ISSN (Print) : 2706-7912
ISSN (Online) : 2788-4112

كلية الشرق الأوسط
Middle East College

Journal of Big Data & Smart City

Volume : 02 Issue : 02 Spring 2022

www.mjbdsc.org

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I am delighted to bring this 4th issue of the Journal of Big Data and Smart City (JBDSC) which contains quality contributions from researchers. On behalf of my co-editors (Prof. Ahmed Nawaz Hakro, Prof. Anupam Srivastav, Prof. Mounir Dhibi) and other members of Editorial Board, I thank all the contributors. This Issue, like its predecessor issues, is an open access journal, with an Arabic translation of the Abstract of every paper published.

The Journal of Big Data and Smart City (JBDSC) has become an exciting platform to scholars, researchers, other related professionals, policy makers, and especially to the students, to showcase their scholarly ideas and research in Smart City applications, building on Big Data technologies. Being open access, the journal has been accessible, engaging and motivating to the young researchers, as it is evident from four out of five papers in this Issue being joint work with students.

The journal has been successful to fulfil its objective to publish original interdisciplinary research. All the published papers, which cover the areas of Expert Systems, IoT, Mobile Applications, etc, have been subjected to a double-blind review process. The multidisciplinary collaborative work combining multiple fields in wider possible contexts, published in this issue integrates theoretical, experimental, and computational approaches, providing solutions towards smart city/ information and communication technologies themes.

I am thankful to those who submitted papers, both individually or jointly with their collaborators from academia and industry. I also take this opportunity to also thank all those who contributed in bringing out this issue of the Journal. My special thanks to Dr. Kiran G.R, Dean, Middle East College, for his guidance and complete support to the Editorial Board. I am extremely thankful for the kind approvals granted by MoHERI and MoI for allowing this scholarly publication.

Special thanks to all the members of the Editorial Board for dedicating their valuable time and energy which made it possible for this issue to be published.

Wishing the readers of the papers of this journal making a fruitful contribution in their future research pursuits.

Dr. Saleh Al Shaaibi
Editor in Chief
Journal of Big Data and Smart City

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Editorial Board

Volume : 02
Issue : 02
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CONTENT

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Mobile Application for Cottage Industries Sales System

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Received: January 2022; Revised August 2022;
Accepted November 2022

Abstract

With the spread of COVID 19 pandemic, many jobs are lost and new others appeared. Cottage industry is an already existing business, which became very popular in the last year since it does not require high capital or rent expenses. These small investors face generally difficulties in marketing their products and use social media for this purpose. This project aims at helping the cottage industries in Oman to show their products and services for the customers and to collect their orders faster by a mobile application. It will also help them in communicating with their customers and viewing their feedback, opinion, and the rate of the business. A survey was shared with some customers and has demonstrated the important need for such project. In the light of the collected results, the design of the mobile application has been completed by drawing diagrams for the most important aspects of the project.

الملخص

مع انتشار جائحة COVID 19 ، فقدت العديد من الوظائف وظهرت وظائف أخرى. تعد صناعة الأكواخ من الأعمال التجارية القائمة بالفعل ، والتي أصبحت شائعة جدًا في العام الماضي لأنها لا تتطلب رأس مال أو نفقات إيجار عالية. يواجه هؤلاء المستثمرون الصغار بشكل عام صعوبات في تسويق منتجاتهم واستخدام وسائل التواصل الاجتماعي لهذا الغرض. يهدف هذا المشروع إلى مساعدة الصناعات المنزلية في عمان على عرض منتجاتها وخدماتها للعملاء وتحصيل طلباتهم بشكل أسرع عن طريق تطبيق الهاتف المحمول. سيساعدهم أيضًا في التواصل مع عملائهم وعرض ملاحظاتهم وآرائهم ومعدل الأعمال. تمت مشاركة استطلاع مع بعض العملاء وأظهر الحاجة المهمة لمثل هذا المشروع. في ضوء النتائج التي تم جمعها ، تم الانتهاء من تصميم تطبيق الهاتف من خلال رسم مخططات لأهم جوانب المشروع.

الكلمات الرئيسية: COVID 19 ، صناعة الكوخ ، المستثمرون ، تطبيقات الهاتف المحمول ، الأعمال.

I. Introduction

Nowadays the world is facing a numerus change in all aspects of life due to COVID-19 virus. One important impact of this virus on people is that they have started staying at home longer than ever, and lots of them has lost their jobs. Due to these circumstances, many people have started their own businesses from their houses which is also called (cottage industries) to be able to cover their life expenses in these special conditions.

II. Problem Statement

The capital of cottage industries is low to medium, and the owners of cottage industries prefer to spend their capital on the everyday costs and in operation cost rather than spending it on the marketing or on designing application or software for their businesses.

III. Objectives

- Provide an integrated solution for marketing, payment and delivery for cottage industries.
- Save time and cost of order making.
- Enhance the reliability of information provided with cottage products and their quality through a unified evaluation and customer review.
- Enhance the customer satisfaction on cottage products by integrating intelligent content recommendation.

IV. Literature review

Digital advertising is more reliable than those of traditional advertising methods. So, many businesses start putting more budget in digital ads on WhatsApp and Facebook. But these advertising methods require a lot of money and time. So, the project is related to advertising application for all type of business (Aizen 2010). This application provides businessman an opportunity to put advertisements and also provide a reliable and efficient ordering system. As, in COVID-19 cottage businesses need to advertise their projects this project will meet the requirements of the small to medium businesses. In this chapter a literature is given on the similar applications, a detailed literature review, feasibility analysis of the proposed method is done (Johnston 2013).

Effective advertisement system can be very beneficial in boosting the sales of retailer by reminding consumers and recommend them to purchase additional products that are not originally on customer' shopping lists. Existing advertisement systems are designed for identification and prediction of top selling items, also known as hot sellers, the customer's behavior and sales data can be predicted using various machine learning techniques. An advertisement system is proposed by (Softky 2010), the framework identifies potential customers of unsought products customer's behavior using boosting-SVM. The system also provide prediction for future shopping for customers. Promising solution is showed by system to target the related advertisement for unsought products.

V. Methodology

RAD Model: is an incremental type of model and the abbreviation of RAD is rapid application development model. The RAD model is most commonly used for the mini or small projects. The functions and the components of RAD methodology are developing parallel which means equal functions and components has in RAD. According to different researches this model is also known as user friendly model because it provides a customer's feedback, delivery and purchasing behavior quickly and easily. The RAD model has five phases in the development process which are business modelling, data modelling, process modelling, generation of applications and the last phase or stage is testing and turnover (Rizwan and Iqbal 2018).

VI. Data analysis method

Linkert scale is used for designing an online questionnaires using google form. Five close-ended questions are designed for end-users while 5 open and close-ended questions are designed for the IT students. Percentage analysis is applied for analyzing the questionnaires.

1. Do you face problems while marketing your business because of COVID-19?

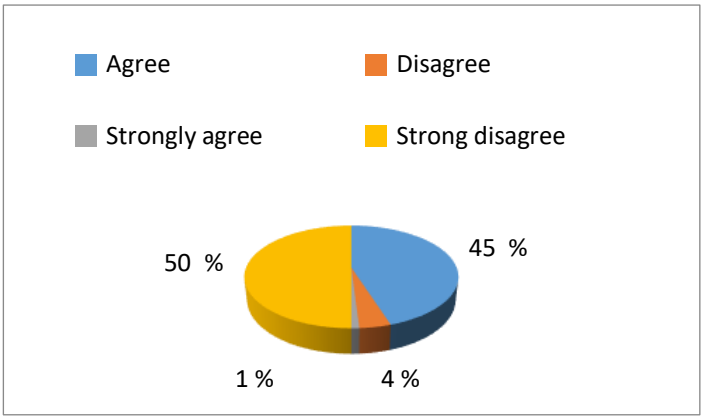

Figure 1 Question1

The majority of people respond that they face problems in the marketing of their business due to COVID-19. Only 4% replied that they do not face any provide in the marketing of their business because of using an online advertisement method.

2. Do you think a marketing system for cottage industry can be helpful?

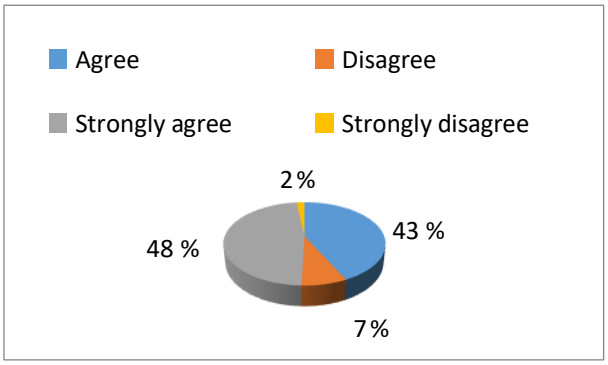

Figure 2 Question2

In response to this question, the majority of people say that the marketing system for cottage industry is so useful and only 9% are against this system.

3. Android platform is suitable for digital marketing?

The majority of people 85% want an android based system for marketing and few of them are against this question. It is because they want a web-based system for marketing.

4. The android platform can give you remote access to your system easily?

In the response to this query, most people think that the android platform gives remote access to the marketing system easily because this is the major advantage of android. Few of them (5%) are against this point.

5. A mobile application will help you to enhance your business?

This question provides a mixed result and all criteria are equal in the result as shown in the pie chart.

VII. Design

Use case diagram: There are two main users of the system, one is buyer who wants to purchase the goods, the other one is seller who wants to sell his products. Seller can post about the products he wants to sell he can post different advertisements of him on the application such as any seminar of business, any business campaign going to start or any products he wants. Buyer will login to view different advertisements of cottage industries. If

he wants to purchase the product directly from the application, then he can directly purchase by ordering the product and the seller will confirm.

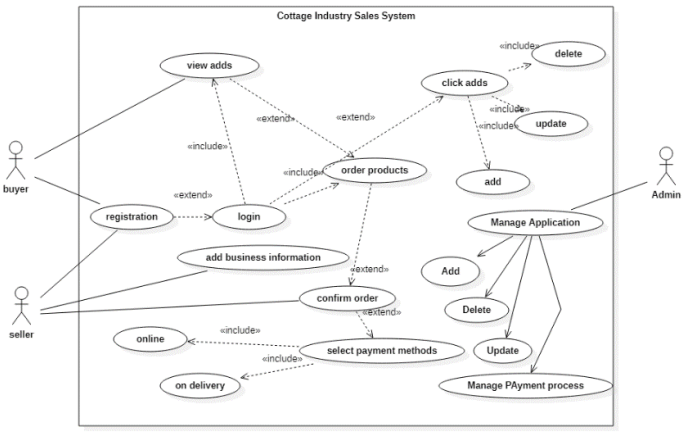

Figure 3 Use case diagram

Class diagram: There are nine main classes in the class diagram. Each class has 1 to 4 main attributes. Buyer has its own information which are the attributes. He has buyer ID, email, name, and password with which he will be registered. Whereas, seller will register with sellerID, sellerName, SellerEmail, and Seller password. Seller can add information about the adds where he will have to assignment a description about the add and the ID. Buyer will order and each order will be assign unique ID and the number of items purchased will be the quantity. Order has the information about each product. each product will have respect price. Each order will have payment which can have method online or on deliver.

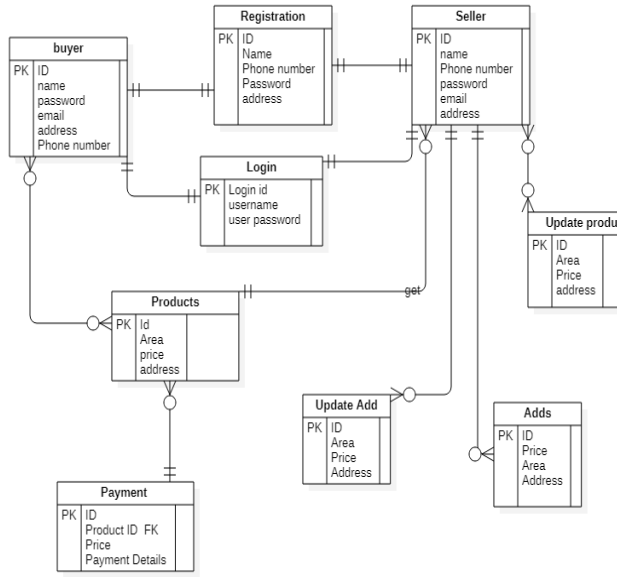

Figure 4 Class diagram

Sellers Sequence diagram: There are three main actors of the system, one is seller who wants to sell the cotton, the other one is system the interface and third is database. seller will register and data will be stored in database. When he will login, system will confirm the data entered by him. He will login to add different add about the business. He will post add and information will be stored in database. He can also add the name of the business which will be added in the data stored. When he will confirm order requested by the buyer he will confirm the order and the status of order form pending will be change to confirmed.

