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Grocery Automated Booking System

Sujatha.R
Department Of Information Technology, Panimalar Institute Of Technology
Bangalore Trunk Road, Varadharajapuram, Poonamallee,
Chennai-600 123

Abstract*—Going to a grocery store and buying goods is a part of life. At present people don't have enough time to go and shop in a crowded super market. An alternate approach is to make things virtual with the help of GRocery Automated Booking System abbreviated as GRABS. Virtual super markets enable us to complete purchase of daily utilities right from the comfort of our home. Unlike a naive application, it gives us a virtual experience which would enable us to view the products with the help of a mini projector attached to stationary device which cover a particular range of space. The Interaction with GRABS is similar to Kinect, controlled by simple hand gestures. The user may select the items just the same way they do in reality and add them in cart and pay through online or COD (cash on delivery) and the items will be delivered on time. Similarly several such devices are to be located at various points within a flat system or over a residential area. The individual devices are made to work in harmony with each other through grid computing technology. It enables collecting information across various nodes of the grid and forwards them to the central server. The knowledge base present within the server aids in categorizing the data and handling requests from the client side. The usage of Radio Frequency Identification (RFID) can be used in monitoring the flow of grocery items at home and notifies, at times of shortage in supplies.

Keywords*—Grid computing; Kinect; Radio Frequency Identification

I. INRODUCTION

There is a drastic development in all the fields. But buying things from a store hasn't changed much. Though online shopping enables us to buy goods with the help of computers and mobiles they lack in providing reality. And shipment takes time to reach to reach the user. All the systems in a locality is connected so there is a heavy data flow, if any system is idle the CPU cycles are wasted. This can be avoided by connecting all the systems in a residential area through grid computing.

GRABS is software which allows you to purchase goods right from home. The device gives user a virtual experience of buying goods through kinect. The output of kinect is fed to a projector, which acts as a display to the user. The user interacts with the display provided by the projector. The kinect senses the motion of the user and performs accordingly. The action of the user is analyzed and corresponding function is performed. The user may walk around the virtual store with the help of kinect, may click on products, view them, add them to cart, view how to use the products by means of mini-clippings finally, pay and exit. The flow of items at home is monitored by means of RFID and if quantity of an item reaches its critical level it informs user during the purchase

II. SYSTEM ARCHITECTURE

The entire system comprises of components such as,

Subsystem	Functions
GRID	The systems in the area connect by means of GRID
Kinect for windows: ➢ 3-D depth sensors ➢ RGB camera ➢ Multiple microphones ➢ Motorized tilt	Sense location and movements of people and their voices Track the body within a range of space Identifies the human Used for Speech recognition Mechanical drive tilts sensor up and down
HDMI Projector	Creates a visual and projects over any surface
RFID	Detects the flow of goods and alerts

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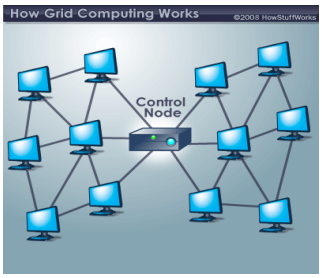
Grabs consists of Kinect for Windows sensor which is a physical device with depth sensing technology, a built-in color camera, an infrared (IR) emitter, and a microphone array. And a HDMI projector is used to display the output from kinect. The software is written in c++ and .Net with XNA Game Studio 4.0 that allows using visual studio 2010 to create virtual supermarkets where the user may walk around and select objects and add them to cart virtually. All the products in the store contain recyclable RFID tags. These tags consist of antenna bonded to a silicon chip and encapsulated inside a plastic module. These RFID tags can be tracked by reader which uses radio frequency waves to communicate with the tag. Transponders play a critical role in wireless identification, recording and providing data quickly and accurately. RFID-enabled systems optimize industrial processes, improve accuracy and increase productivity.

These components together form GRABS which is linked with to a network by means of grid computing. All the buildings containing GRABS with in a locality can process the request by means of grid. Since there is a large flow of data grid computing is preferred.

