Project Proposal

Project Title: Health implications of the use of mobile phones by children
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CW3
Project Development Module
PRMM501
Module Leader: Dr. Paul Filmore

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MSc in Communications Engineering and Signal Processing
2002

1. Contents

2. Introduction

This project is on the health implications of the use of mobile phones by children. The purpose of this project is to consider the health implications of the widespread use of mobile phones by children in developed countries. The project will include an extensive literature review of published works in the field, as well as the carrying out of primary research in the form of surveys of the usage patterns of mobile phones by children in the UK.

The key question is: are mobile phones safe ? There has been a lot of speculation about this subject, by the public, the media, and by professionals. Some research has been carried out, but many have vested interests: their research is partly or wholly funded by mobile phone companies, or companies that are selling accessories to make mobile phones "safe".

3. Background

Although hand-held mobile phones have been around since the late 1980's, it was not until the late 1990's that there was a rapid increase in their ownership and use. By the end of 2000 there were over 27 million users in the UK (Sienkiewicz, 2000), 80 million in the US (COMAR, 2000), and 500 million worldwide (Maier *et al.*, 2000). This explosion in the numbers of mobile phones has prompted widespread speculation among both the public and media about their safety. Governments have reacted to these concerns by setting up official bodies to investigate this. The UK Government formed the Independent Expert Group on mobile phones (IEGMP) with Sir William Stewart as Chairman. The US Government instructed its General Accounting Office (GAO) to investigate. The Australian Government instructed the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to report on it. Various professional organisations have stated their position too: the Institute of Electrical and Electronics Engineers (IEEE) Committee on Man and Radiation (COMAR), and the Institution of Electrical Engineers (IEE) Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields. The consensus view of these august bodies seems to be that mobile phones are safe. However, similar comforting advice has in the past been given on such subjects as the risks of contracting cancer from smoking, and getting CJD from eating contaminated beef. Much of the high-profile research to date has been funded by mobile phone companies, who obviously have a massive financial interest in the outcome of the research. Similarly, experts from these companies sit on the boards of the aforementioned governmental and professional committees.

4. Literature Review

4.1 Microwave radiation

A mobile phone is a two-way radio device where users in a cell transmit mainly digitised voice or text data from their mobile phone to the base station that serves that cell (the uplink, or reverse path) and receive similar data back from the base station (the downlink, or forward path). For this reason, mobile phones (the UK term) are generally referred to as 'cellular telephones' in the US. The communication consists of radio frequency (RF) radiation of frequencies in the microwave band, typically at either 900 or 1800 MHz. The mobile phone's antenna is usually held close to the user's head and transmits a peak power of about 1 to 2W (which gives an average power of 0.125 to 0.25w). In comparison, microwave ovens operate at about 2.4Ghz with a power output of about 600W.

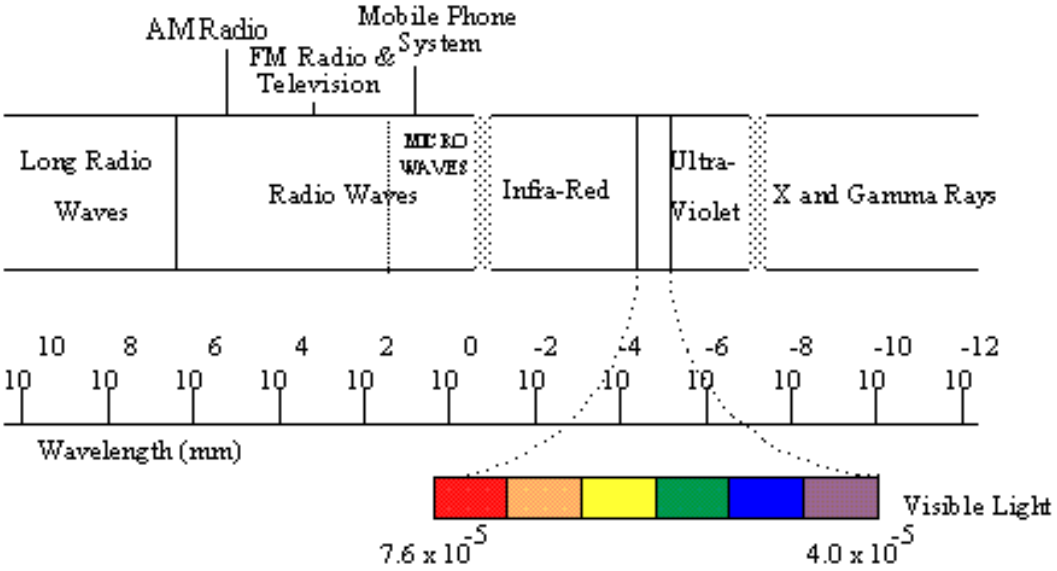


Figure 1: The Electromagnetic Spectrum (ARPANSA, 2002).

