A

Mini Project

On

**CMRTC Canteen WITH E-MENU CARD**

(Submitted in partial fulfillment of the requirements for the award of Degree)

**BACHELOR OF TECHNOLOGY**

In

**COMPUTER SCIENCE AND** **ENGINEERING**

By

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Under the Guidance of

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

### CMR TECHNICAL CAMPUS

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**2022-2026**

##### DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



## CERTIFICATE

This is to certify that the project entitled **“CMRTC Canteen WITH E-MENU CARD”** being

submitted by SHIVA KUMAR (227R1A05J3) in partial fulfillment of the requirements for the award of the degree of B.Tech in Computer Science and Engineering to the CMR Technical Campus, is a record of bonafide work carried out by them under our guidance and supervision during the year 2023-2024.

The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

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**ABSTRACT**

Today’s era is said to be the world of technology. So many efforts have been taken by restaurants owners also to adopt information and communication technologies such as PDA, wireless LAN, costly multi-touch screens etc. to enhancedining experience. This paper highlights some of the limitations of the conventional paper based and PDA based food ordering system and proposed the low cost touch screen based Restaurant Management System using an android Smartphone or tablet as a solution. The system consists of a Smartphone/tablet at the customer table contains the android application with all the menu details. The customer tablet, kitchen display connects directly with each other through Wi- Fi. Orders made by the customers will be instantly reach the kitchen module. This wireless application is user-friendly, improves efficiency and accuracy for restaurants by saving time, reduces human errors and provides customer feedback. This system successfully overcomes the drawbacks in earlier automated food ordering systems and is less expensive as it requires a one-time investment for gadgets.

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**1.INRODUCTION**

**INTRODUCTION TO EMBEDDED SYSTEMS**

Many embedded systems have substantially different design constraints than desktop computing applications. No single characterization applies to the diverse spectrum of embedded systems. However, some combination of cost pressure, long life-cycle, real¬-time requirements, reliability requirements, and design culture dysfunction can make it difficult to be successful applying traditional computer design methodologies and tools to embedded applications. Embedded systems in many cases must be optimized for life-cycle and business-driven factors rather than for maximum computing throughput. There is currently little tool support for expanding embedded computer design to the scope of holistic embedded system design. However, knowing the strengths and weaknesses of current approaches can set expectations appropriately, identify risk areas to tool adopters, and suggest ways in which tool builders can meet industrial needs. If we look around us, today we see numerous appliances which we use daily, be it our refrigerator, the microwave oven, cars, PDAs etc. Most appliances today are powered by something beneath the sheath that makes them do what they do. These are tiny microprocessors, which respond to various keystrokes or inputs. These tiny microprocessors, working on basic assembly languages, are the heart of the appliances. We call them embedded systems. Of all the semiconductor industries, the embedded systems market place is the most conservative, and engineering decisions here usually lean towards established, low risk solutions. Welcome to the world of embedded systems, of computers that will not look like computers and won’t function like anything we are familiar with.

**1.1 CLASSIFICATION**

Embedded systems are divided into autonomous, realtime, networked & mobile categories.

Autonomous systems

They function in standalone mode. Many embedded systems used for process control in manufacturing units& automobiles fall under this category.

**1.2 OTHER COMMON PARTS FOUND ON MANY EMBEDDED SYSTEMS**

**•**UART& RS232

•PLD

•ASIC’s& FPGA’s

•Watch dog timer etc.

**1.3 DESIGN PROCESS**

Embedded system design is a quantitative job. The pillars of the system design methodology are the separation between function and architecture, is an essential step from conception to implementation. In recent past, the search and industrial community has paid significant attention to the topic of hardware-software (HW/SW) codesign and has tackled the problem of coordinating the design of the parts to be implemented as software and the parts to be implemented as hardware avoiding the HW/SW integration problem marred the electronics system industry so long. In any large scale embedded systems design methodology, concurrency must be considered as a first class citizen at all levels of abstraction and in both hardware and software. Formal models & transformations in system design are used so that verification and synthesis can be applied to advantage in the design methodology. Simulation tools are used for exploring the design space for validating the functional and timing behaviors of embedded systems. Hardware can be simulated at different levels such as electrical circuits, logic gates, RTL e.t.c. using VHDL description. In some environments software development tools can be coupled with hardware simulators**,** while in others the software is executed on the simulated hardware. The later approach is feasible only for small parts of embedded systems.

**1.3.1 SPECIFICATION**

During this part of the design process, the informal requirements of the analysis are transformed to formal specification using SDL.

