SMACS Engineering

Mouse Trap Vehicle

Stage 1

Drawings and design, Design specification, Performance prediction, Certification documents, Tender evaluation criteria and Project disposal plan.

CONTENTS

INTRODUCTION

The mousetrap powered car designed by SMACS Engineering is an easy to build, fast, long distance vehicle that fills all of the requirements of the client. It is a simple, 3 wheeled car which is powered through the two front wheels. The cost of the vehicle is low and there is an effective disposal plan to ensure the highest possible amount of recycling can occur. The car is simple to build as there is no complex gearing system while the drawings and construction method are straightforward.

The car is predicted to cover a large distance of ~6m which is far over the required distance of 1.33m. Even though the car is purpose built to maximise distance, it is still fast, having a predicted initial velocity of ~1.2ms^{-1} over the first 1.33m resulting in a time of crossing the bridge of 0.9s . The car fits well within the required dimensions and gives great results making it the best choice.

Certification Document I

We, **SMACS Engineering**, respect and guarantee the clients design specifications of the vehicle. The essential specifications being;

1) Must fit through a 180mm (width) x 210mm (height) cross-section
2) Powered only by a single mouse trap
3) Must travel a minimum of 1330mm on a single recharge
4) Must be entirely self contained / self guided

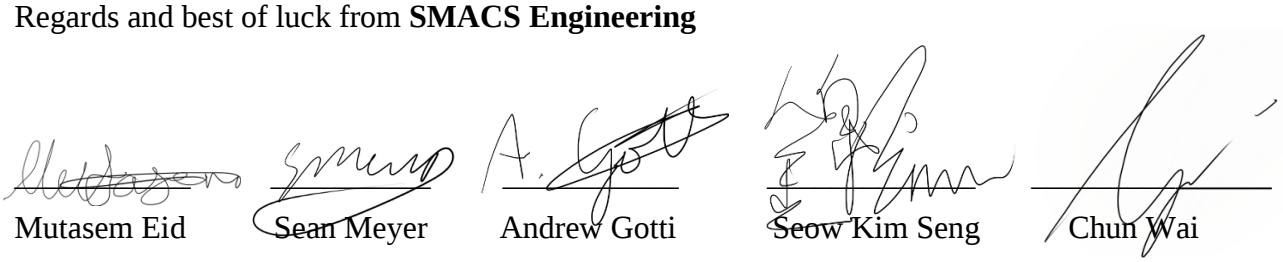
Our company strives to produce maximum performance and the clients desired specifications;

1) To travel as fast as possible
2) To travel as far as possible
3) Must be quick and easy to recharge

This design promises the client and contractors that it will be:

1) As cheap as possible
2) As light as possible
3) Easy to manufacture
4) Easy to set up

Regards and best of luck from **SMACS Engineering**



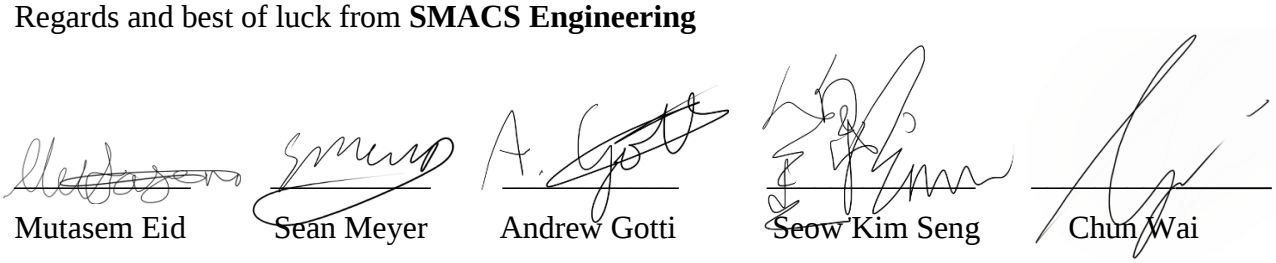
Mutasem Eid Sean Meyer Andrew Gotti Seow Kim Seng Chun Wai

CERTIFICATION DOCUMENT II

We, **SMACS Engineering**, Promise our clients;

1) All information regarding our company can be found on our company profile
2) All designs and specifications can be found on the company profile
3) The contact details of each SMACS Engineering team members can be found on the company profile

