A Report on

Smart Pill Dispenser

For

Third Year/SEM-V/Electronics and Telecommunications

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SDG3: Good Health and Well-Being

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Abstract

This paper proposes a novel idea to provide the information automatically to patients to take their right dosages at appropriate time. Now a day, most of the patients may forget to take their medicines as per the prescription due to mental stress. Hence, it may cause prolong period to recover from the diseases. Sometimes, the aged patients are gulping tablets and their dosage level incorrectly causing a severe problem. Therefore, it is necessary to the patient to take proper medicines at precise quantity and time. To overcome these problems, a novel Smart Pill Dispenser system is proposed. This system uses Microcontroller, LCD display and Real Time Clock (RTC) module, Buzzer used to intimate the patients to take proper dosage according to the prescription at right time. This portable and economical Smart Pill Dispenser system would help aged patients, especially to the illiterate patients.

List of figures

1. Introduction

1. 1 Need

As the people getting busier these days, they tend to forget to take their medicines at prescribed schedule. As a consequence of this Geriatrics are facing unnecessary disposure of themselves into the hospitals. Hence a device or a system is to be designed in such a way that it can dispense the pills at preset time. There has been a need ever since medication was in a pill form for a device that could accurately replace a human being for the need of delivering pills. Humans can determine who to give the pill's to, when and how many and there has not been a pill dispenser to date that has had the capability to replace these three very important aspects. There are many other problems that plague the home pill user, such as someone stealing pills, forgetting to take them or having the pills available to take too many. We started with these basic needs user and came up with a solution using a microcontroller to manage the pill's dispersal and a proximity sensor to read and allow access of only a valid key to have the pill's dispensed. With this there are endless possibilities to where, how and when this pill dispenser could come to help and aid many different kind of people in their lives. With the addition of a buzzer this pill dispenser can also remind you when to take your pills, and also notify others when your pills have not been taken. Below is just the beginning of some of the basic functions an accessed controlled pill dispenser could achieve.

1. Hospitals Domestics

The automatic pill dispenser can simplify pill dispensing for hospitals with small to large capacities. With the presence of a pill dispenser, nurses and doctors can significantly reduce the amount of time for prep work and doing 'rounds,' this way more attention can be given to patients that are in greater need of medical attention. Medical professionals can also be notified by means of a simple database on whom and when dispensed.

2. Domestics

The increased use of daily vitamins and dietary supplements that need to be taken before or after meals can also become a great area of interest for the use of an automatic pill dispenser. An individual keychain key can initiate the pill dispensing for the user's personal diet regime and buzzer can remind them when the supplements need to be taken. This pill dispenser can also control the access to pills that can be sensitive for young children and teenagers, they are locked and only can be retrieved by the person who has the key on their keychain, and only when the right time of day is of a home is just the beginning of some of the basic functions an accessed controlled pill dispenser could achieve.

3. Elderly

Caring of the aged is of an important and serious concern in the developing nation. Family members are responsible for the care and management of the old. In the present situation of the society it is impossible and yet difficult for family members to be available and assist the elderly population all the time. As they would prefer to be independent and their desire for independence is quite natural. Although, the aged fail and are unable to remember to the intake of medicines on time. - The smart medicine dispenser is such a device prototyped to help the elderly to consume medicines in time and efficiently also. Since the expenses of in-home medical care and practice rises, the availability of such device in every home is difficult and it has become more difficult among individuals to opt for a dispenser that effectively monitors their health.

1.2 Definition:

Smart Pill Dispenser will remaind the user by sounding buzzer when to take their medication and it dispenses the medication dose at specific time dusring the day.

The project aims at the design and construction of an Assistive technology that helps in assisting the user for medicine intake time to time without any miss-dosage and skipped dosage.

2. Review of Literature

2.1 S. Mukund, N.K. Srinath[1]: In this Paper the caretaker pre-programs the AMD daily that allows it to set up to 21 medications doses through an ergonomically designed interface, utilizing an alphanumeric keypad and LCD display.. An alarm is provided to load the medicine if the number of pills/capsules falls below a threshold value that can be fixed by the owner. The dispenser can be programmed for 31 days for 21 different medicines. It has the facility to send alarms four times a day. It is possible programmable to dynamically change the number of times and the number of pills to be picked as per requirement. The drawback includes to set the timing on daily basis.

2.2 Mrityunjaya. H, Kartik. U, Teja. B, Kotresh.H [2]:]: In this Paper we switch on device, current time-date is stored in RTC is displayed on LCD. Device asks the user to set the alarm timings. As speaker module connected to the ARM7.The playback voice should be initially recorded in it through microphone in it. The alarm time is compared to the current time by the microcontroller and when they match, Interrupt is generated. Then the LED on the pillbox glows and voice playback is also generated indicating which pill should be taken. Automatic Pill Dispenser reminds people to take medicines regularly and also which medicine to take. Also the implementation is simple and quite small. The drawback includes setting time manually and store the pills daily.

2.3 Hsiu-Ling Tsai, Chun Hsiang Tseng, Long-Cian Wang, Fuh-Shyang Juang , Chung Hwa , Jente, Tainan , Huwei, Yunlin[3]: In this Paper A smart pill box (SPB) for the elderly and nursing homes meets the needs of the market by integrating electronic technology and network functionality. This study uses the Webduino module installed in SPB to achieve two-way messaging with remote relatives via internet of thing (IoT). The module first reads the sensing signal in the kit and uses WiFi to transmit the signal to WiFi Router, and then sends the medication information to a remote webpage or cell phone for monitoring (on LCD). After receiving the signal, Webduino will send it to Arduino for text display and voice playback in the SPB. Therefore, the elderly staying in their home or nursing home institution can easily manage their medication via

this application. The smart interactive pill box will be crucial for medical care management for elder persons of this aging population or in the future.

