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Jnana Sangama, Belagavi – 590018

A Project Report

On

"PERSONAL GARMENT IDENTIFICATION FOR VISUALLY IMPAIRED"

Submitted in partial fulfilment of the requirements as a part of the curriculum,

Bachelor of Engineering in Mechanical Engineering

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CERTIFICATE

Certified that the project work entitled "**PERSONAL GARMENT IDENTIFICATION FOR VISUALLY IMPAIRED"** is a bonafide work carried out by **Mr.GIRIDHAR.N.V, Mr.SHESHADRI.N** bonafide students of **CMR Institute of Technology** in partial fulfilment of the requirements as a part of the curriculum,

Bachelors of Engineering in Mechanical Engineering, of **Visvesvaraya Technological University, Belagavi** during the year **2019-20**. It is certified that all correction/suggestion indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of the project work prescribed for the bachelor of engineering degree.

(Chidhanandan R.S)	**(Dr. Vijayanand Kaup)**	**(Dr. Sanjay Jain)**
Signature of the Guide	**Signature of the HOD**	**Signature of the Principal**

External Viva

Name of the examiner	**Signature with date**

DECLARATION

We, students of Eighth Semester, B.E, Mechanical Engineering, CMR Institute of Technology, declare that the project work titled **"PERSONAL GARMENT IDENTIFICATION FOR VISUALLY IMPAIRED"** has been carried out by us and submitted in partial fulfilment of the course requirements for the award of degree in **Bachelor of Engineering in Mechanical Engineering** of **Visvesvaraya Technological University, Belagavi,** during the academic year 2019-2020.

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Last but not least, we would like to put forward our heartfelt acknowledgement to all classmates, friends and all those who have directly or indirectly provided their overwhelming support during this project work.

ABSTRACT

This project aims to create a system to identify different types of garments using a QR code identification and locate the same on hangers of a wardrobe using iOT and vibrator module connected to a smartphone which is enabled with customized monitoring incorporated in an application.

The required item is added, listed, chosen and selected using the smartphone application and located using the vibrator module and Quick Recognition (QR). The mechanical system is controlled using a 8266 microcontroller functioning as per the algorithm written in the software.

The prototype model uses BLYNK application to function as a application on the software.

List of Tables

Table 3.1 Sample data storage for new item……8

Table 3.2 Sample data storage structure ……..11

List of Figures

Fig 3.2 Screen for new item from developed Application ….....9

Fig 3.3 Search screen on developed application ……..10

Fig 3.4 Screen with push buttons from prototype customised platform……11

Fig 3.5 Generated QR code……..12

Fig 3.6 Firmware Development……..13

Fig 3.7 Node Micro Controller Unit (MCU) ……..17

Fig 3.8 Vibrator Motor 3V-DC ……..19

Fig 3.9 Home Screen ……..20

Fig 4.0 Description to be added……..

Fig 4.1 Generation of QR code.……..

Fig 4.2 Product Identification.……

Fig 4.3 QR identification for android platform of the prototype……..21

Fig 4.4 Beginning of the fabrication of the prototype model……...22

Fig 4.5 Node MCU pin Configuration for vibrator motors……...23

Fig 4.6 Hanger Modification……..

Fig 4.7 CADD Model of the Prototype ……24

Fig 4.8 Schematic representation of the prototype……...25

CONTENTS

Certificate from college..... **ii**

Declaration..... **iii**

Acknowledgement..... **iv**

Abstract ..... **v**

List of Tables ..... **ix**

List of Figures ..... **ix**

Chapter 1 Introduction **1**

1.1 Scope of the Project **2**

1.2 Social Relevance .....

1.3Objective of the project **3**

Chapter 2 Literature Review **4**

2.1 Wireless controlling of DC motor using android platform .....

2.2 Cloth Grasp point Detection Based on multiple view geometric cues **5**

2.3 Mobile Robot Vision System For Object Colour Tracking..... 6

Chapter 3 Methodology.....**7**

3.1Data storage process in the software.....

3.1.1 Algorithm for new item..... 8

3.1.2 Algorithm for Item Search **9**

3.2 Data storage for hangers **10**

3.2.2 Algorithm for Hanger Vibrate 11

3.3 Algorithm for smartphone microcontroller connectivity .....

3.4 QR Code Tagging & Identification 12

3.4.1 Comparing QR code with barcode and RFID **13**

3.5 Firmware Development 14

Chapter 4 Design And Construction 15

4.1 Modelling and Fabrication.....

4.2 Architecture and specifications..... **16**

4.2.1 Node Micro Controller Unit (MCU)..... 17

4.2.2 Vibrator motor 3V DC..... **18**

4.2.3 Customized Blynk app for prototype..... 19

4.2.4 App development for Android Platform..... 20

4.3 Cardboard Box **22**

4.4 Node MCU pin Configuration..... **23**

4.5 Hanger Modification .....

4.6 System Representation of the prototype model (CADD Model) **25**

4.7 Working of the prototype model **26**

Chapter 5 Applications, Benefits And Limitations 26

5.1 Applications.....

5.2 Benefits **27**

5.3 Limitations..... **28**

Chapter 6 Future Prospects And Conclusion 28

6.1 Future Prospects **29**

6.2 Conclusion **8**

5.3 Limitations..... **30**

Chapter 1

INTRODUCTION

The visually challenged community faces challenges everyday of which we have addressed one such necessity.

Clothing is a task which is a part of everyday routine which usually does not need specific emphasis at domestic level use. However it is an effort oriented challenge to identify the desired set of clothing on a daily basis to a person with visual challenges as it involves texture, colour, variety in styles and number of garments in order to choose the apt and suitable item.

Though the community has discovered various ways to eliminate this conflict, database, smartphone, cloud and mechatronic system would make the process more convenient and effortless.

As the visually challenges can be of different dimensions classified based on various grounds, the difficulty to differentiate products is common is same on various levels and might be different for different individual.

While persons with complete loss of vision rely on texture and physical features to identify clothing, the colour blind and partial visual persons face difficulty in narrow view and colour identification respectively. Also, the problem is extended to aged persons with deteriorating vision.

The visual challenged community use smartphone using a screen reader platform to convert text-to –speech. QR code being a 2-dimensional, orientation independent bar code, makes scanning easy for the community.

