**REVIEW OF RELATED LITERATURE**  
  
**The Importance of Attendance Monitoring in Schools**  
  
Attendance monitoring is very important for student success and school performance. Studies show good attendance leads to better grades and social skills. It can also help students later in their careers (Komakech, 2015). Schools that utilize formalized attendance tracking systems are able to recognize at-risk students early on and implement preventive interventions to decrease absenteeism (Sälzer et al., 2024)​. Furthermore, prolonged absenteeism also causes learning setbacks, higher scholastic anxiety, and motivation loss in engagement in school work, which also influences student achievement (Gentle-Genitty et al., 2020)  
  
In order to reduce absenteeism, schools implement digital attendance systems, parental engagement programs, as well as differential intervention models. Solutions that come with technology have facilitated more precise monitoring of the attendance of learners, thus providing easier data precision and a low workload for officials (Santos et al., 2021). Schools that utilize such technologies and active interventions are able to track attendance patterns, anticipate learning difficulties, and have in place support systems that enhance student motivation and general success (Sälzer et al., 2024)​.

**Traditional vs. Digital Attendance Recording**  
  
Traditional attendance recording, using roll calls and paper sign-in, has long been common in schools. These methods take a lot of work. They can have errors. They can also be open to fraud, like students signing in for others (Salih Ali et al., 2018). Manual recording of attendance is also problematic in large classrooms, as confirming every student's attendance can interfere with class time. By contrast, electronic attendance systems have become an option to provide efficiency, precision, and security (Jawad et al., n.d.)​.  
  
Digital attendance systems are based on technology like face recognition, RFID, QR codes, and mobile application to make attendance automated. The face recognition mechanism is a non-contact and unobtrusive method of detecting student presence with fewer chances of human error, enhancing efficiency (Smitha & Hegde, n.d.)​. Like wise, systems based on the ID card like RFID and barcoding enable computerized recording of attendance, thereby reducing administrative workload and enhancing the accuracy of information (Jawad et al., n.d.). Smart-Hadir and other mobile apps use NFC and QR codes. These make it easier to track attendance and monitor students in real time (Keau et al., 2021). Studies show that automated attendance systems reduce administrative work. They also increase student involvement (Ali et al., 2022). As schools move on from the traditional to digital way of teaching and learning, such advanced attendance management systems are coming in handy in order to increase accuracy of records and also contribute towards the enhancement of the entire learning process.  
  
**How Barcode Technology Works in Attendance Systems**  
  
Barcode technology has changed how schools track attendance. It offers a fast, effective, and correct way to record student presence. Before, attendance was logged by hand in paper books. This took a lot of work and often led to mistakes (Dewa & Nyanga, 2020). Barcode attendance systems fix these issues. They use barcode readers and student ID barcodes to make attendance easier. These systems stop students from marking attendance for others. They also lessen the work for staff by auto capturing and storing data (Yakub, 2016).  
  
Barcode systems turn student info into a barcode. This barcode is printed on ID cards or shown on digital devices. When scanned, the barcode data is auto logged and checked against a database. This gives correct attendance records (Sarjiyus et al., 2024). New advances have introduced barcode technology combined with web-based applications, boosting accessibility and real-time tracking (Khan et al., 2018)​. Research has confirmed that such systems significantly enhance efficiency in handling records of students at the same time reducing paper use and human mistake (Dewa & Nyanga, 2020). The more educational facilities incorporate barcode-based technology, they assist in building a more solid and environmentally-friendly system for the management of attendance.

**Common Problems in Manual Attendance Recording**  
  
Manual recording of attendance has been a traditional practice in schools but has the drawback of several inefficiencies. One of them is that manually recording attendance is time-consuming, disrupting class teaching time and lowering the overall efficiency of classes (Dassanayake et al., n.d.)​. Furthermore, paper-based attendance registers are susceptible to human mistakes, including poor handwriting and loss of documents, which cause inconsistencies in student data management (Jacksi & Hasan Mohammed, 2018)​. The risk of proxy attendance, where students attend on behalf of absent peers, also undermines the accuracy and validity of the system (Helwani & Zuanuwar, 2020)​.  
  
