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Lighting Control System to Control Light Beam of Vehicle During Failure

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Chapter 1: Introduction

1.1 Introduction

Modern automotive vehicles variety of headlamps that are typically controlled to alternately generate a low light beam for short distance and a high light beam for long distance. The low light beam is provided in the areas where street light or likewise illuminated place already exists, whereas the high light beam is provided in highways or such roads where provision of street lights does not exists. Failure of these headlamps even for a small duration of time may critically effect the driving experience. Specifically, when the vehicle is at a high speed, failure of the low light beam or the high light beam even for few seconds may lead to situations prone to accidents.

Conventional modern vehicles comes with an Automatic High Beam (AHB) control system to maximize the use of high beam road illumination and control exterior lighting functions when appropriate. FIG. 1.1 illustrates mode of operation of head light control system during normal condition. The control system includes a light source i.e. Head light filaments connected to an electronic control unit. The light source includes a high beam head lamp and a low beam head lamp. The electronic control unit is connected to an input terminal i.e. Head light switch to receive input associated with the light source. During the normal condition, when the input terminal indicates that the high beam is switched ON, the Electronic control unit activates both the high beam head lamp and the low beam head lamp simultaneously. However, when the input terminal indicates that the low beam is switched ON, only the low beam head lamp remains activated as shown in the FIG. 1.2

FIG. 1.3 illustrates mode of operation of control system during failure condition. When the input terminal indicates that only the low beam is switched ON, if the low beam filament burns out, fuse blown, wire cut or the low beam relay fails then the high beam lamp cannot be activated automatically as there is no failure feedback to the control system as shown in the FIG. 1.4. During such failure condition, the driver has to manually switch ON the high beam lamp as soon as possible. This results in accidents on road due to lack of visibility on the road.
Accordingly, there is a need of system that overcomes the above mentioned problem

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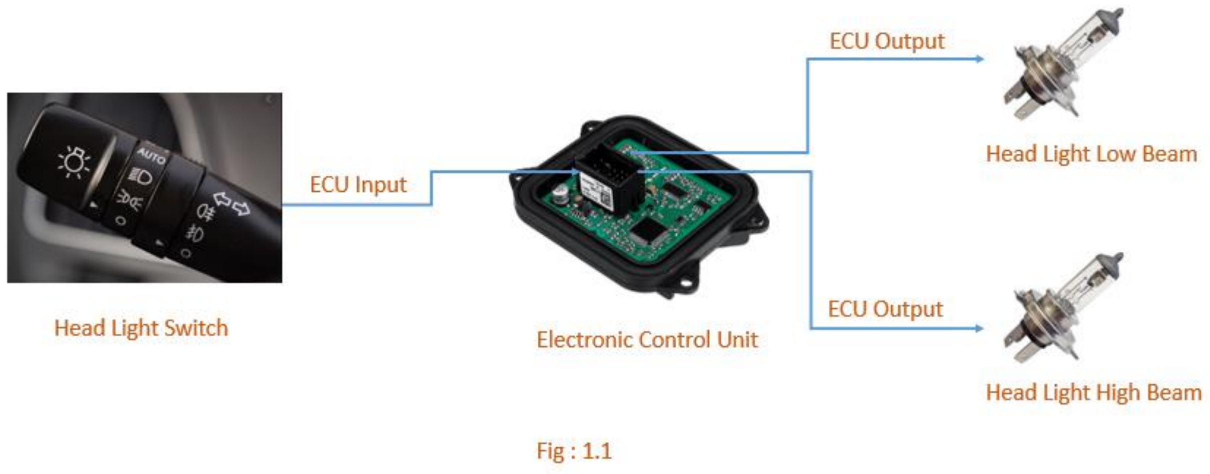

Fig No.1.1 Head lamp control diagram

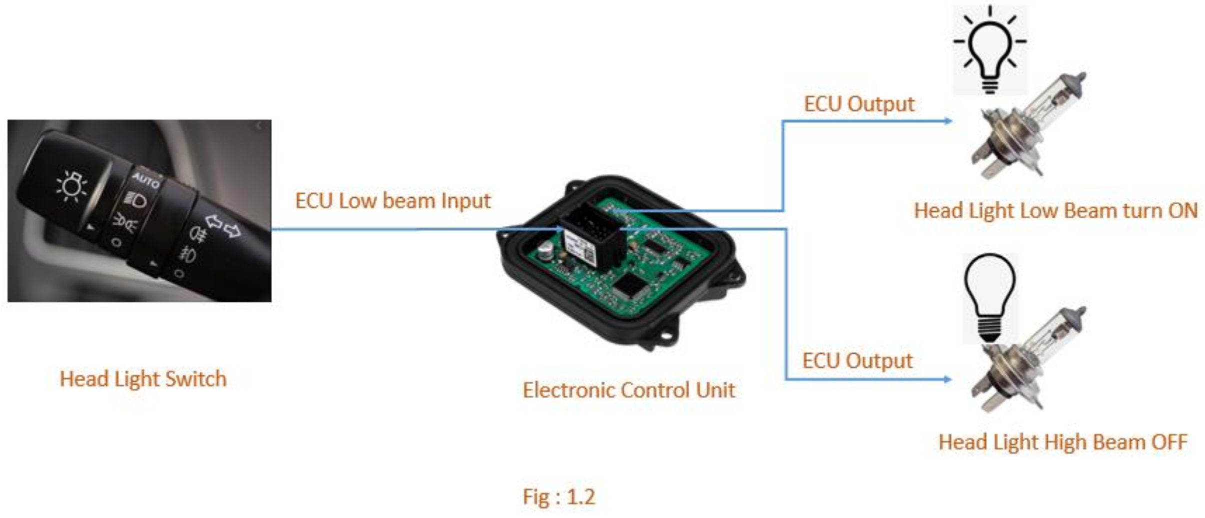

Fig No.1.2 Head lamp control normal operation

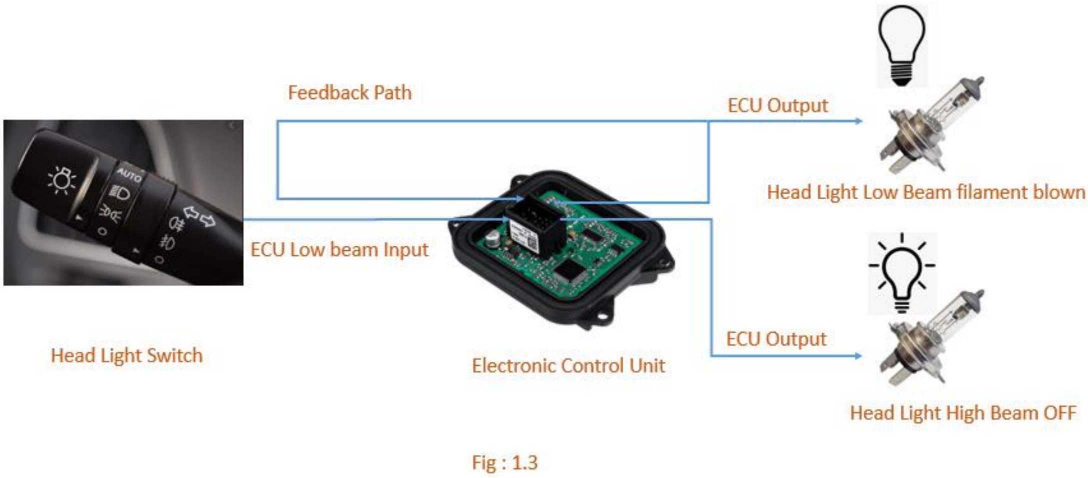

Fig No.1.3 Head lamp control operation in failure condition

1.2 Project Objective

1. By using the Automatic light control we can enhance the safety.
2. By using the Automatic light control we can enhance the driving experience.
3. Possible to change reduce road accidents due to failure in light operation during the driving condition
4. Improved system reliability.

Chapter 2. Literature Review

2.1 Existing systems

1)Speed control of induction motor drive using universal controller:

When connected to main power supply, induction motors run at their rated speed, however there are many applications where variable speed operations are required. Although a range of induction motor control techniques are available, generating variable frequency supply is a popular control technique, having a constant voltage to frequency ratio in order to attain constant (maximum) torque throughout the operating period. This control technique is called as variable frequency control. The main aim of this honours degree project paper emphasizes on the development of a general purpose universal board that is capable of controlling the speed of single or three phase induction motor with minor software and hardware modifications. The absolute system consists of the control, driver and the power circuits. The control circuit includes the power supply circuit and the microcontroller. The power circuit includes the full-bridge single-phase Pulse Width Modulation inverter. Simulation was done using MATLAB Simulink software. The system was implemented, tested and the experimental results are examined.

Published in: Power Engineering and Optimization Conference (PEDCO) Melaka, Malaysia, 2012 IEE Internationaldiscussed.