The scanned code is fed into the application to store related information. The same information is used to match while retrieving the garment from the closet. The ESP8266 uses executable programme to vibrate specific hanger based on the toggle switch in the software.

Wireless communication is established between the smartphone local network and microcontroller to execute the programme. Detachable contact points are made between hanger and the rod to remove it easily.

1.1 Scope Of The Project

- To enable the ease the routine in the daily life of persons with challenges in vision thereby instilling a sense of confidence to carry while presenting themselves with dignity in independence.
- Business model: number of people visually impaired in the world is 285 million, 39 million blind and 246 million having low vision; 65 % of people visually impaired and 82% of all blind are 50 years and older.
- The emphasis of the project is to reach every stakeholder and user of the community through referral marketing within the network of NGOs associated with welfare of such society. This is further extended in collaboration with investment from contributors and furniture houses in order to make the product safe and efficient.
- The basic product will be charged minimally due to the absence of extensive third party advertising. The in-app purchase will be charged for extension of service to clothing suggestions available optionally for those in need of the service. In the longer run, further optimization of the services like planned choices for the week or a specific occasion may be charged.
- Objective of the product is to make it affordable and convenient to the user in identifying the required garment.

1.2 Social Relevance

- The visually challenged society faces hurdles in independence on daily basis. One such crucial routine is choosing their clothes independently.
- The economic viability is also to be considered as the community is not financially not supported in most instances.
- Therefore requires a tool which can boost their confidence yet not burdening financially.
- It also reduces the need to remember the items and location in their closet which can preserve their valuable, previous and crucial time in their lives on a daily schedules

1.3 Objective of the project

- To design a system which can identify different garments in the closet.
- To design a QR based algorithm in order to identify and customize input
- To design a vibrator hanger system in the closet.
- To develop a smartphone app and develop an algorithm using internet of things (iot)
- To demonstrate the system using a prototype model.

Chapter 2

LITERATURE REVIEW

Evaluation of the QR Code Fabric Tag System for Textile Companies in Turkey. They have proposed a QR Code Fabric Tag system, which provides an online archive for the textile companies to keep detailed information about the fabrics and transactions related to them. To provide easy way to access this information, each fabric cartel used by the company should be labelled with a unique QR code label. When the QR code is scanned by a QR Code Fabric Tag mobile application, installed on a company smartphone, all the information related to the fabric will be displayed. They tested the developed system on a group of 60 volunteers, and evaluated the performance of the system using the System Usability Scale questionnaire, filled by each participant.

2.1 Building book inventories using smartphones

The project is designed to implement a mobile book recognition system for conveniently generating an inventory of books by snapping photos of a bookshelf with a smartphone. Since smartphones are becoming ubiquitous and affordable, our inventory management solution is cost-effective and very easy to deploy. Automatic and robust book recognition is achieved in our system using a combination of spine segmentation and bag-of-features image matching. At the same time, the location of each book is inferred from the smartphone's sensor readings, including accelerometer traces, digital compass measurements, and Wi-Fi signatures. This location information is combined with the image recognition results to construct a location-aware book inventory. We demonstrate the effectiveness of our book spine recognition and location estimation techniques in recognition experiments and in an actual mobile book recognition system.

2.2 Product tracking using QR code in inventories

The inventory management system is the main source to handle the goods which are in processing and for semi processed. This project is designed to implement about the Inventory control with the help of QR-Code. Generally, people will use Inventory control with barcode only which makes the work difficult. Some special scanners should be used for scanning the bar code but if the QR-Code is used in the place of barcode we can scan the code by using the smart phone using any type of the Android and IOS. Hence, this contributes on QR-Code to use efficiently using proposed model.

2.3 Wireless Controlling of DC Motor Using Android Platform

The project is designed to develop a four quadrant speed control system for a DC motor. The motor is operated in four quadrants i.e. clockwise; counter clock-wise, forward brake and reverse brake. Operation of the DC motor is best suited for industries where motors are used and as per requirement as they can rotate in clockwise, counter-clockwise and also apply brakes immediately in both the directions. In case of a specific operation in industrial environment, the motor needs to stop immediately. In such scenario, this proposed system is very apt as forward brakes are its integral features. Instantaneous brake in both the directions happens as a result of applying a reverse voltage across the running motor for a brief period and the speed control of the motor can be achieved with the PWM pulses generated by the microcontroller. The microcontroller used in this project is from 8051 family. Remote operation is achieved by any smartphone/Tablet etc. with Android OS, upon a GUI (Graphical User Interface) based touch screen operation. Bluetooth device is provided to connect with android application device for the operation of the motor which are interfaced to the microcontroller

2.4 Cloth Grasp Point Detection Based On Multiple View Geometric Cues

With Application to Robotic Towel Folding. Jeremy Maitin-Shepard, Marco Cusumano-Towner, Jinna Lei and Pieter Abbeel.Presented a novel vision-based grasp point detection algorithm that can reliably detect the corners of a piece of cloth, using only geometric cues that are robust to variation in texture. Furthermore, we demonstrate the effectiveness of our algorithm in the context of folding a towel using a general purpose two-armed mobile robotic platform without the use of specialized end-effectors or tools. The robot begins by picking up a randomly dropped towel from a table, goes through a sequence of vision-based re-grasps and manipulations.

2.5 Mobile Robot Vision System For Object Colour Tracking

To serve in more appropriate positions. Now, what happens when the questions turn to "Is this part of correct colour?" or "Which parts are blue and which are red?”. So in our system, colour based identification of the parts is done and then it is sorted according to different colours. After recognizing the colour of the object, robotic arm will automatically pick & place it accordingly. If the colour of the work piece is not found in accordance to the required one then it will be rejected. The complete sorting system operates on image processing using the MATLAB application & PLC which controls different motors in the system. Machine vision based colour concept has found its wide application in the pharmaceuticals industry, agriculture industry and assembly of parts.

Chapter 3

METHODOLOGY

The prototype Blynk platform is used to establish connectivity with the microcontroller and consequently with the hangers. ESP8266 is a programmable microcontroller with inbuilt Wi-Fi module which can be connected with the Blynk platform. Contact between hanger and the rod is accomplished with the adhesive aluminium or copper tape strips. It works on the principle of electrical conductivity with metals. The vibrator motor is attached to the hanger in which it helps in the easy identification of the required garment to the user. The motor is made to function with the help of in built Wi-Fi connectivity in the Node Micro Controller Unit.