Another major disadvantage of manual attendance monitoring is its effect on administrative efficiency. Instructors tend to calculate attendance percentage manually, expanding their workload as well as error risks (Salih Ali et al., 2018)​. Additionally, absence of a shared database renders report generation and study of attendance trends in real time challenging, particularly important to uncover students in academic danger (Chowdhury, 2023)​. The use of physical attendance sheets also raises security issues, as records can be misplaced or altered, resulting in conflicts over attendance records (Jacksi & Hasan Mohammed, 2018)​.  
  
Because of these issues, many schools are switching to online attendance systems. They want better accuracy and less office work. They also want students to take more responsibility (Dassanayake et al., n.d.). Automated systems, like those using fingerprints or QR codes, give a safer and simpler option than the old way (Jacksi & Hasan Mohammed, 2018). As tech gets better, schools see the need to leave behind manual systems. They are choosing digital systems that can grow and be trusted more.

**Advantages of Using a Barcode-Based Attendance System**  
Barcode-based attendance systems have become a trustworthy and effective substitute for conventional attendance management systems in educational institutions. In contrast to manual attendance systems, which consume time and are vulnerable to error, barcode technology makes the process fast and accurate with the ability of students to be identified through barcode scanning (Dewangan et al., 2019)​. Studies show that barcode-based attendance systems enhance the efficiency of operations through the elimination of data entry errors and paper-based records, hence ensuring a greener and more sustainable practice (Yakub, 2016)​. Barcode scanning technology also offers a more secure method of authenticating student attendance, which reduces fraudulent activities like proxy attendance (Sarjiyus et al., 2024)​.  
  
One of the most important strengths of barcode-based attendance tracking is that it can automate and centralize attendance data management. Through real-time integration into digital databases, institutions are able to generate attendance reports immediately, enabling administrators and faculty members to track student participation effectively (Pangestika et al., 2024). Research has found barcode scanner-based attendance systems also contribute to better student discipline by promoting punctuality and minimizing cases of absenteeism (Yakub, 2016)​. The efficiency of the system in recording attendance within mere seconds also adds to classroom efficiency, enabling teachers to give more attention towards teaching instead of administrative work (Khan et al., 2018)​.  
  
In addition, barcode attendance systems are inexpensive and convenient to install, and hence, they are a viable option for educational institutions of any size. In comparison with biometric and RFID-based attendance systems, barcode technology requires little infrastructure and maintenance and is still highly accurate and dependable (Gomez et al., 2021)​. You can even use phones to scan barcodes for attendance. This makes it easier and needs less special tools (Khan et al., 2018). More schools are going digital. Barcode systems are a good way to make attendance better and help schools run smoother. Think of a small school with 50 students. They could use a simple barcode scanner and student ID cards. This would save time each day. It would also give the principal a quick way to check attendance trends.

**Synthesis**

The Barcode Attendance Monitoring System is changing education. It makes tracking attendance in schools easier. It is also faster and more correct. Students and teachers have less trouble with it. Old ways to check who is at school take up class time. Calling out names wastes minutes that could be used for learning. Paper sign-ins can be wrong. Students might sign in for friends who are not there. This makes records not true. Barcode systems make things flow better. These systems quickly record when students arrive. Teachers have less work to do. Research shows these systems do more than save time. They help students learn to be on time and responsible. They know they must be present and ready. Barcode systems use computers, adding even more help. Attendance tracking happens right away. It is simple to look up old records. Schools use less paper, which helps the Earth. Schools are using more technology. Barcode attendance systems fit this change. They cut down on extra tasks. Schools become more organized. Learning becomes more effective. For example, a school using barcodes might see fewer late arrivals. A teacher can spend more time teaching and less time marking a register. The school office can easily spot patterns of absence. They can then offer help to students who need it. These small changes can add up. They make a big impact on how well a school runs.

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