

MEETING ATTENDANCE RECORDING SYSTEM BASED ON OTHER PARTICIPANT'S CONFESSION

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Abstract

Meeting attendance records are usually used as an indicator of member performance in several institutions or as meeting scheduling evaluation. Since biometric system needs a machine reader in a static place, it cannot be used for mobile meeting. However, recording attendance manually is prone to manipulation. Using smartphone also has disadvantages if participants do not bring them or have some troubles in their smartphone. This study aims to overcome meeting attendance recording problem by complementing attendance proofing using other participants' confession. A handshake algorithm is proposed to be adapted in mobile application development which is inspired from a common behaviour of people when greeting each other. A concept to prove participants' attendance comes from geolocation and Bluetooth detection at meeting time or trusted tagging with some criteria for flexibility reason. This study also adapts small world model to build entire connection between participants and proof the participant's attendance. Some related features for meeting attendance recording are tested by using black box test to show its functionality.

Keywords: Handshake algorithm, Meeting attendance, Meeting scheduling, Mobile application.

1. Introduction

Meeting attendance is crucial for various purposes and is an important criterion [1]. For example, attendance records also become one of the aspects assessed in evaluating employee performance in various institutions that leads the development of attendance recording systems. In a meeting aiming to make a decision, discussion about strategies to meet the quorum indicates that the number of meeting attendees is important to be considered in a meeting scheduling [2]. In other works, some of meeting scheduling research studies attempt to predict participants' attendance based on their behaviour which needs meeting attendance record to build a system's belief [3, 4].

This study is a part of meeting scheduling research, particularly to provide the research a development cycle. The current study of meeting scheduling has not been supported by attendance record to evaluate the scheduling process. Nevertheless, the development of information technology for recording participants' attendance becomes a reliable opportunity in preparing valid data input compared to manual recording. To avoid manipulation, biometric system is a promising technology for attendance recording automation, such as fingerprint [1, 5] or iris recognition [6]. However, this system requires a reader device to be installed which is not proper for a meeting in different places.

Accordingly, for mobility reason, the development of meeting attendance recording application utilizes smartphone features such as Global Positioning System (GPS) [7] and camera for QR codes [8], or Bluetooth [9], Wi-Fi [10], and NFC [11] for close range detection to avoid fake location. This system relies on participants' devices so that it is less flexible for some conditions that might occur such as forget to bring smartphone, low battery, accuracy problem of GPS or Bluetooth trouble, etc. Moreover, if the application needs host confirmation to declare meeting attendance, the application becomes impractical for the type of meeting with a large number of participants. Although many reports have shown the successful program to solve this problem, the system must be monitored with a specific protocol system [12]. And, this protocol can be correlated and used to the further applications such as security system. This study aims to design and develop meeting attendance validation mechanism which is adjusted with meeting scheduling needs. Therefore, the system development depends on the definition of meeting, which in this research is the existence of two or more people at the same time and place to carry out a goal [13]. By using graph modelling, meeting attendance can be concluded by partial valid attendance which is connected in a graph. A mechanism is created to combine not only the use of technology but also the uncertainty of people's behaviour on uncertainty problem.

In speech research, the meeting can be categorized such as Project/Work Planning, Military Block Parties, Games, Chatting, and Topic Discussion [14]. According to that categorization, this study also defines a meeting criteria which is proper with the meeting attending recording system. People behaviour when attending the meeting gives inspiration to the system development of this research. Almost all participants tend to greet others with a handshake. This means that participants who make a handshake on a meeting can make a confession of whom they handshake with. The handshake process represents communication between two participants handshaking with each other has the same basic principle as the Bluetooth communication between participants' device or tag through their

relationship. This study uses a smartphone as participants' device but with some flexibility of use. The idea proposed in this paper is a flexible-trusted meeting attendance recording system by declaring participant's attendance using other participants' confession.