Humans have been subjected to RF radiation from a large number of sources, including TV and radio broadcasts, for several generations, with little perceived health consequences. However, in most instances the transmitter of the radiation is hundreds of metres or even kilometres away from the person receiving it, and so only very low power radiation is incident on them. With a mobile phone the situation is radically changed. Not only do users now transmit as well as receive, but the handset's antenna is held close to the user's head, only centimetres away from the brain. As well as transmitting microwaves, handsets using time division multiple access (TDMA) also produce low-frequency pulsing of this signal that causes a magnet field. This is due to current pulses from the battery at the frame rate of 217 Hz and multiframe rate of 8.34 Hz. Some phones use a discontinuous transmission mode (DTX) that saves energy by only transmitting when the user speaks: this results in a still lower frequency pulse rate of 2Hz.

4.2 Thermal Effects

Microwave energy emitted by mobile phones is absorbed by the water content of body tissue, thereby heating it. The maximum power absorbed by the body is measured by the specific energy absorption rate (SAR) in W/kg. The heat produced by this depends mainly on the power density of the radiation within the tissue and the electrical properties of the tissue. The heating effect in the human head is shown in figures 1 and 2 below.

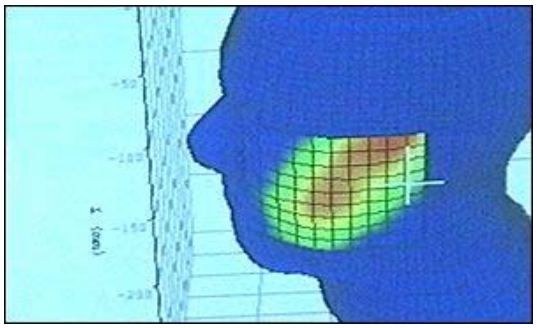


Figure 2: Side view of the heating effect of a mobile phone (BBC, 2002).

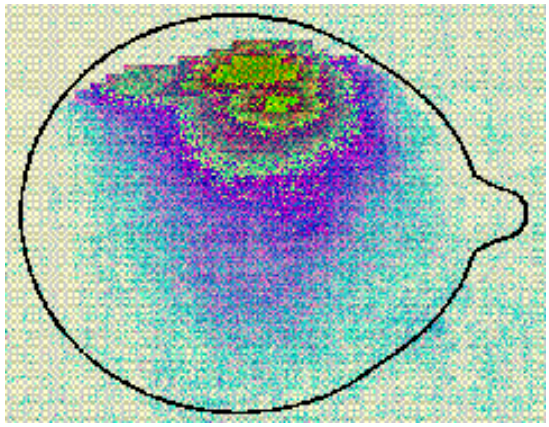


Figure 3: Cross-sectional view of the heating effect of a mobile phone (ARPANSA, 2002).

The body's thermoregulation mechanism is able to maintain a constant temperature in spite of this heating effect, but only up to a certain microwave intensity. Above that level, homeostasis fails, and the tissue temperature rises: once this exceeds about 1°C, health effects are known to occur in animals, and presumably in humans too (Hyland, 2000). These effects are manifested as "behavioural disruption" whereby animals stop performing a complex learned task (Foster and Moulder, 2000).

To ensure this temperature limit is not reached, standards bodies have set exposure limits. In the UK, the National Radiological Protection Board (NRPB) has stated that users of mobile phones must not be exposed to EMFs that raise the average body temperature or the head temperature above 38°C. To ensure this, the NRPB has

restricted the maximum SAR allowed as 10W/kg in the head (averaged over 10g), and 0.4W/kg in the body (averaged over the whole body) (Sienkiewicz, 2000). The International Commission on Non-Ionizing Radiation and Protection (ICNIRP) has set the levels much lower - reducing the UK SAR levels by a factor of five, to 2W/kg in the head and 0.08W/kg over the whole body. In the US, the FCC have set an even lower limit of 1.6W/kg , averaged over 1g of tissue (USGAO, 2001). The various RF safety standards are reviewed by Osepchuck and Petersen (2001).

