SMART AUTO-PRICING SYSTEM USING IoT

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering.

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APPROVAL

This Research Based Project titled **"SMART AUTO-PRICING SYSTEM USING IOT"**, submitted by Marfi Akter Laboni, ID No: 153-15-6592 and Athai Mahbub Mim, ID No: 153-15-6679 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 07-12-2019.

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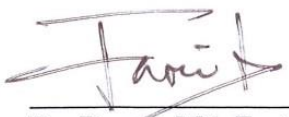

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Dr.Syed Akhter Hossain, Professor and Head, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

Internet of Things (IoT) has brought a revolution in the technology world by making everything automated, smart and intelligent. A thing which has a self-configured network can be considered as a network of things. The development of Smart Auto-Pricing System Using IoT is conceived from making life more easy and reduces the price rising corruption and to reduce the time complexity of the manual price entries. As a result the seller cannot set the price according to their wishes. The aim of this proposed system is to build an automatic and convenient information system to protect the price shoot of products specially food items so that people can buy the products in fair price. The main objective of this project is to measure the weight and recognize the item placed on this machine and shows the total price along with weight according to the total amounts of all items so that the seller need not to input the price manually along with rigged in weight measuring, which in turn reduces the price shoot corruption. This IoT based Smart Auto-Pricing System is proposed as an integrated with Arduino Technology mixed with different Sensors. The load cell is used for the measure weight, color sensor to recognize the object and Wi-Fi module producing updated data for the price of the products that can be obtained from online the database. In the future, AI will be incorporated to support decision making using this system.

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CHAPTER-1

INTRODUCTION

1.1 Introduction

IOT is a new concept in the technology world at present which makes our daily life easier than before. For this reason, we decide to make an IOT based Smart Auto-Pricing System. A Smart Auto-Pricing System will become very high-tech devices in future. A Smart Auto-Pricing System is a base for supporting the platform through the weighing mechanism along with showing the authority's determinate price. Among many reasons, the main reason of the price rising is the tendency to avoid maintain the product price lists which is determinate by TCB. However the moving court audit the market, but in real life it is tough to audit manually all markets at the same time.

In short, IoT based Smart Auto-Pricing System will measure the weight and recognition the given item which keep on this machine and shows the total price along with weight according to the total amounts of the item.

1.2 Motivation

Technology always want to keep our world as possible as connected together. IoT concept has born from that thought. IoT makes it easy and smart to connect all potential objects to interact each other on the internet to ensure a secure and comfort life for human, that's why we want to create the Smart Auto-Pricing System based on IOT so that the producer, the seller and the consumer can be benefited equally in the market. Internet of Things (IoT) has brought a revolution in the technology world by making everything automated, smart and intelligent. We hope that it will be a great new addition in our future automated world.

1.3 Rational of the study

Price rising of food items is not the problem only in Bangladesh, now it is also a global problem. The unusual increase in the price of daily necessaries is called Price-hike. Market syndicate is generally accountable for this price-hike in Bangladesh. In our national newspapers and TVs are captured a common headline like the price of necessary dailies has gone out of the general people's ability, the price of the onion has increase which is going equal to the sky's height . By forming a strong co-ordination efforts and monitoring system, established for the co-operation, co-ordination and exchange of information in between different Government officials entrusted to check price level, price hike could be controlled. Though the Trading Corporation of Bangladesh, the government's trading arm works for keeping stable the market price of the products, however sometimes it becomes so tough to get the products in right price. . But we can make it easy by using technology. Because of beginning building the Smart Auto-Pricing System, we are deciding to monitor the food price rising along with measure the weight. Our primary concern is to make an attempt at formulating a strategy so that the authority could tackle the high food prices using this system.

1.4 Research Question

Many work has already done on the weight measuring and the pricing system individually till now. Among them the digital weight machine is very popular at present. In the pricing system the fixed price style is more preferable. However, today many shopping mall use auto pricing software to determinate the price of an object according to keep their profit in consideration. Now-a-day we have noticed that almost retailers are manipulating their weight measuring machine so that they can give less in weight than the required amount. And also add price according to their wish. So we try to combine the weight measuring procedure and the pricing system. At this moment we have built just a prototype of our expected Auto-Pricing System using IoT. For using in real life, it need to develop it more.

1.5 Expected Output

We hope that this system can be an automatic and convenient system to protect the price rising of food items. First of all, this system is to measure the weight and recognition the given item which keep on this machine and then display the total price along with weight according to the total amounts of the item so that the seller can't input the price manually and can't be rigged in weight measuring, which in turn reduces the price rising corruption and to reduce the time complexity of the manual price entries. This system is helped to buy the products in fair price in the markets.

1.6 Report Layout

The layout of our report is followed as **Chapter 1** will cover the motivation and objective of the Smart Auto-Pricing System. **Chapter 2** deals with the previous works on weighing scale and pricing system. **Chapter 3** will cover an overall view of the techniques used in the system. This chapter also explain the required hardware and software. **Chapter 4** will discuss about the algorithm and flowchart of the overall process carried out in the system and its final graphical output .**Chapter 5** will cover the summary of study which consist of conclusion and future scope of this proposed system.

CHAPTER-2

BACKGROUND

2.1 Introduction

Weighing scales or Balance scale are invented for the necessity of measuring weights of the object. From the ancient age, different types of weighing scales are used in business purpose. The development of the weighing machine has started by Leonardo da Vinci before long ago. Finally Richard Salter invented the digital weighing scale. And the pricing system has continued from when the business profession is developing. People determinate price according to their thinking. After then knowledge developed and also change the concept of pricing. The fixed pricing system is started from the 19th century. At present people use auto pricing software as business purpose.

2.2 Related Works

Previous Work on Weighing Machine

As commercialism developed throughout the period before the Middle Ages, merchants required the simplest process to determinate the price of goods which are shaped in irregular and cannot absolutely be counted by the items. The Indus River valley which is near at present Pakistan, the first ancient relics of a weighing scale discovered during around 2000 B.C. In that time, the weighing machine consists of two plates which attached to an overhead beam and fixed itself on a central pole. Putting the object on one plate and required measurement stones on another plate till equilibrium was reached, thus the weight was measured.

This scale was starting to use before than 2000 B.C. and existed a long time. This scale is same as that scale which found in Egypt around 1878 B.C. Mass amount is marked in carved stones. In the Egyptian hieroglyphic image of gold which indicates an established mass measurement system to measure gold that Egyptian merchants had used during gold shipments.

The balance made of wood and bronze masses used for measuring which used in China during before the third to fourth century BC. From an excavated area of the State of Chu of the Chinese Warring States, this wooded balance weighing machine was discovered [1][2].

The beam balance was the first invented weighing scale. In the oldest balance scale, it consists of two arms with two pan which was in equal length horizontally. In one pan the object is placed and put masses on the opposite pan until the beam come near to the equilibrium situation [5]. This balance is also known as balance scale or laboratory balance.

Different types of the balance scale began to use commonly by many small merchants and their customers from 400 B.C. Some of them were accurate and some of them were inaccurate [3]. This overflow of using different types of scale, each and every benefits and development of the weighing machine had invented by Leonardo da Vinci whose personal hand remained in their development [4].

Through the step by step development today's Digital weighing scale has discovered. Electronic digital scales display weight as a number, usually on a liquid crystal display (LCD) along with calculate the total price by taking price per unit as input manually.

