

Human Resources Monitoring System using Sensors GPS on Android Smartphone

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Submitted : Apr 20, 2022 | **Accepted** : Apr 22, 2022 | **Published** : Apr 24, 2022

Abstract: Smartphone technology is currently developing rapidly. In an effort to improve and empower companies, smart is used as a tool for anything in office work and in projects. For example, smartphones are currently used for meetings or coordination with leaders and employees. In the project, smartphones can be used to monitor employees. One of the problems with work on projects is that employees often leave project work for several reasons. The position of employees is often unknown to other employees or leaders. So the idea arose to find out the whereabouts of the employee. Monitoring employees on the project is very important, where the presence of these employees is needed to coordinate. If the employee is at risk of a work accident, the management quickly knows the position of the employee. The idea of making employee monitoring in the project by creating an application system for employee positions in the project. In addition to monitoring, employees do not need to attend the office, from the employee's home directly to the project site and do asben from the project site. The data will record the name of the employee, the position of the employee in the project, the time of absence, see the tasks that will be carried out per day. The results of the task are carried out by taking selfies as a report to superiors. The purpose of this research is to solve the problem of the existence of employees or the position of employees in the project, to be absent at the project site, to take selfies on the progress of daily work, and to hold meetings with the application. This application is built using technology based on the Android system using Flutter.

Keywords: Human Resources; Monitoring; Android; Flutter; Smartphone.

INTRODUCTION

Today the development of smartphone technology is so fast. Smartphone technology has been widely used as a very powerful tool. Starting from games, doing office work, holding meetings with smartphones, shopping online, to making transportation orders by doing it with a smartphone. Smartphone devices are now equipped with processors, memory and other devices with very powerful capabilities. The ease of operating a smartphone is also quite easy, from parents, adults, children and even toddlers, everything is easy to run without a hitch. This is one of the reasons why using a smartphone as a tool in monitoring a project or in an office. Today's smartphones have the equivalent of a laptop, some even have higher hardware specifications than laptops. In addition, the smartphone business has very good prospects, because smartphone manufacturers continue to innovate better from year to year. This is one of the reasons why making application systems based on mobile apps.

The Android operating system was first developed by Google. Continue to experience feature improvements that are getting better and better. Android is also an open source operating system, where the Android operating system was developed from the Linux operating system. Because it is open source, this operating system is widely used by smartphone businesses to create hardware that is diverse in terms of hardware capabilities. Smartphone manufacturers are currently competing to offer better specifications and performance. In addition, smartphone manufacturers also provide many camera features, wifi features with the best. The addition of this feature is because the Android (Hashmi et al., 2015) operating system continues to be developed and is always updated to a higher Android version, with the hope that the operating system is able to manage smartphone hardware capabilities.

In figure 1, the android operating system was created by Google. The Android (Mazuera-Rozo et al., 2022)operating system was launched by Google on September 23, 2008, at that time still using the name

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Android 1.0 with the name Alpha. The launcher was first paired with an HTC smartphone. The initial Android 1.0 product was already using the Gmail, Google Talk and Youtube applications. To update using Android Market before Google PlayStore (Sadiq et al., 2021). Hardware and sensor features are also equipped with ringtones, screen settings, vibrating tones, bluetooth and wifi. Continue to develop into Cupcake version 1.5, Donut version 1.6, Eclair version 2.0 to the highest version version 12. The possibility is still continuing for the latest version. At the time of this research, Android at version 12.



Fig. 1 Android version 1.5 until last version
Source : Google Image

Because the Android system supports frameworks based on C, C++ and Java, many application systems are developed based on C or Java. From there, many developers in the software field develop application systems for developers such as React, Node JS, Flutter and others. This is in anticipation of the many problems that the system needs to develop to meet the needs of the user. One of the products for developing application systems is Flutter. Flutter was first developed by Google. Because the operating system and application system were both developed by Google, it is hoped that Flutter will be supported by Google, so that there are no technical problems between the Android operating system and the Flutter programming language.

Office problems such as project management by the company's human resources often cause problems. Employees who work on projects often have difficulty finding a project manager position, if assigned outside the office. This has prompted various questions in this research. The first research question (RQ1), How to monitor employees in the field or in the project? The second research question (RQ2), How do employees do attendance, while the office location is very far from the project location? Third Research Question (RQ3), How do employees report work results on projects to superiors or office management about daily work progress?

The purpose of this research is to solve problems regarding employee monitoring in the project. Various solutions will be described in the methods section, based on differences in research from the literature review section as a reference. Then it will display the results of the method or plan, which can then draw conclusions from this research. Don't forget to attach some references in this study as reference attachments from previous studies.