2) Induction Motor Speed Control Using Android Application:

"Android" the world's most popular mobile platform which is tool for creating application that look great and take advantage of hardware capabilities. The advantage of android is that it is an open source operating system is used in terms of mobile application that is smart phone which will act as a remote controller. Here the proposed system is designed to controlling the speed of induction motor using android application where the remotely controlling speed of induction motor is achieved.

Android mobile act as a transmitter and the received by Bluetooth receiver interfaced to AVR microcontroller of 8051 family.AVR is an advanced version of 8051 microcontroller. Each time data is sent by android application as per code written is executed by AVR to deliver supply signal to triac through optical isolation. Hence the power to load connected in series with triac is controlled based on received signal and speed control of induction motor is achieved.

For the improvement of quality product many industrial application requires adjustable speed and constant speed. Due to rapid advance in automation and process control the field of adjustable speed drives continuously. In recent technology, various alternate techniques are available for the selection of speed of drive system. Up to the 1980"s the dc motor was the choice for variable speed drive application. Induction motors are using any application such as Industrial drives control, automotive control, etc. In past few years there has been a great demand in industry for adjustable speed drives. Fan, pump, Compressors, domestic applications and paper machines etc... In this area DC motor was very popular but having many disadvantages so that microcontroller transformed research and development toward control of ac drive.

When the three phase supply is not available for domestic and commercial application, there we are using single phase induction motor which is one of the most widely used type of low power motor in the world An induction or asynchronous motor is a type of AC motor where power is supplied to the rotor by means of electromagnetic induction, rather than by slip rings and commutator as in slip-ring AC motors. It has a squirrel-cage rotor identical to a single phase and 3-phase motor winding on the stator. There are various methods for controlling the speed of AC motors. There are several of method is available for speed control of ac motor one of the method is two vary frequency and voltage of motor. Speed modulation of a single-phase motor is usually achieved either by some electrical means, such as reducing supply voltage by auto-transformer, or by switching windings to change the number of motor poles for different operating condition as required.

The most appropriator actuators for variable speed drive is seem to be capacitor run drive. In our project the speed of induction motor, control with the help of android apps that comes under wireless technology. Android application use here as a transmitter and remote control in order control the speed of induction motor with the help of Bluetooth as a receiver.

Keywords - triac, zero crossing detector, AVR microcontroller, optocoupler

Published by: Assistant professor of Department of electronics and telecommunication, J.D.I.E.T.Yavatmal, India 2015

3)Automatic Speed Control of Single Phase Induction Motor with the Variation of Ambient Temperature:

This paper is based on Automatic Speed Control of Single Phase Induction motor with variation of ambient temperature. The circuitry of the system comprises of temperature detector, control circuit and loading circuit. The control circuit is embedded with comparators, amplifiers and relays. Here algorithm, flowchart and computational approach is initiated. The detailed circuit diagram is given. This system has undergone a successful test approach and its behavior is observed by analyzing its temperature versus load curve. The equation of the curve using Newton‟s Interpolation method is incorporated. Simulation approach is incorporated.

Being in comfort zone is a vital nature of human being. Something less effort able always attracts human mind. This innovation belongs in a zone far more advanced than a fan operated by a manual regulator. Like normal household fan regulators it does not need any attention for controlling the speed of the fan and thus it reduces human effort which is very much clear to us. It uses a TRIAC (Triode for AC) based circuitry which minimizes energy consumption and thus saves power . It gives a wide control of working temperature range to the user while also providing manual control in case of need. These features are as interesting as well as very useful for the mediocre class because of a low buying and maintenance cost. This whole innovation will be discussed in succeeding points.

Published by: 5Faculty member, ECE Dept., JISCE, Kalyani, WB, India

Asst. Prof., ECE Dept., KIEM, Mankar, WB, India

4) Modelling Of Induction Motor & Control Of Speed UsingHybrid Controller Technology :

This paper presents a novel design of a Takagi-Sugeno fuzzy logic control scheme for controlling some of the parameters, such as speed, torque, flux, voltage, etc. of the induction motor. Induction motors are characterized by highly non-linear, complex and time-varying dynamics and inaccessibility of some of the states and outputs for measurements, and hence it can be considered as a challenging engineering problem. The development of advanced control techniques has partially solved induction motor’s speed control problems; because they are sensitive to drive parameter variations and the performance may deteriorate if conventional controllers are used. Fuzzy logic based controllers are considered as potential candidates for such an application. Further, the Takagi-Sugeno control strategy coupled with rule based approach in a fuzzy system when employed to the induction motor yields excellent results compared to the other methods as this becomes a hybrid & integrated method of approach. Such a mixed implementation leads to a more effective control design with improved system performance, cost-effectiveness, efficiency, dynamism, & reliability. The closed loop speed control of the induction motor using the above technique thus provides a reasonable degree of accuracy which can be observed from the results depicted at the end. Simulink based block model of induction motor drive is used for the simulation purposes & its performance is thereby evaluated for the speed control. The simulation results presented in this paper show the effectiveness of the method developed

& have got a wide number of advantages in the industrial sector & can be converted into a real time application using some interfacing cards.

Published by: 1 Research Scholar, EEE Dept., JNTU, Hyderabad-85, Andhra Pradesh, India, Professor & Head of the Department of ECE, HMSIT, Tumkur, Karnataka, India 2 Director, Krishnamurthy Inst. of Tech. & Engg., Hyderabad, Andhra Pradesh, India 3 Professor, Dept. of EEE, JNTUCE, Kukatpally, Hydarabad-85, Andhra Pradesh, India.

5) Microcontroller based speed control of three phase induction motor using v/f method:

Induction motors are widely used AC motors in industrial area. Advanced semiconductor technology & use of microcontroller have made the speed control of induction motor easier. The proposed paper represents variable speed control application of induction motor using v/f method. In this system, the speed of the induction motor can be adjusted to user defined speed. The actual speed & reference speed is compared & the difference is adjusted by changing the firing angles of IGBTs. The system is tested & experimental results are recorded for variable speed under various load conditions

Published by: Mrs.DeepaliS.Shirke, Prof. Mrs.Haripriya, H.Kulkarni

Electrical Dept. PES's Modern College of Engg. Pune

2.2 Problem Statement

Currently Head lights are control through microcontroller based electronic control unit. Microcontroller is not capable to drive 12V, 55/60 W electric load hence microcontroller control the coil of relay and through relay power circuit head light is controlled. For microcontroller relay coil is actual load. He doesn't acknowledge relay power circuit state hence if any failure occurs in relay power circuit will not detected by microcontroller. In current process microcontroller detect failure in relay coil circuit and logged diagnostic trouble code (DTC).

Failure in relay power circuit is not detected by microcontroller because of no feedback path to microcontroller.
To overcome this problem new head light control system is developed.

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Chapter 3 : Methodology

3.1.Block Diagram:

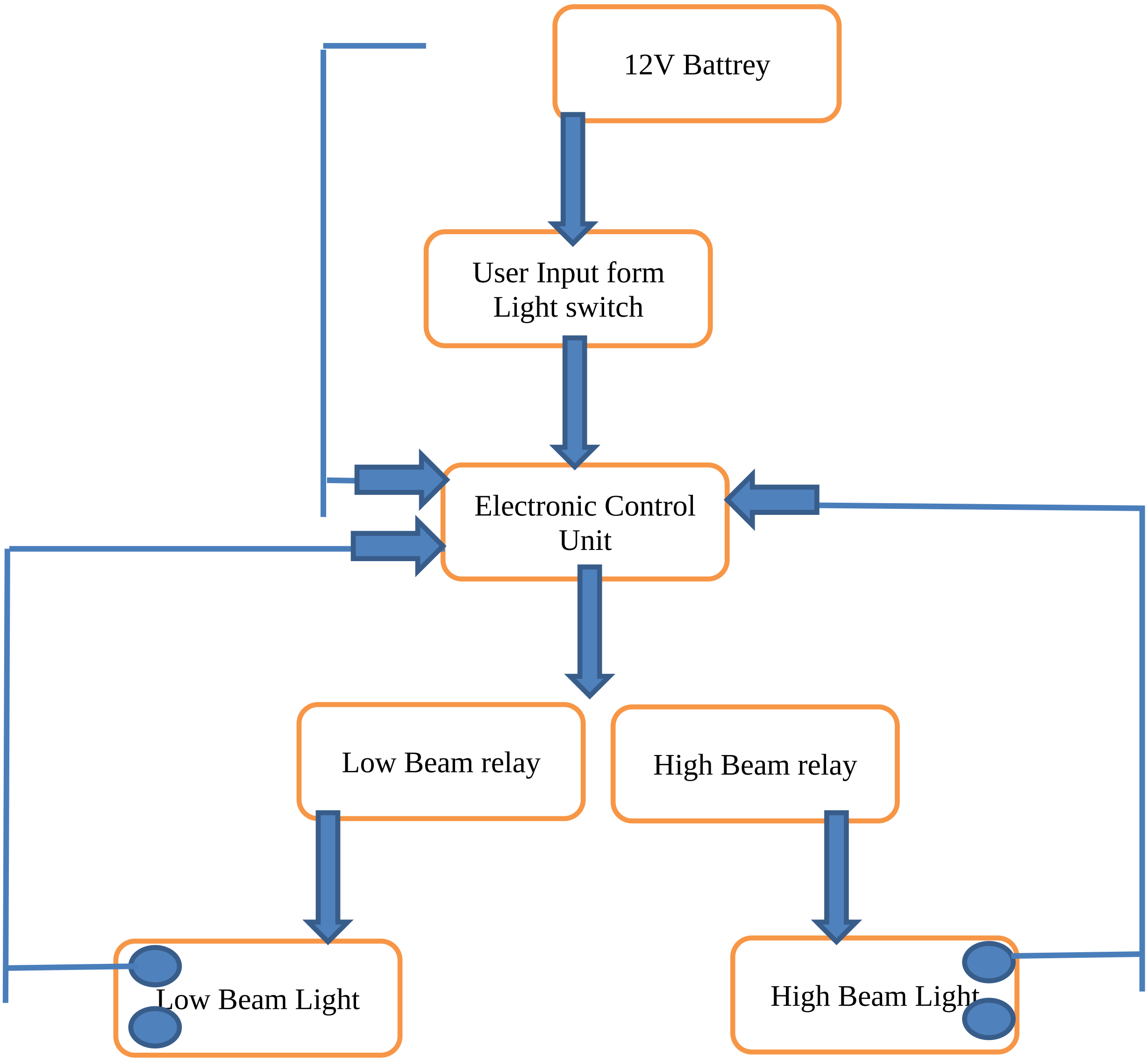

Fig 3.1 Block Diagram of head light control.

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3.1 Operation Of Module:

Microcontroller, it logic and feedback detection is the heart of the system. We have use XXXX Microcontroller, Optical sensor and thermal sensor in this project. Microcontroller and sensors are powered by 12V battery by hardwired method.

Optical sensor senses the light intensity of head lamp chamber and thermal sensor sense the temperature of the head lamp chamber. Both sensor provide the lamp status feedback to the microcontroller. Output of sensors is input to microcontroller in addition to that user intended input receives form head light switch.

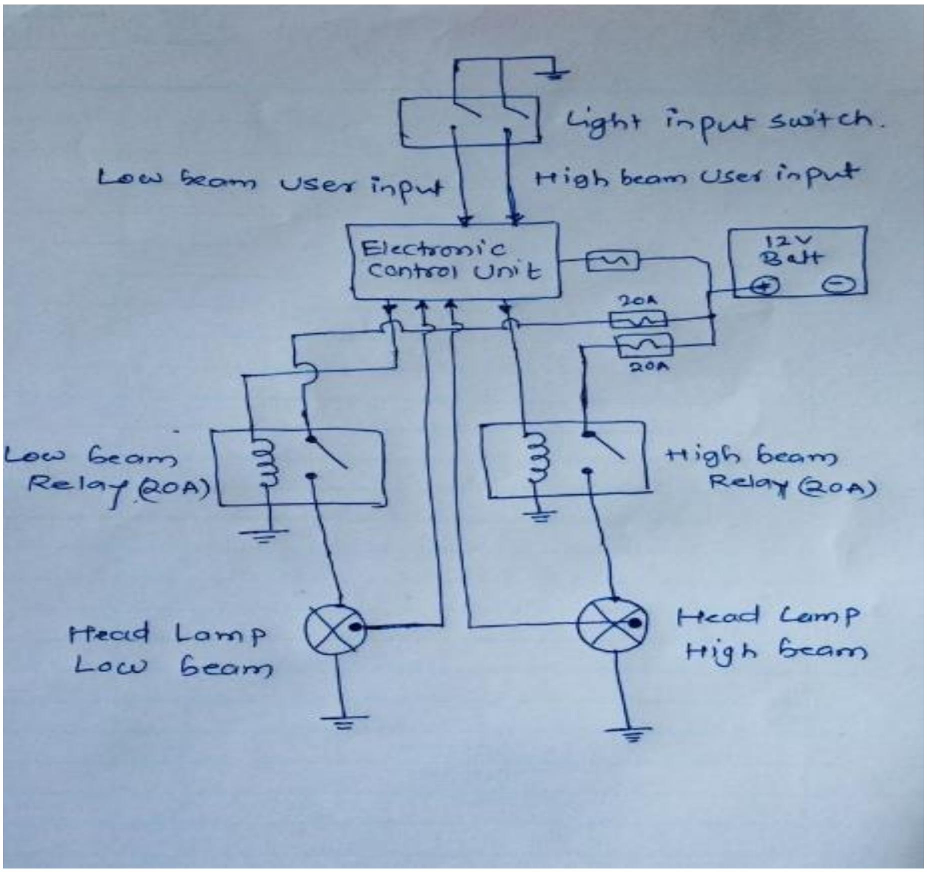
Based on program written in the microcontroller, he checks the input /output condition based on this data microcontroller decided the actual outputs

3.2 Proposed Systems

The proposed system consists of optical sensor, thermal sensor and program logic in addition of conventional head light control system.

CHAPTER4: CIRCUIT DESIGN

4.1. Circuit Diagram:



CHAPTER5: HARDWARE REQUIREMENT

5. Hardware Requirement:

Sr No	Description	Specification	Quantity	Remark
1	Microcontroller		1	
2	Optical sensor		1	
3	Thermal Sensor		1	
4	Relay	12V, 20A	1	
5	Bulb with housing	12V, 55/60W	1	
6	12V Battery	12V , 40Ahr	1	
7	Connecting harness	As per length	1	

5.1. Microcontroller

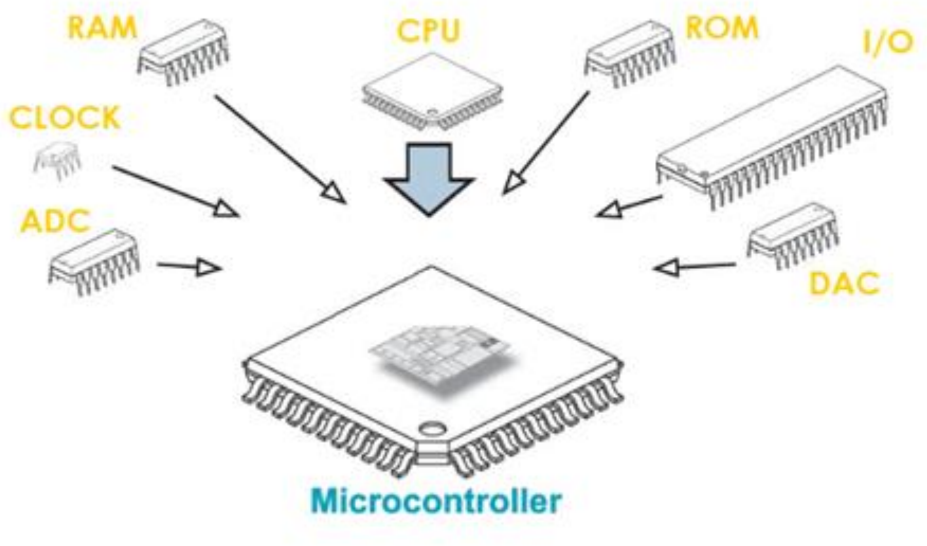


Fig 5.1 Microcontroller

5.1.2. Components of Microcontroller

1. Central Processing Unit (CPU)
2. Program Memory(ROM – Read Only memory)
3. Data Memory (RAM – Random Access Memory)
4. Timers and Counters
5. Serial Communication Interface
6. Clock circuit
7. Interrupt Mechanism

5.1.3. Selection parameters of Microcontroller

1. Number of inputs and outputs pins
2. Memory size
3. Clock Speed
4. Number of bit required
5. Number of Timers and Counters
6. Method of Serial Communication
7. Cost
8. Packaging size
9. Lower power consumption
10. Availability in market

Based on the design circuit diagram and project requirement, we have selected XXXX microcontroller.

5.1.4. Specifications of Microcontroller

5.2. Optical sensor

5.2.2. Optical sensor selection parameters / requirements

5.2.2..1 Optical requirements

Optical sensor is used to detect the status of light beam is ON or OFF. In modern head lamp has dual chamber design. Two separate chambers are used for low beam and high beam. H4 type, 55W filament is used for low beam application and H4 type, 60W filament is used for High beam application. Both light source emits 1100-1500 lumens. Both filaments lumens falls within the 1100 – 1500 lumens, Hence there is requirement to detect light source 0 lumens to 1500 lumens.

