Title:

Smart box pre-payment for taxi cars

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Dedication (Arabic)

يا من احمل اسمك بكل فخر يا من افتقدتك منذ الصغر يا من يرتعش قلبي لذكرك يا من أودعتني لله أهديك هذا البحث **(ابي الغالي)**

إلى كل من في الوجود بعد الله ورسوله **(أمي الغالية)**

إلى سندي وقوتي وملاذي بعد الله, إلى من آثروني على نفسهم, إلى من علموني علم الحياة,

إلى من أظهروا لي ما هو أجمل من الحياة **(اخوتي)**

إلى من كانوا ملاذي وملجئي إلى من تذوقت معهم أجمل اللحظات إلى من سأفتقدهم وأتمنى أن يفتقدوني
إلى من جعلهم الله أخوتي بالله ..... و من أحببتهم بالله **(أصدقائي الاعزاء)**

إلى الذين أجدهم معي في السراء والضراء ..... **(أقاربي الأعزاء)**

إلى أولئك الذين يحملون على كاهلهم بناء جيل المستقبل**....(أساتذتنا الكرام)**.

Acknowledgment (Arabic)

لا بد لنا ونحن نخطو خطواتنا الأخيرة في الحياة الجامعية من وقفة نعود إلى أعوام قضيناها في رحاب الجامعة مع أساتذتنا الكرام الذين قدموا لنا الكثير باذلين بذلك جهودا كبيرة في بناء جيل الغد لتبعث الأمة من جديد

إلى الذين مهدوا لنا وقبل أن نمضي تقدم أسمى آيات الشكر والامتنان والتقدير والمحبة إلى الذين حملوا أقدس رسالة في الحياة طريق العلم والمعرفة

إلى جميع أساتذتنا الأفاضل

وأخص بالتقدير والشكر للدكتور زهدي سلهب:

الذي نقول له بشراك قول رسول الله صلى الله عليه وسلم

"إن الحوت في البحر ، والطير في السماء ، ليصلون على معلم الناس الخير"

إلى من زرعوا التفاؤل في دربنا وقدموا لنا المساعدات والتسهيلات والمعلومات طوال حياتنا الجامعية إلى جميع زملائي ، ربما دون أن يشعروا بدورهم بذلك فلهم منا كل الشكر، وأخص منهم

الزميل محمد مؤمن جواعده

والى الزميل محمد عمايره

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Abstract

Smart box pre-payment for taxicabs:

After examining the problem of payment to the driver in taxis the 4 or 7 passengers whether in the city or in between cities, we found out that this causes frequent accidents and problems between the driver and the passengers. Thus, we are design a device that enables the passenger to pay without disturbing the driver, The passenger pays to the machine and the device reads the amount paid, and returns the balance to the passenger. Further, There is an application on the driver's mobile device in order to show that all passengers have paid. This screen also provides the number of the passengers during the day.

-

-جهاز الدفع المسبق لسيارات التاكسي 4 او 7 ركاب :

بعد النظر الى مشكله الدفع للسائق في سيارات التاكسي 4 او 7 ركاب سواء داخل المدن او بين المدن التي أدت الى حدوث حوادث كثيره والى مشاكل بين السائق والراكب سيتم العمل على جهاز يقوم الراكب من الدفع من خلاله دون ازعاج السائق بحيث يدفع الراكب داخل الجهاز والجهاز يقرأ قيمة المبلغ الواجب دفعه ويعمل على ارجاع المبلغ الزائد الى الراكب ويوجد مع الجهاز تطبيق على الهاتف المحمول لدى السائق لكي يتعرف السائق انه تم الدفع من جميع الركاب ولكي يتعرف أيضا على عدد الراكبين خلال اليوم الواحد .

CHAPTER 1

Introduction

1.1. Background

Device used by passengers to pre-payment in the taxi without interference from the driver and also facilitates the device on the driver to focus in driving and facilitate the passengers also pay through a new system easy to deal with easily. the device pull the money, either metal or paper and take the amount required according to the area and return the rest of the money through the outlet at the end of the device so that the device knows the limits of areas amount to be paid with the possibility of programming the device on any road map, and there is an application on the driver's mobile device can know that all passengers pay the necessary money and also the number of passengers inside the vehicle and also find out the number of passengers total in one day, making it easier for the driver to know the amount he received throughout the day.

1.2. Project Motivation

The reason motivate this work came by studying the car accidents that caused by paying to the drivers of taxis by the passengers, since most of the accidents in the taxi cars relate to this reason, and other reasons are the difficulty of the driver to return the rest of the money to the passenger sometimes, moreover to insure that all passengers pay money.

After showing the idea of the project to many drivers through a questionnaire, they report that they will support such idea and trying it.

The project was presented to the transport and communication departments. The response was positive with support and forcing the drivers to have such device in all transposition cars after success to Impairment and testing the device.

1.3 .Project Objectives

1. Reducing the percentage of accidents in taxis due to the lack of concentration of the driver when returning money and return to passengers.

2. Through the box, the number of people who have been transferred all day through an electronic counter is known.

3. Through the box, the drivers identify the number of passengers who paid the money through an electronic screen at the driver.

4. The solution of the problem returned the rest of the money that was made by the driver where the problem was solved through the box.

5. In order to achieve the previous goals it is necessary to work on the design commensurate with the size of the vehicle and easy to deal with it by passengers.

1.4. Project methodology

We want to design a device to receive coins and cash paper so that it contains two inputs; where there is a sensor inside the device reads the money So that the device takes the necessary amount of money and there is one exit at the end of the device to return the rest of the money so that all cash will be defined (0.5.1.5.10.20.50.100.200)NIS The device has a display for passengers, through which the passenger determines the area to be accessed and recognizes the device on the selected area and determine the price, because each country has a taxi price different from the other, with the possibility of programming the device in any road map. There is also a place where the passenger receives an invoice after payment. And there is an application on the driver's mobile device to be able to know

that all passengers pay money inside the device and can also know the amount received during the day by a sensor(GP2A22 light sensor) inside the device that collects the full money and display on the screen.

1.5. Expected budget:

After identifying the design and all its external and internal components, which includes sensors, electronic devices and electronic displays, and inquire about the cost of these components, the cost was 500 $.

Note: the cost such a system handling with coins and money paper is very high and it takes time to get it.

The expected budget that will use in the project is shown in table.

Table 1.1: budget.

equipment's	**Cost ($)**
The system of differentiation coins	**500$**
The system of differentiation Money the paper	**1000$**
Display Screen	**150$**
Electronic parts and wires	**50$**

1.6.Time table for the first semester

The time table during the first semester as shown in Table 1.2.

Table 1.2 . Time Table for the first semester.

Number of weeks / Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Selecting idea																
literature review																
Proposed design																
Writing report																
Make presentation																

1.7. Time table for the second semester

The time table during the second semester as shown in table 1.3.

Table 1.3.. Time Table for the second semester

Number of weeks task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Modifying the project idea.																
project requirement and collecting data																
Modeling																
Design of a mechanical component																
Testing and experimental result																

1.8. Questionnaire

This questionnaire was presented to a number of taxi drivers in different area of work and the results were good and positive.

نحن طلاب جامعة بوليتكنيك فلسطين من الهندسة الميكانيكية- هندسة سيارات, نرجو من حضرتكم تعبئة استبيان حول وجود جهاز للدفع المسبق في سيارات التاكسي 4-7 ركاب .

1- هل تعاني من اخذ الاجار اثناء قياده المركبة	نعم	لا
2- هل تعاني من وجود باقي النقود داخل المركبة (ترجيع الباقي)؟	نعم	لا
3- هل حصل لك ان تأخذ نقود غير قانونيه دون معرفه (مزيفة)؟	نعم	لا
4- هل تعاني من احصاء النقود وعدد الركاب الذين قد قمت بنقلهم ؟	نعم	لا
5- هل حصل لك ان يقوم الراكب بالنزول من المركبة دون دفع الاجار؟	نعم	لا
6- هل حصل انك عملت حادث اثناء دفع الركاب الاجار او ادركت الحادث بلحظات الأخيرة من هذا السبب؟	نعم	لا

7- ما هو رايك في تركيب جهاز يقوم الركاب بالدفع من خلاله	موافق	موافق بشده	لا أوافق
8- ما هو رايك بان يقوم الجهاز بإحصاء جميع النقود التي قمت بأخذها من الركاب	موافق	موافق بشده	لا أوافق

9- ما هو رايك بان يقوم الجهاز بمعرفه عدد الركاب الذي قمت بنقلهم طوال اليوم	موافق	موافق بشده	لا أوافق
10- ما هو رايك بان يقوم الجهاز بمعرفه موقع نزول الراكب اذا كان خط عملك خارج المدن	موافق	موافق بشده	لا أوافق
11- ما هو رايك بان تتخلص من فكه النقود (الصرافة) وجميع النقود الموجودة بالمركبة من جميع العملة	موافق	موافق بشده	لا أوافق
12- ما هو رايك بان يكون هذا الجهاز (الصندوق) لا احد يقوم بفتحه الا صاحب العمل من خلال رقم سري انت تقوم بوضعه	موافق	موافق بشده	لا أوافق
13- هل تظن بان الجهاز قد يعمل على تقليل نسبه الحوادث وزياده الامان على جميع الركاب ؟	موافق	موافق بشده	لا أوافق
14- هل الجهاز حل كثير من المشاكل التي تعاني منها؟	موافق	موافق بشده	لا أوافق

نتائج الاستبيان :

1.عدد الاستبيانات التي تم توزيعها على السائقين مئة استبيان.

2.المناطق التي تم توزيع فيها الاستبيان :

أ -مجمع بلدية الخليل.

ب -مدخل الجامعة.

ج -وسط الخليل.

الموافق نسبة	نسبة الموافق بشدة	اوافق لا نسبة
26%	52%	22%

CHAPTER 2

Literature review

2.1. Apparatus and method for controlling and receiving and dispensing paper money.[1]

device controlling of normal used paper currency in financial transactions and, more particularly, for the improved con trolling and storing and/or dispensing of such currency bills into or out of compact storage units wherein such bills are in an elongated series line or one after the other but separated to prevent any overlapping or especially wherein such storing is by rotating, spirally rolled-up storage paths (preferably with one such storage unit for each denomination of bills handled) with a selectively and rapidly reversible action for 'each and the bills being transferred to or from feeding and guiding paths acting between such storing paths and the person who is paying in or receiving money.

2.2. Secure money transfer between hand- held devices.[2]

A payment resolution module is configured to communicate with hand-held devices (such as mobile phones, PDA's, or computers) to allow purchase of products using the hand-held devices, Without requiring the user of the hand-held device to enter payment information for each sales transaction. The user of the hand-held device may be identified as the owner of the device either by having the option to enter a personal identification code, or by using a bio metric to identify himself, for example. Accordingly, only an authorized user of the hand-held device may use the hand-held device to purchase products.

2.3. Device for storing money in a taxi.[3]

The device for storing money in a cab is distinguished by the fact that it exhibits, in a lockable housing, one or more openings for the introduction of notes and/or coins, mechanisms for dispensing notes and/or coins, mechanisms for determining the amount to

be dispensed and mechanisms for invalidating at least the notes in the event of forcible tampering.

The object of the invention consists in the creation of a device by which the incentive for cab raids is eliminated. The solution according to the invention consists in the fact that the device, in a lockable housing, exhibits one or more openings for the introduction of notes and/or coins, mechanisms for dispensing notes and/or coins, mechanisms for determining the amount to be dispensed and mechanisms for invalidating at least the notes in the event of forcible tampering.

