Executive Summary

According to a 2014 global financial development report from the World Bank, an estimated 2.5 billion people — almost half of the world’s adult population — do not have an account in a formal financial institution. This trend is more prominent in emerging economies of developing countries, particularly among people who are living in rural areas, many of whom are still not able to obtain a personal savings account. Getting access to basic financial services may require a person who is living in a rural village or town to travel long distances to a bank branch office in a nearby city.

Setting up new branch offices in rural areas incur high initial investment costs and additional human labor costs for maintaining branch operations. Physical branch offices may not be a financially feasible option for banks and financial institutions to expand their customer base to rural areas. The ROI of maintaining a branch office in rural areas is much lower than the ROI of maintaining a similar branch office in highly populated cities or urban areas with large customer populations.

The Intelligent Banking Kiosk provides a cost effective and scalable solution for banks and financial institutions to extend their services to customers in rural areas. Unlike the traditional ATM machines whose main functions are cash and check handling, the intelligent banking kiosk functions to provide banking and financial services to customers that would normally be provided by a bank teller in a branch office. Many of these services cannot be obtained through an ATM machine.

Key Business Objectives

The key business objectives are to expand customer footprint, increase sale and revenue, and maintain customer loyalty and brand relevance for banks and financial institutions while reducing operation costs of maintaining physical bank branch offices.

Who Will Benefit From This Solution

**Banks and Financial Institutions** benefit by using Intelligent Banking Kiosks as scalable and lower cost solutions to expand their customer footprint and increase their revenue stream from a largely untapped customer base in rural villages or towns.

**Governments** can use Intelligent Banking Kiosks as secure and effective banking channels to funnel government aid, funds, and subsidies to families living in rural areas.

**Consumers** travel shorter distances and have 24/7 access to financial services. A consumer may use an Intelligent Banking Kiosk to access banking or financial services outside office hours when the local branch office is closed or if travelling to a distant branch office is inconvenient.
Meeting New Market Demand

A large number of people from developing economies in South East Asia (Indonesia, Vietnam, Philippines, Thailand and so on), PRC, India, and Pakistan have no access to financial services. Banks, governments and financial institutions in these developing economies are looking for new solutions to extend banking services to these unbanked groups of people beyond the traditional bank branch offices and ATM machines.

This push for banking penetration to previously unbanked groups of people in rural areas of developing economies is largely driven by government regulations stipulating that government aid, payments and subsidies, including agricultural subsidies and medical insurance claims must be channeled through bank accounts. Government and the banking industry’s willingness to work together to increase financial access to lower income groups of people or people living in rural areas is a key factor for accelerating regulation adoption in the banking industry that promotes this banking penetration trend.

In 2015, the financial service authority of Indonesia introduced the “Laku Pandai” project with new branchless banking incentives and regulations to drive domestic banks to provide basic banking and insurance services to a larger number of lower-income groups of people in rural Indonesia. The successful deployment of a pilot project has accelerated future efforts to deploy additional Intelligent Banking Kiosk solutions across the entire country of Indonesia.

Selective example of intelligent banking kiosk adoptions may be found in the following link:

https://www.youtube.com/watch?v=BFSMbqCPqre

An Intelligent Banking Kiosk solution may be developed using Intel® Core™ i5/i7 processors with Intel® vPro™ technology based remote manageability.

The Business Challenge

Banks and financial institutions face business challenges relating to scaling their business operations, maintaining customer loyalty and brand relevance, and increasing their revenue stream:

Business operations excellence: Banks and financial institutions are constantly looking for new solutions to increase their operational excellence by reducing operation costs. The Intelligent Banking Kiosk solution reduces the need for a bank to proportionately increase the number of workers or tellers in their branch offices when the bank’s customer base increases. Bank tellers can focus their time and efforts on higher value-added tasks such as promoting a bank’s financial services to customers. Some existing customer service tasks that can be handled by an Intelligent Banking Kiosk may be offloaded from them.

Customer base and revenue expansion: The video conferencing feature of an Intelligent Banking Kiosk empowers bank tellers to service a larger customer base beyond the four walls of a bank branch office. Deeper penetration of financial services to new customer bases includes people who were previously unreachable by traditional banking infrastructures and provides financial institutions and their partners with new revenue streams. Tapping into these new markets and customer segments also opens new opportunities to do cross-selling and upselling of financial services.

Customer loyalty and brand relevance: The Intelligent Banking Kiosk provides new channels or touch points for banks to maintain relationships with and to provide 24/7 banking services to their customers. The video conferencing feature provides an option for customers to have face to face conversations with a bank teller for their banking needs, without the need for the customer to travel to a branch office.

Capital cost reduction: Reduces the need to invest in high cost and high maintenance infrastructures in the form of new bank branch offices in rural towns or villages.