Regards and best of luck from **SMACS Engineering**



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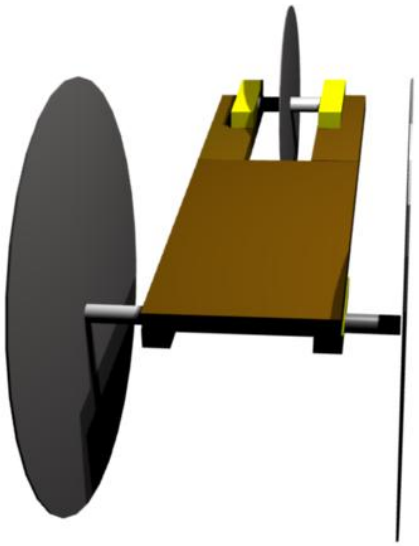
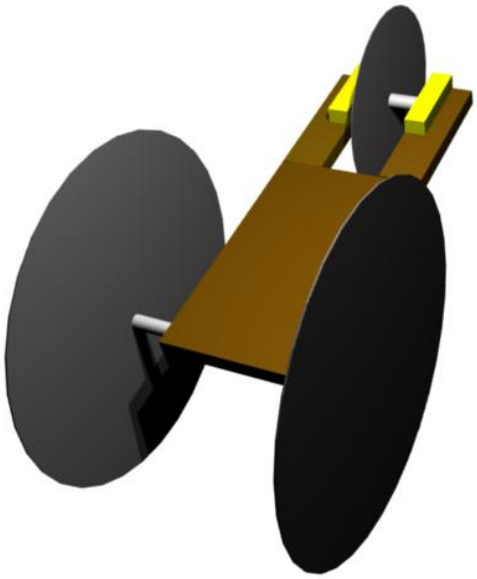
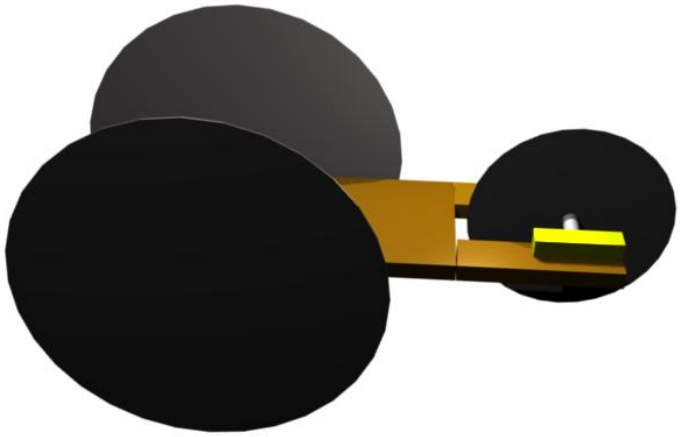
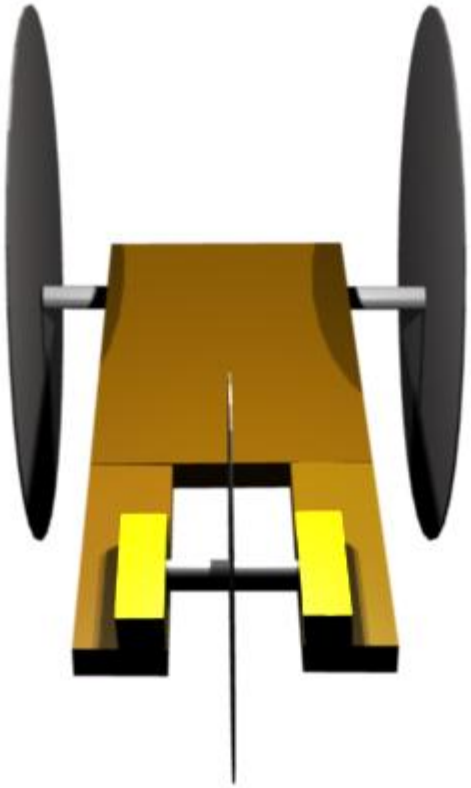
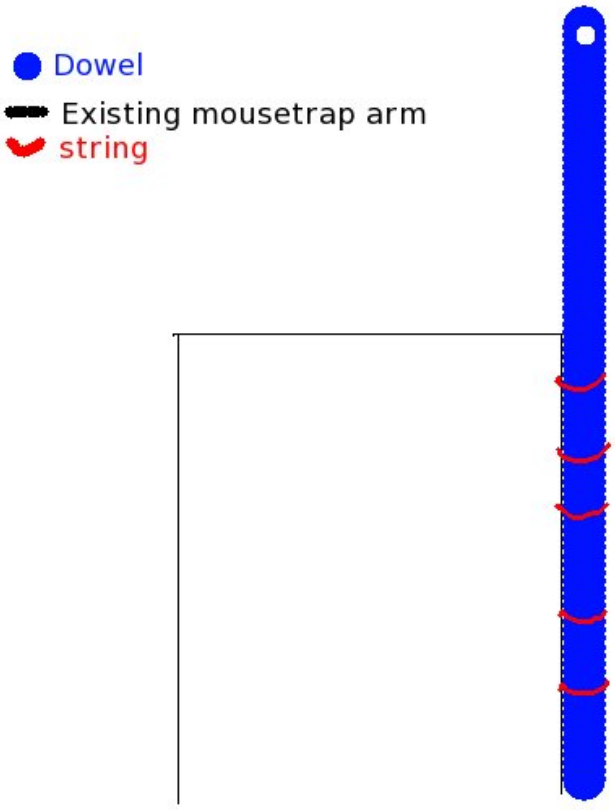
Drawings