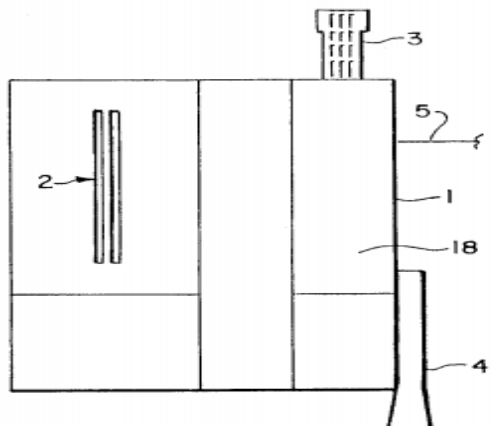


Figure 2.1 :frontal view of the device[3]

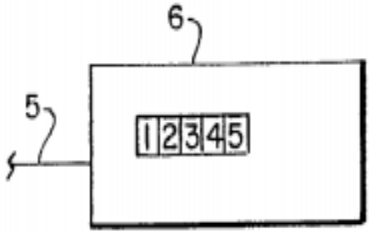


Figure2.2:the taximeters[3]

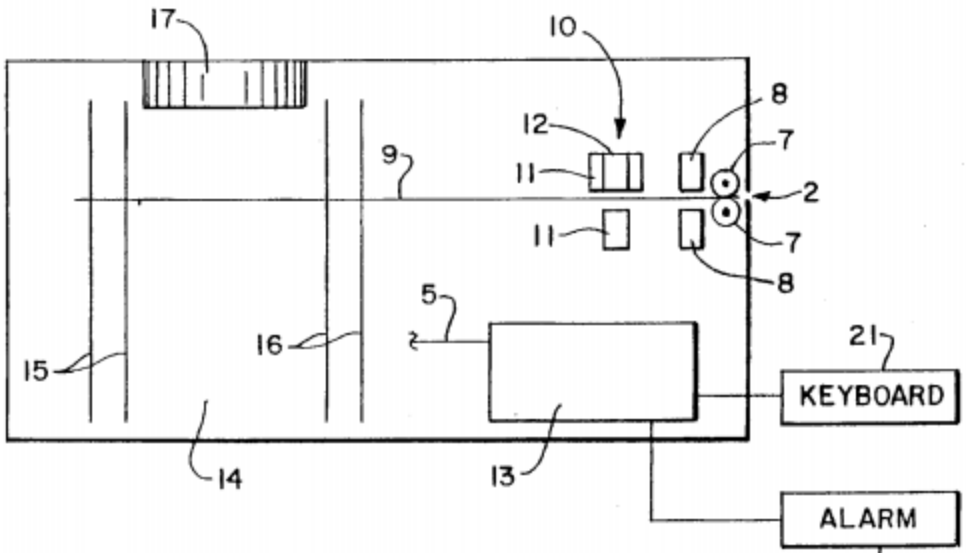


Figure 2.3: sectional view of the device [3]

2.4. System and method for using a universal payment card for transportation vehicles. [4]

The present invention comprises a payment debit system specifically tailored to transportation vehicles and the method for its use wherein a passenger preferably will pre-purchase a card for a predetermined amount of fare at local outlets to be used in any hired vehicle located throughout the world equipped with the system. A second preferred embodiment will allow the passenger to swipe the card into a computer terminal located within a transportation vehicle, thus allowing a passenger to choose her or his destination and fare, upon which occurrence terminal connects to a main computer database after pin confirmation via satellite, thereby deducting the amount of fare from the debit card and printing a confirmation receipt for the passenger. A third preferred embodiment of the present invention includes a panic device akin to LoJack® system for security purposes that may be depressed by both a driver and/or a passenger in case of emergency.

Figure 2.4 shows the front perspective view of a sample embodiment of a universal transportation payment card for prepaid transportation payments and services.

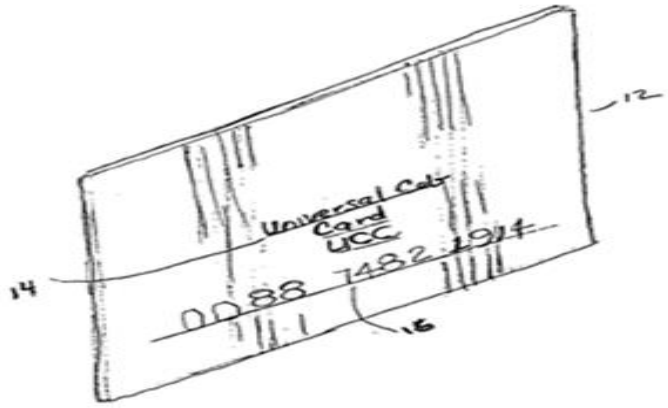


Figure 2.4: front perspective of card

Figure 2.5 shows a back perspective view of a sample embodiment of a universal transportation payment card for prepaid transportation payments and services.

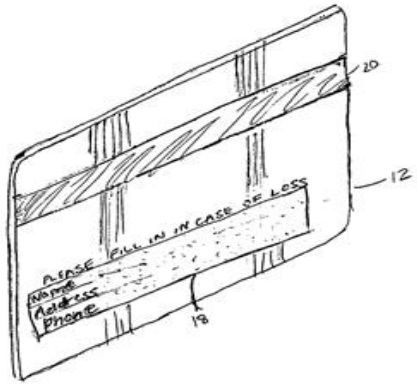


Figure 2.5**:** back perspective of card

Figure 2.6 shows a front perspective view of a sample embodiment of the swiping terminal with LCD display, GPS Navigational System, number and letter keypad, and possible panic button device akin to LoJack® emergency systems.

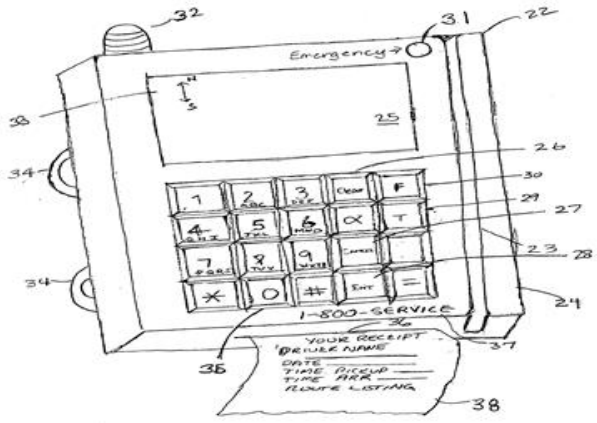


Figure 2.6**:** input device.

CHAPTER 3

Design

3.1. Introduction

Design smart box pre-payment for taxi cars that used to reduce the effort that the driver do while driving the taxi, the system consists of the box contain coins stream that designed to be incline to facilitate the movement of coins

The coins stored in cylinder tube, a light sensor used to count the money inter each tube ,a crank slider mechanism that used principle of converting rotation motion to used return the change, in the bottom of each tube .then the change out to small box in the bottom of the device

3.2. proposed design

3.2.1. Design of box

The box is made of aluminum material. The box contains an entrance that the passenger pays the money through. It also contains a screen that the passenger deals with a specific .program and also contains a cash outlet (return change)

The box is designed in a way that is easy to handle, without taking into space in the vehicle

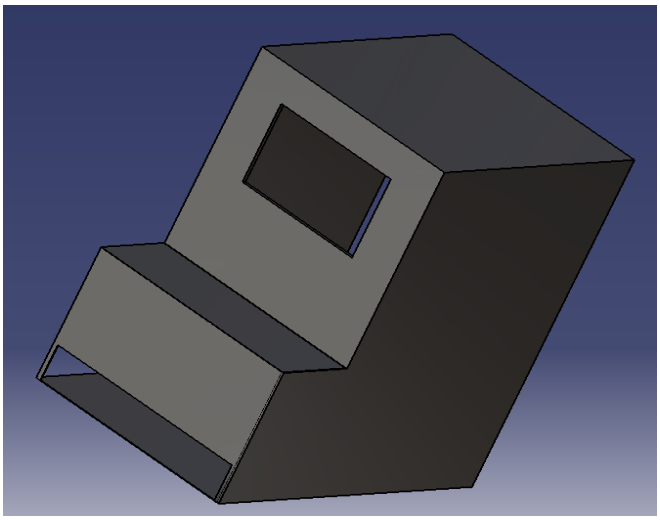


Figure 3.1.box

3.2.2.Design of incline inlet

The design of the incline inlet depends on the size of the money and the angle of inclination so that there are holes suitable for the size of each coin and arranged according to diameters of money from the smallest to the largest .

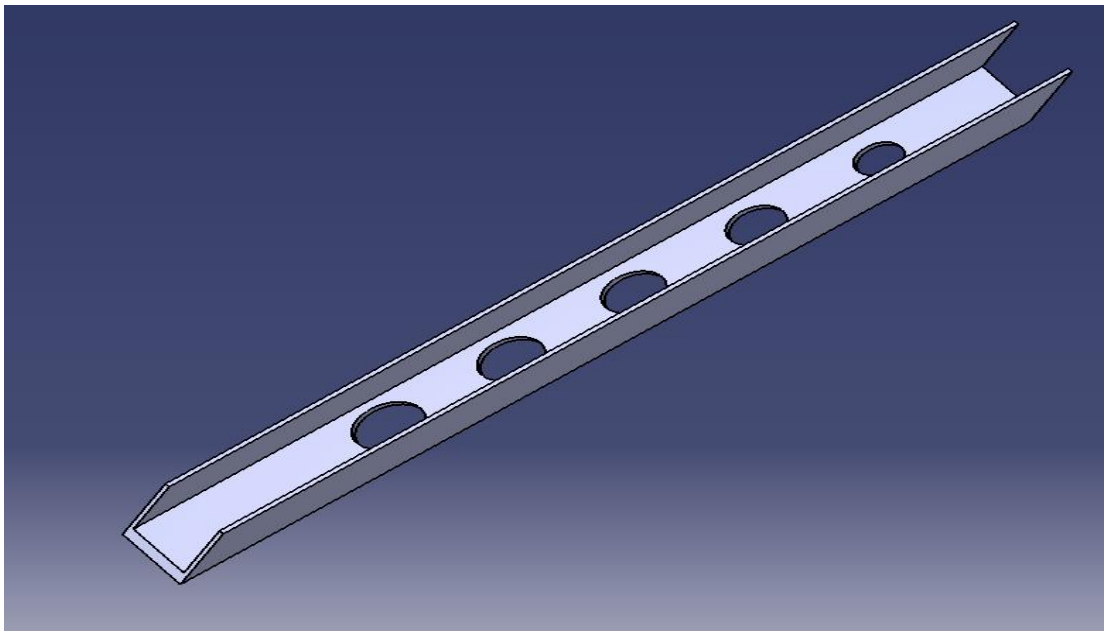


Figure 3.2.incline inlet

3.2.3. Cylinders

Each hole contains to a cylinder slightly larger than the size of the coin and in end connected to a system crank slider mechanism.