This paper is divided into five sections. The first section is introduction, the second section is about terminology that is used in this research, the third section tells handshake algorithm, the fourth section is the development of meeting attendance recording systems, and the last part is the conclusions and future work.

2. Terminology

Meeting criteria that need to be fulfilled in the development of a meeting attendance recording system include meetings that can be held anywhere (one or several various places), anytime (regularly or incidentally), no matter many (a few or a large number of participants), whoever (among acquaintances or strangers), and however (formal, semi-formal or informal situation). Meeting attendance is deduced from two principles, namely On Schedule and A Handshake.

2.1. On schedule

Participants can be considered attending the meeting if they are at the meeting location at the scheduled time which is proven by the attendance list that can only be filled during the meeting time. Therefore, every meeting invitation contains information about the meeting time and place through meeting initiation menu in the system. Meeting can be initiated by anyone who acts as a host, then invites other participants through Relation menu. The system will detect geo location of all participants during the meeting time. The system will record the participant attendance as long as they are in the meeting location, come and leave on time, come over due, leave early, or do not attend the meeting. Therefore, the attendance record will be saved and reported to the host automatically.

2.2. A handshake

Re-checking meeting attendance list is a common task for a host, especially in the class of lectures. In other words, besides being recorded On Schedule, participant attendance must be recognized by the host to be declared present. Since this system accommodates meeting with large number of participants, re-checking all participants by the host becomes inefficient. Although the system utilizes Bluetooth to communicate between two participants' devices as if handshake process, central approval by host is still an impractical task.

The handshake principle is adapted from behaviour of participants who attend the meeting. They often handshake each other, either all participants or partially. In a meeting with a few number of participants, handshake process can form a complete graph, especially if the participants know each other as depicted in Fig. 1.

Figure 1 shows an illustration of the communication between host and several people. Host can contact to all people. Then, one and other people connect each other to confirm the communication. Thus, we can reply that the communication is clear to all members.

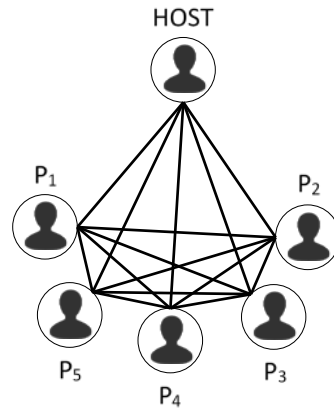


Fig. 1. A complete graph handshake.

In other case, the probability of handshake process comes from three conditions, that are adjacent position, host recognized, and other known participants, such as small world model in Fig. 2. This type of communication is different from Fig. 1. Host can only contact to some people (*i.e.*, P4 and P5), while connection between host to other people such as P1, P2, and P3 need indirect communication. The Bluetooth use is able to detect another participant existence. Approval is based on who are in a position adjacent, who becomes the host, or who knows whom. Even though the handshake just partially involves the number of participants, the meeting attendance declaration can be deduced as in handshake algorithm in the next section.

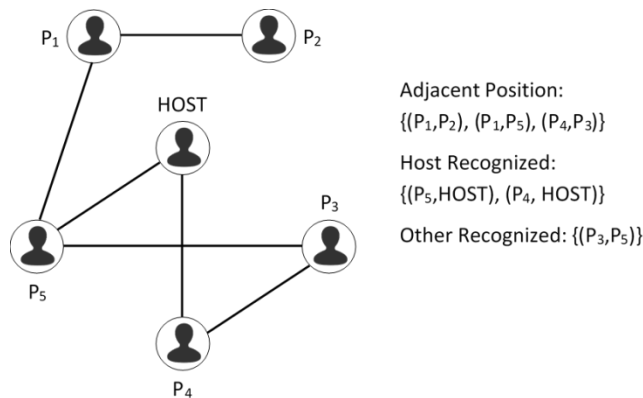


Fig. 2. A Small world model handshake.