3.1 Data storage process in the Software

- The data in the application is to be stored in the form of a data table.
- The primary table would consist of 4 columns and “n” rows.
- Here, n is the number of items to be added to the closet.
- The first column is the serial number of the item .The ordering number depends on the order in which items are added to the application data set.
- The second column is the QR code of the item. Output of the QR scan which is the result of code name is stored in this column.
- The third column is the custom name input by the user. This is created by creating a input data which can be typed by the user.
- The fourth column is the item type. It can be shirt, trouser, saree or any other item type obtained using a drop down selection while adding the item.

Sl n(C1RX)o	QR CODE(C2)	(C3)	ITEM TYPE(C4)
1(R1)	1001	ALLEN SOLLY light blue stripes	SHIRT
2(R2)	1002	VAN HEUSEN dark green plain	TROUSER
3(R3)	1003	RMKV red with yellow border	SAREE

Table3.1 sample data storage for new item

3.2.1 Algorithm for new item

An algorithm is a well-defined procedure that allows a computer to solve a problem. Another way to describe an algorithm is a sequence of unambiguous instructions. The use of the term 'unambiguous' indicates that there is no room for subjective interpretation.

The algorithm is for new item in this case is processed by the following steps shown below:

Step 1: select add new item button on home screen

Step 2: perform QR scan using QR scan library

Step 3: output of QR scan allocated to C2R(x) in the table

Step 4: input customised name into text input.

Step 5: store the input text in C3R(x) in the table.

Step 6: select item type from dropdown menu.

Step 7: finish

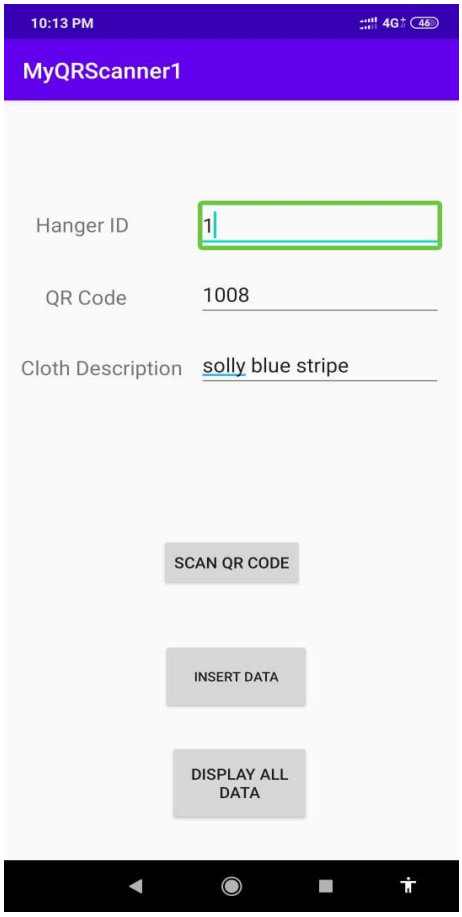

Fig 3.2 screen for new item from developed application

3.2.2 Algorithm for Item search

Step 1: select add new item button on home screen

Step 2: perform QR scan using QR scan library

Step 3: output of QR scan allocated to C2R(x) in the table

Step 4: input customised name into text input.

Step 5: store the input text in C3R(x) in the table.

Step 6: select item type from dropdown menu.

Step 7: finish

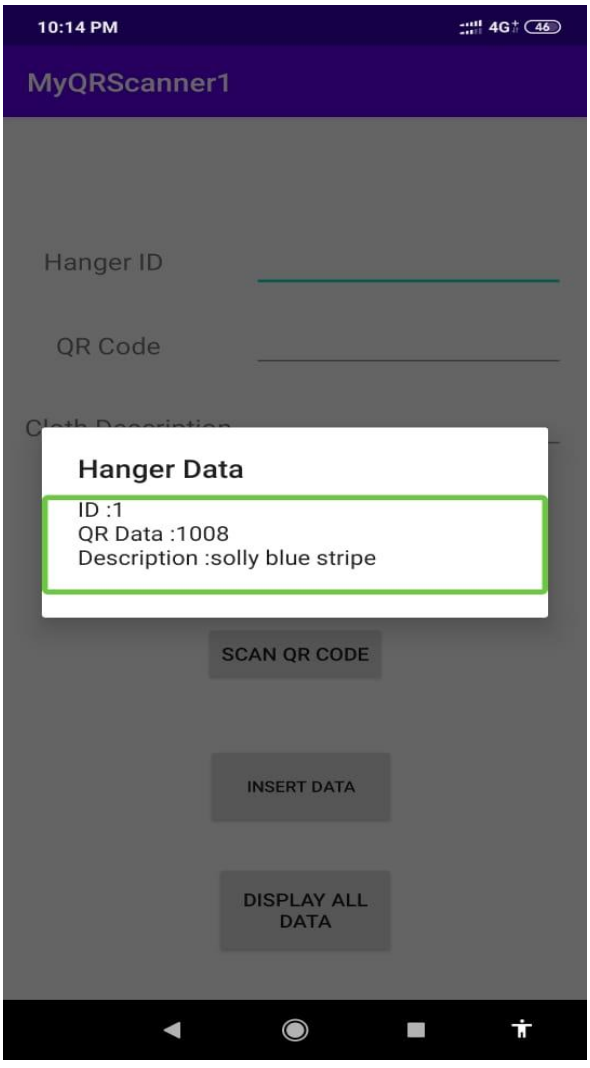

Fig 3.3 Search screen on developed application

3.3 Data storage for hangers

A temporary memory is created in the form of table in the local storage.

The first column is the hanger number which is fixed and predetermined.

The second column is the item name which is customised by the user.

The third column is the QR code corresponding to the item name. This column is auto filled based on the item name on the list.

HANGER NUMBER(C1)	ITEM NAME(C2)	QR CODE (C3)	IDENTIFIED BY TEXTURE OR COLOR
1(R1)	ALLEN SOLLY	1001	GREEN COLOUR WITH BOX PATTERN
2(R2)	VAN HEUSEN	1002	WHITE COLOUR WITH BLACK TRIM
3(R3)	U.S. POLO	1003	YELLOW COLOUR WITH CIRCLE PATTERN

***The user can input his own data as per their wish**

Table 3.3 Sample data storage structure

3.3.2 Algorithm for Hanger vibrate

Step 1: clicking on hanger button on the home screen opens item list in recycler view.