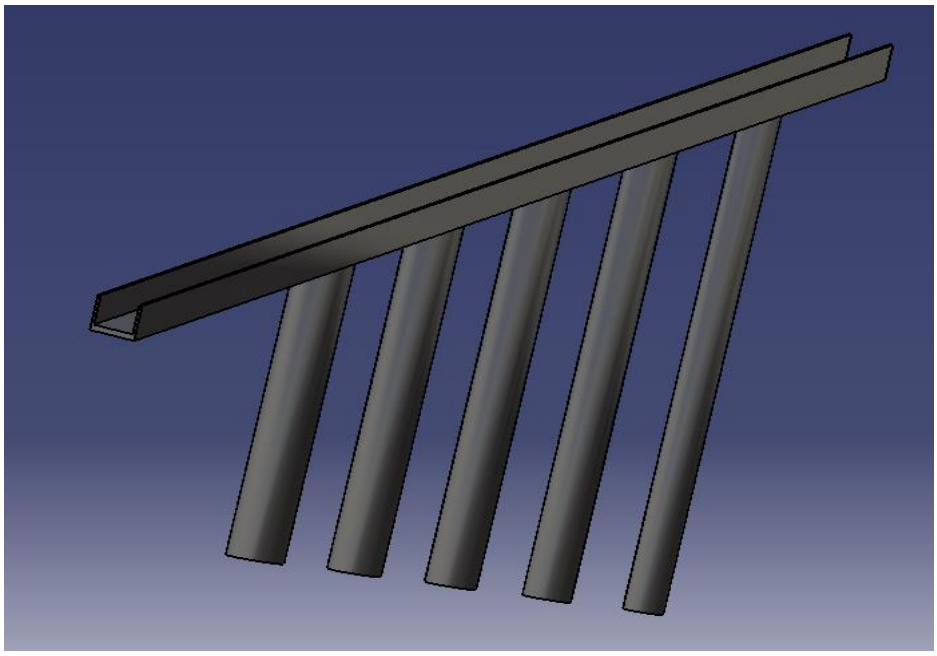


Figure 3.3. cylinders

3.2.4.crank slider mechanism

The Slider-crank mechanism is used to transform rotational motion into translational motion by means of a rotating driving beam, a connection rod and a sliding body. In the present example, a flexible body is used for the connection rod. The sliding mass is not allowed to rotate and three revolute joints are used to connect the bodies

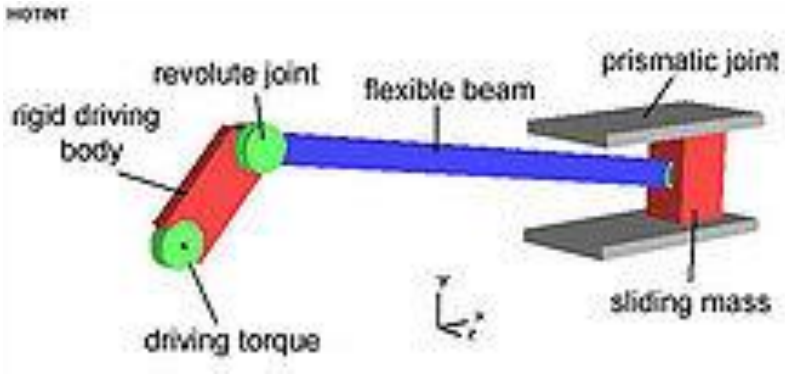


Figure 3.4. crank slider mechanism

Calculate the degree of freedom:

While each body has six degrees of freedom in space, the kinematical conditions lead to one degree of freedom for the whole system.

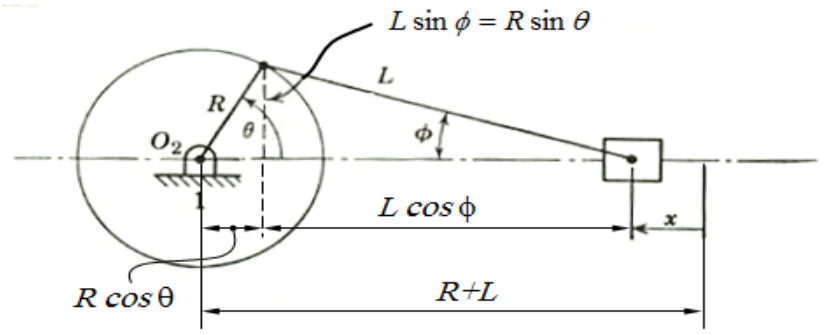
$$M = 3(n-1) - 2j_1 - j_2$$

$$M = 3(4-1) - 2*4 - 0$$

$$M = 1$$

3.3.The theoretical calculation for the proposed design

3.3.1. Design of crank slider mechanism [5]



$$x = (R + L) - (Rcos\theta + Lcos\emptyset) \qquad (3\text{-}1)$$

$$x = R(1 - cos\theta) + L(1 - cos\emptyset)$$

$$cos\emptyset = \sqrt{1 - sin^2\theta} = (1 - \frac{R}{L} sin^2\emptyset)^{\frac{1}{2}} \qquad (3\text{-}2)$$

$$cos\emptyset = 1 - \frac{R}{2L} sin^2\theta \quad (3\text{-}3)$$

$$x = R(1 - cos\theta) + \frac{R^2}{2L} sin^2\theta \quad (3\text{-}4)$$

Design of crank slider mechanism that poll the coins, the crank angle ∅ , Moves from 0 to 90, the crank length R is equal 1.5cm, x is the distance that needs to move the coin out, we assume that x equal to the largest, Diameter of the coin, and its equal 2.6cm . using equ (3-5) to calculate the length of the arm L according to the equ (3-5) , its equal to 10cm.

$$L = \frac{R^2 \sin^2\theta}{2(x - R(1 - \cos\theta))} \quad (3\text{-}5)$$

3.3.2. Calculate the inclination angle of the inlet

Determine the inclination angle of the inlet by applied newton law, fig 3.5 show the coin while its sliding on the incline inlet. W represent the weight of the coin, f_k represent the friction fours, R represent the normal force and, θ is inclination angle that we want to calculate, according to the newton laws the normal force equal to the w cosθ and the friction force f_k equal to the normal force multiplying by the friction coefficient.

The friction force equal w sin θ, the friction coefficient for the material that have been used, copper over steel is equal 0.18. Then by substrate the friction coefficient in equ (3-6) it results that

the inclination angel for the inlet that overcome on the friction force is 27 degree, to insure that the coins sliding on the incline inlet, 30 degree inclination angle have been selected.

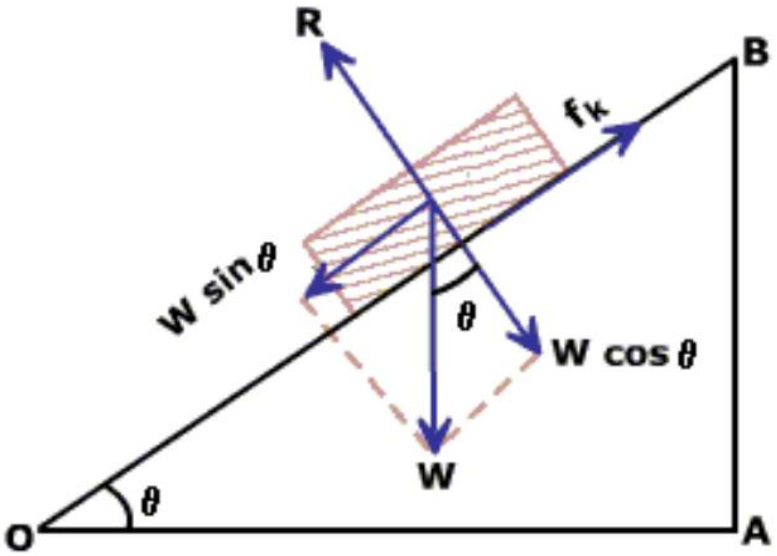


Figure 3.5.free body diagram

$$\sum Fx = 0$$

$$mg\ sin\theta = f_k$$

$$\sum Fy = 0$$

$$R = mg\ cos\theta$$

$$f_k = R * \mu s$$

$$f_k = mg\ cos\theta * \mu s$$

$$must,, f_k < \text{mg sin}\theta$$

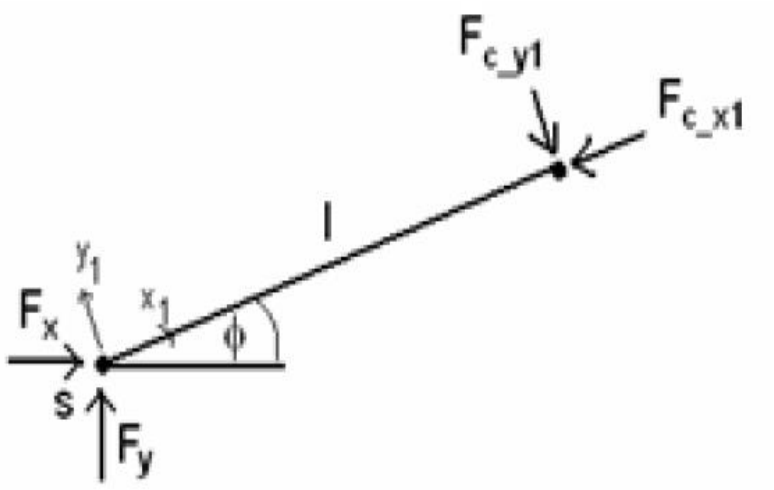
$$f_k = mg\ sin\theta$$

$$mgcos\theta * \mu s = mgsin\theta$$

$$\theta = tan^{-1}(\mu s) \qquad (3\text{-}6)$$

$$\theta = 27^\circ$$

3.3.3. determine the torque and motor selection .[6]



where

Fc = Force transmitted between links l and r

Fx = x component of reaction force at slider

Rx, Ry = Reaction forces at driving crank

T = Torque applied at crank

x1,y1,x2,y2 = local coordinate systems

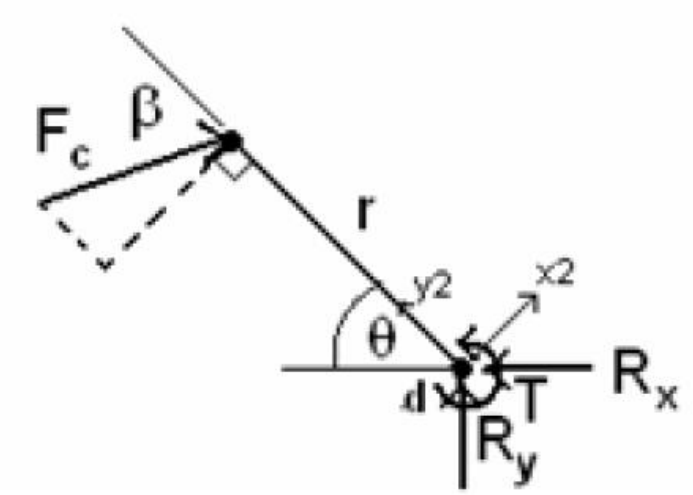
$$\sum M_S = -F_{C_{Y1}} L = 0$$

$$F_{C-Y1} = 0$$

$$F_C = F_{C-X1}$$

$$\sum F_X = F_X - F_{C-X1} \cos(\emptyset) = 0$$

$$F_X = F_C * \cos(\emptyset)$$



FBD for the link

$$\sum M_d = T + Fc * r = 0$$

$$T = Fc * r * \sin(\beta)$$

$$Fc = \frac{T}{r * \sin(\theta + \emptyset)} \quad (3\text{-}7)$$

$$Fx = \frac{T}{r * \sin(\theta + \emptyset)} * \cos(\emptyset) \tag{3-8}$$

$$Fx = \frac{T}{r * \sin(\theta + \sin(\frac{r}{L}\sin(\theta))} \cos(\sin\left(\frac{r}{l}\sin(\theta)\right)) \tag{3-9}$$

$$cos\theta = 1 - \frac{R}{2L} sin^2\emptyset \tag{3-10}$$

To calculate the torque in the motor using equ (3-9). the force Fx need to move the coins is the force to overcame in the friction between coins and the base, according to the greatest weight in the coins, and with fraction coefficient between copper and steel the force must be greater than 50N

To find the connecting rod angle using equ (3-10).

$$cos\theta = 1 - \frac{1.5}{2 * 10} sin^2 90$$

$$\theta = 23°$$

To find the torque T using equ (3-9) .

$$50 = \frac{T}{1.5 * \sin(23.07 + \sin(\frac{1.5}{10}\sin(23.07))} \cos(\sin\left(\frac{1.5}{10}\sin(23.07)\right))$$

T= 0.3N.m

According to the Design conditions , servo motor MG995 have been selected to over com required torque, fig 3.6 show MG955 servo motor. the motor move from angle 90 to 0 and that is the reason behind selecting servo motor that is able to control with angle .