1. LITERATURE REVIEW

The literature review presented in this study is a reference from previous studies where the application system has been discussed in previous research.

Table 1. List of previous studies.

Author	Topic	Advantage	Disadvantage
(Maulana & Setiawan, 2019)	Utilization of Sensors on Android Smartphones for Plant Nursery	The discussion about sensors on Android is used quite well.	This study has a weakness because it has not utilized other

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	Recommendations		
(Riantana, 2015)	Accelerometer Sensor Application on Android Phones as an Online Earthquake Vibration Recorder	The discussion about the Accelerometer sensor is used to detect earthquakes and determine the position of the location contained in the earthquake location.	features. As in GPS, it should also display a map, so that it is clear that its use is real. The weakness in this study is that Android smartphones are only used as sensors, they have not maximized the use of their smartphones, meaning that smartphones are less used for other features, such as the use of controls on smartphones using a mobile application system. So that the smartphone has not been used to its full potential.
(Arjo & Anbeni, 2018)	Recognition of Driving Activities Based on Accelerometer Sensors on Smartphones With Auto Feedback Features Using the k-Nearest Neighbor Algorithm	Discussion of the use of the Accelerometer sensor on smartphones and perform analysis using Machine Learning such as the k-Nearest Neighbor Algorithm.	The disadvantage of this system is that it does not use a GPS sensor, so it cannot know the position of the location based on the GPS signal. Sensors found in Android do not take advantage of the sound feature. So that if there is an incoming message, in addition to providing notifications, it also provides a sound or vibration sensor. So if there is a vibration there is an incoming message.
(Neforawati et al., 2016)	Using Android-Based Notifications to Monitor Maintenance on Aquaponic Automation Systems Using the ATmega 2560 Microcontroller	Discussion of android smartphone devices as monitoring of the micro-controller to control Aquaponik. Atmega 2560 is used to control.	The drawback of this research is that it does not take full advantage of Android devices. Android devices already have many sensors, so Android-based smartphones can be used as devices for the Internet of Things. By utilizing car programming, Android devices can use the sensors found on Android smartphones.

From the results of previous studies regarding the use of sensors in Android smartphones, it turns out that Android smartphones are not used optimally. Still using other devices to control, even though there are a lot of smartphones on Android. Gyroscope sensors, GPS sensors, Accelerometer sensors, and others are sensors that are embedded in smartphone devices. Therefore, this research is different from previous studies. **State-of-the-art** in this research is to maximize the sensors embedded in the Android smartphone system. By utilizing Flutter

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programming, this research produces ideas and prototypes of employee monitoring systems on projects, and can take attendance and report activities or project progress every day.

METHOD

The following methodology is proposed to answer the research questions. This method is made by creating an application system whose main purpose is to monitor the position of employees in the project. To perform attendance and to provide project progress reports. The proposed method can be seen in Figure 2.

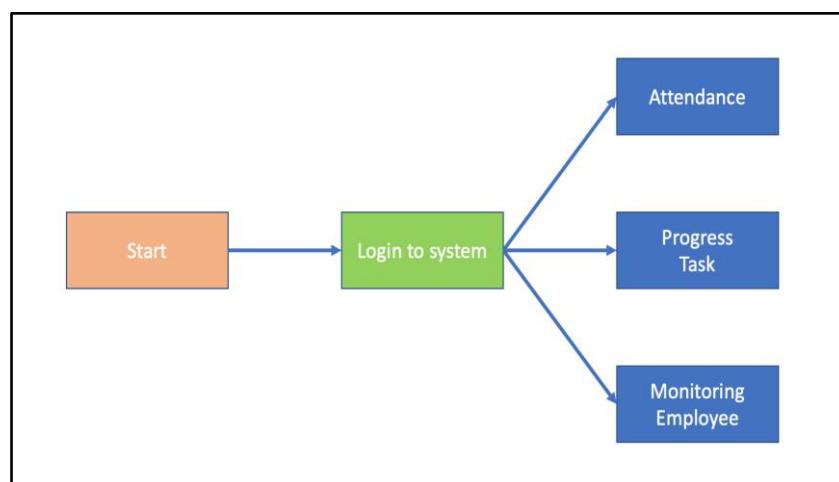


Fig. 2 Proposed research method

Source : researcher property

This method starts from logging into the application system. User and password are entered or you can do fingerprints for the purpose of entering the application system. After logging into the application system, the user can perform work such as attendance as an office employee. Office attendance uses Global Positioning System (GPS) sensors. This GPS is already embedded in Android smartphones. Then employee attendance data, hours or time of attendance, longitude and latitude from the coordinates are also sent to the cloud. So it will be seen that the employee doing attendance is at the project location. Employees also perform work in accordance with the job description that has become their responsibility. Reporting task progress is an employee's obligation to superiors or management. The system can also monitor the existence of employees whether they are on the project or out of the project. So that superiors or management can monitor the whereabouts of employees. This makes it easier for superiors or management to know the position or location of the employee.

