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ENABLING ACCESSIBLE SHOPPING FOR VISUALLY IMPAIRED PEOPLE USING RFID AND IOT

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ABSTRACT

In this article, we propose an intelligent RFID(Radio Frequency Identification) checkout to facilitate access and payment, to assist visually impaired people and improve market strategy. To avoid saturated queues which we used to see in conventional remote identification of the customer and items is used to purchase later. RFID technology represents an alternative to automatic identification system and needs improvements to cost effectiveness, besides rather than wasting millions on various traditional advertising strategies. This technology stands out as an attractive and successful option for fighting stores to sell their products in the highly competitive way. In this system we use RFID reader and RFID tag to detect a particular product. The blind people identify the product and it's a cost with a help of voice module. The system database stores product and its cost. The data is send to the database with a help of raspberry pi and Internet of things (IoT).

Keywords: RFID, PIC16F877A, Raspberry Pi,IoT

I. INTRODUCTION

Advances in information and communication technology have led to the emergences of IoT. Here, we propose an intelligent RFID (Radio Frequency Identification) checkout to facilitate access and payment, to assist visually impaired people and to improve marketing strategy. To avoid saturated queues which we used to see in conventional stores remote identification of the customers and items is used to purchase the latter. Cost of the purchased items is then performed by online payment or by ATM or credit cards. In addition, to ensure high performance and smooth operation of this checkout, we thought of seven major criteria namely:

- Improving marketing strategy by displaying specific advertisement for each customer depending on the history of his previous purchases.
- Vocally assisting vocally the visually impaired people (Vocal Messages: welcome, total,confirmation...)
- Checking the validity of products during purchase process to avoid sales of expired unhealthy products
- Addition of product to press add button so that the customer can confirmhis identity and validate his purchase.

- Enabling the customer performing the transaction faster by automatic online payment and sending electronic invoice to his inbox.
- Offering to the owner the possibility to check and supervise the history of transactions via internet.
- Saving energy by activating the RFID reader only if a user enters or leaves.

Managing service checkouts have always been a matter of concern for ensuring quality customer service. Several attempts have made to design efficient automated systems to solve problems of queue lengths, waiting time, non-targeted advertisements and non-assisting of visually impaired people.To solve these problems and to add further enhancements to the complex difficulty met by conventional checkout we propose the idea of "Intelligent checkout using RFID".RFID technology represents an alternative to automatic identification systems and needs improvements to ensure cost effectiveness.Additional benefits can be reached by combining RFID with biometrics to prevent fraud and increase security of purchasing. Radio frequency identification (RFID) is a rapidly growing technology that has the potential to make great economic impacts on many industries.

Radio frequency identification (RFID) technology may not only be useful for streamlining inventory and supply chains: it could also make shoppers swarm.These advancements have the potential to revolutionize supply-chain management, inventory control, and logistics.In this system we use RFID reader and tag for the identification of the product. The IOT also proposed in this system to get the data in the webpage. There are several methods of identification, but the most common is to store a serial number that identifies a person or object, and perhaps other information, on a microchip that is attached to an antenna. The antenna enables the chip to transmit the identification information to a reader.

The reader converts the radio waves reflected from the RFID tag into digital information that is passed on to a computer store and analyze the data. Radio waves travel through most non-metallic materials, so they can be embedded in packaging or encased in protective plastic for weatherproofing and greater durability. And tags have microchips that can store a unique serial number for every product manufactured around the world.

II.ANALYSIS AND LITERATURE SURVEY

One of the RFID's most and attractive offerings is its fundamental attribute of not requiring line-of-sight when reading RFID tags. RFID scanners can communicate to tags in milliseconds and have the ability to scan multiple items simultaneously RFID promises to help automate the billing to unprecedented levels, leading to labour reduction throughout the counter. The reliability of RFID tags is an issue that could make or break their widespread success. RFID tags can be read at much greater distance; an RFID reader can pull information from a tag at distance up to 300 feet. RFID readers can interrogate; or read RFID tags much faster; read rates of forty or more tags per second are possible. Barcodes have no read/write capability; that is, you cannot add to the information written on a printed barcode. RFID tags, however, can be read/write devices; the RFID reader can communicate with the tag and alter as much of the information as the tag design allow. Line of sight requirements also limit the ruggedness of barcodes well as the reusability of barcodes. With the increasing prevalence and affordability of radio frequency identification (RFID) tags in everyday authentication system, RFID hold great promise in the retail world for both customers and stores in inventory control, convenience, and

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cost savings. The proposed solution is as shown in the Fig2.1. Our project utilized these RFID tags to automate the checkout process by building a system that could read the RFID signals of all the objects that would be placed in proximity to an antenna platform. This eliminated the need for barcode scanning of each individual item, making checkout significantly faster experience. The tags are very small in size and hence can be pasted on products.