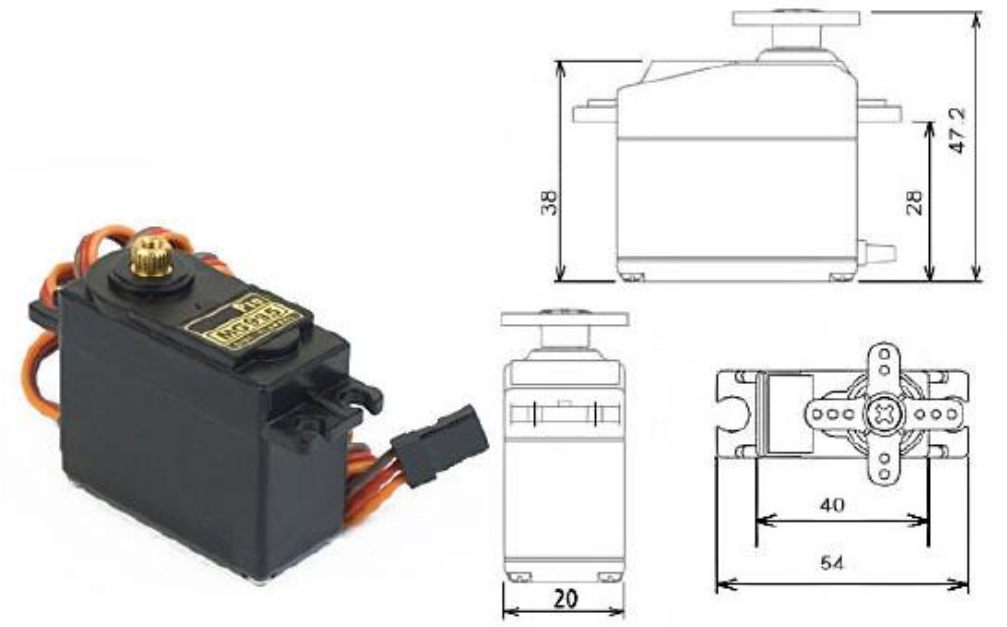


Figure 3.6.servo motor

The unit comes complete with 30cm wire and 3 pin 'S' type female header connector that fits most receivers, including Futaba, JR, GWS, Cirrus, Blue Bird, Blue Arrow, Corona, Berg, Spectrum and Hitec.

This high-speed standard servo can rotate approximately 120 degrees (60 in each direction). You can use any servo code, hardware or library to control these servos, so it's great 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. The MG995 Metal Gear Servo also comes with a selection of arms and hardware to get you set up nice and fast.

Specifications

• Weight: 55 g
• Dimension: 40.7 x 19.7 x 42.9 mm approx.
• Stall torque: 8.5 kgf·cm (4.8 V), 10 kgf·cm (6 V)
• Operating speed: 0.2 s/60º (4.8 V), 0.16 s/60º (6 V)
• Operating voltage: 4.8 V a 7.2 V
• Dead band width: 5 µs
• Stable and shock proof double ball bearing design
• Temperature range: 0 ºC – 55

.

3.4.proposed controller and screen

The device includes touch screen and money box. At the first passengers select the area where they want to go. This done by using touch screen. After that the system didn't approve the passengers request until the user pay money on the money box. And by programing microcontroller that counts the money in to the box then computing the change. Sensor that will use to observe the process of counting the money in and out from the box. The final process is to show the data to the driver. Data such as approve the passengers request manually, the Ares that passengers want to go for it , the number of passengers and Cash . The interfacing process in the touch screen with raspberry pi microcomputer that manage the process.,fig3.7 show the touch screen and the Raspberry pi microcomputer respectively.

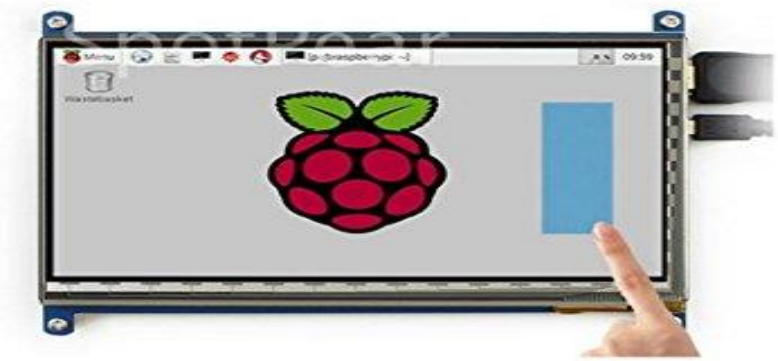


Figure3.7 Touch screen.

Figure3.8 Raspberry pi.

3.4.1. Flow chart

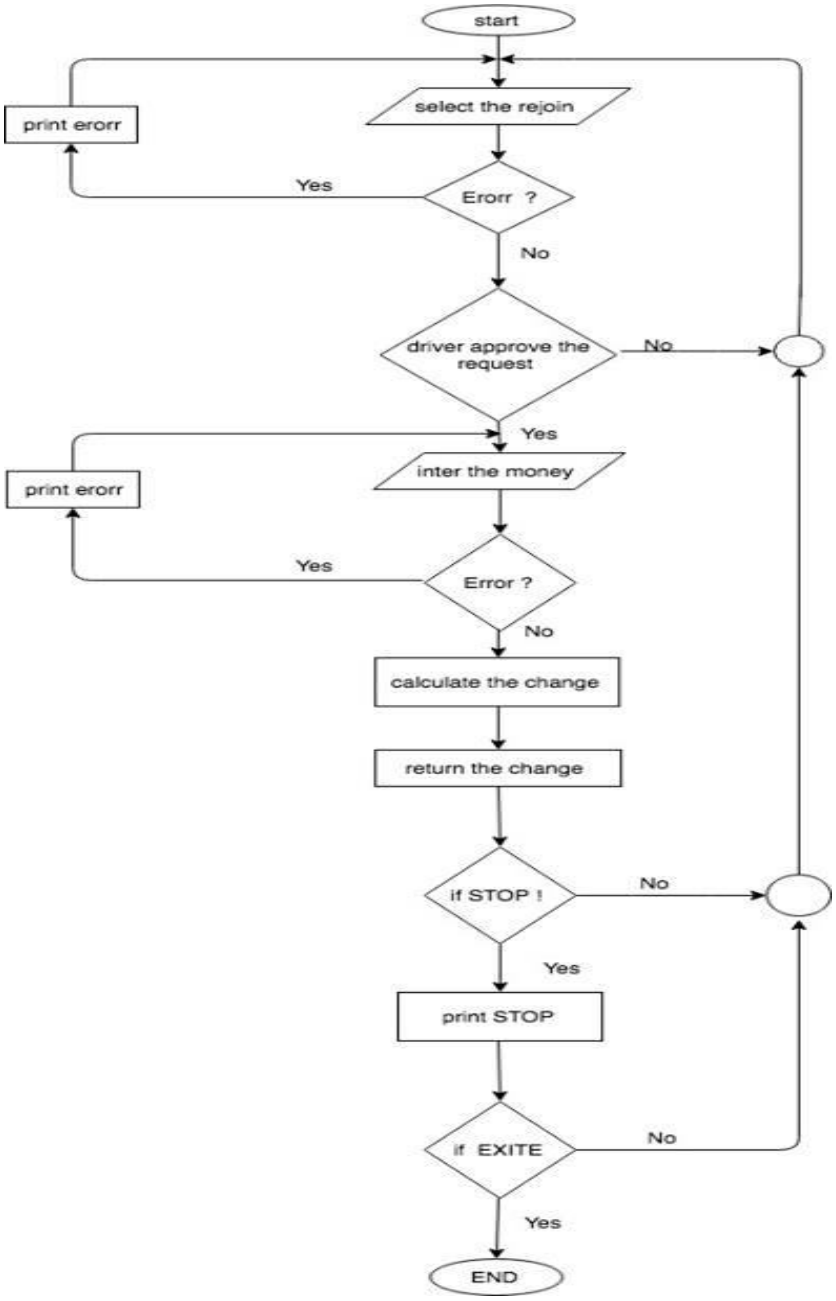


Figure 3.9. flow chart

3.5. sensor

In order to count the money in to the box by the passenger, light sensor used to recognize when the passenger in the money to the box. Five light sensors used, one on each, tube, to cam deferent type of coins. GP2A22 light modulation type is selected fig 3.10 show the sensor.

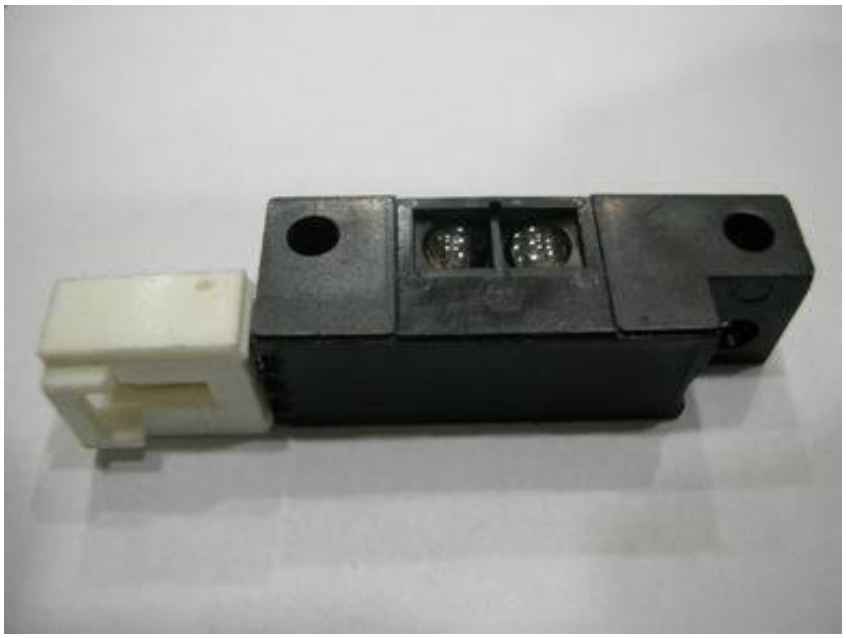
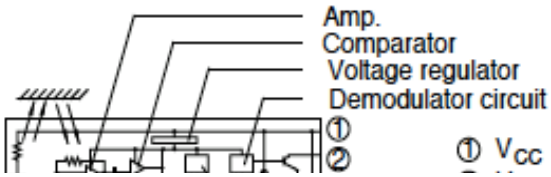


Figure 3.10. GP2A22 light sensor

The sensor selected based on its features, with focal distance detecting range between 9mm to 15mm, which is satisfying to detect the coins while its threw to the store tube. the sensor connecting to the controller and sending digital signal when detecting any objects on its range, The following is the specification of GP2A22 light sensor .

■ Outline Dimensions (Unit : mm)

Internal connection diagram



■ Absolute Maximum Ratings (Ta= 25°C)

Parameter	Symbol	Rating	Unit
Supply voltage	Vcc	- 0.5 to 7	V
*1Output voltage	Vo	30	V
*2Low level output current	IOL	50	mA
*3Operating temperature	Topr	- 10 to + 60	°C

■ Features

1. Light modulation type, free from external disturbing light
2. Long focal distance type
   Detecting range
   (**GP2A20**: 3 to 7mm)
   (**GP2A22**: 9 to 15mm)
3. Capable of TTL direct connection
4. With 3-pin connector provided for easier interface with peripheral control circuit

9.6, 3.5, 4.0, 11.0, 3.5, 2.5), ①, 3.5, 3.0+0 -0.2

*Unspecified tolerances shall be as follows;

Dimensions(d)	Tolerance
d<6.0	±0.2
6.0<=d<14.0	±0.3
14<=d	±0.4

*( ) : Reference dimensions

✹ MOLEX JAPAN CO., LTD made
3 - pin connector
52135 - 0350
Housing SD-51030-0310
Terminal SD-50084-8100

Marking:

GP2A20 SHARP ○○ └ Lot No.