Buyers sequence diagram: There are three main actors of the system, one is buyer, the other one is system the interface and third is database. Buyer will register and data will be stored in database. When he will login, system will confirm the data entered by him. login to view different add about the business. If he directly wants to go to the company own website, he will be directed on the website. And if he wants to purchase the product directly from this system then he can directly purchase by ordering the product and the seller will confirm. When he will order the product the information about the order will be stored in database.

Context diagram: There are two main external entities, one is buyer. Buyer will first have to login or register. After that he can view the ads uploaded on the system or application. He can also click on the advertisement of product to view the product and buy the product. he will first have to order for the product and if the particular seller will confirm the order then his order will confirm. He can select the payment method whether online or on delivery. He can also check the description about the business. seller can upload the ads which can also have information about the product. Seller can also add the link of his business in the description about the product.

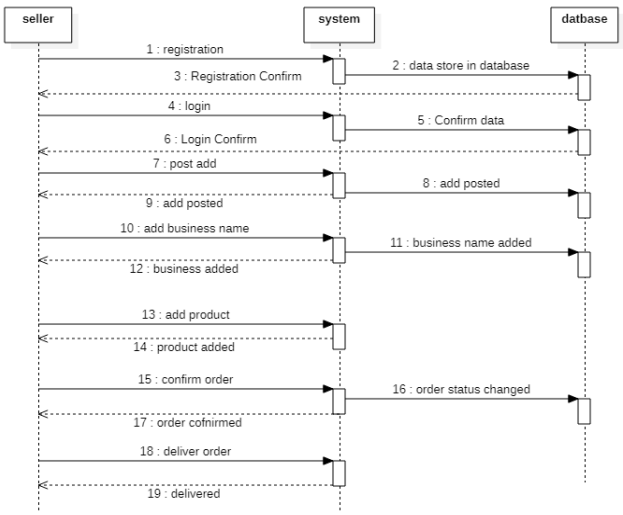

Figure 5 Sellers Sequence diagram

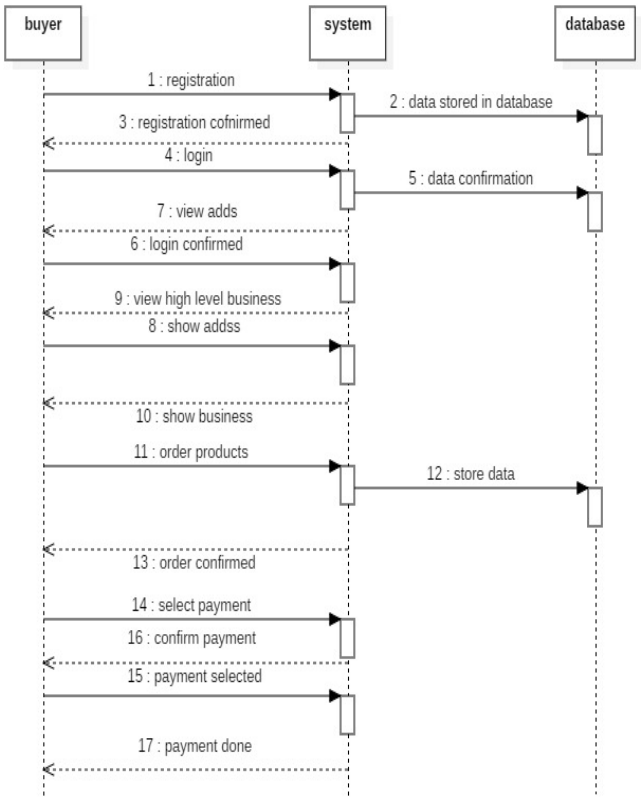

Figure 6 Buyers sequence diagram

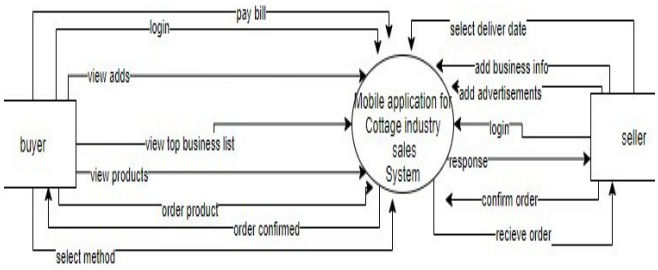

Figure 7 Context diagram

VIII. Conclusion

In conclusion, the project's major aim is to contribute in the benefits of the cottage industries in Oman and to improve their marketing and sales activities by providing a mobile application using the iterative model. By giving cottage industries in Oman the integrated solution for their businesses they will be able to focus on the quality on their products and services. The application will help in increasing the sales and the profit of cottage industries in Oman and therefore the contribution of these businesses in Oman GDP. It must increase the independence on the local products and services and improve the welfare of Omanis people.

Acknowledgements

The journal would like to acknowledge Middle East College and Ministry of Higher Education, Oman for the support.

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Smart Beach Cleaning Robot System

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Received: August 2021; Revised: April 2022;
Accepted: October 2022

Abstract

Robots that clean beaches can get rid of trash left by people and other contaminants that are bad for the ecosystem and marine life. The beach might become pristine and secure for everyone. This robot will free up cleaners from having to work as many hours, which will save time and money. In this work, a beach cleaning robot is created with the goal of easily handling and cleaning the sandy beach surface while using less power and spending less money. The goal is to decrease labor costs for the town while also lowering environmental pollution caused by litter, garbage, and abandoned things at the seaside that can be used by volunteers, organizations, and the general public. This microcontroller-based project includes a control unit, sensors, a solar panel, and batteries. The device transmits and receives the signal to the microprocessor that manages the robot's actions using four ultrasonic sensors. The robot moves in a set pattern until the cleaning is complete after covering a predetermined square area, detecting dirt there and picking it up. If it is unable to pick up the object or runs into an impediment, it adjusts its course to get around it and carry on with the process. It contributes to a green environment by using solar electricity. When the job is done, it moves back to the starting place and sends an SMS to the person in charge updating them on the progress. Test results demonstrate successful achievement of the objectives.

Keywords: *Microcontroller, sensor, robot, obstacle avoidance, beach cleaning, green environment*

الخلاصة: يحتاج المولود الجديد إلى رعاية أساسية على مدار 24 ساعة بطريقة آمنة ومتقدمة تقنيًا في مستشفيات العصر الحديث ، كما أن كثافة الرعاية أكثر حتى للأطفال الخدج. يهدف المشروع إلى تركيب أجهزة استشعار ذكية في حضانة للأطفال الخدج لاستخدامها في المستشفيات لمنح الأطفال أجواء آمنة وصحية. يهدف هذا الجهاز أيضًا إلى توفير وقت المهنيين الصحيين وإعادة طمأنة الوالدين بأن أطفالهم في بيئة آمنة. يستخدم المشروع مستشعرات درجة الحرارة والأكسجين والضغط التي تعمل وفقًا لمعايير محددة مسبقًا وهي آمنة للأطفال الخدج. يقارن المتحكم الدقيق هذه البيانات المحسوسة بالقيم المحددة مسبقًا ويرسلها إلى نظام السجل المركزي عبر تطبيق Blynk ويعرضها على شاشة LCD. في حالة حدوث خطأ ، يتم تنشيط الإنذارات الضوئية والمسموعة حيث يكتشف الميكروكونترولر ظروفًا غير صحيحة لتنبيه الممرضة أو القائم بالرعاية لفحص ظروف الرضيع. في غضون ذلك ، تبدأ مروحة التبريد في العمل عندما تصل درجة الحرارة إلى قيمة عالية للتهوية.
بالإضافة إلى ذلك ، تبدأ مروحة التفريغ في العمل عندما تتغير قيم الضغط والغاز داخل الحاضنة.

I. INTRODUCTION

Cleaning the beach is a crucial step in protecting both the health of people and marine life. Robots can be used to clean surfaces in accordance with the user's chosen robot movement direction in order to safeguard human health, keep the area free of trash, and preserve the environment. This application was very suited and motivating for completing and learning several facets of embedded system design and analysis at the undergraduate level. This undergraduate project's goal is to create a prototype that will enable it to achieve its defined objectives. The Wi-Fi connection between the user and the machine must be used for this trash-disposal robot to operate on the beach. The main function of this prototype robot is to wirelessly travel a predetermined distance from the main control station while following a predetermined mobility pattern. Using a trailer belt, it gathers up debris that gets in its way as it travels. When the robot is unable to pick up the object or encounters a roadblock, it finds another route.

II. RELATED WORK

The components used in this project and their related technical essential data and theory have been obtained by reviewing a variety of state-of-the-art literature (Hoekstra 1996). Few similar projects and their reports were reviewed as well. According to Marques and Hamano (2017), an autonomous mapping robot was developed that uses inexpensive sensors to produce a two-dimensional depiction of its surroundings. The robot collects information from a variety of sensors, including rotary encoders, gyroscope sensors, and ultrasonic sensors, and wirelessly transmits that information to a processing unit. Using an application that was also developed as part of the scope of this project, this unit filters the incoming data and

uses it to build an environment map. Applications for the resulting map include path planning, security, cleaning, and monitoring. Varuneshreddy and Nikhil (2018) developed a wirelessly communicated rubbish pickup robot for the seashore. The robot is constructed with caterpillar wheels and is powered by a 12V/30Ah battery coupled with 40W solar cells. Through a program created from a Visual Basic 2005 application running on Windows XP, the user can control a robot. Bluetooth is used to transfer user commands to the PIC18F4550 for processing. Additionally, it has an IP camera with pan/tilt capability that transmits feedback data to the human operator through an Ad-hoc system. According to the results of the robot's performances, the machine can wirelessly collect large trash with a side measurement of 12.5 x 49 cm and move on the sand at an average speed of 0.5 meters per second. Ichimura and Nakajima (2018) developed a robot's design and carried out its analysis. They talk about how to create the "Hirottaro 3" little beach cleaning robot. The robot was outfitted with a mechanism that collected objects as if somebody were mopping a floor with a brush in order to successfully collect little trash on a sandy surface. The created robot may use poles and a scanning range finder to self-localize and move independently around a sandy beach with few natural landmarks. In line with these projects, this project intends to clean the beach using microcontroller based circuit. This paper reports the performance evaluation of the designed prototype tests performed on the sandy beach.

III. METHODOLOGY

This section goes over the process that was utilized to create the prototype utilizing flowcharts and block diagrams. The block diagram in Figure 1 shows the specifications for the hardware and software components. The system flow chart outlines the methods used by this beach cleaning robot based on an in-depth examination of the requirements, design calculations utilizing data sheets, and (Guru99 2020).

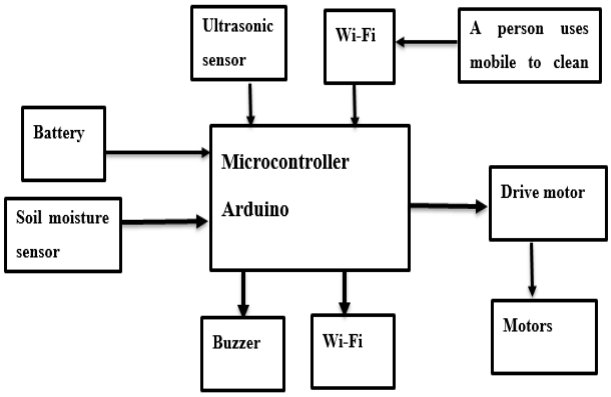

Figure 1: Block diagram for robot cleaning beach

The microcontroller is coupled to the soil moisture sensor, which measures the moisture content of the soil. The robot beach cleaner's Arduino is in charge of running it. To perform their functions, all components are connected to Arduino (Nayyar and Puri 2016). In order to communicate, the Arduino is wired up to sensors. The readings from these sensors are converted by the Arduino into data, which it then analyzes based on the algorithms it was programmed with. After that, it makes choices like starting the motors. Between the Arduino and the DC motor, there is a drive motor that supplies electricity to the motors. The DC motor is managed by the engine driver, who also receives data from Arduino. The microprocessor and other system components use the battery (iwebsite4you.uk 2020). The Arduino is connected to the Buzzer via ground and digital input. It activates a beep sound when it is linked to the power source, and the loudness may be adjusted by setting a function that indicates the device has been turned on. The Arduino board is wired to the Wi-Fi modem. By using an IOT system, it is used to control the robot. The robot's goal is to move wirelessly in a square area while picking up rubbish, avoiding any obstacles in its path, and returning to the starting place after doing the assignment.