5.2.2..1 Thermal requirements

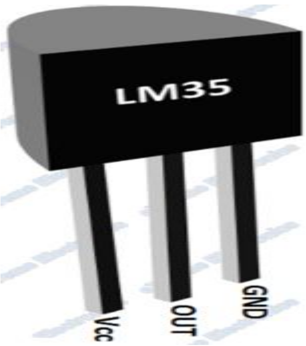
Head lamp chambers are closed hence temperature build in low beam chamber is 80 Deg C to 90 Deg C and temperature rise up to 120Deg C in High beam chamber , hence there is requirement optical sensor should withstand 120 Deg C

5.2.2..1 Packaging requirements

Mechanical dimensions of Optical sensor is such way that it should be easily package in head lamp chamber

5.2.3. Technical Specification of Optical Sensor

5.3 Temperature sensor



5.2.3. Optical sensor selection parameters / requirements

5.2.3.1 Thermal requirements

Head lamp chambers are closed hence temperature build in low beam chamber is 80 Deg C to 90 Deg C and temperature rise up to 120Deg C in High beam chamber , hence there is requirement of thermal sensor should sense up to 150 Deg C

5.2.3.2 Packaging requirements

Mechanical dimensions of temperature sensor is such way that it should be easily package in head lamp chamber

5.2.3. Technical Specification of Optical Sensor

5.4 Relay

5.4.1. Relay selection parameters / requirements

Following parameters are considered while selecting the realy for 12V, 55/60 W load

1. Operating Voltage
2. Operating Current
3. Operating temperature
4. Coil resistance
5. Coil suppression mechanism
6. Number of output terminal required.
7. Vibration requirement

5.4.1.1 Operating Voltage

In Conventional car electrical system is powered by 12V Battery and alternator in case of internal combustion engine and 12V battery and DC-DC converter in case of Electrical cars hence operating voltage of relay is 12 V

5.4.1.2 Operating Voltage

55W /60 W electric load is connected to the relay and 12V system hence current drawn by circuit is max 5.0 A but considering s 1.8 times safety factor calculated current is 5.0 X 1.8 = 9A each side lamp. There are two filament connected for low beam and High beam one in left side lamp and another is in right side lamp. Hence total current drawn through 18A as per calculation, but 18A relay not available in market hence we selected higher side 20A relay.

5.4.1.3 Operating Temperature

Head lamp relay packaged in Engine compartment and temperature around in engine compartment is about 90 Deg C to 110 Deg C hence selected relay should withstand 150 Deg C temperature

5.4.1.4 Relay coil resistance

Relay coil is resistive load and relay coil is controlled by selected Microcontroller hence relay coil resistance selected such way that microcontroller can drive relay coil load and it should have sufficient number of turn to generate magnetic field so as to operate contact circuit.

5.4.1.5 Power Source or Battery

12V, 40Ahr battery is used for this project.

5.4.1.6 Connecting wiring Harness.

For designing the wiring harness following parameters need to be considered

1. Length of wire
2. Cross section of wire
3. Type of wire
4. Fuse rating selection
5. Wire harness protection from temperature and mechanical damages
6. Selection of suitable connectors.

Based on above parameters we have selected 1.5 Sqmm cross section, FLRY B type, 20A fuse and corrugated tube or full insulation taping on the wiring harness. Wiring harness length is selected as per layout of components.

CHAPTER 6: WORKING AND DESIGN LOGICS

6.1 Working.

FIG. 1.1 illustrates various components of a lighting control system to control a light beam of a vehicle, according to design logic. The lighting control system includes a light source connected to a front of the vehicle and an electronic control unit (Microcontroller) connected to the light source

The light source includes a first lamp to generate the light beam in the first mode and a second lamp to generate the light beam in the second mode. The first mode is a high light beam mode and the second mode is a low light beam mode. In another condition, the first mode is a low light beam mode and the second mode is a high light beam mode.

In an condition, the first lamp can be a low light lamp to produce the light beam in the low light beam mode and the second lamp can be a high light lamp to produce the light beam in the high light beam mode. Similarly in another condition, the first lamp can be a high light lamp to produce the light beam in the high light beam mode and the second lamp can be a low light lamp to produce the light beam in the low light beam mode.

Further, the light source is configured to produce the light beam in several different modes including conventional low-beam and high-beam states. The light source can also be operated as daytime running lights, and additionally as super-bright high light beams in those countries where they are permitted. The headlamp brightness may also be continuously varied between the low, high, and super-high states. Examples of the lighting source include but not limited to light source headlamps, tail lights, foul weather lights such as fog lights, brake lights, center-mounted stop lights (CHMSLs), turn signals, back-up lights, cargo lights, puddle lights, license plate illuminators, etc.

In an condition, the first lamp includes one or more sensors and hardwired connection. The temperature and optical sensors is configure to detect a status information of the light beam produced in the first mode by the first lamp and transmit a signal corresponding to the status information of the light beam produced in the first mode by hardwired. The status information indicates one of operation and non-operation of the light beam produced in the first mode. The optical sensor is placed inside a chamber of the light source. The Electronic control unit is connected to the light source and the optical sensor and communicates with the optical sensor through hardwired. The engine control unit is configured to receive the measured status information of the light beam produced in the first mode from the optical sensor and detect a beam failure event associated with the light beam produced in the first mode by the first lamp based on the measured status information. In response to detecting the beam failure event associated with the light beam produced in the first mode by the first lamp, the electronic control unit configures first lamp of the light source to produce a light beam in a second mode. Further, the electronic control unit is configured to provide a notification about the production of the light beam in the second mode. Furthermore, the electronic control unit is configured to automatically diagnose the non-operation of the sensor.

Lighting control system during normal condition, according to conditions as disclosed herein. In this example, the first lamp is considered as low light lamp and the second lamp is considered as high light lamp. During the normal condition, when the input terminal indicates that the high beam is switched ON, the electronic control unit activates both the high beam head lamp and the low beam head lamp simultaneously. However, unlike the conventional control system, when the input terminal indicates that the low beam is switched ON, not only the low beam head lamp is activated but also the low beam head lamp is activated. FIG. 3b illustrates an example mode of operation of proposed lighting control system during failure condition, according to embodiments as disclosed herein. When the input terminal indicates that only the low beam lamp is switched ON, the engine control unit receives signal corresponding to the current status of the low beam lamp measured by the optical sensor and determine whether the failure event is detected based on the current status. In response to detecting the failure of the low beam lamp, the engine control unit automatically configures the high beam lamp cannot be activated as shown in the FIG. 3b. Hence during the failure condition, the driver need not to manually switch ON the high beam lamp. This increases the overall driving experience of the user and also decreases the changes of accidents due lamp failures.

When the low beam turns ON, it generally takes few seconds for the chamber to get heated up. Thus, based on the thermal sensor input only, the engine control unit cannot determine whether the lamp is ON or OFF, in the initial few seconds. So the proposed invention uses the optical sensor which can sense directly whether the low beam lamp is ON. The engine control unit will ignore the low temperature input from the thermal sensors in the initial few seconds if the optical sensor indicates that low beam lamp is ON.

Although the optical sensor illustrates as being mounted insider or near the light source, but those skilled in the art will recognize that the optical sensor could be mounted at other locations that provide the sensor to appropriately measure the status of the lamps.

FIG. 4 illustrates a method for controlling a light beam of a vehicle, according to embodiments as disclosed herein. The method includes producing a light beam in a first mode by a light source. In an embodiment, the first mode is a low light beam mode and the second mode is a high light beam mode. In another embodiment, the first mode is a high light beam mode and the second mode is a low light beam mode.

The method includes measuring a status information of the light beam produced in the first mode using the optical sensor and transmit the status information to the engine control unit. The optical sensor transmits a signal corresponding to the status information of the optical sensor to the engine control unit over the LIN (110).

At step 406, the method includes receiving the signal corresponding to the status information of the light beam produced in the first mode by the engine control unit (106) over the LIN (110). The status information indicates one of operation and non-operation of the light beam produced in the first mode.

At step 408, the method includes determining whether a beam failure event associated with the light beam produced in the first mode is detected based on the measured status information. When the status information indicates that the light source (102) is non-operable then the engine control unit (106) detects the beam failure event.

In response to detecting the beam failure event associated with the light beam produced in the first mode, at step 408, the method includes configuring the light source (102) to produce a light beam in a second mode. Further, at step 410, the method includes providing a notification about the production of the light beam in the second mode and at step 412, the method includes automatically diagnosing the light source upon detecting the failure event.

Although the present invention primarily addresses the control of the vehicle headlamps, but those skilled in the art will recognize that proposed lighting control system and method thereof can be used for controlling the tail lights and foul weather lights. Indeed, the present invention is generally applicable to for controlling any exterior lighting on the vehicle.

The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the embodiments as described herein

Flow Chart.