**1.3.2 SYSTEM-SYNTHESIS**

For performing an automatic HW/SW partitioning, the system synthesis step translates the SDL specification to an internal system model switch contains problem

graph& architecture graph. After system synthesis, the resulting system model is translated back to SDL.

**1.3.3 IMPLEMENTATION-SYNTHESIS**

SDL specification is then translated into conventional implementation languages such as VHDL for hardware modules and C for software parts of the system.

**1.3.4 PROTOTYPING**

On a prototyping platform, the implementation of the system under development is executed with the software parts running on multiprocessor unit and the hardware part running on a FPGA board known as phoenix, prototype hardware for Embedded Network Interconnect Accelerators.

**1.3.5 APPLICATIONS**

• Embedded systems are finding their way into robotic toys and electronic pets, intelligent cars and remote controllable home appliances. All the major toy makers across the world have been coming out with advanced interactive toys that can become our friends for life. ‘Furby’ and ‘AIBO’ are good examples at this kind. Furbies have a distinct life cycle just like human beings, starting from being a baby and growing to an adult one. In AIBO first two letters stands for •Artificial Intelligence. Next two letters represents robot. The AIBO is robotic dog. Embedded systems in cars also known as Telematic Systems are used to provide navigational security communication & entertainment services using GPS, satellite. Home appliances are going the embedded way. LG electronics digital DIOS refrigerator can be used for surfing the net, checking e-mail, making video phone calls and watching TV.IBM is developing an air conditioner that we can control over the net. Embedded systems cover such a broad range of products that generalization is difficult. Here are some broad categories.

•Aerospace and defence electronics: Fire control, radar, robotics/sensors, sonar.

•Automotive: Autobody electronics, auto power train, auto safety, car information systems.

•Broadcast & entertainment: Analog and digital sound products, camaras, DVDs, Set top boxes, virtual reality systems, graphic products.

•Consumer/internet appliances: Business handheld computers, business network computers/terminals, electronic books, internet smart handheld devices, PDAs.

•Data communications: Analog modems, ATM switches, cable modems, XDSL modems, Ethernet switches, concentrators.

•Digital imaging: Copiers, digital still cameras, Fax machines, printers, scanners.

•Industrial measurement and control: Hydro electric utility research & management traffic management systems, train marine vessel management systems.

•Medical electronics: Diagnostic devices, real time medical imaging systems, surgical devices, critical care systems.

•Server I/O: Embedded servers, enterprise PC servers, PCI LAN/NIC controllers, RAID devices, SCSI devices.

**2.LITERATURE SURVEY**

**LITERATURE SURVEY**

The adoption of e-menu cards in canteens represents a significant shift from traditional paper-based menus to digital solutions, driven by the need for efficiency and improved customer experience. E-menu cards, which can be displayed on devices such as tablets, kiosks, or smartphones, offer numerous advantages over their traditional counterparts. They provide dynamic and interactive interfaces, enabling easy updates and customization of menu items and prices. This eliminates the need for reprinting and reduces paper waste. Moreover, e-menu cards can integrate with other systems like inventory management, ordering, and payment processes, streamlining operations and reducing human error. The technology behind e-menu cards includes both hardware, such as the display devices, and software, which encompasses applications designed for menu creation, management, and data analytics. Studies have shown that the use of e-menu cards can enhance customer satisfaction by providing detailed information about dishes, including ingredients, nutritional values, and potential allergens, thereby aiding informed decision-making. Additionally, they can support multiple languages, making them accessible to a diverse customer base. Overall, the implementation of e-menu cards in canteens not only modernizes the dining experience but also offers operational efficiencies and environmental benefits.

Conducting a literature survey on e-menu cards in canteens involves examining various studies and articles to understand their development, implementation, and impact. Research has shown that e-menu cards are not just a technological upgrade but a transformative tool in the food service industry. Several studies highlight how e-menu cards improve operational efficiency by automating the ordering process, reducing wait times, and minimizing errors in order taking. They also offer customizable features, such as real-time updates on menu items and promotions, which can enhance marketing efforts and boost sales. Additionally, literature indicates that e-menu cards contribute to better inventory management by integrating with backend systems to track stock levels and reduce food waste. Customer-centric research points out that e-menu cards can enhance the dining experience through interactive elements like high-resolution images and detailed descriptions, which help customers make more informed choices. Furthermore, they can cater to dietary preferences and restrictions by filtering options based on customer inputs. The literature also explores the challenges associated with implementing e-menu cards, such as the initial cost of setup, the need for reliable internet connectivity, and potential resistance from staff and customers accustomed to traditional menus. Overall, the literature survey provides a comprehensive view of the advantages, challenges, and future prospects of e-menu cards in canteens, emphasizing their role in revolutionizing the dining experience through technology.