Step 2: select the item name from the list.

Step 3: C2R(x) corresponding to item name from table 1 is copied to C2R(x) of table 2.

Step 4selecting item name on hanger tab executes push button library

Step 5: selecting item name again turns off push button library and clears C2R(x) data

3.4 Algorithm for smartphone microcontroller connectivity

Step 1: Create a push button in the application with on and off state.

Step 2: Assign individual pins on the micro controller to each of the buttons

Step 3: Assign the buttons to the created list of hanger page in recycler view.

Step 4: Copy the IP address of the MCU connectivity LAN address.

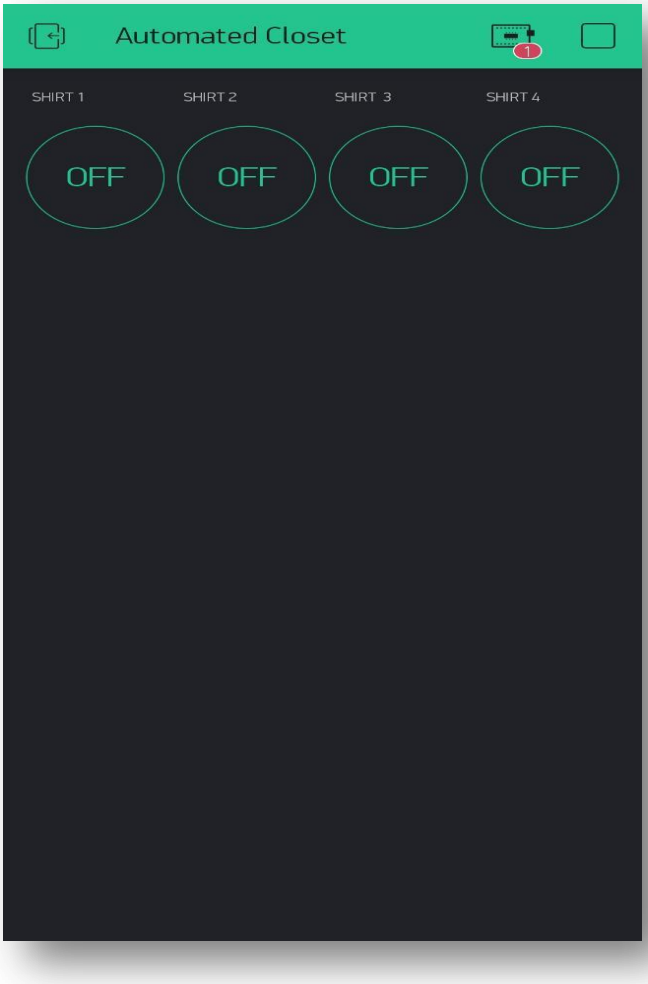

Fig 3.4 screen with push buttons from prototype customised platform

3.5 QR (Quick Response) Code Tagging & Identification

QR codes (2D barcodes) are used to encode and decode data at a rapid rate. Using camera phones to read two dimensional barcodes for various purposes and in practical applications. A QR code consists of black squares arranged in a square grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image. Applications include product tracking, item identification, time tracking, document

management, and general marketing

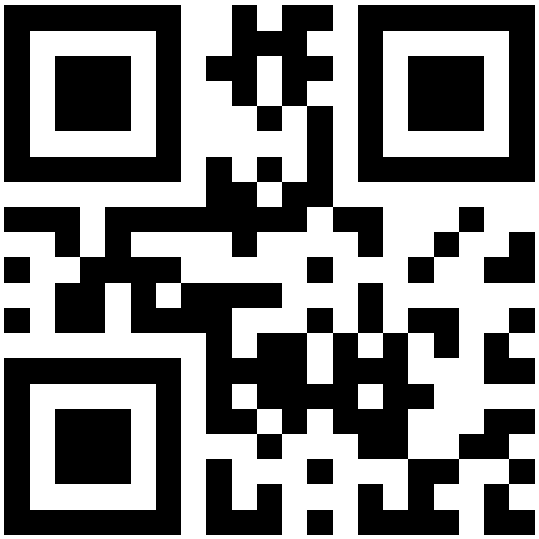

Fig 3.5 above image is the generated QR code reading “ARROW”

3.5.1 Comparing QR code with Barcode And RFID(Radio Frequency Identification)

- QR code holds thousands of alphanumeric characters of information while barcode holds up to 20 numerical digits.
- QR code encodes information horizontally and vertically so that it can fit more data into a smaller space. ...
- Barcode can be read from any angle.

Advantages of QR over RFID:

- QR codes are efficient to scan and read.
- The investment to set up the technology is minimal. As, it requires only a scanner and related software.
- Generating a QR code is simple and the range of data input is vast.
- The time consumed is not more than few seconds to scan the code.

3.6 Firmware development

Firmware is a software program or set of instructions programmed on a hardware device. It provides the necessary instructions for how the device communicates with the other computer hardware.

System on Chip (SOC) A system on a chip is an integrated circuit that integrates all or most components of a computer or other electronic system.

In a microcontroller, the processor core, memory, and programmable Input-Output (IO) peripherals are integrated into a single System on Chip (SoC).

Internet Of Things (iOT) The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