In a digital scale, strain gauges is measured the amount of deformation by one or more transducers that is deformed by the force of a spring. In a strain gauge conductor, the electrical resistance changes according to its length. The capacity of strain gauges is limited. For a bigger digital scales which is known as a load cell could use a hydraulic transducer. The current is passed through the digital weight machine and make variation in voltage of that device. Therefore the weight has generated for passing the current through it. A digital value is generated by an analog-to-digital converter using current. Usually a microprocessor chip is used to run the device and translated digital logic to the correct units, and displayed value on the display.

Previous Work on Pricing System

Pricing is that the method whereby a business sets the price at that it will sell its products and services, and will be part of the business's promoting arrange. There are many factors to think about once rating associate item. However, the pricing system will depend upon the merchandise, market and their competition. The producer, the seller and the customer can affect by setting the

wrong price for a product. When pricing a product, weighing technological factors plays a vital role in everything from producing to the sale of the ultimate product.

A free price system is a mechanism that informally referred to as the price system could be a mechanism of resource allocation that depends upon financial costs set by the interchange of supply and demand. Through the free price system, supplies are rationed, income is distributed, and resources are allocated.

A free price system contrasts with a fixed price system wherever costs square measure administered by government during a controlled market. The price system, whether or not free or controlled, contrasts with physical and non-monetary economic planning.

Fixed pricing system has invented in the 19th century. Before invented this system, shopkeepers and customers need to bargain to set a price of a product. The shopkeepers say the price according to their customer's outlook. A well-dressed customer who walked into a shop or moved in a market stall, they expect to pay considerably more than a middle class or poor buyer. If any person become a regular customer, the shopkeepers were more likely to give discounts. The fixed prices has brought more structure and freedom to retail.

Value-based pricing system is a pricing strategy. In this strategy, first costs are balance with the estimated price of a product to the client instead of consistent with the previous prices [6][7].It is also called as value optimized pricing.

Many factor like the manufacturing cost, the market place, market condition and quality of product etc. should take into consideration during set the price at which it could acquire the products.

In a manual or automatic methodology of the pricing system to set costs during buy and sales orders, depend on factors. Such as:

- A fixed amount
- Quantity break
- Shipment or invoice date
- Combination of multiple orders etc.

A lot of setup and maintenance is required in automated pricing systems but it may set accurate price of a product. Auto-Pricing is that the practice of automatically setting the requested value for things purchasable so that the seller gain maximum profits.

Normally price of one product is determine by the seller so the seller concern more about his profit. Now-a-days many businessman use pricing optimization software for their business. Almost of this software is made according to Value-based pricing strategy.

Previous Work on Object Recognition

The process of finding and identifying objects in an image or video sequence using technology is known as object recognition. In multiple decades many techniques to find and identify have been implemented. Almost methods of the object recognition are time consuming and also require a well laboratory facilities which is enriched with modern technology. On the other side, image processing and machine vision of the computer vision can generate more accurate result even can take dimensional measurements accurately.

There are many methods for different types of object identification. For identify more accurately different types of potato, molecular markers might right function approach to selection variety identification. This approach can be cheap and faster than any other approach. For potato genetics and type identification, various molecular marker techniques can be applied.

Polymerase chain reaction method is based on the amplification of DNA sequences which is more quick approach which offer advantages for identification. This method need comparatively short target DNA. We should avoid the use of radioactivity method. For this method require no prior knowledge of the DNA sequences of interest, and use readymade commercially available materials. Random amplified polymorphic DNA (RAPD) is another method of identification which marks area ten nucleotide length DNA segments from PCR amplification of random segments of genomic DNA. The single primer of humorous DNA nucleotide sequence and which are able to differentiate between genetically distinct individuals. Though it is not necessary in a reproducible way. Applying the method named RAPDs for variety discrimination is very interested method.

To classify different types of oranges using the image processing technique and correlation analysis based on size. Using frequency domain in all the process for identify the types of orange.

The objective was to identify the types of orange. Another aim was to determine the quality control of the orange measuring the size of oranges. An algorithm generated depending on the image processing. After using this algorithm, the amount of error was reported as 1.4% for the classification of orange varieties [8].

Color analysis is another popular method for the object (fruits) detection. By the color analysis, different colored leaves like the fresh green or dry leaves, the ripe fruits or the branches can be identified. But some colored fruits may be insufficient to distinguish from one another fruits using only color analysis [9]. Only applying of color analysis method may not always give an accurate solution. For this limitation, the color analysis approach is not much used in the realistic implementation.

Previous Work On Object Recognition Using Sensor

The light sensor is one the great invention in the technology world. Using this sensor, we can also recognize an object. First this sensor blocks the light path by its elements which is primary filter and first stage of working. This sensor consists of primary filter and another one is clear filter. From the light path, this sensor calculated the light intensity by measuring the intensity of visible light [10]. The calculation is calculated by compared a difference between an output signal of the first color sensor with an output signal of the clear sensor.

In other words, the measure of surrounded light level is computed based on the different types of way. First one is color channel and another one the clear channel. IR is automatically cancelled by sensing in the light path when calculating the difference between the output signals of the color and clear sensors [11].

The Kinect sensor measure color space in the RGB which is gained from a picture. For the color recognition of different objects this color space is detected by shortfalls [14]. By an RGB-D sensor for gathering required information to identify the object. This method is normally used in making robot or in that technology which uses the computer vision [12].

This method works in two steps for an object (shirt) recognition:

Firstly, for the shirt segmentation method introduces a mask based on the depth information of the sensor to segment the shirt from the image;

Secondly, it extracts the color information of the shirt for recognition and tracking for shirt recognition [15].

The RGB color space method is also used to identify artificial images like flags [13]. This method compared the extracted vectors data of given image with the known vectors data of that relevant object. Finally, the image can be classified by matching the minimum similarity between the two vector's data.

2.3 Research Summary

We have built a model of the Smart Auto-Pricing System using IoT to make human life easier. This is made by the combination of the smart weight machine and the price list. Basically one person when going for the market, almost person have to bargain with the shopkeepers on this issue. And sometimes the customer are cornered by the retailers. They have nothing to do and constrained to buy the food items with extra price. On other side, the farmers are not getting the right price. Sometimes they have to sell their products less than their producing costs. Among the group of the buyer and the seller, third party make their profit. We believe that our research work will help to develop such a system so that the producer, the seller and the consumer will be benefited equally. And the authority can also audit the market price easily. We hope that this system concept will help to develop a reliable procedure in the online shopping system. People have not too much concern to get right amount of products in a fair price.

2.4 Scope of the Problem

The primary concern of our work is to develop an automated machine so that the consumer can buy products in government's determinate price and also can get in right amount. By using this system marketing procedure will be easier and bargain free. But as many people are not used to technology in our country, they may be not show much interest it in first time. On the other hand, people wants to get a reliable and easy procedure so that they can buy their daily necessaries

without any anxiety. The scopes of this research are many in different aspects. This concept can be used in the super shopping mall. They have no need to use any bar code sticker. And if this system will be implement fully there is no need to extra person to make memo of the marketing. The businessman cannot add more value creating scarcity of the products in the absence of the authority. This concept can be applied in a robot to make a self-depended system. Undoubtedly, this will be a great system in business technology world. And it will also be convenient system for sides of the users such as the retailer, the consumer, the producer, the wholesaler and the authority auditor.

