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Software and Hardware Development of Madrasah Ibtidaiyah Student's Fitness Evaluation based on Hexagonal Obstacle Microcontroller (Evabugar Mikrohexo)

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Abstract

One area of testing, measuring, and evaluating sports fitness components is agility. This field of agility really needs a touch of technological information, such as software and computer hardware, to help overcome problems that arise in this development. With the existence of agility tests, measurements, and evaluations, it is hoped that the agility scores obtained will be more objective. This research aims to develop an evaluation of student software and hardware based on a hexagonal resistance microcontroller (evabugar microhexo). This research design uses a research and development plan. The stages in this development research go through several stages, namely: (1) initial needs analysis and information gathering; (2) planning; (3) product development; (4) preparation for small group trials; (5) first product revision; (6) field trials; (7) second product revision; (8) field trials; (9) third product revision; (10) dissemination and implementation. The results of the agility test in small group trials were 61.90%. This is because the operational method is not yet user-friendly, and there are still many confusing commands. The use of Evabugar Mikrohexo in large group trials has improved. The level of ease of carrying out measurement tests and reading results is 80.95%. In general, the level of ease of designing the Evabugar Mikrohexo and ease of use reaches 80.95%.

Keywords: *agility, fitness, hexagonal, microcontroller*.

Abstrak

Salah satu bidang tes, pengukuran, dan evaluasi komponen kebugaran olahraga adalah kelincahan. Bidang kelincahan ini sangat membutuhkan sentuhan teknologi informasi seperti perangkat lunak dan keras komputer untuk membantu mengatasi permasalahan yang timbul dalam perkembangan tersebut. Dengan adanya tes, pengukuran dan evaluasi kelincahan, maka diharapkan nilai kelincahan yang didapat semakin objektif. Penelitian ini bertujuan untuk mengembangkan software dan hardware evaluasi kebugaran mahasiswa berbasis mikrokontroler hexagonal obstacle (*evabugar mikrohexo*). Rancangan penelitian ini menggunakan rancangan penelitian dan pengembangan. Tahapan dalam penelitian pengembangan ini melalui beberapa tahapan, yaitu (1) analisis kebutuhan awal (*need assement*) serta pengumpulan informasi; (2) perencanaan; (3) pengembangan produk; (4) persiapan uji coba kelompok kecil; (5) revisi produk pertama; (6) uji coba lapangan; (7) revisi produk kedua; (8) uji coba lapangan; (9) revisi produk ketiga; (10) desiminasi dan implementasi. Hasil tes kelincahan pada uji coba kelompok kecil sebesar 61,90%, hal ini dikarenakan cara pengoperasionalannya belum user friendly dan masih banyak perintah yang membingungkan. Penggunaan Evabugar Mikrohexo pada uji coba kelompok besar sudah semakin membaik, tingkat kemudahan melakukan tes pengukuran serta membaca hasil sebesar 80.95%. Secara umum tingkat kemudahan desain Evabugar Mikrohexo dan kemudahan dalam menggunakannya mencapai 80.95%.

Keywords: *kelincahan; kebugaran; hexagonal, mikrokontroler*.

INTRODUCTION

The slogan of the Indonesian government is Superior Human Resources (HR) for Advanced Indonesia. These superior human resources must be implemented in all people's lives, including the world of education; moreover, today's technological developments are very fast in quality and quantity. Since 2011, when the concepts of Industry 4.0 were first announced, this industrial revolution has grown and expanded from some theoretical concepts to real-world applications, its practicalities can be found in many fields and affect nearly all of us in so many ways (Yang & Gu, 2021). The scale, scope and complexity of how technological revolution influence our behavior and way of living will be unlike anything humankind has experienced (Morraret et al., 2017). The development of digital technology in the form of software and hardware in the 4.0 industrial revolution era should have penetrated the world of education to assist education actors in improving the quality of human movement preventing health problems, as well as for tests, measurements, and evaluations. One of the fields of test, measurement, and assessment of sports fitness components is agility, which needs a touch of information technology to help overcome and solve problems that arise in these developments, one of which is the development of computer software and hardware. With the test, measurement, and evaluation of agility, it is hoped that the agility value obtained will be more objective because it avoids measurement errors made by the tester.

Tests, measurements, and evaluations of sports agility in Islamic higher education institutions (PTKI) students still use conventional and manual methods. Based on the problems above, in the era of disruption 4.0, there is a need to have tools for measuring the agility of body movements that are effective and efficient using information technology assistance in software and hardware. The information technology approach was used in measuring agility using a microcontroller. Agility is a movement that involves footwork and rapid changes in body position (Lesmana, 2023; Ulfiansyah et al. 2018). To provide quality results, an athlete needs good agility, which will affect performance during training. This will improve athlete performance by involving dominant limbs such as muscles and joints. Agility is a physical condition that also plays a role in sports skills, even in certain sports, such as football, futsal, volleyball, badminton, martial arts, and others, so that the agility factor becomes dominant in sports (Putra et al., 2021; Paryadi et al., 2023). To get good physical fitness, systematic preparation, execution, and training process are needed so that good conditions are formed and can support having speed and agility so that they can become reliable and outstanding players (Wijaya & Indarto, 2023; Ar Rasyid, 2023).