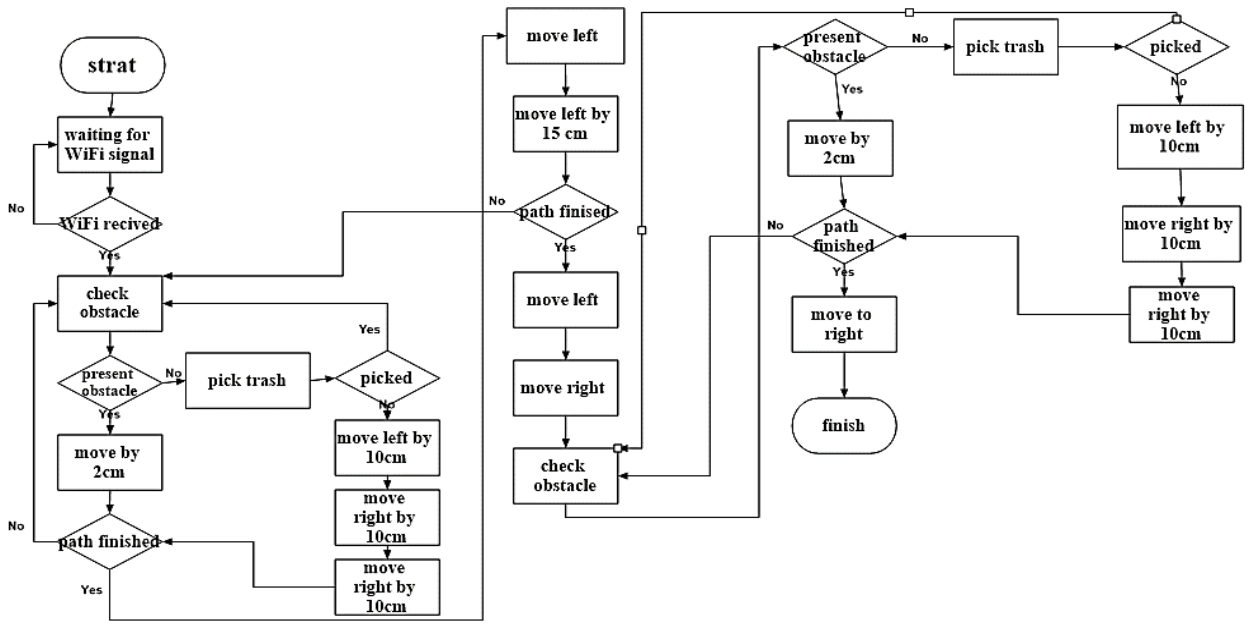

Figure 2: flow chart for robot cleaning beach

The flowchart in Figure 2 depicts the robot's connected operations as it completes the tasks. The microcontroller watches for the Wi-Fi signal; if none is detected, it waits; if one is, it begins to operate. The DC motor begins to advance as the robot begins to operate. When the distance exceeds 50 cm, the ultrasonic sensor measures any obstacles and sends the information to the IoT cloud through Wi-Fi. It will continue to go forward simultaneously if the distance is less than 50 cm. When it reaches the predetermined point, the cycle restarts and the area is cleaned. If the robot runs into something, it stops, changes course, and finishes the task using a different route. It looks for obstacles in front of the way, picks them up, and travels 100 cm along the path if there are any. If not, it moves 100 cm along the path until the straight path is complete. Following this, it proceeds 10 cm to the right, 10 cm to the left, 100 cm to the left, and 100 cm to the right to return to the original path, avoiding the obstruction. It checks for obstacles in the way of each step and then repeats them all until the task is complete.

IV. RESULTS DISCUSSION

The real distance is the distance traveled by the ultrasonic sensor to the object and reflected by dividing the distance by 2, which is half the distance traveled by the sound wave, as calculated using the (time/rate/distance) calculation formula. As an illustration, if an object is 10 cm away from the sensor and the speed of sound is 340 m/s, the wave needs to travel 294us, yet an echo pin will receive a double number (Banao 2019). Table 1 lists the test points for the intended prototype.

Table 1: Test Points

Test Point	Location	Description
Test1	Ultrasonic waterproof sensor is connected to the microcontroller (Arduino)	An ultrasonic waterproof sensor generates wave signals in the form of digital signals that are attached to the Arduino.
Test2	The soil moisture sensors is connected to the microcontroller (Arduino)	The second test point is soil moisture sensors connected by analog pin?
Test3	Buzzer is connected to the microcontroller (Arduino)	At this point, it is required to check whether the buzzer is works.
Test4	The operation of the Driver Motor is attached to the DC Motor	The fourth test point is the drive motor of DC motors with voltages between 5 and 35V, with current up to 2A, 12V is the power source, the voltage at the engine stations is around 10V.
Test5	Wi-Fi connected to Arduino	To check connection between Arduino and Wi-Fi

The circuit is designed and examined using the Proteus 8. Each significant section and component's test points are listed. The code is created for Arduino and its related hardware, such as soil sensors, ultrasonic sensors, and WiFi. The ultrasonic waterproof sensor connection, which operates with 5V connected to a digital pin and links the variable resistance to modify the ultrasonic sensor sensitivity, serves as the first point of testing. The second test point is a soil sensor that is connected to an analog pin on an Arduino and requires 5V from the board. The third test point is the buzzer, which is connected to an Arduino digital pin and requires 5V from the Arduino (Electronics Hub 2021). The fourth test point's drive motor is connected to a DC motor, and the Arduino is powered by the drive motor's 5V connection. The battery's 8 volts were used to power the driving motor (Components101 2020). Wi-Fi is the fifth test point, which is linked to Arduino via 5 volts. Every link is simulated using the software Proteus. The results of the simulation are contrasted with the designed parameters in Table 2.

Table 2: Testing points for robot

Test cases at test points	Design Value	Simulation Value
First test point Ultrasonic waterproof sensor is connected to Arduino	The needed power supply is roughly 5V, with a distance rating of 2cm – 500cm, a current of 15mA, and a frequency of 40KHZ.	voltage 5V and 0.25 A
Second test point soil sensor connected to Arduino	Operating voltage 3.3V to 5V DC and Operate Current is 15mA. Easy to use with microcontrollers with Analog and LM393 based design.	Input voltage 5V and current 0.15m A.
Third test point Buzzer connected to Arduino	The operating voltage ranges from 4 to 8 volts DC, with a rated current of 30 milliamps. The sound is a continuous beep with a 2300 Hz resonant frequency.	Input voltage 4.81V and current 0.25 A

Fourth test point Frist driver motor connected to 4 DC motor and second drive motor connected to 2 DC motor	The input voltage for the DC motor is roughly 8V from the battery, while the power supply for the switched logic circuit inside the IC is 5V.	4.24 volt 0.36 A
Fifth test point Wi-Fi connected to Arduino	The power supply is simply +3.3V. The input and output voltages are both 3.6 volts, and the current is 12 mill amperes. It has a low-power 32-bit processor with a frequency of 80 MHz built-in. it is Supports serial communication.	Wi-Fi 5 volt Power supply for battery 8 volt.

Table 2 lists the datasheet design parameters for each test point as well as the actual simulation values used by the software. Figure 3 shows the simulation results for Test Situation 1. The simulation outcomes for each test point are in close agreement with the datasheet, and the Arduino input voltage is 5V. The clean robot can operate with an error of less than 10% and a circuit output accuracy of about 90% thanks to voltage and circuit changes, which significantly improves the circuit's performance in comparison to the actual object. Figures 4 and 5 show the hardware implementation outcomes of the project.

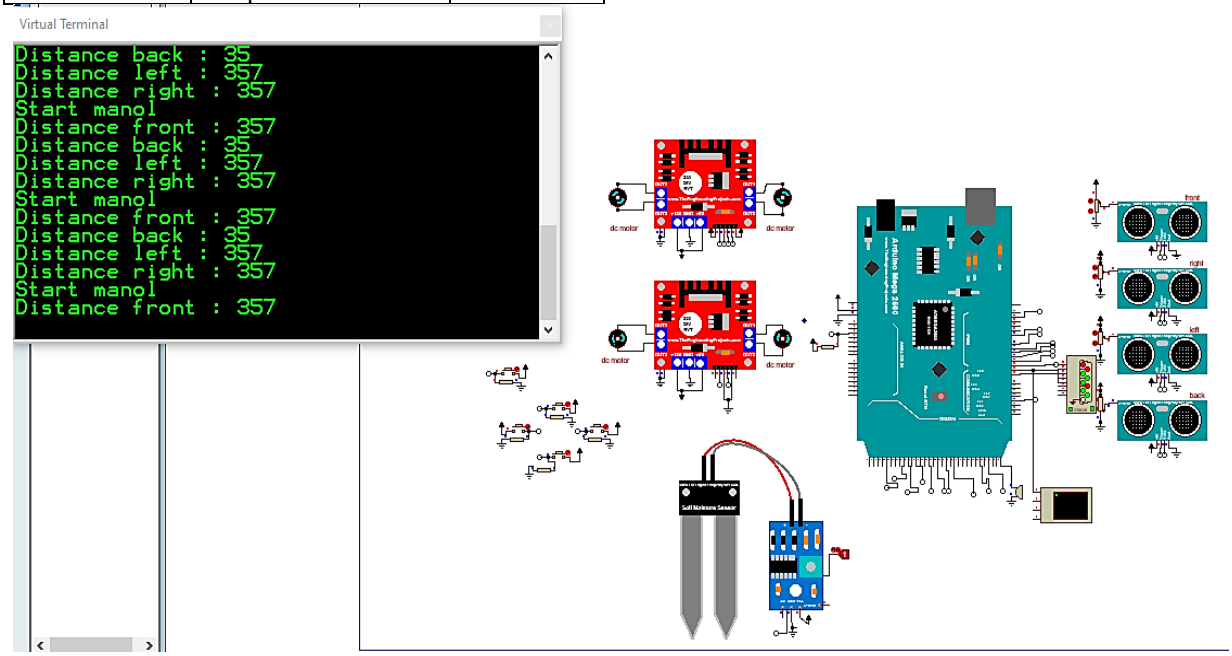

Figure 3: Test Situation 1

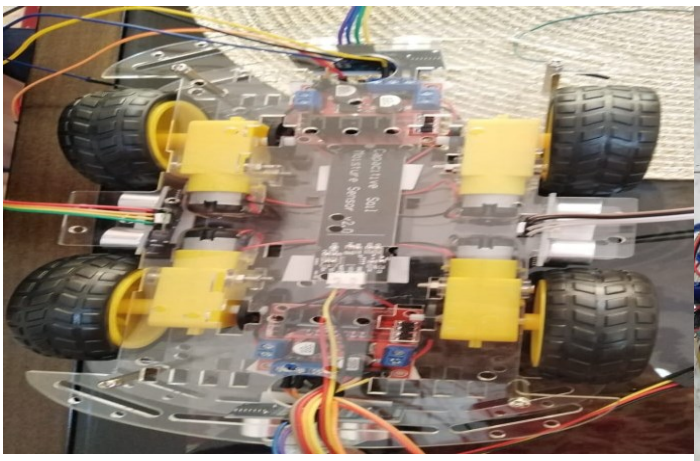

Figure 4: Connected Sensor, Motors and Drive motor

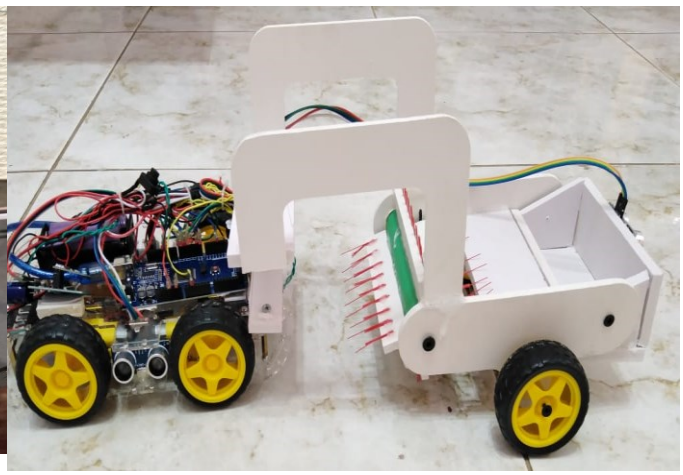

Figure 5: Robot Cleaning Beach

Table 3: System Validation

Item or element	Observations	Updates or response
Auto control	In simulation in Proteus software to control the robot depended on steps written in the program. the researcher wrote 6 steps front and 6 steps right and 6 steps left, when the robot moves, it makes clean the beach at the same time. The soil sensor in simulation press 1 that means water is detected. The buzzer makes an alarm. By changing the resistor, the ultrasonic sensor can detect whether obstacle is far or near to the robot depending on the program code (in this case, less than 30 cm). The default screen shows the direction of the robot and distance for all ultrasonic sensors.	The hardware to control the robot depends on the steps written in the program. The program needs to be downloaded on the Arduino board. The researcher wrote 6 steps front and 6 steps right and 6 steps left, when the robot moves, it makes clean the beach at the same time. If the soil sensor senses water, the buzzer makes an alarm. The ultrasonic sensor senses an obstacle to the robot. It stops a quarter second then moves 10 cm left then moves 10 cm right then moves 10 cm left to back on the path until it covers a specific area. The limitation for the robot is that when it completes cleaning, it should return to the start point.
Mobile control	In simulation to control the robot by using the mobile application (Blynk). Blynk needs to be downloaded on the phone and create an account and password. Also, need to download VSPE software in the computer to the connection between computer and the mobile. When the robot moves, it makes cleans the beach at the same time. The soil sensor should press 1 then the buzzer makes an alarm. The ultrasonic sensor senses an obstacle to the robot. To control the robot easily and fast. Also it can avoid obstacles and water.	In hardware to control the robot by using the mobile application (Blynk). It needs to download Blynk on the phone and create an account and password. Needs to download the program on the Arduino board. When the robot moves, it cleans the beach at the same time. The ultrasonic sensor senses an obstacle to the robot to control the robot easily and fast. Also it can avoid obstacles and water.