Risk management: Reduces the risk of human error and fraud by reducing the need to engage a human agent for cash handling when providing remote banking services to customers in rural villages or towns (e.g. telephone banking and person to person banking).

Solution Overview

An Intelligent Banking Kiosk is a branchless banking solution that provides one or more specialized banking or financial services to customers that would normally be provided by a bank teller in a branch office.
Some of the financial services that may be offered by an Intelligent Banking Kiosk solution includes one or a combination of the following:

- Opening and closing of personal accounts
- Cash deposit or withdrawal using a passbook
- Financial statement printouts
- Loans, insurance, credit cards and other financial services applications
- Bill and loan payments
- Ticketing services
- Customer inquiries and professional advice on financial products and services

Figure 1 shows a functional breakdown of the various services an Intelligent Banking Kiosk can provide.

**High Level Architecture**

Figure 2 is a high level architecture of an Intelligent Banking Kiosk system. This system can be partitioned into multiple functional sub-systems for handling specific customer services.

**Customer Authentication**

The customer authentication sub-system of an Intelligent Banking Kiosk functions to authenticate a customer. Functional blocks of this system are shown in Figure 3. An Intel® Core™ processor functions to coordinate the overall operations of the authentication process. The Intel® Core™ processor may prompt a customer to insert an ID card into the card reader interface to initiate an authentication process by displaying a welcome message on the touchscreen display. The Customer ID card may be an ATM card or a credit card that conforms to international security standards and financial practices such as PCI–DSS compliance and EMV chip and pin compliance. The customer ID card may also be a social security card issued by a local government or a personal security card issued by a local financial authority, both of which may be locally regulated.

When a customer presents an ID card to the Intelligent Banking Kiosk, the card reader extracts the user information from the ID card, and sends the user information to a remote authentication server or a kiosk controller for verification. The authentication server may communicate with a financial institution's backend server or a government database during the authentication process. The backend server or database contains account information of all customers of a financial institution. In some implementations, customer authentication may also be performed locally using smart card technology.

Communications between an Intelligent Banking Kiosk and a back office server may be implemented using a communication protocol that conforms to international standards such as the NDC (NCR Direct Connect) or DDC (Diebold Direct Connect) protocol, both of which are widely used by ATM machines today. The Intelligent Banking Kiosk may also use a proprietary communication protocol defined by a local government or a local financial authority to communicate with its backend server.

The authentication server may further request a user to input a personal identification number or security pin using the secure keypad. The security pin will be sent encrypted from the secure keypad to the authentication server to ensure its confidentiality. Alternatively the authentication sub-system may utilize a biometrics reader such as a fingerprint scanner, a vein scanner or a face recognition camera to extract biometrics data from a customer and use it for second level authentication of the customer in place of a security pin. Biometrics is the authentication method of choice for social security ID card-based customer authentication, while a security pin is used extensively in debit card, credit card or ATM card based customer authentication.
Upon successful verification of a customer’s identity, the Intelligent Banking Kiosk may present a list of available services to the customer via the touchscreen display. Customer may then select one or more services from the touchscreen display.

Some customers may be reluctant to touch a public display screen for hygienic reasons such as fear of being exposed to viruses, especially during flu season. An Intelligent Banking Kiosk may provide customers with alternative interaction methods beyond the conventional touchscreen. For example, a customer may initiate an online transaction through a banking app on a personal smartphone and then scan a QR code generated by the banking app on an Intelligent Banking Kiosk’s QR code reader. The Intelligent Banking Kiosk completes the online transaction, for example, by dispensing cash, tickets or a prepaid card. Alternatively, an Intelligent Banking Kiosk may also allow a customer to interact with a display screen of the kiosk using their hands without physically touching the display.

**Maintenance and Remote Management**

The Intelligent Banking Kiosk is connected to a remote maintenance server. The maintenance server functions to remotely push software updates or security patches to all connected Intelligent Banking Kiosk systems across a network.

When a new software update or security patch is available, the maintenance server broadcasts the new update to all connected Intelligent Baking Kiosk systems across its network domain. The Intel® Core™ processor checks the data integrity of the downloaded update and authenticates the update’s binary files with the help of the kiosk controller before the processor installs the update and restarts the updated software module. In some implementations, the Intelligent Banking Kiosk may authenticate the software update binary file locally through the help of a platform TPM module.

On-site repair visits to remote villages or towns are costly and time consuming, hence remote management capability is necessary for Intelligent Banking Kiosks to reduce machine down time and maintenance costs as well as to increase customer satisfaction and customers’ brand perception of a financial institution. To minimize on-site repair visits, banks or financial institutions can use Intel® Active Management Technology (Intel® AMT) to remotely monitor, diagnose and fix software issues on their Intelligent Banking Kiosks from a centralized remote management server.

