A PROTOTYPE OF A SHOOTING EQUIPMENT USING RASPBERRY PI MICROCONTROLLER AND ANDROID

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ABSTRAK

Infantry Armory Center (PUSSENIF) kodiklat TNI AD is a government agency that serves for the development of infantry weaponry, education, training, research and development of infantry within the army in support of the main task of kodiklat TNI AD. The ballistic unit serves as a unit that conducts research and development of armament infantry.

The problem is when they want to implementing weaponry technology of researchers and equipment test that still using conventional firing tool, when using the conventional firing tool is considered ineffective because new technology will continue to change according to the times and require big budget to develop technology.

Based on the problems above then needed another model that can implement the ideas of firing technology that does not require much budget in the making but it is enough to represent the concept of technology that want to be implemented.

Therefore, a prototype of a shoot tool using a raspberry pi microcontroller and android is made possible by researchers in the ballistic unit to develop a prototype model designed to squeeze large budgets and replace conventional firing capabilities.

Keyword : Shooting Equipment, Shooter, Raspberry Pi, Android.

1. PRELIMINARY

The Army Infantry Armory Center (PUSSENIF) Kodiklat TNI AD is a government agency agency that serves as an arms boosting arm of Infantry, Education, Training, Infantry Research and Development within the Army in support of the main task of Kodiklat TNI AD. One of the existing units in PUSSENIF is a ballistic unit that functions as a unit conducting research and development of armaments, in this case like research and research on new weapon technology.

Researchers at the firefighting technology development department in the ballistic division of PUSSENIF are currently having difficulties when they are about to make a new gun tool. Problems that occur is when implementing the idea of weapon technology that is with the limitations of the researchers and test equipment that still use conventional firearms, the use of conventional weapons is considered ineffective because of new technologies that will continue to change along with the times that require that the model must be made rearranged, repaired or embedded components and tools in accordance with the needs of which the addition of this tool will require budget, research personnel and additional time to make it happen. This is because there is no other solution that can replace the prototype model in pouring or implementing the idea of current firing technology.

Based on the above problems, we need another model that can implement the idea of firing technology technology that does not require a budget that is too big in the making, but it is enough to represent the needs of technology concepts that want to be implemented, and easy when it needs additional features, component turnover, Or change of algorithm used to improve

Shooting accuracy without having to create a new model in every change of concept.

Therefore, a prototype of the Petroleum Tool Utilizing Raspberry Pi and Android Microcontrollers was made possible by researchers in the ballistic unit to develop a prototype model designed to reduce substantial budgets and could replace conventional firefighting tools in model development Prototype that is using Raspberry Pi and Android microcontroller as the controller that regulate the work process of electronic circuit.

1.1 MICROCONTROLLER THEORY

Microcontroller is a chip that acts as an electronic circuit controller and can generally store programs in it.

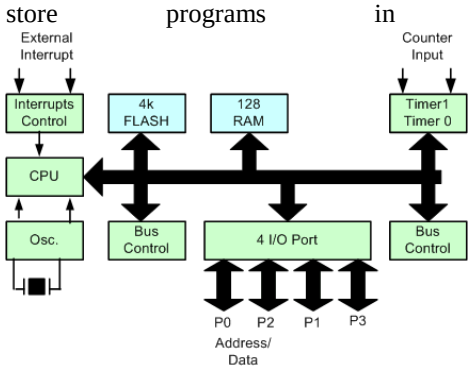


Image 1 Block diagram of microcontroller

Microcontrollers generally consist of CPU (Central Processing Unit), memory, certain I / O

and support units such as Analog-to-Digital Converter (ADC) which is already integrated in it. The main advantages of the microcontroller is the availability of RAM and equipment I / O support so that the size of the microcontroller board to be very concise.

1.2 Raspberry Pi Definition

Raspberry Pi is a mini computer that is look like a credit cad who can be pluged in to computer or a television and and using a keyboard and standard mouse to operating. Raspberry Pi can be reached by all ages to operated computation, and to learn how to programing in begining level like, and this mini pc can do all the things that you wish from a computer desktop like browsing internet , playing video game an make a spreadsheeet.

Microcontroller Raspberry Pi on this research using to be a controller to controlling a shoting equipment and connect with motor servo and laser diode with smartphone android to use the Wi-Fi later..



Image 2 Raspberry Pi

1.3 Micro Sd Definition

Micro SD is a non-volatile memory card developed by SD Card Association used in portable hardware. Currently, microSD technology is already used by more than 400 product brands and is considered the de-facto industry standard.