Table 3 lists the specifications for system validation that support system operation. The objectives attained at this level include: In order to better illustrate the software design, the driver motor is helped by the ultrasonic sensor's basic operation in determining the direction of the DC motor that is connected to it. The addition of the soil sensor was made to monitor soil moisture. The robot's power supply is its battery. Additionally, mobile apps were developed to make operating the robot quicker and easier.

V. CONCLUSIONS

This robot is intended to serve as a useful and practical remote control with some user interaction and limited autonomy. The project's primary objective was to gather little pieces of beach debris. The robot will be controlled by a mobile app connected to Wi-Fi by the person cleaning the beach. The developed prototype uses the Internet of Things (IoT) to operate the robot and offers a highly effective and environmentally friendly approach to quickly clean huge areas. Garbage was successfully gathered quickly and efficiently throughout testing. The robot always moved at the same speed. The excrement was clearly visible when it was 20 cm distant from the trash. The mobile robot is built using ESP8266-based modules, enabling a low-cost design with Wi-Fi wireless control. This semi-autonomous robot that finds and gathers objects is made with an Arduino microcontroller. Future IoT and big data platforms will be used to enable the development of integrated management systems, timely tracking and problem-solving with robot usage, and even remote maintenance. Instead of batteries, solar panels can be utilized to make the system more energy-efficient (Thomas et al. 2018).

Acknowledgements

The conducted research is supported by Middle East College Muscat. The authors are extremely grateful and would like to thank the department of Electronics and Communication Engineering as well as those who supported this research directly or indirectly.

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Journal of Big Data & Smart City
كلية الشرق الأوسط
Middle East College

Inventory Management Optimization with Data Analytics for a Trading Company

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Received: August 2021; Revised: April 2022;
Accepted: November 2022

Abstract

Distributors, manufacturers, and suppliers face the daunting challenge of inventory control. Each supply management problem that arises has ramifications. To satisfy supply and demand, inventory optimization will ensure that the correct commodity is available in the right amounts, at the right price, and in the right places. Furthermore, companies that optimize their inventory can reduce stock levels and, as a result, prevent bearing expenses and obsolescence write-downs. Data analytics helps suppliers and marketers assess their stocking goals and whether any upstream or downstream problems need to be resolved, which is critical in resource control and optimization processes. This study aims to explore how inventory management optimization, supported by data analytics, would be beneficial for a trading company operating in Oman. Currently, trading companies can only solve inventory management problems by either hiring expensive offshore software or using open-source software with little to no knowledge on how to adapt that software to suit specific needs. An online inventory management system is developed using the Java language and MySQL as the database server. Optimization is performed using the Orange data mining tool. The methodology chosen for application development is the Dynamic Systems Development Method. An interview has been conducted with a trading company employee for data collection purposes and the testing was done to ensure optimal performance. Data analytics was performed on the data collected from the online system and data mining was applied by applying feature reduction methods to optimize the results. The study showed a promising result to provide insights on the latest business trends and access the inventory effectively and efficiently.

Keywords: *Classification, Data Analytics, Inventory Management, Optimization, Random Forest.*

الملخص

يواجه الموزعون والمصنعون والموردون التحدي الصعب المتمثل في مراقبة المخزون. لذا فان كل مشكلة في إدارة التوريد تنشأ لها تداعيات . لذا فان تلبية العرض والطلب لتحسين المخزون توفر السلعة الصحيحة بالكميات المناسبة وبالسعر المناسب وفي الأماكن المناسبة. علاوة على ذلك ، يمكن للشركات التي تعمل على تحسين مخزونها أن تقلل من مستويات المخزون ، ونتيجة لذلك ، تمنع نفقات تحمل التكاليف والتقادم. تساعد تحليلات البيانات الموردين والمسوقين على تقييم أهداف التخزين الخاصة بهم وما إذا كانت هناك حاجة إلى حل أي مشاكل في المراحل الأولية أو النهائية ، وهو أمر بالغ الأهمية في عمليات التحكم في الموارد والتحسين. تهدف هذه الدراسة إلى استكشاف كيف سيكون تحسين إدارة المخزون ، بدعم من تحليلات البيانات ، مفيدًا لشركة تجارية تعمل في عمان. في الوقت الحالي ، يمكن للشركات التجارية فقط حل مشاكل إدارة المخزون إما عن طريق الاستعانة ببرامج خارجية باهظة الثمن أو باستخدام برامج مفتوحة المصدر مع القليل من المعرفة أو عدم معرفتها بكيفية تكييف هذا البرنامج ليناسب الاحتياجات المحددة. تم تطوير نظام إدارة المخزون عبر الإنترنت باستخدام لغة Java و MySQL كخادم قاعدة بيانات. يتم إجراء التحسين باستخدام أداة استخراج البيانات من Orange. المنهجية المختارة لتطوير التطبيق هي طريقة تطوير الأنظمة الديناميكية. تم إجراء مقابلة مع موظف شركة تجارية لأغراض جمع البيانات وتم إجراء الاختبار لضمان الأداء الأمثل. تم إجراء تحليلات البيانات على البيانات التي تم جمعها من النظام عبر الإنترنت وتم تطبيق التنقيب عن البيانات من خلال تطبيق طرق تقليل الميزات لتحسين النتائج. أظهرت الدراسة نتيجة واعدة لتقديم رؤى حول أحدث اتجاهات الأعمال والوصول إلى المخزون بفعالية وكفاءة.

الكلمات الرئيسية: التصنيف ، تحليلات البيانات ، إدارة المخزون ، التحسين ، الغابة العشوائية.

I. Introduction

The manufacturing industry is a vital component for the economy of a country. It is the key component in a country's Gross Domestic Product (GDP). Due to this importance, the manufacturing industry has to operate as efficiently as possible in order to reduce costs, wastage, and increase profitability in the process. The low production cost gives the company a price advantage over competitors both within the country and in the export market.

The manufacturing industry will design and manufacture products using raw materials that may be procured locally or imported from outside the country. These raw materials are stored either in a warehousing facility within the premises or in an off-premises central warehousing facility. The finished goods are also stored in a warehouse which may be on or off-premises. These warehouses act as a transit station to store inventory temporarily before it is either sent to production, in the case of raw materials, or to sales, in the case of finished goods. Therefore, the warehouse is a crucial area in the supply chain process that needs to be managed properly.

An efficient warehouse is one where the inventory is sorted and kept in a manner which makes it easily accessible, identifiable and moveable. In addition to this, there are times when the warehousing department needs to know the status of the goods, especially when they are in transit, in order to prepare the space and finish the receiving formalities well in advance instead of wasting time and beginning preparations late. Such information must be trickled down to all concerned and using phone calls and/or emails is very inefficient.

The warehousing department plays a very crucial role and acts as an intermediary between the procurement department, the production department, and the sales department. Therefore, a key tool in ensuring these departments are aligned and the company runs efficiently is an Inventory Management System (IMS) or Warehouse Management System (WMS). It ensures real-time access to stock level reports, usage reports etc. while ensuring that proper picking methods (FIFO/LIFO) are followed.

The objective of the study is (1) To provide users with an easy-to-use system that fulfils all their inventory management needs, such as knowing the status of goods in transit, suppliers of goods, and item storage within the warehouse. (2) To establish vital communication between the company's employees and their suppliers and customers, keeping each other up-to-date on all available information about the stock. (3) To review existing literature and similar systems in order to obtain a better understanding of how to model the system to meet the client requirements. (4) To keep in touch with the company that uses this system in order to fulfil any future needs they have.

II. Background Study

Inventory management exists only to serve the customer with a company's inventory. The inventory can include finished goods or materials. If a company wishes to service a customer, they must put the customer's viewpoint first and consider factors such as availability in the correct quantity at the right time, place, and cost. The author further states that good inventory planning covers fluctuations in demand, forecast errors, and supply errors, since customer demand is always changing and can never be predicted to a high level of accuracy. The primary goal of a company is to minimize costs on inventory while still meeting the functional requirements. Here, improved forecasting and process reliability allows for reductions in inventory, but keeps the same level of manufacturing efficiency and customer service. The process of inventory management is continuous, meaning that standards have to be maintained constantly. A basic understanding of the processes within inventory management is the minimum requirement for all involved personnel [1].

Inventory management must be thought of by companies very carefully, as any mistakes can be costly. Good inventory management leads to higher profitability and reduced vulnerability in competitive markets and globalization. Therefore, strategy evaluation and optimal decision-making are the key in the optimization of the total flow of materials to and from the company, be it suppliers, manufacturers, or end users. The authors further state that managers have to make appropriate decisions at the operational, strategic, and tactical level. A company should maintain robust supply chains in order to remain competitive in the industry; they must be responsive to changes. The authors then discuss two approaches to solve inventory issues: analytic and simulation. Simulation approach involves managers testing out different scenarios before deciding on the one with the best results. The analytic approach is more simplistic in nature, and this is the method most decision makers prefer for this reason [2].

III. Literature Review

Large scale data can influence decisions regarding inventory management and how it can make a company competitive. They state that, in recent years, more and more data has become readable by machines. This paved the way for applications that could predict results, and the authors cite two examples, one of them being the prediction of video game demand based on search engine query results. Inventory management is mainly dependent on the demand for the company's stock. Using the prediction data, the company can decide how much to stock their shelves with their products.

Using this data, the authors created inventory prescriptions for each location and period when stock will be replenished. The performance of the method is then compared to the performance of the perfect-forecast policy, which has unparalleled knowledge on future demand, and the performance of a data-driven policy. When the authors created a graph out of the performance

data, it was discovered that their method was 88% close to the performance of the perfect-forecast policy in terms of the volumes of sell-through [3].

The authors further state that big data analysis can be performed with the help of various software tools. They list the benefits of using big data analytics such as faster market response time, recognizing revenue streams, improved efficiency, increase profitability, and enhancing relationships with end users. The method also allows the organization to get a better understanding of their data, and so classify and analyze that data accordingly. The authors conclude that companies should strive to employ big data analytics for various reasons. They claim it improves the profitability of the organization based on demand using customer retention [4].

The authors list drawbacks that occur in manual inventory management; they include human errors, increased labor costs from operating a manual system, and poor efficiency in materials-handling. Computing technologies have demonstrated great improvements to warehouse management in recent years, introducing benefits such as tighter inventory control, lower response time, and a more diverse variety of stock-keeping units. [5] Also shows that RFID technology has become more popular in this sector. The authors present multiple papers that show the benefits of employing such technology. These include eliminating inaccurate data records, the maximum utilization of inventory within a company, shelf space and reduction in operational errors. One of the RFID systems examined used a decision maker, which improved the evaluation of company operations. The authors continue to look into multiple RFID systems in detail and their impact, which is generally positive, on inventory management. They then conclude by summarizing how RFID systems can automate the inventory management tasks and improve company operational efficiency. They recommend that companies use simulation tools to decide how best to employ such systems [5].

The impact of data analytics on various sectors of operations management. Due to the recent advances in machine learning technologies and optimization methodologies, as well as the growing availability of data, there has been an increasing usage of data analytics to solve problems in operations management. The authors have reviewed such changes in different sectors, such as location operations and inventory management. Data analytics is defined by the authors as data that is used to create models that lead to decisions to create value. In inventory management, data analytics may use data such as weather forecasts and consumer price index. The authors look at other papers that have explored methods to improve inventory decision-making [6].

[7] Proposed two approaches to inventory decisions, which are data-driven. The first approach involves risk minimization and finding the order quantity by solving a single problem; decision variables is the decision rule that maps the features to the order quantity, and thus minimize the sample-based estimate of the cost. The second approach is to model the conditional demand distribution using kernel regression and apply a sorting algorithm to determine the optimal order quantity. The authors of that paper discovered that their proposed methods outperformed the benchmark for best practices by 24%. [6] Also look a number of other papers and the proposed methods within them, describing how to implement them and their success rates.

The technologies employed by these approaches differ significantly. The authors state that while they both aim to revolutionize and deployment and managing businesses through cloud computing, there is no knowledge that guides in choosing which technology is better. Therefore, a customer should examine both technologies and select which one best suits their needs. They must also be an expert in one of the technologies for successful deployment.

IV. Methodology

For this project, the Dynamic System Development Method (DSDM) was chosen for the implementation of the project. The methodology has been attributed to a high number of successful projects compared to traditional methodologies for a number of reasons [8] [9] [10] [11] [12]. Establishes that a change in requirements is always expected in a project life cycle, and as such there is an increasing demand for a project framework with the least amount of risk. By switching from a traditional methodology to the Dynamic System Development Method, the cost of development, time, and overall productivity are impacted positively. Dynamic System Development Method is well-suited for changing requirements, with a focus on continuous user involvement and frequent delivery. Therefore, the methodology can satisfy the aforementioned demand. The methodology strictly follows the project time and budget that was established at the beginning of the life cycle. The methodology also has a strong reliance on system testing and cooperation between the user and the developer, thus eliminating as many software errors as possible [8].