Conventional in-band remote management solutions today remotely manage a client device with the help of the device’s operating system. The device’s operating system provides the necessary connectivity and management framework for a remote management console to connect to the device and to remotely control the device through a keyboard, video and mouse (KVM) feature.

If the operating system of the managed device gets corrupted or becomes non-functional, this management solution may become unusable. However, remote management solutions with Intel® AMT enable a remote management console to remotely diagnose and repair a managed device even when the device’s operating system is not functional.

A significant percentage of system downtime is software related, and typically related to operating system corruption or operating system crashes. Management solutions with Intel® AMT empower banks and financial institutions to remotely diagnose and resolve the software related problems of their Intelligent Banking Kiosks without needing to dispatch a technician. As a result, banks and financial institutions are able to reduce overall downtime and maintenance costs of the Intelligent Banking Kiosks. They are able, in addition, to increase customer satisfaction - due to increased availability of the kiosk.

**Cash and Financial Document Handling**

This sub-system provides the fundamental peripheral device building blocks for cash and document handling, and for document printing. The Intel® Core™ processor functions as a host that coordinates the use of these peripheral devices during a financial transaction or a service rendered by the kiosk.

![Figure 3 Simplified Architecture Block Diagram of Customer Authentication Subsystem](image-url)
Cash and Check Handling

Customers can make cash deposits or withdrawals from their personal bank accounts through an Intelligent Banking Kiosk. This feature may be very similar to the cash handling feature of an ATM machine that uses a bill acceptor, a bill dispenser or cash recycler module to manage collection and distribution of cash stored inside the machine. A check processing module may be used to capture, endorse and temporarily store customer checks until a collection service agent picks up and delivers the collected checks to a bank branch office for further processing. Customers may also make personal loans or credit/ debit card payments by cash or check. To make a payment, a customer may first login to their loan or personal credit account and then proceed to make a cash or check deposit.

In some emerging economies where cash and check is used as the preferred method of payment, retail store owners may want to deposit cash or checks into their bank accounts at the end of a business day when the retailer’s bank branch office is closed. Some retailers may not want to travel long distance to a bank branch office in another city to deposit their cash for safety reasons. The retailer can use the Intelligent Banking Kiosk as a lump sum cash and check deposit machine.

Scanner & E-cash Handling

The scanner and e-cash handling subsystem enables customers to withdraw cash from an Intelligent Banking Kiosk using their personal smartphones. An account debit request may be initiated from a customer smartphone which will generate a QR code on the smartphone’s touchscreen display. The QR code may then be scanned on a scanner module of an Intelligent Banking Kiosk to complete the cash withdrawal transaction. The Intelligent Banking Kiosk debits the customer’s account and then dispenses the cash. The smartphone cash withdrawal feature enables customers to withdraw cash from an Intelligent Banking Kiosk using an account from any bank or financial institution.

Document Printing and Update

Figure 6 shows examples of types of documents that can be printed from an Intelligent Banking Kiosk.

One or a combination of the following printers may be integrated into an Intelligent Banking Kiosk, based on the kiosk’s printing requirements:

**Thermal Printer**

Customers may request for a receipt to be printed for each transaction on an Intelligent Banking Kiosk. Receipts may be printed using an integrated thermal printer module.

**Laser Printer**

Some banks and financial institutions may be required by law to keep an original signature of a customer when the customer applies for a new account or a bank loan. To simplify the application process, the Intelligent Banking Kiosk may guide a customer to complete a form by displaying a series of information request messages on its display screen, and prompting the customer to fill in their personal information using its integrated keyboard. After a customer has provided all the required information, the Intelligent Banking Kiosk prints out a customized application form with all customer information included using a laser printer module. The customer may proceed to sign the form and submit it along with other supporting documents.

An Intelligent Banking Kiosk may offer additional services of printing financial statements or bank account information and ticketing sales upon customer request. The printer is suitable for these types of print jobs because it is configurable to print on papers of different shapes, sizes and orientations. A financial statement or bank account information may be printed on letter size paper with a letter head of a financial institution while tickets issued by an Intelligent Banking Kiosk may come in various shapes and sizes.

In some implementations, a laser printer may also be used to print transaction receipts.
Passbook Printer

In some emerging economies, it is customary for customers to record all their cash transactions in a passbook. A customer may insert a passbook into the passbook printer interface of an Intelligent Banking Kiosk and perform a cash deposit or withdrawal. Each successful transaction is recorded on the passbook. Some passbook printers have features for automatic page turning and for locating the last printed line on a page so that consecutive transaction records will be printed below the last printed line. Some passbook printers may be dot matrix printers with the sample features.