TRANSMITTER:

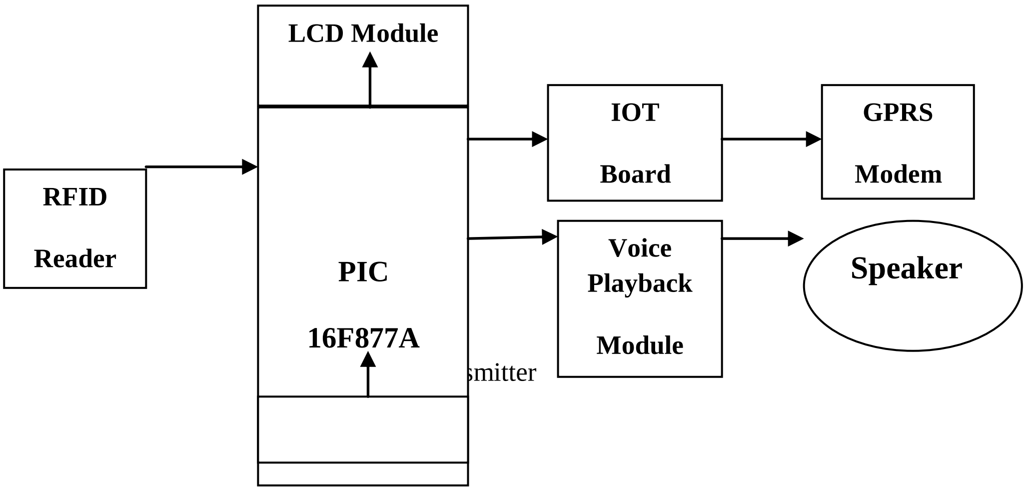

Fig.2.2 Proposed Solution

RECEIVER:

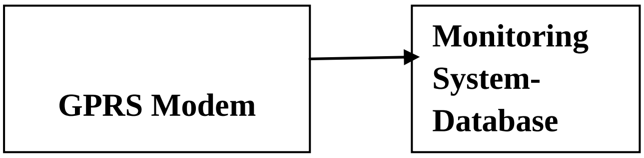

Fig.2.2 Receiver

III. COMPONENTS SPECIFICATION:

PIC16F877A Controller:

Fig.3.1 PIC16F877A

These devices feature a 14-bit wide code memory, and an improved 8 level deep call stack. The instruction set differs very little from the baseline devices, but the 2 additional opcode bits allow 128 registers and 2048 words of code to be directly addressed. There are a few additional miscellaneous instructions, and two additional 8-bit literal instructions, add and subtract. The mid-range core is available in the majority of devices labeled PIC12 and PIC16.

The first 32 bytes of the register space are allocated to special-purpose registers; the remaining 96 bytes are used for general-purpose RAM. If banked RAM is used, the high 16 registers (0x70–0x7F) are global, as are a few of the most important special-purpose registers, including the STATUS register which holds the RAM bank select bits. (The other global registers are FSR and INDF, the low 8 bits of the program counter PCL, the PC high preload register PCLATH, and the master interrupt control register INTCON.)

The PCLATH register supplies high-order instruction address bits when the 8 bits supplied by a write to the PCL register, or the 11 bits supplied by a GOTO or CALL instruction, is not sufficient to address the available ROM space.

IoT-Internet of Things:

RFID and near-field communication - In the 2000s, RFID was the dominant technology. Later, NFC became dominant (NFC). NFC has become common in smart phones during the early 2010s, with uses such as reading NFC tags or for **access** to public transportation. Optical tags and quick response codes - This is used for low cost tagging. Phone cameras decode QR code using image-processing techniques. In reality QR advertisement campaigns gives less turnout as users need to have another application to read QR codes.Bluetooth low energy - This is one of the latest technologies. All newly releasing smart phones have BLE hardware in them. Tags based on BLE can signal their presence at a power budget that enables them to operate for up to one year on a lithium coin cell battery.Low energy wireless IP networks - embedded radio in system-on-a-chip designs, lower power Wi-Fi, sub-GHz radio in an ISM band, oftenusing a compressed version ofIPv6 called 6LowPAN.