V. Design

The user wishes to access the database, the

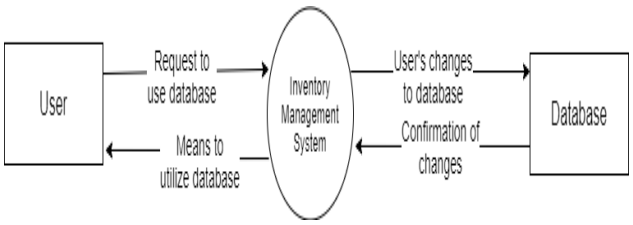

Figure 1. Level 0 Data Flow Diagram

Figure 1. Shows the relation between the user, system, and database. system will provide the means to do so, and pass the requested changes onto the database. Figure 2. Shows the relation between the user, system, and database in more detail. Reports are also involved. The user can either request changes to the database or request a report to be made from the data stored in the database.

Figure 2. Level 1 Data Flow Diagram

Figure 3. Shows all the attributes and relationships between the entities in the system. Item includes all attributes of the items. Data analytics can be performed on the item data. Report's attributes include the type, the data displayed, and the date of creation.

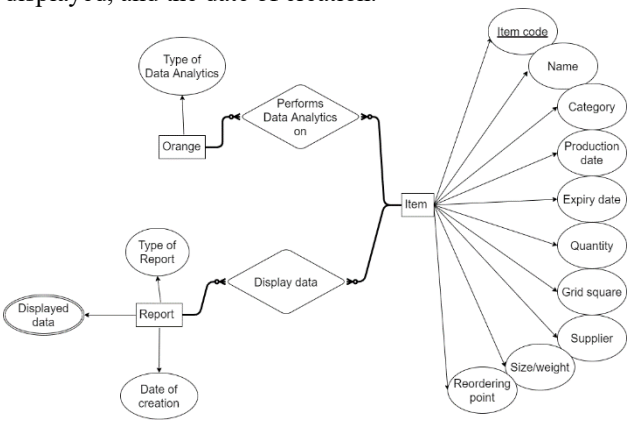

Figure 3. Entity Relationship Diagram

Figure 4. Shows the steps involved in the data curation process. First, the data is cleansed to eliminate any corrupt data, and is then sent to pre-processing where the data is modified after being exported from the system into an Excel spreadsheet. The data is then classified using classifications like Random Forest and Tree, before having its performance evaluated through a confusion matrix. Feature reduction will be applied through Principal Component Analysis. Finally, the data will be interpreted to extract some useful meaning.

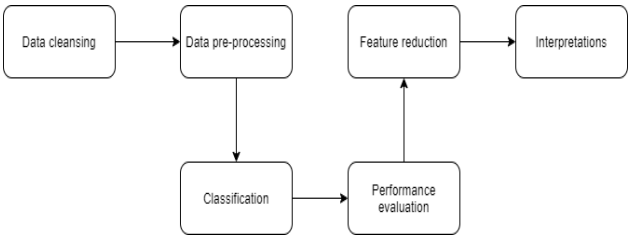

Figure 4. Data curation model

Tree, Naïve Bayes, SVM, Logistic Regression, and kNN. It can be discretized, ranked, tested and scored, and then put through a confusion matrix to evaluate the accuracy of results from those classifications. The performance can also be evaluated using ROC (receiving operating characteristic) analysis and Principal Component Analysis. The data is visualized through RadViz.

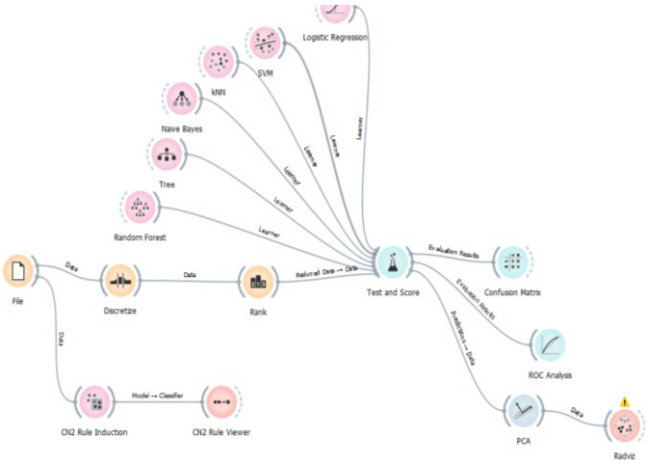

Figure 5. Data analytics model

VI. Implementation

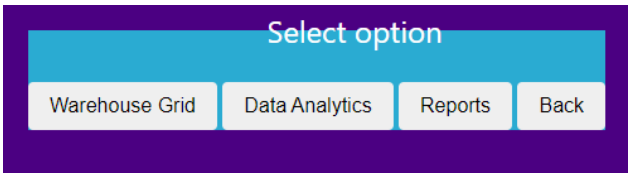

Figure 6. Main Menu.

The main menu page as shown in Figure 6. allows the user to select which page they would like to go to by clicking the appropriate button. They may also return to the login screen by clicking "Back."

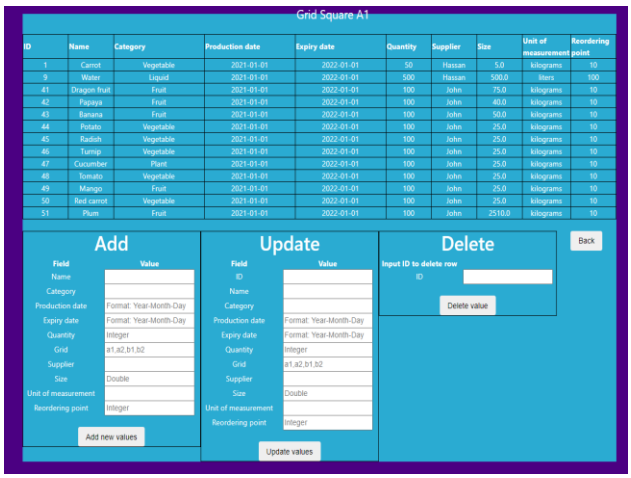

Figure 7. Grid Square Page.

Each grid square page displays a certain number of items depending on where those items are stored in the warehouse. The pages also allow the user to add new items, update existing items, or delete items from the database by filling in the required fields. They can return to the main menu by clicking "Back." As shown in Figure 7.

VII. Results and Discussion

(Chen et al., 2018) discusses different algorithms that extract some meaning out of the dataset. The algorithms selected for this project were principal component analysis, regression analysis (logistic regression), association rules (CN2 rule induction), Bayesian classification (Naive Bayes), and decision tree. For prediction and early warning, support vector machines algorithm was selected. Data visualization is done through RadViz [13][14] [15][16][17][18][19].

Based on these results, the random forest algorithm had the highest accuracy of all six algorithms. Random forest yielded the highest accuracy with 97% with no transformation or feature selection, cross validation with twenty folds, and non-stratified method.

Table 1. No transformation or feature selection, cross validation with five folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.96	0.85	0.85	0.85	0.85
Tree	0.94	0.91	0.91	0.92	0.91
Naive Bayes	0.91	0.74	0.74	0.74	0.74
SVM	0.81	0.67	0.67	0.72	0.67
kNN	0.79	0.62	0.62	0.62	0.62
Logistic Regression	0.45	0.35	0.29	0.25	0.35

Table 2. No transformation or feature selection, cross validation with ten folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.97	0.87	0.87	0.87	0.87
Tree	0.94	0.91	0.91	0.92	0.91
Naive Bayes	0.92	0.75	0.75	0.76	0.75
SVM	0.82	0.68	0.68	0.73	0.68
kNN	0.81	0.66	0.66	0.67	0.66
Logistic Regression	0.42	0.39	0.33	0.28	0.39

Table 3. No transformation or feature selection, cross validation with twenty folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.97	0.85	0.85	0.85	0.85
Tree	0.96	0.93	0.93	0.93	0.93
Naive Bayes	0.92	0.76	0.76	0.77	0.76
kNN	0.82	0.67	0.67	0.68	0.67
SVM	0.81	0.63	0.63	0.69	0.63
Logistic Regression	0.38	0.42	0.35	0.29	0.42

Table 4. Transformation with equal-frequency discretization, no feature selection, cross validation with five folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.91	0.72	0.72	0.73	0.72
Tree	0.86	0.71	0.71	0.72	0.71
kNN	0.89	0.74	0.74	0.74	0.74
SVM	0.85	0.70	0.70	0.71	0.70
Logistic Regression	0.91	0.71	0.71	0.71	0.71
Naive Bayes	0.90	0.70	0.70	0.70	0.70

Table 5. Transformation with equal-frequency discretization, no feature selection, cross validation with ten folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Tree	0.88	0.68	0.68	0.69	0.68
SVM	0.85	0.64	0.64	0.64	0.64
Random Forest	0.90	0.66	0.66	0.66	0.66
Naive Bayes	0.90	0.70	0.70	0.70	0.70
Logistic Regression	0.91	0.71	0.71	0.71	0.71
kNN	0.90	0.74	0.74	0.75	0.74

Table 6. Transformation with equal-frequency discretization, no feature selection, cross validation with twenty folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Logistic Regression	0.91	0.68	0.68	0.68	0.68
Random Forest	0.91	0.67	0.67	0.68	0.67
kNN	0.90	0.73	0.73	0.74	0.73
Naive Bayes	0.90	0.72	0.71	0.73	0.72
Tree	0.88	0.66	0.66	0.67	0.66
SVM	0.86	0.62	0.62	0.62	0.62

Table 7. Transformation with equal-frequency discretization, feature selection with ranking (gini decrease), cross validation with five folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.90	0.72	0.72	0.73	0.72
Tree	0.86	0.71	0.71	0.72	0.71
kNN	0.89	0.74	0.74	0.74	0.74
SVM	0.84	0.70	0.70	0.71	0.70
Logistic Regression	0.91	0.71	0.71	0.71	0.71
Naive Bayes	0.90	0.70	0.70	0.70	0.70

Table 8. Transformation with equal-frequency discretization, feature selection with ranking (gini decrease), cross validation with ten folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.91	0.71	0.71	0.71	0.71
Tree	0.88	0.68	0.68	0.69	0.68
kNN	0.90	0.74	0.74	0.75	0.74
SVM	0.85	0.64	0.64	0.64	0.64
Logistic Regression	0.91	0.71	0.71	0.71	0.71
Naive Bayes	0.90	0.70	0.70	0.70	0.70

Table 9. Transformation with equal-frequency discretization, feature selection with ranking (gini decrease), cross validation with twenty folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.89	0.65	0.65	0.65	0.65
Tree	0.88	0.66	0.66	0.67	0.66
kNN	0.90	0.73	0.73	0.74	0.73
SVM	0.83	0.62	0.62	0.62	0.62
Logistic Regression	0.91	0.68	0.68	0.68	0.68
Naive Bayes	0.90	0.72	0.71	0.73	0.72

Table 10. Transformation with equal-width discretization, feature selection with ranking (gini decrease), cross validation with twenty folds, non-stratified

Model	Accuracy	Sensitivity	F-Measure	Specificity	Recall
Random Forest	0.91	0.69	0.69	0.69	0.69
Tree	0.90	0.70	0.70	0.70	0.70
kNN	0.86	0.72	0.71	0.72	0.72
SVM	0.83	0.66	0.66	0.67	0.66
Logistic Regression	0.90	0.64	0.64	0.64	0.64
Naive Bayes	0.87	0.71	0.70	0.72	0.71

Actual \ Predicted	High	Low	Medium	Σ
High	22	0	8	30
Low	2	23	4	29
Medium	10	4	27	41
Σ	34	27	39	100

Figure 10. Confusion matrix for random forest algorithm.

CN2 Rule Viewer

	IF conditions		THEN class	Distribution	Probabilities [%]	Quality	Length
0	id≥86.0	→	reorder=Medium	[0, 0, 15]	6 : 6 : 89	-0.00	1
1	id≥69.0	→	reorder=Low	[0, 17, 0]	5 : 90 : 5	-0.00	1
2	id≥51.0	→	reorder=High	[18, 0, 0]	90 : 5 : 5	-0.00	1
3	id≥38.0	→	reorder=Medium	[0, 0, 13]	6 : 6 : 88	-0.00	1
4	id≥26.0	→	reorder=High	[12, 0, 0]	87 : 7 : 7	-0.00	1
5	id≥13.0	→	reorder=Medium	[0, 0, 13]	6 : 6 : 88	-0.00	1
6	id≤2.0	→	reorder=Low	[0, 2, 0]	20 : 60 : 20	-0.00	1
7	id≤4.0	→	reorder=Low	[0, 2, 0]	20 : 60 : 20	-0.00	1
8	id≤6.0	→	reorder=Low	[0, 2, 0]	20 : 60 : 20	-0.00	1
9	id≤8.0	→	reorder=Low	[0, 2, 0]	20 : 60 : 20	-0.00	1
10	id≤10.0	→	reorder=Low	[0, 2, 0]	20 : 60 : 20	-0.00	1
11	id≤12.0	→	reorder=Low	[0, 2, 0]	20 : 60 : 20	-0.00	1
12	TRUE	→	reorder=Medium	[30, 29, 41]	30 : 29 : 41	-1.566	0

Figure 11. CN2 Rule Inducer Algorithm.