2.4 Nijiya Jabin Najeeb , Aysha Rimna , Safa KP , Silvana M , Mr. Adarsh TK [4]: In this Paper Central to most aspects of medicine from primary care to specialized treatments, prescription drugs have become a major component of health systems worldwide. Owing to their psychoactive effects, these drugs are often taken in ways not in- tended by the doctor or by someone other than the person for whom it had been prescribed. Patients often forget to take their prescribed medications or consume it out of the schedule recommended by the doctor. .Our goal for this project is to build a system around prescription drugs that helps authenticate a patient's access of such medication based on their identity and prescribed schedule, and also facilitates the pharmacist or doctor to monitor this consumption.

3. Problem Statement

3.1 Problem Statement:

Currently two types of pill dispensers available in market viz. Non- electric and electric ones. Although the majority of them have a reminder mechanism (not always suitable for people with visual or sensory impairments), both types normally require a person who organizes the pills daily or weekly in different compartments, making the patient a dependent person. Nowadays due to Covid-19, family members or assistants to the elderly have more difficulties taking care of dependent persons. That is why we saw the necessity to create a smart pill dispenser which doesn't need a handmade pill organization, accessible to disabled people, and has the capacity to help the patients be more independent.

4. Project design

4.1Block Diagram of proposed project

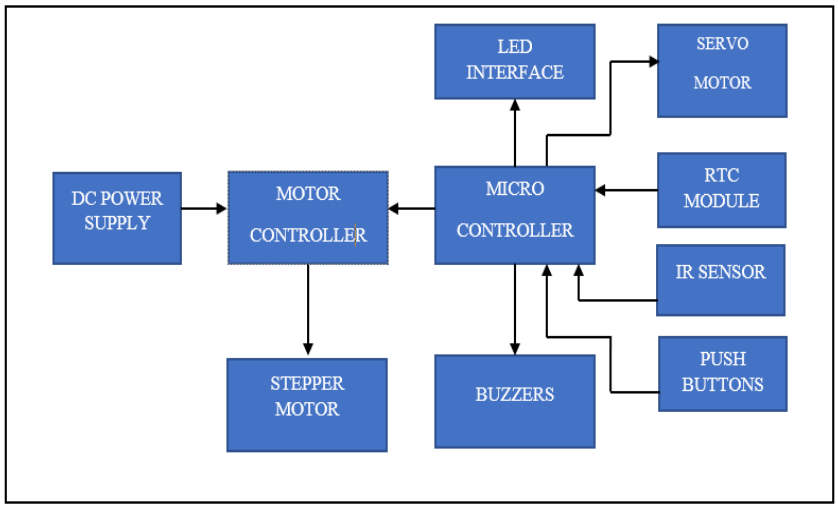


Fig 4.1 Block Diagram

4.2 Working of proposed project

The block diagram of the Smart Pill Dispenser is shown in Figure 3.3. The automatic pill dispenser will consist of a circular base with 30 fan-like blades that rotate about the central axis. The blades will form the compartments where pills can be manually placed for dispensing at predetermined times. The dispenser will be controlled by a microcontroller that interfaces with an LCD display. The LCD screen is placed on the outside of the pill dispenser to let the user know how many pills they must take.

A Infrared Sensor is used to signal the opening and closing of the door (via servo motor). When the pills are ready for the user and the buzzer is sounding, the user will come to the dispenser and place their finger over the IR sensor. When the IR sensor detects thermal radiations of the user hand's then it will go in working condition and it will give command to servo motor to open and close the door. So once the user has taken their medication, they may place their hand over the sensor once more to close the door and reset the program.

The project will be realized with the development of a compact, pill-dispensing unit that can be placed on a table or countertop.

5. Components to be used

5.1 Components to be used

5.1.1 Stepper Motor

The stepper motor is a four phase, unipolar, permanent magnet stepper motor. It is a standard size, 200-steps-per-revolution, NEMA 17 (1.7 in. square footprint, 5 mm shaft diameter), 12 V motor. This motor, like most stepper motors is a permanent magnet motor. The Mosaic stepper is typical of common high resolution motors – a full revolution requires 200 steps, while each step turns the shaft only 1.8° for a full step, or 0.9° in half-stepping mode. In our project we used a 5V brushless unipolar DC stepper motor to ensure the tray only rotates 25.7 degrees each turn, as there are 14 compartments.

Fig 5.1.1 Stepper Motor

5.1.2 Servo Motor

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation : 0°-180°
- Weight of motor : 9gm
- Package includes gear horns and screws

A servomotor attached to a 4 bar linkage is used to open and close the door, through which the user collects their medication. The motor was set to rotate 90 degrees, allowing a suitable range of motion for the door.

Fig 5.1.2 Servo Motor

5.1.3 Motor Controller

- ULN2003A motor driver chip.
- Chip all the pins already leads for easy connection to use.
- 5-12V power supply.
- 4-way signal indicator.
- Step angle: 5.625 x 1 / 64.
- Reduction ratio: 1 / 64.
- Phase: 4.
- Current / Phase: 5V.

Fig 5.1.3 Motor Controller

5.1.4 Serial LCD 20X4

- Character LCD 20x4
- 5x8 dots includes cursor
- Bulit-in controller (RW1063 or Equivalent)
- +5V power supply (Also available for +3V)
- Negative voltage optional for +3V power supply
- 1/16 duty cycle
- LED can be driven by PIN1, PIN2, PIN15, PIN16 or A and K
- Interface : WH2004G - 6800, WH2004G1 - SPI, WH2004G2 - I2C

Fig 5.1.4 Serial LCD 20X4

5.1.5 RTC Module DS3231

At the heart of the module is a low-cost, extremely accurate RTC chip from Maxim – DS3231. It manages all timekeeping functions and features a simple two-wire I2C interface which can be easily interfaced with any microcontroller of your choice.