The handshake process is similar to tagging other participants automatically using Bluetooth on a smartphone device. Somehow, with flexibility reason, tagging process can be done manually especially if participants do not bring their smartphones or if there is any trouble with their smartphones. Thus, the meeting attendance recording system in this study needs to adapt the concept of social networking as a system requirement. Each participant must have an official account. Every tagging may influence every account credibility to avoid a fake confession.

3. A Handshake Algorithm

Consider there are $N : (N \in \mathbb{N} > 1)$ number of persons who were invited to a meeting. Let $h_i : (S_i \in Boolean)$ represent the attendance of person with index $i : (i \in N)$. Suppose $j : (j \subset N; j \neq i)$ represent the index of other people who are invited to the meeting. Suppose also $S_i : (S_i \in Boolean)$ represent the on-schedule value related to person with index i and $H_{i,j} : (H_{i,j} \in Boolean)$ represent the shake hand value between person with index i and other persons j . Thus, the attendance h_i of personnel i in the meeting can be expressed as the Equation (NUMBER).

$$h_i = \begin{cases} true, & (S_i \cap H_{i,j}) \cup (H_{i,j} \cap S_j) = True \\ false, & otherwise \end{cases} \quad (1)$$

Referring to Equation (NUMBER), equation on the left side $S_i \cap H_{i,j} = True$ means person i can determine his/her location using GPS and can perform handshake using Bluetooth with other persons j . When person i cannot determine his/her location using GPS but can perform handshake using Bluetooth or tagging with other persons j , then the attendance of person i can be accepted ($h_i = True$) if one of j can determine their location using GPS. Hence, if $h_i = True$ then $h_j = True$.

A truth table can be formed based on the Equation (1) which can be found in Table 1. This table shows the correlation between some parameters and decision. Types of true and false are used for understanding the final decision. In this case, it can be said absent if all parameters are false, while if there is some true in the parameter, we can add present in the decision.

Table 1. Table of presence truth.

$(S_i \cap H_{i,j})$ AS A	$(H_{i,j} \cap S_j)$ AS B	$h_i = A \cup B$	Decision
False	False	False	Absent
False	True	True	Present
True	False	True	Present
True	True	True	Present

In other words, this system uses double authentication to prove the attendance of a person in a meeting that is through GPS and Bluetooth or tagging. For some reasons, a person cannot connect to the internet, so GPS is unavailable. A person still can prove his/ her attendance by using Bluetooth handshake with other persons who can use GPS to prove their attendance. Here, this algorithm overcome limitation on connectivity in a person to prove their attendance in the meeting.

4. Results and Discussion

The system developed runs on Android 4.4 or newer devices. This system registers the attendance of meeting participants using participants' geo location parameters. However, in addition to location-based, this system is also designed to record attendance with the help of a Bluetooth connection, through relation menu. To support the main features in registering attendance of attendees, this system requires supporting features so that it becomes a complete system. This system uses the list of upcoming schedules and schedule history as the first screen seen (after logging in), thus making this section the basic part or commonly referred to as

home. The system will display the log in screen first if the system is in a status not logged in. In this section, there is a list of meeting schedules for upcoming schedules and schedule history. Users' own meetings are available in the side tab, displaying all manageable schedules. This system also provides meeting details, meeting notes, and relation lists.

4.1. Mobile application navigation

This is necessary because the system workflow requires internet connection, but if a participants' device is not available in the network, it can go through manual tagging. Figure 3 shows the flow map of the meeting attendance record system. The system presents the condition for algorithm from begin to done. Indeed, this algorithm system contains several decisions (relating to true or false) and input from the user.