2.5 Challenges

The biggest challenge of our research work was prototyping the system. It was cost consuming and also difficult to collect all required components. And the resource of learning more about IoT in practical is very delicate in our country till now. So the required knowledge gain for the prototyping Internet of Things is little bit tough. But recently for going to participate in the fourth industrial revolution, many work has started to do more in practical implementation on robotics and the automated technology. The realistic implementation will be cost consuming. Another challenge is people wants to get a reliable and easy procedure so that they can buy their daily necessaries without any anxiety. But they are not too much interest to use the technological system. Actually there is no option to avoid the technology if we want to keep harmony in the steps with the modern world. However, by using technology we can make our life comfortable.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Basically we build a prototype for the Smart Auto-Pricing System. The main cause is it is possible to implement and develop in future. By using this concept, it is possible to build a realistic useable automated weight measuring machine and developed the auto pricing system combinable machine. We use Firebase for the creating database. We work in primary phase of this concept.

3.2 Research Subject and Instrumentation

The object of this research is explained before in the first chapter of this report. Now we want to understand why we want to implement this system using IoT. Before that we have to understand what is IoT actually and when we can say one thing as internet of things.

Concept & Definition of IoT

IOT is the abbreviation form of Internet of things which is divided into two words Internet and Things .The term things in IOT means different IOT devices must have an unique identity and have to capable for performing through sensing, actuating and live monitoring of certain sort of data from another distance via Internet. IOT devices are also capable to set out directly or indirectly live exchange of knowledge with another side connected devices or application. However, it can be collected information from alternative devices, processed the data if necessary and also can send the data to another servers. Another term internet can be explained as a communication media through connecting the trillions of computers across the world which network is enabled for sharing the information.

Thus the IOT can be define as: “One thing can be considered as an IoT which has the capability of self-configuring network for the communication to protocol where physical part and virtual part have an unique identities, physical properties and virtual existence and use intelligence for exchanging the information via network . Often data communicate depend upon user and the environment.” For the connectivity of IoT devices use different types of interface which can be

wired or can be wireless. A standard IoT device may have various interfaces for communication to other devices.

IoT based device are made of the following components:

- Internet Interface for connecting to the network.
- Memory and Storage Interface.
- Audio Interface.
- Video Interface.
- I/O Interface.

Types of Connectivity in IoT Technologies

For communication with web services, Internet and Search Engines, Internet of Things which have different connectivity of networks like wireless sensor networks, big data, cloud computing, embedded systems, Architectures of Security Protocols are using to develop this technologies.

Wireless Sensor Network: Different types of sensor which are called as nodes are integrated together and build a wireless communication for monitoring various sorts of data.

Cloud Computing: Cloud Computing is a type of Internet based computing which provides a common network for shared the processing resources and receive or send data to other computers or another devices on demand. It can be in various forms like SAAS, IAAS, PAAS, and DAAS etc. It is also known as on-demand computing.

Big Data: To check large data sets which contains various forms of data types is the process of big data analysis. To uncover the hidden patterns of data, unknown relations between data, market strategy, customer's preferences information and other useful business information, big data analysis is used.

Embedded Systems: Embedded system is a sort of computer system which consists of both hardware and software to perform a particular task. It consists of microprocessor or microcontroller, RAM or ROM, Wi-Fi module, storage devices, I/O units and many other required sensors.

We implement the Smart Auto-Pricing System using the combination concept of wireless sensor network and embedded system.

Algorithm of the Smart Auto-Pricing System working procedure:

Step 1: Start the process

Step 2: Detect Fruit by using color sensor

Step 3: Is fruit detected?

Step 4: If fruit is detected, go to step 6

Step 5: If fruit is not detected, go to step 2

Step 6: Show the fruit name

Step 7: Measure the weight

Step 8: Go to database and fetch the price

Step 9: Is Price found?

Step 10: If price is found, go to step 12

Step 11: If price is not found, go to step 13

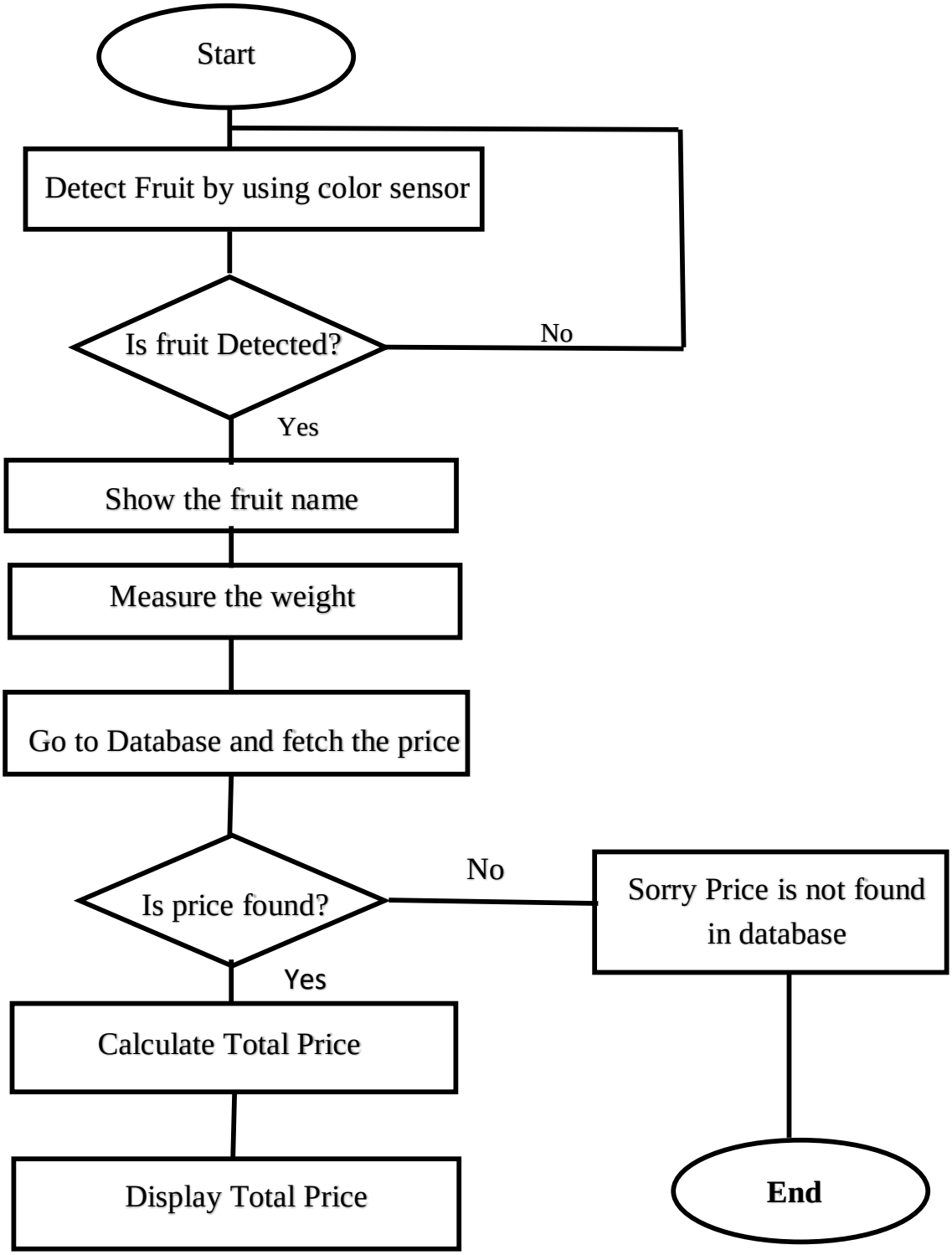
Step 12: Calculate total price

Step 13: Sorry price is not found in database!