III. WORKING OF SUBSYSTEMS

A. *Grid Computing*

Grid computing is the collection of computer resources from multiple locations to reach a common goal that is a server. The grid can be thought of as a distributed system with non-interactive workloads that involve a large number of files. We use grid computing in connecting all the systems within a locality or residential area. All nodes lead to the server present in the supermarket where requests are handled.



One of the main strategies of grid computing is to use middleware to divide and apportion pieces of a program among several computers, sometimes up to many thousands. CPU-scavenging, cycle-scavenging, or shared computing from the unused resources in a network of participants is efficiently used in Grid. The technique of using computer instruction cycles which would be wasted at night, during lunch, or even in the scattered seconds throughout the day is saved. We save these CPU cycles for future use, because people don't buy groceries every day. Hence Grid computing is used in employing GRABS. Grid computing is used so that the resources on a network are shared equally.

All the residents in a locality are connected by means of Grid computing. The request from GRABS is processed using Grid where resources are applied from many computers in a network at the same time i.e., several customers' may place order at the same time in a network using GRABS. In case of scientific or technical problems which requires a great number of processing cycles or access large amount of data Grid computing is used. In this technique idle systems in a network and their wasted CPU cycles can be efficiently used by uniting pools of servers, storage systems and networks into a large virtual system for resource sharing dynamically at runtime.

To use Grid computing certain procedures are to be followed, such as security, resource management, data management, fault detection, portability. Security may be provided through authorization, authentication, and secure data transfer. Resource management helps in submission of remote jobs. Therefore data management and movement are made secure and robust. Grid provides authorization of every remote system on a network so the data in the grid is safe and secure.

B. *Kinect For Windows*

Kinect sensor[] is a horizontal bar connected to a small base with a motorized pivot and is designed to be positioned lengthwise above or below the video display. The device features an RGB camera, depth sensor and multi-array microphone running proprietary software, which provide full-body 3D motion capture, facial and voice recognition capabilities.

The kinect for windows consists of a RGB camera that stores three channel data in a 1280x960 resolution. This makes capturing a color image possible. An infrared (IR) emitter emits infrared light beams and the IR depth sensor reads the IR beams reflected back to the sensor. The reflected beams are converted into depth information measuring the distance between an object and the sensor. This makes capturing a depth image possible. A multi-array microphone contains four microphones for capturing sound. Because there are four microphones, it is possible to record audio as well as finds the location of the sound source and the

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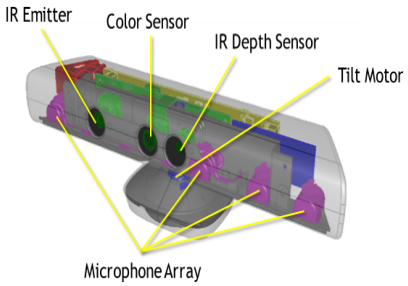
direction of the audio wave. A 3-axis accelerometer configured for a 2G range, where G is the acceleration due to gravity. It is possible to use the accelerometer to determine the current orientation of the Kinect.



This is connected to a remote system may be a PC at home, through which kinect can be operated. The visual from the desktop is projected over a wall or kind of surface and interaction is done with the surface by means of kinect. The software is written in c++ and .Net by means of Microsoft XNA Game Studio 4.0, (a recursive acronym for XNA's Not Acronymed) is a freeware set of tools with a managed runtime environment provided by Microsoft that facilitates video game development and management. The kinect plays a major component in GRABS, it tracks the gestures of the user within a specific range and reads their gesture using 3D camera. Kinect provides a virtual environment with which user interacts. The projector displays the software and interaction made by human with the screen is read by kinect. The software is developed in a game studio hence the user may have a livelier interaction.

C. HDMI Projector

The LCD projector and the user's system are connected by means of a HDMI cable. LCD stands for Liquid Crystal Display.