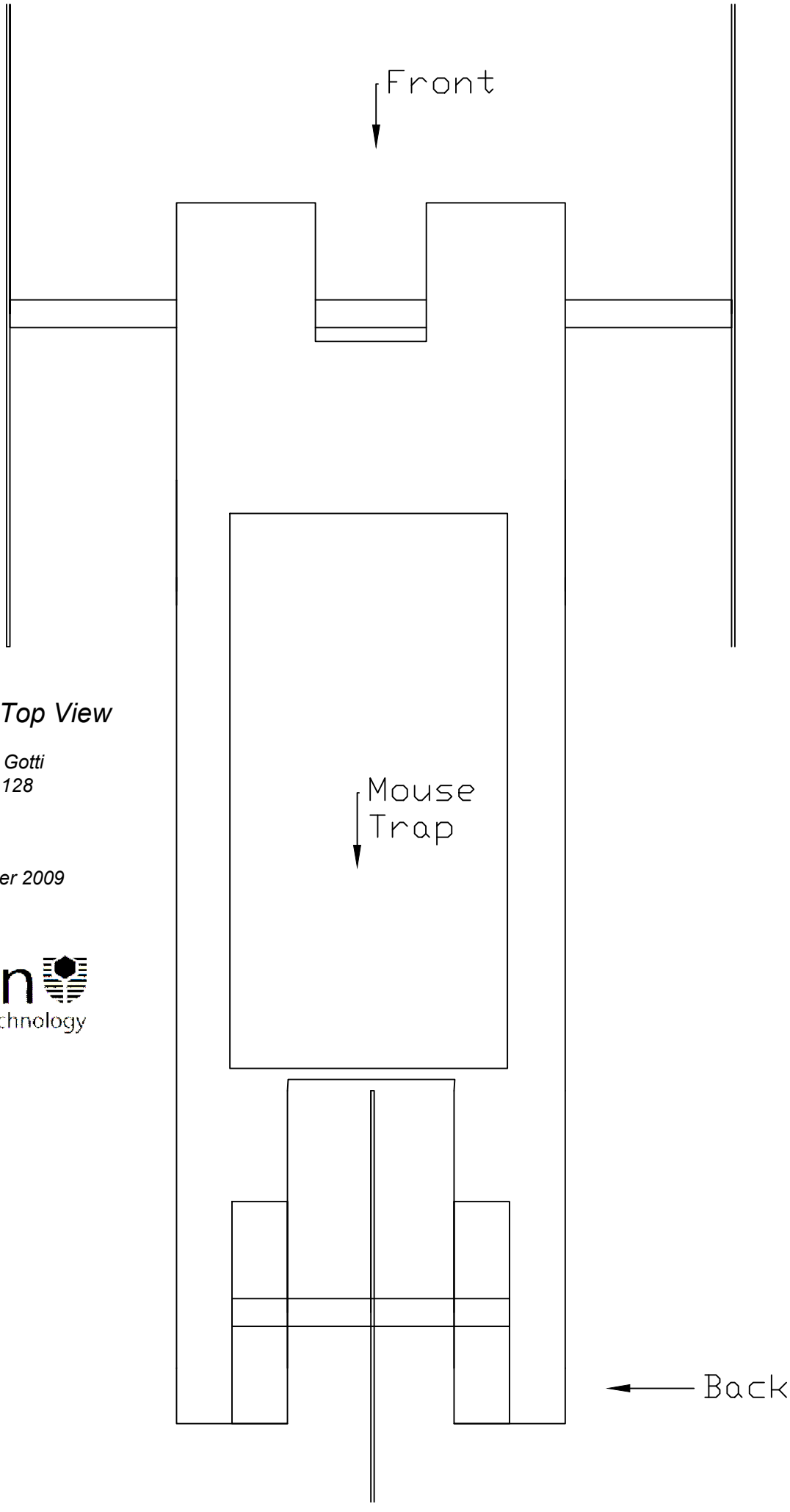









Dowel
Existing mousetrap arm
string



WG TITLE: Top View

RAWN - Andrew Gotti
TUD. No - 14291128

CALE - 1:1 (mm)