The tester (person who collects data) in the form of manual tests, measurements, and evaluations in the field is often not less thorough or less careful in observations, so the child being measured may gain benefits or even suffer losses; this is not very objective in collecting the data (Martin, 2016; Teferi & Endalew, 2020). On the other hand, a tester's responsibility is to observe a large number of testicles (children being tested), so it requires a long duration of time and a relatively long time to carry out tests and measure and evaluate their anomalous agility. This lack of objective assessment makes the athlete or testee very disadvantaged, especially if the agility test is carried out twice or more, as the testee will already experience fatigue, so the results obtained will be less than optimal. Another problem is when the number of testers/athletes is very large, and the testers are not comparable or even less, so it takes a long time to carry out agility tests.

The usefulness of this Hexagonal Obstacle Microcontroller-Based Student Fitness Evaluation Software and Hardware (Evabugar Mikrohexo) is to be used by testers in recording each score of agility achieved by athletes in real time or up to date or directly when giving the score so that all testers, coaches and spectators can see on the board the Evabugar Mikrohexo which has been installed in sevensegment form live. The hexagon obstacle test as an agility assessment tool, evaluating foot speed as individuals change directions between backward, forward, and sideways movements (Pratama et al., 2023). Moreover, this drill also tests the body's capacity to maintain balance while executing rapid directional changes. In addition, Evabugar Mikrohexo can require only one tester even though many tests are tested at the same time and place. The hope obtained in the development of Evabugar Mikrohexo is that the assessment given is more objective in the agility test using a hexagonal obstacle.

Based on this background, the authors formulate the following problems: 1) What is the range of fitness norms for the agility sub-sports in the student body at PTKI? 2) What is the development model for Software and Hardware Evaluation of Student Fitness Based on Hexagonal Obstacle Microcontrollers (Evabugar Mikrohexo) to Improve Sub-Agility Sports Fitness to PTKI Students? 3) What is the feasibility of evaluating student fitness based on a Hexagonal Obstacle Microcontroller (Evabugar Mikrohexo) to improve sports agility in PTKI students? This research aims to design and develop Evabugar Mikrohexo Software and Hardware for improving Fitness Sub-Agility Sports in Students Based on the AT89S52 Microcontroller. The development at this stage is to create a scenario script to manufacture software and hardware for Evabugar Mikrohexo. Based on the data from the needs analysis, the prototype and specifications of the Evabugar Mikrohexo hardware-software product will be known. The next stage is the manufacture of Evabugar Mikrohexo hardware-software based on the AT89S52 microcontroller with the steps carried out in this research and development activity consisting of preparation of development activities, product development, expert validation, small and large group product trials, product revision, and product review. The final output of this research is the agility test of PTKI students based on the AT89S52 microcontroller with a physical form of hardware.

Software is a collection of electronic or digital data to execute a machine language command by passing through several storage, processing, and procedural flows controlled by a computer or by an electronic circuit infrastructure characterized by interactions between components. Research on software quality is as old as software construction, and concern for product quality emerges with error-free program design and efficiency during use (Miguel et al., 2014; Hammam & Isnianto, 2021; Handayani et al., 2023; Qadafi & Wahyudi, 2020; Novitasari & Kurnia, 2021). Hardware is a physical component that can be touched and arranged into a series of inputs, process circuits, and output circuits that form a computer so that the computer system can be operated. Each piece of hardware has a specific function and is mutually integrated between one piece of hardware and another with the same goal of supporting computer performance (Raven et al., 2016; Umar & Qudsia, 2022; Sajad et al., 2016; Yusuf & Budiarto, 2021).

Agility is a sub-fitness, where agility is defined as a series of separate tasks to form a serial task. As such, athletes must be able to combine the various movement patterns discussed in this section in the right order and at the right time while accelerating, decelerating, and transitioning in different directions (Dawes & Roozen, 2012; Shamshuddin et al., 2020). The same principles of positioning and body mechanics that are emphasized during power movements, such as performing explosive movements or linear velocity work, are also important when generating explosive forces in changes of direction. As such, the driving force generated through the extension of the three is essential for optimal agility performance.

Microcontroller is a small processor used for control systems and operating systems for electronic components (Dada et al., 2018; Prathiba & Nagendra, 2017, Raven et al., 2016). A microcontroller is a scaled-down mini-computer with a defined and specific task with or without input or output devices. Microcontrollers are often used as embedded systems such as fuel injectors, security systems, or traffic monitors. A microcontroller is also called an embedded controller because microcontrollers and their supporting circuits are often built into or embedded in the device they control.

METHODS

This research uses research and developmental (R&D) design for positive innovation, which refers to the theory of Borg and Gall with ten stages that must be passed. Overall research on making software and hardware Evaluation of Hexagonal Obstacle Microcontroller-Based Student Fitness (Evabugar Mikrohexo) is aimed to improve sports agility sub-fitness in PTKI students based on the AT89S52 microcontroller. The process that must be passed in development research goes through several stages, including (1) Need assessment, (2) Planning, (3) Product development, (4) Expert Judgement, (5) First product revision, (6) Small group experiment, (7) Second product revision, (8) Large group experiment, (9) Third product revision, and (10) Dissemination and Implementation.