SAR cannot be measured directly, but can be estimated by using a phantom head. This allows the SAR produced by different handsets to be measured and compared, and this service is offered by a number of independent laboratories such as EMC Technologies of Australia. The SAR levels of 14 popular mobile phones are shown in table 1 below (EMC, 2002).

Manufacturer	**Model**	**SAR (W/kg)**
Ericsson	T28s	1.27
Siemens	C35i	1.19
Nokia	6210	1.19
Samsung	SGH 2400	1.17
Motorola	V3690	1.13
Sony	CMDZ5	1.06
Siemens	S35i	0.99
Motorola	P7389	0.83
Nokia	3210	0.81
Bosch	GSM 909	0.81
Nokia	7110	0.76
Nokia	3310	0.75
Ericsson	T18s	0.61
Nokia	8850	0.22

Table 1: SAR levels of popular mobile phones (EMC, 2002).

However, the quoted SAR value does not give the whole picture, since its value can vary with carrier frequency (giving a different value at 900 or 1800 MHz) and how the handset is held (Lin, 2001a). There is also debate about the interpolation and extrapolation of SAR measurements in a phantom head, since the phantom interferes with electric fields differently than a human's head (Brishoual *et al.*, 2001).

4.2.1 Children's heads

Most SAR measurements use an adult sized phantom head, however Gandhi and Kang (2001) have found that reducing the head size by 10% on each of its three axes gives peak SARs of up to 45 % higher than for the standard sized model. They also found that there was a correspondingly deeper penetration of the absorbed energy into the brain. This suggests that children are being exposed to a much higher heating effect than adults. The Stewart Report notes that SAR will also be higher in a child than in an adult because their tissue has a higher conductivity since it contains a larger number of ions (IEGMP, 2000).

Another factor that makes children more vulnerable to RF absorption is that their skulls are considerably thinner than an adult's. A 5 year-old's skull is approximately 0.5mm thick at the ear, a 10 year-old's is 1mm, whereas an adult's is 2mm. This allows the radiation to penetrate far further into a child's brain (Chapman, 2002).

When tissue temperature rises by over 1°C, damage occurs as mentioned above, and current safety guidelines have been formulated with this limit in mind. However, animal studies have shown that temperature rises of below 1°C can also produce a number of behavioural and physiological disorders (Hyland, 2000). Further investigation is required into this.

4.3 Non-thermal Effects

Many systems within the human body oscillate at specific frequencies that are close to those used by mobile phones - either at 900 or 1800 MHz carrier, or at the 2, 8 and 217 Hz frequencies caused by the pulsed or DTX modes (Smith in Hyland, 2000). There is therefore the likelihood of the mobile phone radiation interfering with these sensitive oscillations, and thereby causing a biological effect. It is known that mobile phones can effect (man-made) electronic equipment, which is why they are banned from aircraft and hospitals. So why is it so widely assumed by government and professional bodies that they do not have a non-thermal effect on the electrochemical processes within the human body?

4.3.1 Blood-brain barrier

A recent study of 800 random people in Singapore found that mobile phone users had 30% more headaches than non-users, and the prevalence of headaches increased with duration of usage (Chia, 2000). Headaches can be caused by a change in permeability of the blood-brain barrier, and it is thought that mobile phone radiation can affect this (Lin, 2001b). Another study, by the Radiation and Nuclear Safety Authority of Finland, has recently found that mobile phone radiation causes temporary alteration in cells, changing the functioning of many proteins, one of which may increase the permeability of the blood-brain barrier (Leszczynski *et al.*, 2002). They conclude that brain tissue damage might accumulate and become a health hazard.

4.3.2 Brain cancer

Leszczynski *et al.* also hypothesised that this might facilitate the development of brain cancer. A study in the US of 1600 patients, half diagnosed with brain cancer, and half without, found no correlation between mobile phone use and the risk of brain cancer (Inskip *et al.*, 2001). However this study was of patients admitted between 1994 and 1998, and mobile phone usage has increased greatly since then. Lin notes that there is a lack of scientific consensus on the results of such studies (Lin, 2001c). Moulder's review of the evidence for a connection between mobile phones and cancer concludes that the evidence for such a connection is implausible, but notes that the studies are few (Moulder *et al.*, 1999). Similarly Frumkin's review concludes that it is unlikely that mobile phones cause cancer, but we need long-term follow-up on their biological

effects (Frumkin *et al.*, 2001). Rothman's review concludes that although there is not any clear evidence or a link at present, it is too soon for a definitive verdict (Rothman, 2000).