ATE - 3 September 2009

WG No 06

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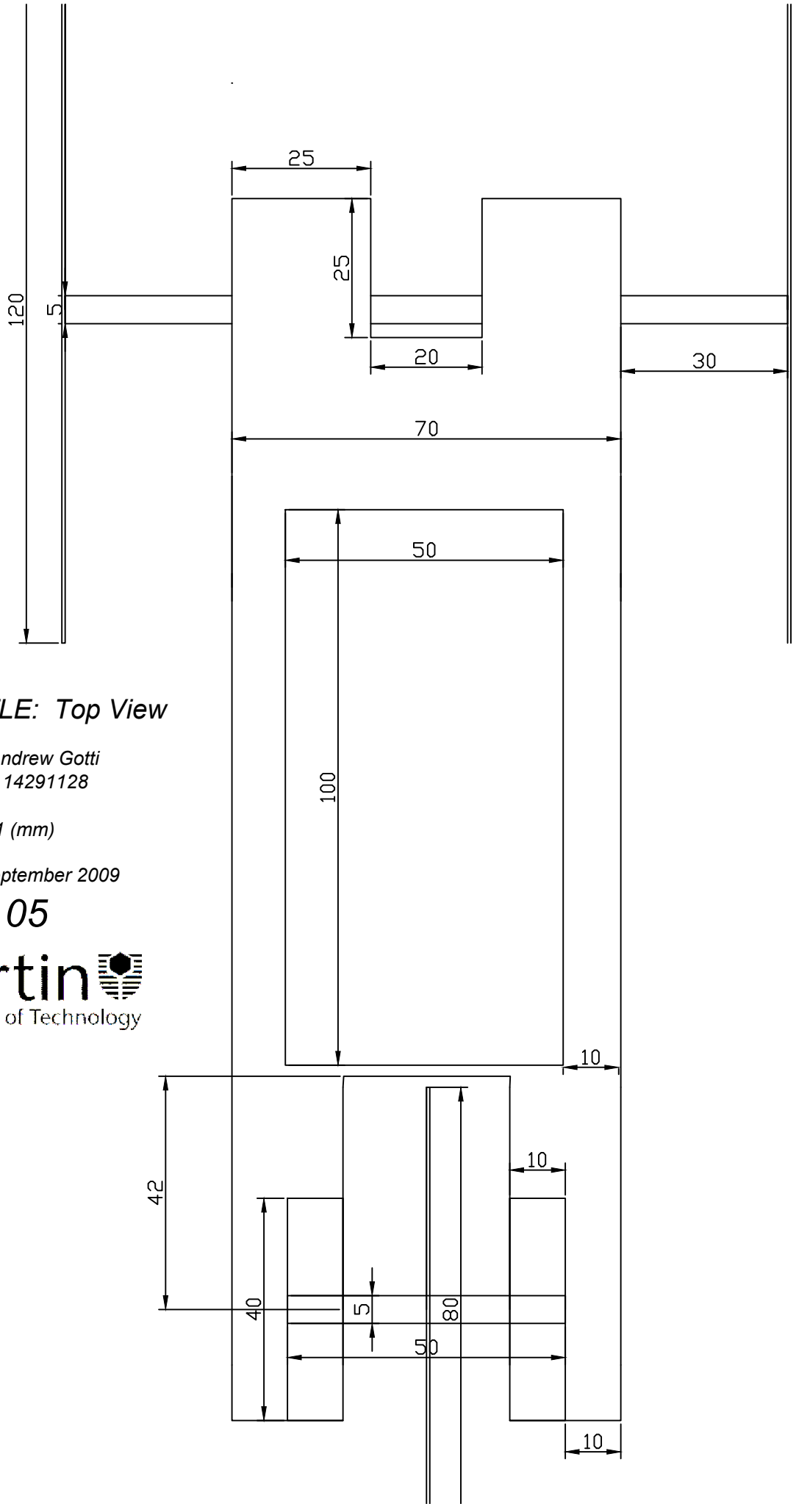

DWG TITLE: Top View

DRAWN - Andrew Gotti
STUD. No - 14291128

SCALE - 1:1 (mm)

DATE - 3 September 2009

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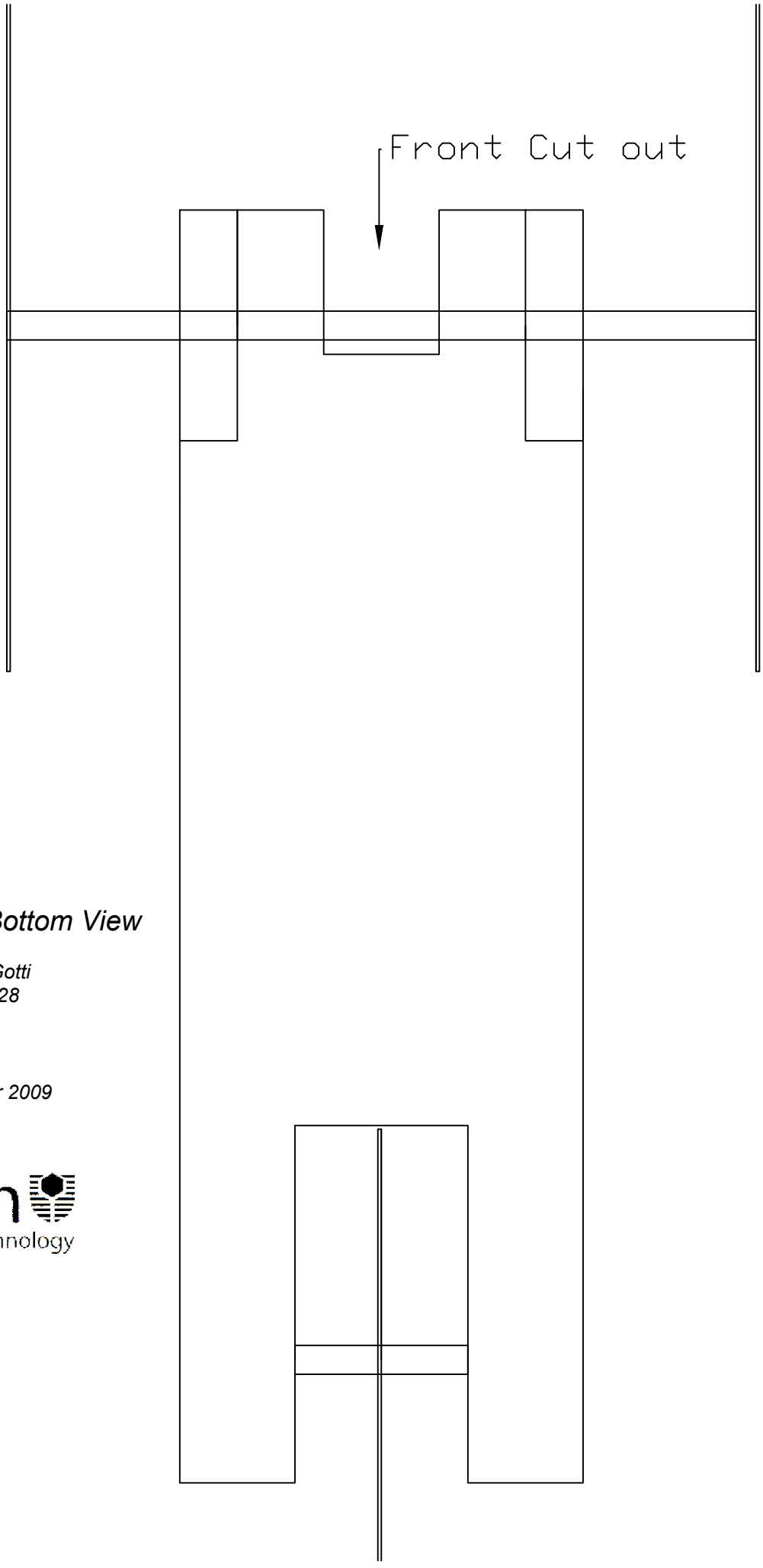
University of Technology



