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IoT Based Vending Machine with Cashless Payment

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Abstract - *A vending machine is an automated machine that provides items such as snacks and lottery tickets to consumers after money, a credit card or specially designed card is inserted into the machine. This concept can be implemented using cashless payment. Even after reaching the spot the process takes additional time for locating, and billing process. Another disadvantage of the current system involves money which has several problems. A user always has to carry money with him which is not a good option in today's era as every money transfer takes place in the form of digital transaction. Also, there is a possibility in the theft of money. We hereby present a solution where the payment part is bypassed to the online sources. Here we are solving an intricate problem with a simple algorithm providing an interface to the user that even a layman can easily understand.*

Key Words: IoT, Automation

1. INTRODUCTION

Mobile phones have becomes an integral part of people's lives. They are not only used for communication via short messaging services, calls, emails, and internet but advanced applications such as remote health monitoring systems and security systems have been integrated with mobile phones.

The recent years have seen rapid advancements in the value addition applications in mobile phones such as high definition cameras and high speed internet connectivity. The country has also experienced developments in the infrastructures to support the rising need of faster internet connectivity.

Despite the advantages enjoyed by these advancements in mobile technology, there has been auxiliary effort to implement this into the field of shopping. Paper money and coins are a huge threat to the environment. Large number of trees are cut down annually for currency printing purpose, also large amount of metal is required to make coins. Deforestation is the one main factor affecting environment and this has to be reduced in the future decades. Digitalization provides a proper solution for this problem where need for physical medium is eliminated. Transferring the currencies are another difficult factor which is solved by digitalization. With rapid development of semiconductors allowing electronic components to be miniaturized encompassing a large no. of transistors in a given space , developments in recent networking technology archit andectures the development of light weight based server applications has led us to come up with a solution that is both facile and elegant , which enables consumer to purchase the products they need through his mobile and he can obtain the product from a vending machine that will identify the user and the product he has paid. This will bypass the human intervention and delay related to the purchase of product.

1.1 MAIN OBJECTIVES

The main objective of this project is to build an online payment incorporated vending machine that will dispatch product. The customer has to perform payment of the given product. Once the payment is completed he can receive the corresponding product from the vending machine which will be installed in each sections of the building.

2. PROPOSED SYSTEM

A website is designed for the interface. The admin logs into his account and he will enter that details regarding the products available in the machine. Along with that he can also choose the count for it. Then the customer can choose the product of his interest [2]. When he enters he can see the list of available products. In both cases after that the user can move on to the payment section. Online payment can be done using Razorpay. Now a unique number code will be displayed on the screen. Now user can go towards the vending machine and just enter this specific code in the keypad. Immediately the machine runs and the corresponding products are provided to the user. Here the admin can log into his account and modify the product details.

3. SYSTEM REQUIREMENTS

3.1 SOFTWARE REQUIREMENTS

Software components are selected in such a way that the use of that specific software may produce efficient output. Software requirements may be the prerequisite that is needed to be installed on the system for the proposed system to work smoothly. Else it can be the supporting libraries needed for the project to work.

3.1.1 Php

PHP is a server-side scripting language designed for web development but also used as a general purpose programming language. PHP code may be embedded into HTML code, or it can be used in combination with various web template systems, web content management systems, and web frameworks. PHP code is usually been processed by a PHP interpreter implemented as a module in the web server or as a Common Gateway Interface (CGI) executable. The web server combines the results of the interpreted and executed PHP code, which may be any type of data, which also including images, with the generated web page.

It can also be used for command-line scripting and client-side graphical user interface applications. PHP can be deployed on most web servers, many operating systems and platforms, and can be used with many relational database management systems. Most web hosting providers support PHP for use by their clients. It is available free of charge, and the PHP Group provides the complete source code for users to build, customize and extend for their own use.

PHP acts primarily as a filter, taking input from a file or stream containing text and/or PHP instructions and outputting another stream of data. Most commonly the output will be HTML, although it could be JSON, XML or binary data such as image or audio formats. Since PHP 4, the PHP parser compiles input to produce bytecode for processing by the Zend Engine, giving improved performance over its interpreter predecessor.