A recent survey of consultant neurosurgeons, who most commonly deal with patients with brain tumours, found that 83% of them thought there was no connection between brain tumours and mobile phones (Ashkan, 2002).

4.3.3 Other effects

Other effects that have been reported in humans or animals include:

- hearing problems and tinnitus
- pulsed microwaves can be heard as a buzzing, clicking, hissing or popping sound (Lin, 2001d).
- migraines
- affect brain functions
- learning and memory problems
- reduced motor activity
- eye problems including cataracts
- reduced sperm count

4.4 Professional Organisations

An IEE Working Group was established in 1992 to review the possible health effects of electromagnetic fields (EMFs). Its initial remit was solely power frequencies, but in 1998 this was expanded to cover radio frequencies too. It reports every 2 years, and its latest report (IEE, 2002) concluded that "there is still no convincing scientific evidence that shows harmful effects of low-level electromagnetic fields on humans". However it notes that less data is available for higher frequencies (such as those used by mobile phones) and recommends that further research should be supported.

The IEEE's COMAR agrees that there is only limited data concerning human exposure to RF energy, especially long-term exposure, but concludes that "present scientific evidence ..does not demonstrate health or safety risks from cellular and other communications transceivers" (IEEE, 2001).

The US GAO concludes that "scientific research to date does not demonstrate that the RF energy emitted from mobile phones has adverse health effects" (USGAO, 2001), but it too agrees that further investigation is needed and recommends that the SAR testing procedures should be revised.

In the UK, the IEGMP noted in its report (the "Stewart Report") that levels of exposure from mobile phones are substantially greater than from base stations (IEGMP, 2000), and there may be biological effects from such exposure. However, it concludes that "the balance of evidence to date suggests that exposures to RF radiation below [recommended levels] do not cause adverse health effects to the general population." Like the bodies above, it recommends that "more detailed and

scientifically robust information “ is required, and until then a precautionary approach be adopted.

5. Aims

The primary aims of the project are to:
- investigate the theoretical basis supporting possible health hazards
- perform a detailed review of recent studies
- carry out primary research into usage patterns by children
- produce recommendations for mobile phone usage by children

6. Approach

Search and analyse publications for mobile phones’
- power output patterns
- perceived health hazards
- researched health problems
- “safety devices” available
- effectiveness of such devices

Why have I chosen to focus this project on children?

Figure 4: School children using mobile phones (BBC, 2001).

- majority of teenagers own a mobile phone
- nervous system not fully developed
- thinner skulls
- higher tissue conductivity
- more years ahead for effects to accumulate
- more susceptible to marketing
- less able to make informed choice

Also, it seems that children are targeted both by mobile phone companies, and those selling accessories.

Figure 5: Licensing for these mobile phone covers was withdrawn by Disney Corp. following an outcry from concerned parents in the US (Lazerbuilt, 2002).

Figure 6: These mobile phone cases that appeal primarily to children are still available from Clinton Cards shops in the UK (Clinton Cards, 2002).

7. Research Method

Due to the possibly industry-biased nature of many of the surveys on mobile phones that have been carried out to-date, I intend to carry out my own independent survey of usage patterns of mobile phones by children in the UK, and their perceived health effects. Following the key issues that I identified in the literature review, I have designed a trial version of the survey, and have distributed 200 copies of it to a school in the Southwest. I have received positive feedback about the survey, and have incorporated the teachers' comments in the final version, which can be found in the

Appendix below. I will shortly distribute 1000 copies of this to schools in the Northeast and Southwest of England.

When sufficient copies have been returned, I intend to analyse the survey results using a Chi squared distribution, which is commonly used to analyse medical data. I will break the results down into age, sex, and region, and perform independent and objective analysis

I also intend to do a personal study as a "mystery shopper" in high street shops, to find out whether when purchasing a mobile phone for a child's use

- is any usage advice given?
- is advice relevant?
- is health leaflet available in shop?