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RAWN - Andrew Gotti
TUD. No - 14291128

CALE - 1:1 (mm)

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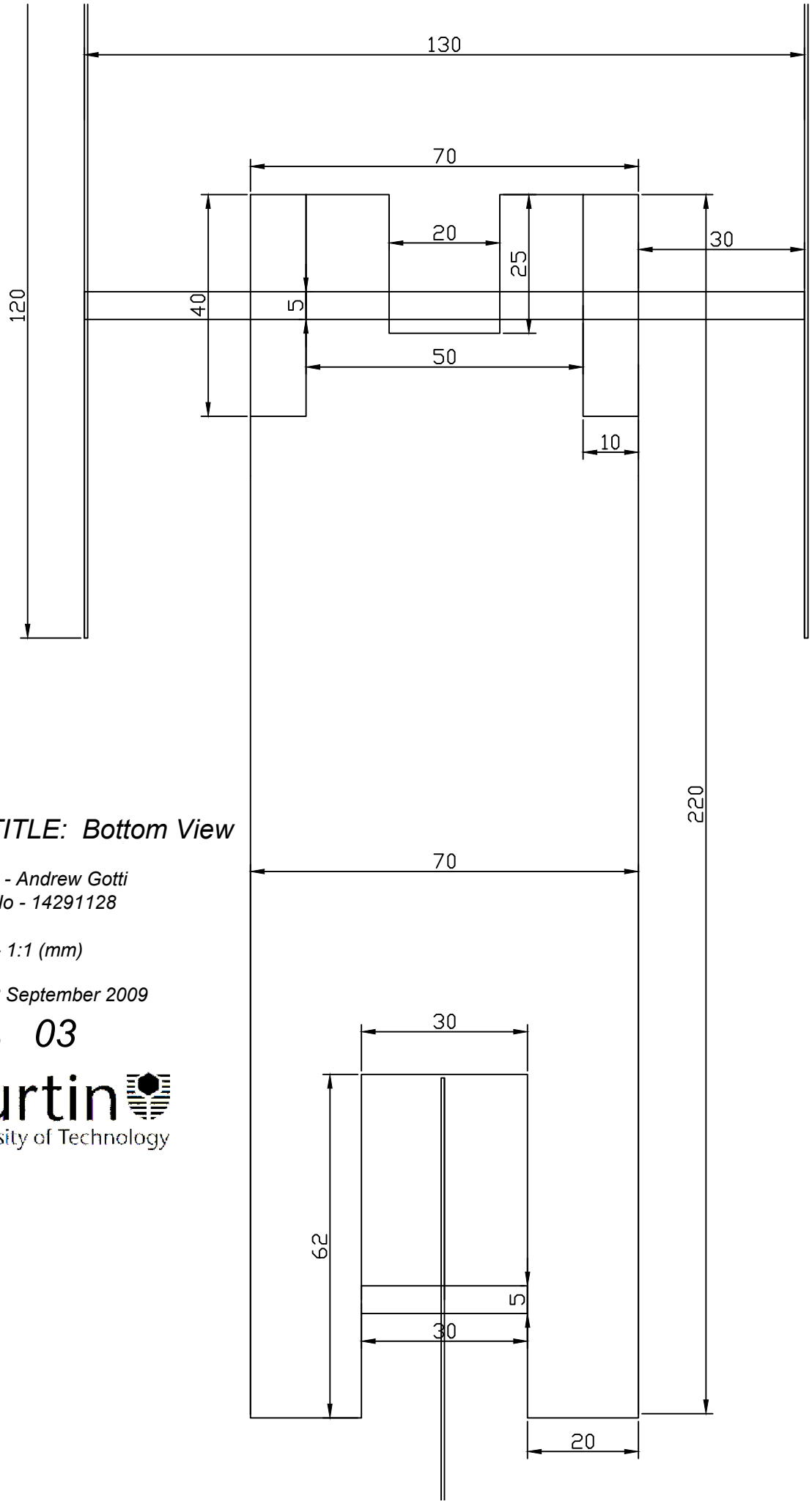
University of Technology