**3. ANALYSIS AND DESIGN**

**ANALYSIS AND DESIGN**

# EXISTING METHOD:

# Conventional systems like restaurant services such as making reservations, processing orders, and delivering meals generally require waiters to input customer information and then transmit the orders to kitchen for meal preparation. When the customer pays the bill, the amount due is calculated by the cashier.

# Electronic POS Terminals like the servers/waiters generally take the order from the customer and head onto a terminal, where they can feed the order into a computer. The order can then be transmitted to the kitchen automatically via the terminal through a network, or it may even be delivered manually by the server to the kitchen.

**PROPOSED METHOD:**

The e-Menu provides additional information about menu items and drinks than a traditional paper menu. With interactive pictures it gives additional information about the food item. Here we require a mobile with android application. When the customer gets login into the app, he can find a wide variety and colorful images of all the menu items which will be helpful in selecting the exact item which gives the customer a great satisfaction.

## BLOCKDIAGRAM

## 

**REMOTE UNIT:**

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**BLUETOOTH TECHNOLOGY:**

Bluetooth was selected as our way of communicating PDA/Mobile with a central system. The reason Bluetooth was selected over Bluetooth for various reasons. First of all, Bluetooth security is less complex and more stable than that of Wi-Fi. Bluetooth manages a security measure of only permitting certain selected devices to interact with them; Wi-Fi in the other hand establishes a WEP key that has been known to be cracked. Another reason that Bluetooth was selected over Wi-Fi is that Bluetooth has a shorter range of signal emission than Wi-Fi. This is a pro because the shorter the range the less the amount intruders that will try to infiltrate your home system.

Android:

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. The [Android SDK](http://developer.android.com/sdk/index.html) provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language.

**SOFTWARE:** Embedded ‘C’, android .apk.

**TOOLS:** Keil uVision3, ISP.

**TARGET DEVICE:** AT89S52, Smart Android Mobile**.**

**APPLICATIONS :** Restaurants, Hotels.

**ADVANTAGES :** Can have a clear idea of all items, Overcomes errors in order taking**.**

**2.INTRODUCTION TO EMBEDDED SYSTEMS**

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2.1 CLASSIFICATION

Embedded systems are divided into autonomous, realtime, networked & mobile categories.

Autonomous systems

They function in standalone mode. Many embedded systems used for process control in manufacturing units& automobiles fall under this category.

Real-time embedded systems

These are required to carry out specific tasks in a specified amount of time. These systems are extensively used to carry out time critical tasks in process control.

**Networked embedded systems**

They monitor plant parameters such as temperature, pressure and humidity and send the data over the network to a centralized system for on line monitoring.

Mobile gadgets

Mobile gadgets need to store databases locally in their memory. These gadgets imbibe powerful computing & communication capabilities to perform realtime as well as nonrealtime tasks and handle multimedia applications. The embedded system is a combination of computer hardware, software, firmware and perhaps additional mechanical parts, designed to perform a specific function. A good example is an automatic washing machine or a microwave oven. Such a system is in direct contrast to a personal computer, which is not designed to do only a specific task. But an embedded system is designed to do a specific task with in a given timeframe, repeatedly, endlessly, with or without human interaction.

Hardware

Good software design in embedded systems stems from a good understanding of the hardware behind it. All embedded systems need a microprocessor, and the kinds of microprocessors used in them are quite varied. A list of some of the common microprocessors families are: ARM family, The Zilog Z8 family, Intel 8051/X86 family, Motorola 68K family and the power PC family.

2.2 **OTHER COMMON PARTS FOUND ON MANY EMBEDDED SYSTEMS**

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2.3 **DESIGN PROCESS**

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• Aerospace and defence electronics: Fire control, radar, robotics/sensors, sonar.

• Automotive: Autobody electronics, auto power train, auto safety, car information systems.

• Broadcast & entertainment: Analog and digital sound products, camaras, DVDs, Set top boxes, virtual reality systems, graphic products.

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• Data communications: Analog modems, ATM switches, cable modems, XDSL modems, Ethernet switches, concentrators.