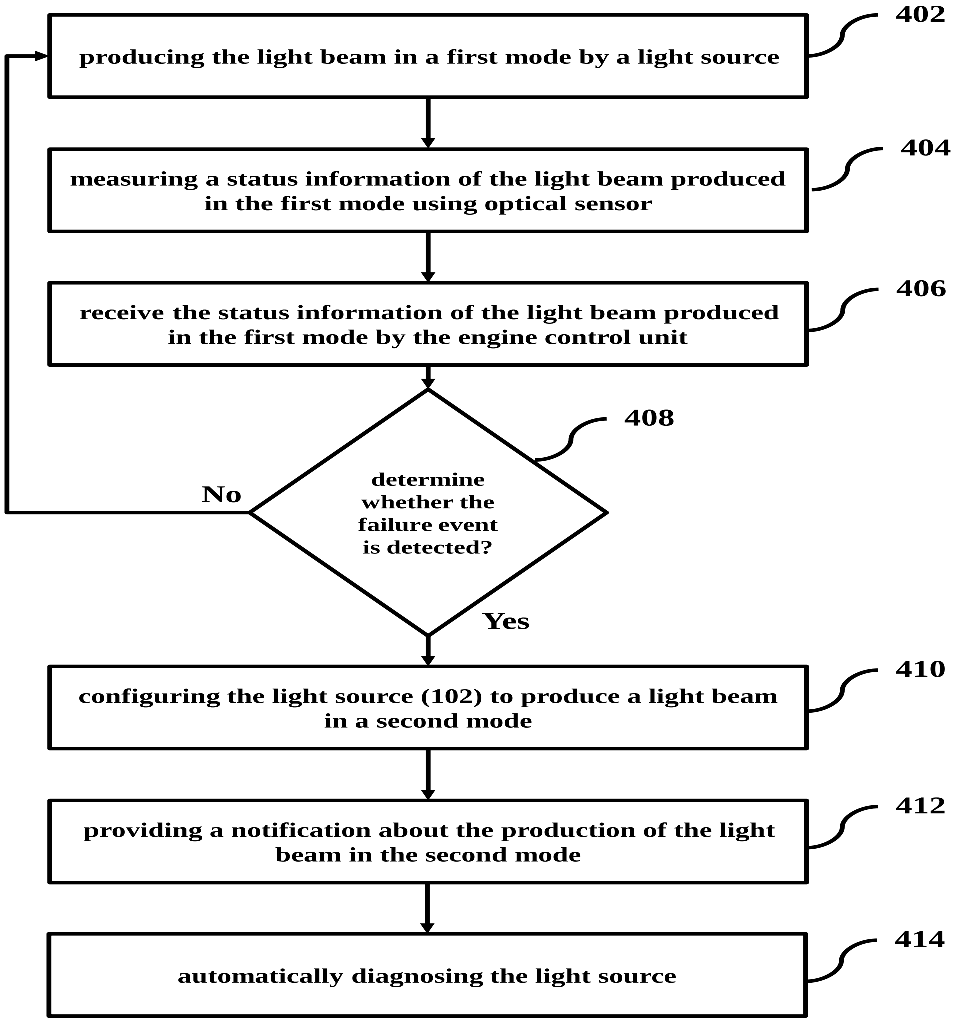


FIG. 4

4.1.2)Digital Dimmer Module

The board can be used in applications where dimming of 110-220V AC power is required like dimming of bulb or fan. The input can be simple 4 bit high/low signal from microcontroller working at 3V or 5V which is isolated with the use of opto- couplers. Total of 16 levels of power control can be set from totally off(0%) to full on(100%) as per input control levels.

Fig4.2:Digital Dimmer Module

Features :

1. Works on AC power supply.
2. 16 levels of control.
3. Works from any microcontroller input.

Specifications:

Parameter	Value
Operating Voltage	3-5v dc
Load capacity	12A AC

Table 4.2 Specification of Digital Dimmer Module

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Pin Details:

Pin	Name	Details
1	GND	Power supply ground
2	VCC	Power supply
3	D0	Data 0
4	D1	Data 1
5	D2	Data 2
6	D3	Data 3

Table 4.3 Pin Details Of digital Dimmer Module

Working:

A dimmer switch rapidly turns a light circuit on and off to reduce the energy flowing to a light switch. The central element in this switching circuit is a triode alternating current switch, or triac.

A triac is a small semiconductor device, similar to a diode or transistor. Like a transistor, a triac is made up of different layers of semiconductor material. This includes N-type material, which has many free electrons, and P-type material, which has many "holes" where free electrons can go.

The triac has two terminals, which are wired into two ends of the circuit. There is always a voltage difference between the two terminals, but it changes with the fluctuation of the alternating current. That is, when current moves one way, the top terminal is positively charged while the bottom terminal is negatively charged, and when the current moves the other way the top terminal is negatively charged while the bottom terminal is positively charged.

Input for dimmer module:

It is of digital input of 4bit data D0,D1,D2,D3 are the input pins of dimmer which can be connected to I/O pins of microcontroller. 16 levels of dimmer controlling input of 0 to 100% is shown below.

4.1.3) 2 Channel 5V Optical Isolated Relay Module

This is a LOW Level 5V 2-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller. This module is optically isolated from high voltage side for safety requirement and also prevent ground loop when interface to microcontroller.

Fig.4.3.2 Channel 5V Optical Isolated Relay Module

Brief Data:

• Relay Maximum output: DC 30V/10A, AC 250V/10A.

• 2 Channel Relay Module with Opto-coupler. LOW Level Trigger expansion board, which is compatible with Arduino control board. • Standard interface that can be controlled directly by microcontroller (8051, AVR, *PIC, DSP, ARM, ARM, MSP430, TTL logic).

• Relay of high quality low noise relays SPDT. A common terminal, a normally open, one normally closed terminal.

• Opto-Coupler isolation, for high voltage safety and prevent ground loop with microcontroller.

Schematic:

VCC and RY-VCC are also the power supply of the relay module. When you need to drive a large power load, you can take the jumper cap off and connect an extra power to RY-VCC to supply the relay; connect VCC to 5V of the MCU board to supply input signals. NOTES: If you want complete optical isolation, connect "Vcc" to Arduino +5 volts but do NOT connect Arduino Ground. Remove the Vcc to JD-Vcc jumper. Connect a separate +5 supply to "JD-Vcc" and board Gnd. This will supply power to the transistor drivers and relay coils. If relay isolation is enough for your application, connect Arduino +5 and Gnd, and leave VCC to JD-VCC jumper in place.

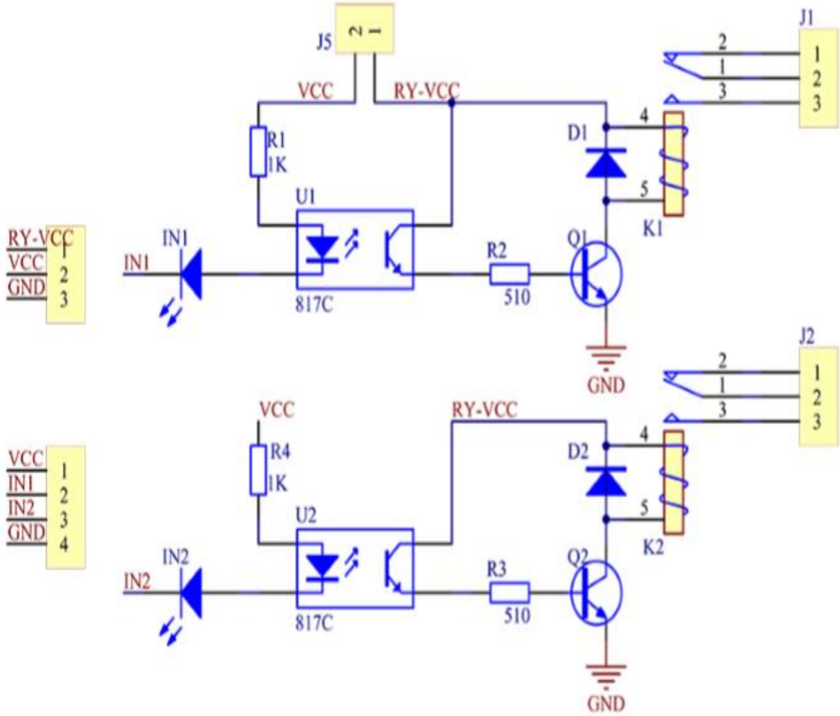

Fig.4.4 Schematic diagram of 2 channel 5V optical Isolator Relay Module

It is sometimes possible to use this relay boards with 3.3V signals, if the JD-VCC (Relay Power) is provided from a +5V supply and the VCC to JD-VCC jumper is removed. That 5V relay supply could be totally isolated from the 3.3V device, or have a common ground if opto-isolation is not needed. If used with isolated 3.3V signals, VCC (To the input of the opto-isolator, next to the IN pins) should be connected to the 3.3V device's +3.3V supply.

