.pluginTypes = null
73 # contentSecurityPolicy.requestURI = null
74 # contentSecurityPolicy.sandbox = false
75 # contentSecurityPolicy.upgradeInsecureRequests = false
76
77
78 # COOKIE
79
80
81 # cookie.prefix = ''
82 # cookie.expires = 0
83 # cookie.path = '/'
84 # cookie.domain = ''
85 # cookie.secure = false
86 # cookie.httpOnly = false
87 # cookie.sameSite = 'lax'
88 # cookie.raw = false
89
90

```

Figure 3. Inastec Program

The results of the application of the Inastec assistive technology model based on the internet of things are applied effectively as a learning medium for inclusive students. Inclusive students can understand the material presented by the lecturer easily, do assignments, and communicate efficiently. Figure 4 describes the effect of applying Inastec assistive technology on inclusive students with the following before and after conditions.

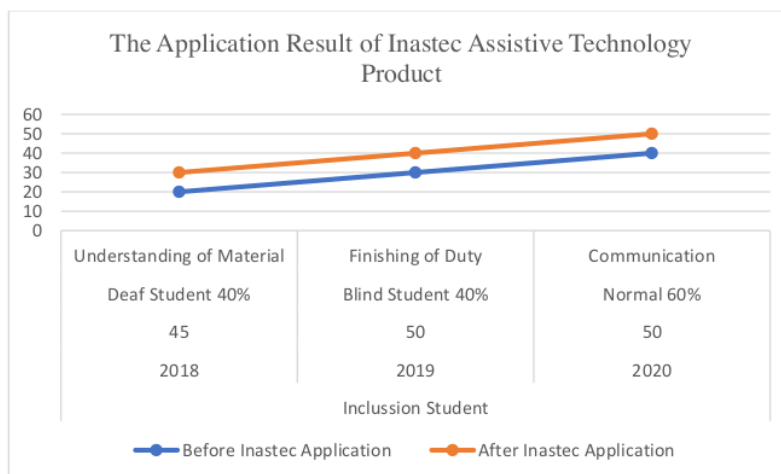


Figure 4. Application of Inastec Products to Inclusive Students

#### 4. CONCLUSION

An inclusive student learning process can be achieved with adaptive technology. Technological innovation has an important role to solve problems and provide convenience for students with special needs. Teaching staff can adapt to technology-based learning media to provide equal quality education. So that inclusive students do not experience differences with other students. One of the applications of Inastec adaptive technology based on the internet of things has a significant impact such as understanding material, completing tasks, and communication in the learning process in the Extraordinary Education study program at PGRI Argopuro Jember University. In addition, the learning process can be monitored remotely by the lecturer.

#### 5. ACKNOWLEDGEMENT

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