In the Android system there are three major sensors: Motion sensor (Hernández-Álvarez et al., 2021), this sensor aims to measure acceleration and rotational forces on three axes, namely the X-axis, Y-axis, and Z-axis. Sensors that include motion sensors include an accelerometer, gravity sensor, gyroscope (Kundra & Ekler, 2014), and a rotation vector sensor. Environmental sensors, these sensors aim to perform measurements with various environmental parameters. Several environmental sensors include ambient air temperature and pressure, lighting, and ambient air humidity. Sensors that include environmental sensors are barometers, photometers, and thermometers. Position sensor, this sensor aims to measure the physical position of the device. Sensors (Gunawan et al., 2019) that include position sensors are orientation sensors and magnetometers.

Global Positioning System (GPS) Android

The GPS sensor (Yerima et al., 2018) in the Android Smartphone is embedded and can be used as a tool to manage latitude and longitude. This GPS system is a positioning system that uses satellite technology. Initially, this GPS system was used as a system for positioning in the military. At that time GPS was not used for civil society purposes. First used in civil society, in 2004 the company Qualcomm tested an application system that uses GPS technology with satellites on mobile phones successfully. In the military field, GPS navigation systems are used to launch missiles from bases to enemy targets. In the field of transportation, GPS systems are used to navigate drivers to find addresses as delivery targets.

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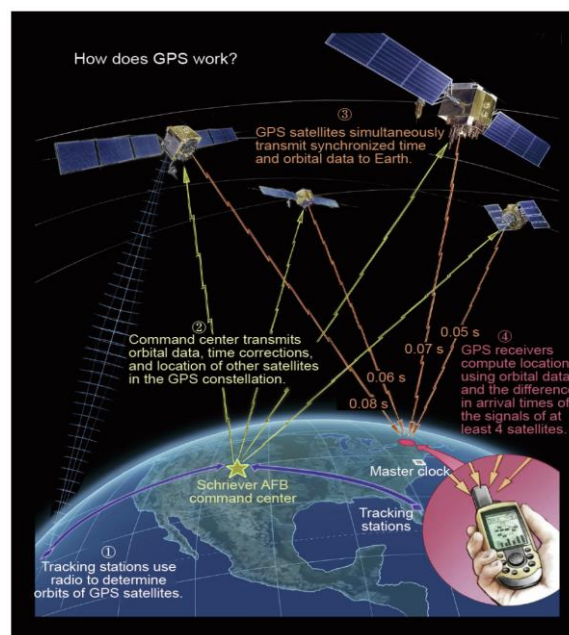


Fig. 3 How does GPS navigation work?
Source : (Weiss, 2021)

On figure 3, a handheld receiver (bottom right) tracks the arrival times of signals from at least four satellites to determine the distances to those satellites. Combining those range calculations with precise satellite positioning and timing correction information also broadcast from those satellites allows the user device to calculate its position on Earth. The system includes tracking stations that observe satellite orbits to collect data for command centers that transmit essential updates and corrections to the constellation. These updates and corrections ensure that each satellite broadcasts precise system time and observation-verified, orbital positions, guaranteeing them as reference points in space for accurate user-position fixes on the ground Schriever AFB: Schriever Air Force Base (Weiss, 2021).



Fig. 4 Global Positioning System and Map
Source : Google Image

In figure 4, GPS and Map are used to monitor the activities of employees in the project, whether later their position leaves the project location or still stays in the project to work on project tasks. Employee monitoring using a GPS tracker can also be used to monitor employees. The library to access GPS has been provided by Android. Library maps are also available in Android. Therefore, to create a User Interface / User Experience (UI / UX) Adobe software and Flutter framework are needed in developing the application system.

Flutter Framework

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Flutter (Google.com, 2018) is an open source framework developed by Google. This framework is able to create application systems in the form of websites, desktop or mobile. Many developers use Flutter to develop mobile application systems. Several reasons why use Flutter to develop apps on mobile. One of the reasons is because the Flutter framework is supported by the Google company, so there is no need to hesitate in developing applications using the Flutter framework.