4.2 Software Requirement:

4.2.1) MQTT(MQ Telementry Transport)

MQ Telemetry Transport (MQTT)

- Lightweight messaging protocol for M2M communication
- Telemetry = Tele-Metering = Remote measurements
- Invented and sponsored by IBM. Now Open source. Open Source libraries available.
- MQ originated from “message queueing (MQ)”architecture used by IBM for service oriented networks. There is no queueing in MQTT.
- Telemetry data goes from devices to a server or broker. Uses a publish/subscribe mechanism.
- Lightweight = Low network bandwidth and small code footprint.

MQTT (Cont)

- Facebook messenger uses MQTT to minimize battery usage. Several other applications in medical, environmental applications
- Many open source implementations of clients and brokers are available

1. Really small message broker (RSMB): C
2. Mosquitto
3. Micro broker: Java based for PDAs, notebooks

MQTT Concepts

1. Topics/Subscriptions:

Messages are published to topics. Clients can subscribe to a topic or a set of related topics.

2. Publish/Subscribe:

Clients can subscribe to topics or publish to topics.

MQTT Concepts (Cont)

- Quality of Service Levels: Three levels:

0 = At most once (Best effort, No Ack),

1 = At least once (Acked, retransmitted if ack not received),

2 = Exactly once [Request to send (Publish), Clear-to-send (Pubrec), message (Pubrel), ack (Pubcomp)]

- Retained Messages: Server keeps messages even after sending it to all subscribers. New subscribers get the retained messages
- Clean Sessionsand Durable Connections: At connection set up: Clean session flag all subscriptions are removed on disconnect Otherwise subscriptions remain in effect after disconnection Subsequent messages with high QoS are stored for delivery after reconnection
- Wills: At connection a client can inform that it has a will or a message that should be published if unexpected disconnection Alarm if the client looses connection
- Periodic keep alivemessages -If a client is still alive
- Topic Trees: Topics are organized as trees using / character /# matches all sublevels /+ matches only one sublevel

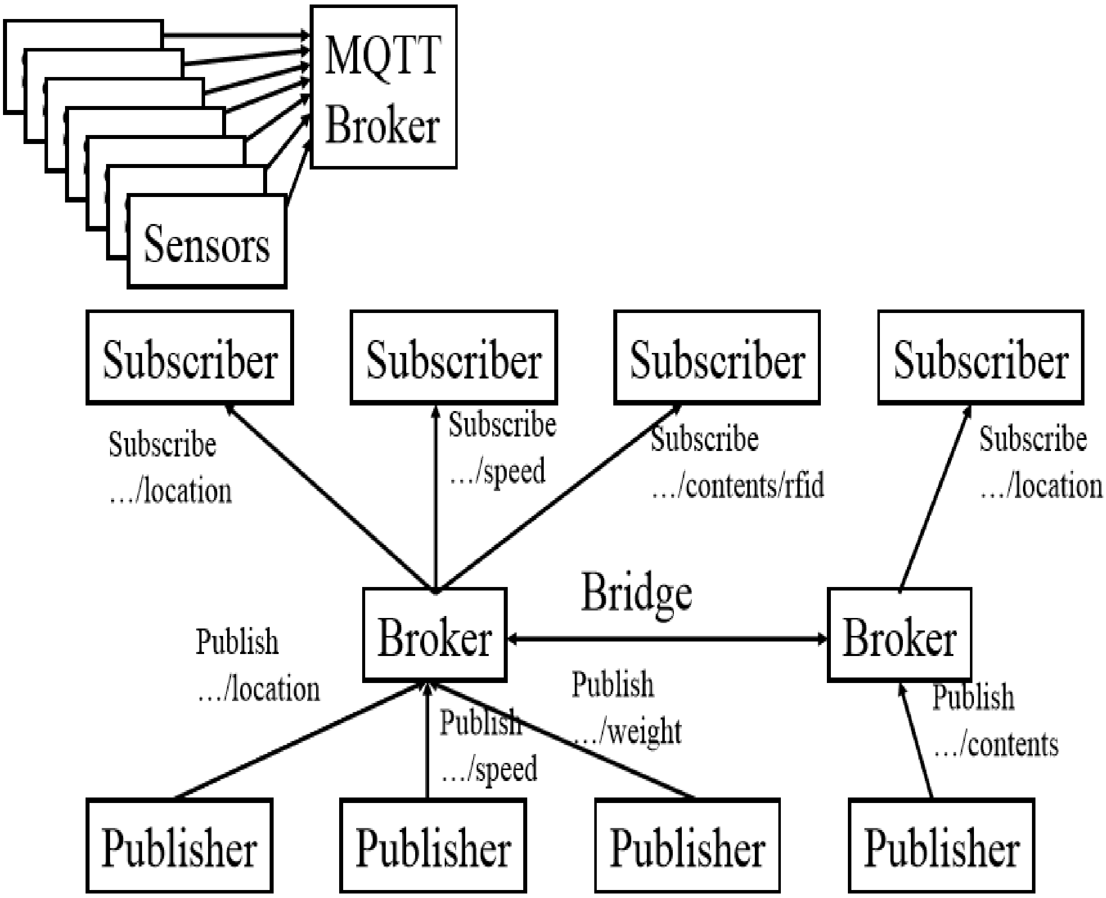

Fig 4.5: MQTT Example

MQTT Application Examples:

Home pacemaker monitoring solution:

1.Sensors on patient

2.Collected by a monitoring equipment in home (broker) using MQTT 3.Subscribed by a computer in the hospital

4.Alerts the doctor if anything is out-of-order

MQTT vs. HTTP:

	MQTT	HTTP
Design	Data centric	Document centric
Pattern	Publish/Subscribe	Request /Response
Complexity	Simple	More Complex
Message Size	Small. Binary with 2B header	Large. ASCII
Service Levels	Three	One
Libraries	30kB C and 100 kB Java	Large
Data Distribution	1 to zero, one, or n	1 to 1 only

Table 4.4:Difference between MQTT and HTTP

4.2.2 About Android Application

How Android is used in IOT:

It was once thought to be the stuff of science fiction. But the 'internet of things' (IOT) is already here and growing at a rapid rate. Simply put, IOT refers to the increasing interconnectedness of different smart devices over the internet. These devices feature sensors and internet connectivity that allows them to receive, gather and transmit information.

A wide variety of devices are have already hit the market and many more are set to be released as developers work towards increased connectivity of electronic devices in homes and offices. Today you can easily control your refrigerator, treadmill, smart TV or toaster from your smart phone.

However, IOT is only possible as a result of the availability of a platform on which these devices can operate. Enter Android.

Why Android has become the Major Driving Force behind IOT:

A quick look at the market shows that most smart devices run on Google's operating system, Android. Anyone familiar with smart phones is also familiar with the operating system. It is currently the world's leading mobile device operating system edging out iOS. As of 2013, Android smart phones had outsold Apple's iPhones 4 to 1.

However, the war didn't stop with smartphones. The battle for the top is now being fueled by the expanding demand for interconnected devices and Android is leading the charge. The world of IOT is being created and managed for Android.

There are various reasons why Android is at the forefront:

1. Android is a universal front end from which developers can work

Android has risen quickly as a software platform mostly because Google (the company behind it) chose to give it away to developers and device makers. The Linux-based software is open source, therefore allowing just about anyone to use its source code and therefore customize it for use in just about any gadget they can imagine.

The number of devices that rely on Android as an operating system today are numerous. With such a large number of devices run on Android it is easy to see how Android acts as a front end for IOT. It is easy and cheap to develop devices for IOT making them even more affordable for consumers.

2. Apps drive IOT

A gadget is just a gadget. However, with the right app to and software to help it run and perform different tasks, it becomes much more. Apps are what make it possible to use IOT devices. Android is currently the world's largest app platform. As of December 2016, Google Playstore was reported to host more than 2.6 million apps. It is not surprising that Android drives the IOT movement.

3. IOT is being built on Java

Many IOT devices are being built on Java. It therefore makes sense that Android is driving the IOT market. Android allows for Java to be applied in a way that makes sense as opposed to the use of embedded JAVA which requires dedicated devices.

The Android IOT Ecosystem

To understand the application of Android in IOT, you must understand the IOT ecosystem and Android's role in it.

· The sensor

Sensors detect physical properties such as temperature and generate digital signals. Many hardware vendors rely on specific domains such as Linux, Android and Windows. The popularity and availability of Android makes it an easy winner in this area. The fact that Android is open source and can be tweaked for use in any device makes it a popular choice for device makers.

· Data Transfer

There must be a component that supports the transfer of data from the sensor. The two simplest options available for this are MQTT and XMPP. Android supports both of these open source implementations. The libraries can be used on Windows, Linux and Android.

· Device

There must a device or processor with an operating system that supports the components of the IOT ecosystem. This ought to be a small and portable device that doesn't consume too much power but can provide continuous connectivity. In many cases, inexpensive Android devices are chosen for this. Android devices meet the requirements to support a wide variety of sensors. There are also various tutorials available to assist developers.