In our project it is used to show the date and time of medication.

Fig 5.1.5 RTC Module DS3231

5.1.6 IR Sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems.

Fig 5.1.6 IR Sensor

5.1.7 Piezoelectric Buzzer

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

Fig 5.1.7 Piezoelectric Buzzer

5.1.8 Push Buttons

Push-button switches work on simple electric mechanism to activate or deactivate machinery. A push-button can push-to-make or push-to break (SPST Momentary Switch), where it makes or breaks contact with an electronic system.

Fig 5.1.8 Push Buttons

5.1.9 Microcontroller

5.1.10 LED

5.1.11 5V Adapter

6. Proposed execution steps

1. LCD shows current time with date, also it will show medicine alarm time.
2. When medicine time happened, Buzzer and LED turned ON.
3. User will keep hand on the IR sensor.
4. Servo motor starts working and door will open.
5. Then stepper motor starts working and compartment will starts moving in the particular angle.
6. So particular dose of medicines will dispense through that compartment in the cup which is place inside the door.
7. User will collect the dose of medicines and again keep hand on sensor, then again door will get closed.
8. Same steps involved for the next medicine doses time.

7. Implementation

7.1Hardware

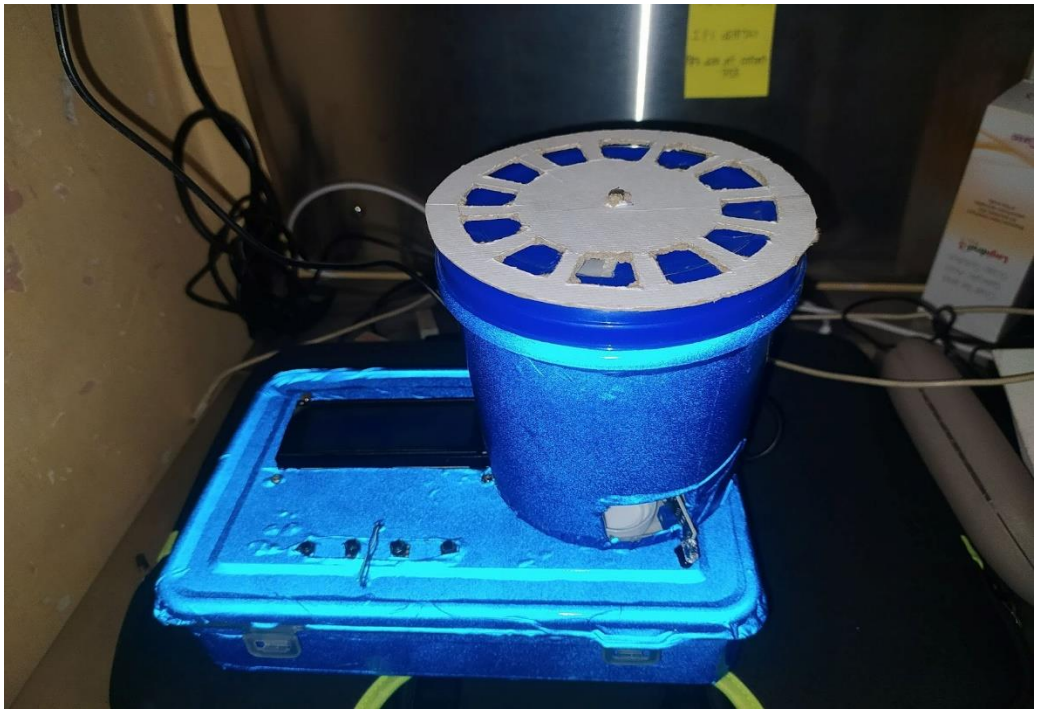


Fig 7.1(a) Setup

7.2Software (Flowchart/Algorithms)