The other microSD family is divided into SDSC with its official maximum capacity of around 2GB, although some are up to 4GB. SDSC (High Capacity) has capacities from 4GB to 32GB. And SDXC (Extended Capacity) has capacities above 32GB to a maximum of 2TB. The diversity of capacities often makes the kebinungan because each communication protocol is slightly different.

In microSD research used as storage media Raspbian operating system and also storage media directory that reside on microcontroller Raspberry Pi.



Image 3 Micro Sd

1.4 Power Bank Definition

Power Bank is as a gadget charger when we are out and away from a power source.

In this study power bank is used as a power source for raspberry pi.



Image 4 Power bank

1.5 Wifi Definition

Wifi is a well-known technology that utilizes electronic equipment to exchange data wirelessly (using radio waves) through a computer network, including high-speed internet connections. The Wi-Fi Alliance defines Wi-Fi as any wireless local area network (WLAN) product based on the 802.11 Institute of Electrical and Electronics Engineers (IEEE) standard,

Wi-Fi in this research is used as a way of parsing from android smartphone to Raspberry Pi.

1.6 Servo

Servo is a motor who can working in two way (CW dan CCW) where the direction and the motor can be controlled by giving a setting to a duty cycle and PWM signal in the pin controller part.



Image 5 microSD

1.7 Dioda Laser

The nm635 laser diode is a type of laser in which the active medium is a p-n junction semiconductor similar to that of a light-emitting diode..



Image 6 n635 Dioda Laser

1.8 Webcam

Webcam is a combination of the word web and camera peripherals in the form of camera as image / image taker and microphone (optional) as a sound / audio taker controlled by a computer or by computer network.



Image 7 Webcam

Images taken by the webcam are displayed to the monitor screen, as it is controlled by the computer then there is an interface or port used to connect the webcam with a computer or network. There are some people interpreting a webcam with a computer or network. There are some people interpret the webcam as web pages + camera, because by using a webcam to take actual video images can be directly uploaded when the computer that mengandalikan connected to the internet.

In this study webcam is used to monitor the target /target that will appear later on android smartphone.

1.9 Android

Android is a mobile operating system that grows in the middle of other operating systems are growing today. Other operating systems such as Windows Mobile, i-Phone OS, Symbian and many more also offer a wealth of content and optimization running on existing hardware devices. However, this existing operating system runs by prioritizing the built-in core application without seeing any substantial potential of third-party applications. Therefore, there is limited distribution of third-party applications for their platforms.

Android in this study is used as an operating system that will make the application tool run on the android smartphone.

1.10 Python Programming Language

Python is an interpretable, interactive, object-oriented programming language, it combines modules, exceptions, dynamic typing, very high level dynamic data types, and classes. Python combines extraordinary power with a very clear syntax. It has an interface to many call and library systems, as well as various windows systems, and is extensible in C or C ++. It can also be used as a language extension for applications that require a deprogrammed interface. Finally, portable python runs on many Unix, Mac, and PC variants under MS-DOS, Windows, Windows NT, and OS / 2.

The python programming language in this research is used as the commands in the Raspberry Pi microcontroller.

1.11 Java Programming Language

Java programming is a pure object-oriented programming language created based on the best capabilities of previous object programming languages (C ++, ADA, Simula), java created by James Gosling, a developer of microsystems in 1991, the java programming language in this study used for loading APK Android as a remote control tool.

Java programming language in this research is used to create applications that will run on android smartphone.

1.12 Android Studio

Android studio is the official unified development environment (IDE) for android platform development, it was delivered on May 16 2013 Google I / O, android studio is freely available under the Apache 2.0 license.

Android studio was originally previewed version 0.1 which was used on 1 May 2013 and entered the beta stage in June 2014 and started stable released in December 2014 with version 1.0, based on jetBrains' IDEA Intellij Software, android studio specially designed for development of android available For Windows, Mac OS X and Linux as a replacement for Eclipse.

2. Content Of Study

2.2 Analysis Of Running System

The current Firefighting System at the Infantry Armament Center (PUSSENIF) is still using the prototype building stage by using tools or materials that are consuming enormous budgets and if in the event of a renewal on the idea of building a firing tool, then the prototype must be recreated in accordance with the components Which are required as well as the firing tools currently in use are mostly still operated directly.

2.3 Problem Analysis

A Prototype of a shooting equipment using raspberry pi microcontroller and android is a mechanism designed in such a way that is used by Ballistic units in PUSSENIF to make it easier to implement the idea of a gun tool. As for the research conducted there are problems that occur so the system is made as follows:

1. The Ballistic Division is always in the same state when trying to implement the idea of new weapon weapon technology because it does not find any other form of model other than building a prototype of the firing tool to be built.
2. The Ballistic Division always uses a very large budget and a long time to build a prototype of the firing tool, and it is considered ineffective in building a prototype.