• Digital imaging: Copiers, digital still cameras, Fax machines, printers, scanners.

• Industrial measurement and control: Hydro electric utility research & management traffic management systems, train marine vessel management systems.

• Medical electronics: Diagnostic devices, real time medical imaging systems, surgical devices, critical care systems.

• Server I/O: Embedded servers, enterprise PC servers, PCI LAN/NIC controllers, RAID devices, SCSI devices.

• Telecommunications: ATM communication products, base stations, networking switches, SONET/SDH cross connect, multiplexer.

• Mobile data infrastructures: Mobile data terminals, pagers, VSATs, Wireless LANs, Wireless phones.

**3.ARUDINO:**

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they’re dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. Unlike, say, a Raspberry Pi, it’s designed to attach all kinds of sensors, LEDs, small motors and speakers, servos, etc. directly to these pins, which can read in or output digital or analog voltages between 0 and 5 volts.

Figure 2.2 Structure of Arduino Board

Looking at the board from the top down, this is an outline of what you will see (parts of the board you might interact with in the course of normal use are highlighted)

Figure 2.3 Arduino Board

Starting clockwise from the top center:

Analog Reference pin (orange)

Digital Ground (light green)

Digital Pins 2-13 (green)

Digital Pins 0-1/Serial In/Out - TX/RX (dark green) - These pins cannot be used for digital i/o (Digital Read and Digital Write) if you are also using serial communication (e.g. Serial.begin).

Reset Button - S1 (dark blue)

In-circuit Serial Programmer (blue-green

Analog In Pins 0-5 (light blue)

Power and Ground Pins (power: orange, grounds: light orange)

External Power Supply In (9-12VDC) - X1 (pink)

Toggles External Power and USB Power (place jumper on two pins closest to desired supply) - SV1 (purple)

USB (used for uploading sketches to the board and for serial communication between the board and the computer; can be used to power the board) (yellow)

**DIGITAL PINS**

In addition to the specific functions listed below, the digital pins on an Arduino board can be used for general purpose input and output via the pin Mode(), Digital Read(), and Digital Write() commands. Each pin has an internal pull-up resistor which can be turned on and off using digital Write() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input. The maximum current per pin is 40mA.

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. On the Arduino Diecimila, these pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip. On the Arduino BT, they are connected to the corresponding pins of the WT11 Bluetooth module. On the Arduino Mini and LilyPad Arduino, they are intended for use with an external TTL serial module (e.g. the Mini-USB Adapter).

External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11 Provide 8-bit PWM output with the analog Write() function. On boards with an ATmega8, PWM output is available only on pins 9, 10, and 11.

BT Reset: 7. (Arduino BT-only) Connected to the reset line of the bluetooth module.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

LED: 13. On the Diecimila and LilyPad, there is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

**ANALOG PINS**

Pin Description

VCC:

Digital supply voltage.

GND:

Ground.

**Port A (PA7-PA0):**

Port A serves as the analog inputs to the A/D Converter. Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability.

**Port B (PB7-PB0):**

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running. Port B also serves the functions of various special features of the ATmega32.

**Port C (PC7-PC0):**

Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs. \.

**Port D (PD7-PD0):**

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

**Reset (Reset Input):**

A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

**XTAL1:**

Input to the inverting Oscillator amplifier and input to the internal clock operating circuit

**XTAL2:**

Output from the inverting Oscillator amplifier.

**AVCC:**

AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

**AREF:**

AREF is the analog reference pin for the A/D Converter.

FEATURES

1.8-5.5V operating range

Up to 20MHz

Part: ATMEGA328P-AU

32kB Flash program memory

1kB EEPROM

2kB Internal SRAM

2 8-bit Timer/Counters

16-bit Timer/Counter

RTC with separate oscillator

6 PWM Channels

8 Channel 10-bit ADC

Serial USART

Master/Slave SPI interface

2-wire (I2C) interface

Watchdog timer

Analog comparator

23 IO lines

Data retention: 20 years at 85C/ 100 years at 25C

Digital I/O Pins are 14 (out of which 6 provide PWM output)

Analog Input Pins are 6.

DC Current per I/O is 40 mA

**AVR CPU CORE**

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

**OVERVIEW**

This section discusses the AVR core architecture in general. The main function of the CPU core is to ensure correct program execution. The CPU must therefore be able to access memories, perform calculations, control peripherals, and handle the interrupts.

**Figure AVR core architecture**

In order to maximize performance and parallelism, the AVR uses a Harvard architecture – with separate memories and buses for program and data. Instructions in the program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the program memory. This concept enables instructions to be executed in every clock cycle.