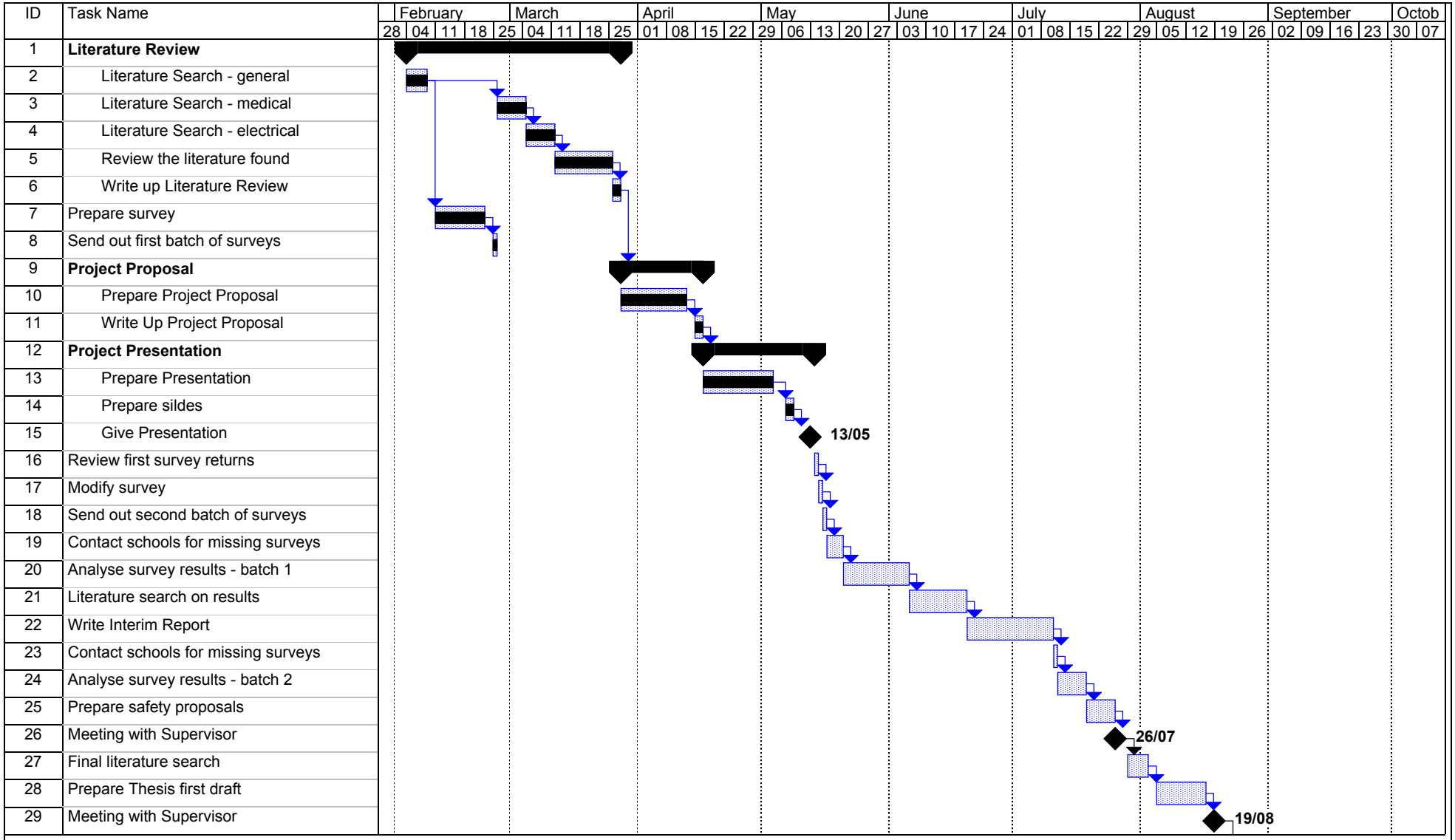
8. Schedule

As can be seen from the general outline of the schedule given below, there are 4 distinct phases to the project: a literature search, which is used to prepare the survey; the carrying out of the survey; the analysing of the survey results; the preparation of the final thesis.