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STUD. No - 14291128

SCALE - 1:1 (mm)

)ATE - 3 September 2009

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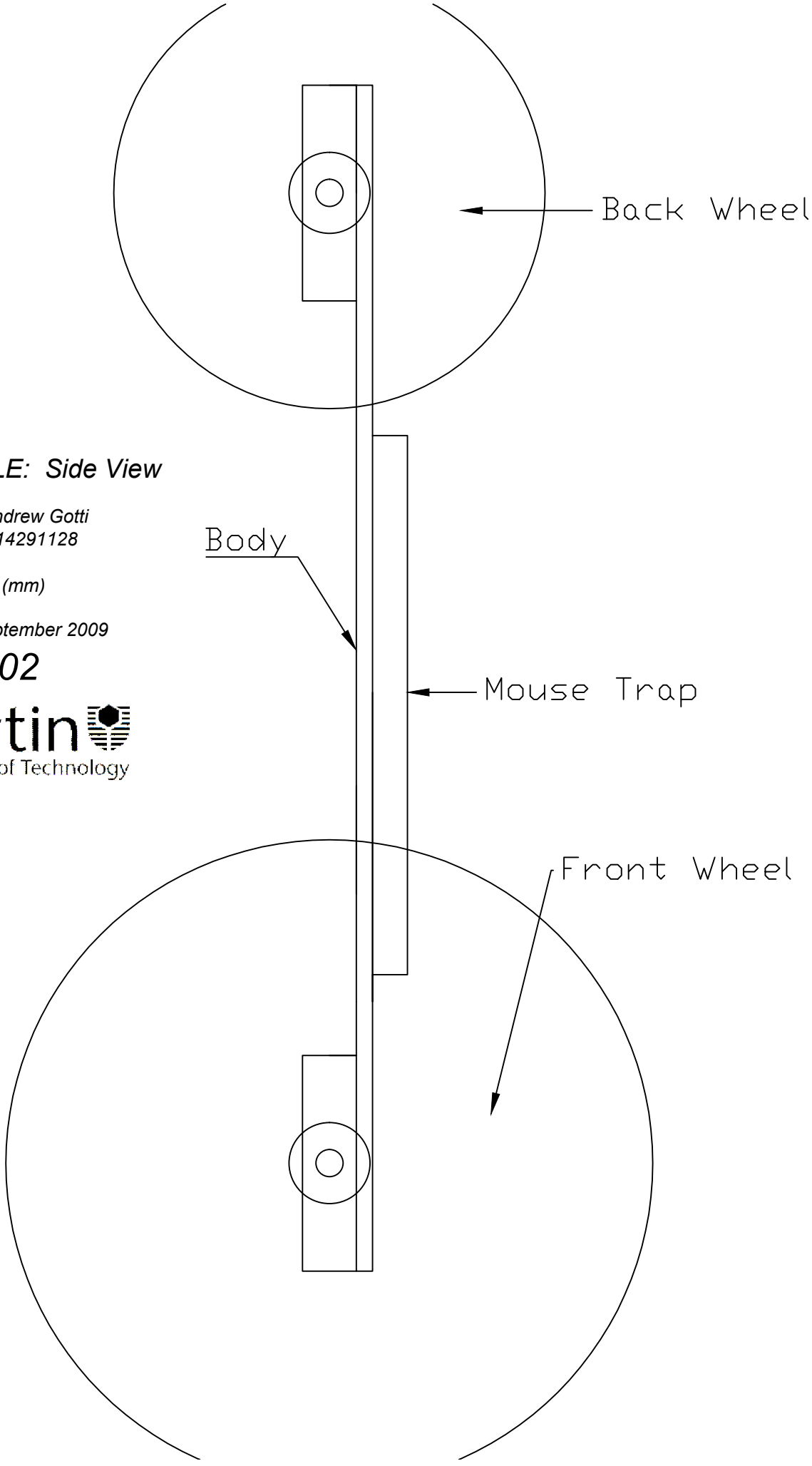
University of Technology



DWG TITLE: Side View

DRAWN - Andrew Gotti
STUD. No - 14291128

SCALE - 1:1 (mm)