GP2A22 SHARP ○○ └ Lot No.

*" OPIC " (Optical IC) is a trademark of the SHARP Corporation.
An OPIC consists of a light-detecting element and signal-processing circuit integrated onto a single chip.

Figure 3.11. specification

Chapter 4

Implementations and result

4.1. Implementations

4.1.1.Assembely

The outer shape of the box as shown in fig 4.1, which includes all parts of the project inside, which was created from light aluminum, The size of the box has been chosen to suit the cabin car ,the dimension of the box is (40 cm * 30 cm x 20 cm).

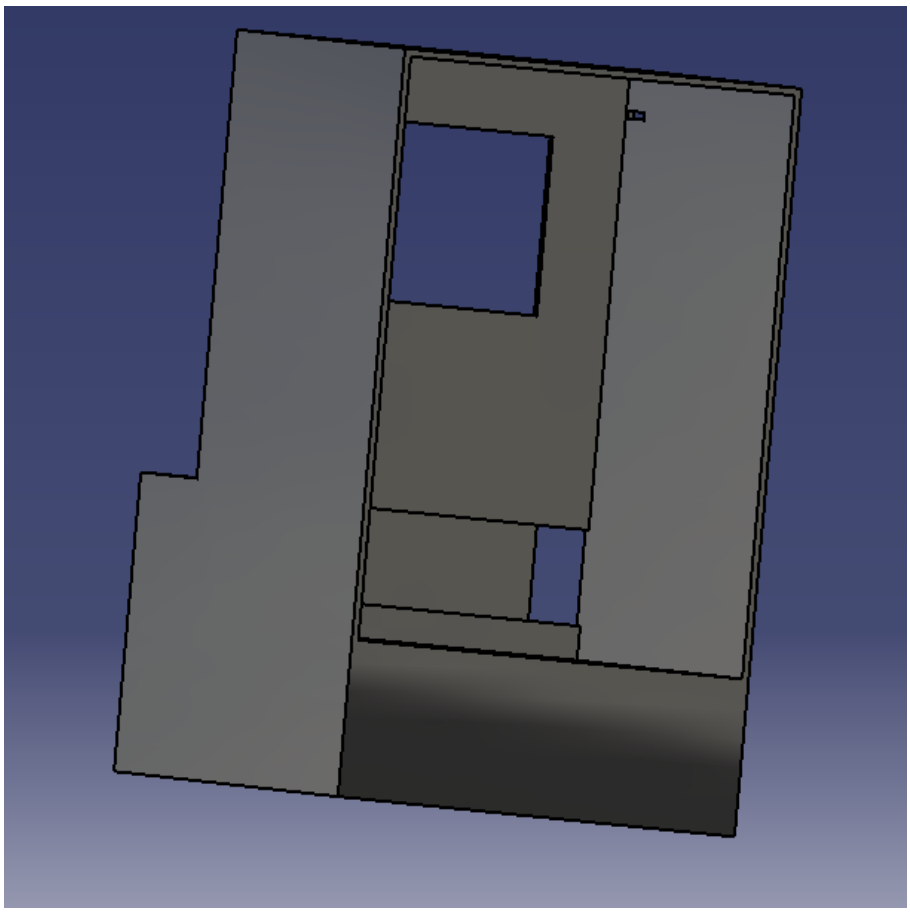


Figure 4.1.inside box

Fig 4.2 shows the process of assembling the cylinders with incline inlet , and put the sensor in the top of the cylinder to count the money while they fall inside the cylinder and closed the bottom of the cylinders with a steel plat, and grooved the bottom of the cylinder as much as the diameter of the coin and on the other side opened a hole in the width of the Slider.

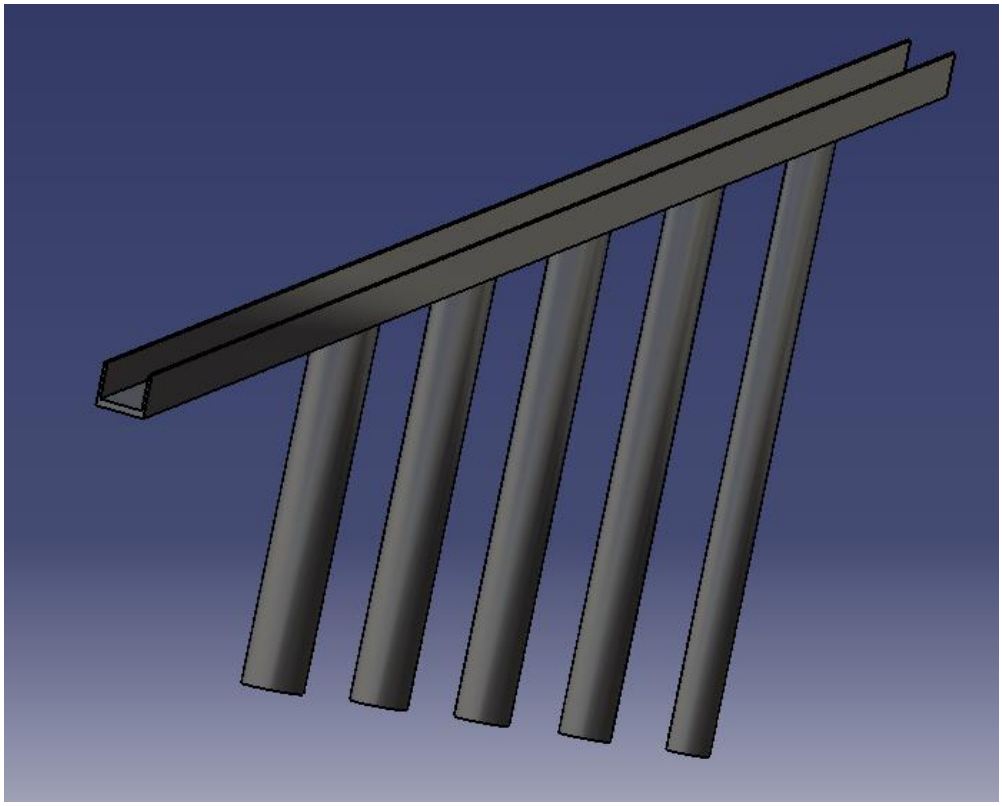


Figure 4.2. assembling the cylinders with incline inlet

placing the incline inlet and cylinders inside the box at an angle of inclination of 30 degrees, which was previously calculated as shown fig 4.3, with observance the size of the other pieces below the box

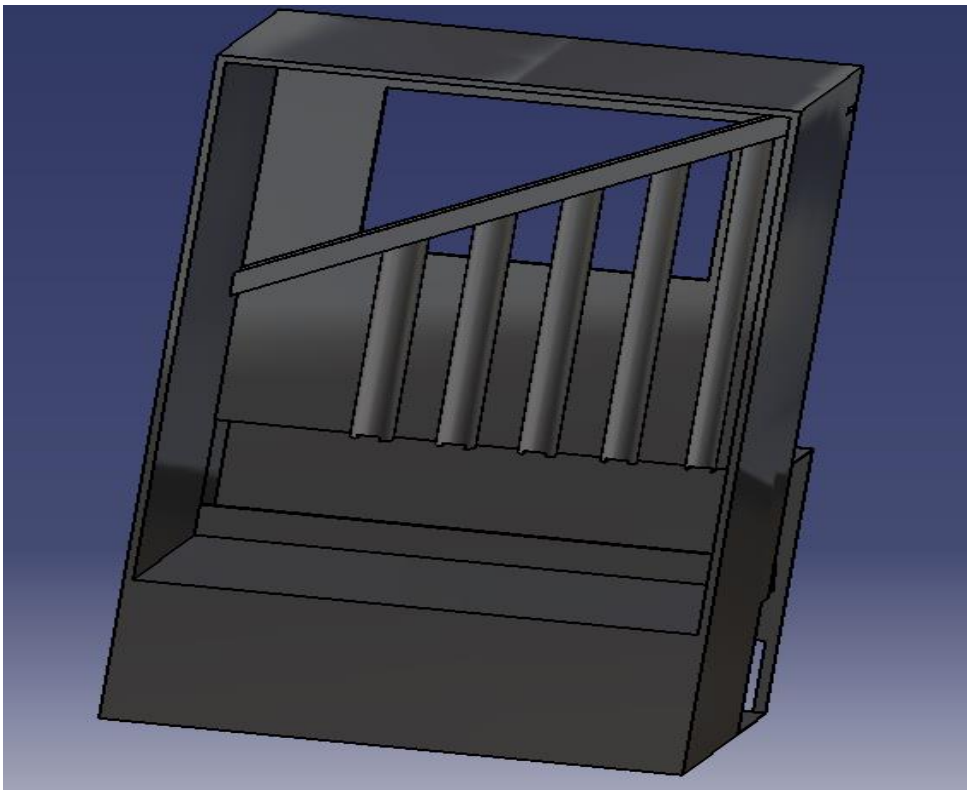


Figure 4.3. incline inlet and cylinders inside the box

Fig 4.4 show process of assembly first the crank slider mechanism system inside the box in the bottom and we adjusted the angle of the motors , and adjusted distance to the Slider to make the process of taking out money easily, then fixing the motors in the base of the box.

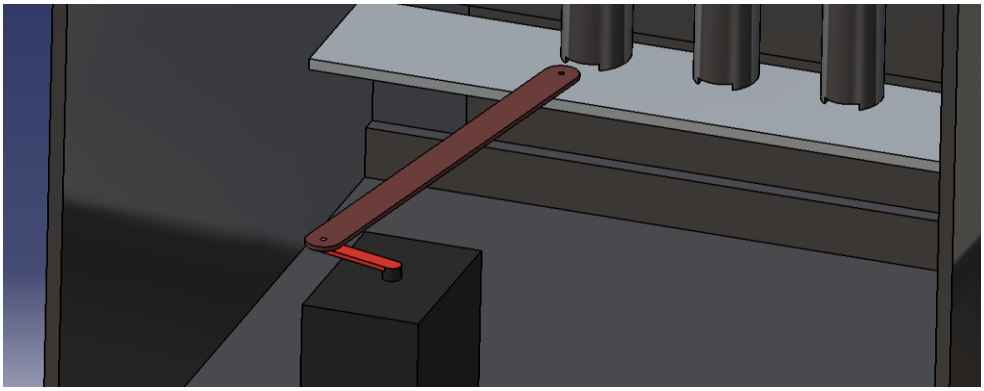


Figure 4.4. the crank slider mechanism system inside the box

The final process of assembling the device as shown fig 4.5.