Expert Judgement consisted of two experts: 1) three persons of sports science experts and 2) three persons of electronics or information and communication technology experts. A small group experiment is testing the product being developed. The experiment testes were PGMI students at PTKI (UIN SATU Tulungagung). At the same time, the people who carried out the tests, measurements, and evaluations (testers) were lecturers of physical education, health, and sports in each primary school teacher education (PGMI) major. The test subjects as large group experiment subjects were a group of PTKI students (UIN MALIKI Malang and IAIN Kediri) majoring in PGMI who were not involved in the small group trials. At the same time, the testers were lecturers of physical education, health, and sports in each PGMI major.

RESULTS AND DISCUSSION

Need assessment is the first step that must be carried out to identify and solve problems to support the next step in preparing the software and hardware to be produced. Items regarding the meaning of agility showed that more than half of the total respondents answered that they understood 64.44%. In comparison, the respondents who responded did not really understood 33.33%, and those who answered understood well 2.22%, and none responded that they did not understood because students generally understand the basic concept of agility.

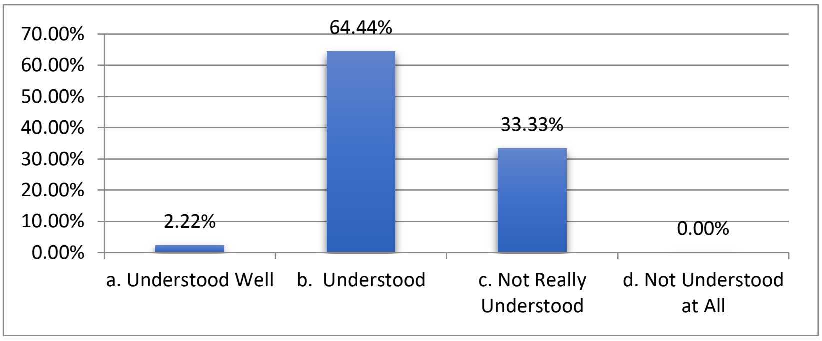


Figure 1. Level of Understanding of Agility

Based on the results of the questionnaire given to the respondents, it was found that they knew very well about understanding technology at 4.44%, knew at 84.44%, did not know about technology at 11.11%, and did not know at 0%. While understanding of the various types of agility in sports is very low, this can be observed from Figure 7 that at 71.11, they do not understand and understand the types of agility tests used in sports.

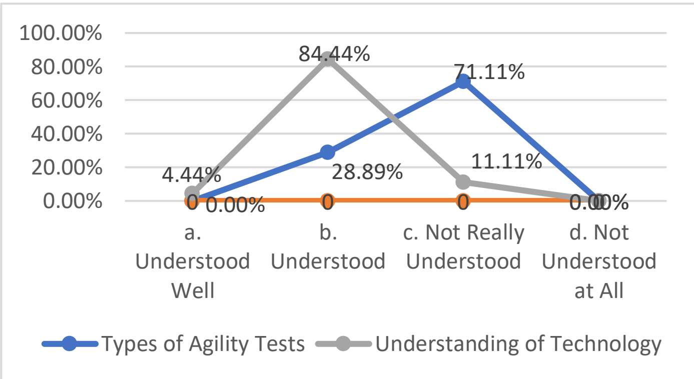


Figure 2. Types of Agility Tests and Understanding of Technology

They know very well about understanding of technology by 4.44%, know by 84.44%, do not know about technology by 11.11%, and do not know by 0%. While understanding the various types of agility in sports is very low, this can be observed from Figure 7, which shows that at 71.11, they do not understand the types of agility tests used in sports.

The need for technology in assisting sports tests and measurements, especially agility respondents stated that 20.00% of respondents stated that technology was needed in agility tests and measurements, another 77.78% of respondents stated that technology was needed in agility tests and measurements, 2.22% stated that it was not needed, and no respondents stated that technology was not needed in the test and measurement of agility. This is because technology can facilitate the implementation of tests and measurements of children's body agility; besides that, the assessment is very objective, measures what should be measured, and reduces fraudulent practices in carrying out tests and measuring body agility.

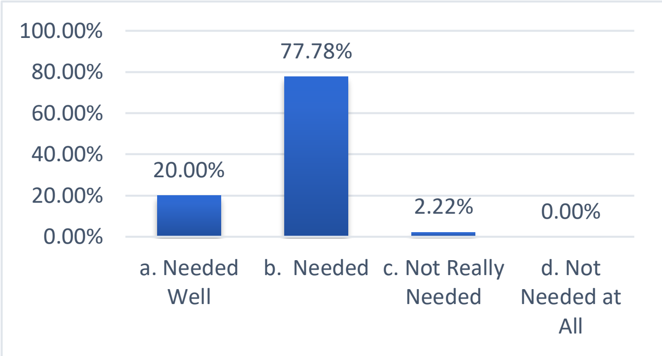


Figure 3. Analysis of technology needs in sports

Automatic digitization is necessary in tests and measurements of agility. From the data obtained, it is explained that as many as 13.33% of respondents stated that it was very necessary to make software and hardware of an agility system automatically to support determining a person's agility level, 82.22% of respondents stated that it was necessary and 4.44% less need to make an automatic agility test.