**ALU – ARITHMETIC LOGIC UNIT**

The high-performance AVR ALU operates in direct connection with all the 32 general purpose working registers. Within a single clock cycle, arithmetic operations between general purpose registers or between a register and an immediate are executed. The ALU operations are divided into three main categories – arithmetic, logical, and bit functions. Some implementations of the architecture also provide a powerful multiplier supporting both

signed/unsigned multiplication and fractional format. See the “Instruction Set” section for a detailed description.

**4. EXPERIMENTAL INVESTIGATIONS**

Experimental investigations into the use of e-menu cards in canteens typically focus on various aspects such as customer satisfaction, operational efficiency, and financial impact. These studies often employ a mix of quantitative and qualitative research methods to provide comprehensive insights.

One experimental approach involves setting up a controlled environment in a canteen where traditional paper menus are replaced with e-menu cards. Researchers then gather data on several key performance indicators (KPIs) such as order accuracy, customer wait times, sales volume, and customer satisfaction before and after the implementation of e-menu cards. Surveys and interviews with customers and staff can provide qualitative data on the perceived ease of use, satisfaction, and any challenges faced during the transition.

Another common method is to conduct a comparative study between two similar canteens, one using traditional menus and the other using e-menu cards. This allows for a direct comparison of metrics such as operational efficiency, cost savings, and customer engagement. For example, a study might measure the time taken to place and process orders in both settings, along with error rates in order fulfillment.

Additionally, experimental investigations can include usability testing of the e-menu card interfaces. This involves having users interact with the e-menu cards while researchers observe and record any usability issues, such as difficulties in navigation, responsiveness of the system, and overall user satisfaction. Eye-tracking technology can also be used to study how customers interact with the e-menu interface, identifying areas that draw attention and those that might need improvement.

Moreover, experimental research can assess the impact of e-menu cards on sales by analyzing data trends before and after their introduction. This includes monitoring changes in the average transaction value, the popularity of promoted items, and overall sales figures. Researchers can also examine the environmental impact by comparing the reduction in paper use and waste generated by traditional menus versus e-menu cards.

Overall, experimental investigations provide valuable data on the effectiveness and impact of e-menu cards in canteens, helping to identify best practices for their implementation and areas for further improvement.