Step 14: Display total price

Step 15: End

Flowchart of the Smart Auto-Pricing System working procedure:



3.3 Data Collection Procedure

We collect data to know the opinion of the general people. We do this procedure in two ways. One is doing by Google survey form which is online survey procedure. Another one is executed in offline conversation. We follow the question answering method for collecting data. This collected data help us to understand the opinion of the people about the auto-pricing system.

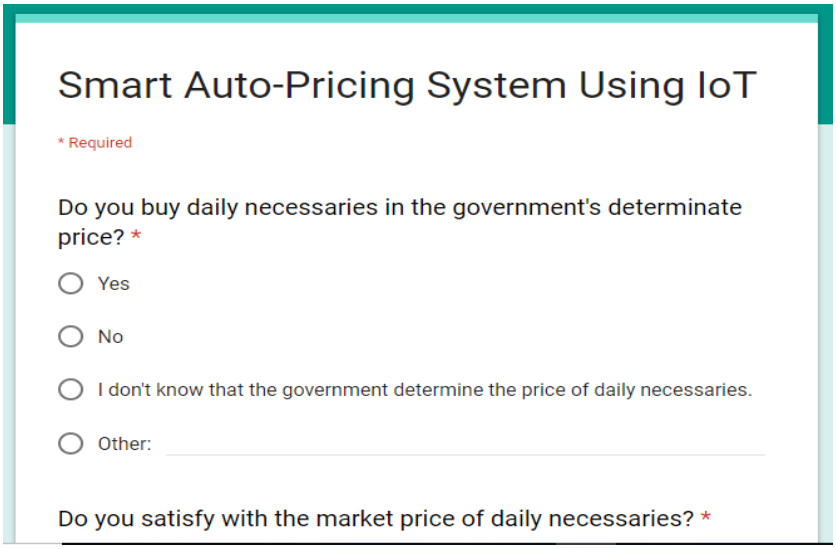


Figure 3.3.1: Google survey form

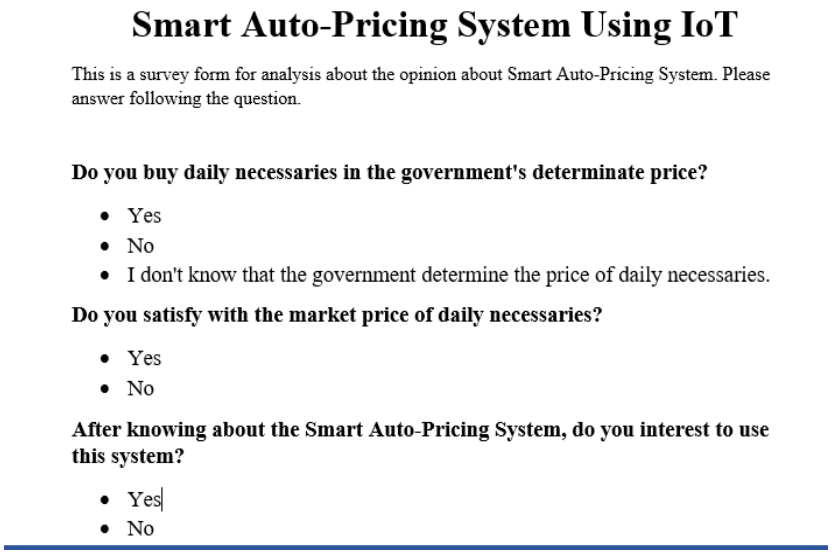


Figure 3.3.2: Offline survey form

3.4 Statistical Analysis

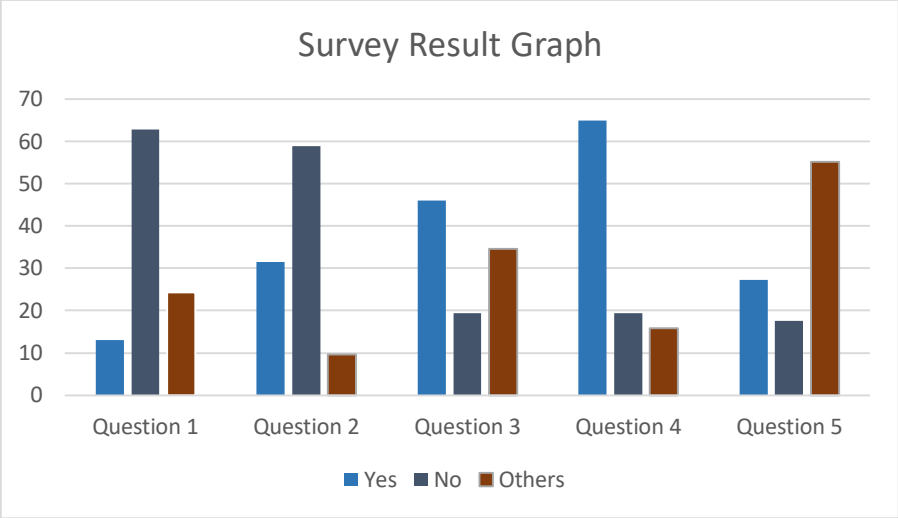


Figure 3.4.1: Survey graph

We do our survey depend on five questions.

In question 1, 2, 3, 4 and 5 our expected result was No, No, Yes, Yes, Others respectively. Among five results four results are match with our expected result. That indicates positive opinion to build our system prototype.

The percentages of yes, no and other option are 13.03 colored in blue, 62.73 colored in gray and 24.24 colored in orange respectively in first question. The percentages of yes, no and other option are 31.52 colored in blue, 58.78 colored in gray and 9.7 colored in orange respectively in second question. The percentages of yes, no and other option are 46.06 colored in blue, 19.39 colored in gray and 34.54 colored in orange respectively in third question.

The percentages of yes, no and other option are 64.85 colored in blue, 19.39 colored in gray and 15.76 colored in orange respectively in fourth question. The percentages of yes, no and other option are 55.15 colored in blue, 17.58 colored in gray and 27.27 colored in orange respectively in fifth question.

From seeing the graph, we can say people are not satisfied with the market price of daily necessaries. And they also want a change in this field. But many people are not interested to use technological because they are not used to it.

3.5 Implementation Requirements

We required different types of hardware components to implement this system like color sensor, load cell etc. And use the Arduino platform for coding purpose.

NodeMCU Wi-Fi Module

NodeMCU, this word can be divided into two parts. One is Node, by this term it represents that it is a firmware and also a development tools or kits. Another one is MCU stands for micro controller. This an open-source firmware helps to build IoT product. The code is run background of its. NodeMCU works as which really means it is a computer on a single chip. A microcontroller is a mini computer for a particular work. It contains memory and programmable I/O equipment. This module normally used to make automate engine control, remote controls, power tool, toys etc.

We use this module to connect as a micro controller which make our system automated.