Zig-Bee –This communication technology is based on the IEEE 802.15.4 protocol to implement physical and MAC layer for low-rate wireless Private Area Networks. Some of its main characteristics like low power consumption, low data rate, low cost, and high message throughput make it an interesting IoT enabler technology.Z-Wave - is a communication protocol that is mostly used in smart home applications.LTE-Advanced - LTE-A is a high-speed communication specification for mobile networks. Compared to its original LTE, LTE-A has been improved to have extended coverage, higher throughput and lower latency. One important application of this technology is Vehicle-to-Vehicle (V2V) communications.WiFi-Direct - It is essentially WiFi for peer-to-peer communication without needing to have an access point. This feature attracts IoT applications to be built on top of WiFi-Direct to get benefit from the speed of WiFi while they experience lower latency.

Fig.3.2 IOT SIM900A

RFID Working:

RFID Reader:

Fig.3.3 RFID Reader and Tag

Radio-frequency identification is the is of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a rag attached to an object, for the purposes of automatic identification and tracking. Some tags require no battery and are powered by the electromagnetic fields used to read them. Other use is a local power source and emits radio waves (electromagnetic radiation at radio frequencies). The tag contains electronically stored information which can read from up to several meters away. A radio-frequency identification system uses tags, or labels attached to the objects to be identified. The Two-way radio transmitter-receivers called *interrogators* or *readers* send a signal to the tag and read its response. The readers generally transmit their observations to a computer system running RFID software or RFID middleware. A typical RFID system consists of 3 main parts: (i). A Reader or Transceiver (ii). An antenna (iii). A tag or transponder. A simple RFID system consists of a RFID reader and a RFID tag. And, inside of each sophisticated tags there then consists of a radio transmitter and radio receiver. This enables a RFID reader and a RFID tag communication each other through a specified radio frequency. There are 3 main roles a RFID reader plays other than signaling RFID tag to transmit desired information back to the RFID reader. Firstly, a RFID reader has the responsibility of keeping the RFID tags powered up. Secondly, a RFID reader demodulates incoming signals down enough so that the RFID reader is able to process the signals. Finally, after the incoming signals are slowed down, RFID then has the responsibility of deco ding the incoming signals into the words people can interpret. Both RFID reader and tag can be easily made into almost any desired shape and size. Because of the versatility, RFID system can almost fit into wherever needs to identify, track and manage objects.

RFID Tag:

A radio-frequency identification system uses *tags*, or *labels* attached to the objects to be identified. Two-way radio transmitter-receivers called *interrogators* or *readers* send a signal to the tag and read its response.RFID tags can be either passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A battery-assisted passive (BAP) has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. However, to operate a passive tag, it must be illuminated with a power level roughly a thousand times stronger than for signal transmission. That makes a difference in interference and in exposure to radiation.Tags may either be read-only, having a factory-assigned serial number that is used as a key into a database, or may be read/write, where object-specific data can be written into the tag by the system user. Field programmable tags may be write-once, read-multiple; "blank" tags may be written with an electronic product code by the user.

RFID tags contain at least two parts: an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, collecting DC power from the incident reader signal, and other specialized functions; and an antenna for receiving and transmitting the signal. The tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively.

An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information. Since tags have individual serial numbers, the RFID system design can discriminate among several tags that might be within the range of the RFID reader and read them simultaneously.

Voice play back module:

A **sound module** is an electronic musical instrument without a human-playable interface such as a keyboard. Sound modules have to be operated using an externally connected device, which is often a MIDI controller, of which the most common type is the musical keyboard (although wind controllers and guitar controllers are also used). Controllers are devices that provide the human-playable interface and may or may not produce sounds of its own, or a sequencer, which is computer hardware or software designed to play electronic musical instruments. Connections between sound modules, controllers, and sequencers are generally made with MIDI (Musical Instrument Digital Interface), which is a standardized protocol designed for this purpose.