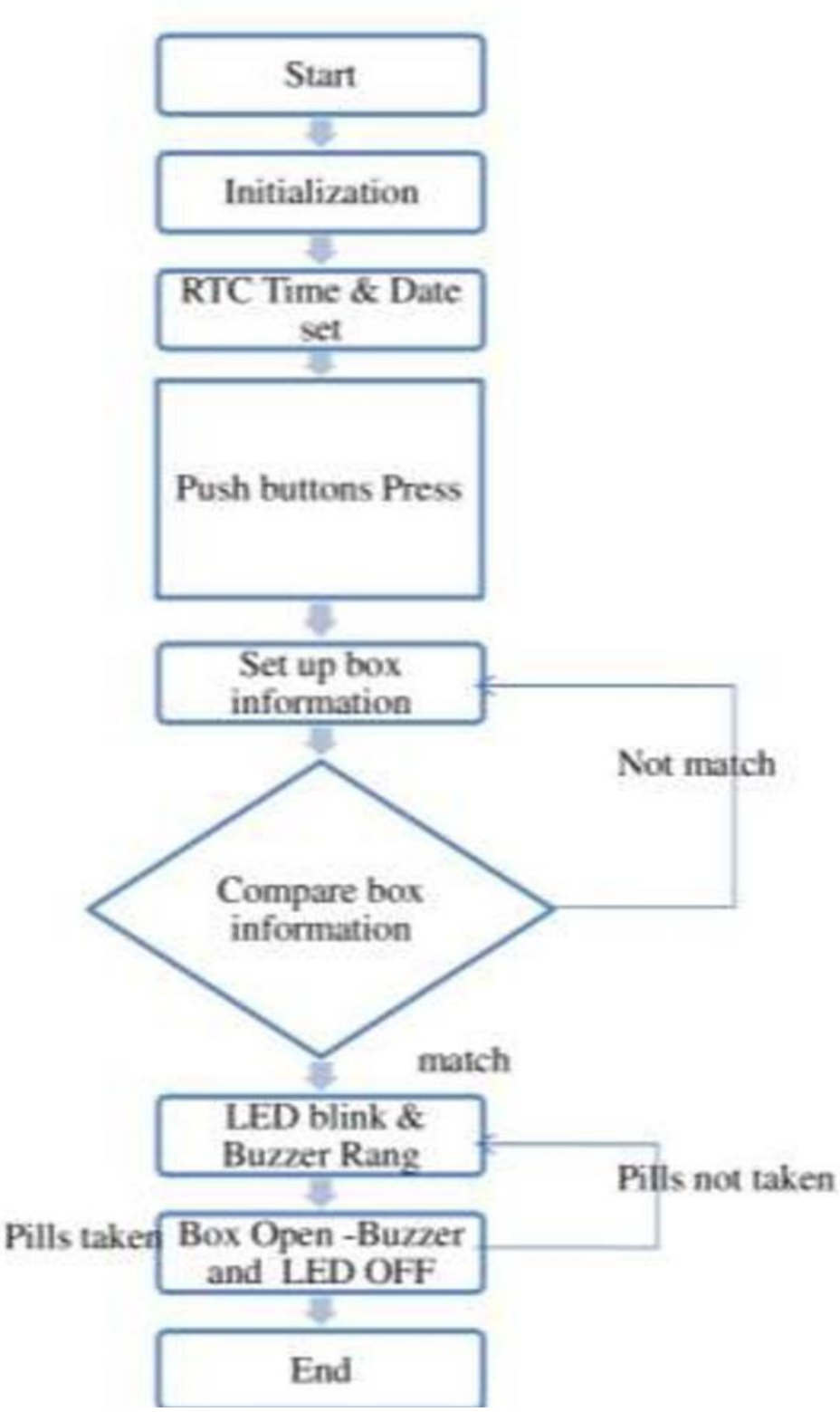


Fig 7.2 Flowchart

8. Results

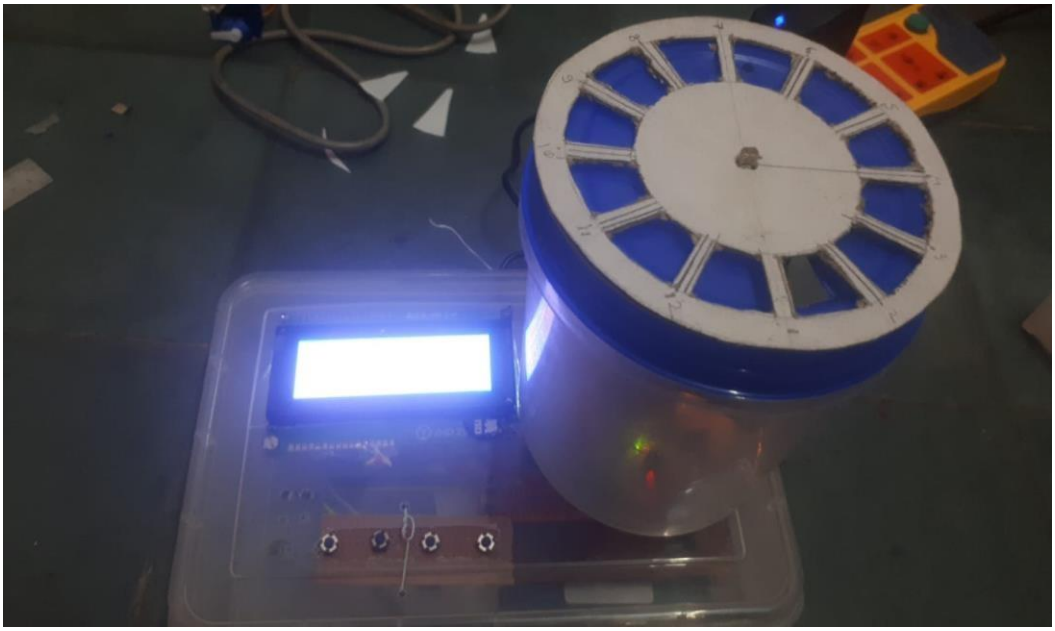


Fig 8.1(a) Result

Fig 8.2(b) Result

We have successfully implemented a smart pill dispenser. It consists of a circular base with fan-like blades that rotate around the axis. The dispenser is controlled by microcontroller that interfaces with LCD. With the help of the RTC module and push buttons, we set the time as per our requirement of pills. When the pills are ready to dispense the buzzer will sound and the user has to come to the dispenser and place their finger over the IR sensor. Once the user has taken the medicines they have to again place their hand over the IR sensor to close the door.

References

[1] R. L. Ownby, “Medication adherence and cognition: medical, personal and economic factors influence level of adherence in older adults,” Geriatrics, vol. 61, no. 2, pp. 30–35, 2017.

[2] S. F. Laster, J. L. Martin, and J. B. Fleming, “The effect of a medication alarm device on patient compliance with topical pilocarpine,” Journal of the American Optometric Association, vol. 67, no. 11, pp. 654–658, 2017.

[3] S. Mukund and N.K. Srinath, ”Design of Automatic Medication Dispenser” , International Conference of Advanced Computer Science & Information Technology, Karol Bagh, New Delhi, Dec. 2016, pp. 127–133.

[4] Mrityunjaya. H, Kartik. U, Teja. B and Kotresh.H , ”Automatic Pill Dispenser ”, International Journal Of Advanced Research in Computer and Communication Engineering, vol. 52, no. 22, pp. 47–54, 2016.