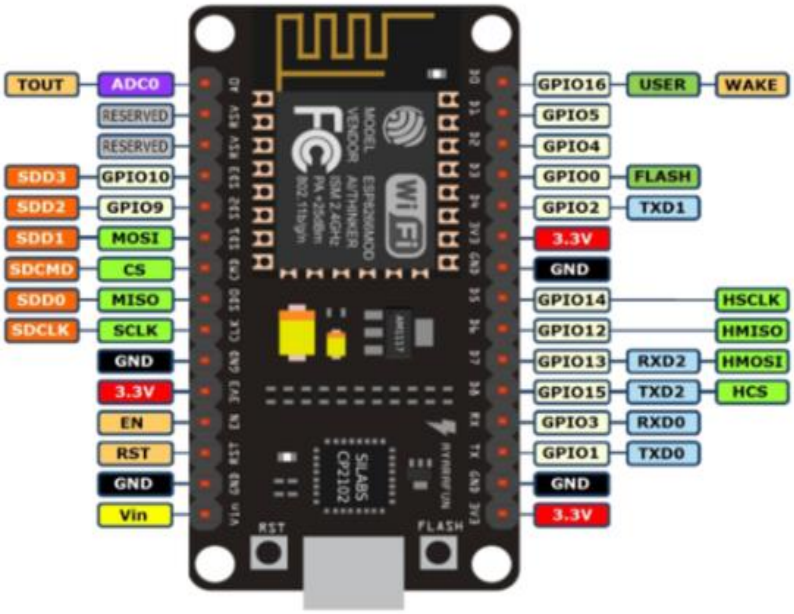


Figure 3.5.1: ESP8266 NodeMCU

Load Cell (10Kg)

A load cell is a sensor or a device that converts a force which is deformed for any object which keep on it. Then this force is convert into an electrical signal. This current is produce by the change of the voltage modification. This current is change according to the voltage change.

There are many kinds of load cells. Load cell is made of four parts which are the elastic component, resistance strain gauge, measuring circuit and transmission cable respectively.

We use a load cell of ten kg which can translate up to 10kg of pressure into an electrical signal. Each load cell is measured the mass by responding to the force on the load cell bar which force provides by the given object.

With this load cell we can tell how heavy an object which keep on it. That means the weight of an object.

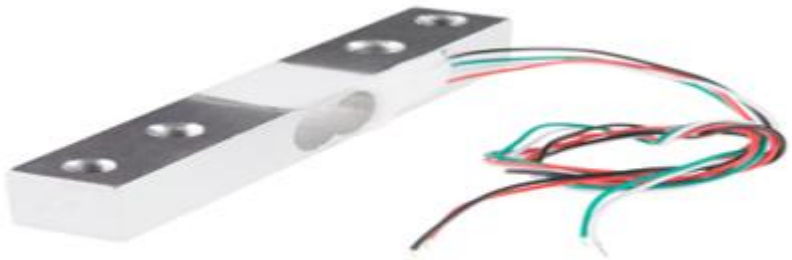


Figure 3.5.2: Load Cell (10kg)

HX711 Load Cell Amplifier Module

This Load Cell Amplifier is a small breakout board for the HX711 IC that helps to read the small amount weight of the object and then amplify that value. It has twenty fours high accurate A/D device.

This chip is used for high-precision electronic scale. It has two analog input channels for making programmable the amplifier. First connecting the amplifier to the microcontroller for reading the accurate result of the load cell. It amplifies a small amount of weight into a big digit.

The HX711 has a two wire interface for communication. To read data from this module, first connect it with the GPIO pins of the microcontroller. And then add required libraries during coding for getting accurate result.

These are used four colored connection points which are red, black, white and green. Each color coding of load cell amplifier module represents difference of it's connecting points:

- Red port is signed in positive and connect with the voltage source
- Green port is signed in negative
- Black port is signed in negative and connect with the ground
- White port is signed in positive and normally connect with the output device.

Figure 3.5.3: Hx711 Load Cell Amplifier Module

20x4 LCD

20×4 LCD has 20 columns and 4 rows. So it is named as 20x4 LCD. There are many types of LCD display available like 8×1, 10×2, 16×2, etc. The 16×2 LCD is mostly used one.

In 20x4 LCD, it can manage maximum 80 characters in total which calculated as 20*4=80. Each character is made of 5×8 Pixel Dots. AS each character has 40 pixels calculated as 5*8=40. In total 80 Characters require maximum 80*40= 3200 pixels. About the position of the pixels of the LCD should mention in code from which it starts to display. WH2004G – 6800 IC of the micro controller is worked on the backside of the LCD Module itself.

The Interface function of WH2004G – 6800 IC is used to get the commands for execution and data from the micro controller unit. Finally process the commands and data to display the meaningful information onto LCD Screen.

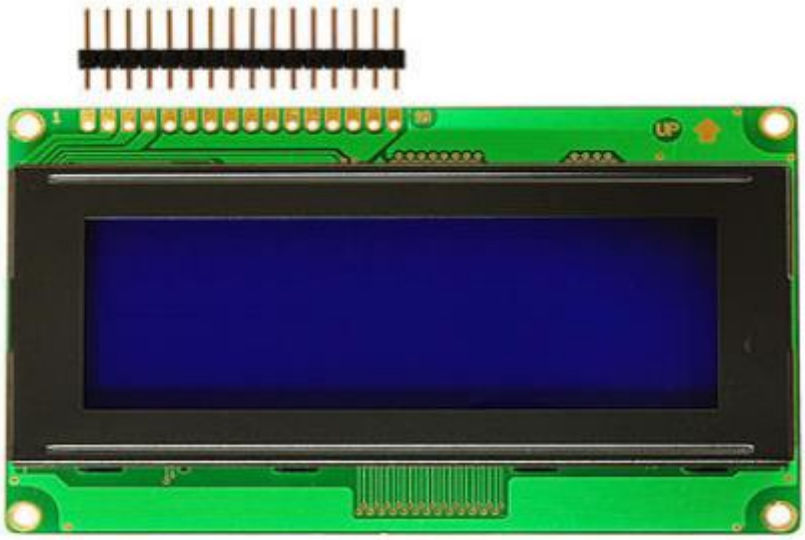


Figure 3.5.4: 20x4 LCD

TCS230 TCS3200 Color Sensor

TCS230 sensor can sense color light by the intensity of the light. This sensor has eight by eight array of photodiodes. This sensor generate a square shaped wave depends on the readings from the photodiodes. The result is depends on the intensity of the light.

This sensor has four white leds and a RGB chip based on the RGB color scale. The TCS3200 consists of photo detectors, one red, one green or one blue filter or no filter. Every color's filter is distributed equally to eliminate location of the light bias among the colors.

Each photodiodes have four type color filters. In four photodiodes have sixteen red color filters, sixteen green color filters and blue color filters and sixteen clear filters in total. The result is measured depend on all the readings of the filters in the photodiodes.

Each photodiodes are connected in parallel. This sensor has the two control pins S2 and S3 and select one of them which can receive the readings of the photodiodes. To get right result, connect the pin such as high and low combinations so that it can calculate the readings accurately.

We use this sensor in our system to object recognition by the light intensity of an object.