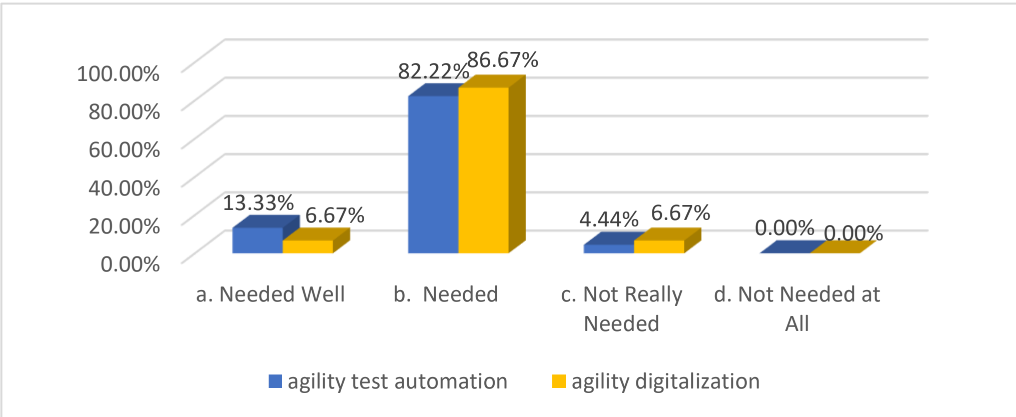


Figure 4. Level of need for agility test automation and agility digitalization.

There are 86.67% of respondents are willing to use if there is agility software and hardware, a number of 6.67% stated that they are very pleased, 6.67 are not pleased, and there are no respondents who are not delighted. This indicates that respondents really hope to use the device to help test and measure agility.

Based on the results of the needs analysis, further discussion is carried out by development partners. Discussions were carried out to compile software and hardware scripts for Hexagonal Obstacle Microcontroller-Based Fitness Evaluation and the preparation of Level 2 Data Flow Diagrams, Databases, Entity Relationship Diagrams, Relational Tables, Flowcharts and Dependency Diagrams. Context diagrams explain the relationship between the main system and its environment or entities in simple terms. The Context Diagram has only one process, namely the Evabugar Mikrohexo Hardware Software process. While the entities consist of Administrators, Testors, Lecturers, and Testi/Students.

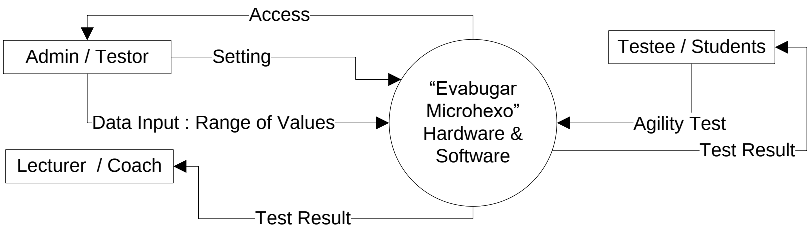


Figure 5. Context Diagram

The flowchart created functions to assist the workflow of the Evabugar Mikrohexo hardware; with this flowchart, the process steps are detailed and complete as a means of communication and documentation.