Kinect	Array Specifications
Viewing angle	43° vertical by 57° horizontal field of view
Vertical tilt range	±27°
Frame rate (depth and color stream)	30 frames per second (FPS)
Audio format	16-kHz, 24-bit mono pulse code modulation (PCM)
Audio input characteristics	A four-microphone array with 24-bit analog-to-digital converter (ADC) and Kinect-resident signal processing including acoustic echo cancellation and noise suppression
Accelerometer characteristics	A 2G/4G/8G accelerometer configured for the 2G range, with a 1° accuracy upper limit.

A projector is used to display the software because user may need a wider and bigger display to interact with. We may display the output to a wall, so user may interact with the visuals displayed by the projector. Kinect receives information in the form of gestures. Remote System screens are not big enough to display the software and they can't provide reality. But projectors will provide the user with a better display and an improved virtual reality.

HDMI (High-Definition Multimedia Interface) is a proprietary audio/video interface for transferring uncompressed video data and compressed or uncompressed digital audio data from an HDMI-compliant source device, such as a display controller.

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The HDMI specification defines the protocols, signals, electrical interfaces and mechanical requirements of the standard. The maximum pixel clock rate for HDMI 1.0 was 165 MHz, which was sufficient to allow 1080p and WUXGA (1920×1200) at 60 Hz. HDMI 1.3 increased that to 340 MHz, which allows for higher resolution (such as WQXGA, 2560×1600) across a single digital link. An HDMI connection can either be single-link (type A/C/D) or dual-link (type B) and can have a video pixel rate of 25 MHz to 340 MHz (for a single-link connection) or 25 MHz to 680 MHz (for a dual-link connection). Video formats with rates below 25 MHz (e.g., 13.5 MHz for 480i/NTSC) are transmitted using a pixel-repetition scheme.

D. RFID

Radio-frequency identification (RFID) is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by electromagnetic induction from magnetic fields produced near the reader. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response.

We use passive RFID tags which are chipless so that they are not powered using battery and also costs low at the same time.. The flow of the products can be monitored via RFID. Each product has a recyclable RFID associated with it. These RFIDs costs less, and placed along the side of the barcodes. The passive tags are attached to the packets of the product. When the user makes a purchase the list of items selected is stored for future purchases. Each grocery has its unique tag. If the user purchases a product in great quantity, then the number of items of the same product is also stored.

When the goods are delivered, they come within the range. And the RFID checks whether all the products ordered have been delivered or not. If not it intimates the user regarding the missing product. Once the items enter the range, the RFID reader notes the number of items to sense the flow of goods. On complete use of the product, the packets are sent to recycle. So the tag associated with the product goes out of range. When RFID reader sends radio frequency wave it recognizes that the tag is out of range and updates the software. The software intimates the user regarding the purchase of the product which has gone out of stock

IV. WORKNG OF THE SOFTWARE

Using GRABS (Grocery Automated Booking System) groceries can be booked from the comfort of our home. The projector and kinect is connected to a remote device. The user may interact with the software by means of gestures. This gesture made by means of hand is captured through a RGB camera which identifies the presence of human. This interaction is possible only within a certain range of space; the range is monitored by means of 3D depth sensors. If the user moves out of range it will automatically intimate the user to come within the range. The multi-array microphones also provide voice recognition. The user may operate the software by means of voice also. The kinect has a motorized tilt which adjusts according to the position of the user, it may move up and down.