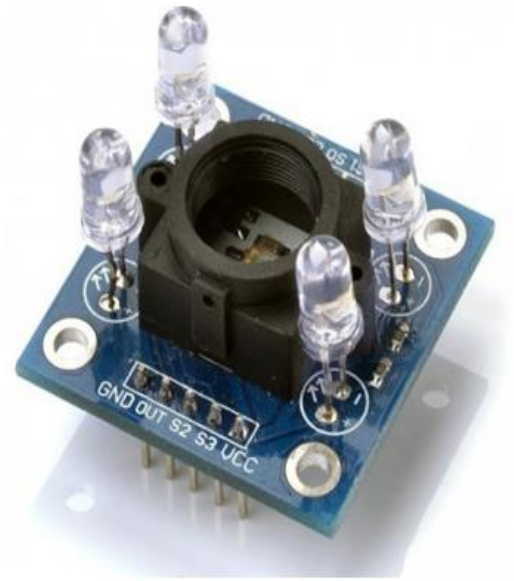


Figure 3.5.5: TCS230 TCS3200 Color Recognition Sensor

18650 Rechargeable Battery

The Internet of Things development is approving the collection of information from sensor nodes anywhere within the surroundings, and giving non-electronic objects the power to communicate, gap up a whole new sphere of applications for electronic systems. Selecting batteries for Internet of Things connected systems are often difficult, as there is such a large kind of application types. There are many types of rechargeable battery. In this rechargeable battery need charged, when the charge remain full on it discard the charger. When need to load charge again, it can be charged. But in a non-rechargeable battery is discarded once discharged, there is no option to load any charge into it again.

The accumulator of this battery reserves the energy. Battery-powered devices are comfortable to use though it has also some major problems. Some vital aspects should be taken into consideration that it is not simply reject the power plug.

Breadboard & Connecting wire

The breadboard is made by plastic. It is shaped in rectangular. This board is adorned with a bunch of tiny holes in it. These holes help to insert easily the electronic components like battery, resistor, and LED etc. to build a circuit. It is easy to remove a component form the breadboard when any mistake happened. Because the connections are not permanent in breadboard

For making our project prototype by creating a preliminary model from which other forms are developed, we use the breadboard is used.

Connecting wires are using to connect all the components with each other in the circuit.

Arduino IDE

Arduino IDE is a software which is for coding. It is an open source platform. This platform is very user friendly for coding and implement different kinds of embedded system. After coding user can remain code in the cloud. This environment code is written in JAVA language and run on almost in all operating system like Windows, Linux etc.

Delivery Requirement

To implement this system for real user, we think it may take about six months.

CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Introduction

We make this system model experimentally. By this prototype implementation we can say that it is possible to implement. We try to understand what will be challenging if it goes to implement in a realistic way. Actually the experimental results can give a concept if any system can implement really or not. So this is the most important part of this report.

4.2 Experimental Results

We represent our experimental results by required images in three steps.

Step 1: In this step, we display the hardware architecture's image of our system.

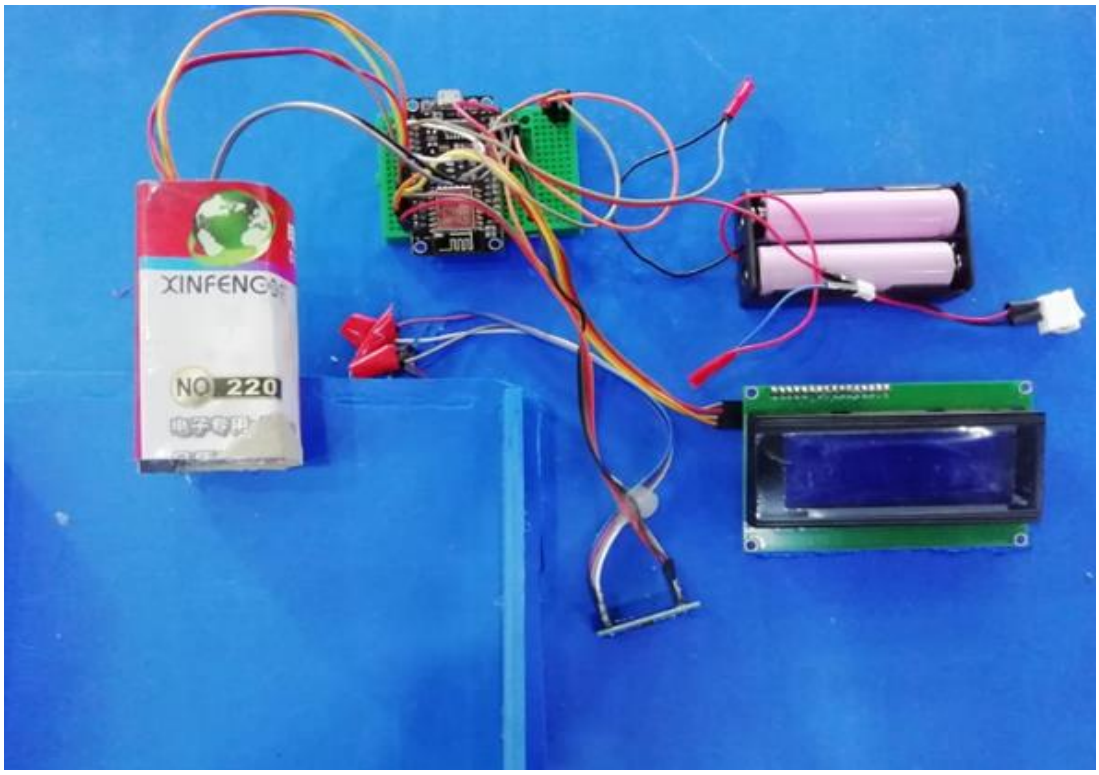


Figure 4.2.1: Auto-pricing system hardware architecture

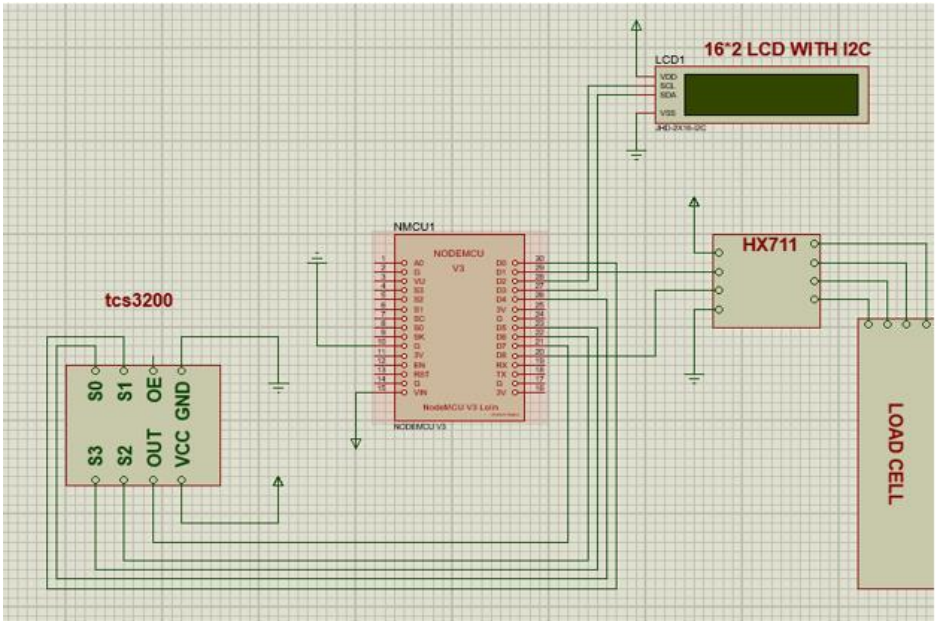


Figure 4.2.2: Auto-pricing system Circuit Diagram

This curcuit diagram will help us to understand easily the connections between all components of this system.In which pins, the components are connected respectively.