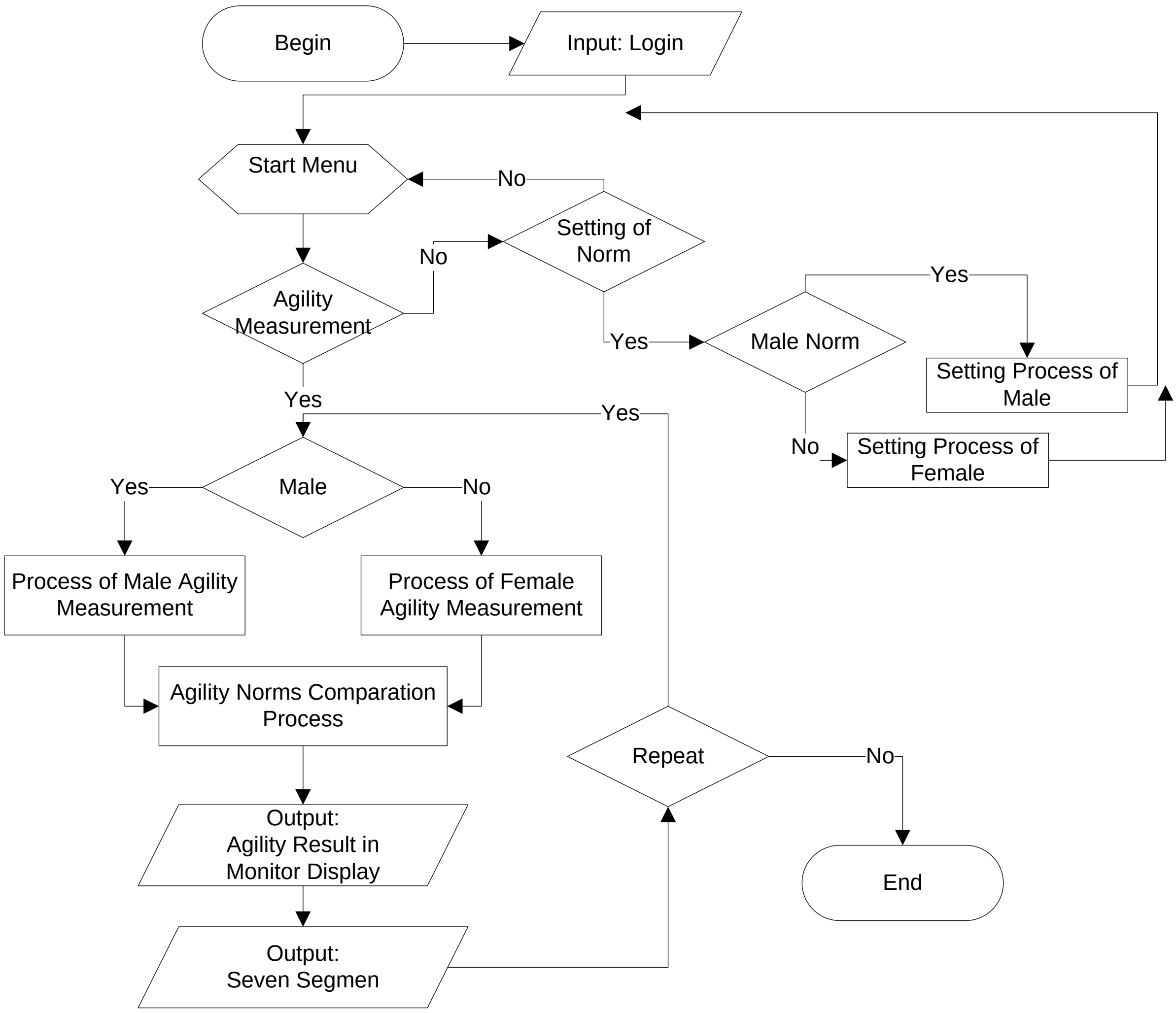


Figure 6. Evabugar Microhexo flowchart

The initial product design of agility software and hardware uses a microcontroller and, with the help of an integrated ultrasonic sensor, to produce an initial prototype. The Protel For Windows 1.5 application is used to create and design a computer's printed circuit board (PCB) display path.

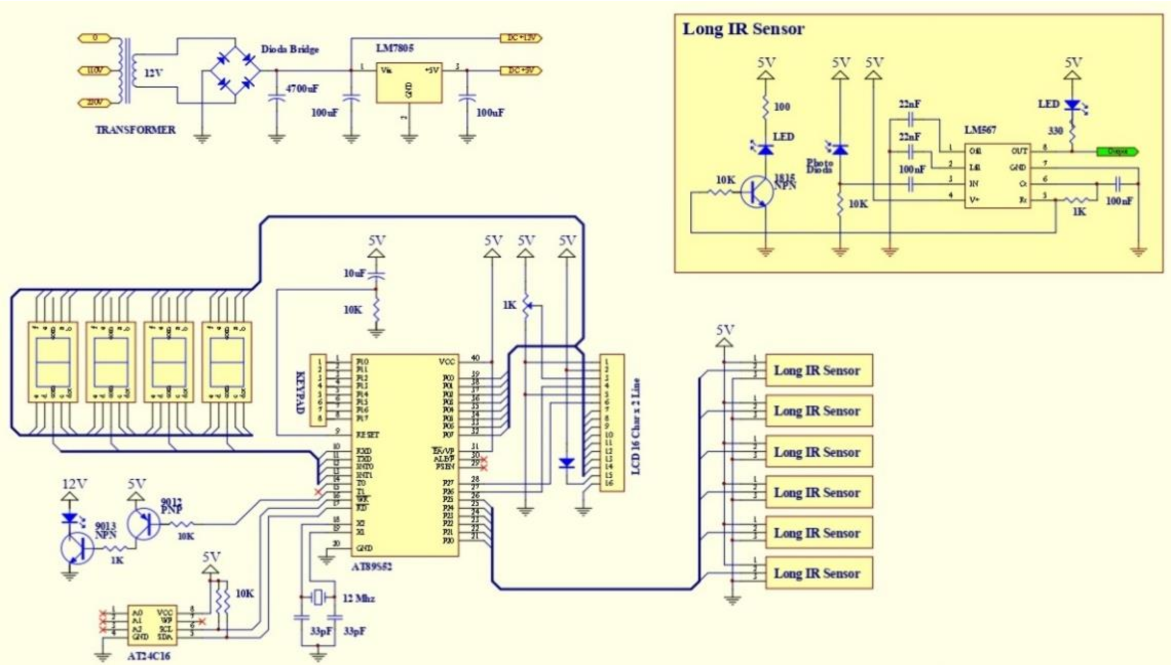


Figure 7. Schematic series of Evabugar Mikrohexo

Finished hardware cannot be run when no software acts as the brain in carrying out commands. For this reason, coding is required in a programming language so that the computer or hardware can process data according to what the user wants; the programming language used in this research is assembly language. The display of the microcontroller user interface uses an electro box with a length of 10 cm, a width of 5 cm, and a height of 15 cm, which consists of several number buttons (0 to 9) and the command button * (cancel) to fail the command, the crash button (#) to execute the command, A and B buttons for correction buttons, and C D buttons for selection navigation. Inside the electro box, there is also an LCD screen with a size of 16x2 in the form of seven segments to display all the information and results or data contained on the microcontroller.