Consists of a table that displays the probabilities under several conditions.

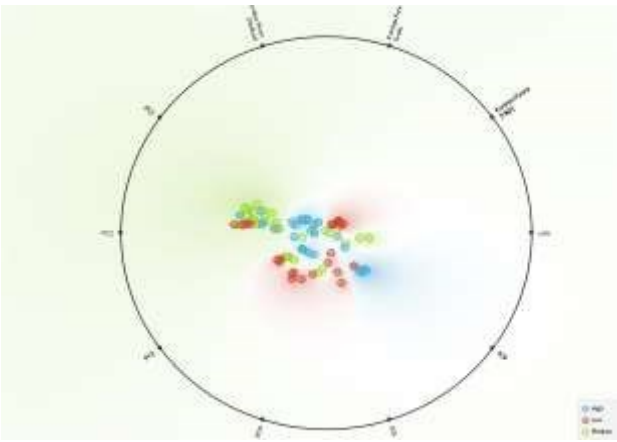

Figure 12. Visualization of Principal Component Analysis and Random Forest through RadViz.

Consists of a circle with multiple dots around different positions. Results show that medium values are more common towards PC1, Random Forest (Medium), and PC2, while low and medium values are geared towards the center.

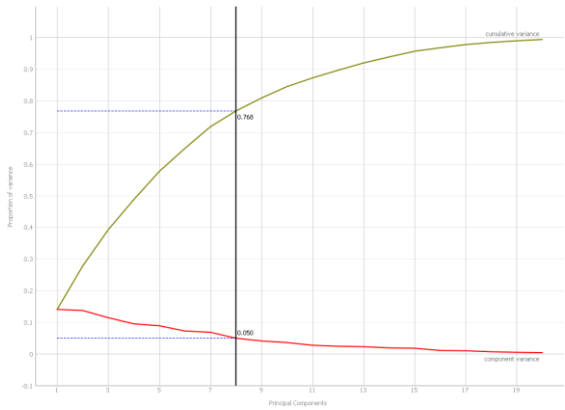

Figure 13. Principal Component Analysis.

VIII. Conclusion

The study met the requirement of the study conducted, save for establishing communication between the supplier and customer due to a lack of expertise. The system was developed with Omani trading companies in mind and built for their needs specifically. With this system, updating stock and tracking items within the warehouse are much easier tasks using up-to-date methods of inventory management optimization. The system will keep track of which item is stored in which grid square and stock counting is automatized. However, the system could not be deployed due to the high cost of setting up a Java web application for public use.

The limitation of the study is that the system uses an excel file to be fed into the data mining tool. This can be done in a real-time situation to provide information quickly.

For future works, the online system can be embedded with real-time data analytics to help the logistics sector of Oman.

Acknowledgements

We would like to thank Middle East College, Department of Computing for the support.

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Journal of Big Data & Smart City
كلية الشرق الأوسط
Middle East College

Smart Thermal Preservation Nursing for Premature Babies

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Received August 2021; Revised: April 2022;
Accepted: November 2022

Abstract: The newborn baby require 24-hour essential care in a safe and technologically advanced manner in modern day hospitals and intensity of care is even more for premature babies. The project's goal is to install intelligent sensors in a nursery for premature infants to be used in hospitals to give infants a safe and healthy atmosphere. This addresses their thermal incubator demands for premature infants as well. This device is also intended to save health professionals' time and to re-assure the parents that their child is in a secure environment. The project uses temperature, oxygen, and pressure sensors that operate under predetermined standards that are safe for premature infants. The microcontroller compares these sensed data to the predetermined values and sends them to the central log system via the Blynk application and displays them on LCD. In case of fault, light and audible alarms are activated as the microcontroller detects incorrect conditions alerting the nurse or caretaker to inspect the infant conditions. Meanwhile cooling fan begins to operate when the temperature reaches a specific high value to ventilate. Additionally, the suction fan begins to operate when the pressure and gas values inside the incubator are changed.

Keywords: *child care, sensor, central log system, microcontroller, alarm*

الملخص
يمكن للروبوتات التي تنظف الشواطئ أن تتخلص من القمامة التي يتركها الناس والملوثات الأخرى الضارة بالنظام البيئي والحياة البحرية. قد يصبح الشاطئ نقيًا وآمنًا للجميع. سيحرر هذا الروبوت عمال النظافة من الاضطرار إلى العمل لساعات عديدة ، مما سيوفر الوقت والمال. في هذا العمل ، تم إنشاء روبوت لتنظيف الشواطئ بهدف التعامل مع سطح الشاطئ الرملي وتنظيفه بسهولة مع استخدام طاقة أقل وإنفاق أموال أقل. الهدف هو تقليل تكاليف العمالة للمدينة مع تقليل التلوث البيئي الناجم عن القمامة والقمامة والأشياء المهجورة على شاطئ البحر والتي يمكن استخدامها من قبل المتطوعين والمنظمات وعامة الناس. يتضمن هذا المشروع القائم على وحدة تحكم دقيقة وحدة تحكم وأجهزة استشعار ولوحة شمسية وبطاريات. ينقل الجهاز ويستقبل الإشارة إلى المعالج الدقيق الذي يدير حركات الروبوت باستخدام أربعة أجهزة استشعار فوق صوتية. يتحرك الروبوت في نمط محدد حتى يكتمل التنظيف بعد تغطية منطقة مربعة محددة مسبقًا ، واكتشاف الأوساخ هناك والتقاطها. إذا كان الجهاز الغير قادر على التقاط الكائن أو اصطدم بعائق ، فإنه يعدل مساره للالتفاف عليه والاستمرار في العملية. يساهم الجهاز في بيئة خضراء باستخدام الكهرباء الشمسية. عند الانتهاء من المهمة ، تعود إلى مكان البداية وترسل رسالة نصية قصيرة إلى الشخص المسؤول لتحديثها عن التقدم. تظهر نتائج الاختبار النجاح في تحقيق الأهداف.

الكلمات المفتاحية: متحكم دقيق ، جهاز استشعار ، إنسان آلي ، تجنب العوائق ، تنظيف الشواطئ ، بيئة خضراء

I. INTRODUCTION

For a youngsters to adapt to life, they must be healthy. We must therefore take care of their health from the beginning of the proper development. While "intelligent heat care for premature babies" lessens the strain on the staff by minimizing the requirement for manual observation when a regular, non-technical thermal incubator is present, some preterm babies require 24-hour extra care and supervision and workers give it great importance. A baby is considered preterm by the World Health Organization and the American Academy if it is born at 37 weeks of pregnancy, or 259 days after the first day of the last menstrual cycle. We intend to examine important health conditions related to premature babies in this work. We use a thermal device that offers acceptable environmental conditions for them, keeping these considerations in mind and using sensors that keep an eye on the temperature and oxygen levels in the incubator for premature babies. The microcontroller is to compare the sensed values to the preset values and display them on the LCD before sending the data to the central log system via the Blynk application. Upon reaching a certain temperature, the cooling fan turns on. Additionally, the baby incubator's suction fan runs when the pressure and gas readings fluctuate, and the sensors instantly return to normal when the alert sounds. If the microcontroller detects wrong circumstances for an extended period of time, it will emit an audible alarm and a light to alert the nurse to inspect the child.

II. LITERATURE REVIEW

A range of projects with goals similar to those of our project have been selected, and their conceptualization is studied. The work reported by (Joshi & Shinde 2015) uses PIC micro-controller, and sensors for temperatures, humidity, and heart rate all linked to this system. When a threat condition appears, an audio alert is set off. Because the child is not in this controller's custody, the child is not in risk. The controller operates at a frequency of 20 MHz. An LED is activated if a baby's heartbeat is discovered by one of the sensors connected to the control

unit. The DHT11 sensor was used in the work reported by (P. Kshirsagar 2019) to measure the temperature. To control the temperature that is appropriate for the child, a heating device and a cooling promoter were also used. A portion of the battery is used in this sensor, as well as the use of a breathing sensor and measuring the heartbeat. The values are displayed on the LCD screen and using IOT, they are sent via Wi-Fi and can be controlled from a distance. A device that operates with the presence of a controller connected to temperature and humidity sensors, which monitors the vital changes that influence the infant, is reported by (Roban 2018). The LCD panel displays the values. The work reported by (Suruthi & Suma 2015) "Microcontroller Based Baby Incubator Using Sensors" project entails the connection of a controller to three humidity, temperature, and pressure sensors. The single-chip microcontroller reads all the sensor data and displays it on the LCD screen. If any of the data changes, an automatic notification to the child's parents is sent. In this project, an effort is made to find a simple, low-cost solution to the problem. Based on the technical details and methodology used by these mentioned work, this work designs a smart system to monitor the health conditions for premature baby in hospital.

III. METHODOLOGY

Figure 1 depicts the system block design for the smart incubator project. The device will use a power transformer and an open-source, programmable process controller of the Arduino UNO type to supply it with a 5V power supply. The information will be provided by the sensors, which you will then transmit by WiFi, an app, and an LCD display. Temperature, pressure, and gas sensors were used. Each sensor communicates with the Arduino using an analog signal, and when the sensor values change, the Arduino links its digital ports to an LED and beeps. So that the values show in the application, program the Arduino to receive and send data from external components like WIFI (ESP8266), which is what connects it to the Internet. Additionally, the LCD panel displays all parameters.

This device works by setting the sensors to specific temperature, pressure, and oxygen levels that should suit the infant and encourage their development, as indicated in a flowchart in Figure 2. One of the project's goals is to have the Arduino send a command to turn on the LED and alert or bell for one minute if the temperature or one of the sensors goes above the appropriate level. If the temperature or one of the sensors exceeds the required temperature, the Arduino will send the information to the hospital equipment via the app. The process is then repeated when the sensors automatically return to normal and all of these changes show up in the application. The equations used to calculate the necessary parameters are mentioned in equations 1 to 4.

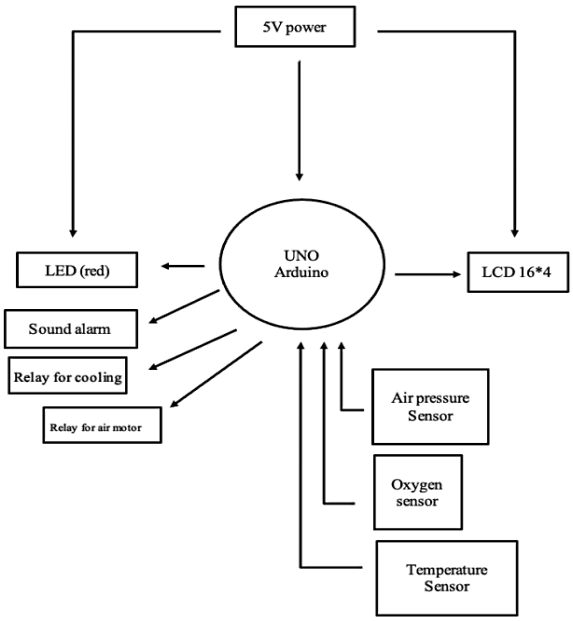

Figure 1: System block diagram of Smart Thermal Preservation Nursing for Premature Babies.

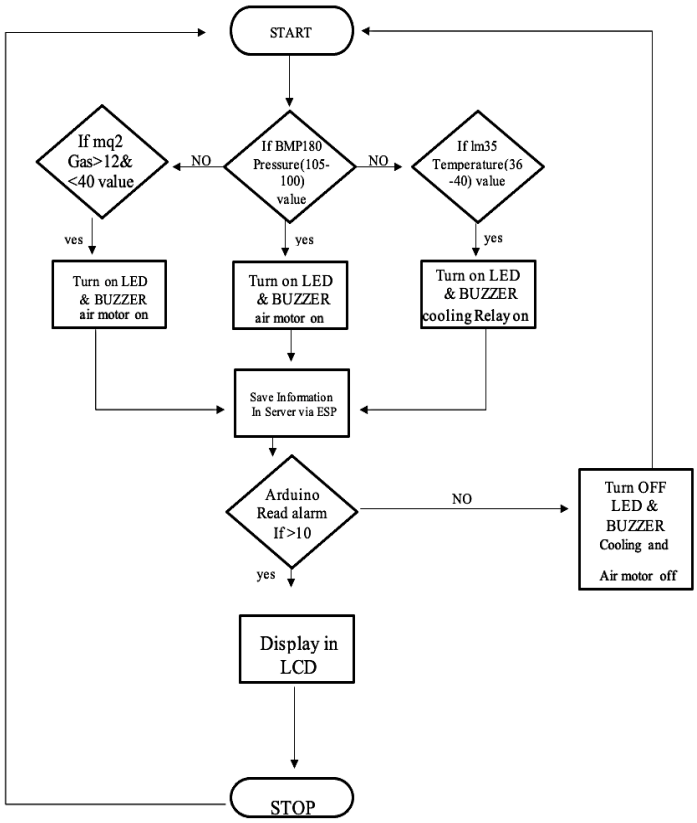

Figure 2: System Flowchart of Smart Thermal Preservation Nursing for Premature Babies.