Fig.3.4 Voice play back module

A sound module has the same advantages over a fully integrated instrument as does any system with a modularized design:

- Cost - a sound module is cheaper than a comparable instrument equipped with a controller
- Space - a sound module takes up less room than an instrument equipped with a controller
- Expandability - many sound modules can be expanded with sounds and memory
- Troubleshooting - if a sound module develops problems, just this one unit can be removed for repair or replacement, leaving the rest of a keyboard player's rigs the same.
- Obsolescence cycles — when it becomes obsolete, a sound module can be replaced without changing a favorite controller, or vice versa.

RASPBERRY PI:

While operating at 700 MHz by default, the first generation Raspberry Pi provided a real-world performance roughly equivalent to 0.041 GFLOPS. On the CPU level the performance is similar to a 300 MHz Pentium II of 1997–99. The GPU provides 1 Gpixel/s or 1.5 Gtexel/s of graphics processing or 24 GFLOPS of general purpose computing performance. The graphics capabilities of the Raspberry Pi are roughly equivalent to the level of performance of the Xbox of 2001.

The LINPACK single node compute benchmark results in a mean single precision performance of 0.065 GFLOPS and a mean double of 0.041 GFLOPS for one Raspberry Pi Model-B board.A cluster of 64 Raspberry Pi Model-B computers, labeled "Iridis-pi", achieved a LINPACK HPL suite result of 1.14 GFLOPS (n=10240) at 216 watts for c. US$4,000.Raspberry Pi 2 is based on Broadcom BCM2836 SoC, which includes a quad-core Cortex-A7 CPU running at 900 MHz and 1 GB RAM. It is described as 4–6 times more powerful than its predecessor. The GPU is identical to the original.

Over clocking:

The first generation Raspberry Pi chip operated at 700 MHz by default, and did not become hot enough to need a heat sink or special cooling unless the chip was over clocked. The second generation runs at 900 MHz by default; it also does not become hot enough to need a heat sink or special cooling, although over clocking may heat up the SoC more than usual.

Most Raspberry Pi chips could be over clocked to 800 MHz and some even higher to 1000 MHz. There are reports the second generation can be similarly over clocked, in extreme cases, even to 1500 MHz (discarding all safety features and over voltage limitations). In the Raspbian Linux distro the over clocking options on boot can be done by a software command running 'sudo raspi-config' without voiding the warranty.[28] In those cases the Pi automatically shuts the over clocking down in case the chip reaches 85 °C (185 °F), but it is possible to overrule automatic over voltage and overclocking settings (voiding the warranty). In that case, an appropriately sized heatsink is needed to keep the chip from heating up far above 85 °C.

Newer versions of the firmware contain the option to choose between five over clock ("turbo") presets that when turned on try to get the most performance out of the SoC without impairing the lifetime of the Pi. This is done by monitoring the core temperature of the chip, and the CPU load, and dynamically adjusting clock speeds and the core voltage. When the demand is low on the CPU, or it is running too hot, the performance is throttled, but if the CPU has much to do, and the chip's temperature is acceptable, performance is temporarily increased, with clock speeds of up to 1 GHz, depending on the individual board, and on which of the turbo settings is used. The seven settings are:

- none; 700 MHz ARM, 250 MHz core, 400 MHz SDRAM, 0 over volt,
- modest; 800 MHz ARM, 250 MHz core, 400 MHz SDRAM, 0 over volt,
- medium; 900 MHz ARM, 250 MHz core, 450 MHz SDRAM, 2 over volt,
- high; 950 MHz ARM, 250 MHz core, 450 MHz SDRAM, 6 over volt,
- turbo; 1000 MHz ARM, 500 MHz core, 600 MHz SDRAM, 6 over volt,
- Pi2; 1000 MHz ARM, 500 MHz core, 500 MHz SDRAM, 2 over volt,
- Pi3; 1100 MHz ARM, 550 MHz core, 500 MHz SDRAM, 6 over volt. In system information CPU speed will appear as 1200MHz. When in idle speed lowers to 600MHz.

In the highest (*turbo*) preset the SDRAM clock was originally 500 MHz, but this was later changed to 600 MHz because 500 MHz sometimes causes SD card corruption. Simultaneously in *high* mode the core clock speed was lowered from 450 to 250 MHz, and in *medium* mode from 333 to 250 MHz.The Raspberry Pi Zero runs at 1 GHz.