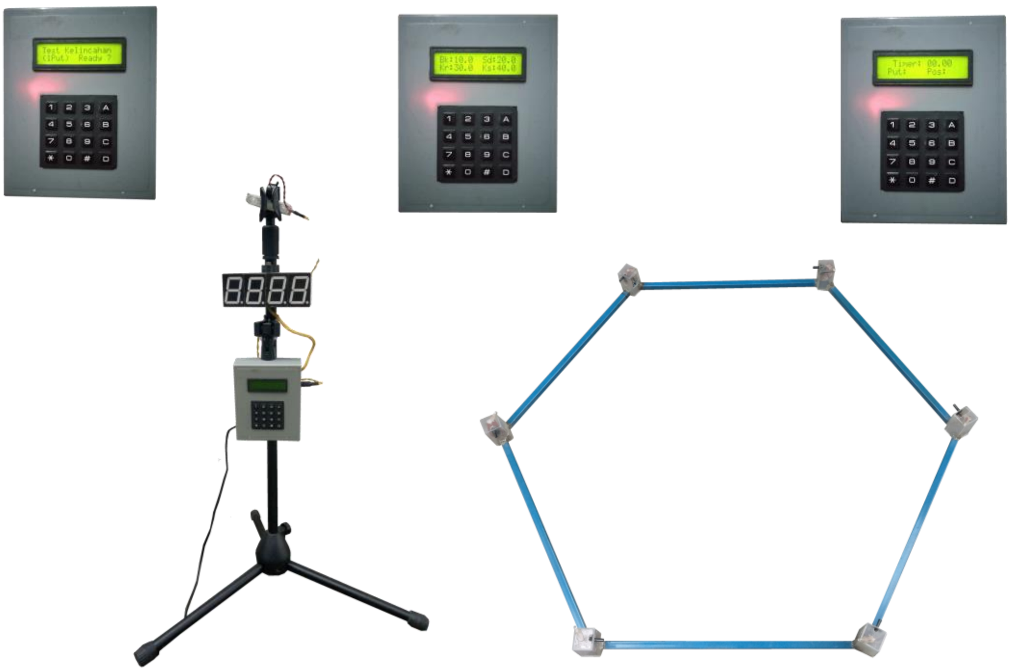


Figure 8. Evabugar Mikrohexo User Interface

Experts first tested the Evabugar Mikrohexo product to obtain input before entering the field trial stage I, often called a small group experiment. Based on the questionnaire given to the expert, several inputs must be corrected, including those from sports science experts: (1) Add flash lighting as a preparatory requirement and start the agility test; 2) The Seventh Segment Must be made larger so that it can be seen clearly; 3) Each side should be numbered at the bottom of the tool to facilitate installation; 4) There must be a repetition setting for the test to be performed.

Overall, sports science experts state that the development of agility test kits needs to be followed up to assist in the implementation of objective and real-time agility measurement tests. Developing technology that helps test and measure flexibility so that sports physical education lecturers can easily operate is necessary.

Criticisms from electronics or information and communication technology experts are: 1) Display agility data results in real-time on the LCD Display and simultaneously on the Seventh Segment; 2) There must be signal detection of the sender and receiver functioning on the six sides; 3) The data cable is too short, so the testee will not be optimal in executing the jump for fear of touching the microcontroller master; 4) sensor detection at each point is inefficient because it has to detect four new obstacles counting one side, preferably detecting at least one is enough; 5) The conclusion of the results of the test and agility measurement must be known as soon as possible when the students have done the test, this means that there is an added value that Evabugar Mikrohexo owns. 6) The tool support frame needs to be improved in aesthetics and function, especially when it is often moved, so it must be removable or easy to carry anywhere.

Improvements to some of the inputs from the sports science experts above, so there are improvements to the Evabugar Mikrohexo product, including 1) Adding a white flash as a preparatory code requirement and signs starting the hexagonal agility test; this light helps the person being tested to make it easier to prepare for agility movements. 2) Adding seven segments with a height of 8 cm to display the results of the agility test obtained; besides that, it is used to display errors or errors that occur if one side is missed or out of sequence. 3) On each side behind the Evabugar Mikrohexo frame, writing has been marked so that the teacher or lecturer places the correct side in order. 4) The rotation setting has been added to the software; the rotation setting is used for the number of times the test reps carry out the agility test using the Evabugar Mikrohexo.