The system components follow a designed values as:

<u>For the LED</u>

$$R=\frac{Vs-Vled}{Iled} \quad (1)$$

Temperature sensor

$$V=R\times I \quad (2)$$

$$Vout=[R2/(R2+R1)]\times v1 \quad (3)$$

Pressure sensor

$$Pt=(ps+\rho\times\frac{v^2}{2}) \quad (4)$$

IV. RESULTS DISCUSSION

Results of implementation testing are presented in this section. Multiple test points are highlighted in Table 1. The table lists the components that go into the controller, the components that come out of the controller, and the number of volts required for each component to operate effectively. Figure 3 depicts the system's simulation results. In order to give all the elements in the program and make it simple to link the components, we utilized the Proteus 8 software to construct the circuit. We also used YouTube to demonstrate how to connect the components. The circuit connection to the project and the operation of the thermal incubator device with the Proteus software are shown in the diagram above. the components that go into and come out of an Arduino. An open-source microcontroller called the UNO Arduino was used by our team. The controller has been equipped with the temperature sensor in addition to the pressure (POT-HG) and gas (POT-HG) sensors. As indicated in Table 2, all sensors are linked to the Arduino via the analog ports. These sensors are set to specific values that suit the child, as these values differ from one child to another. Any change of change in values sends this change to the controller.

Table1: Test points

Test Point	Component	Type	Parameter	Value
TP1	Gas sensor	INPUT	Voltage	5v
TP2	DHT sensor	INPUT	Voltage	5v
TP3	Pruser Sensor	INPUT	Voltage	5v
TP4	LCD	OUTPUT	Voltage	5v
TP5	Buzzer	OUTPUT	Voltage	2.7 v
TP6	LED	OUTPUT	Voltage	2.7 v
TP7	Relay	OUTPUT	Voltage	5v
TP8	Fan	OUTPUT	Voltage	9v
TP9	Pump Air motor	OUTPUT	Voltage	9v

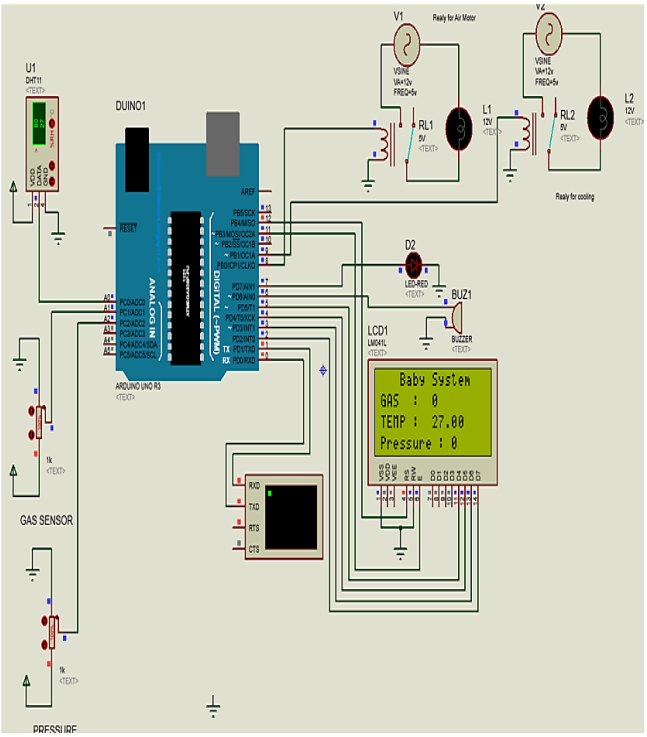

Figure 3: Schematic diagram of the circuit in the program

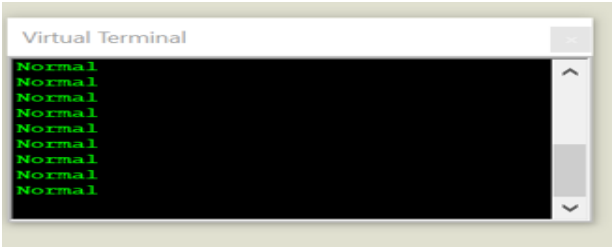

Figure 4: Results.

Table 2: Connecting the sensors to the Arduino

Sensors	Arduino pin (ANALOG IN)
DHT	A0
gas	A1
pressure	A2

The LCD display, cooling relay, air drive relay, sound alarm, and esp (WI FI) are all connected to the Arduino digital ports. When a parameter changes, such as when the temperature rises, a visual and audible alert is given, the cooling fan is activated until the temperature returns to normal without the need for human intervention, and the sensor values are displayed on the LCD screen. This is accomplished through Wi-Fi using the Blink program. where the work crew can use this application to observe the variables Similar to how the gas and pressure sensors alter how the air motor operates. Table 3 displays how components are connected to the Arduino's various ports.

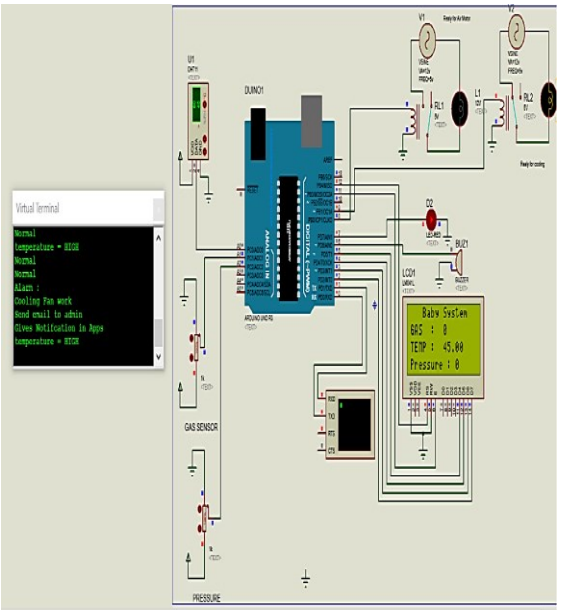

Figure 5: Simulation Results

The alarm bell, light alarm, and cooling fan all function when the temperature deviates from the norm recommended for the premature newborn. Both the values and the variables are displayed in Blynk as well as illustrated by Figure 8. Modifying the value of the gas sensors as illustrated in Figures 5, the alarm bell and the light alarm bell sound while the relay for the air motor operates when the gas or pressure deviates from the standard value needed for the premature baby. Figure 6 is the real time hardware implementation of the prototype which was tested for the decided tests while message communicated through Blynk application is illustrated by Figure 7.

Table 3: Connect components with digital ports

components	Arduino pin (DIGITAL)
Buzzer	6
LED (red)	7
Realy for motor	8
Realy for cooling	9
ESP (WIFI)	1,0

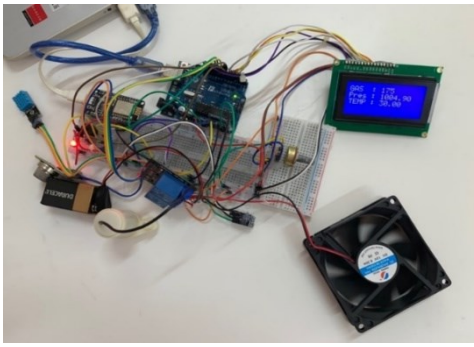

Figure 6: Hardware Implementation

V. CONCLUSIONS

Technology must be created to make life simpler and easier due to the growth in preterm births so that people can live comfortably and worry-free. We integrated technology into our project to make life easier, so we connected three sensors that a newborn baby needs to the Arduino and programmed the Arduino with the necessary numbers so that if the values increased or decreased, the red LED and sound alerts would activate, but the sensors would then automatically switch back to normal. The values displayed on the LCD panel and on the Blynk app allow doctors and parents to view the child's vital parameters in both their normal state and when they change. This is appropriate for big hospitals with plenty of patients. The ultimate goal of this project is to guarantee the safety and wellbeing of neonates (premature babies). Using this technology will save doctors time and effort, and the child's parents will feel more at peace. The project ultimately achieved its goals, therefore it can be improved to improve its quality and work idea in the future. For example, adding a blood oxygen sensor for the child to improve their health.

Figure 7: Application

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Journal of Big Data & Smart City
كلية الشرق الأوسط
Middle East College

Smart Bus Alert System for Blind People Navigation

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Received: September 2021; Revised: June 2022; Accepted: November 2022

ABSTRACT: Internet of things can be thought of as a platform which allows you to manage and transfer the data generated from sensors connected by Arduino to a platform for the storage and management of that data. We can help blind and visually impaired people navigate the bus by making a smart bus alert system that integrates through IoT devices in bus station and smartphone in the bus. By using the smart bus system, blind people can get to their destination on time and save time. The Sultanate of Oman offers hundreds of services to assist the blind, yet the lack of special transportation for the blind remains a challenge that hinders them from living independently. A smart bus alert system provides people with the ability to receive notifications online through a smart device, making it so they can reach their destination in a timely manner.

Keywords: IoT, Smart Navigation System, visually impaired system, Sensor technologies

يمكن اعتبار إنترنت الأشياء كمنصة تتيح لك إدارة ونقل البيانات التي تم إنشاؤها من أجهزة الاستشعار المتصلة بواسطة Arduino إلى نظام أساسي لتخزين تلك البيانات وإدارتها. لذا فان فان هذا المشروع يساعد المكفوفين وضعاف البصر على التنقل في الحافلة من خلال إنشاء نظام تنبيه ذكي للحافلة يتكامل من خلال أجهزة إنترنت الأشياء في محطة الحافلات والهاتف الذكي في الحافلة. باستخدام نظام الحافلات الذكية ، يمكن للمكفوفين الوصول إلى وجهتهم في الوقت المحدد وتوفير الوقت. تقدم سلطنة عمان مئات الخدمات لمساعدة المكفوفين ، إلا أن نقص
وسائل النقل الخاصة للمكفوفين لا يزال يمثل تحديًا يمنعهم من العيش بشكل مستقل. يوفر نظام التنبيه للحافلة الذكية
للأشخاص القدرة على تلقي الإشعارات عبر الإنترنت من
خلال الأجهزة الذكية ، مما يجعلهم قادرين على الوصول إلى وجهتهم في الوقت المناسب.

الكلمات المفتاحية: إنترنت الأشياء ، نظام الملاحة الذكي ، نظام ضعاف البصر ، تقنيات الاستشعار

I. INTRODUCTION

Cultural values are different when it comes to disabilities such as blindness. Many individuals with disabilities are perceived as misfortunes and weak bodies by policy makers and business owners. Blindness was viewed differently in ancient times. As well as societal norms and attitudes that impact the way blind people receive rehabilitation, there are a number of other factors that can make a difference. As a consequence, blindness cannot be predicted adequately by visual measurements alone. In order to understand the negative consequences of blindness, one must first consider the negative impact of society on the blind. Education, employment, and economic conditions can all serve as indicators of societal accessibility. It is important to remember that in several societies, disabilities are seen in a different light.. (Maria & Arsova, 2013)

According to a report by the Ministry of Health, in 2000 there were 17,000 blind people in the Sultanate of Oman. With a current blindness rate of 165,000 people aged 40 and over, it's estimated that 165,000 people will be blind in 2050. A non-governmental organization called Al Noor Association for the Blind operates within the Sultanate of Oman. The organization has been registered by the Omani Ministry of Social Affairs since 1997 and has a 100% funded from donations. People with visual impairments have plenty of trouble getting around, so they can't participate in many aspects of life. But this organization's dedicated to helping them. Considering that blind individuals cannot drive, they are dependent upon others to provide transportation. Therefore, they require a smart technological solution to assist them in locating safe, reliable transportation. The reason for our smart bus alert system which is designed to help the blind by guiding and guiding the bus to assist them using the smart bus alert system to aid them with their destinations. In order to provide the blind with appropriate intelligent transportation, we will provide them with devices in bus station and train them how to use them. (Crudden & Ph.D, 2018).

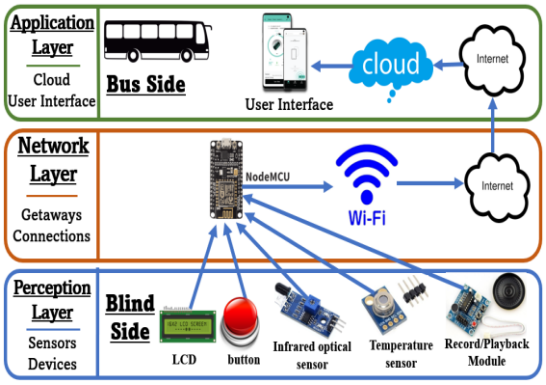
II. PROBLEM STATEMENT

Transportation has become a serious issue as the blind need to move around and reach their desired destinations. Studies presented by the Ministry of Health indicate that the number of blind people has increased in recent years. In the Sultanate, blind people have doubled in numbers, and transportation has become one of the biggest difficulties for them. Therefore, it is essential to provide transportation system for people who are blind.