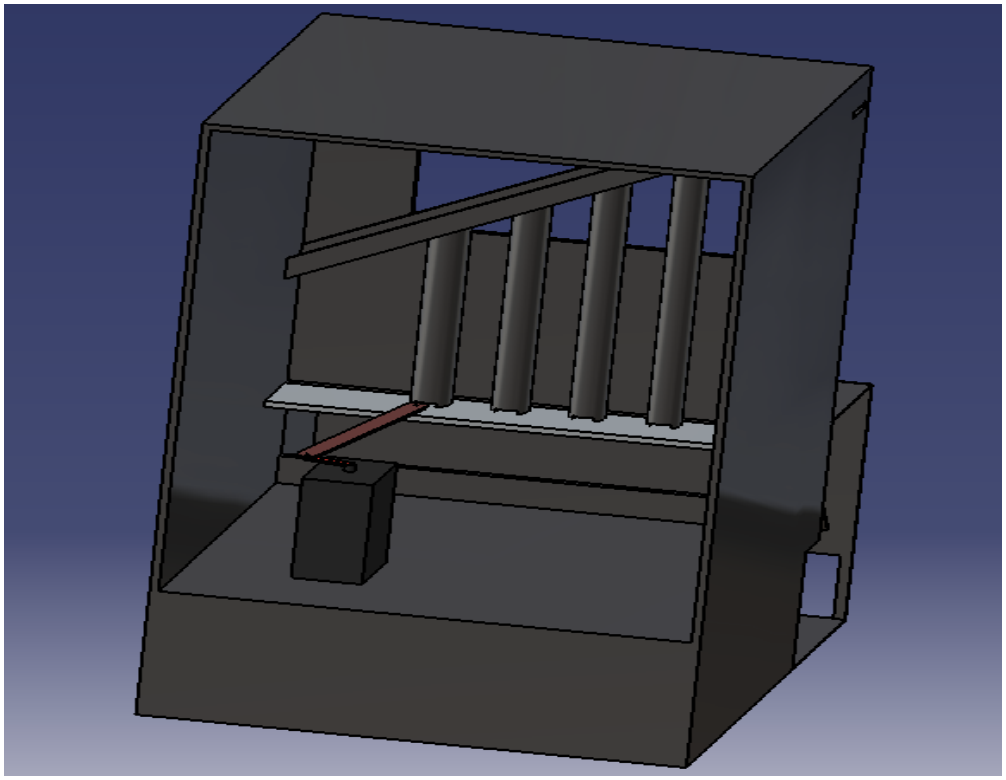


Figure 4.5. final assembly of the device

4.1.2 Programing graphical user interface

The device crate on order to facilitate the passengers and drivers using of public transportation, so the device contain touch screen connecting to the controller, the purpose of chosen respire pi microcontroller its ability to connect with screen that make user and drivers handling easily with the device.

Graphical user interface programming using python programming language, fig4.6 show a screenshot of graphical user interface that display on the touch screen. the instruction that user

most follow while handling with the device as shown in the figure. an example for four regions labeled with the cost for each region.

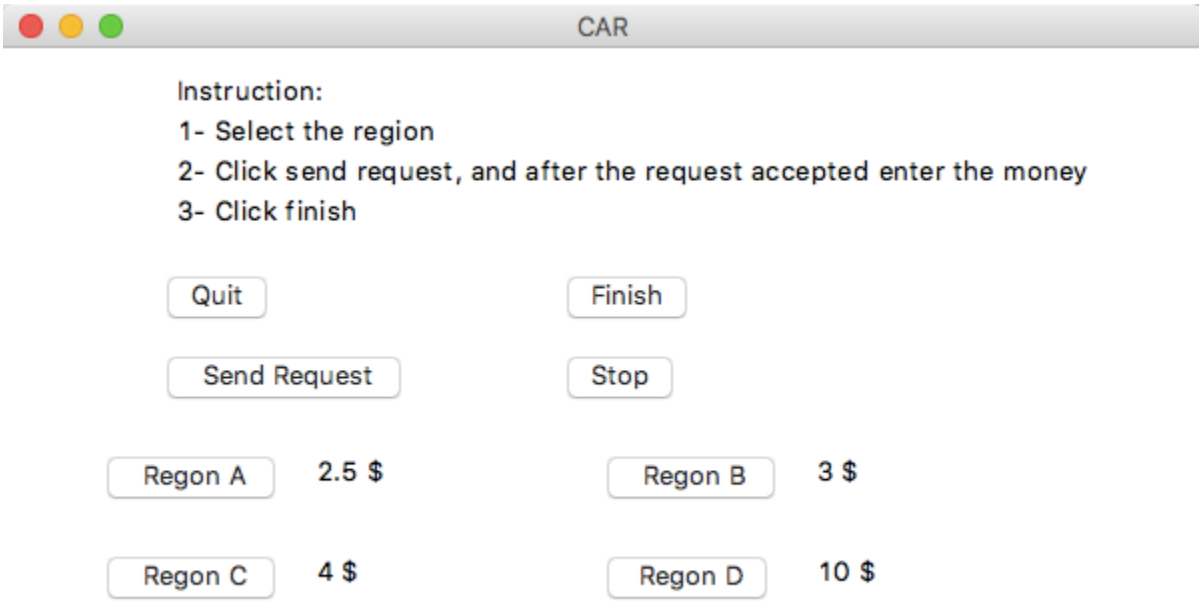


Figure 4.6.secreen shot of graphical user interface

At first the user must select which region he want to go , then click on send request bottom that show massage for the driver to approve or reject the request , if the driver approve the request the user must inter the money to the box .when user finished from interring the money he must click finish bottom. when the passenger reach when the passenger arrives to his destination he must click on stop bottom.

The driver approves or reject the request using his Mobil phone fig 4.7 show screenshot for the proposed Mobil phone application, at the first the mobile phone application mast connect with respire pi controller via Bluetooth. User mast click on connect bottom, then a lest of connect

devises dispelled, the user mast select respire pi to connect with it. When a massage appear on a screen show that anew passenger send request , the driver may select please approve request bottom to approve it or reject request bottom to reject it.

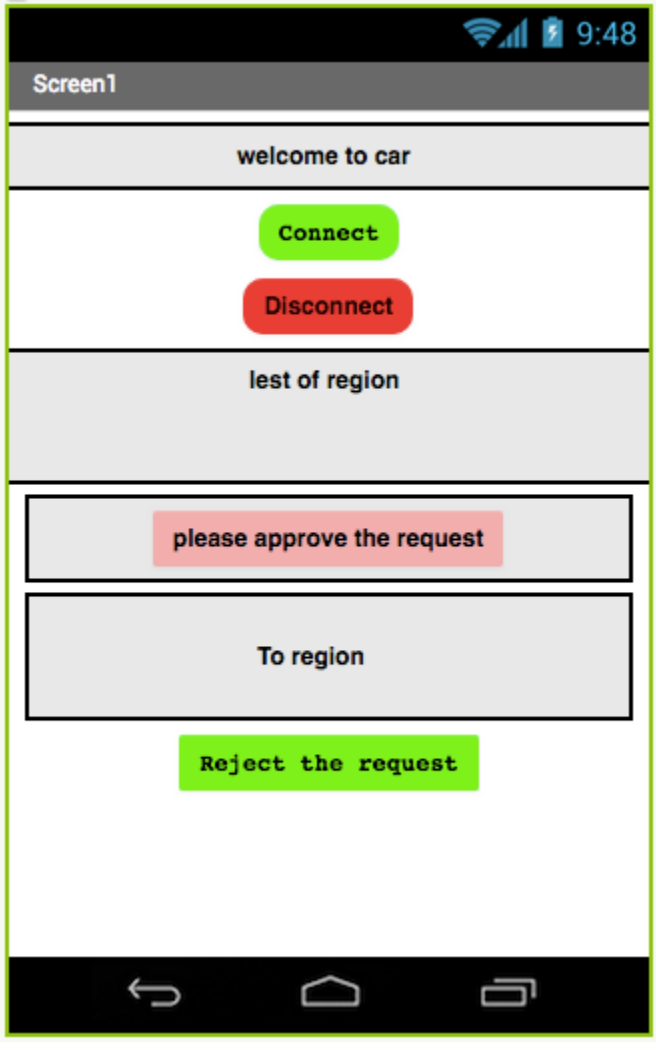


Figure 4.7. Mobil phone application

4.1.3.Error navigation

In order to use the controller with its graphical user interface and the mobile application easily, an error navigation system proposed to debug the error, fig 4.8 show a message appear when the user click on send the request without select the desired rejoin that he want to go for it.

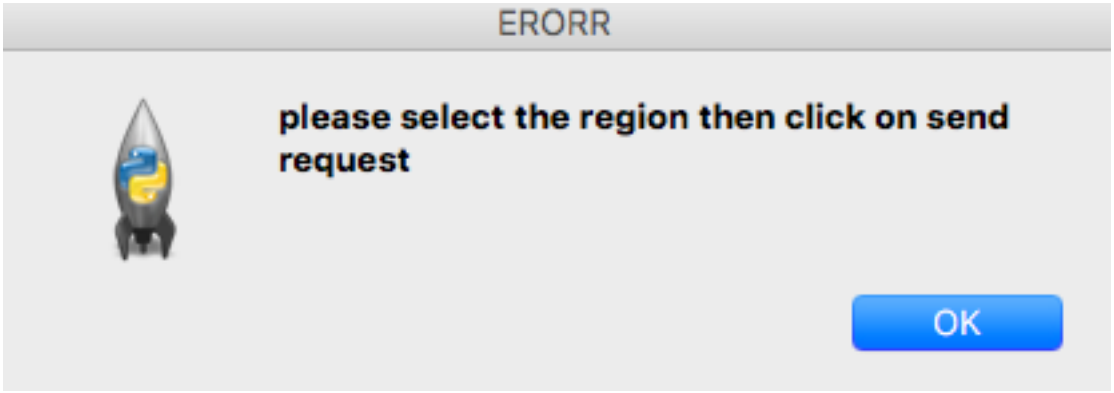


Figure 4.8.Error massage1

An error also may occur when user click on finished button, but he didn’t bay the money or the money that the passenger pays didn’t enough for his destination cost. Fig 1 show the message appear when such an error occurs.

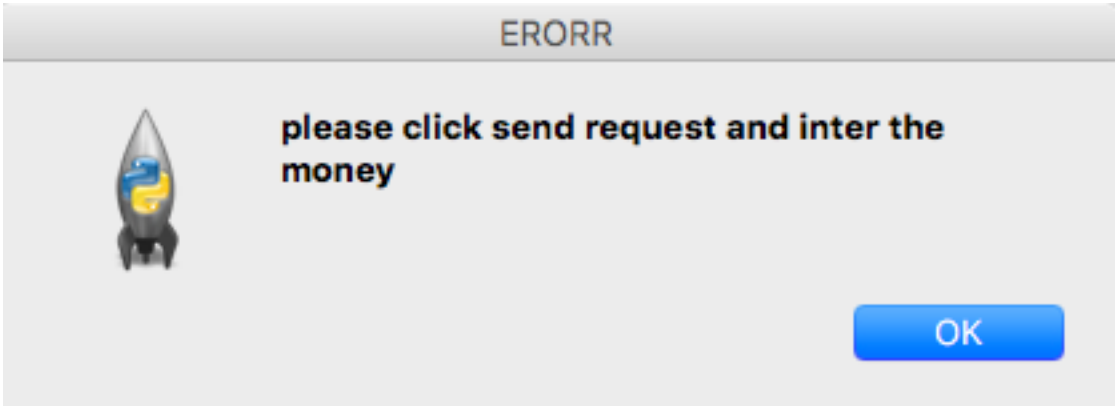


Figure 4.9.Error massage 2

4.2. Results

Smart box pre-payment for taxicabs designed to satisfy both condition, easy to use and by the user and consume a small place in the car cabinet, the final product with its ability to use by the passenger to pay for the taxi and selecting the destination, then the controller (Raspberry Pi) calculate the change, after that the controller send signal to the motors to move the money from tubes to the outlet. When the passenger arrives his distention he can alarm the driver using stop button in the touch screen.

The selection of controller, sensors and motor based on design calculation in chapter 3, the controller selected based on its specification and ability to connect with touch screen, motor and sensor. The selection of the motor biased on the total torque need to overcome the friction fours between the coins and the base. In order to select the suitable sensor to count the money in to the box with appropriate distance range between 9 mm to 15 mm.

Using python programing language to program the controller (Raspberry Pi), using graphical user interface to display on the touch screen, and its general purpose input/output pins (GPIO) to read the digital signal from the sensors, and controlling the servo motor.

References

[1] Couri, Joseph M. "Apparatus and method for controlling and receiving and/or dispensing paper money." U.S. Patent No. 3,222,057. 7 Dec. 1965.

[2] Linlor, James. "Secure money transfer between hand-held devices." U.S. Patent Application No. 11/071,054.

[3] Peters, Hans-Jakob. "Device for storing money in a cab." U.S. Patent No. 5,575,373. 19 Nov. 1996.