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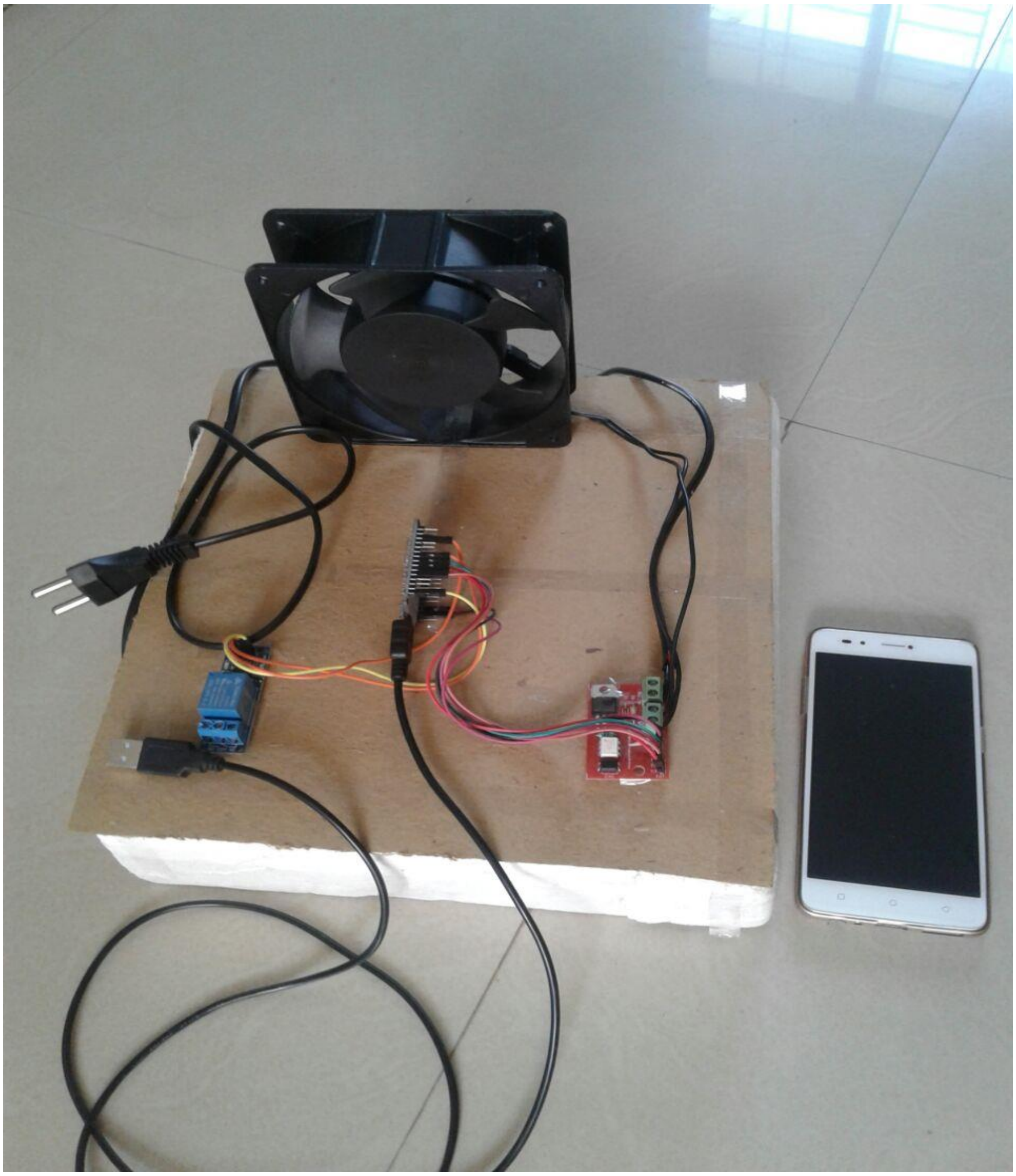
· Program

There must be a program that receives the data and stores it. This could take the form a standard Linux Server. This server receives the data, decodes it and processes it. The data can be used for subsequent analysis.

There is no doubt that Android is the major driving force behind IOT devices. Reach out to an Android app developer if you are planning to build IOT Apps.

CHAPTER 7: IMPLEMENTATION OF HARDWARE AND SOFTWARE



Hardware Design:

Aurdino is the heart of the system. We have use Node MCU Aurdino in this project. It is getting a 3.3V power supply through USB powered,because Node MCU has feature of USB powered. It is also interfaced with the AC Load, Wifi module, optoisolator, triac & induction motor. The NodeMCU is an open source firmware and development kit that helps you to prototype your IOT product with few Lua script lines. The Development kit based on ESP8266, integrates GPIO,PWM, IIC, 1Wire and ADC all in one board.

Aurdino is high-performance, low-power 8-bit Microcontroller provided by Node MCU. It is having a modified Harvard architecture. Power supply is provided through microcontroller. The Node MCU that is Aurdino will be interfacing with the Wifi

module that will act as transmitter for the aurdino and it will act as receiver to the android application. The necessary data to control the speed of induction motor will be provided to the controller and with the help of android application remotely controlling speed of induction motor is achieved. Here android application is created by MQTT dashboard which is interfaced with iot.eclipse.org.

The optoisolator is used to drive the triac which provides complete pulse to the motor in order to rotate and to control the speed of inductor motor via android application.

Software Design

5.2.1 Web Application:

IOT means Internet Of Things. It contains three things i.e. Application, Network, Physical. We use web application for controlling the speed of induction motor.As per the program we set five types of signal i.e.relay on,relay off,motor on,motor off and motor at medium.

By using this application we give indication to the Relay and Motor.Thus it can varied.

5.2.2 Coding

```
#include <ESP8266WiFi.h>
#include <PubSubClient.h>
const char* ssid = "TestApp";//TestApp
const char* password = "password";//password
const char* mqtt_server = "iot.eclipse.org";
//const char* mqtt_server = "broker.mqttdashboard.com";
WiFiClient espClient;
PubSubClient client(espClient);
long lastMsg = 0;
```

```
char msg[50];
int value = 0;

void setup_wifi()
{

  delay(100);
  pinMode(D2, OUTPUT); // bulb switch pin

  pinMode(D5, OUTPUT); // induction motor1 pin
  pinMode(D6, OUTPUT); // induction motor2 pin
  pinMode(D7, OUTPUT); // induction motor1 pin
  pinMode(D8, OUTPUT); // induction motor2 pin

  //digitalWrite(D5, LOW);
  //digitalWrite(D6, LOW);
  Serial.print("In setup wifi...");
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  randomSeed(micros());
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
}

void callback(char* topic, byte* payload, unsigned int length)
{
  Serial.print("Command is : [");
  Serial.println(topic);
```

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```
for (int i = 0; i < length; i++)
{
 Serial.print((char)payload[i]);
}
Serial.println();

switch (payload[0])
{
 case 'a':
    Serial.println("Bulb On!");
    digitalWrite(D2, HIGH);
  break;

 case 'b':
    Serial.println("Bulb off!");
    digitalWrite(D2,LOW);
    break;

 case 'l':
    Serial.println("Induction Low!");   /* 40% Duty Cycle*/
    digitalWrite(D5, LOW);
    digitalWrite(D6, LOW);
    digitalWrite(D7, HIGH);
    digitalWrite(D8, LOW);
  break;

 case 'm':
    Serial.println("Induction Medium!"); /* 75% Duty Cycle*/
    digitalWrite(D5, LOW);
    digitalWrite(D6, HIGH);
    digitalWrite(D7, LOW);
    digitalWrite(D8, HIGH);
  break;

 case 'h':
    Serial.println("Induction High!");
```

```
        digitalWrite(D5, HIGH);
        digitalWrite(D6, HIGH);
        digitalWrite(D7, HIGH);
        digitalWrite(D8, HIGH);
      break;01
    default:
      break;
  }
}

void reconnect()
{
  while (!client.connected())
  {
    Serial.print("Attempting MQTT connection...");
    String clientId = "ESP8266Client-";
    clientId += String(random(0xffff), HEX);
    if (client.connect(clientId.c_str()))
    {
      Serial.println("connected");

      //      client.subscribe("fan");
      client.subscribe("bulb");
    }
    else
    {
      Serial.print("failed, rc=");
      Serial.print(client.state());
      Serial.println(" try again in 5 seconds");
      delay(6000);
    }