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2.4 System Analysis

A prototype of a shooting equipment using raspberry pi microcontroller and android microcontroller is a simulation model designed in such a way that is used to model the idea of technology by using hardware and sorware device that is raspberry pi microcontroller integrated with Android mobile device through Wifi network, so as to provide convenience to the user In controlling the firing apparatus using an android smartphone remotely.

In the construction of this system there are several provisions that must be met, both the user and technically, the user of this tool appliance tool not everyone has this application can use it, to guard against misuse of the application in its use. In the implementation of this system will perform the command in accordance with the command usage.

Here's an analysis of existing systems in the A prototype of a shooting equipment using raspberry pi microcontroller and android:

The system is controlled through an Android app that is connected via a Wifi network.

1. This tool uses 3 servo motors used to direct the target vertically and horizontally and as a trigger pistol.
2. In this application the user can see the target shot to direct the device according to the direction of the shot.
3. In this application the user can control the firing tool that is by tapping the screen on the smartphone android ..
4. In this application the user can fire a toy gun that has been directed previously to the target

2.5 System Architecture analysis

Analysis of system architecture is the stage to get a general overview of the system to be built. Whether it is a image of the back end system or a image of the user's front end system or user. Image of system architecture can be seen in the image

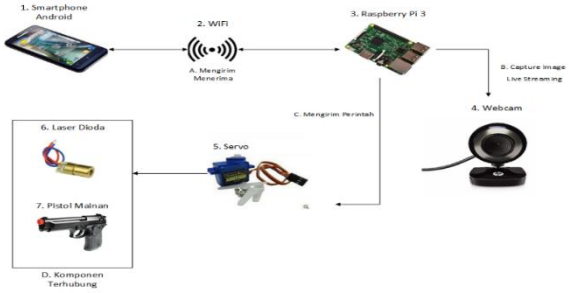


Image 8 System Architecture

2.6 The Order Of Problem Solving

To solve that promblem then need to make a simulation model which can make work be easier, and the way is to make an equipment which can describe a model who will be a prototype with using microcontroller Raspberry Pi, because when it changed to a simulation model, that can be reducing the budget which can be use to made a prototype or maybe the shooting equipment and the algorithm can be easier to be use or to upgrade to another next idea

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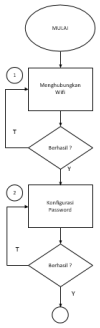


Image 9 Wifi Configuration Diagram



Image 10 Showing Live Streaming Diagram

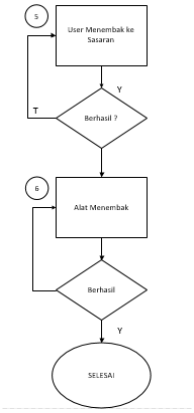


Image 11 Shooting Proccess Diagram



Image 12 Shooting Equipment

2.7 Library Requirement on Raspberry Pi

The need for libraries on Python algorithms or any modules used to perform functions within the raspberry microcontroller PI.

Table 1 Library Requirement

Fungtion	Explanation
import RPi.GPIO as GPIO import time import socket import struct import json import RPi.GPIO as GPIO import time	*Import* digunakan untuk memasukan modul yang telah terinstal sebelumnya di *Raspberry Pi*.
GPIO.setmode(GPIO.BCM)	*Setmode* digunakan untuk mengatur motor servo.
GPIO.setup(4,GPIO.OUT) GPIO.setup(17,GPIO.OUT)	*Setup* digunakan untuk mengatur output data dari *Raspberry Pi* ke pin *motor servo*.
x.start(center) y.start(center)	*Start* digunakan untuk memulai menggunakan x atau y (titik tengah koordinat *horizontal* ataupun *vertical*).
time.sleep(1)	*Sleep* digunakan untuk membuat delay.
p.stop()	*Stop* digunakan untuk berhenti menggunakan p.
GPIO.cleanup()up()	*Cleanup* digunakan untuk mengembalikan *Raspberry Pi* ke kondisi awal.