RAM:

On the older beta model B boards, 128 MB was allocated by default to the GPU, leaving 128 MB for the CPU. On the first 256 MB release model B (and model A), three different splits were possible. The default split was 192 MB (RAM for CPU), which should be sufficient for standalone 1080p video decoding, or for simple 3D, but probably not for both together. 224 MB was for Linux only, with only a 1080p framebuffer, and was likely to fail for any video or 3D. 128 MB was for heavy 3D, possibly also with video decoding (e.g. XBMC). Comparatively the Nokia 701 uses 128 MB for the Broadcom VideoCore IV. For the new model B with 512 MB RAM initially there were new standard memory split files released(arm256_start.elf, arm384_start.elf, arm496_start.elf) for 256 MB, 384 MB and 496 MB CPU RAM (and 256 MB, 128 MB and 16 MB video RAM). But a week or so later the RPF released a new version of start.elf that could read a new entry in config.txt (gpu_mem=xx) and could dynamically assign an amount of RAM (from 16 to 256 MB in

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8 MB steps) to the GPU, so the older method of memory splits became obsolete, and a single start.elf worked the same for 256 and 512 MB Raspberry Pis.The Raspberry Pi 2 and the Raspberry Pi 3 have 1 GB of RAM. The Raspberry PI Zero has 512 MB of RAM.

Networking:

Though the model A and A+ and Zero do not have an 8P8C ("RJ45") Ethernet port, they can be connected to a network using an external user-supplied USB Ethernet or Wi-Fi adapter. On the model B and B+ the Ethernet port is provided by a built-in USB Ethernet adapter. The Raspberry Pi 3 is equipped with 2.4 GHz WiFi 802.11n and Bluetooth 4.1 in addition to the 10/100 Ethernet port.The Raspberry Pi may be operated with any generic USB computer keyboard and mouse.

Fig.3.5 Raspberry pi-2 model B

IV.TESTING:

1) Every product has an RFID tag which contains a Unique ID.These ID's are fed in the database assigned to the corresponding products.

2) If there needs to be a purchase done, then that product can bedropped in the cart where the RFID reader reads the tag. Theinformation of the product is extracted and displayed on the LCD screen. At the same time billing information is also updated.

3) When a customer wants to purchase another product to press add button.There will beoptions on the LCD screen "ADD". Byselecting desired button one can add any product from the cart.

4) At the same time the billing information is updated. The totalamount of purchases is also displayed on screen

5) These steps are repeated until the end of shopping button orsend bill button is pressed. This generated bill is sent to billingside computer to get the computerized bill.

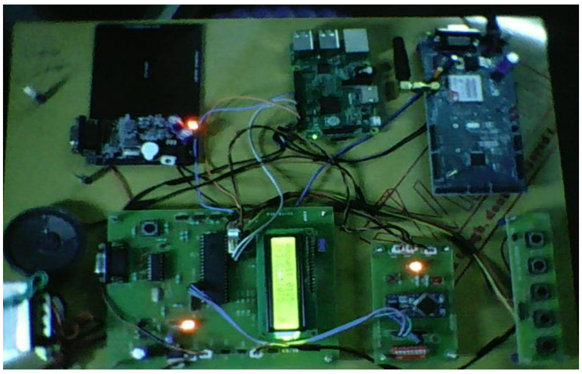
7) The customer can straight away pay the bill and leave.

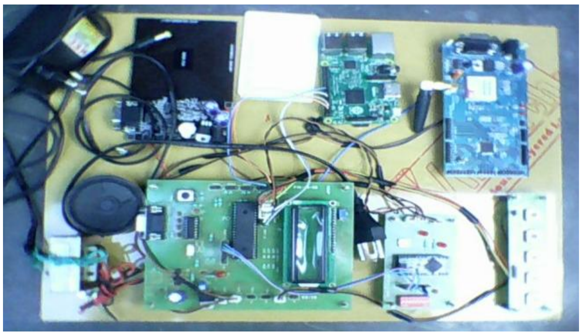
8) Inventory status of the products is also updated at the end ofshopping. Simultaneously the temporary data present in microcontroller is reset by pressing key.So that it can bereused.

V.CONCLUSION:

In this proposed system, we have proposed architecture for creating an easy accessible shopping for visually impaired people.Our system is based on the principle of RFID technology and IOT. The high performance of our approach can be judged from the features and advantages. We have also made many tests for success in evaluating and implementing the technology. The obtained results provided comparative overview of strengths and weaknesses of various scenarios which can be met in our system.

RESULT:





Thus the product information is extracted and displayed on the LCD screen. At the same time billing information is also updated. The total amount of purchases is also displayed on screen.

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