Step 2: The price database of the objects looks like this database at present.

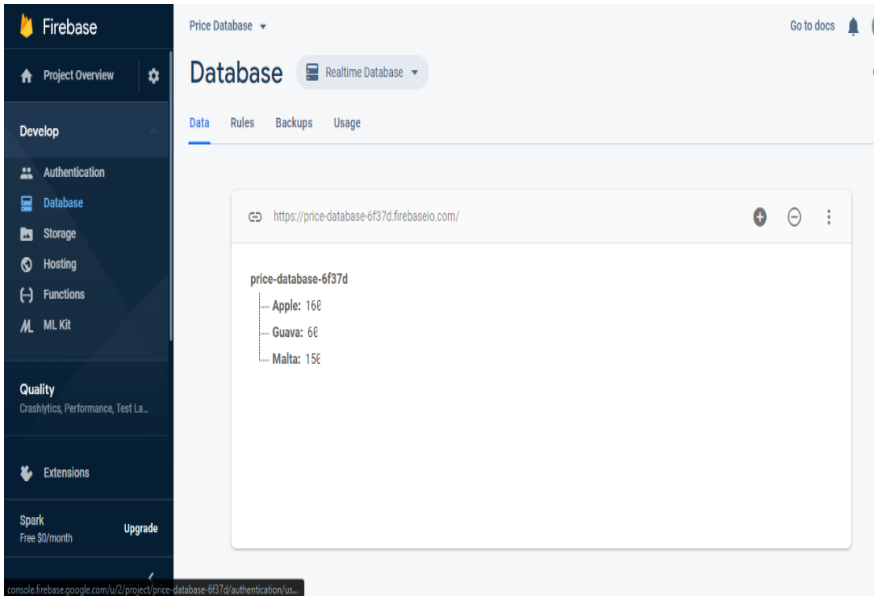


Figure 4.2.3: Database Create

The price database of the objects will be organized like this database.

	Price Type	Measurement	Dhaka	Chittagong	Khulna	Rajshahi	Rangpur	Sylhet	Barisal
Beans Ordinary	Retail	24	58	66	69	75	61	71	0
	Wholesale	30	4463	5470	5970	6406	4581	5559	0
Brinjal - Ordinary Quality	Retail	24	38	39	29	31	31	43	37
	Wholesale	30	2920	3204	2238	2489	2528	3500	3144
Cabbage	Retail	49	25	41	24	33	34	33	34
	Wholesale	51	1750	3442	1747	2500	2847	2425	2808
Cucumber	Retail	24	37	39	0	32	31	0	0
	Wholesale	30	2791	3128	0	2514	2200	0	0
Khejur (date)	Retail	24	230	0	0	250	0	0	0
	Wholesale	30	0	0	0	20500	0	0	0

Figure 4.2.4: Database Example

Step 3:

Figure 4.2.5: Display the object name, weight & price

Our main objective is reflected on this output display screen. This output mention the object's name, show it's price and weight at the same time.

4.3 Descriptive Analysis

This descriptive analysis will be explained in different phases in this report so that we can easily understand this system working procedure.

Step 1: First keep the object surface of this system.

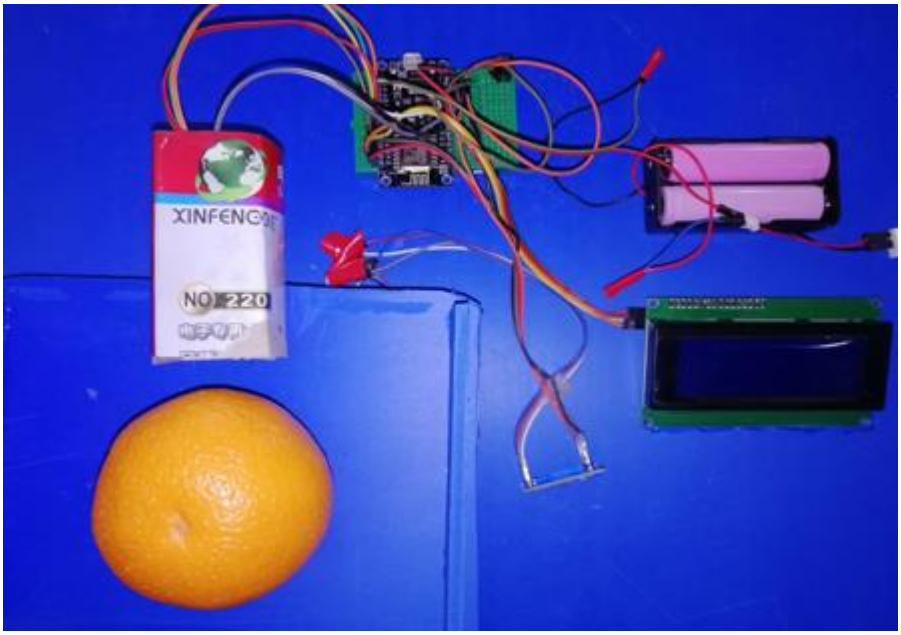


Figure 4.3.1: Object (Fruit) is put on the load cell

We first take one piece Malta and placed it on the load cell. The light sensor first take the color frequency to generate the final result.

Step 2:

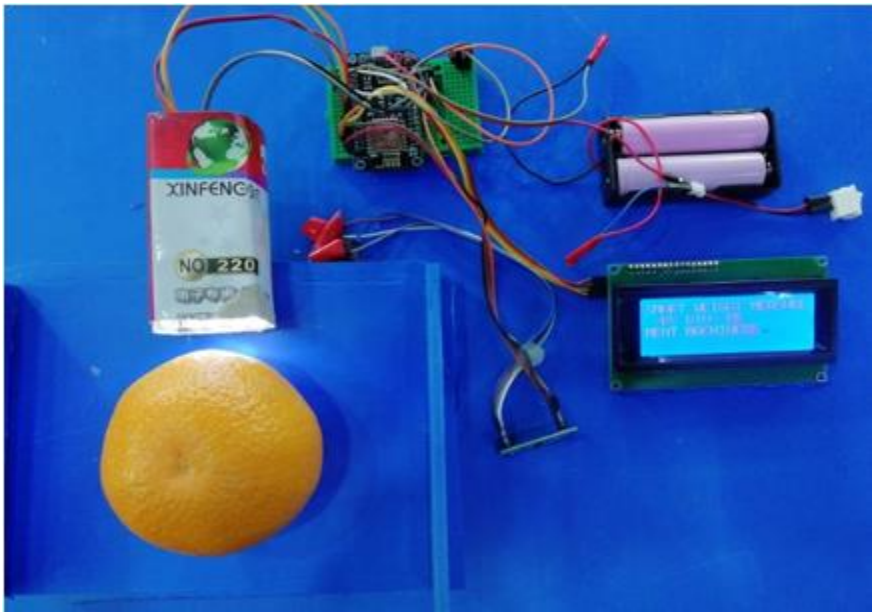


Figure 4.3.2: Object is detected and display the result

The image of the final result has provided in the above in the part of experimental result.