2.8 *Use Case* Diagram

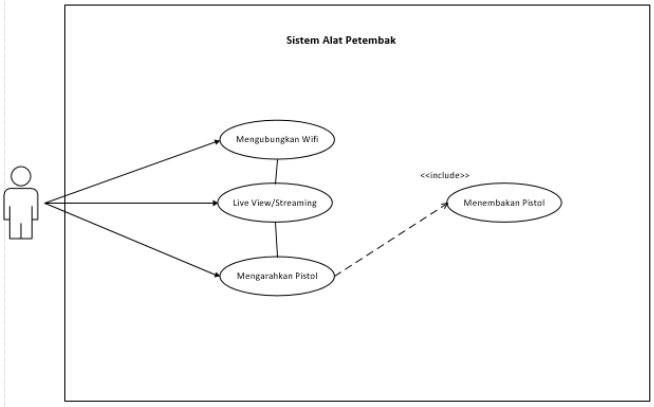


Image 12 *Use Case* Diagram

2.9 Mobile System Design

The design of the sub menu structure of the mobile system can be seen in the following figure:

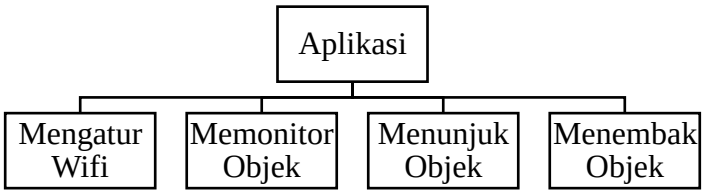


Image 13 Menu Structure

2.9.1 Interface Design

The following figure is the design of mobile interface.

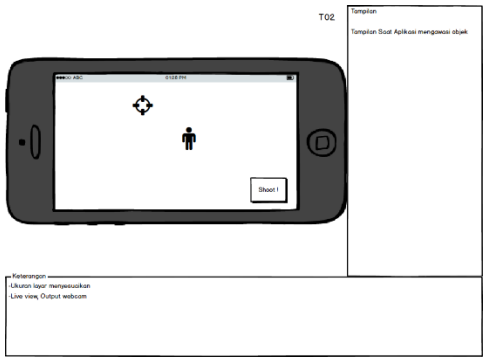


Image 14 Main Menu

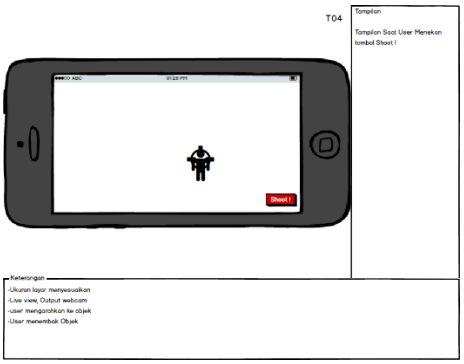


Image 15 Shooting Object

2.10 Implementation

Implementation stage is the design translation phase based on the results of analysis into a programming language, and application of software built in the real environment. The purpose of implementation is to implement the design that has been done on the application, so users can provide input for the development of applications that have been built.

2.10.1 Hardware Implementation

Perangkat yang digunakan dalam membangun aplikasi Purwarupa Alat Petembak Memanfaatkan Mikrokontroler Raspberry Pi dan Android adalah sebagai berikut :

Table 2 microcontroller hardware spesfication

No	Perangkat Keras	Spesifikasi
1	Mikrokontroler	Raspberry Pi 3 model B
2	Micro Servo	SG90
3	Laser Diode	1 channel
4	Webcam	Logitech
5	MicroSD	Toshiba 8GB
6	PowerBank	Samsung

Tabel 3 hardware build spesification

No	Perangkat Keras	Spesifikasi
1	Layar	540 x 960 pixel
2	Memory	512 MB
3	Processor	800 MHz
4	Perangkat Lain	Koneksi *Wi-Fi*

Tabel 4. Mobile hardware minimum requirement

No	Perangkat Lunak	Spesifikasi
1	Sistem Operasi Android	Versi 4.1 Jelly Bean
2	Sistem operasi Microsoft (develope)	Windows 10 Professional
3	Android Studio versi	Versi 2.0
4	Java JDK	Versi 7
5	Android SDK untuk Android	Versi 4.1

2.10.2 Software Implementation

The software used in making the application is described in the following table.

Table 5 Implementation of the software used

No	Perangkat Lunak	Spesifikasi
1	Sistem Operasi Android	Versi 4.1 Jelly Bean
2	Sistem operasi Microsoft (develope)	Windows 10 Professional
3	Android Studio versi	Versi 2.0
4	Java JDK	Versi 7
5	Android SDK untuk Android	Versi 4.1

2.11 Interface Implementation

Implementation of the interface is a display-interface interface on Prototype Tool Shoot Utilizing Raspberry Pi and Android Microcontroller.