3.1.2 MySQL

MySQL is free and open-source software that keeping under the terms of the GNU (General Public License), and is also available under a variety of proprietary licenses[4]. MySQL was owned and sponsored by the Swedish company MySQL AB, which was bought by Sun Microsystems (now Oracle Corporation). In 2010, when Oracle acquired Sun, Widenius forked the open-source MySQL project to create MariaDB. MySQL is a component of the LAMP web application software stack which is an acronym for Linux, Apache, MySQL, Perl/PHP/Python. MySQL is used by many database-driven web applications, including Drupal, Joomla, phpBB, and WordPress. MySQL is also used by many popular websites, including Facebook, Twitter, Flickr, and YouTube.

3.1.3 Arduino

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License or the GNU General Public License, permitting the manufacture of Arduino boards and software

distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself kits.

3.1.4 MATLAB

MATLAB is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, C, Java, Fortran and Python.

Although MATLAB is intended primarily for numerical computing, an optional toolbox uses the MuPAD symbolic engine, allowing access to symbolic computing abilities. An additional package, Simulink, adds graphical multi-domain simulation and model-based design for dynamic and embedded systems.

3.2 HARDWARE REQUIREMENT

The set of hardware components needed for the proposed system to work is known as hardware requirements. Most software defines two sets of system requirements: minimum and recommended. With increasing demand for higher processing power and resources in newer versions of software, system requirements tend to increase over time. Industry analysts suggest that this trend plays a bigger part in driving upgrades to existing computer systems than technological advancements. A second meaning of the term of System requirements, is a generalisation of this first definition, giving the requirements to be met in the design of a system or sub-system. Usually the hardware components are selected in a fashion which is cost effective and efficient at the same time.

3.2.1 ESPNODEMCU

NodeMCU is an open source IoT platform [Parul, 2016]. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term 'NodeMCU' by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266.

It uses many open source projects, such as lua-cjson, and spiffs.

Figure 3.1: ESPNODEMCU 12 E

3.2.2 LCD Display

Liquid Crystal Display (LCD) is a flat display used in digital watches, cameras and many portable computers. LCD displays utilize two sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. Each crystal, therefore, is like a shutter, either allowing light to pass through or blocking the light. LCD's consume

much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it.LCD's are used in flat screen TV's,smartphones, computer monitors,digital watches,etc.

For example,take LCD 16x2 which means it can display 16 characters per line and there are 2 such lines. All these LCD's performs the same functions such as display characters, numbers, special characters ASCII characters etc.Hence their programming is also the same since they all comes with same 14 pins (0-13) or 16 pins (0 to 15).

Figure 3.2: 16X2 LCD Display

3.2.3 Matrix Keypad

Matrix keypad use a combination of four rows and four columns to provide button states to the host device, typically a microcontroller. Underneath each key is a push button, with one end connected to one row, and the other end connected to one column. This 16-button keypad provides a useful human interface component for microcontroller projects. Convenient adhesive backing provides a simple way to mount the keypad in a variety of applications. In the matrix keypad, the first 4 pins are for rows and next 4 pins are for columns. The user can connect the keypad to any digital pin of Arduino Uno.

Specifications

- Maximum Rating: 24 VDC, 30 mA
- Interface: 8-pin access to 4x3 matrix
- Operating temperature: 32 to 122 F(0 to 50 C)
- Dimensions:Keypad, 2.7 x 3.0 in (6.9 x 7.6 cm),Cable: 0.78 x 3.5 in (2.0 x 8.8 cm)

Figure 3.3: 4X4 Matrix Keypad

3.2.4 Servo Motors

Servo motors have three wires: power, ground, and signal. The power wire is typically red, and should be connected to the 5V pin on the Arduino board. The ground wire is typically black or brown and should be connected to a ground pin on the Arduino board. The signal pin is typically yellow, orange or white and should be connected to a digital pin on the Arduino board. Note that servos draw considerable power, so if you need to drive more than one or two, you'll probably need to power them from a separate supply (i.e. not the +5V pin on your Arduino). Be sure to connect the grounds of the Arduino and external power supply together. This library allows an Arduino board to control RC (hobby) servo motors.