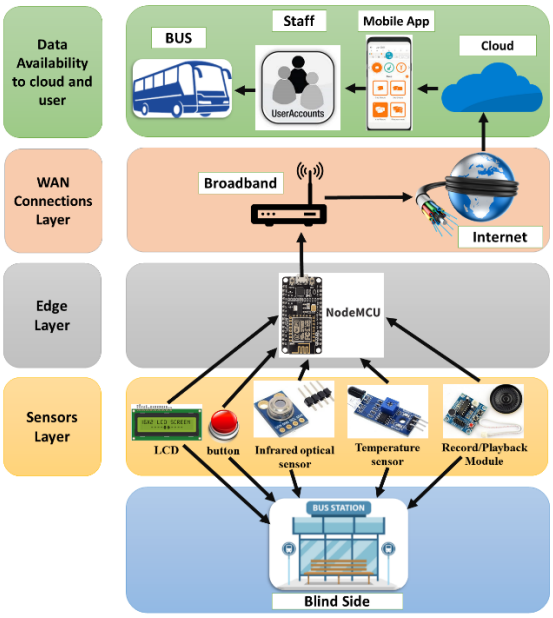
There is still a problem with blind people's ability to move independently despite the many services and programs provided by the Sultanate of Oman to help them. The lack of freedom they experience with regards to freedom of movement is what makes them unable to attend computer workshops, language classes, or manual workshops. Also they have trouble going to school, visiting the doctor, and buying supplies, since they don't have people who can provide them transportation. People had no one to help them with their needs at that time due to the different tasks they had and that resulted in them reaching their destinations late because no transportation was available to them. Intelligent bus alert systems will be crucial for blind people who need transportation. Smart bus alert systems can solve this problem by informing people online via smart devices and enabling them to easily reach their destinations.

III. PROJECT DESIGN

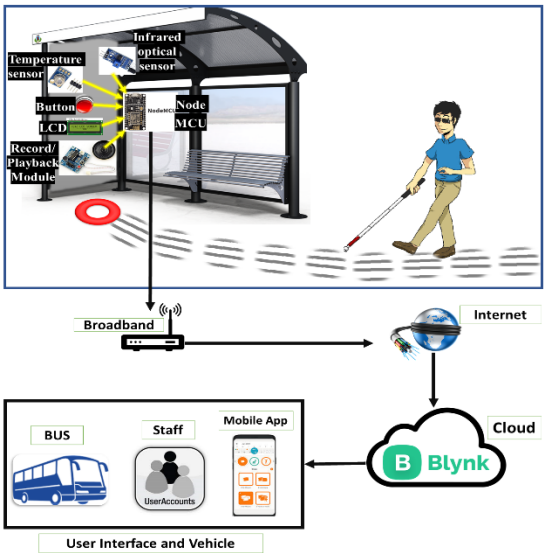
Initial Design



Logical Design

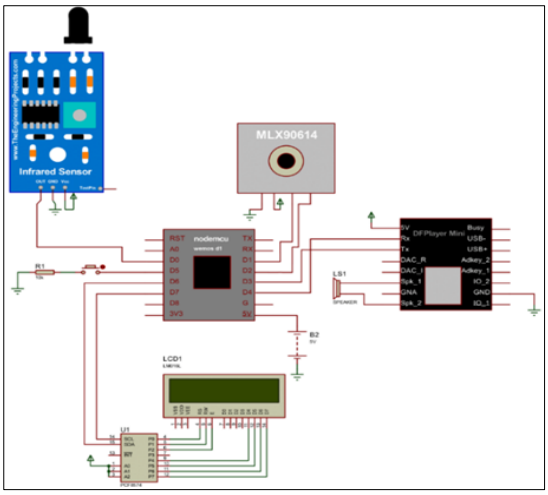


Physical Design



IV. BLOCK DIAGRAM

A record/playback port, a button port, and a LDC port are all connected via ports D3 and D4 on the NodeMCU. Ports D0 and D1 and D2 are connected to the optical infrared sensor, and port D0 is connected to the optical infrared sensor.



V. SWOT ANALYSIS

An analysis of a project's strengths, weaknesses, opportunities, and threats is conducted using the SWOT technique of strategic planning. (Valueprop, 2021).

Strengths

- At the moment I'm setting up a system that finds the people who need transportation who are blind.
- Voice response will be used to assist the blind, using new technology.

Weaknesses

- As the primary language, English is used in the system.
- Internet access is required.

For the purchase of the devices needed, the project lacks adequate funding.

Opportunities

- Blind people can now move around independently without the aid of others thanks to this project.

The Internet of Things encompasses the latest technologies and development.

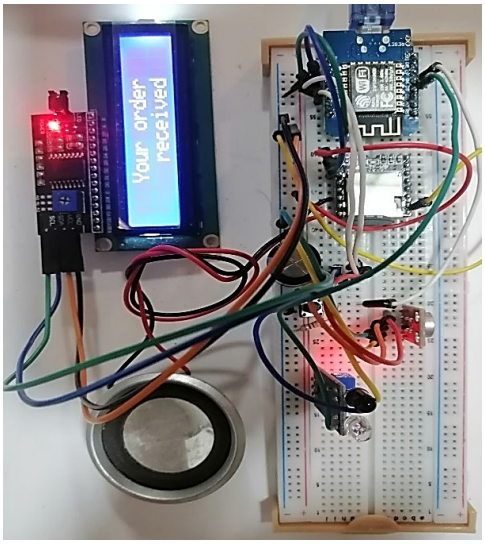
Threats

- With little resources, the project will have low quality.

In terms of coding or creating a mobile application, there is a lack of experience.

VI. HARDWARE IMPLEMENTATION

As far as programming goes, I used the Arduino IDE libraries in order to turn on the infrared optical sensor, the IR temperature sensor, and the speaker with the Arduino NodeMCU. As far as the project goes, I program the Arduino NodeMCU in C++ and software it using the Arduino IDE. In addition to wire.h, LiquidCrystal_I2Ch is included as well, which opens the LCD screen to allow typing.



There are two lines and 16 liters in this definition of Liquid Crystal I2C LCD (0x27,16,2), which indicate how fast data transfers to the screen, while the data can be viewed.

Breadboard

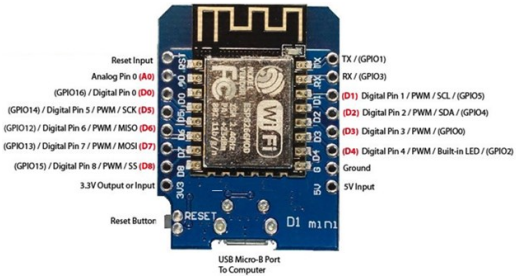
Among the most important components in the building of electronic circuits are breadboards.

An early electronic circuit can be easily constructed using this plastic rectangle plate, since it permits the electronic components for easy introduction during prototyping or circuit construction. (M-Short & Joel_E, 2020)

Node MCU

It has 11 Digital I/O and I2C connectors on the board, each with I2C, interrupt, PWM and one-wire capabilities.

This NodeMCU is an ESP8266-based D1 mini WIFI board designed for the Internet Of Things and compatible with the Arduino IDE. (Deltakit, 2022).



Breadboard Jumper Wire Kit

Breadboard jumper wires are often used for electronic circuit boards, as they have pins on both ends, making connecting two points easier, and they can also be arranged in 8 different colors so that a circle is formed. (MikroElektronika, 2021)

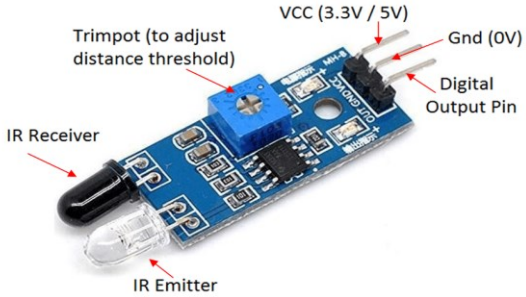
LCD Display

During the control of an LCD display, the microcontroller must be able to control at least five pins at the same time. LCD interface pins consist of five:

• A register select (RS) pin:
RS pins are used to select where data will be written on LCD displays.
• A Read/Write (R/W) pin:
• An Enable pin:
It is possible to write to the chip's registers via an Enable pin.
• 8 data pins (D0 -D7).
Depending on whether you are writing or reading, you write bits into these pins.

IR Infrared Sensor

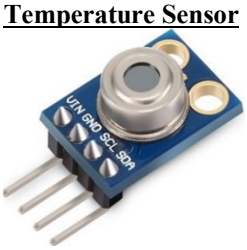
Sensors that detect obstacles, objects, colors and lines are among the many uses of IR Infrared Sensors. In addition to a digital output, the sensor also provides an analog output. (potentiallabs, 2022).



Reading or writing is determined by the pin.

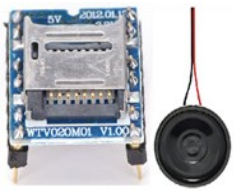
To implement my project, I have identified and provided all the necessary sensors and devices to provide an alert system for blind people to navigate buses.

Temperature Sensor



Infrared thermometer MLX90614 is an infrared thermometer which can sense temperature without contact with the object. It combines both an ASIC and IR detector chip in a TO-39 package. To achieve high accuracy and resolution, the MLX90614 is a low-noise amplifier, equipped with a powerful 17-bit ADC and a high-performance DSP unit.

Record and Playback Module



A feature of the ISD1820 is the ability to record and play back multiple segments simultaneously. With the on-board resistor set for infinite recording time, you can obtain a high quality recording.An embedded Flash memory is used in the design of Replay Module and a Voice Recorder.A record can also be erased and archived. (Components101Team, 2020).

Key Button 1x1

The keypad, for example, provides users with the ability to press a key, which is then read and then taken action upon.

During key press, a switch connects two points, resulting in one button and one keypad. (electronicwings.com, 2020).

VII. DEPLOYMENT

To implement this research, authors have identified and provided all the necessary sensors and devices to provide an alert system for blind people to navigate buses.
in the course of the development of my project, I mounted a display on blind side of the bus station, and connected a recording and playback module, a temperature sensor, an infrared sensor, and a nodeMCU to the breadboard. NodeMCU is programmed through the Arduino IDE using the C++ language to communicate with devices and sensors.Libraries are used to facilitate the programming of the sensors and devices so that the process of programming can be simplified. Blynk software, available on mobile devices, is required for bus-side implementation. Blynk is a software that allows sensors to be programmed via an Arduino core on a microcontroller, which can be used with Blynk via adding functions from (V1, V2 and V3). Programming shows how the Blynk application can be connected to a MCU with the Blynk software. Programs are used to implement several replay functions.In V1, a voice reply is coded to be provided within 10 minutes, in V2, within 20 minutes, and in V3, within 30 minutes.I designed and deployed the smart bus alert system for blind people navigation based on the following factors which helped me estimate the bus' arrival time at the bus station, not the actual arrival time:

• Hardware: An LCD display, an infrared sensor, temperature sensors, a Record and Playback Module, and a key button are required for the system. It also involves a computer, a microcontroller called the NodeMCU, a breadboard, an LCD display, an infrared sensor and temperature sensor.

• Software: A computer with Arduino software installed and Blynk app for Arduino, which is available from Google Play, is needed in order to write the code using C++ programming language for the system.

• Cloud Service: In order to access data from the internet, a blynk database must be used to store and access data.

VIII. CONCLUSION

In conclusion, authors would like to highlight my project which provides a variety of coding and software concepts that are beneficial to gaining new experience and knowledge in engineering and networking, even though they may not be directly relevant.

The Internet of Things (IoT) and smart cities are two recent technologies that have aided society in many ways. Bus companies can provide services enabled by the Internet of Things (IoT) such as a smart alert system for blind people to navigate. Globally, blinds are constantly inconvenienced when traveling to their destinations. A solution to this problem needs to be found in order to reduce its inconvenience.
My project will be implemented in the Oman community since it is most appropriate and optimal for this type of project. There is a need to support the independent movement of blind people in the Oman community without the aid of external helpers. The problem of movement to one's destination is the same for all blind people, so the solution for blind people navigation on a smart bus provide an improved and effective vision to both people with visual impairments and other disabilities that have the same problems. A special demand area at the bus station is equipped with infrared sensors that detect the presence of blind people for ten seconds.
A bus station uses infrared sensors to detect whether a blind person is present for ten seconds and A microcontroller (ESP8266 nodeMCU) is used to route the data in this manner. A cloud-based platform (Blynk) connects the bus to the Internet, and data is transmitted through the bus.
A mobile device shows bus order and bus stop location via an app using Blynk software. The Arduino was programmed in C++ to implement the IR sensor and nodeMCU. When searching for another person to assist, hospital appointments are delayed or tasks are not completed. Implementing a smart bus system for the blind will help solving the lack of transportation problem within Oman, allowing the blind to move around with ease and avoiding transportation problems as a result of a lack of transportation resources. This project resulted in an easy-to-use, smoothly functioning system as a result of the work we did.

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