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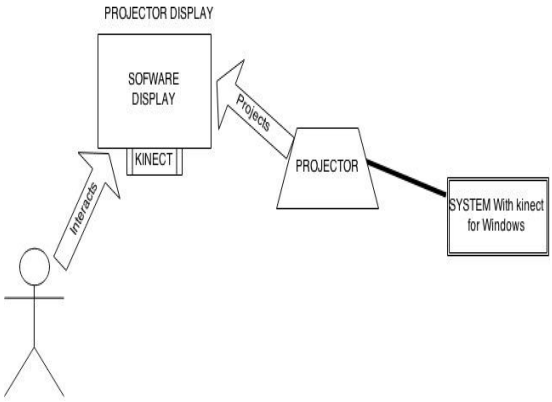
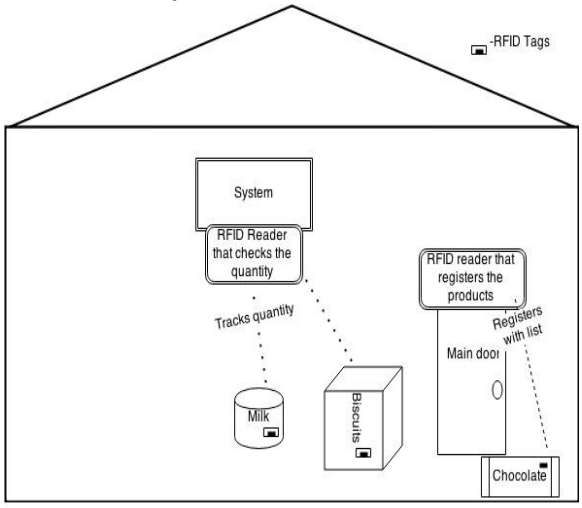
GRABS



The user may have a virtual walk around the supermarket for the purchase of products. The software for GRABS is developed by means of c++ and .Net with XNA Game studio 4.0 using visual studio express 2010, which is commonly used for game developments. The software developed resembles a game where user virtually interacts with the products by means of kinect. The user may click on products, view them, add them to cart, remove items from cart and also view how to use the products by means of mini-clippings. After adding all the items to the cart the user may finally confirm the order and pay either by means of COD or by online payment. While purchasing the products the user will be notified about the flow of goods at home by means of RFID. If any of the products has gone out of stock, the RFID immediately intimates about the product. So it may be added on cart by the user. The software also has a list of previous purchases made, so it can help the user in picking up regular goods and notifies when he tries to buy a product which is already in excess from virtual store.



Once the products are delivered, the RFID reader identifies the tags which arrived newly and checks them with the order made by the user. If any product in the order is not delivered, it immediately intimates the user through a pop up in the system. So the user may simply check their systems once their order is delivered. As the goods come in range for RFID reader it reads all the items with different quantities. The packets of the product contain a RFID tag and these tags are recyclable. If the same item is purchased in more quantity, the number of same products bought is maintained by the RFID reader. On consuming the product, the packet is sent to recycle, so the tag goes out of range. Once the tag goes out of range, the RFID reader identifies the lost tag's product and updates the user in their next purchase regarding the flow of goods.

This saves the time of the user in great extent. Because the user need not make a list before beginning the purchase and also it is not necessary to remember about the quantities to be purchase because of RFID. The user purchases items from home and need not carry heavy goods from store either. Hence it saves time right from the start and also provides a real buying experience. Thus RFID can manage the flow of goods at a place with the help of GRABS. After the order is placed the request is send to the server. We use Grid computing in processing the requests because we operate on resources that are more likely to be common. The request is sent to the server by means of LAN. The server denotes the system used in the Supermarkets. The supervisor may

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deal with the orders made online and pack the goods and send them accordingly. Since the systems in a locality are connected to a local supermarket the delivery of goods will be right in time. Hence it also reduces the time in delivery of goods.

V. CONCLUSION

Grid computing is an emerging technology that will have a major impact on productivity and cost improvements at the enterprise level. It exploits un-utilized or under-utilized power of all computing resources within a network environment – including desktop PCs. Using GRABS reduces the effort of user tremendously. The entire system is a small step to the future technology where all the work is done right from home. This system allows user to not only purchase groceries but also intimates user regarding the flow of goods. Unlike a normal application it provides a virtual departmental store in front of the user. The user may walk around the store by making simple gestures as walking look at the products and add them in cart as the same they would do in a real super market; this facility is provided by kinect. The XNA Game studio 4.0 software is used for gaming, but we use this to build a 3D supermarket so it allows the user to interact virtually with the objects present on screen. RFID reduces the difficulties of user by making them remember what they need through small notifications while using the software.

The entire list of items is verified by user and then submitted to the server by means of Grid computing. Grid is used because it enables us to download files very fast. Security isn't matter because each step has its authentication in Grid. Implementation of Grid in case of similar resources is easy and efficient. But integration over heterogeneous resources to accommodate variety of applications is an obstacle in Grid. It is cost efficient and delivers actual results, by enhancing collaboration and sharing of resources.