Figure 3.4: Servo Motor

4. SYSTEM DESIGN

Systems design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. This is the phase in which the details of the system selected in the study phase is designed. Software design is the preliminary step and is also building block of software engineering. The efficiency software is promoted through design phase. The design phase begins when the requirement specification

document for the software to be developed is available. Design is the first step to moving from the problem domain to the solution domain. Design is essentially the bridge between requirement specification and the final solution for satisfying the requirements.

4.1 INPUT DESIGN

It is the part of the overall system design. The input methods can be broadly classified into batch and online. Internal control must be established for monitoring number of input and for ensuring that the data is valid. The basic steps involved in the system design are:

- Review input requirement.
- Decide how the input data flow will be maintained.
- Design the source document.
- Prototype online input screens.

The quality of the system input determines the quality of the system output. Input specification describes the manner in which data enter the system for processing.

Input design features can ensure the reliability of the system and produce results from the accurate data, or they can result in production the input design also determines whether the user can interact efficiently with the system.

Input design is the process of converting a user oriented description to a computer based system. Input design is designed on estimating what the inputs are and how often they are to be arranged on the input screen, how frequently the data are to be collected etc. The input in this project is taken from the keypad and is fed into the arduino board.

4.2 MODULE DESIGN

The major modules in this project are listed as follows.

4.2.1 User

Users need to login or register via the web application. The users are provided with a code which contains information about the purchase details of the product which he can provide to the system via keypad. The user is provided with these provisions:

- Change product count to suit his purchase
- Navigation system for finding nearest vending machine
- Make payment through various means
- Know the count of product in a particular vending machine

4.2.2 Data Acquisition and Processing

User has the provision to change the count of products to suit his wallet and can make payment accordingly, after the payment the user is provided with a unique code which the user can provide as an input to a vending machine for dispatching product, after the unique code is entered it is received by arduino board,the entered code is sent as a query to server to know its authenticity, if the code is present in the database a flag value indicating truth of the value is returned to the arduino board via nodemcu which connect arduino board to server, if the flag value is true the corresponding code is divided with a series of prime numbers to find which

product is to be dispatched. In case of emergency where the user cannot consult doctor immediately a interface has been provided where user can enter symptoms and the interface predicts what type of disease has affected the user and also give suggestions on what product the user should take.

4.3 OUTPUT DESIGN

It is the part of overall system design. The goal of the output design is to capture the input and get the product as expected by the user. Data flow diagram identifies the data tone captured and the output to the system. Output is the information delivered to the users through the information system. Without quality output the entire system appears to be unnecessary that users will avoid using it. Users generally merit the system solely by its output in order to create the most useful output possible. One works closely with the user through an interactive process until the result is considered to be satisfactory. The output of the system depends on the authenticity of input code and the output is product prescribed to the user.

4.4.1 User

User DFD specifies how user interacts with the system. The Figure 4.1 shows the user data flow diagram.