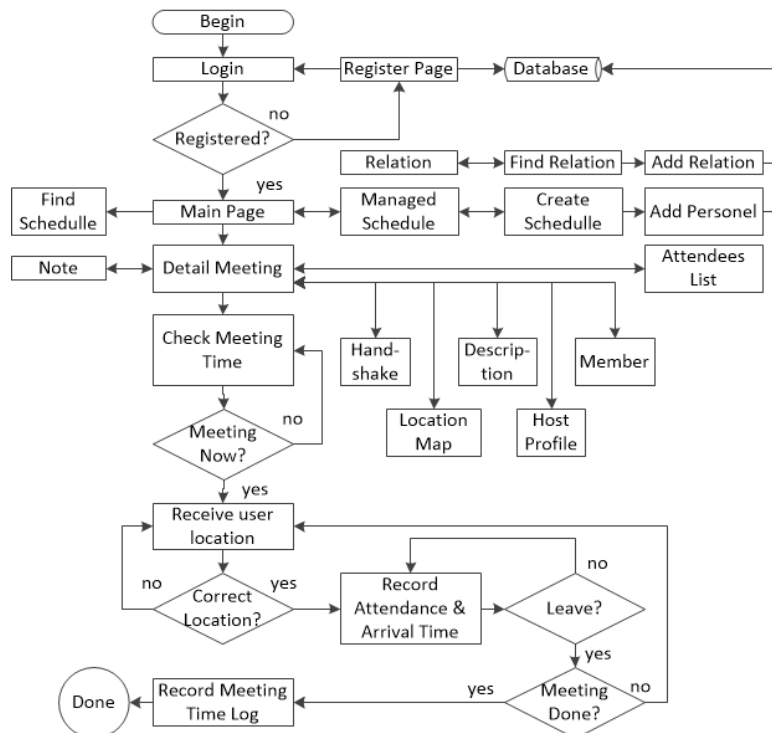


Fig. 3. A flow map of meeting attendance record system.

Attendance lists are the main features and objectives of this study. Record of attendance is done in three ways. First, it automatically uses the location of members, marked by other members, and through the 'handshake' feature that utilizes a Bluetooth connection. Attendance checking will begin when a member has entered the meeting location area at the time scheduled. This location move will trigger the geolocation feature to send an "enter" code so that the system knows that members are in the location area and immediately records attendance along with the time of arrival. This feature will also record the exit time when members leave the location area. This feature requires a mobile phone to be connected to the

internet. If an internet connection is not available, the system requires confession from other participants who are marked as attending the meeting by using tagging feature. In meetings, each member usually does a handshake. Digitally, this is applied using a Bluetooth connection. One-member device will be connected to other member devices. When the two are connected, it can be concluded that the two members meet and are present at the meeting.

4.2. Testing

We also use black box testing for checking the app feature functionality as described in Table 2. This table explains about several scenario and system's response. These parameters are used for getting test result. We used 9 scenarios, in which each scenario is connected to the system response. If the results and system response is equal, the test result can create success point.

Table 2. Table of presence truth.

Scenarios	System's Response	Test Result
add other participant	Email required, a new list in relation	Success
create new meeting	Open the form of meeting description	Success
receive meeting invitation	Receive notification	Success
come to the meeting on time	Attendance detected	Success
come to the meeting overdue	Time of attendance is recorded	Success
leave meeting early	Time of leaving is recorded	Success
not attending meeting	Recorded as not attending the meeting	Success
handshake via Bluetooth	Other participant's Bluetooth detected	Success
handshake via tagging	Open relation list	Success

The system was developed using the spiral development method. The main function of the software process model is to determine the sequence of stages involved in software development and evolution, as well as to establish transition criteria to progress from one stage to the next. Functional system testing using the black box method in each cycle shows successful results on every function and feature that is executed.

5. Conclusions

This study aims to design mobile app for declaring meeting attendance based on the proposed algorithm which is inspired by handshake behaviour between participants when attending the meeting. This app uses both GPS and Bluetooth features in each participant's smartphone for attendance validation but can be substituted by tagging manually by using other participants' smartphones who do not mind to confess. To complete development process, this app has also been tested using black box testing. The result shows that every feature in this app can run well as it should. For future work, we will investigate the usability of its app in user experience perspective and also get the assessment from expert to enhance

insight for the next development. The development of this app is to support meeting scheduling research as the main research.

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