SAMS: An IoT Solution for Attendance Management in Universities

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***Abstract*- An autonomous and effective platform for students' attendance management is presented in this paper by using most of the advanced technologies of the IoT (Internet of Things), such as mobility, wireless network, fingerprint sensor and cloud computing. The research aims at developing a smart device and a system to support attendance management in Universities. Smart Attendance Management System (SAMS) has been developed and implemented to record daily attendance of students in lecture halls and to provide web services for academic staff to manage and maintain attendance. The result reveals that the SAMS overcomes many of the limitations in the traditional methods of taking attendance and ensures the solutions are more accurate, secure, efficient and automatic.**

Keywords—IoT, fingerprint, attendance, portable, - autonomous, web service

I. INTRODUCTION

The emergence of the internet era changes the trend of learning. The availability of almost all information on the internet has caused students to be less motivated to attend lectures than ever before. However, direct participation in the lectures is always important for the success of their learning. Thus lecturers and administration of universities have to come up with different ways to ensure the healthy participation of students in lectures and practical sessions. In the Sri Lankan University system, each student must maintain attendance above 80 % for any course unit before writing their final examination. Student attendance is the main factor to assess the quality of learning process in Sri Lanka Qualifications Framework (SLQF), which is an important element of systems development in the higher education sector.

Most of the Universities are using traditional methods, where the printed attendance sheets used to collect students' signature. Students need to sign on attendance sheets in every lecture and practical session to ensure their participation. Lecturers take attendance of students manually for each lecture and practical session. This manual procedure has many limitations such as it increases the paperwork where the lecturer has to take care of the register and enter the attendance into the datasheet (or) database [1], and calculate and retrieve attendance for each student using software tools or a database management system. This procedure is a time-consuming activity, stressful and laborious and this valuable time would have been used for academic activities. Another disadvantage of this manual system is the accuracy level, which may decrease due to human errors. In addition to all these challenges, students can forge their absent friend's signature on attendance sheets. These fraud signatures make more difficulty in finding out absent students and initiate security problems. The researchers have tried to solve these problems and create various kinds of student attendance management systems for a decade. Many studies have been reported to improve and replace traditional paper-based attendance system using different technologies including RFID (Radio frequency identification) and Bluetooth [4-8]. RFID methods used to include an RFID tag (transporter) inside the student identity card. Students wave their identity card in front of the RFID readers to confirm their attendance in the lectures or practical sessions. These methods have some serious drawbacks such as there are no alternative ways to register a student attendance if a student forgets to bring his/her identity card and it is possible to make fault attendance using absentee's identity card. Implementing smart student identity cards and RFID based attendance system is also an expensive solution for the Sri Lankan Universities.

Biometric data allow a person to identify based on fingerprints, face, irises, retinal patterns, palm prints, voice, and gait, which are unique to the person. These techniques, which use physical data, are receiving attention as a personal authentication method that is more convenient than conventional methods such as a password or ID cards or signature [2]. Fingerprint data is more unique, reliable and easy to use among other biometric data. Fingerprint scanners are already been used in most of the workplace to manage employees' attendance and working hours. However, fingerprint scanners only will not solve the entire students' attendance problem as one student may have different subjects on different lecture halls, every lecture hall needs to use a fingerprint scanner, and students need to register their fingerprint on multiple fingerprint scanners. A student attendance data reside on multiple scanners, thus to collect attendance data, lecturers have to go through all fingerprint scanners in the lecture halls. IoT (Internet of Things) [3] technology can be used to resolve this problem in an effective way. The approach presented in this paper aims at producing an IoT derived SAMS (Smart Attendance Management System), which consist of PFS (Portable Fingerprint Scanner) and cloud-based centralized attendance management application. SAMS has been designed and implemented successfully and a lecturer or teacher can bring his/her PFS to take students' attendance and manage it smartly with the help of SAMS. SAMS successfully tested in ICT students of the department of physical science, Vavuniya campus of the University of Jaffna for a period of half a semester and a satisfactory result has been achieved.

II. SYSTEM ARCHITECTURE

Generally, University student attendance management systems have some essential functional and non-functional requirements such as user-friendly, reliability, mobility, less or no human errors, time and cost-effective, centralized management control, and customizable for the specific environment. IoT has the capability to provide the best solution to fulfil these important requirements. A good IoT

978-1-7281-1895-6/19/$31.00 ©2019 IEEE