DATE - 3 September 2009

DWG No *02*

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DWG TITLE: Side View

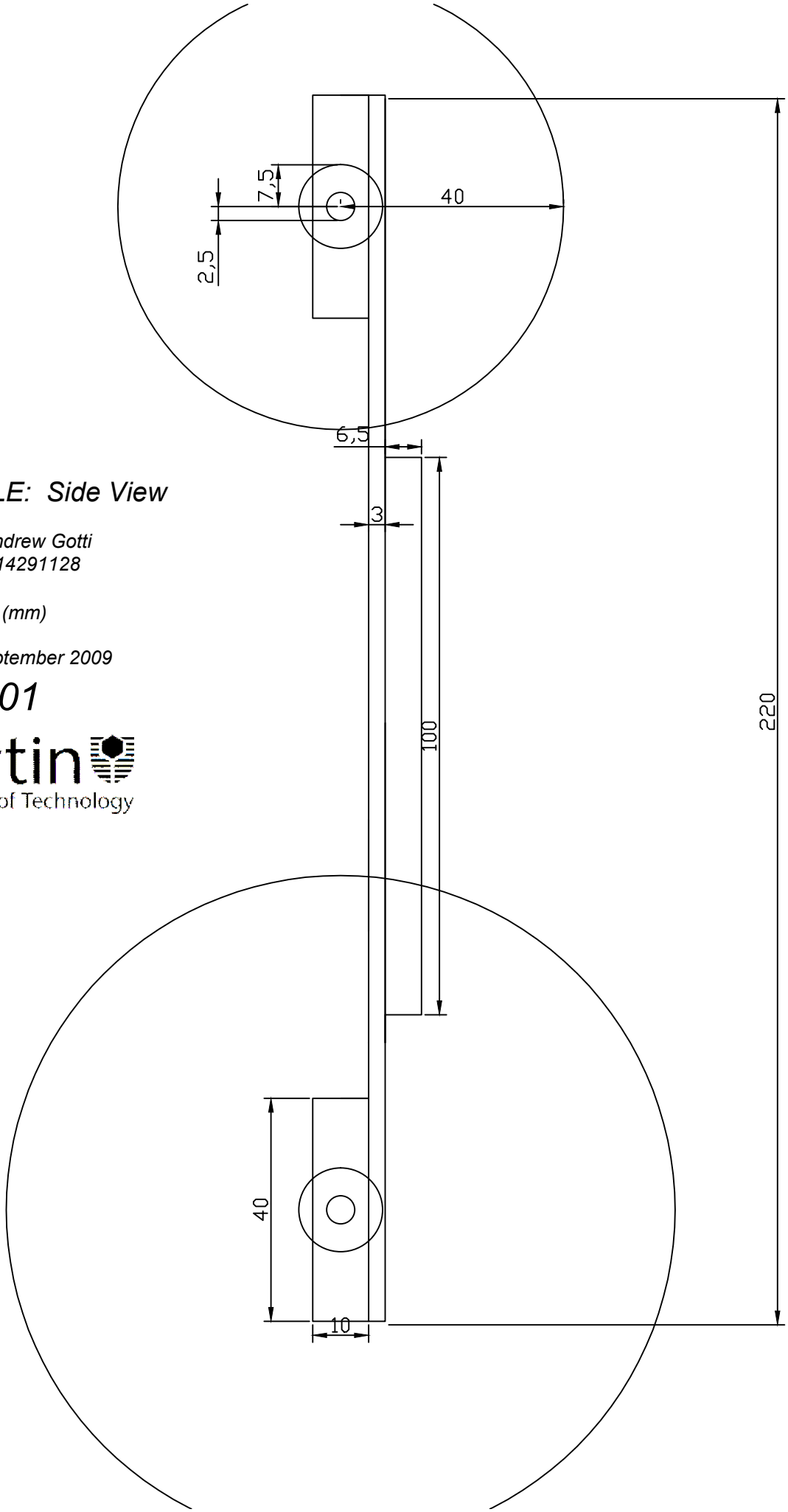
DRAWN - Andrew Gotti
STUD. No - 14291128

SCALE - 1:1 (mm)

DATE - 3 September 2009

DWG No 01

Curtin
University of Technology



Specifications

Materials Required:

- 220x70x6mm Balsa Wood
- 2 x CD's (120mm in diameter, standard CD/DVD)
- 1 x Mini CD (80mm in Diameter)
- strong glue
- 300-350mm string (strong, not fishing line)
- 2 x Lego Axles
- 4 x Lego attaching blocks for axle
- 120mm dowel
- 3 x 15x15x9mm strong wood
- Mousetrap (provided)
- Strong tape (optional)

Supplementary Tools:

- Utility Knife
- Drill and drill bit (slightly smaller than diameter of axle)
- Saw to cut wood

Chassis and Arm Construction

1. Drill small hole in one end of the dowel (for string to be thread through).
2. Attach dowel to either side of the mousetrap arm such that it is secure and will not move in relation to the arm. Ensure the drilled hole is at the top. Attach using 50-100mm of string and glue.
3. Cut a 52x30mm section out from one end of the balsa.
4. Cut a 25x20mm section out from the other end of the balsa.
5. Attach the mousetrap such that the “baited” end of the mousetrap is facing the 52x30mm cut out and such that it is 52mm from the end of the balsa (i.e. 0mm from the edge of the 52x30mm cut out).

Wheel and Axle Construction

1. Attach two Lego axle attaching blocks either side of the back end of the racer, such that the axle can be placed 42mm from the edge of the cut out. Use glue or tape to firmly secure.

2. Attach two Lego axle attaching blocks to either side of the front of the mousetrap such that the attaching blocks are in the corner of the balsa. Use glue or tape to firmly secure.
3. Cut the 3 15x15x9mm wood such that it fits inside the inner circle of each CD, glue these into place.
4. Drill a hole perpendicular to the CD, in each wood block such that the hole is in the centre of the CD.
5. Insert axles to the attaching blocks. Attach CD's to axles by inserting the axle into the drilled hole, ensuring a tight fit, tape can be added to end of the axle to match the hole size.