[5] Naga Udayini Nyapathi, Bhargavi Pendlimarri, Karishma Sk, Kavya Ch, “Smart Medicine Box using ARM7 Microcontroller” International Research Journal of Engineering and Technology (IRJET), vol. 38, no. 9, pp. 14–28, 2016.

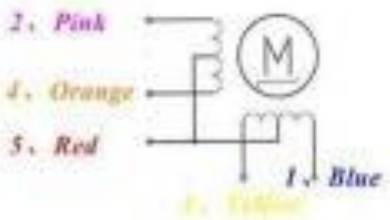
Datasheet

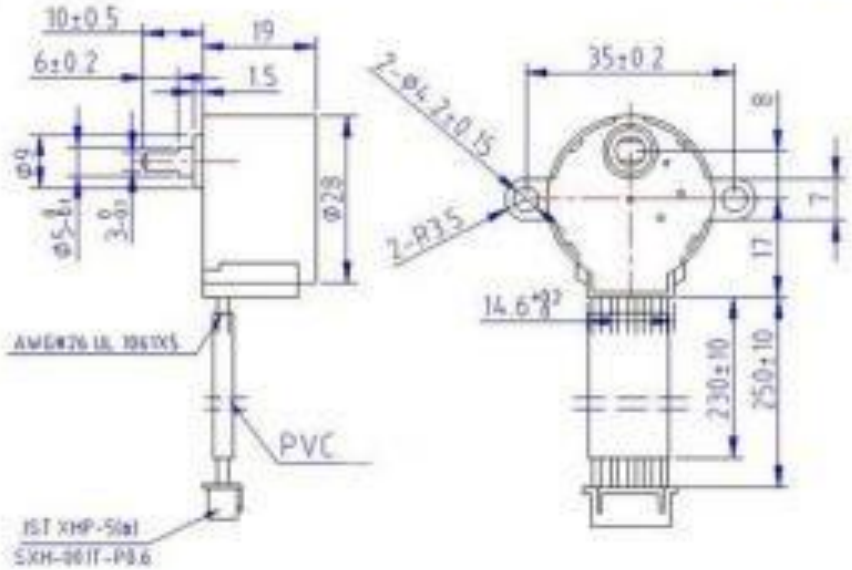
Stepper Motor 28BYJ-48 5V:

28BYJ-48 – 5V Stepper Motor

The 28BYJ-48 is a small stepper motor suitable for a large range of applications.

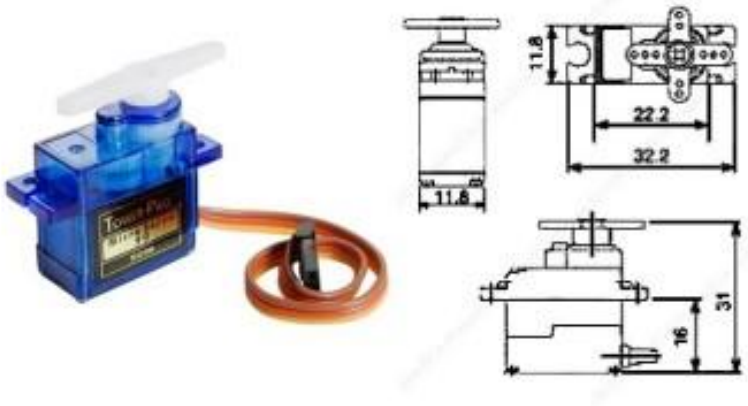
Rated voltage	5VDC
Number of Phase	4
Speed Variation Ratio	1/64
Stride Angle	5.625°/64
Frequency	100Hz
DC resistance	50Ω±7%(25°C)
Idle In-traction Frequency	> 600Hz
Idle Out-traction Frequency	> 1000Hz
In-traction Torque	>34.3mN.m(120Hz)
Self-positioning Torque	>34.3mN.m
Friction torque	600-1200 gf.cm
Pull in torque	300 gf.cm
Insulated resistance	>10MΩ(500V)
Insulated electricity power	600VAC/1mA/1s
Insulation grade	A
Rise in Temperature	<40K(120Hz)
Noise	<35dB(120Hz,No load,10cm)
Model	28BYJ-48 – 5V





Servo Motor SG-90:

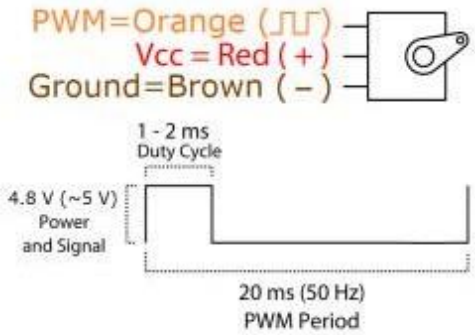
SG90 9 g Micro Servo



Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but *smaller*. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.