Screenshot of some codes

testv2colorcode | Arduino 1.8.5

File Edit Sketch Tools Help

testv2colorcode

```
  digitalWrite(S3,HIGH);

  // Reading the output frequency
  blueFrequency = pulseIn(sensorOut, LOW);

  // Printing the BLUE (B) value
  Serial.print(" B = ");
  Serial.println(blueFrequency);
  if(85>=blueFrequency && blueFrequency>=75 && 70>=greenFrequency && greenFrequency>=60 && 45>=redFrequency&&redFrequency>=35)
   {
     Serial.println("banana detected");

   }

  else if(72>=blueFrequency && blueFrequency>=60 && 68>=greenFrequency && greenFrequency>=58 && 37>=redFrequency&&redFrequency>=27)
   {
    Serial.println("Malta detected");

   }

  else if(67>=blueFrequency && blueFrequency>=57 && 59>=greenFrequency && greenFrequency>=50 && 48>=redFrequency&&redFrequency>=40)
   {
    Serial.println("Apple detected");

   }


  delay(100);
}
```

Figure 4.3.3: Object detection code

According to first condition, when the frequency of blue light is equal to or greater than 75 and equal to or less than 85, green light frequency is equal to or greater than 60 and equal to or less than 70 and red light frequency is equal to or greater than 35 and equal to or less than 45, the detected fruit will be banana.

According to second condition, when the frequency of blue light is equal to or greater than 60 and equal to or less than 72, green light frequency is equal to or greater than 58 and equal to or less than 68 and red light frequency is equal to or greater than 27 and equal to or less than 37, the detected fruit will be Malta.

According to third condition, when the frequency of blue light is equal to or greater than 57 and equal to or less than 67, green light frequency is equal to or greater than 50 and equal to or less than 59 and red light frequency is equal to or greater than 40 and equal to or less than 48, the detected fruit will be Apple.

Output:

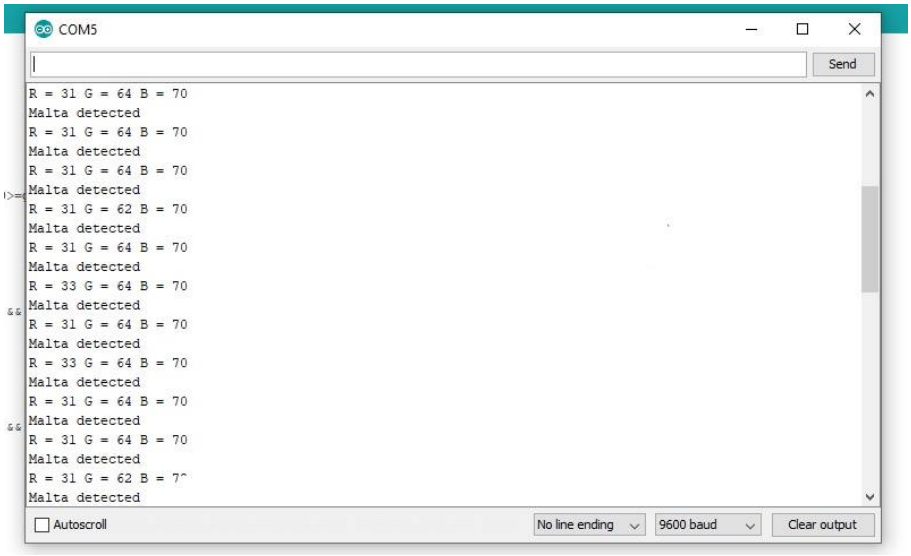


Figure 4.3.4: Malta is detected

Here the frequency of blue light is 70 which is greater than 60 and less than 72, green light frequency is 62 to 64 which is greater than 58 and less than 68 and red light frequency is 31 to 33 greater than 27 and less than 37.

So according to the condition the detected fruit is Malta.

4.4 Summary

From the above evidences of the experimental result and discussion, we can say that we are successful to implement our thought named “Smart Auto-Pricing System Using IoT”.Though there are some limitations of our prototype, it can be developed. And how can be improved that is discussed in the implication of further study part of this report. To solve all limitations, we have to contributing more time and required to gain more practical knowledge. However, we have to face another challenge for the realistic implication of this system because it is very cost consuming to implement. And the collection of exact required equipment is also a challenges. If this demands are fulfill, the development of this system can be extended.

CHAPTER 5

SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH

5.1 Summary of Study

We represent the whole report's gist in this section. First of all, we try to introduce our research work on "Smart Auto-Pricing System using IoT". The second section of the first chapter reflects how and why we want to do this work. And the logical reason to do this research is explained in the rational of the study part. The previous work on weighing scale and pricing system also discussed in the second chapter. We present the procedure of this research work is described in the third chapter. The works flowing is shown by an algorithm and the the flowchart. A short description of the hardware equipment has also provide. After going through all these steps, we are successful to make a model of IoT based Smart Auto-Pricing System. It has also some defects but all of them will be solved in the further development.

5.2 Conclusion

IoT based Smart Auto-Pricing System for making easy and corrupted free selling in right weight and price has been proposed using Arduino. The system can accurately fetch the product price from the updated database. The IoT based Smart Auto-Pricing System being proposed via this report will assist the producers and the seller during sell his products, the buyer during buying products in fair price. Using this system one can avoid the malpractices because there is no manual operations and also all information is stored in a database. So this system will be really helpful to the people.

5.3 Recommendations

The limitation of our project is when we give the object of same color it can't give the right result. But it can be solved. And without internet connection this system can't work properly. As we use the light sensor for object recognition, so sometimes it returns wrong result in different intensity of the light. Because light sensor works depend on the intensity of the light. To make more flexible system, it will be cost consuming. To develop this system more, we recommend to study the implication for further study of this report.

5.4 Implication for Further Study

The government of Bangladesh has taken some necessary project to develop the Information and Technology sector which is the major part of "Vision 2021"Our mission is to develop an automated pricing system using IoT which help people to buy products in a fair price which will be time reducing, supportive services to clients and also authority can monitor the price of market easily.

Overall, we hope that this Project that we are discussing about is very useful for the people, we have learned a lot and got chances to implement. If we grow intelligence of this system, it will be more flexible, realistic and efficient. For growing its intelligence, computer vision concept can use to do it. And the any type of object can be detected accurately. It also can be used in smart warehouse, super shopping malls. If we use this system in super shopping mall, there is no need to add bar code sticker. Finally, we can say in a word that the intelligence of this proposed system must have to grow more than at this moment.

APPENDIX

Appendix A: Research Reflection

The purpose of this Appendix is to provide an introduction to research refection. The group research project was a challenging and enjoyable experience typical of the course as a whole. We have had little exposer to group work at university. So, it was a nice change to be part of an effective and dynamic team. We complemented one another quite well both in bringing together inter disciplinary perspectives and in balancing the work at hand.

The experience taught us that planning and crafting responses takes a longer time in teams than on your own. The extensive effort required was ultimately a good think. When working alone, we can end up with a result that is identical to our initial plans. In our group we are constantly developing and refining one another's ideas. It was fascinating just how productive our group meetings were. The time seemed to fly and yet we always got a lot done and manage to help another along the way towards the end point of having a substantive policy.

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