Improvements to the Evabugar Mikrohexo product based on input from experts in electronics or information and communication technology are: 1) Added agility results that are displayed on the LCD as well as simultaneously on the seven segments, and the results are immediately or real-time visible to other spectators. 2) the sensor calibration check menu has been added; the sensor calibration check is used to see whether the sending sensor can be detected or not by the receiving sensor; performs sensor calibration can be done by pressing the "B" button, then the detected sensor is worth 1, if it is not detected has a value of 0, so that it is detected, the sending sensor must be directed to the receiving sensor in a straight line so that the LED lights up and the sensor has a value. 3) The data cable has been added to protect the child being tested so that the child can jump freely and freely. 4) The software has repaired the sensor detection at each point so that only one detected by the sensor is sufficient and does not need to be up to four times. 5) The conclusion of the results of agility tests and measurements must be known as soon as possible through the LCD by displaying the results in the form of normal numbers (seconds) in the form of strings Bs (Very Good), Bk (Good), Sd (Moderate), Kr (Poor), Ks (Less Once). 6) the input of the supporting frame for the tool needs to be improved in terms of aesthetics and function, especially when it is often moved from place to place. For this, the researcher did not carry it out because if it is made separately between the sides, then it is necessary to take into account the precision of the sensor, which is always resetting, as well as cables that are installed in a frame uses a lot of sockets, where these sockets are prone to electricity flow and data being cut off.

This small group experiment consists of PGMI students taking physical and health education courses at the Faculty of Tarbiyah and Teacher Training at Sayyid Ali Rahmatullah Islamic University Tulungagung (UIN SATU). The inputs from the Evabugar Mikrohexo improvement from the trial are: 1) the sensor box is too high, which is feared to be a disturbance when the testee jumps, 2) it is necessary to add a software operational guide in carrying out the process, 3) in addition to light, sound should be added so that when carrying out the test and not facing forward but facing down so that the test taker can still listen to signals such as ready, start and if an error occurs when it does not pass through the sensor in order.

Improvements to Evabugar Mikrohexo's software and hardware are making the sensor box 10 cm shorter with a transparent color. The next improvement is to create a manual book or operational guide from Evabugar Mikrohexo to facilitate installation and assembly as well as ways to set up the program and how to run the program. The addition of sound, often referred to as a buzzer, has also been carried out in this improvement. The sound serves as a preparatory signal and a signal to start the hexagonal agility test; this sound helps the person being tested to make it easier to prepare for agility movements through their hearing because it could be that the child being tested is not facing the lights, so voice assistance is very helpful for them.

The results of agility in the small group experiment were that males were more agile than females. In two rounds of the agility test, it was found that the average male was 11.34 seconds, while the average female was 14.07 seconds. These data indicate that men have better dynamic balance and leg muscle explosive power than women.

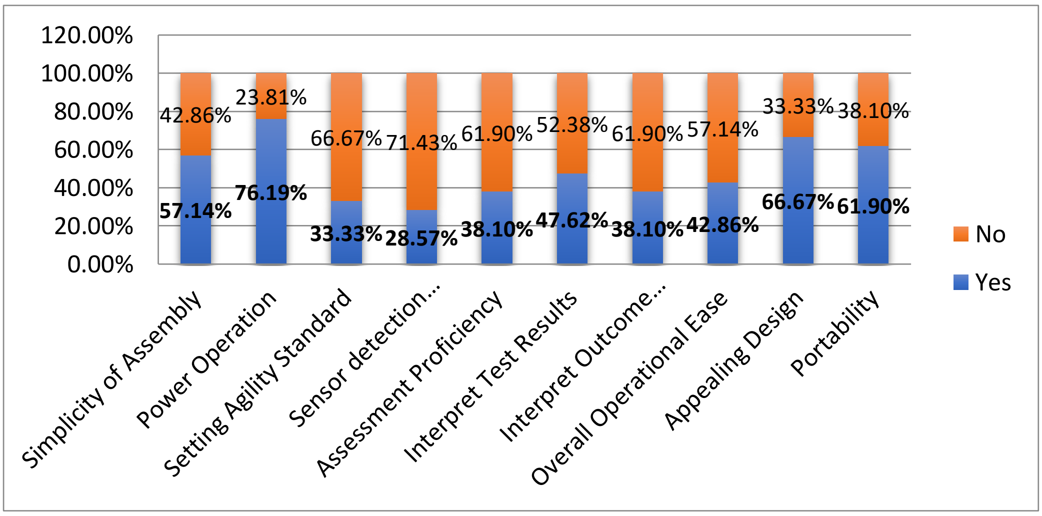


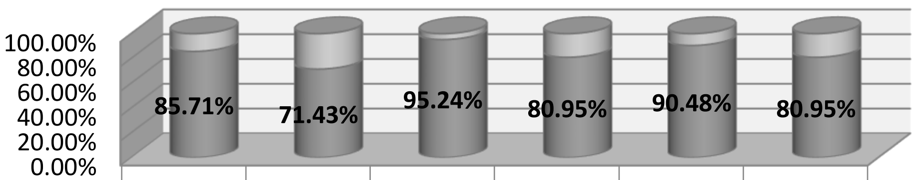
Figure 9. Results of Small Group Experiment Questionnaire

The results of the questionnaire on the use of Evabugar Mikrohexo explained that, in general, it was still impossible to use Evabugar Mikrohexo operationally because the operational method was not user-friendly, and there were still many confusing orders. In detail, the ease of assembling Evabugar Mikrohexo is still at 57.67% and can be done easily. Meanwhile, in the Evabugar Mikrohexo power operation, almost all respondents (76.19%) said they could do it because it was very easy and virtually the same as turning on other electrical devices. The ease in setting up agility norms on Evabugar Mikrohexo is still very small at 33.33% due to the way the logic flows are not synchronized between the user and the user interface. The ease of reading sensor detection on Evabugar Mikrohexo is very low at 28.77%. In comparison, the ability to carry out tests and measurements of agility using Evabugar Mikrohexo is 38.10%, and the ease of mobilizing tools is 69.90%, stating that it is easy because it only lifts the hexagonal frame.