Flutter is an open source framework (Google.com, 2018) by Google for building beautiful, natively compiled, multi-platform applications from a single codebase. Flutter code compiles to ARM or Intel machine code as well as JavaScript, for fast performance on any device. Productive, Build and iterate quickly with Hot Reload. Update code and see changes almost instantly, without losing state. Flexible, Control every pixel to create customized, adaptive designs that look and feel great on any screen.

RESULT

The results of the proposed method then developed a system that aims to attend attendance, monitor employees in the project, report activities during the project or project progress. This is very useful for the company, because it can know the productivity of employees. So that the project can be completed quickly because the management sees for themselves the employees in the field.



Fig. 5 Login and attendance apps
Source : researcher property

In figure 5, it can be seen that the system is used to login, the employees before carrying out activities first login to the application system. Next, take attendance to be reported to human resources, that the employee entered the office. In doing absent employees only take photos, automatically the hours of work, employee names, employee numbers, locations according to GPS will be recorded into the system. It will be monitored if employees are absent when they are in a location according to GPS coordinates, longitude (Lissa et al., 2020) and latitude (Reddybattula & Panda, 2019). The time of entry is also directly there according to the clock on the smartphone. For project progress reporting, all you have to do is take photos of the work in accordance with the given task in accordance with time management. GPS sensors can help to monitor employees.

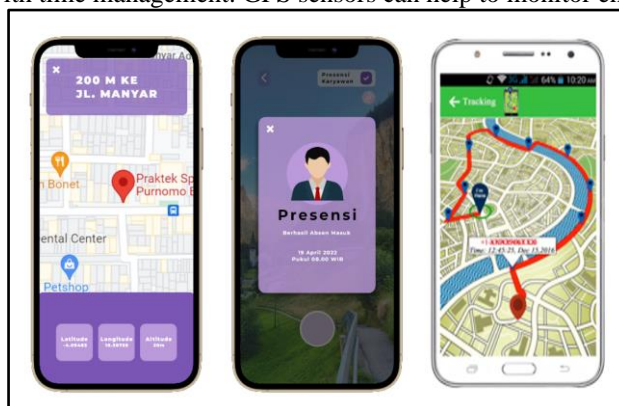


Fig. 6 GPS Tracker Apps
Source : researcher property

In figure 6. It can be seen that the application system displays the GPS position, employees from home go directly to the site or project. So employees do not need to come to the office, but just come directly to the

project, then take attendance and carry out project activities. This system can also track employees where they are. This makes it easier for management to monitor employees.

This application system was developed using Flutter and MySQL and runs on the Android operating system. The system also takes advantage of the GPS and map libraries to display the actual position or the real position when on the project.

DISCUSSIONS

The system in the research has answered the problems that exist in the office in controlling and monitoring employees. Management can report on real facts in the field or in the project. Because the application system monitors and controls. This research also attaches a snippet of the Flutter script to see the GPS position.

```
package com.example.gps;
import android.location.Criteria;
import android.location.Location;
import android.location.LocationListener;
import android.location.LocationManager;
import android.os.Bundle;
import android.os.Looper;

import java.util.HashMap;
import java.util.Map;

class GpsHandler implements LocationListener {
    private final GpsPlugin gpsPlugin;
    private final LocationManager locationManager;

    GpsHandler(GpsPlugin gpsPlugin, LocationManager locationManager) {
        this.gpsPlugin = gpsPlugin;
        this.locationManager = locationManager;
    }

    void handleGps() {
        Criteria criteria = new Criteria();
        criteria.setAccuracy(Criteria.ACCURACY_FINE);
        criteria.setAltitudeRequired(false);
        criteria.setCostAllowed(true);
        locationManager.requestSingleUpdate(criteria, this, Looper.getMainLooper());
    }

    @Override
    public void onLocationChanged(Location location) {
        locationManager.removeUpdates(this);
        Map<String, String> map = new HashMap<>();
        map.put("lat", String.valueOf(location.getLatitude()));
        map.put("lng", String.valueOf(location.getLongitude()));
        gpsPlugin.setResult(map);
    }

    @Override
    public void onStatusChanged(String provider, int status, Bundle extras) {
    }

    @Override
    public void onProviderEnabled(String provider) {
    }

    @Override
    public void onProviderDisabled(String provider) {
    }
}
```

CONCLUSION

This research has explained and has answered the problems posed. How to control employees on the project? How employees do attendance. The answer given is to create a monitoring system that runs on a smartphone. The monitoring system has features, performs attendance, does tracking and monitoring, and can perform project reports in real time. This is the current solution that is right for monitoring and tracking employees.

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SUGGESTION

Can be developed using accelerometer and gyroscope sensors for employees who do high-altitude work, such as climbing towers. The system can be developed by conducting more research with more advanced topics.

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