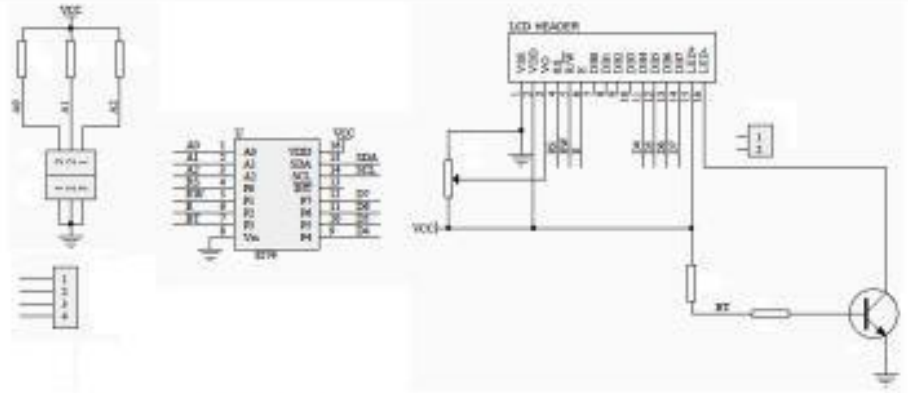
Specifications

- Weight: 9 g
- Dimension: 22.2 x 11.8 x 31 mm approx.
- Stall torque: 1.8 kgf·cm
- Operating speed: 0.1 s/60 degree
- Operating voltage: 4.8 V (~5V)
- Dead band width: 10 µs
- Temperature range: 0 °C – 55 °C



Position "0" (1.5 ms pulse) is middle, "90" (~2 ms pulse) is all the way to the right, "-90" (~1 ms pulse) is all the way to the left.

20*4 LCD:

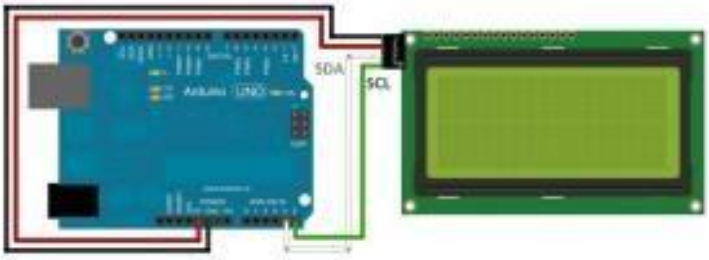


Reference circuit diagram of the I2C-to-LCD piggy-back board.

I2C LCD Display.

At first you need to solder the I2C-to-LCD piggy-back board to the 16-pins LCD module. Ensure that the I2C-to-LCD piggy-back board pins are straight and fit in the LCD module, then solder in the first pin while keeping the I2C-to-LCD piggy-back board in the same plane with the LCD module. Once you have finished the soldering work, get four jumper wires and connect the LCD module to your Arduino as per the instruction given below.

LCD display to Arduino wiring.



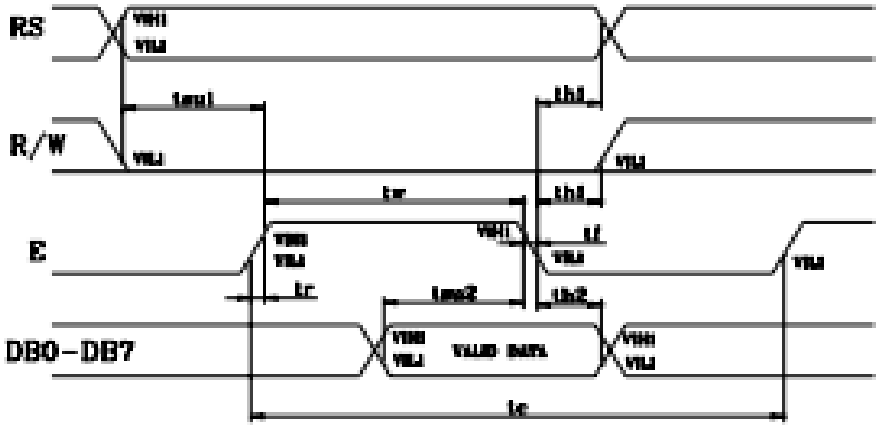
GDM2004D-FL-YBW

"L" level output voltage	V_{OL}	LOH=1.6mA	-	-	0.4	
Backlight supply current	I_F	V_{DD}=5.0V,R=6.8Ω	-	240	-	

Write cycle (Ta=25℃, VDD=5.0V)

Parameter	Symbol	Test pin	Min.	Typ.	Max.	Unit
Enable cycle time	t_c	E	500	-	-	ns
Enable pulse width	t_w		230	-	-	
Enable rise/fall time	t_r, t_f		-	-	20	
RS; R/W setup time	t_{su1}	RS; R/W	40	-	-	
RS; R/W address hold time	t_{h1}		10	-	-	
Data output delay	t_{su2}	DB0–DB7	80	-	-	
Data hold time	t_{h2}		10	-	-	

Write mode timing diagram



Read cycle (Ta=25℃, VDD=5.0V)

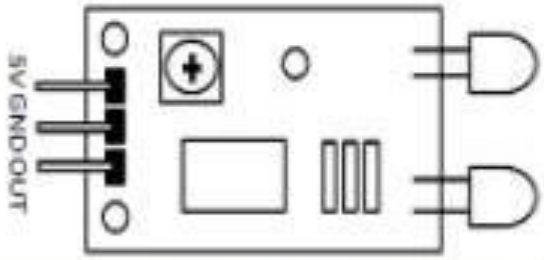
Parameter	Symbol	Test pin	Min.	Typ.	Max.	Unit
Enable cycle time	t_c	E	500	-	-	ns
Enable pulse width	t_w		230	-	-	
Enable rise/fall time	t_r, t_f		-	-	20	
RS; R/W setup time	t_{su}	RS; R/W	40	-	-	
RS; R/W address hold time	t_h		10	-	-	
Data output delay	t_d	DB0–DB7	-	-	120	
Data hold time	t_{dh}		5	-	-	

IR Sensor Module:

IR Sensor Module

30 August 2020 | 0 Comments

IR Sensor/Obstacle Sensor Module



IR Sensor Module Pinout

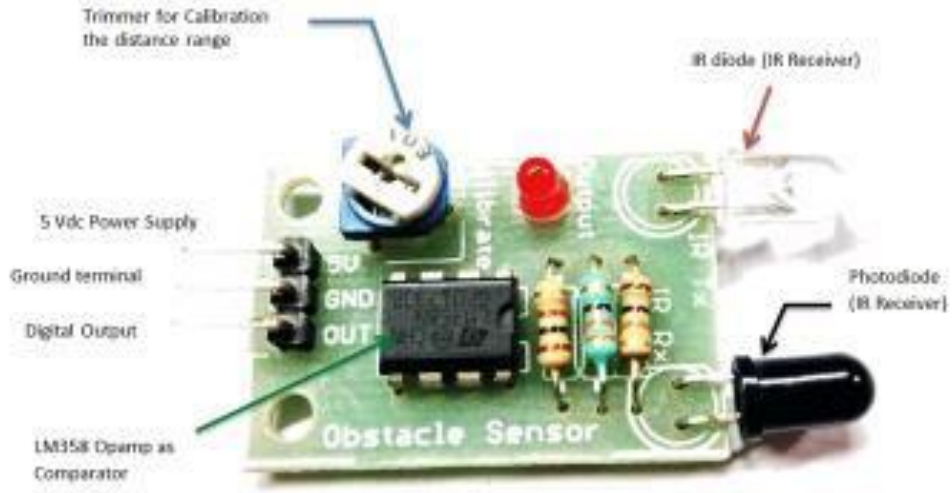
IR Sensor Module Pinout Configuration

Pin Name	Description
VCC	Power Supply Input
GND	Power Supply Ground
OUT	Active High Output

IR Sensor Module Features

- 5VDC Operating voltage
- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable Sensing range
- Built-in Ambient Light Sensor
- 20mA supply current
- Mounting hole

Brief about IR Sensor Module



The IR sensor module consists mainly of the IR Transmitter and Receiver, Op-amp, Variable Resistor (Trimmer pot), output LED along with few resistors.

IR LED Transmitter

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimeters to several feets, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers. IR LED white or transparent in colour, so it can give out amount of maximum light.

Photodiode Receiver

Photodiode acts as the IR receiver as its conducts when light falls on it. Photodiode is a semiconductor which has a P-N junction, operated in Reverse Bias, means it start conducting the current in reverse direction when Light falls on it, and the amount of current flow is proportional to the amount of Light. This property makes it useful for IR detection. Photodiode looks like a LED, with a black colour coating on its outer side. Black colour absorbs the highest amount of light.

LM358 Opamp

LM358 is an Operational Amplifier (Op-Amp) is used as voltage comparator in the IR sensor. the comparator will compare the threshold voltage set using the preset (pin2) and the photodiode's series resistor voltage (pin3).

Photodiode's series resistor voltage drop > Threshold voltage = Opamp output is High

Photodiode's series resistor voltage drop < Threshold voltage = Opamp output is Low

When Opamp's output is **high** the LED at the Opamp output terminal **turns ON** (Indicating the detection of Object).

Variable Resistor

The variable resistor used here is a preset. It is used to calibrate the distance range at which object should be detected

RTC Module DS3231:

DS3231

Extremely Accurate I²C-Integrated RTC/TCXO/Crystal

General Description

The DS3231 is a low-cost, extremely accurate I²C real-time clock (RTC) with an integrated temperature-compensated crystal oscillator (TCXO) and crystal. The device incorporates a battery input, and maintains accurate timekeeping when main power to the device is interrupted. The integration of the crystal resonator enhances the long-term accuracy of the device as well as reduces the piece-part count in a manufacturing line. The DS3231 is available in commercial and industrial temperature ranges, and is offered in a 16-pin, 300-mil SO package.

The RTC maintains seconds, minutes, hours, day, date, month, and year information. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with an AM/PM indicator. Two programmable time-of-day alarms and a programmable square-wave output are provided. Address and data are transferred serially through an I²C bidirectional bus.

A precision temperature-compensated voltage reference and comparator circuit monitors the status of V_{CC} to detect power failures, to provide a reset output, and to automatically switch to the backup supply when necessary. Additionally, the RST pin is monitored as a pushbutton input for generating a µP reset.

Benefits and Features

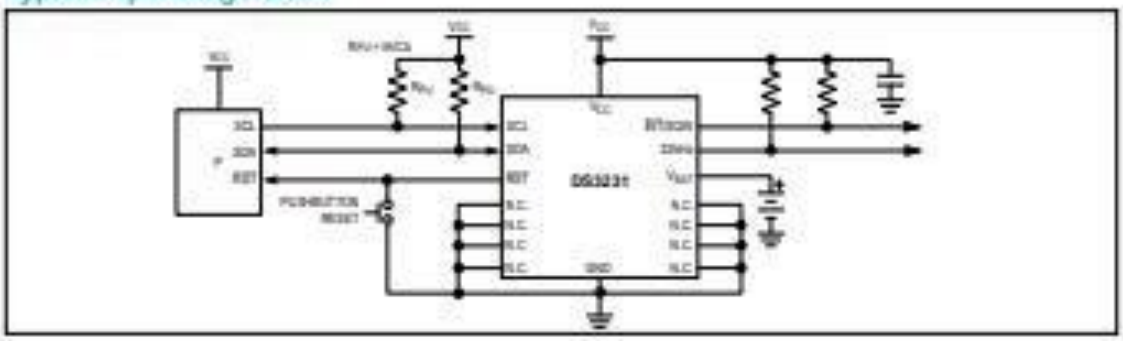
- Highly Accurate RTC Completely Manages All Timekeeping Functions
  - Real-Time Clock Counts Seconds, Minutes, Hours, Date of the Month, Month, Day of the Week, and Year, with Leap-Year Compensation Valid Up to 2100
  - Accuracy ±2ppm from 0°C to +40°C
  - Accuracy ±3.5ppm from -40°C to +85°C
  - Digital Temp Sensor Output: ±3°C Accuracy
  - Register for Aging Trim
  - RST Output/Pushbutton Reset Debounce Input
  - Two Time-of-Day Alarms
  - Programmable Square-Wave Output Signal
- Simple Serial Interface Connects to Most Microcontrollers
  - Fast (400kHz) I²C Interface
- Battery-Backup Input for Continuous Timekeeping
  - Low Power Operation Extends Battery-Backup Run Time
  - 3.3V Operation
- Operating Temperature Ranges: Commercial (0°C to +70°C) and Industrial (-40°C to +85°C)
- Underwriters Laboratories® (UL) Recognized

Applications

- Servers
- Telematics
- Utility Power Meters
- GPS

Ordering Information and Pin Configuration appear at end of data sheet.