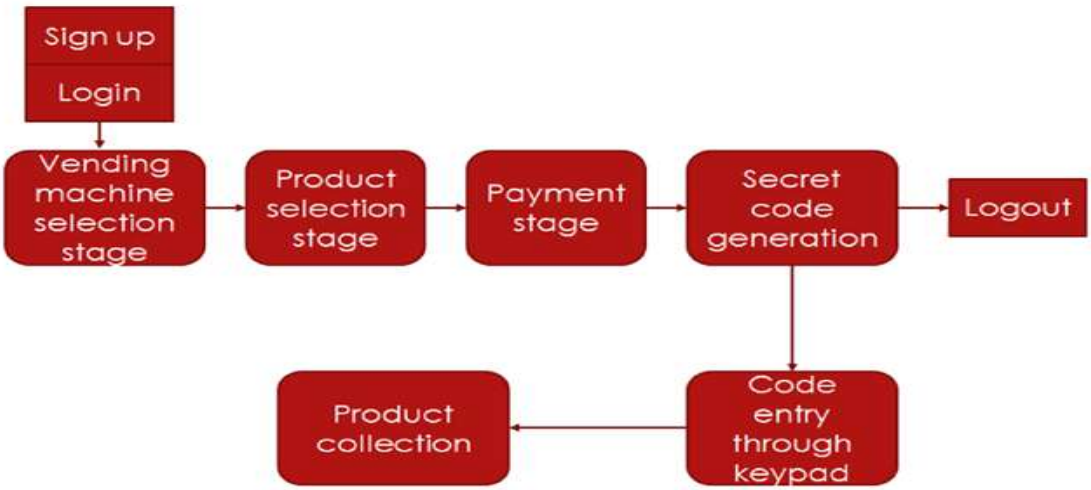

Figure 4.1: User DFD

4.4.2 Admin

Figure 4.2

The Figure 4.2 shows the admin DFD which specifies the interface of admin.

5. IMPLEMENTATION

Implementation comprises of detailed modular design of the system, how various functions work, their core algorithm. Detailed design of a project deals with the entire functionality it handles. A well-defined detailed

description includes major functional components in that application along with sub modules included and table handled. It shows actual data flow within the system and how each function handles the data. In computer science, an implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through computer programming and deployment. Many implementations may exist for a given specification or standard. In an information technology context, software or hardware implementation encompasses all the post-sale processes involved in something operating properly in its environment, including analysing requirements, installation, configuration, customization, running, testing, systems integrations, user training, delivery and making necessary changes. The word 'deployment' is sometimes used to mean the same thing.

For an implementation process to be successful, many tasks between different departments need to be accomplished in sequence. Companies strive to use proven methodologies and enlist professional help to guide them through the implementation of a system but the failure of many implementation processes often stems from the lack of accurate planning in the beginning stages of the project due to inadequate resources or unforeseen problems that arise. Software/hardware implementations should always be designed with the end user in mind and the implementation process usually benefits from user involvement and support from managers and other top executives in the company. If users participate in the design and implementation of the system, ideally it will serve their business objectives more accurately and reflect their priorities and the ways in which they prefer to work. Software/hardware implementations should always be designed with the end user in mind and the implementation process usually benefits from user involvement. Their involvement in the process also makes them more receptive to changes that need to be implemented because they have first hand experience of what the system comprises.

5.1 WEB INTERFACE

User Sign Up/Log In and choose the vending machine followed by the selection of products. Interface created by html, Java script, CSS in the front end and PHP in the back end.JavaScript often abbreviated as JS, is a high-level, interpreted programming language that conforms to the ECMAScript specification. JavaScript has curly-bracket syntax, dynamic typing, prototype-based object-orientation, and first-class functions.

Alongside HTML and CSS, JavaScript is one of the core technologies of the World Wide Web.JavaScript enables interactive web pages and is an essential part of web applications. The vast majority of websites use it, and major web browsers have a dedicated JavaScript engine to execute it.

As a multi-paradigm language, JavaScript supports event-driven, functional, and imperative programming styles. It has APIs for working with text, arrays, dates, regular expressions, and the DOM, but the language itself does not include any I/O, such as networking, storage, or graphics facilities. It relies upon the host environment in which it is embedded to provide these features.

Initially only implemented client-side in web browsers, JavaScript engines are now embedded in many other types of host software, including server-side in web servers and databases, and in non-web programs such as word processors and PDF software, and in runtime environments that make JavaScript available for writing mobile and desktop applications, including desktop widgets.

The terms Vanilla JavaScript and Vanilla JS refer to JavaScript not extended by any frameworks or additional libraries. Scripts written in Vanilla JS are plain JavaScript code.

Although there are similarities between JavaScript and Java, including language name, syntax, and respective standard libraries, the two languages are distinct and differ greatly in design. JavaScript was influenced by programming languages such as Self and Scheme.JavaScript supports much of the structured programming syntax from C. One partial exception is scoping: JavaScript originally had only function scoping with var. ECMAScript added keywords let and consist for block scoping, meaning JavaScript now has both function and block scoping. Like C, JavaScript makes a distinction between expressions and statements. One syntactic

difference from C is automatic semicolon insertion, which allows the semicolons that would normally terminate statements to be omitted.

Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language like HTML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.CSS is designed to enable the separation of presentation and content, including layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple web pages to share formatting by specifying the relevant CSS in a separate .css file, and reduce complexity and repetition in the structural content.Separation of formatting and content also makes it feasible to present the same markup page in different styles for different rendering methods, such as on-screen, in print, by voice, and on Braille-based tactile devices. CSS also has rules for alternate formatting if the content is accessed on a mobile device.The name cascading comes from the specified priority scheme to determine which style rule applies if more than one rule matches a particular element. This cascading priority scheme is predictable.

The CSS specifications are maintained by the World Wide Web Consortium. Internet media type (MIME type) text css is registered for use with CSS by RFC.The W3C operates a free CSS validation service for CSS documents.In addition toHTML, other markup languages support the use of CSS including XHTML, plain XML, SVG, and XUL.

User redirected to payment section. .The payment is performed using Razorpay payment gateway, which was chosen based on a very interactive test mode provided Razorpay provides an excellent test mode facility, powerful mobile SDKs are provided for both Android and iOS. Razorpay is a payments company that provides payment solutions to online merchants in India. Razorpay is headquartered in Bangalore, India. Razorpay allows online businesses to accept, process and disburse digital payments through several payment modes like debit cards, credit cards, net banking, UPI and prepaid digital wallets. Razorpay payment solutions can be integrated by both web and mobile applications. Razorpay has collaborated with Indian Railway Catering and Tourism Corporation to help customers make online payments on latter's website and mobile app through UPI.

After successful payment based on the following algorithm unique code generated. Algorithm developed: Each column in a vending machine are represented as a matrix and each unique column is identified using a prime number as the base, so for corresponding purchases the algorithm will help in identifying product purchased. The power of every prime number is only divisible by the same prime number. On each purchase of unique product from box, the corresponding base is squared and this number is decoded and provided to the user as product key

Figure 5.1 : Login Page

Figure 5.2 : Vending Machine Selection

Figure 5.3 : Product Selection

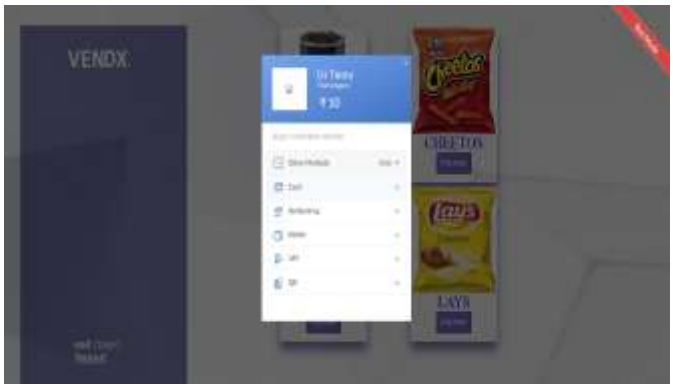

Figure 5.4 : Payment via Razorpay

Figure 5.5 : Product Key Generation

5.2 DATA PROCESSING

We provide the unique identification code which we got after payment of product as input to vending machine. The unique code is updated in the database. The user enters the code in the keypad of the vending machine. Arduino Mega (Microcontroller board) connected to it will decode the code. With the help of NodeMCU (An open source IOT platform) attached arduino mega checks the database to verify the data. Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License or the GNU General Public License, permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards or breadboards and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus on some models, which are also used for loading programs from personal computers.

The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment based on the Processing language project. This Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors. The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name Arduino to be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in -duino Most Arduino boards consist of an Atmel 8-bit AVR microcontroller with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an IC serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the LilyPad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions.

Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic level signals. Current Arduino boards are programmed via Universal Serial Bus, implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE,

standard AVR in-system programming is used. This Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1- inch headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and Boarduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility.