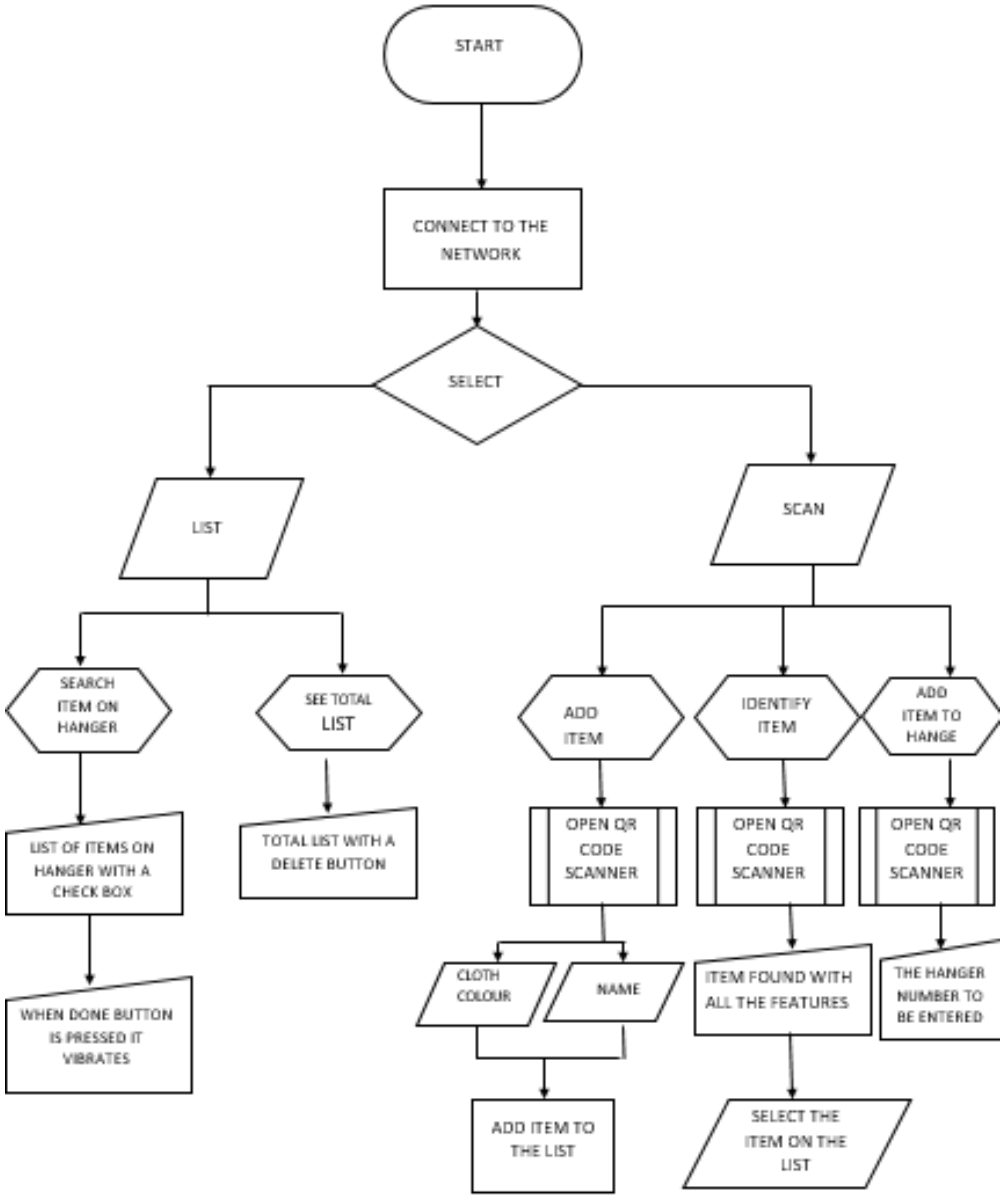

Fig 3.6 Sequence of firmware development

Chapter 4

DESIGN AND CONSTRUCTION

4.1 Modelling and Fabrication

Based on the data we gathered from several research papers, we developed a performance model for the wardrobe.

First, we decided to make a small working prototype so as to experience the device and run various performance tests.

The below mentioned illustrates the design and the fabrication of the prototype.

Choice of Materials:

- The prototype was constructed on a corrugated 2-ply box with dimensions of 60 x 60 x 60 cm with front face being open.
- A lithium iron disulphide battery was used as a power source vibrator and microcontroller. The nominal voltage being 9v discharged with a capacity of 550 mA-hour.
- A 2-inch diameter PVC pipe was used as a substitute for a hanger rod for the purpose of insulation. Its centre was positioned at a distance of 7 cm from the top surface and 30 cm from the front face of the casing.
- Holes are drilled with a diameter of 5mm at equal intervals of 5 cm from each hole and initial spacing of 10 cm from either ends.
- Standard copper insulated wire of diameter of range 3mm- 5mm were used for wiring the entire circuit.
- The software working application was built and tested on android platform of version 9 The application was created on android studio OS version 9.
- Standard hanger of plastic material with neck height of 2 inch and shoulder height of 1.5 inch was used with standard shoulder width.
- ESP8266 microcontroller was used to programme with voltage rating of 5v and current rating of 600m-ampere. However operating range is 3.3v to 5v and 80 ma current.

– Vibrator of 3v and current of 200 m-amp in DC.

4.2 Architecture and specifications

- Node Micro controller unit (MCU)
- Vibrator motor 3V-DC
- Customized Blynk app for the prototype
- Cardboard box

4.2.1 Node Micro Controller Unit(MCU)

The Node MCU (Node Microcontroller Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Expressive Systems, contains the crucial elements of a computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK. That makes it an excellent choice for the Internet of Things (IoT) projects of all kinds

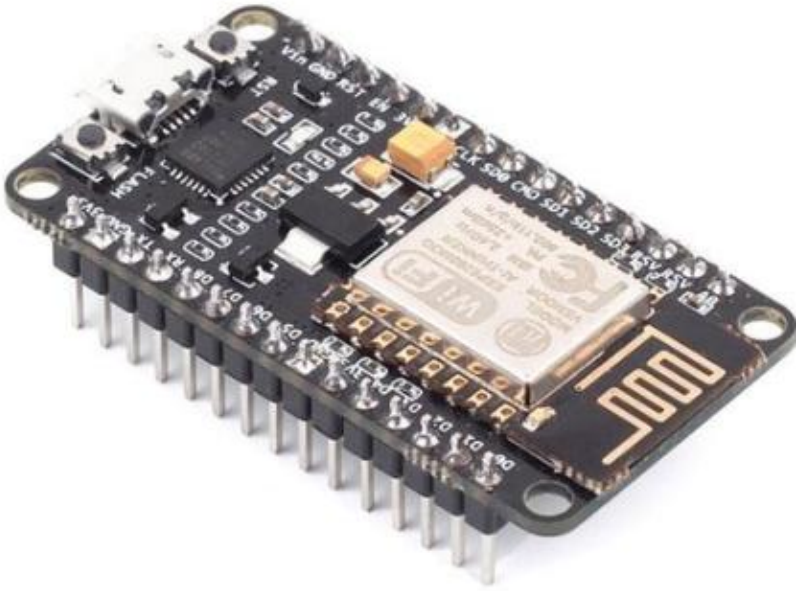

Fig3.7 Node Micro Controller Unit

SPECIFICATIONS:

- Microcontroller: Ten silica 32-bit RISC CPU Xtensa LX106.
- Input Voltage: 7-12V.
- Digital I/O Pins (DIO): 16.
- Analog Input Pins (ADC): 1.
- UARTs: 1.
- SPIs: 1.
- I2Cs: 1.
- Flash Memory: 4 MB.
- Operating Voltage: 2.5V to 3.6V
- On-board 3.3V 600mA regulator
- 80mA Operating Current
- 20 µA during Sleep Mode

4.2.2 Vibrator Motor 3Volts-DC

An eccentric rotating mass vibration motor (ERM) uses a small unbalanced mass on a DC motor when it rotates it creates a force that translates to vibrations. These are commonly used in handheld products because their variety of shapes and sizes allows for easy design and mounting. Therefore, vibration alerting is a common application for these motors. Also although they are small in size, they can still be powerful enough to be used in massaging and stimulation applications.

Fig3.8 Vibrator motor 3V-DC

SPECIFICATIONS:

- Product Name : Vibration Motor
- Voltage - DC 3V
- Current : 0.2A
- Speed : 1100RPM
- Diameter : 6mm/0.23";
- Size Spec. : 6 x 17mm/0.23" x 0.66"(D*L)
- Cable Length : 2cm/0.79"
- Net Weight : 3gms

4.2.3 Customized Blynk app for prototype

Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.

Supported Hardware Blynk supports more than 400 boards already, including support for Arduino, Particle, ARM mbed, TI Energia, Micro Python, Node.js,

Fig3.9 Home screen

Fg 4.0 Description to be added

Fig 4.1 Generation of QR code

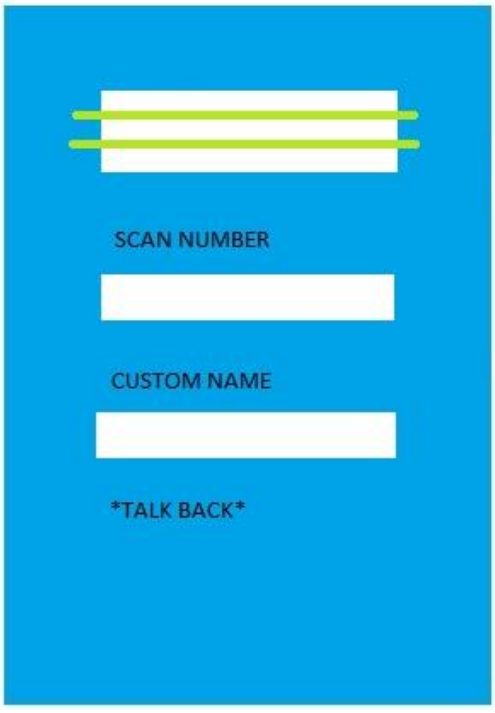

Fig 4.2 Product Identification

4.2.4 App development for Android platform

The following is the library for QR code scan on android:

Library for QR code scanner:

Code scanner library for Android, based on ZXing

Features:

- Auto focus and flash light control
- Portrait and landscape screen orientations
- Back and front facing cameras
- Customizable viewfinder
- user friendly
- Touch focus

The below image shows a sample QR scan page on or prototype app BLYNK

4.3 QR identification for android platform of the prototype

4.2.4 Cardboard box

The prototype was constructed on a corrugated 2-ply box with dimensions of 60 x 60 x 60 cm with front face being open.

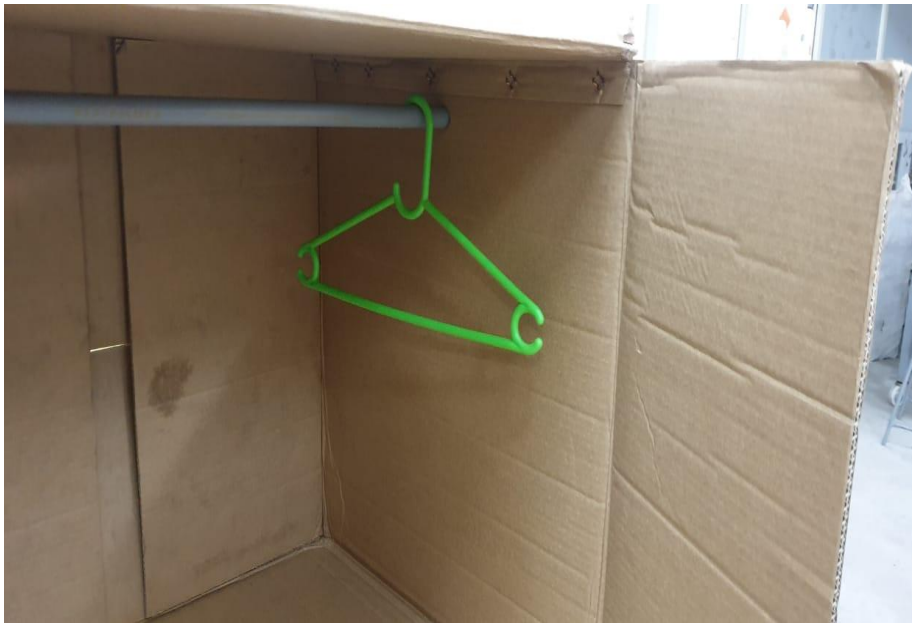

Fig4.4 Beginning of the fabrication of the prototype model with dimensions 60*60*60 cm

4.2 Node MCU pin configurations

ESP 8266 pin configurations:

General-purpose input/output (GPIO) is a pin on an IC (Integrated Circuit). It can be either input pin or output pin, whose behaviour can be controlled at the run time.

Node MCU Development kit provides access to these GPIOs of ESP8266. The only thing to take care is that Node MCU Development kit pins are numbered differently than internal GPIO notations of ESP8266 as shown in below figure. For example, the D0 pin on the NodeMCU Development kit is mapped to the internal GPIO pin 16 of ESP8266.