Typical Operating Circuit



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Absolute Maximum Ratings

Voltage Range on Any Pin Relative to Ground.....-0.3V to +6.0V
Junction-to-Ambient Thermal Resistance (θ_{JA}) (Note 1)73°C/W
Junction-to-Case Thermal Resistance (θ_{JC}) (Note 1)....23°C/W
Operating Temperature Range
DS3231S .....0°C to +70°C
DS3231SN.....-40°C to +85°C
Junction Temperature.....+125°C
Storage Temperature Range.....-40°C to +85°C
Lead Temperature (soldering, 10s).....+260°C
Soldering Temperature (reflow, 2 times max).....+260°C
(see the *Handling, PCB Layout, and Assembly* section)

Note 1: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to www.maximintegrated.com/thermal-tutorial.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

(T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{CC}		2.3	3.3	5.5	V
	V_{BAT}		2.3	3.0	5.5	V
Logic 1 Input SDA, SCL	V_{IH}		0.7 x V_{CC}		V_{CC} + 0.3	V
Logic 0 Input SDA, SCL	V_{IL}		-0.3		0.3 x V_{CC}	V

Electrical Characteristics

(V_{CC} = 2.3V to 5.5V, V_{CC} = Active Supply (see Table 1), T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Typical values are at V_{CC} = 3.3V, V_{BAT} = 3.0V, and T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Active Supply Current	I_{CCA}	(Notes 4, 5)	V_{CC} = 3.63V			200	µA
			V_{CC} = 5.5V			300	
Standby Supply Current	I_{CCS}	I²C bus inactive, 32kHz output on, SQW output off (Note 5)	V_{CC} = 3.63V			110	µA
			V_{CC} = 5.5V			170	
Temperature Conversion Current	$I_{CCSCONV}$	I²C bus inactive, 32kHz output on, SQW output off	V_{CC} = 3.63V			575	µA
			V_{CC} = 5.5V			650	
Power-Fail Voltage	V_{PF}			2.45	2.575	2.70	V
Logic 0 Output, 32kHz, INT/SQW, SDA	V_{OL}	I_{OL} = 3mA				0.4	V
Logic 0 Output, RST	V_{OL}	I_{OL} = 1mA				0.4	V
Output Leakage Current 32kHz, INT/SQW, SDA	I_{LO}	Output high impedance		-1	0	+1	µA
Input Leakage SCL	I_{LI}			-1		+1	µA
RST Pin I/O Leakage	I_{OL}	RST high impedance (Note 6)		-200		+10	µA
V_{BAT} Leakage Current (V_{CC} Active)	I_{BATLKG}				25	100	nA

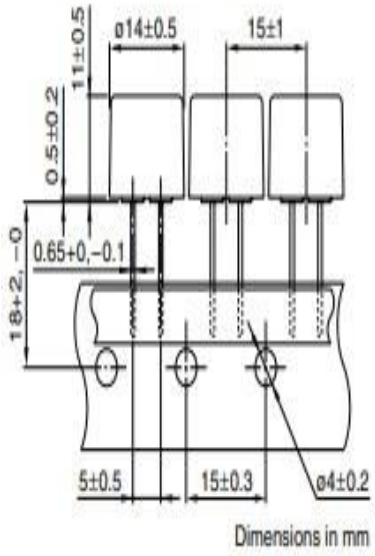
Piezo Electric Buzzer:

PS1420P02CT

FEATURES

- Low frequency tone(2kHz).
- Suitable for automatic radial taping machine(15mm-pitch).

SHAPES AND DIMENSIONS

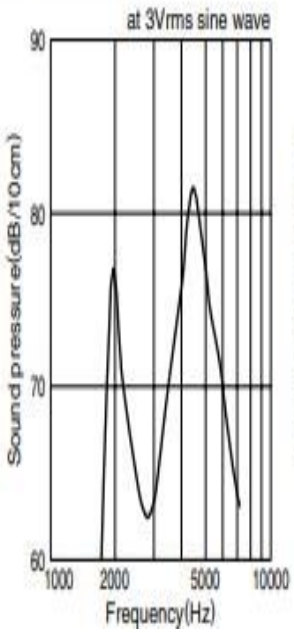


SPECIFICATIONS AND CHARACTERISTICS

Sound pressure	70dBA/ 10cm min.	[at 2kHz, 5V$_{0\text{-}P}$ rectangular wave, measuring temperature: 25±5°C, humidity: 60±10%]
Operating temperature range	−10 to +70°C	
Storage conditions	+5 to +40°C, 20 to 70%RH, please use within 6 months	
Maximum input voltage	30V$_{0\text{-}P}$ max.	[without DC bias]
Minimum delivery unit	1750 pieces	[350 pieces/1 reel×5 reels]

FREQUENCY SOUND PRESSURE CHARACTERISTICS

SINE WAVE DRIVE



SQUARE WAVE DRIVE