Outline schedule and deadlines:

- Literature Review - Feb to March (8 weeks)
- Project Proposal - mid April (2 weeks)
- Project Presentation - beginning May (3 week)
- Survey - mid February and mid May (4 weeks)
- Analyse survey results - May to July (3 weeks)
- Interim Progress Report - end July (1 week)
- Write up Thesis - August (4 weeks)
- Prepare for Viva - mid September (2 weeks)

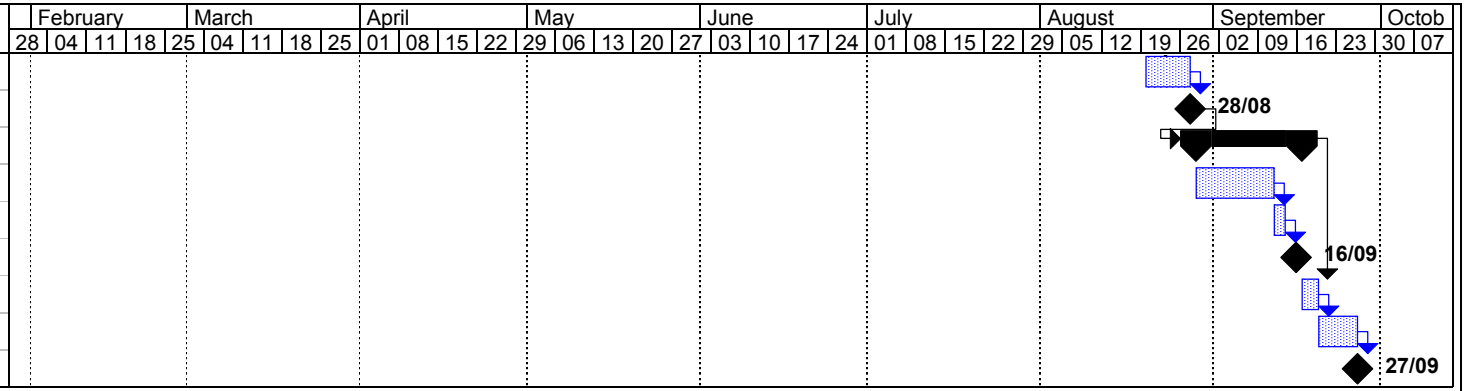
A more detailed breakdown is shown in the Gantt chart on the next page.



Project: Mobile Phones & Health
Date: Mon 25/11/02

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary
External Milestone
Deadline

ID	Task Name
30	Prepare Thesis second draft
31	Hand in unbound Thesis
32	**Viva**
33	Prepare Viva Presentation
34	Prepare Viva slides
35	Viva
36	Modify unbound Thesis
37	Bind Thesis
38	Hand in Bound Thesis



Project: Mobile Phones & Health
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Task		Rolled Up Task		Project Summary	
Split		Rolled Up Split		External Milestone	
Progress		Rolled Up Milestone		Deadline	
Milestone		Rolled Up Progress			
Summary		External Tasks			

9. Project On-line

I have also made the Survey and supporting documentation available online at www.ieee.org.uk/mobile

The final Report will be available in Web format as well as in the traditional printed format, and will be placed on the IEEE Website.
It is intended that a summary of the results will be presented at PREP 2003.
Possible publication in IEEE Microwave Magazine.

10. Conclusion

The literature review found that there is conflicting evidence on whether there are any adverse effects arising from the use of mobile phones. However, it seems that children are at particular risk, if any risk does indeed exist, due to their smaller heads, thinner skulls, and higher tissue conductivity. The other recurring theme from the literature reviewed is that most experts agree that **there is as yet insufficient evidence for it to be concluded that mobile phones are safe**. Many of them advocate the precautionary principle: there is insufficient knowledge in this area for a decision to be made, so we should err on the side of caution (Leszczynski, 2001) and use wide safety margins when formulating safety standards (Lin, 2001e).

Following a comprehensive literature review, the project will involve the carrying out of an independent survey to establish the facts of mobile phone use by children in the

UK, and the results will be analysed. A "mystery shopper" survey will also be carried out to see whether adequate health advice is given to someone buying a mobile phone for a child to use.

The final Report will be available on-line on the IEEE UK website, and will be presented at PREP 2003, the UK's annual postgraduate research conference. It is also hoped that a summary will be published in IEEE Wireless Communications magazine.

11. References

Ashkan, K. (2002) Mobile phones and the brain: What do the experts think? *British Medical Journal e-letters.* [on-line] http://bmj.com/cgi/eletters/324/7332/256#19271

Blakemore, C. *et al.* (2000) The health hazards of mobile phones. *British Medical Journal.* **320**:1288-89.