Tabel 6 Interface Implementation

No	Nama Antarmuka	Keterangan
1	Pengaturan *Wi-fi*	Halaman yang menampilkan pilihan untuk mengaktifkan koneksifitas - *Wi-Fi* atau tidak bagi user untuk masuk ke aplikasi alat petembak raspi.
2	Tampilan Memonitor Objek	Halaman yang menampilkan *livestream* dari alat yang di simpan di tempat tertentu.
3	Tampilan Menunjuk Objek	Halaman yang menampilkan *livestream* dan user menggerakan *microservo* untuk di arahkan ke objek.
4	Tampilan Menembak Objek	Halaman yang menampilkan *livestream* dan user menggerakan *microservo* untuk di arahkan ke objek lalu user menekan tombol shoot untuk menembak objek.

2.12 System Testing

Testing is done in order to find errors and flaws in the application being tested. Testing is intended to determine whether the application is made alreadymeet the criteria in accordance with design goals made.

Tests conducted are alpha testing and beta testing. Alpha testing is done by black box testing. Black box testing is used to find out functional errors, whereas beta testing is used to determine the response of users or ballistic division in PUSSENIF by using interviews.

2.13 Case and System Testing

Cases and test results Prototypes of Petroleum Equipment Utilizing Raspberry Pi and Android Microcontroller using Black box technique, based on observations made then generate the following test conclusions.

Tabel 7 Wifi Activate testing

Kasus dan Hasil Uji (Data Normal)			
Data Masuk	**Yang Diharapkan**	**Pengamatan**	**Kesimpulan**
User menekan tombol YA	*Wi-Fi* pada *smartphone android* aktif dan user masuk ke tampilan *livestream*	*Wi-Fi* aktif dan user masuk ke tampilan utama.	[√] Diterima [ ] Ditolak
Kasus dan Hasil Uji (Data Salah)			
Data Masuk	**Yang Diharapkan**	**Pengamatan**	**Kesimpulan**
User menekan tombol TIDAK	*Wi-fi* pada *smartphone android* tidak aktif dan user tidak dapat mengguna kan aplikasi.	*Wi-fi* tidak aktif dan user tidak dapat mengguna kan aplikasi.	[√] Diterima [ ] Ditolak

2.14 Basic Testing Against the tool

Testing Tool is a test of the microcontroller device that is in order to know that the tool is working.



Image 17 Tool Off



Image 18 Tool On

2.15 Conclusion Black Box Testing

Based on the Black Box test results against the application, it can be concluded on the points below:

1. Tests Enable Wi-Fi.

Testing Enabling Wi-Fi works fine.

2. Testing Main Menu.

On the main menu page that displays livestreaming and firing buttons that work properly.

3. Basic Testing Against the Tool

The basic test of the tool that is laser, microservo, webcam, toy gun can work well.

4. Laser Laser Accuracy Testing

Laser ray accuracy test matches that shown on livestreaming on android smartphone.

5. Testing Accuracy Pistol Gun Shots

Testing of gunshot accuracy on toy guns is still less accurate by several centimeters, due to the limited tools used in the study.

2.16 Conclusion Beta Testing

Get feedback on the accuracy of the shot to be more accurate. Given the inferred input that the application and the tool is good enough to be used as a Model Simulation in terms of functional such as functioning tools using android smartphone and also can model the idea to create a weapon technology before making it further into a prototype, but it would be better accuracy More accurate shots.

3. CLOSING

3.1 Conclusion

Conlcusions from the results of research, analysis, system design, and implementation and testing in the form of interviews, can be drawn conclusion as follows :

1. This facility can assist PUSSENIF ballistic division in modeling the idea of research and development of firing tool.
2. The application of this tool can be an alternative in building of modeling a firing device before building a prototype model, and assisting soldiers in operating the prototype model, and assisting soldiers in operating the firing device via android smartphone at a safe distance of course if this application has been further developed.

3.2 Suggestion

A prototype of a shooting equipment using raspberry pi microcontroller and android are still many shortcomings. Therefore it is necessary to do further development and refinement. As for some suggestions that may be applied to Prototypes of Petroleum Equipment Utilizing Raspberry Pi and Android Microcontroller to be better, as follows:

1. Can improve the accuracy of the shot so that the built tool can be implemented directly to a condition.
2. Can use RF Trasnmitter and Receiver to serve as an identifier that is planted on objects that will not

be detected by the tool to avoid errors in target shooting.

3. Can do automatic detection for detection can be perfect and no error. Can use Raspberry PI microcontroller to be faster in processing and features such as streaming video can be done.
4. Can add user image capture feature by user.

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