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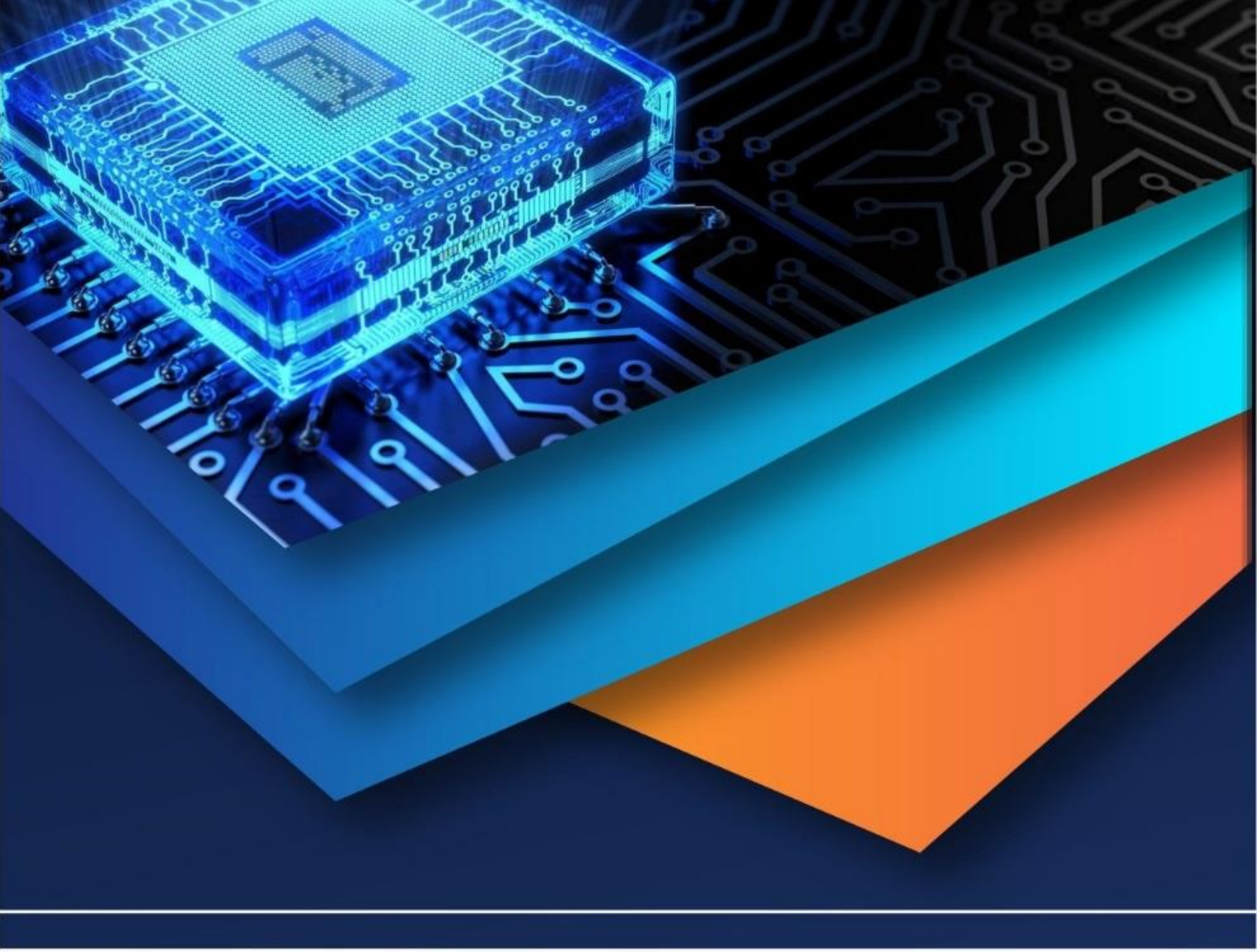

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