  }
}
```

```
void setup()
{
  Serial.begin(115200);
  setup_wifi();
  client.setServer(mqtt_server, 1883);
  client.setCallback(callback);
  delay(1500);
}

void loop()
{

  if (!client.connected());
  {
    reconnect();
  }

  client.loop();
}
```

Algorithmic Steps:

Step 1: Start

Step 2: Step up input & output of controller

Step 3: Connect the Wifi with controller retry again until Wifi connect with Controller then after connection go to next step.

Step 4: Client connection with server retry again until connect with server after connection go to next step.

Step 5: Take controlling input from user.

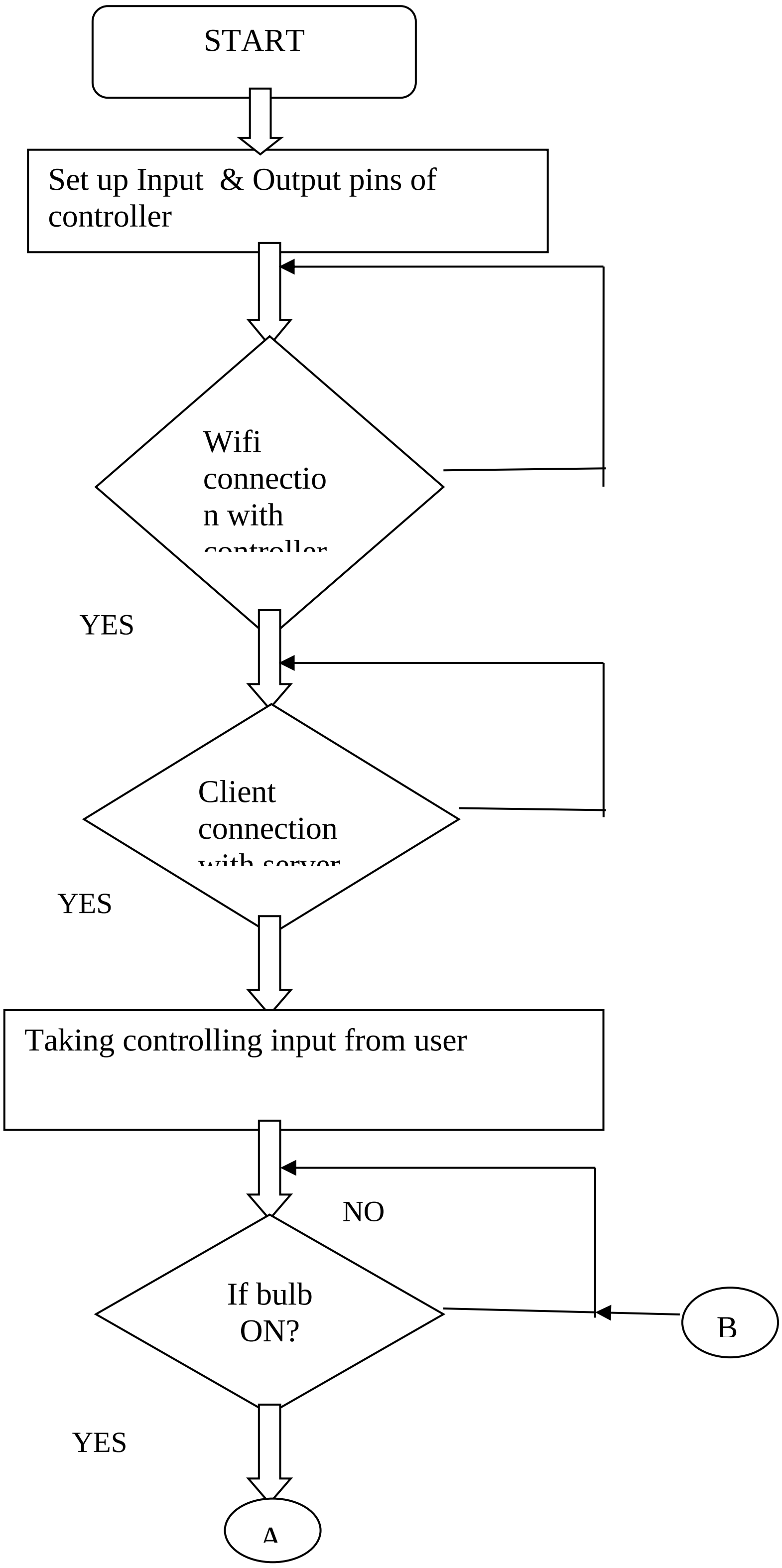
Step 6: Check the bulb connection if bulb ON go to next step otherwise go to previous step by giving output to the D2 high.

Step 7: Same as giving input to the D2 200 check the bulb if bulb is LOW go to next step otherwise go to step 6

Step 8: Giving input to the D2 0 check the bulb connection if Bulb is OFF go to next step otherwise go to step 6.

Step 9: Stop.

Flowchart:


START
Set up Input & Output pins of controller
Wifi connectio n with controller
YES
Client connection with server
YES
Taking controlling input from user
NO
If bulb ON?
B
YES
A

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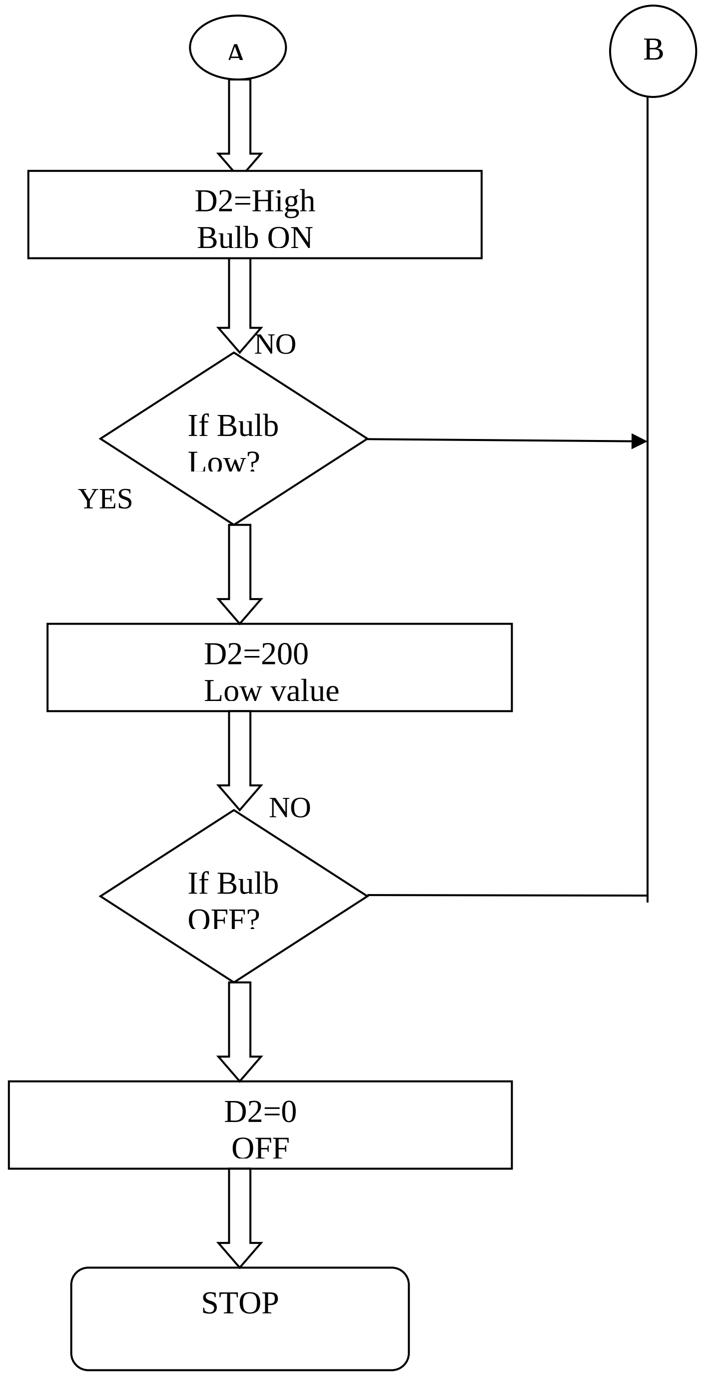

Fig 5.1: Flowchart

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CHAPTER NO.8: ADVANTAGES, DISADVANTAGES & APPLICATION

Advantages:

1) Remote operation is achieved by any smart phone or pc with android os.
2) Technically expert controller is not required.
3) Android app is an open source system to develop any programming code.
4) Programming code in not always required to change for different input parameters.

Disadvantages:

1) Android app we are using consumes more battery of users phone.
2) High complexity i.e. device and application impact**.**

Application

1.In home automation application, convinced of the remotely controlling the speed of the fan achieved

2.Many industrial application required adjustable speed and constant speed for improvement of the quality product.

3.Wood working machinery air compressor, high processor, water pump vaccum pump and high torque application.

4. motor speed regulation

5. In manufacturing industries.

6.Speed control of motor.

CHAPTER NO.9 : CONCLUSION & FUTURE SCOPE

Conclusion:

The objective of project has been achieved which has been developing the hardware and software for controlling speed of induction motor using android application. Android mobile act as a transmitter and the received by Wifi receiver interfaced to Node MCU of Aurdino family.

Future scope:

The future scope will be controlling the speed of single phase induction motor likewise that of the three phase induction motor using android application.

Many of the Industries are controlling by using this technology by adding some advance instrument

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