If product key entered is identified as true value arduino mega provide power to the servo motor to rotate and give away the product.NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from

Espressif Systems, and hardware which is based on the ESP-12 module. The term 'NodeMCU' by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.Servo motors have three wires: power, ground, and signal. The power wire is typically red, and should be connected to the 5V pin on the Arduino board. The ground wire is typically black or brown and should be connected to a ground pin on the Arduino board. The signal pin is typically yellow, orange or white and should be connected to a digital pin on the Arduino board. Note that servos draw considerable power, so if you need to drive more than one or two, you'll probably need to power them from a separate supply (i.e. not the +5V pin on your Arduino). Be sure to connect the grounds of the Arduino and external power supply together. This library allows an Arduino board to control RC (hobby) servo motors. Servos have integrated gears and a shaft that can be precisely controlled. Standard servos allow the shaft to be positioned at various angles, usually between 0 and 180 degrees. Continuous rotation servos allow the rotation of the shaft to be set to various speeds.

5.3 OUTPUT

The output of the application is dispatching of product.

6. RESULT

Separate portal for admin and users have been created, where the admin can edit the details of the products available in the machine. The user after login can view the products available through the website and can purchase the product as his wish and make payment accordingly using Razorpay API. After the payment a unique code has been generated depending upon customer's purchase. Now customer can input the code received and the products are dispensed according to the count provided by the user.

The main problem addressed by the proposed system was delay in purchase and dispatching of product. The system design is in such that the cost and resources required are restricted to a minimal level. This was necessary in order to cut the production cost to an extent where the product will be affordable for the offices and buildings. The features implemented are online payment and dispensing product with the help of IoT.

Figure 6.1: Front view

Figure 6.2: Top view

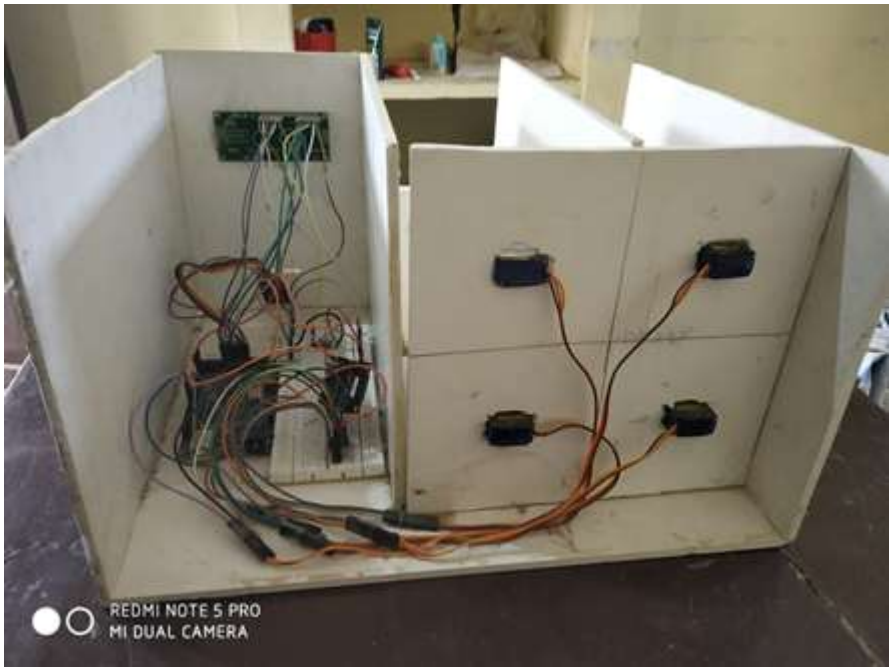

Figure 6.3: Side view

7. CONCLUSION

Product has become a necessity, taking into consideration about how our environment evolves. There is an immediate demand in dispatching the products with minimum delay and high efficiency, by considering the above problem statement and justification provided. We believe that the technologies suggested and implemented by us will set a benchmark in the industry thus directing the use of technology as a way to ease the lives of people. The proposed method is a more advanced technique to access the product at offices and other buildings with ease, saving precious time and effort of users, by introducing the concept of digitalization in industry has created a revolution the way in which people can get benefits in a more personalised and effective manner, and also opened doors for other business ventures to invest in this kind of development, thus easing lives of people and creating more job opportunities to the people. The use of web technology for product searching and payment has decreased the use of paper and cash in a tremendous way and also use of IoT for product dispensing and network interfacing has made human delay incurred in dispatching of product almost negligible in addition to that the system is developed at a minimal cost making it affordable to any organization.

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