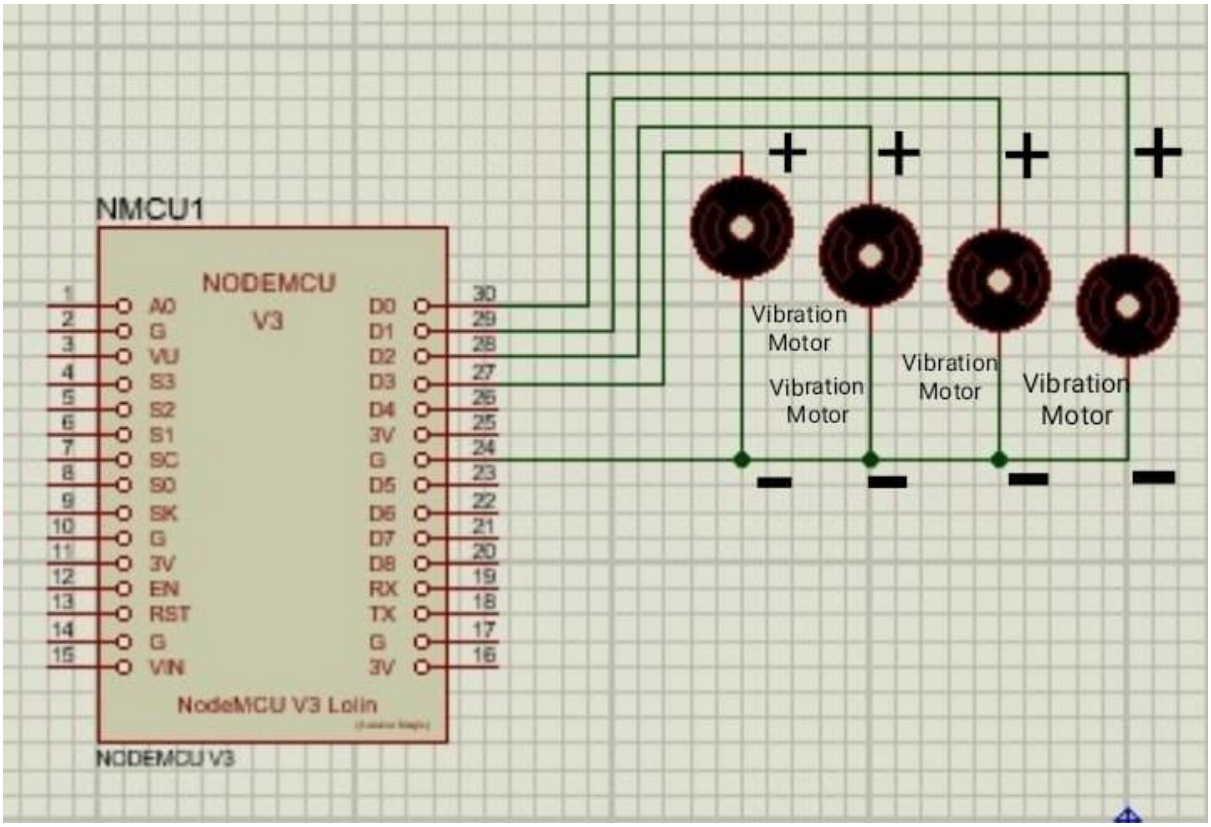

Fig 4.5 ESP8266 internal GPIO pins mapping for controlling vibrator motors

4.3 Hanger Modification

The vibrator motor is fixed to the hanger shoulder. Wires from 2 terminals of motor is wound to the hook of the hanger. Ends of the wire are connected to metal strips and glued to the ends.

Contact points on the hanger rod are internally wired from within, ends of the wires are soldered to metal adhesive strips onto the rod. The contact point consists of 2 wires connected to positive and negative terminal of the power source respectively.

The contact is positioned such that it can touch with metal strips on the hanger.

Internal wires are connected to respective pins of the microcontroller pins to form a closed circuit.

+ve pin is connected to positive terminal and ground to negative terminal of power source.