**5 . IMPLEMENTATION**

**Code :**

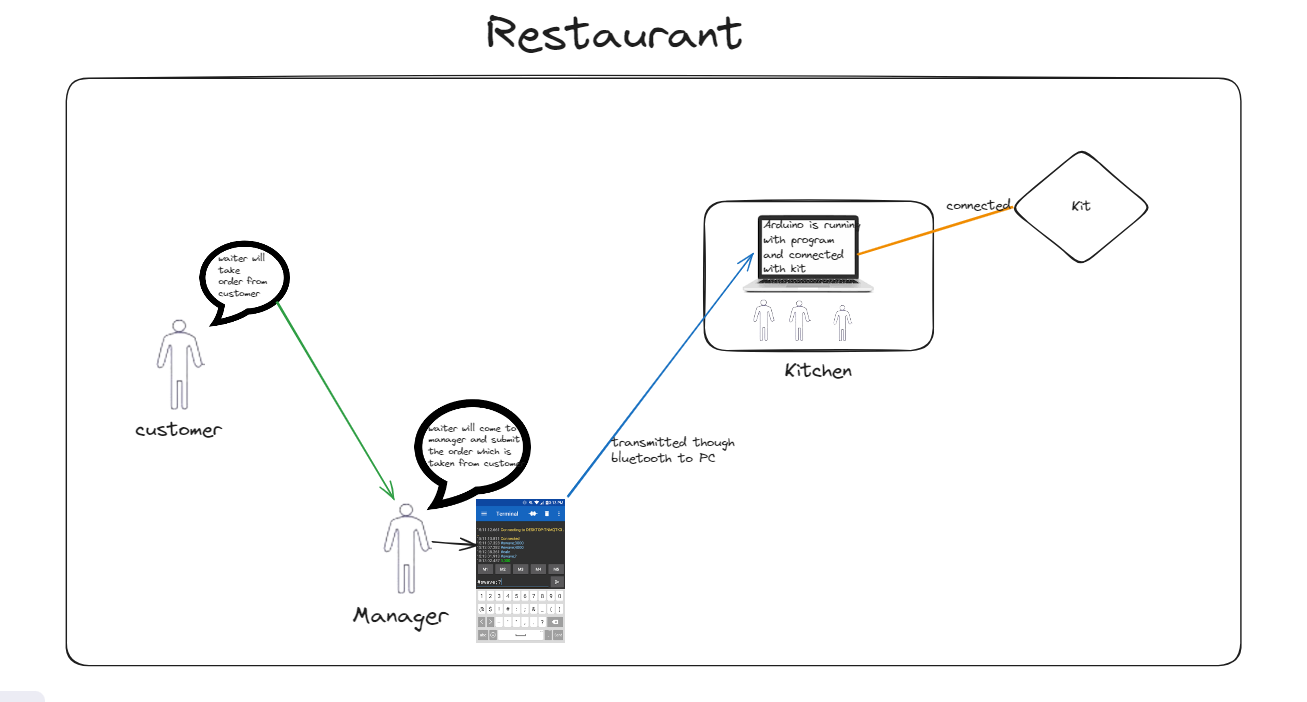
****

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**6. RESULTS**

**RESULT:**

Results from experimental investigations into the implementation of e-menu cards in canteens generally indicate several positive outcomes, although they also highlight some challenges. There is often a significant reduction in order processing time and customer wait times, as automation and digital displays streamline the ordering process, allowing staff to manage orders more quickly and accurately. This efficiency leads to quicker table turnover and enhanced overall service speed. Additionally, customer satisfaction tends to increase, with users appreciating the detailed descriptions, images, and customization options provided by e-menu cards. Customers value the additional information on ingredients, nutritional facts, and potential allergens, which helps them make more informed choices about their meals. Operationally, e-menu cards can be integrated with inventory management systems, allowing real-time tracking of stock levels and reducing in



**7. CONCLUSION**

CONCLUSION

In conclusion, the implementation of e-menu cards in canteens offers numerous benefits that significantly enhance both operational efficiency and customer satisfaction. The digitalization of menu displays streamlines order processing and reduces wait times, resulting in quicker service and higher table turnover. Customers appreciate the interactive features, detailed menu descriptions, and the ability to make more informed dining choices. Additionally, the integration of e-menu cards with inventory management systems leads to better stock control and cost savings through reduced paper use and printing expenses. Increased sales from effective upselling and customer engagement further highlight the advantages of this technology. However, the successful adoption of e-menu cards requires addressing challenges such as initial setup and maintenance costs, technical issues, staff training, and data security concerns. Despite these hurdles, the overall positive impact on efficiency, satisfaction, and sales makes e-menu cards a valuable innovation for modernizing canteen operations.

**8.REFERENCE**

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**9. APPENDICES**

APPENDICES

In the appendices of the canteen with e-menu card project report, detailed supplementary information is included to support the main findings and analysis presented in the main body of the report.

**Appendix A: Survey Questionnaire** contains the comprehensive set of survey questions used to collect data from both customers and staff regarding their experience with the e-menu cards. The questionnaire includes quantitative and qualitative questions aimed at assessing usability, satisfaction, and perceived benefits of the e-menu card system.

**Appendix B: Data Analysis** presents the results of the data collected, featuring tables, charts, and graphs that summarize the findings from the survey and experimental data. This section includes statistics on order processing times, customer satisfaction ratings, sales data before and after implementing e-menu cards, and other relevant metrics analyzed to evaluate the impact of the e-menu cards.

**Appendix C: Case Studies** includes detailed case studies of specific canteens or restaurants that have successfully implemented e-menu cards. Each case study provides in-depth information on challenges faced, solutions implemented, and outcomes achieved, offering practical examples of effective e-menu card utilization.

**Appendix D: Technical Specifications** provides detailed technical specifications of the e-menu card system used in the study. This section includes information on the hardware components (e.g., tablets, kiosks), software platforms (e.g., menu management software, integration with POS systems), and other technical details necessary for understanding the setup and operation of the e-menu cards.

**Appendix E: Additional Figures and Charts** includes supplementary figures and charts referenced in the main report but not included within the body of the text due to detail or volume. These visuals provide additional information and support to the main findings and analysis presented in the report.

**Appendix F: References** lists all references cited throughout the report, formatted according to the chosen citation style (e.g., APA, MLA). This section provides readers with a complete list of sources used to support the project's findings and conclusions.

**Appendix G: Glossary of Terms** defines and explains technical terms or jargon used throughout the report that may not be familiar to all readers, ensuring clarity and understanding.