Large group experiments were carried out at Maulana Malik Ibrahim State Islamic University and IAIN Kediri. The research sample was PGMI students taking or having taken physical education, sports, and health courses. The inputs from the large group trials were: The display of the buzzer and flash should be packaged neatly so that the aesthetics of the tools are visible and not cluttered. The final revision of the Evabugar Mikrohexo product is the addition of a box to place the buzzer and flash so it doesn't look cluttered and looks neat, and when moving from place to place, there's no difficulty in carrying the hardware.

Figure 10. Documentation of large group experiment

The results of agility in the large group experiment show that males are more agile than females. In two rounds of the agility test, it was found that the average male was 10.18 seconds, while the female averaged 12.15 seconds. Comparisons by sex are still the same as in the small group trial, but both are faster than the data in the small group trial. The use of Evabugar Mikrohexo in large group experiments has improved; it can be seen in general that the level of ability to operate Evabugar Mikrohexo is very high. The ease of assembling, turning on, and operating Evabugar Mikrohexo for respondents reached 85.71%, while the level of ease of setting agility norms in Evabugar Mikrohexo hardware reached 71.43%.



	Simplicity of Assembly and Power Operation	Setting Agility Standard	Sensor Detection Readability	Assessment Proficiency and Interpret Test…	Interpret Outcome Criteria	Appealing Design and Portability
No	14.29%	28.57%	4.76%	19.05%	9.52%	19.05%
Yes	85.71%	71.43%	95.24%	80.95%	90.48%	80.95%

Figure 11. Results of the Large Group Experiment Questionnaire

The level of ease of detecting the sensor is 95.24%, while the ease of carrying out measurement tests and reading values is 80.95%, and the ease of reading the criteria obtained from the test is 90.48%. In general, the ease of design and carrying of the Evabugar Mikrohexo reached 80.95%.

Movement control during agility tests and measurements using Evabugar Software and Hardware involves the study of the neural, behavioral, environmental, and synergistic mechanisms responsible for human movement and stability. All motor skills, regardless of the skill level with which they are executed, are expressions of the motor control system. The ultimate targets of this system are the muscles and joints responsible for acting. Control is essential for movement control and stability or posture control. When moving the body from one location to another or moving a limb to produce a desired skill, the movement control system is responsible for coordinating the activity of more than 600 muscles in the body. Engaging in regular exercise has the potential to enhance our cognitive abilities, such as perception and attention. In addition to the advantages it offers for brain function, consistent physical activity also brings about numerous benefits (Grospreˆtre & Gabriel, 2021), participating in sports offers unique cognitive advantages because of the significant demands they place on perception and motor skills strategies. (Müller et al., 2020). All these movements are related to kinesthetic organs. The kinesthetic sense organ is the proprioceptor, which includes special sensory receptors in muscles, tendons, joints, and the vestibular apparatus (i.e., the auditory center/labyrinth). The kinesthetic or proprioceptor sense is sometimes referred to as muscle sense because tension receptors in the muscles are the main source responsible for kinesthetics.

These specific sensory receptors are activated by bodily movement and orientation, granting the body an understanding of its own position and spatial awareness (Josi & Josi, 2018). Proprioception embraces a holistic approach to sports. While attributes like power, strength, and endurance are crucial for athletic performance, they have limitations. The Central Nervous System serves as the central hub for processing sensory input from the external environment. When joints, muscles, and ligaments receive stimuli, the CNS swiftly relays this information throughout the body, directing it on how to respond (Danut & Tatiana, 2021). Both the brain and spinal cord receive and act upon these signals subconsciously, culminating in the achievement of proprioception. Muscles, ligaments, and joints possess a form of memory known as "motor memory," enabling them to respond promptly to sensory input without conscious intervention. Whether prompted by the body's own actions or external forces, they react swiftly based on the information received from nerve endings. Conversely, working memory (WM) pertains to the mechanisms employed for the temporary retention and manipulation of information within the mind, representing a fundamental aspect of cognitive function (Shi et al., 2021). Consequently, exploring the relationship between motor skill acquisition and WM offers theoretical perspectives that can inform strategies for enhancing cognitive development and understanding associated pathways and mechanisms.

CONCLUSION

Based on the results of research and discussion shows that agility results in small groups and large groups explain that men are more agile than women. Two rounds of agility tests found that men were, on average, faster and more agile than women. These data show that men have better dynamic balance and leg muscle explosive power than women. The level of effectiveness of the Evabugar Mikrohexo hardware can be seen from the ease of assembling, turning on and operating the Evabugar Mikrohexo. Therefore, this microhexo evabugar hardware can be an alternative for measuring students' fitness and agility levels.

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