Bortkiewicz, A. (2001) A study on the biological effects of exposure mobile-phone frequency EMF. [Article in Polish] *Medycyna Pracy*. **52**(2):101-6

Brishoual, M. *et al.* (2001) Methodology to interpolate and extrapolate SAR measurements in a volume in dosimetric experiment. *IEEE Transactions on Electromagnetic Compatibility.* **43**(3):382-89

Chande, M. (2000) Good news for mobile phone users? *Lancet.* **356**:2163

Chapman, J. (2002) Cynicism of the Mobile Phone Firms. *Daily Mail*. 26 January 2002, pp.1 and 6.

Chia, S. *et al.* (2000) Increase prevalance of headache among mobile phone users in Singapore - a community study. *British Medical Journal.* **321**(7269):1155

Dendy, P.P (2000) Mobile phones and the illusory pursuit of safety. *Lancet.* **356**(9244):1782

Department of Health (2000) *Mobile Phones and Health.* HMSO, London.

Foster K.R. and Moulder J.E. (2000) Are mobile phones safe? *IEEE Spectrum*. **37**(8):23-28.

Frumkin, H. *et al.* (2001): Environmental Carcinogens - Cellular Phones and Risk of Brain Tumors. *CA: A Cancer Journal for Clinicians.* **51**:137-141.

Ganhi, O.P. and Kang, G. (2001) Effect of the Head Size on SAR for Mobile Telephones. Bioelectromagnetics Society Annual Meeting 2001. 9-5

Gottlieb, S. (2001) Evidence grows for safety of mobile phones. *British Medical Journal.* **322**(7279)129

Grant, R. (1999) Mobiles on the Brain. *British Medical Journal.* **318**(7196):1495.

Hardell, L. (2001) Cellular telephones and risk of brain tumours. *Lancet.* **357**:961

Hyland, G.J. (2000) Physics and biology of mobile telephony. *Lancet.* **356**(9244):1833-36

IEE (2002) *Position Statement. The Possible Harmful Biological Effects of Low Level Electromagnetic Fields of Frequencies up to 300 GHz.* IEE, London.

IEEE Committee on Man and Radiation (COMAR). (2001) Human Exposure to Radio Frequency and Microwave Radiation from Portable and Mobile Telephones and Other Wireless Communication Devices. *IEEE Engineering in Medicine and Biology Magazine.* **20**(1):128-131.

Independent Expert Group on Mobile Phones (2000) *Mobile Phones and Health.* National Radiological Protection Board, Chilton.

Inskip, P.D. *et al.* (2001) Cellular-Telephone Use and Brain Tumors. *New England Journal of Medicine.* **344**(2):79-86.

Leszczynski, D. (2001) Mobile phones, precautionary principle, and future research. *Lancet.* **358:**1733

Leszczynski, D. *et al.* (2002) Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier-related effects. *Differentiation*. **70**(2-3):120

Lin, J.C. (2001a) Specific absorption rates induced in head tissues by microwave radiation from cell phones. *IEEE Microwave Magazine.* **2**(1):22-25

Lin, J.C. (2001b) Health effects: the blood-brain barrier, cancer, cell phones, and microwave radiation. *IEEE Microwave Magazine.* **2**(4):26-30. and *IEEE Antennas and Propagation Magazine.* **43**(3)141-43

Lin, J.C. (2001c) Cell phone testing and fundamental scientific research *IEEE Antennas and Propagation Magazine.* **43**(4):156-58

Lin, J.C. (2001d) Hearing microwaves: the microwave auditory phenomenon. *IEEE Antennas and Propagation Magazine.* **43**(6):166-68

Lin, J.C. (2001e) Health effects. The precautionary approach - a rose by another name. *IEEE Microwave Magazine.* **2**(3):34-38. and *IEEE Antennas and Propagation Magazine.* **43**(2):129-31

Moulder J.E., *et al.* (1999) Cell Phones and Cancer: What Is the Evidence for a Connection? *Radiation Research* **151**(5):513-531.

Osepchuk, J.M. and Petersen, R.C (2001) Safety standards for exposure to RF electromagnetic fields. *IEEE Microwave Magazine*. **2**(2):57 - 69.

Petrie, K.J. and Wessely, S. (2002) Modern worries, new technology, and medicine. *British Medical Journal.* **324**(7339):690-91.