Distance and Speed Prediction

Below are the steps that our team taken to calculate and predict the distance and speed of our mouse trap car:

Front wheel's diameter, **D** =120mm

Circumference of the front wheel, $C_f=\pi D$

$=0.12(\pi)$

$= 377$ mm

Axle's diameter, $D_a=5$mm

Circumference of the axle, $C_a=\pi D_a$

$=0.005(\pi)$

$=15.71$mm

Displacement travelled by mousetrap arm A=200mm

∴ The maximum number of turns made by the axle for that length of fishing line:

No. of turns, $\mathbf{N=A / C_f}$

$=250 / 15.1$

≈ 16 turns

Since, the number of turns made by the axle is equal to the number of turns made by the front wheel (the axle is fix to the front wheel),

∴Distance covered by the mouse trap car=$N.C_f$

$=16(377)$

$=6000$mm

Time taken for the mousetrap arm to go from starting position to finish position
T = 5s

Applying the formula: $V = \frac{s}{t}$

Given, T = 5s

s=6m

Hence V= $1.2 ms^{-1}$

∴The velocity of our mouse trap car for the first 6m is 1.2 $ms^{-1.}$

This velocity will also be the speed that our mouse trap car travels across the 1.33m bridge.

Time taken to cross the 1.33m bridge can be calculated from the formaula $V = \frac{s}{t} \rightarrow t = \frac{s}{V}$

Since V = 1.2ms^{-1}

s = 1.33m

hence t = 0.90 s

V-12

ENGINEERING FOUNDATIONS PRINCIPLES AND COMMUNICATIONS 100

STAGE 1 DRAWING AND DESIGN - SEMESTER 2, 2009

Prediction Form
VEHICLE DESIGN

Company Name	**SMACS Engineering**

PERFORMANCE PREDICTION		
As designers of the vehicle we submit the following performance predictions.		
Overall Distance (including 1330mm):		6000 (mm)
Time to travel across the 1330mm span of the bridge:		0.9 (secs)
Which factor, if changed, would lead to the greatest improvement in performance? Select the performance limitation you think is most likely.	☐ Friction Losses In the Vehicle ☐ Steering ☒ More Powerful Rat trap ☐ Strength of Components ☐ Running Surface	
*** DETAILS**	**The calculation was done assuming that the car will cease to move after the period during which it is powered. During the period it is powered, friction can be neglected as we assume the wheels will turn 16 times so the distance is guaranteed.**	
Endorsed on behalf of the Designers' Team	**Name: Sean Meyer and Andrew Gotti**	
	Signature:	

Tender Evaluation Criteria

At SMACS Engineering we have a specific criteria in which we rate other companies who wish to contract with us. For this criteria to be met, companies must pass each section of the interview. The following table is an indication to how each section is weighted.

Evaluation	Maximum **Mark of:**	Company 1	Company 2	Company 3
Communication	1			
Presentation	3			
Goals	2.5			
Team Work	3.5			

Communication; What SMACS Engineering looks for in a contractor is those who are able to express them selves fluently by written, verbal and graphical means. In the written and graphical cases, we will view each company profile, and rate it based on what we view. For verbal communication we will rate that based on the interview.

Presentation; This is one of the more important aspects which SMACS Engineering looks at, we believe a good company is one which is well presented. To pass this section of the evaluation, contractors must be well dressed, and have a professional attitude when they come for the interview. Also, the company profile will be judged at how professional it is.

Goals; Every company strives to achieve their goals, unfortunately some of these goals are often unrealistic. SMACS Engineering expects that companies have a timeline to present and systematic explanation/evidence to compromise their goals. A measure of how well a company is able to express this will earn them more points in this section of the evaluation.

Team Work; this is one of the most misunderstood concepts that many take lightly. It is our belief that bad team work means an unorganized company and thus poor results. As such in the interview we will ask a set of questions which will enable us to judge how well each company values team work. For example if only one person is doing all the work and speaking, it is a strong indication of poor company team work.

Disposal Plan

Materials	Amount	Disposal plan
Lego	6	• Can be reused as kids toys
String	1	• Can be used as a spare shoe lace.
Excess Wood	1	• It can be simply recycled by placing them into the recycle bin.
Compact Disc	3	• The four CDs can be recycled and made into a helmet. (Korzeniewski, 2009) • It is also able to make into some creative crafts like a CD Lamp. (Watters, 2006)
Mouse Trap	1	• It can be used back as a mouse trap after the removal of the added components of the vehicle because it will be still maintain as the purpose of mouse trap originally.

Conclusion

The SMACS Engineering design is a simple yet effective mousetrap powered racer that meets all the requirements of the client. The drawings and 3d models of the car show its compact design while remaining simple to construct. The car is predicted to travel well over the minimum distance while being relatively quick over the first 1.33m.

References

Korzeniewski, J. 2009, Motorcycle helmets made from recycled Cds and DVDs. Retrieved August 11, 2009, from http://green.autoblog.com/2009/03/20/motorcycle-helmets-made-from-recycled-cds-and-dvds

Watters, J. 2006, CD Lamp 2. Retrieved August 11, 2009, from http://photocreations.ca/cd_lamp2/index.html