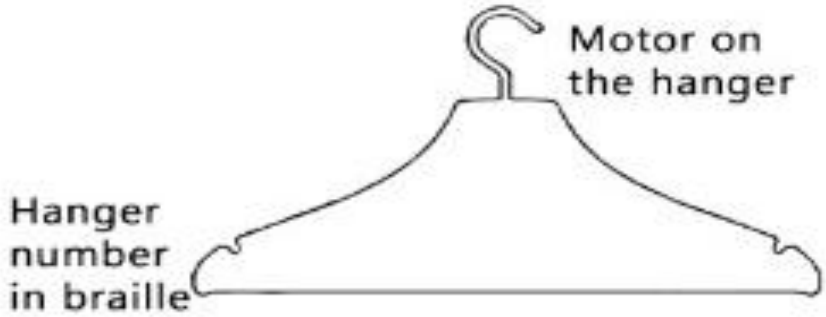

Fig4.6 Hanger modification

4.4 System representation of the prototype (CADD Model)

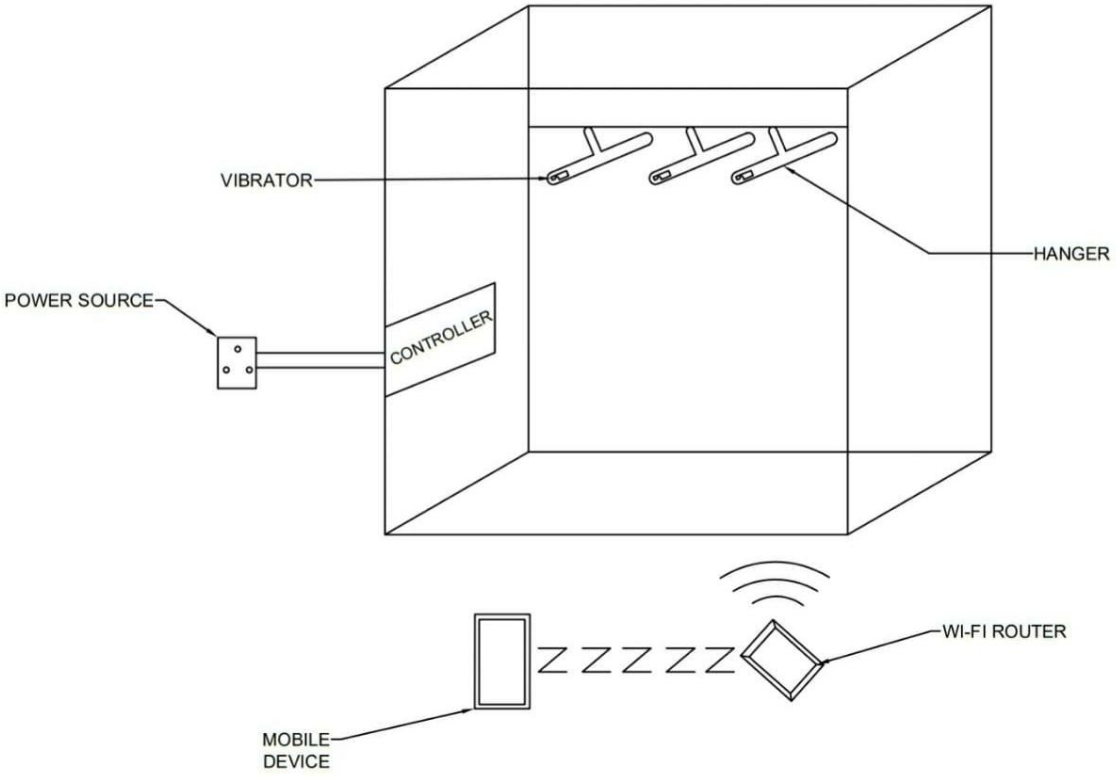

Fig 4.7 CADD model of the prototype

The above figure represents the prototype CADD model in which it describes the working of whole system. It consists of controller, Wi-Fi-router, and hanger with vibrator attachment which are connected to the power source. The mobile device ensures the connection between the controller and the device which in turn performs the necessary operation. The customized application in the mobile device built for the working system contains the QR code scanning which enables the easy identification of the required garment to the user. The hangers are positioned horizontally at required distance with the help of PVC rod (for prototype) and vibrator motor is fixed at pre-defined position at each hangers. When the communication between the mobile device and controller is ensured the vibrator receives its signal and starts vibrating. This enables the visually impaired person to identify the required garment by making physical contact with the hanger.

4.5 Working of the prototype model

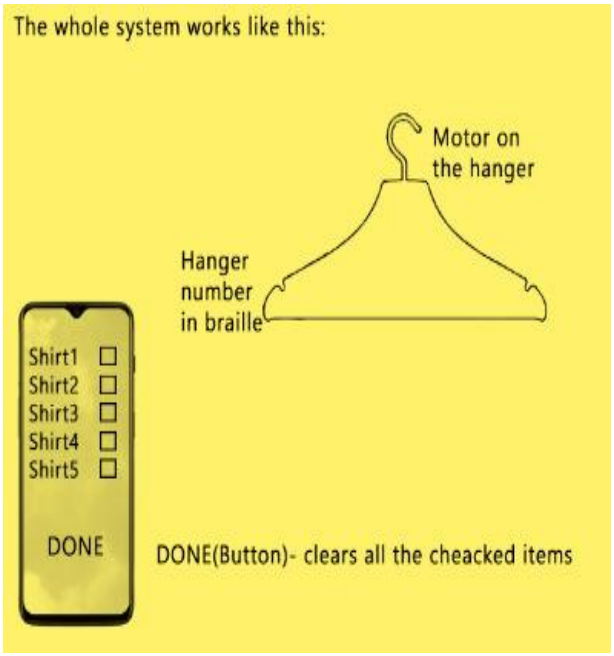

Fig 4.8 schematic representation of the prototype

The above figure shows the actual working page in the application consisting of buttons to vibrate the hanger.

Each of the buttons have two operating states i.e. on and off. When the button is in off state, there is no signal to the corridor. When it is turned on, a signal is sent to the controller through Wi-Fi.

Each button is named as per item.

The following steps explain the detail working of the prototype model

- Step 1: Choose a random QR tag from the available tags. Either stitch or glue the tag on the desired location on the item.
- Step 2: Scan the code through the designed application on the smartphone.
- Step 3: Encrypted code is displayed on the screen.
- Step 4: Enter the customized name below the encrypted code and select add item.
- Step 5: Item is added in the selected category and stored in the data grid of internal memory.
- Step 6: When the items have to be scanned, select the desired listed item. a page opens displaying the original name.
- Step 7: When the searched item matches desired item, phone vibrates.
- Step 8: To add items on the hanger, tab with hanger is selected where buttons are available with hanger numbers, corresponding to add or remove buttons.
- Step 9: When new item is added, respective bar code is mapped with the hanger number in the hanger data storage.
- Step 10: when the push button adjacent to the name is selected, hanger in the closet vibrates. Consequently, it seizes to vibrate when push button is deselected.
- Step 11: similarly, items can be removed from hanger by remove option.

Chapter 5

APPLICATIONS, BENEFITS AND LIMITATIONS

5.1 Applications

- The system works well in external environments such as whole travelling due to the stored data on smartphone.
- It can be used for various items like books, accessories and kitchen compartments.

5.2 Benefits

- Minimal use of electrical and mechanical components makes it easy to maintain and monitor.
- Wireless connectivity from smartphone to controller gives an opportunity to use it from an operating Wi-Fi range.
- Modifying existing design in the closet reduces investment costs and need to procure structural components.
- Cloth identification can be done without electricity using the smartphone.
- QR being orientation independent, is convenient to scan and quick.
- The system being personalised, is usable only by the consumer and cannot be tampered by external individual.

5.3 limitations

- Internal wiring in the hanger rod is difficult to distinguish when increasing the number of hangers.
- This system does not work in case of basic mobiles without camera and non-android platform However it can be implemented with the same logic on any other operating system
- Hanger rod modifications are subjective to the type of rod material and could bee complex in case of hard and this materials.
- Fixed position of drilled holes restrict the number of hangers and their positions.

Chapter 6

FUTURE PROSPECTS RESULTS AND CONCLUSION

6.1 Future prospects

- To create a wireless network in order to establish connectivity between controller and hanger
- To Design a cost effective completely automated closet.
- Develop an application using AI to customise and suggest ideal pairs.

6.2 Conclusion

- A personalised system was designed to identify and retrieve garments on the closet.
- Vibration system was employed to identify items on the hanger with ease.
- Connectivity was established between smartphone and vibration module through a microcontroller.
- A complete application was developed for Android smartphone and connectivity was achieved through customisable platform as a prototype model.

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