Rothman, K.J. (2000) Epidemiological evidence on health risks of cellular telephones. *Lancet.* **356**(9244):1837-40

Senior, K. (2000) Mobile phones: are they safe? *Lancet.* **355**(9217):1793

Sienkiewicz, Z. (2000) *The ABC of Mobile Phones.* National Radiological Protection Board, Chilton.

United States General Accounting Office (2001) *Research and Regulatory Efforts on Mobile Phone Health Issues.* GAO, Washington, DC.

World Health Organization (2000) Electromagnetic Fields and Public Health. *Radiological Protection Bulletin*, No. 224, July/August 2000 pp 12-16.

Websites *(Dates visited needed)*

http://www.doh.gov.uk/mobilephones UK Department of Health

http://www.tassie.net.au/emfacts/mobiles/ EMFacts Consultancy

http://www.who.int/peh-emf WHO International EMF Project Home Page

http://www.arpansa.gov.au/mph_sys.htm Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). The mobile phone system and health effects.

http://www.seas.upenn.edu:8080/~kfoster/phone.htm IEEE COMAR Statement

http://www.iee.org/Policy/Areas/BioEffects IEE Position Statement

http://www.mcw.edu/gcrc/cop/cell-phone-health-FAQ/toc.html Basestations FAQ - addresses the issue of whether base station transmitter/antennas for mobile phones are a risk to human health.

http://www.electric-words.com/cell/cellindex.html Cell-phones and Health

http://www.emctech.com.au EMC Technologies - offer RF Dosimetry – SAR Testing of Mobile Phones

12. Appendix

The final version of the Survey form is on the next page.

SURVEY ON MOBILE PHONE USE

Please fill in your name: _____ Form:_____

Please tick: ☐ Male or ☐ Female

Please fill in this survey by ticking the appropriate boxes. Thank you.

1. How often do you use a mobile phone (tick only one box)?

☐ Never	☐ Less than once a week	☐ More than once a week	☐ Every day

2. What make of mobile phone do you usually use (tick only one box)?

☐ Nokia	☐ Siemens	☐ Motorola	☐ Sony
☐ Samsung	☐ Ericsson	☐ Panasonic	☐ Alcatel
☐ Other (please write make):_____			

3. What model of mobile phone do you usually use?
   e.g. for a Nokia 3310 write "3310" or for a Siemens C35i write "C35i"

Model:_____

4. How many mobile phone calls (**not** text messages) do you make or receive a day on average?

☐ 0 or 1 a day	☐ 2 to 5 a day	☐ 6 to 10	☐ 11 to 20	☐ more than 20

5. How long is each call on average?

☐ 0 to 1 minute	☐ 1 to 5 mins	☐ 5 to 10 mins	☐ 10 to 30 mins	☐ over 30 mins

6. Do you use a hands-free kit when making a mobile phone call?

☐ Never	☐ Sometimes	☐ Usually	☐ Always

7. What do you make or receive most mobile phone calls for?

☐ Chatting to friends	☐ Speaking to your parents	☐ Emergency calls only	☐ Finding out information

Please turn over for next question.

8. How many text messages do you **send** a day on average?

☐ 0 or 1 a day	☐ 2 to 5 a day	☐ 6 to 10	☐ 11 to 20	☐ more than 20

9. Where do you usually hold your mobile phone when you send a text message?

☐ in your lap	☐ on the table	☐ in your hand near your body	☐ in your hand away from your body

10. Do you use WAP (Internet) on your mobile phone?

☐ no	☐ occasionally	☐ at least once a day	☐ several times or more a day

11. At what age did you start regularly using a mobile phone?

At age:_____

12. When buying a mobile phone, which of these are the **two** most important features? (tick **2** boxes)

☐ Price	☐ Wide range of covers available	☐ Wide range of ring tones available	☐ number of lines on text display
☐ WAP	☐ Games	☐ Number of hours before battery needs recharging	☐ health issues - how safe the phone is (SAR value)

13. When you bought your mobile phone, were you given any advice by the shop staff on health issues when using it?

☐ no	☐ yes

14. Have you seen the leaflet "Mobile Phones & Health" ?

☐ no	☐ yes

15. Are you worried about health issues when using your mobile phone?

☐ I've never heard about these	☐ not worried	☐ fairly worried	☐ very worried

16. Have you ever had any symptoms that you think might have been caused by your mobile phone? (e.g. headaches, nausea, short-term memory loss, ringing sound in your ears etc.)

☐ no	☐ yes

If yes, please state which symptoms: _____