Remote Customer Support

Customers who are interested in opening an account or applying for a personal loan may want to speak to a consultant or a customer representative to get professional advice on products or services that best meet their personal banking needs. For example: a customer may want to make a comparison between a fixed interest rate loan and a variable interest rate loan before making a decision on which one to select.

Customers can initiate video conference sessions with remote bank tellers sitting in a call center to get advice or to make inquiries about an account. Selecting this menu option from an Intelligent Banking Kiosk configures an integrated camera on the kiosk to start a video stream capture of the customer’s face. The video stream from the camera is encoded by a Media SDK enabled video encoder hardware accelerator in the Intel® Core™ processor before it is streamed via a network to the remote bank teller’s customer support terminal. A media player on the remote bank teller’s terminal decodes and displays the video stream of the customer during the video conference session. The customer may speak to the bank teller through an integrated speaker module of the Intelligent Banking Kiosk. Likewise, a camera on the bank teller’s terminal captures a video stream of the teller’s face and transmits it to the Intelligent Banking Kiosk for display so that customer on the other side can also see the face of the bank teller throughout the video conference session.

A call center may house many bank tellers working in tightly knitted cubicles arranged side by side in multiple rows. To prevent the background environment of a call center (e.g. exposed cubicle areas and people walking around the call center) from distracting a customer during a video conference, each cubicle may be enclosed within a physical wall to block out the background environment of the call center. However, this cubicle configuration may increase the overall size of a bank teller’s cubicle and reduce the number of bank tellers that can be effectively housed in a call center.

Differences between an Intelligent Banking Kiosk and an ATM Machine

An Intelligent Banking Kiosk is a new vertical sub-segment of the kiosk and is not an extension of the ATM machine although both may share some common features such as cash acceptance and dispensing. The main differences between the traditional ATM machine and the Intelligent Banking Kiosk are:

1. The Intelligent Banking Kiosk implements banking and financial services that are traditionally offered by a bank teller in a branch office. Many of these services cannot be obtained through an ATM machine.
2. End user authentication methods of an Intelligent Banking Kiosk may be defined and regulated by a local government body or a local financial authority and may not necessarily conform to international ATM/credit card authentication standards (e.g. PCI–DSS compliance). For example: a local government affiliated bank or financial institution may use social security cards issued to the citizens of a country as an authentication tool for accessing financial services from an Intelligent Banking Kiosk. Social security cards issued by different local governments may adhere to different formats and security standards which may differ from conventional ATM/Credit card requirements.

3. The Intelligent Banking Kiosk’s usage model may be customizable based on common banking practices of a country, area, city or town in which the solution is being deployed. For example: it is common practice in some emerging economies for people to use passbooks to record their cash based transactions.

4. The Intelligent Banking Kiosk allows sufficient flexibility for a local government, a local financial institution or a local financial institution affiliated business entity to define their own security and regulatory standards and requirements for a kiosk that handles banking and financial services without the need to conform to present day international standards or practices.

Technology

Remote Management

Banks and financial institutions can minimize costly onsite repair visits using Intel® Active Management Technology (Intel® AMT) to remotely monitor, diagnose and repair devices in rural villages and towns. The technology enables technicians to power-cycle machines and repair software issues, along with other device management tasks through a remote management console. A keyboard–video–mouse (KVM) feature allows technicians to control the system as if they are sitting right in front of it, even when the operating system does not respond and the system is down. This secure link can also be used to send software updates and security patches between individual machines and the financial institution headquarters.

The remote management console for Intel® AMT may be implemented using the Mesh Commander toolkit. Additional information is at: http://www.meshcommander.com/meshcommander


Intel® Media Software Development Kit

The Intel® Media Software Development Kit is a software development library API that exposes the media acceleration capabilities of Intel platforms for decoding, encoding and video processing. In this case study for Intel® Media SDK in the media broadcasting sector: https://software.intel.com/sites/default/files/managed/38/21/netup-case-study.pdf, multiple real time media streams may be transcoded and broadcasted across a network to audiences. Information and instructions on downloading the Intel® Media SDK are at https://software.intel.com/en-us/media-sdk.

Figure 6. Representative Types of Documents Handled by Printer Subsystem
Summary

Intelligent Banking Kiosks are a unique solution for banks and financial institutions to extend their services to people from rural villages and towns beyond the traditional branch offices and ATM machines. This solution helps banks and financial institutions expand their existing customer base, increase revenue, enhance customer brand perception, and reduce operating costs of maintaining branch offices. The solution is powered by Intel® Core™ processors with Intel® vPro™ technology remote manageability which provide the computing performance, platform manageability, and graphics capabilities needed to deliver this branchless banking experience to customers.