[4] Taylor, Acquenetta. "System and method for using a universal payment card for transportation vehicles for hire." U.S. Patent Application No. 10/756,665.

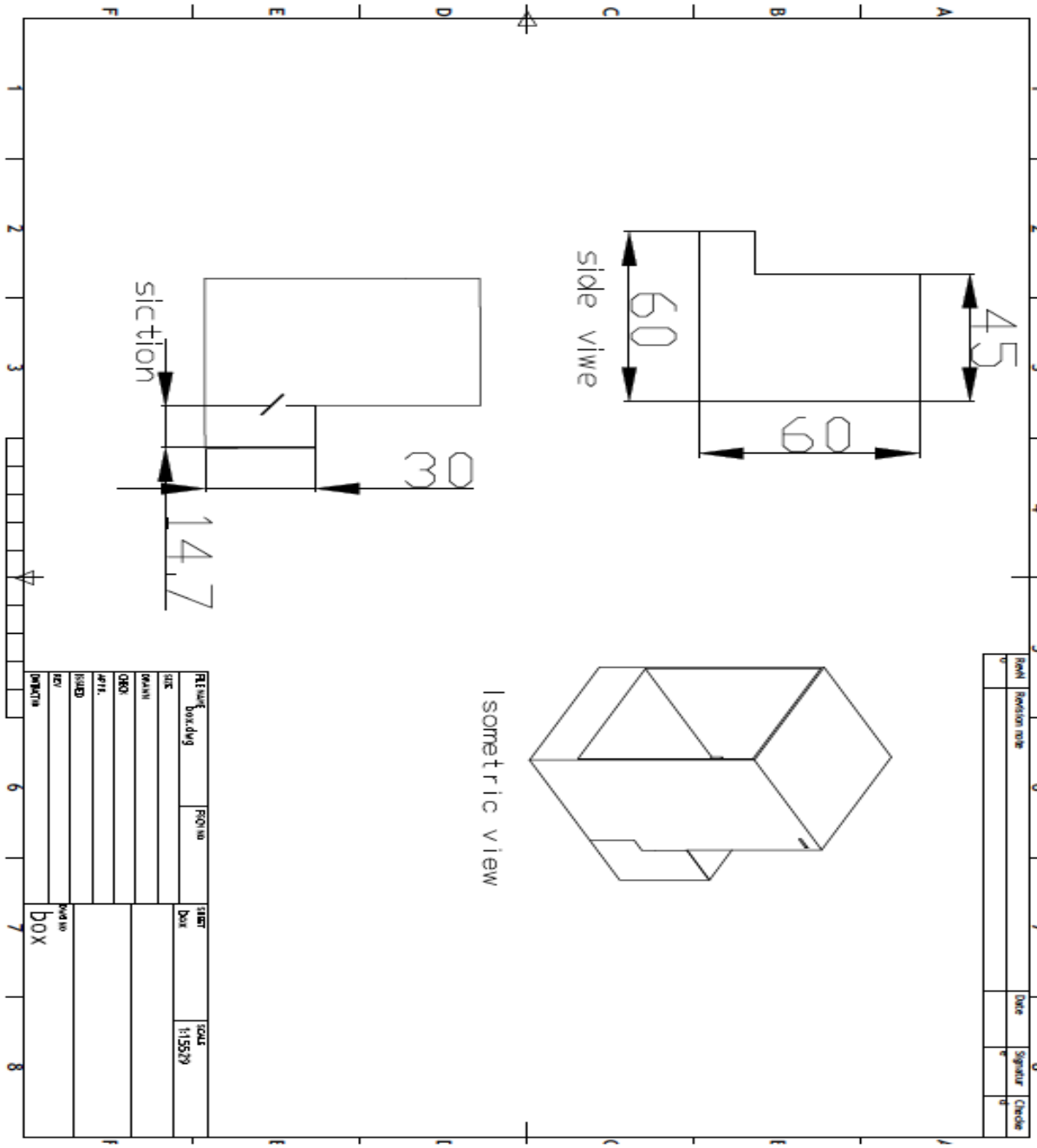
[5] Khurmi, R. S., and J. K. Gupta. *Theory of machines*. Eurasia publishing house, 2005.

[6] Meriam, James L., and L. Glenn Kraige. *Engineering mechanics: dynamics*. Vol. 2. John Wiley & Sons, 2012.

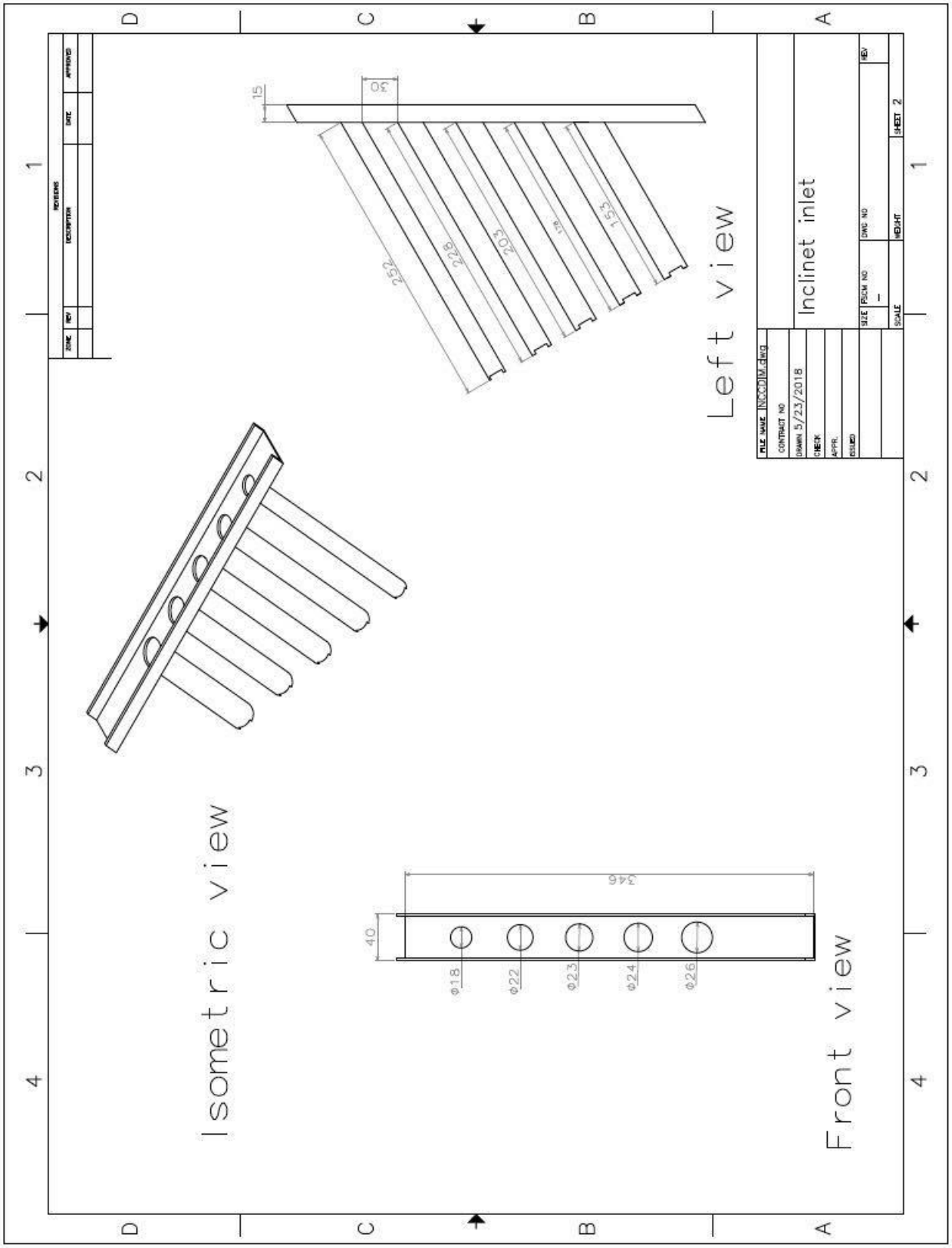
Appendices

APPENDIX A

Dimension of the box



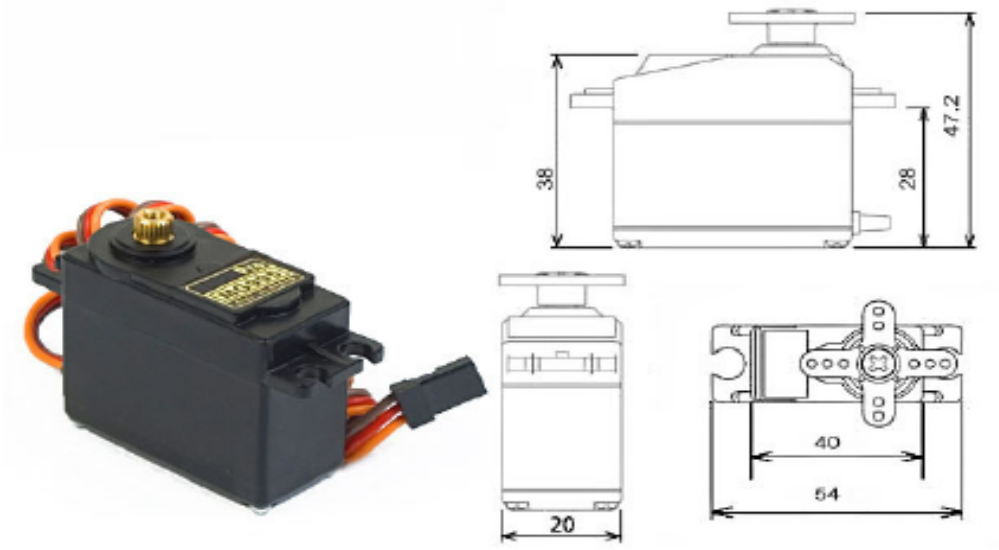
Dimension of the cylinders



APPENDIX B

Servo motor datasheet

MG995 High Speed
Metal Gear Dual Ball Bearing Servo

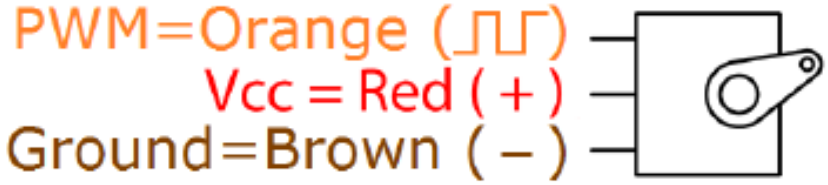


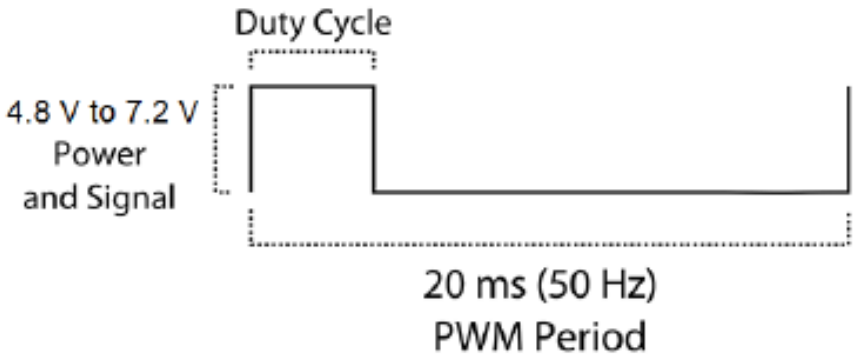
The unit comes complete with 30cm wire and 3 pin 'S' type female header connector that fits most receivers, including Futaba, JR, GWS, Cirrus, Blue Bird, Blue Arrow, Corona, Berg, Spektrum and Hitec.

This high-speed standard servo can rotate approximately 120 degrees (60 in each direction). You can use any servo code, hardware or library to control these servos, so it's great 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. The MG995 Metal Gear Servo also comes with a selection of arms and hardware to get you set up nice and fast!

Specifications

- Weight: 55 g
- Dimension: 40.7 x 19.7 x 42.9 mm approx.
- Stall torque: 8.5 kgf·cm (4.8 V), 10 kgf·cm (6 V)
- Operating speed: 0.2 s/60º (4.8 V), 0.16 s/60º (6 V)
- Operating voltage: 4.8 V a 7.2 V
- Dead band width: 5 µs
- Stable and shock proof double ball bearing design
- Temperature range: 0 ºC – 55 ºC


PWM=Orange
Vcc = Red (+)
Ground=Brown (–)


Duty Cycle
4.8 V to 7.2 V
Power
and Signal
20 ms (50 Hz)
PWM Period

APPENDIX C

Light sensor datasheet

GP2A20/GP2A22

Light Modulation, Long Focal Distance Type OPIC Photointerrupter

■ Features

1. Light modulation type, free from external disturbing light
2. Long focal distance type
   Detecting range
   (**GP2A20**: 3 to 7mm)
   (**GP2A22**: 9 to 15mm)
3. Capable of TTL direct connection
4. With 3-pin connector provided for easier interface with peripheral control circuit

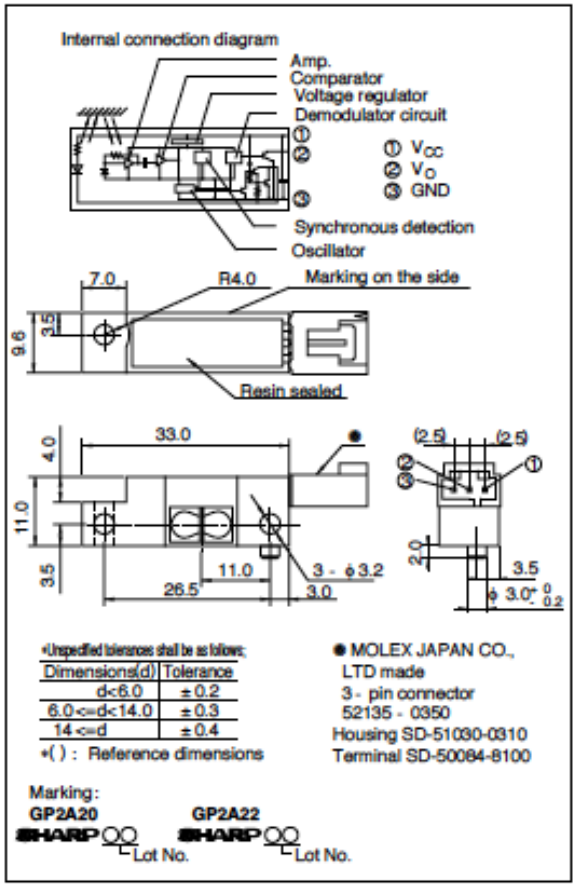
■ Applications

1. Copiers
2. Laser beam printers
3. Facsimiles

■ Line-ups

	Detecting range	
	3 to 7mm	9 to 15mm
Model No.	**GP2A20**	**GP2A22**

■ Outline Dimensions (Unit : mm)



*"OPIC" (Optical IC) is a trademark of the SHARP Corporation.
An OPIC consists of a light-detecting element and signal-processing circuit integrated onto a single chip.

■ Absolute Maximum Ratings (Ta= 25°C)

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	- 0.5 to 7	V
*1Output voltage	V_O	30	V
*2Low level output current	I_{OL}	50	mA
*3Operating temperature	T_{opr}	- 10 to + 60	°C
*3Storage temperature	T_{stg}	- 20 to + 80	°C

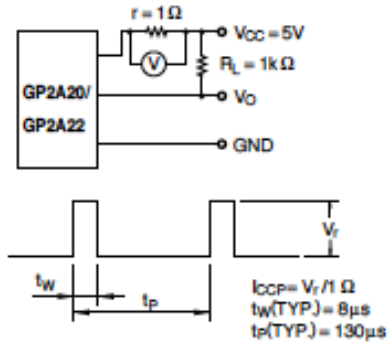
*1 Collector-emitter voltage of output transistor
*2 Collector current of output transistor
*3 The connector should be plugged in/out at normal temperature.

■ Electro - optical Characteristics

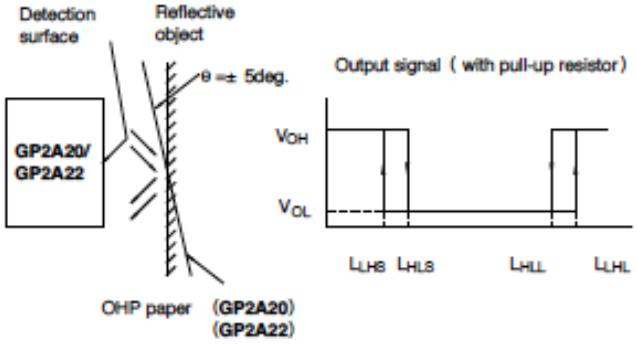
(V_{CC}= 5V, Ta= 25°C)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Operating supply voltage		V_{CC}		4.75	-	5.25	V
Dissipation current	Peak pulse value	I_{CCP}	*4 r= 1Ω	-	-	150	mA
	Smoothing value	I_{CC}	R_L=∞	-	-	30	mA
Low level output voltage		V_{OL}	I_{OL}= 16mA at detecting time	-	-	0.4	V
High level output voltage		V_{OH}	R_L= 1kΩ at non-detecting time	4.5	-	-	V
Non-detecting distance	GP2A20	L_{LHL}	*6 Reflective object: Kodak 90% reflective paper	-	-	20	mm
	GP2A22			-	-	50	
			*5 Reflective object: Chloroprene rubber	-	-	25	
Minimum detecting distance	GP2A20	L_{HLS}	*5 Reflective object: Artwork tape	-	-	3.0	mm
	GP2A20		*6 Reflective object: Kodak 90% reflective paper	-	-	1.0	
	GP2A22			-	-	7.0	
	GP2A22		*5 Reflective object: Black paper	-	-	9.0	
	GP2A20		*6 Reflective object: OHP paper, θ = 5deg. (X,Y direction)	-	-	3.0	
	GP2A22			-	-	9.0	
Maximum detecting distance	GP2A20	L_{HLL}	*5 Reflective object: Artwork tape	7.0	-	-	mm
	GP2A20		*6 Reflective object: Kodak 90% reflective paper	9.0	-	-	
	GP2A22			17.0	-	-	
	GP2A22		*5 Reflective object: Black paper	15.0	-	-	
	GP2A20		*6 Reflective object: OHP paper, θ= 5deg. (X,Y direction)	7.0	-	-	
	GP2A22			15.0	-	-	
Response time	"High→Low" propagation delay time	t_{PHL}	*6	-	-	1	ms
	"Low→High" propagation delay time	t_{PLH}		-	-	1	ms

*4 Test Condition for Dissipation Current (Peak Pulse Value)



*5 Test Condition for Detecting Distance Characteristics



*6 Test Condition for Response Time

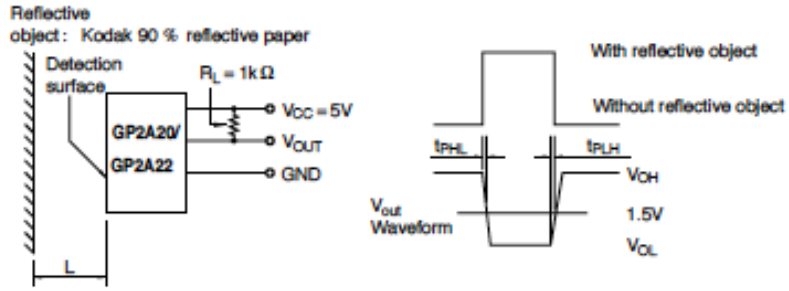


Fig. 1 Low Level Output Current vs. Ambient Temperature

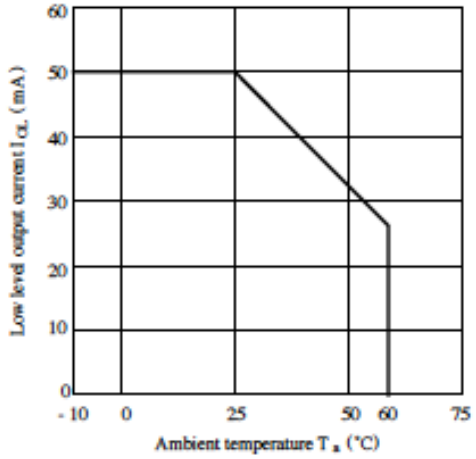


Fig. 2 Low Level Output Voltage vs. Ambient Temperature

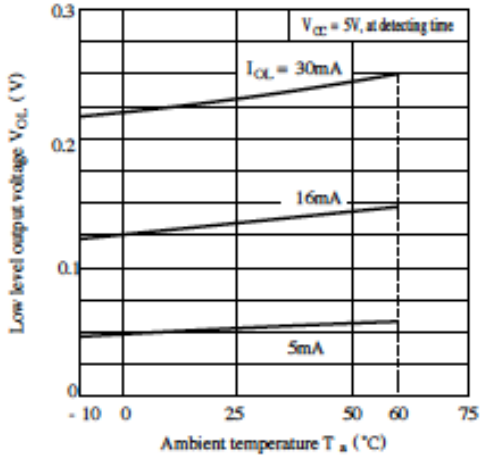


Fig. 3 Low Level Output Voltage vs. Low Level Output Current

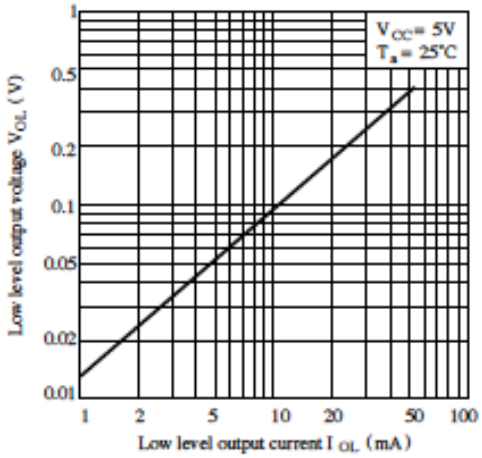
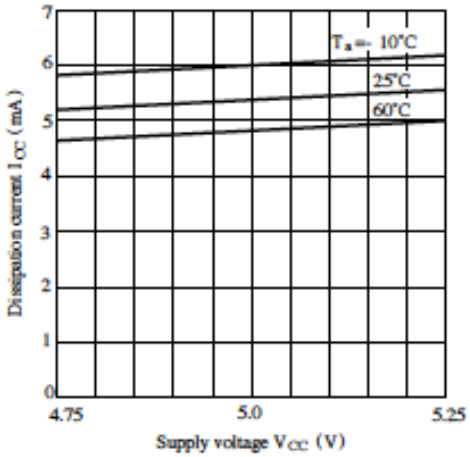


Fig. 4 Dissipation Current (Smoothing Value) vs. Supply Voltage



■ Precautions for Use

(1) In order to stabilize power supply line, connect a by-pass capacitor of more than 0.33μF between Vcc and GND nea

(2) Please do not perform dip cleaning or ultrasonic cleaning because lens part of this product is an optical device of acrylic resin.

(3) Remove dust or stains, using an air blower or a soft cloth moistened in cleaning solvent. However, do not perform the above cleaning using a soft cloth with cleaning solvent in the marking portion.
In this case, use only the following type of cleaning solvent used for wiping off:
Ethyl alcohol, Methyl alcohol, Isopropyl alcohol
When the cleaning solvents except for specified materials are used, please consult us.

(4) As for other general cautions, refer to the chapter "Precautions for Use".